

# Chapter 7

## Maintenance Procedures

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### 7.1 Maintenance Schedule

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Table 7-1 lists periodic maintenance schedules that ensure optimum instrument performance.

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

Table 7-1 Maintenance Schedule

Maintenance Procedure	Frequency
Replace the source enclosure and probe O-rings (see Section 7.3).	Annually.
Empty the nitrogen exhaust bottle (see Section 7.4).	As required.
Gas-ballast the rotary pump (see Section 7.5).	Weekly (ESI). Daily (APCI).
Inspect and adjust the rotary pump oil level (see Section 7.6).	Weekly.
Change the rotary pump oil (see Section 7.7).	Every 3000 hours of pump operation.
Replace the rotary pump oil mist filter element (see Section 7.8).	Six-monthly. <b>Note:</b> For applications that contaminate the rotary pump oil, this period will be reduced and must be determined from experience.
Replace the rotary pump odor filter element (see Section 7.8).	Monthly, or whenever the rotary pump emits an oily odor.
Replace the scroll pump seals.	Annually (see the Edwards document <i>XDS 35i Instruction Manual A730-01-880</i> , supplied with the instrument).

Table 7-1 Maintenance Schedule (Continued)

Maintenance Procedure	Frequency
Clean the source assembly (see Section 7.9).	When sensitivity decreases to unacceptable levels.
Clean the ESI probe tip (see Section 7.10).	When sensitivity decreases to unacceptable levels.
Clean the APCI probe tip (see Section 7.12).	When sensitivity decreases to unacceptable levels.
Clean the corona discharge pin (APCI mode) (see Section 7.11).	When sensitivity decreases to unacceptable levels.
Clean the ion block assembly (see Section 7.9).	When it is visibly fouled. When background or high peak contaminants are unacceptably high.
Clean all source components (see Section 7.9).	When sensitivity decreases to unacceptable levels. When cleaning the cone gas cone, sample cone, and gas exhaust port fails to improve analytical results.
Replace the ESI probe capillary (see Section 7.14).	When sensitivity decreases to unacceptable levels.
Perform ZSpray APCI probe maintenance (see Section 7.15).	When sensitivity decreases to unacceptable levels.

## 7.2 Safety and Handling

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



**Warning:** *The instrument components may be contaminated with biologically hazardous materials. Always wear nitrile gloves while handling the components.*



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



**Warning:** To avoid electric shock, do not remove the instrument's panels. There are no user-serviceable items inside the instrument.



**Warning:** To avoid electric shock, ensure that the instrument is in Standby before commencing any maintenance.



**Warning:** The probe and source may be hot. To avoid burns, take great care while working with these components.

## 7.3 Replacing the Source Enclosure and Probe O-rings

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**Warning:** To avoid possible excessive leakage of solvent into the laboratory atmosphere, the O-rings listed below must be renewed at intervals of no greater than one year, exactly as described in this section.

To avoid possible excessive leakage of solvent into the laboratory atmosphere, the following O-rings must be renewed at intervals of no greater than one year:

- Source enclosure door O-ring
- Source enclosure door glass O-ring
- Source enclosure housing O-ring
- Source enclosure side flange O-ring
- Probe adjustment flange O-ring

**Note:** To complete this procedure, you will be required to perform a pressure test on the source, as described in the Waters Micromass Source Pressure Test Unit Operator's Guide.

### Procedure

1. Remove the probe from the source (see Section 7.9.3).
2. Disconnect the Probe electrical connection at the instrument front panel (see Figure 7-5).
3. Disconnect the PTFE tubing at the Desolvation gas connection on the front panel.



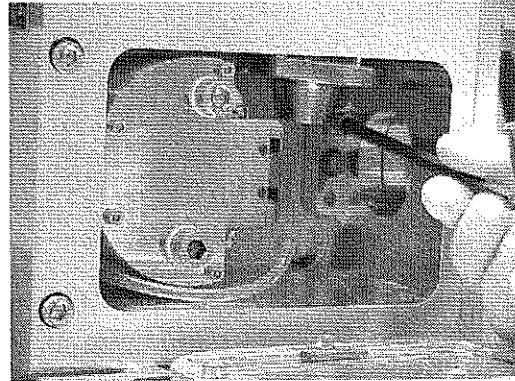
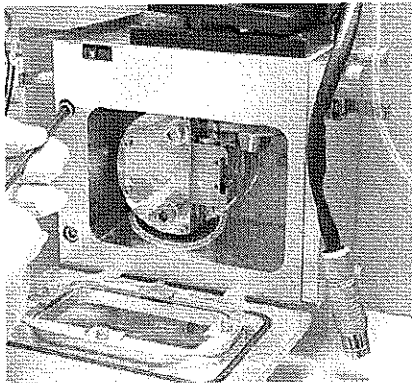
**Warning:** The source may be hot; to avoid burns, take great care while working with this component.

4. Unfasten the source enclosure door's securing clips and open the door (see Figure 7-5).



**Warning:** The source components may be contaminated with biohazardous and/or toxic materials. Always wear nitrile gloves while performing this procedure.

5. Use a hex (Allen) key to loosen the three captive source enclosure securing screws.



**Caution:** To avoid damage, do not apply any force to the source enclosure door when removing the source enclosure from the instrument's pumping block.

6. Remove the source enclosure from the instrument's pumping block, sliding it off the two guide pins.
7. Unscrew and remove the three thumbscrews that secure the source enclosure side flange to the source enclosure.
8. Remove the source enclosure side flange from the source enclosure.
9. Use a jeweller's screwdriver to carefully remove the following from the source enclosure (see Figures 7-1 and 7-2):
  - Source enclosure door O-ring
  - Source enclosure housing O-ring
  - Source enclosure side flange O-ring

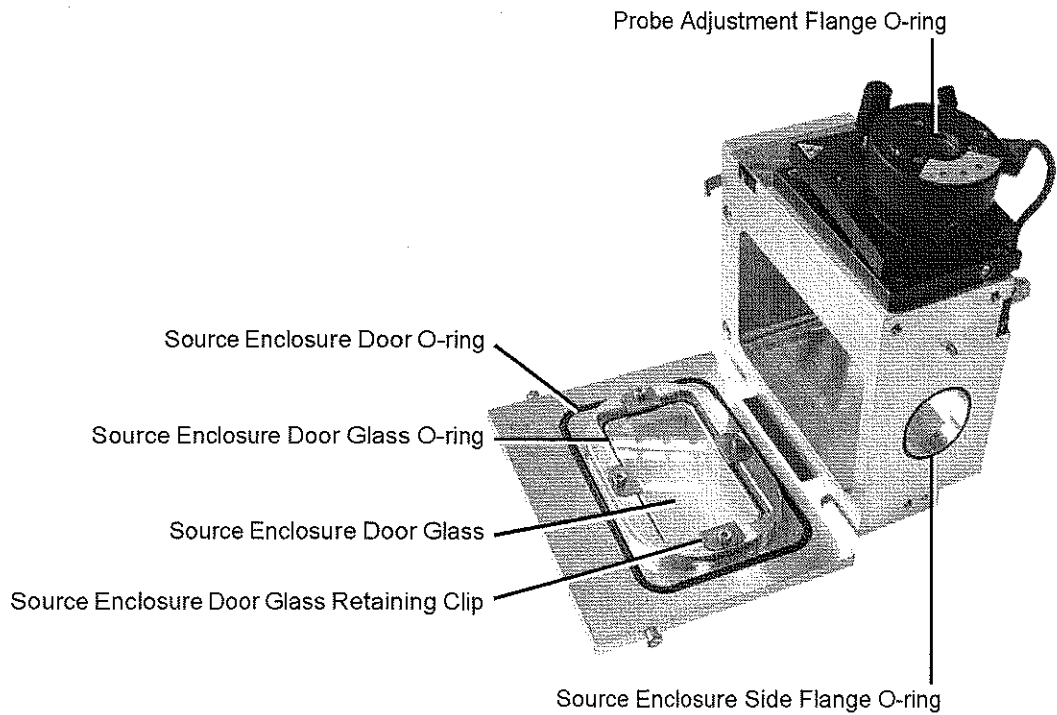


Figure 7-1 Source Enclosure and Probe Adjustment Flange

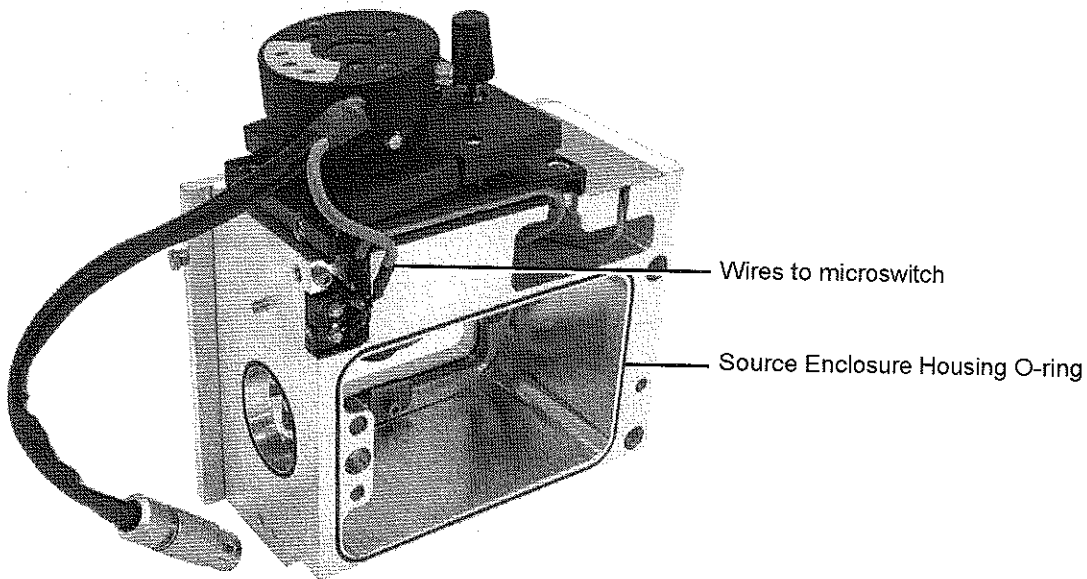


Figure 7-2 Source Enclosure Rear View

10. Use a hex (Allen) key to remove the four bolts securing the source enclosure door glass retaining clips to the source enclosure door (see Figure 7-1).
11. Remove the four source enclosure door glass retaining clips from the source enclosure door.
12. Remove the source enclosure door glass from the source enclosure door.
13. Use a jeweller's screwdriver to carefully remove the source enclosure door glass O-ring from the source enclosure door.
14. Use a jeweller's screwdriver to carefully remove the probe adjustment flange O-ring from the probe adjustment flange (see Figure 7-1).



**Warning:** The O-rings may be contaminated with biohazardous and/or toxic materials. Ensure that they are correctly disposed of according to local environmental regulations.

15. Dispose of the O-rings in accordance with local environmental regulations.
16. Ensure that all the grooves for O-rings are free from dirt and hairs.
17. Fit the new probe adjustment flange O-ring to the probe adjustment flange.
18. Fit the new source enclosure door glass O-ring to the source enclosure door.

19. Fit the source enclosure door glass to the source enclosure door.
20. Fit the four source enclosure door glass retaining clips to the source enclosure door.
21. Use a hex (Allen) key to fit and tighten the four bolts securing the source enclosure door glass retaining clips to the source enclosure door.
22. Fit the following to the source enclosure:
  - New source enclosure door O-ring
  - New source enclosure housing O-ring
  - New source enclosure side flange O-ring
23. Fit the side panel to the source enclosure.
24. Fit and tighten the three thumbscrews that secure the side panel to the source enclosure.
25. Ensure that each of the two source enclosure guide pins is fully tightened into the instrument's pumping block; a suitable lever can be inserted into the hole in each guide pin to achieve this.
26. Ensuring that the wires to the microswitch do not become trapped between the source enclosure and the pumping block (see Figure 7-2), fit the source enclosure to the pumping block.
27. Fit and tighten the three source enclosure securing bolts.

***Note:** The securing bolts must each be sequentially tightened a small amount until they are all fully tight; this ensures that the source enclosure is uniformly seated on the pumping block.*
28. Close the source enclosure door and fasten the securing clips (see Figure 7-5).
29. Connect the Probe electrical connection at the instrument's front panel (see Figure 7-5).
30. Connect the PTFE tubing to the Desolvation gas connection at the instrument's front panel (see Figure 7-5).
31. If using an APCI probe, carefully fit the corona discharge pin (see Section 3.1.2).
32. Install the ESI or APCI probe, as required (see Sections 2.1.3 and 3.1.3).
33. Start up the instrument (see Section A.1).



**Warning:** To avoid possible excessive leakage of solvent into the laboratory atmosphere, a source pressure test must be performed.

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

## 7.4 Emptying the Nitrogen Exhaust Waste Bottle

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**Warning:** The waste liquid in the nitrogen exhaust waste bottle comprises LC solvents and analytes. Always wear nitrile gloves while handling the nitrogen exhaust waste bottle, and ensure that the waste liquid is correctly disposed of according to local environmental regulations.

The nitrogen exhaust waste bottle in the nitrogen exhaust line (see Section 1.6.11) must be emptied before it is completely full.

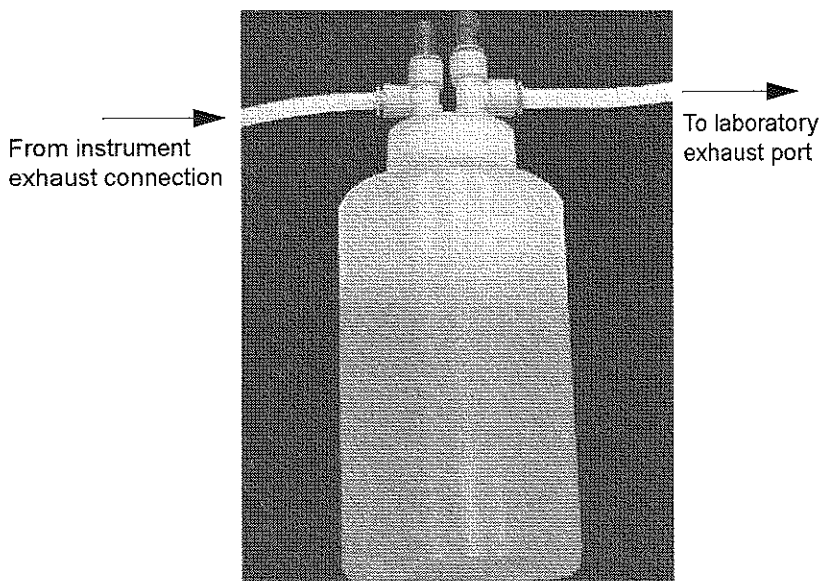




Figure 7-3 Nitrogen Exhaust Waste Bottle



## Procedure

1. In the MassLynx Tune window, click Press for Standby and confirm that the adjacent instrument status indicator shows red.
2. In the MassLynx Tune window, click  to stop the nitrogen flow.
3. Disconnect the instrument exhaust and laboratory exhaust system lines from the nitrogen exhaust waste bottle.
4. Dispose of the waste liquid in accordance with local environmental regulations.
5. Connect the instrument exhaust and laboratory exhaust system lines to the nitrogen exhaust waste bottle.
6. In the MassLynx Tune window, click  to start the nitrogen flow.
7. In the Source page Gas Flow pane, set Desolvation (L/hr) to 1200.
8. Set Cone (L/hr) to 300.



**Warning:** To avoid possible excessive leakage of solvent into the laboratory atmosphere, a leak test must be performed.

9. Use Snoop<sup>®</sup> (or equivalent) leak detector liquid to ensure that there are no leaks at the instrument exhaust and laboratory exhaust system line connections.

## 7.5 Gas-Ballasting the Rotary Pump (E2M28)

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When the rotary pump draws large quantities of solvent vapors, the vapors tend to condense in the pump oil, reducing pump efficiency. Gas-ballasting purges condensed contaminants from the oil and returns any oil to the pump from the oil mist filter. Gas-ballast the rotary pump when any of the following conditions apply:

- With ESI operation, once a week.
- With frequent APCI operation, once a day.
- If the pump oil appears cloudy.
- If the vacuum pressure is higher than normal.
- If condensate forms in the rotary pump exhaust line.
- When changing the rotary pump oil.
- If the level of accumulated oil in the oil mist filter is high.



**Warning:** To avoid burns, take great care while working with the rotary pump, as it may be hot.



**Caution:** Failure to routinely gas-ballast the rotary pump shortens oil life and consequently pump life.



**Caution:** Do not vent the instrument when the rotary pump is gas-ballasting.



**Caution:** Do not gas-ballast the rotary pump while the instrument is in Operate.

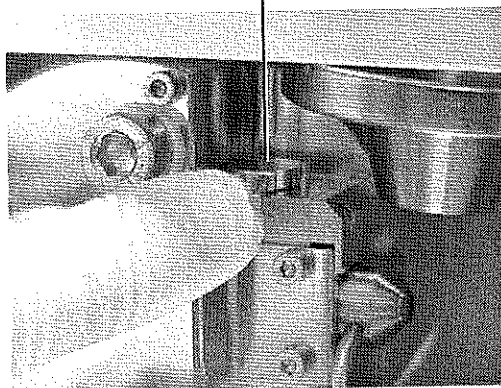


**Caution:** Never gas-ballast the rotary pump for more than 2 hours.

## Procedure

1. Close the isolation valve by moving its lever fully to the right.

Isolation Valve



2. Operate the gas-ballast control (Figure 7-4).
3. When the oil is clear and has drained back to the rotary pump, return the gas-ballast control to its normal position.
4. Open the isolation valve.

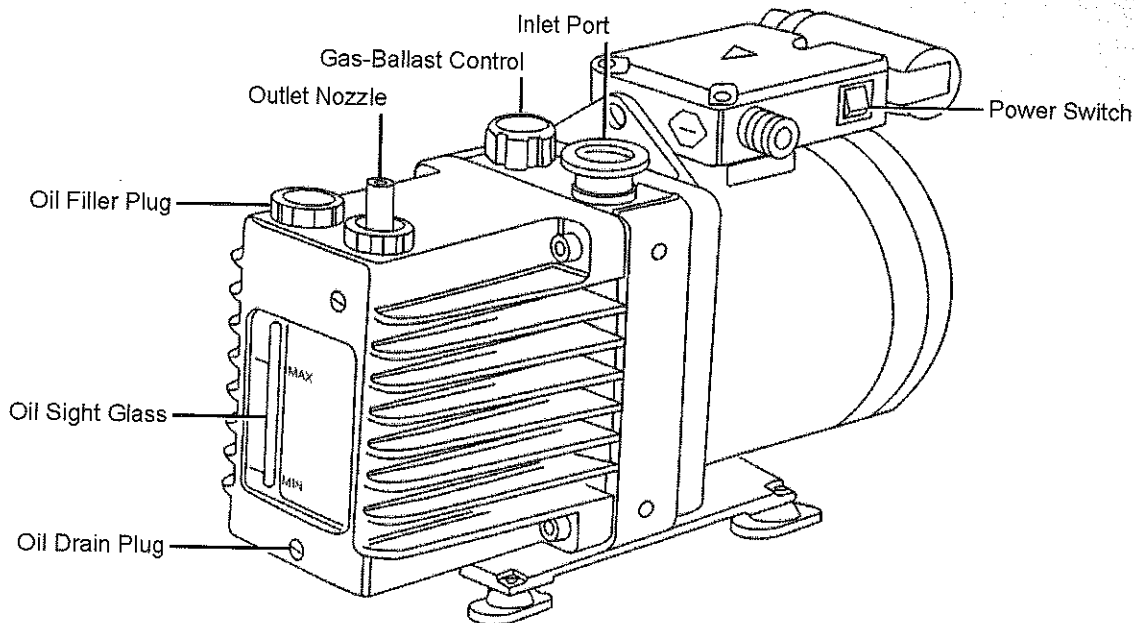


Figure 7-4 Rotary Pump

## 7.6 Checking the Rotary Pump Oil



**Warning:** To avoid burns, take great care while working with the rotary pump, as it may be hot.

The oil level can be checked while the pump is operating. However, the instrument must be vented and shut down before adding oil.

The rotary pump oil level appears in the oil level sight glass on the pump (see Figure 7-4).

Check the oil level at weekly intervals; at all times it should be at, or near, the MAX level indicated by the markings beside the sight glass. If oil must be added, vent and shut down the instrument before removing the oil filler plug (see Section A.2.3).

Examine the oil each time the its level is checked. It should be colorless and free of visible contaminants. If the oil is discolored, change it (see Section 7.7).

## 7.7 Changing the Rotary Pump Oil

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Change the rotary pump oil every 3 to 4 months, or whenever it becomes noticeably discolored.

### 7.7.1 Required Materials

- Nitrile gloves
- Flat-blade screwdriver
- Container for used oil
- Funnel
- Vacuum oil – use only Ultragrade 19 or Inland Q45 (Edwards 45) vacuum pump oil

### 7.7.2 Procedure



**Warning:** *The rotary pump oil may be contaminated with biohazardous and/or toxic materials. Always wear nitrile gloves while handling the oil and ensure that the waste oil is correctly disposed of according to local environmental regulations.*

1. Operate the pump to warm the oil before draining it.
2. Gas-ballast the rotary pump (see Section 7.5).
3. Vent and shut down the instrument (see Section A.2.3).
4. Power-off the power supply to the backing pump interlock box.



**Warning:** *To avoid burns, take great care while working with the rotary pump and pump oil, as they may be hot.*

5. Raise the pump 6 to 8 inches (150 to 200 mm) above the floor, if necessary.
6. Place an object under the motor to tilt the pump toward the side on which the oil drain plug is located (see Figure 7-4).
7. Remove the oil filler plug.
8. Use the flat-blade screwdriver to remove the oil drain plug.
9. Let the oil drain completely.
10. Fit the oil drain plug.

11. Remove the object used to tilt the pump.
12. Fill the pump until the oil in the sight glass reaches the MAX level.
13. Allow a few minutes for the oil to drain into the pump.
14. Recheck the oil level and, if necessary, add more oil.
15. Fit the oil filler plug and, if applicable, lower the pump to the floor.
16. Switch on the pump, by operating the power switch.
17. Switch on the power supply to the backing pump interlock box.

## 7.8 Replacing the Oil Mist and Odor Filter Elements

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### 7.8.1 Required Materials

- Nitrile gloves
- 4-mm hex (Allen) key
- Lint-free cloth

### 7.8.2 Procedure



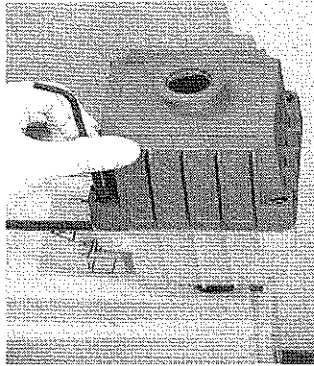
**Warning:** The rotary pump oil may be contaminated with biohazardous and/or toxic materials. Always wear nitrile gloves while handling the oil mist filter assembly.



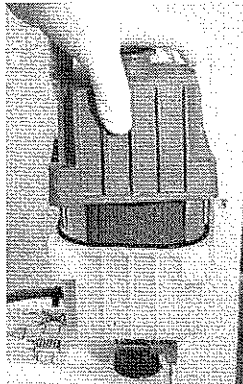
**Warning:** To avoid burns, take great care while working with the rotary pump and oil mist filter assembly, as they may be hot.

1. Gas-ballast the rotary pump to drain the oil from the oil mist filter (see Section 7.5).
2. Turn off the power supply to the rotary pump interlock box.
3. Wipe clean the outside of the oil mist filter body.

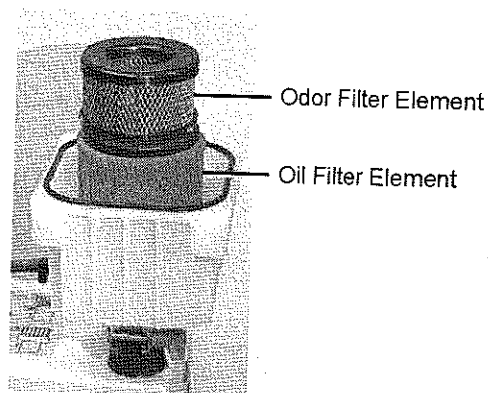
4. Use the hex (Allen) key to remove the four screws that secure the filter upper body to the lower body.



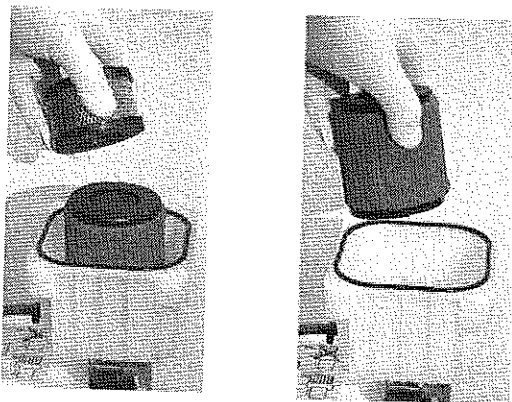
5. Remove the upper body from the lower body.



This exposes the oil filter element and odor filter element.

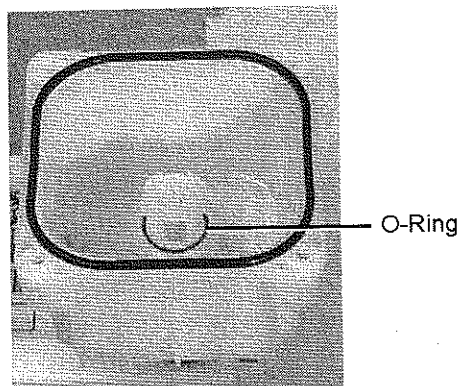


6. Lift out the element(s) that are to be replaced.



7. Wipe clean the insides of the upper and lower body assemblies.

8. Ensure that the oil filter element O-ring is in position on the lower body assembly.



9. Fit the new filter elements to the lower body assembly, ensuring that the foam sealing rings are correctly seated on the top and bottom of the elements.
10. Fit the upper body assembly to the lower body assembly.
11. Fit and tighten the four screws that secure the upper body to the lower body.

## 7.9 Cleaning the Source Components

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### 7.9.1 Overview

Clean the source components (sample cone, cone gas cone, and gas exhaust port) when:

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

If cleaning these parts fails to increase signal sensitivity, also clean the extraction cone, source T-Wave, and ion block.

#### Procedure


1. Disassemble the source components and source T-Wave assembly (see Sections 7.9.3 to 7.9.8).
2. Clean the source components and source T-Wave assembly (see Sections 7.9.10 to 7.9.14).
3. Reassemble the source T-Wave assembly and the source components (see Sections 7.9.15 to 7.9.20).



## 7.9.2 Required Materials

- Nitrile gloves
- Needle-nose pliers
- Two wrenches
- Hex (Allen) keys
- Jeweller's screwdriver
- Large, flat-blade screwdriver
- Glass-fiber pen
- Appropriately sized glass vessels in which to completely immerse components when cleaning. Use only glassware not previously cleaned with surfactants.
- HPLC-grade methanol
- HPLC-grade water
- Formic acid
- Ultrasonic bath
- Source of oil-free, inert gas (nitrogen or helium) for drying (air-drying optional).
- Lint-free paper towels

## 7.9.3 Removing the Probe from the Source

1. Disconnect the LC system from the probe.
2. In the MassLynx window, click Press for Standby and confirm that the adjacent instrument status indicator shows red.
3. Wait for 3 minutes to allow the desolvation gas flow to cool the probe and source.
4. Click  to turn off the nitrogen flow.



**Warning:** The probe and source may be hot. To avoid burns, take great care while working with the instrument's access door open.

5. Open the instrument's access door.
6. Disconnect the electrical connection(s) at the instrument front panel (Figure 7-5).

**Note:** The probe electrical connection will not be connected if the APCI probe is being used.

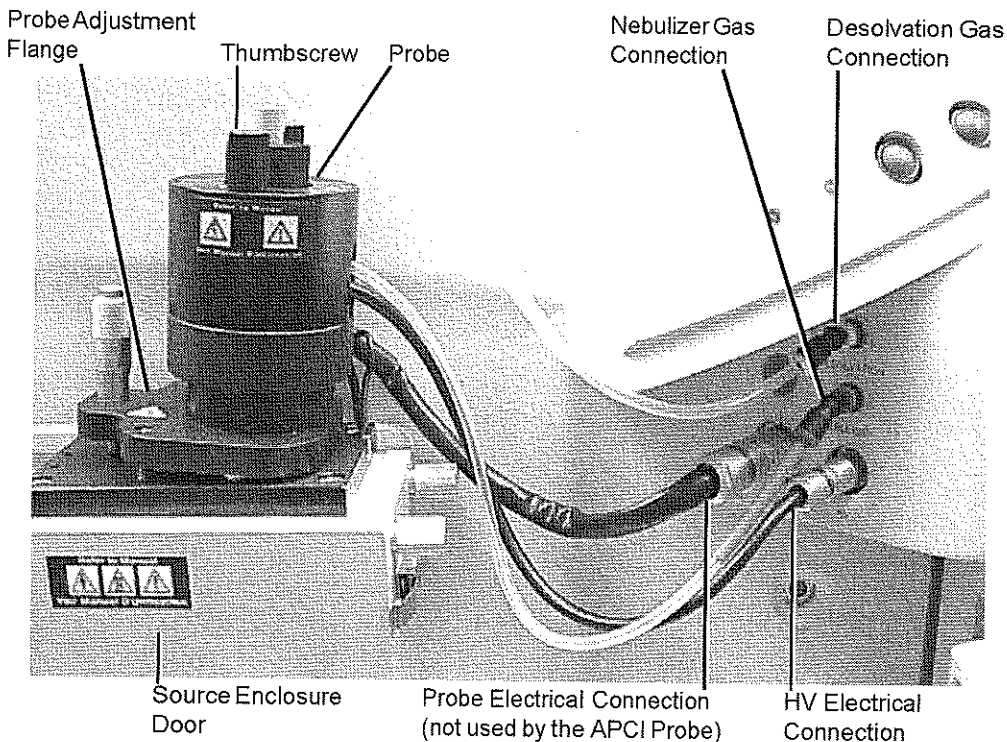


Figure 7-5 Probe Connections (ESI Probe Shown as an Example)

7. Disconnect the PTFE tubing at the Nebulizer gas connection on the front panel.
8. Undo the two thumbscrews securing the probe to the probe adjustment flange.



**Warning:** The probe may be contaminated with biohazardous and/or toxic materials. Always wear nitrile gloves while performing this procedure.



**Caution:** To avoid damaging the probe seals when removing an APCI probe, confirm that the probe temperature is less than 150 °C, as displayed on the Tune window APCI Probe Temp (°C) readback, before removing the probe.

9. Carefully remove the probe from the probe adjustment flange.

## 7.9.4 Removing the Sample Cone



**Warning:** The source components may be contaminated with biohazardous and/or toxic materials. Always wear nitrile gloves while performing this procedure.



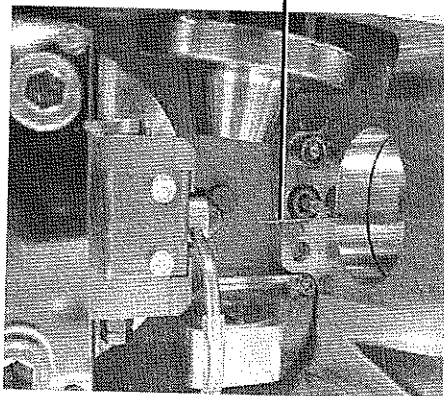
**Warning:** To avoid electric shock, ensure that the instrument is in Standby before commencing this procedure.



**Warning:** The source may be hot. To avoid burns, take great care while performing this procedure.

1. Unfasten the source enclosure door's securing clips and open the door (see Figure 7-5).
2. If using ESCi mode or an APCI probe, carefully remove the corona discharge pin.

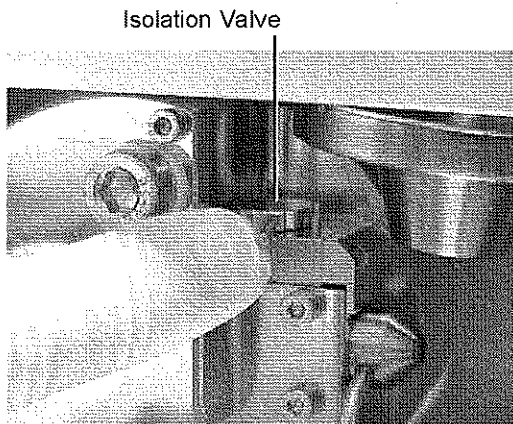
Corona Discharge Pin



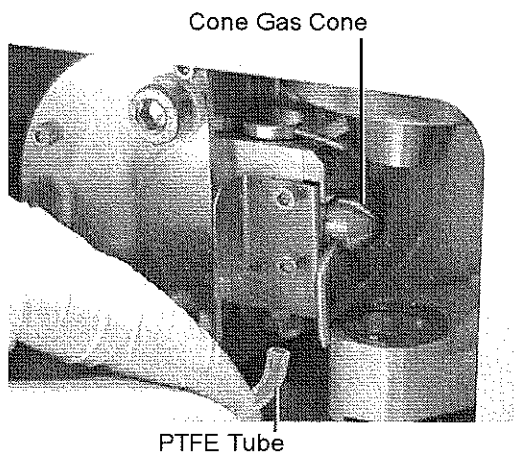


**Caution:** Failure to close the isolation valve before removing the sample cone may damage the instrument.

3. Close the isolation valve by moving its lever fully to the right.

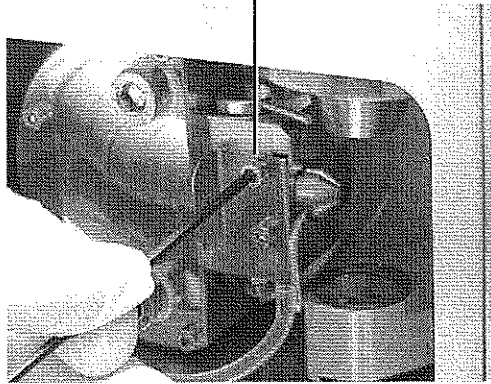


4. Disconnect the PTFE tube from the cone gas cone.

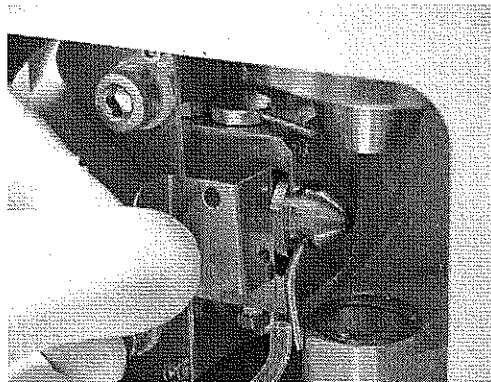


5. Use a hex (Allen) key to remove the two cone retaining plate securing screws.

Cone Retaining Plate

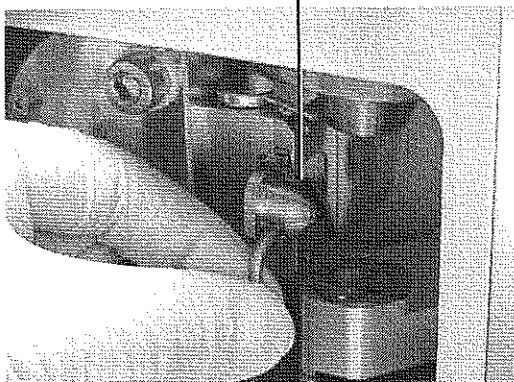


6. Remove the cone retaining plate.

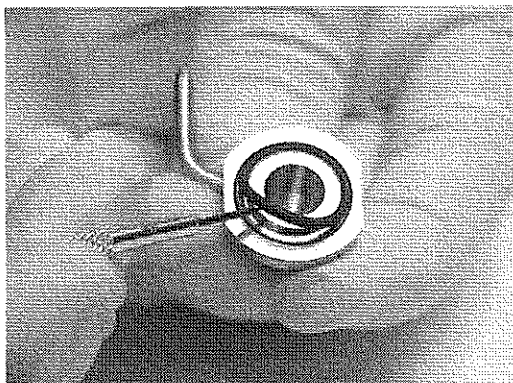


7. Carefully remove the sample cone/cone gas cone assembly from the isolation valve body.

Sample Cone/Cone Gas Cone Assembly



8. Use a jeweller's screwdriver to carefully remove the O-ring from the sample cone/cone gas cone assembly.





**Caution:** The sample cone is fragile. To avoid damaging it, never place the sample cone on its tip; always place it on its flanged base.

9. Separate the sample cone from the cone gas cone.

Figure 7-6 shows the sample cone, cone gas cone, and O-ring.

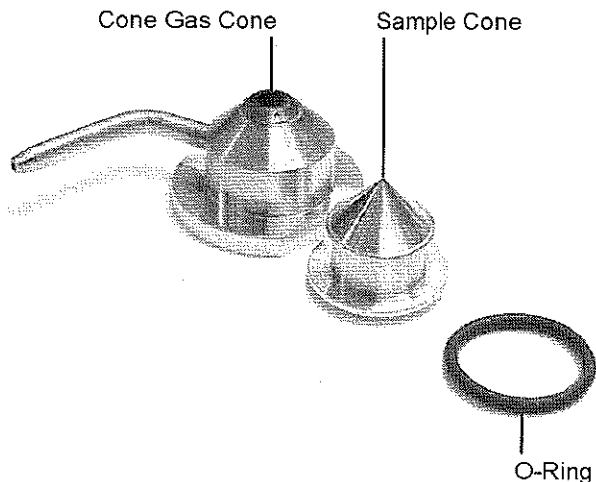


Figure 7-6 Sample Cone/Cone Gas Cone Assembly Components

10. Clean the sample cone and cone gas cone (see Section 7.9.10).

## 7.9.5 Removing the Gas Exhaust Port



**Warning:** The source components may be contaminated with biohazardous and/or toxic materials. Always wear nitrile gloves while performing this procedure.



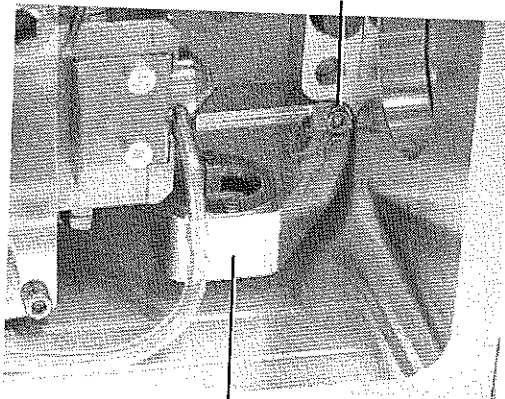
**Warning:** To avoid electric shock, ensure that the instrument is in Standby before commencing this procedure.



**Warning:** The source may be hot. To avoid burns, take great care while performing this procedure.

1. Use a hex (Allen) key to remove the gas exhaust port securing screw.

Gas Exhaust Port Securing Screw

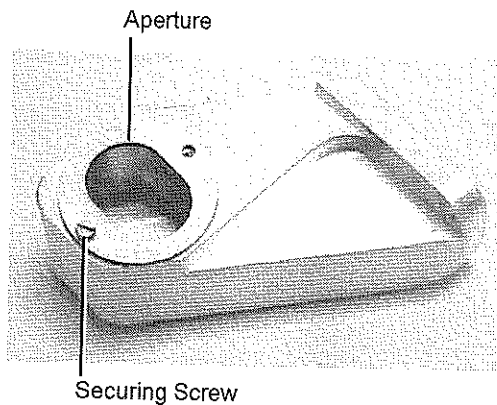


Gas Exhaust Port

2. Remove the gas exhaust port from the source enclosure.



3. Remove the two screws securing the aperture to the gas exhaust port.



4. Remove the aperture from the gas exhaust port.
5. Clean the gas exhaust port (see Section 7.9.11).

### 7.9.6 Removing the Ion Source Enclosure and Ion Block

1. Shut down the instrument (see Section A.2).



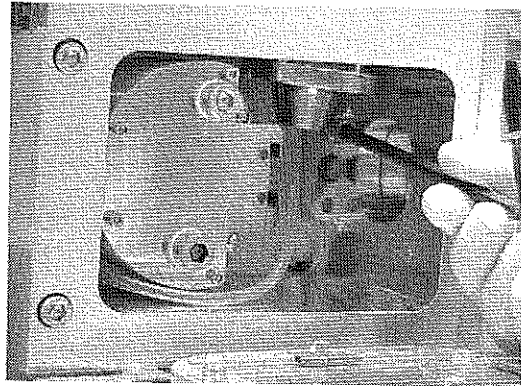
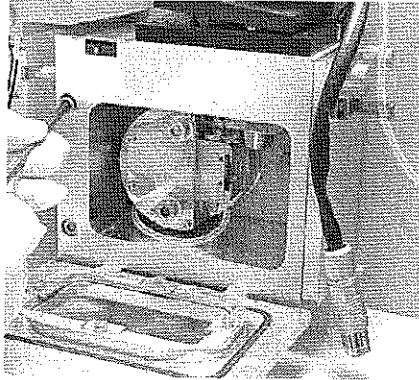
**Warning:** The source may be hot; to avoid burns, allow it to cool down for at least 30 minutes before proceeding.

2. Disconnect the Probe electrical connection at the instrument front panel (see Figure 7-5).
3. Disconnect the PTFE tubing at the Desolvation gas connection on the front panel (see Figure 7-5).



**Warning:** The source components may be contaminated with biohazardous and/or toxic materials. Always wear nitrile gloves while performing this procedure.

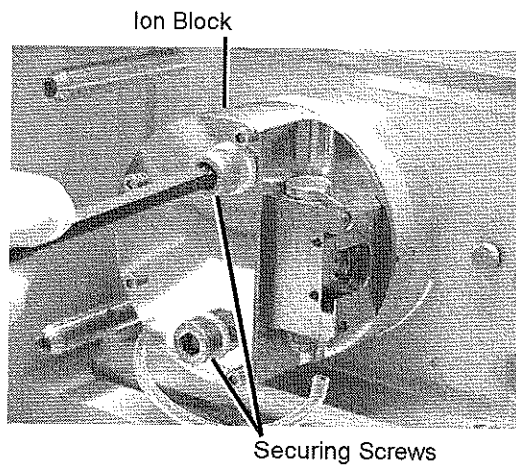
4. Use a hex (Allen) key to loosen the three captive source enclosure securing screws.



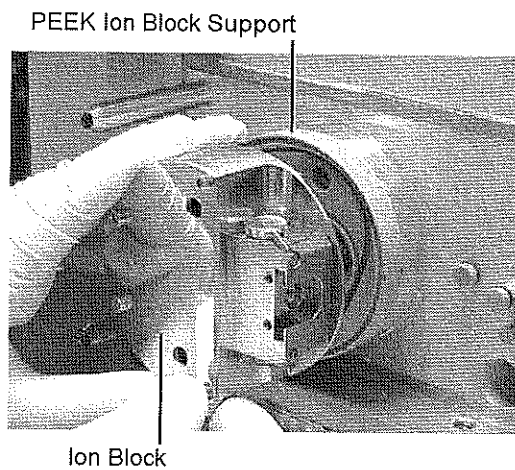
**Caution:** To avoid damage, do not apply any force to the source enclosure door when removing the source enclosure from the instrument's pumping block.

5. Remove the source enclosure from the instrument.

6. Use the 6-mm hex (Allen) key to remove the two ion block securing screws.



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



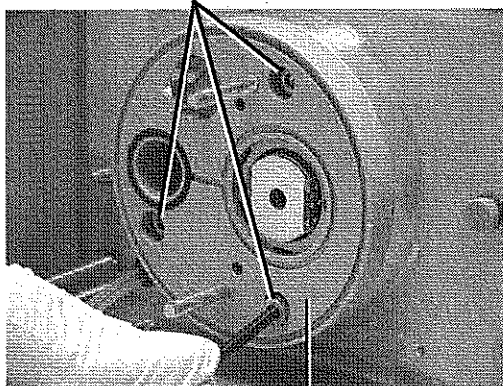
## 7.9.7 Removing the Source T-Wave Assembly from the Instrument



**Warning:** The source components may be contaminated with biohazardous and/or toxic materials. Always wear nitrile gloves while performing this procedure.

1. Use a hex (Allen) key to remove the three PEEK ion block support securing screws.

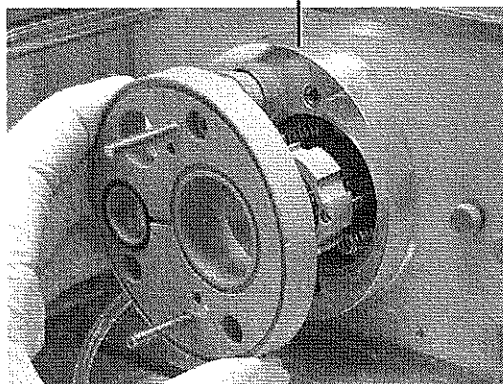
Securing Screws



PEEK Ion Block Support

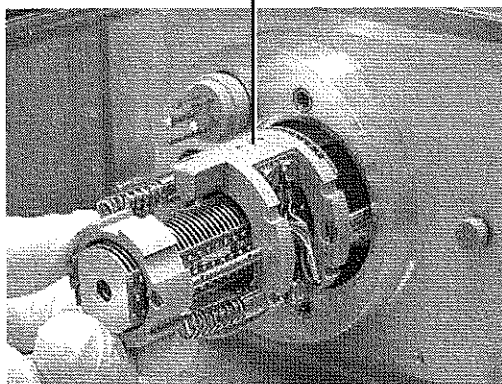
2. Remove the PEEK ion block support from the pumping block.

Pumping Block



- Carefully remove the source T-Wave assembly (see Figure 7-7) from the pumping block.

Source T-Wave Assembly



**Note:** Later versions of the source T-Wave assembly are fitted with PEEK covers over the electrical wiring.

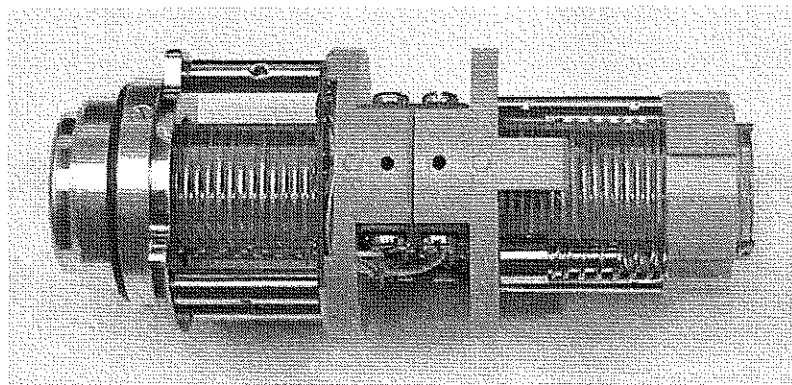


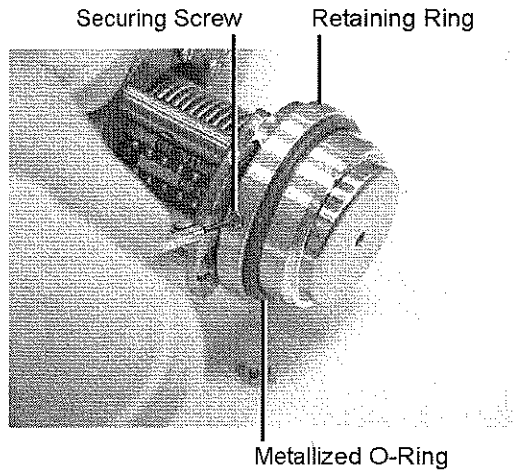
Figure 7-7 Source T-Wave Assembly

## 7.9.8 Disassembling the Source T-Wave Assembly



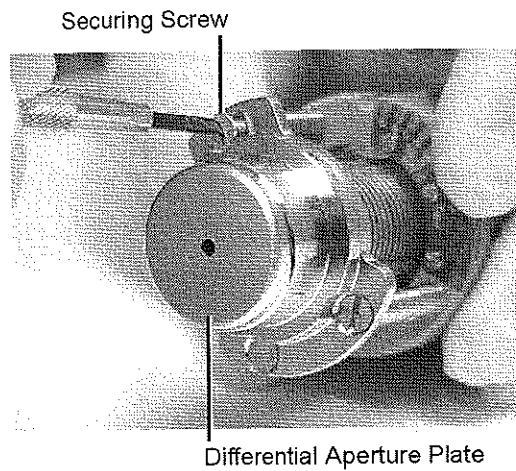
**Warning:** The source T-Wave components may be contaminated with biohazardous and/or toxic materials. Always wear nitrile gloves while performing this procedure.

1. On later versions of the source T-Wave assembly only, remove the PEEK covers after removing the two screws securing the covers to the assembly.
2. Use the jeweller's screwdriver to remove the three screws securing the retaining ring to the source T-Wave assembly.



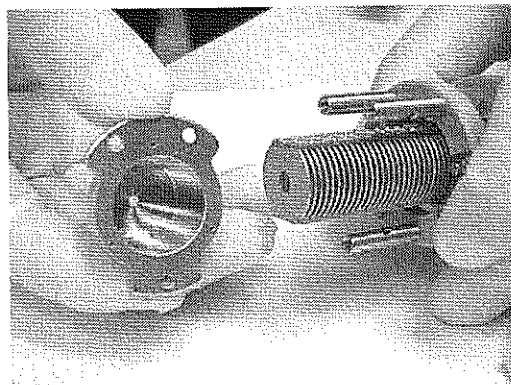
3. Remove the metallized O-ring and retaining ring from the assembly.

4. Remove the three screws securing the differential aperture plate to the assembly.



5. Remove the differential aperture plate from the assembly. The source T-Wave assembly components are shown in Figure 7-8.

**Note:** No further disassembly of the source T-Wave assembly is required.



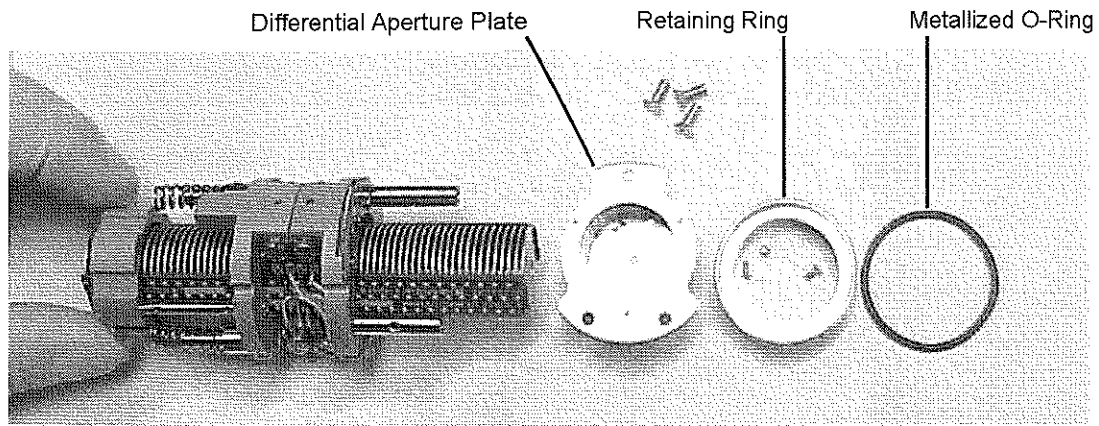


Figure 7-8 Source T-Wave Assembly Components

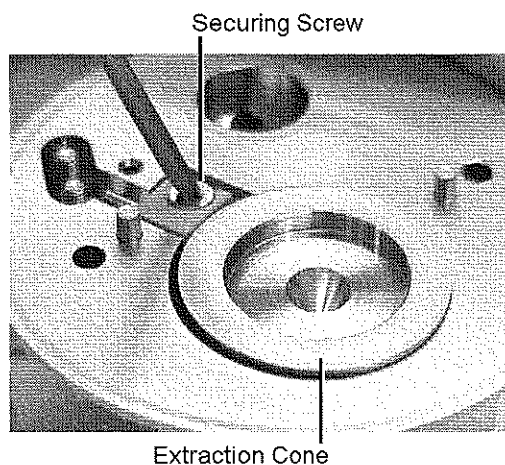
6. Clean the source T-Wave assembly and differential aperture plate (see Section 7.9.12).

### 7.9.9 Disassembling the Source Ion Block



**Warning:** The source ion block components may be contaminated with biohazardous and/or toxic materials. Always wear nitrile gloves while performing this procedure.

1. Remove the extraction cone securing screw.







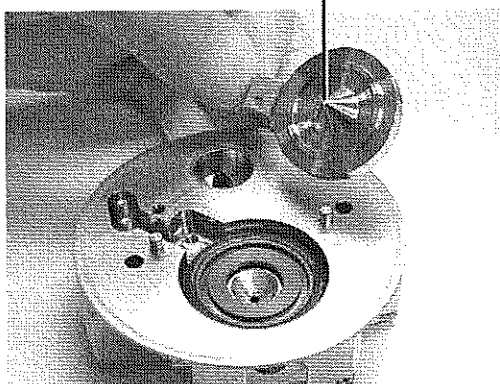
**Caution:** Take great care not to damage the extraction cone aperture when removing the extraction cone from the ion block.



**Caution:** The extraction cone is fragile. To avoid damaging it, never place the extraction cone on its tip, always place it on its flanged base.

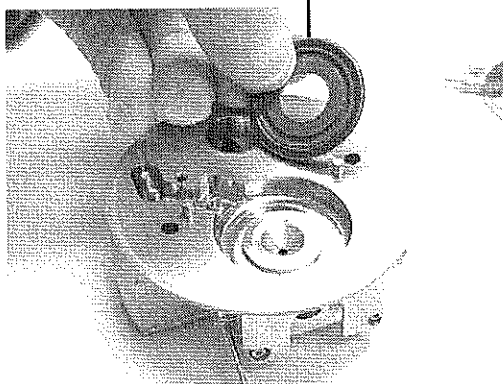
2. Remove the extraction cone from the ion block.

Extraction Cone Aperture

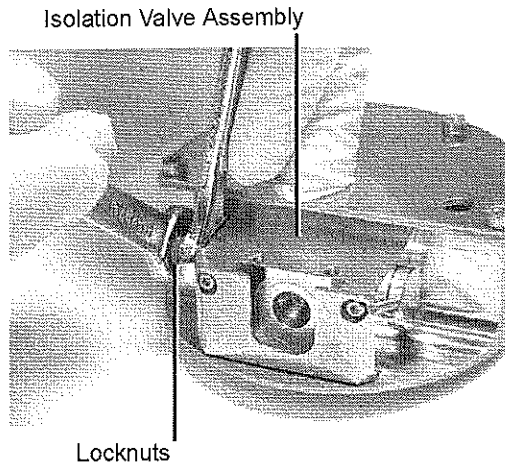


3. Clean the extraction cone (see Section 7.9.13).
4. Remove the extraction cone seal from the ion block.

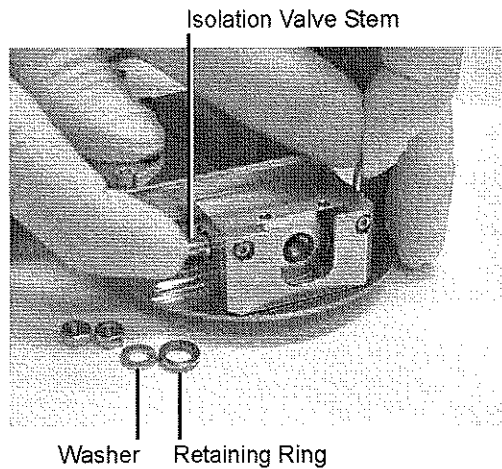
Extraction Cone Seal



5. Remove the two locknuts from the bottom of the isolation valve body.



6. Remove the washer and retaining ring from the isolation valve stem.



7. Remove the isolation valve stem from the isolation valve body (gently push the stem while repeatedly opening and closing the isolation valve).

The isolation valve stem components are shown in Figure 7-9.

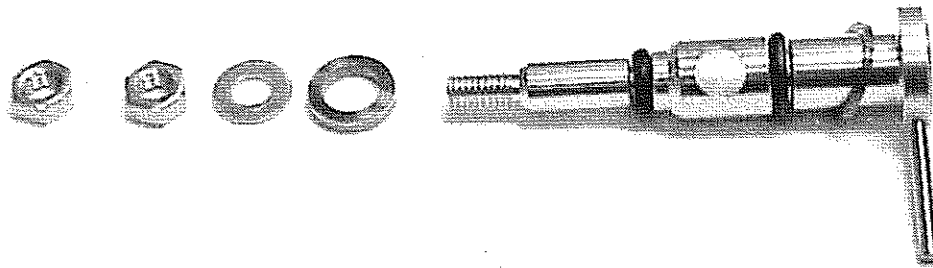
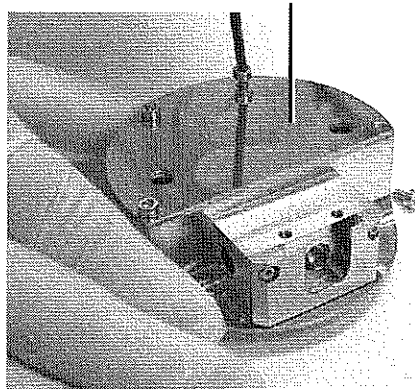


Figure 7-9 Isolation Valve Stem Components

8. Clean the isolation valve stem as described in Section 7.9.14.
9. Use a hex (Allen) key to remove the four ion block cover plate securing screws.

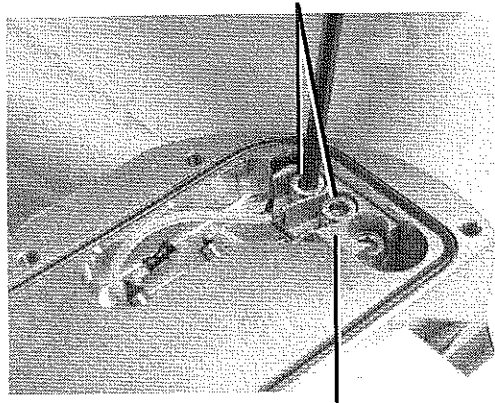
Ion Block Cover Plate



10. Remove the ion block cover plate.

11. Use a hex (Allen) key to remove the two screws securing the heater cartridge wires to the PEEK terminal block.

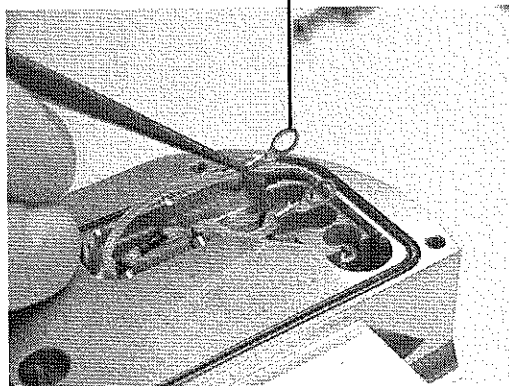
Cartridge Heater Wire  
Securing Screws



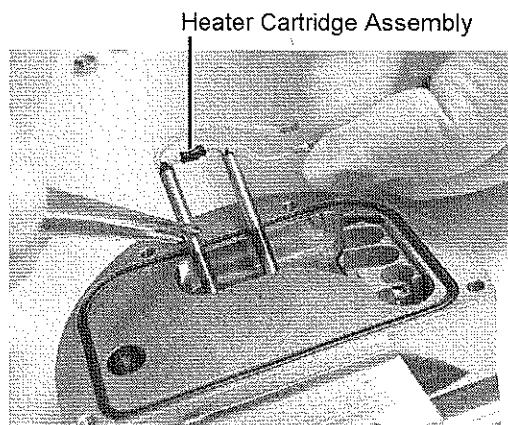
PEEK Terminal Block

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

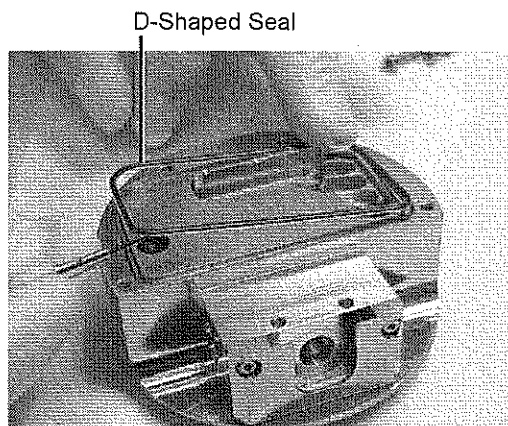
Ring Terminal Tag



13. Use the needle-nose pliers to gently slide the heater cartridge assembly out of the ion block.

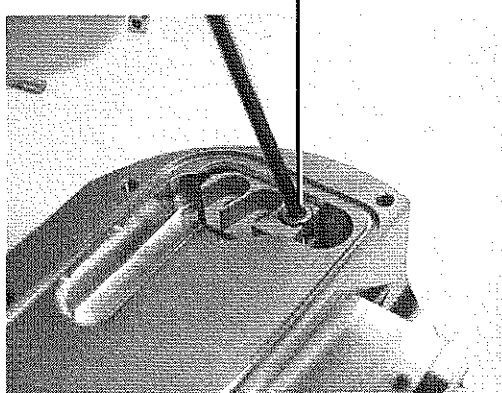


14. Use the jeweller's screwdriver to carefully remove the D-shaped seal from the ion block.

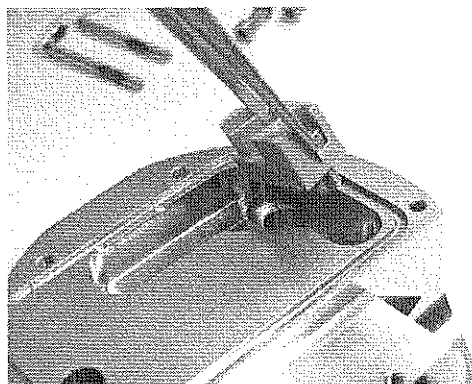


15. Use a hex (Allen) key to remove the PEEK terminal block securing screw.

PEEK Terminal Block Securing Screw

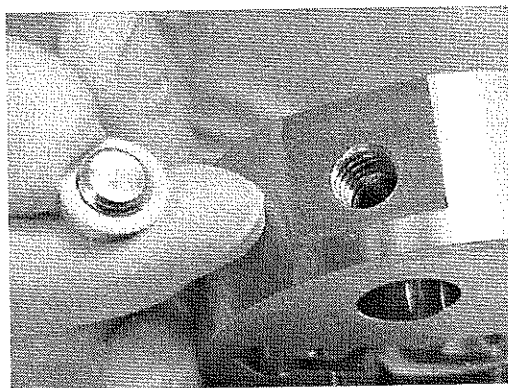
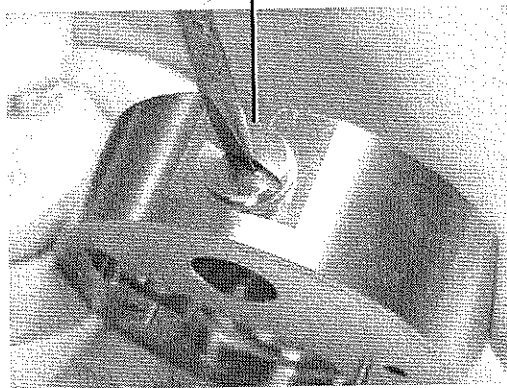


16. Use the needle-nose pliers to remove the PEEK terminal block from the ion block.



17. Use the screwdriver to remove the ion block blanking plug.

Blanking Plug



18. Clean the ion block as described in Section 7.9.13.

19. Reassemble the ion block as described in Section 7.9.15.

## 7.9.10 Cleaning the Sample Cone and Cone Gas Cone



**Warning:** The sample cone and cone gas cone may be contaminated with biohazardous and/or toxic materials. Always wear nitrile gloves while performing this procedure.



**Caution:** The sample cone is fragile. To avoid damaging it, never place the sample cone on its tip; always place it on its flanged base.

1. Use a glass-fiber pen to remove gross contamination from the cone gas cone surface by gentle abrasion.



**Warning:** Use extreme care when working with formic acid. Use a fume hood and appropriate protective equipment.

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

**Note:** If the parts are obviously contaminated, use 45:45:10 methanol/water/formic acid.

4. Place the vessels in the ultrasonic bath for 30 minutes.
5. If formic acid was used in the cleaning solution:
  - a. Rinse the parts by immersing them separately in glass vessels containing water, and placing the vessels in the ultrasonic bath for 20 minutes.
  - b. Displace the water by immersing the parts in separate glass vessels containing methanol, and placing the vessels in the ultrasonic bath for 10 minutes.
6. Carefully remove the parts from the vessels, and blow-dry them with inert, oil-free gas. Alternatively, place the components on lint-free towels, and allow them to air dry. Wipe off any water spots with a lint-free cloth.

## 7.9.11 Cleaning the Gas Exhaust Port



**Warning:** The gas exhaust port may be contaminated with biohazardous and/or toxic materials. Always wear nitrile gloves while performing this procedure.

1. Remove gross contamination from the gas exhaust port and aperture by rinsing them in water.



**Note:** Gentle abrasion, using a glass-fiber pen, may be required to remove solid deposits.

2. Immerse the gas exhaust port and aperture in a glass vessel containing 1:1 methanol/water.
3. Place the vessel in the ultrasonic bath for 30 minutes.
4. Carefully remove the components from the vessel, and blow-dry them using inert, oil-free gas. Alternatively, place the components on lint-free towels, and allow them to air dry. Wipe off any water spots with a lint-free cloth.

### 7.9.12 Cleaning the Source T-Wave Components



**Warning:** The source T-Wave components may be contaminated with biohazardous and/or toxic materials. Always wear nitrile gloves while performing this procedure.

#### Cleaning the Source T-Wave Differential Aperture Plate

1. Use a glass-fiber pen to gently remove ion burn marks, paying particular attention to the inner surfaces of the differential aperture plate.
2. Immerse the differential aperture plate in a glass vessel containing 1:1 methanol/water.
3. Place the vessel in the ultrasonic bath for 30 minutes.
4. Carefully remove the differential aperture plate from the vessel, and blow-dry it using inert, oil-free gas. Alternatively, place the differential aperture plate on lint-free towels, and allow it to air dry. Wipe off any water spots with a lint-free cloth.

#### Cleaning the Source T-Wave Assembly



**Caution:** Use of acetone, chlorinated solvents, or acid as solvents when cleaning the source T-Wave assembly will damage the assembly. Use only methanol or water.



**Caution:** Take great care not to damage the T-Wave assembly's plates when using the wire brush for cleaning.

1. Gently insert the wire brush (provided) into the T-Wave assembly's aperture, and use a rotary motion to clean the plates along the length of the device.

2. Use a glass-fiber pen to remove any burn marks on the assembly's entrance and exit plates.
3. Flush-out the assembly, using methanol from a wash-bottle.
4. Immerse the assembly in a glass vessel containing 1:1 methanol/water.
5. Place the vessel in the ultrasonic bath for 30 minutes.



**Caution:** Do not dry the source T-Wave assembly by any method other than blow drying, otherwise reintroduced contamination may lead to difficulty in pumping down the instrument.

6. Carefully remove the assembly from the vessel, and blow-dry it using inert, oil-free gas.
7. Visually inspect the assembly to confirm that no fibers from the wire brush are lodged in it. If fibers are present, repeat the procedure from step 3 onwards.

### 7.9.13 Cleaning the Ion Block and Extraction Cone



**Warning:** The ion block and extraction cone may be contaminated with biohazardous and/or toxic materials. Always wear nitrile gloves while performing this procedure.



**Warning:** Use extreme care when working with formic acid. Use a fume hood and appropriate protective equipment.



**Caution:** The extraction cone is fragile. To avoid damaging it, never place the extraction cone on its tip.

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

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

2. Place the vessels in the ultrasonic bath for 30 minutes.
3. If formic acid was used in the cleaning solution:
  - a. Rinse the ion block and extraction cone by immersing them separately in glass vessels containing water, and placing the vessels in the ultrasonic bath for 20 minutes.

- b. Displace the water by immersing the ion block and extraction cone separately in glass vessels containing methanol, and placing the vessels in the ultrasonic bath for 10 minutes.
4. Carefully remove the ion block and extraction cone from the vessels, and blow-dry them using inert, oil-free gas. Alternatively, place the components on lint-free towels, and allow them to air dry. Wipe off any water spots with a lint-free cloth.

#### 7.9.14 Cleaning the Isolation Valve Stem



**Warning:** The isolation valve components may be contaminated with biohazardous and/or toxic materials. Always wear nitrile gloves while performing this procedure.

1. Use a glass-fiber pen to remove carbon deposits by gentle abrasion.
2. Rinse the valve stem by placing it in a vessel containing 1:1 methanol/water, and placing the vessel in an ultrasonic bath for 20 minutes.

#### 7.9.15 Reassembling the Source Ion Block

**Note:** Use clean nitrile gloves when reassembling the source components to avoid re-contaminating them.

1. Examine the condition of all O-rings and seals; replace any that are damaged.
2. Fit the ion block blanking plug to the ion block and tighten.
3. Fit the PEEK terminal block to the ion block.
4. Fit and tighten the PEEK terminal block securing screw.
5. Fit the D-shaped seal to the ion block, ensuring that it is correctly seated.
6. Use the needle-nose pliers to slide the new heater cartridges into the ion block.
7. Position the two heater cartridge ring tags onto the PEEK block terminals.
8. Use a hex (Allen) key to fit and tighten the two screws securing the heater cartridge wires to the PEEK terminal block.
9. Fit the ion block cover plate.
10. Fit and tighten the four ion block cover plate securing screws.
11. Fit the isolation valve stem to the isolation valve body.
12. Fit the washer and retaining ring to the bottom of the isolation valve stem.
13. Fit and tighten the two lock nuts to the bottom of the isolation valve stem.
14. Fit the extraction cone seal to the ion block.

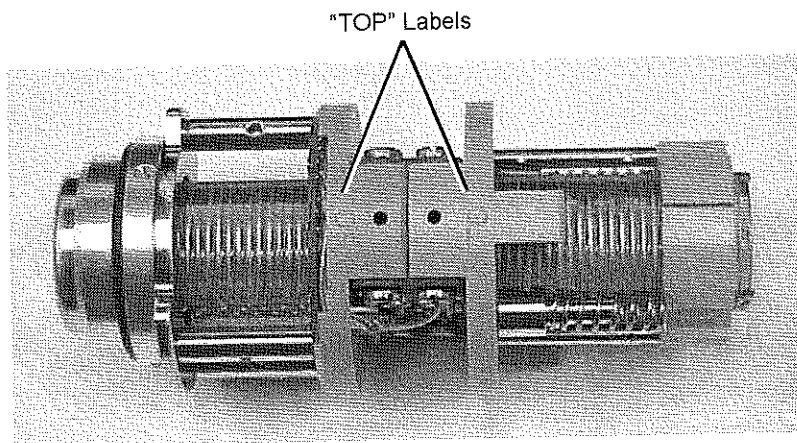
15. Fit the extraction cone to the ion block.
16. Fit and tighten the extraction cone securing screw.

### 7.9.16 Reassembling the Source T-Wave Assembly

1. Fit the differential aperture plate to the source T-Wave assembly.
2. Fit and tighten the three screws that secure the differential aperture plate to the source T-Wave assembly.
3. Fit the retaining ring to the assembly.
4. Check the condition of the metallized O-ring; if it is damaged, replace it.
5. Fit the metallized O-ring to the assembly.
6. Fit and tighten the three screws that secure the retaining ring to the source T-Wave assembly.
7. On later versions of the source T-Wave assembly, fit the PEEK covers to the assembly, then fit and tighten the two screws securing the covers to the assembly.

### 7.9.17 Fitting the Source T-Wave Assembly to the Instrument

1. Ensuring that the "TOP" labels (stamped on the assembly's PEEK supports) are uppermost, carefully slide the source T-Wave assembly into the pumping block.



2. Fit the PEEK ion block support to the pumping block.
3. Fit and tighten the two PEEK ion block support securing screws.

## 7.9.18 Fitting the Ion Block and Ion Source Enclosure



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

1. Check the condition of all O-rings; replace any that are damaged.
2. Ensure that all the O-rings are in position on the ion block.
3. Fit the ion block to the PEEK ion block support.
4. Fit and tighten the two ion block securing screws.
5. Ensure that each of the two source enclosure guide pins is fully tightened into the instrument's pumping block; a suitable lever can be inserted into the hole in each guide pin to achieve this.
6. Ensuring that the wires to the microswitch do not become trapped between the source enclosure and the pumping block (see Figure 7-2), fit the source enclosure to the pumping block.
7. Fit and tighten the three source enclosure securing bolts.

**Note:** The securing bolts must each be sequentially tightened a small amount until they are all fully tight; this ensures that the source enclosure is uniformly seated on the pumping block.

8. Close the source enclosure door and fasten the securing clips (see Figure 7-5).
9. Connect the Probe electrical connection at the instrument's front panel (see Figure 7-5).
10. Connect the PTFE tubing to the Desolvation gas connection at the instrument's front panel (see Figure 7-5).



**Warning:** To avoid possible excessive leakage of solvent into the laboratory atmosphere, if any of the O-rings detailed in Section 7.3 has been replaced, you must perform a pressure test on the source, as described in the Waters Micromass Source Pressure Test Unit Operator's Guide.

11. If any of the O-rings detailed in Section 7.3 has been replaced, perform a pressure test on the source, as described in the *Waters Micromass Source Pressure Test Unit Operator's Guide*.

## 7.9.19 Fitting the Gas Exhaust Port

1. Fit the aperture to the gas exhaust port.
2. Fit and tighten the two aperture retaining screws.
3. Fit the gas exhaust port into the source enclosure.
4. Fit and tighten the gas exhaust port securing screw.

## 7.9.20 Fitting the Sample Cone



**Caution:** *The sample cone is very fragile. To avoid damage, never place the sample cone on its tip; always place it on its flanged base.*

1. Fit the sample cone into the cone gas cone.
2. Check the condition of the sample cone/cone gas cone assembly O-ring; replace it, if it is damaged.
3. Fit the O-ring to the sample cone/cone gas cone assembly.
4. Fit the sample cone/cone gas cone assembly to the side of the isolation valve body.
5. Fit the cone retaining plate.
6. Fit and tighten the two cone retaining plate securing screws.
7. Connect the PTFE tube to the cone gas cone.
8. Open the isolation valve by moving its lever fully to the left.
9. If an APCI probe is to be used, fit the corona discharge pin.
10. Close the source enclosure door and fasten the clips.

## 7.10 Cleaning or Replacing the ESI Probe Tip

---

Clean the ESI probe tip if a blockage occurs in the internal metal sheathing through which the stainless steel capillary passes.

Replace the ESI probe tip if the threads are damaged.

Replace the O-ring if gas leaks from the O-ring.

## 7.10.1 Required Materials

- Nitrile gloves.
- ¼-inch (6-mm) wrench.
- Appropriately-sized glass vessels, in which to completely immerse components when cleaning. Use only glassware not previously cleaned with surfactants.
- HPLC-grade methanol.
- HPLC-grade water.
- Ultrasonic bath.
- Source of oil-free, inert gas (nitrogen or helium) for drying (air-drying optional).

## 7.10.2 Procedure



**Warning:** *The probe and source components may be contaminated with biohazardous and/or toxic materials. Always wear nitrile gloves while performing this procedure.*

1. Remove the probe from the source (see Section 7.9.3).
2. Use the ¼-inch (6-mm) wrench to unscrew and remove the probe tip.
3. If the probe tip is damaged, replace it; alternatively, clean the probe tip as follows:
  - a. Immerse the probe tip in a glass vessel containing 1:1 methanol/water.
  - b. Place the vessel in the ultrasonic bath for 20 minutes.
  - c. Carefully remove the probe tip from the vessel, and blow-dry it using inert, oil-free gas.
4. If necessary, remove the O-ring and fit a new one.
5. Fit and tighten the probe tip to the probe.
6. Adjust the probe tip so that the fully extended capillary (when the probe nebulizer adjuster knob is fully screwed down) protrudes by approximately 1 to 1.5 mm.
7. Fit the probe to the source.

## 7.11 Cleaning or Replacing the Corona Discharge Pin

Clean the corona discharge pin if it appears to be corroded or black, or when the signal intensity weakens.

### 7.11.1 Required Materials

- Nitrile gloves
- Needle-nose pliers
- Lapping film
- HPLC-grade methanol
- Lint-free tissue

### 7.11.2 Procedure



**Warning:** The probe and source components may be contaminated with biohazardous and/or toxic materials. Always wear nitrile gloves while performing this procedure.



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

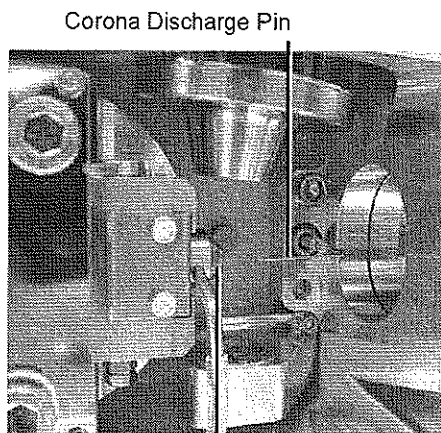


**Warning:** The probe and source may be hot. To avoid burns, take great care while performing this procedure.

1. Remove the probe from the source, as shown in Section 7.9.3.
2. Unfasten the source enclosure door's securing clips, and open the door (see Figure 7-5).
3. Use the needle-nose pliers to remove the corona discharge pin from the source, pulling it straight out.
4. Clean and sharpen the tip of the pin with the lapping film, then wipe it clean with a methanol-saturated tissue. Replace the pin if it is deformed or otherwise damaged.



5. Reinstall the pin with the tip pointing toward the sample cone apex.




Sample Cone Apex

6. Close the source enclosure door, and fasten the clips.
7. Fit the probe.
8. Reconnect the front panel gas and electrical connections.

## 7.12 Cleaning the APCI Probe Tip

---

Clean the APCI probe tip when a buffer build-up is detected on the probe tip, or when the signal intensity weakens.

1. Stop the liquid flow.
2. In the Tune window, click  to start the nitrogen flow.
3. Set Desolvation (L/hr) to approximately 650.
4. Set APCI Probe Temp (°C) to 650.
5. Click Press for Operate, and wait 10 minutes with the APCI probe heater temperature at 650 °C. This will remove any chemical contamination from the probe tip.

## 7.13 Replacing the Ion Block Cartridge Heater

Replace the cartridge heater if it fails to heat.

### 7.13.1 Required Materials

- Nitrile gloves
- Flat-blade screwdriver
- Needle-nose pliers
- Hex (Allen) keys

### 7.13.2 Procedure



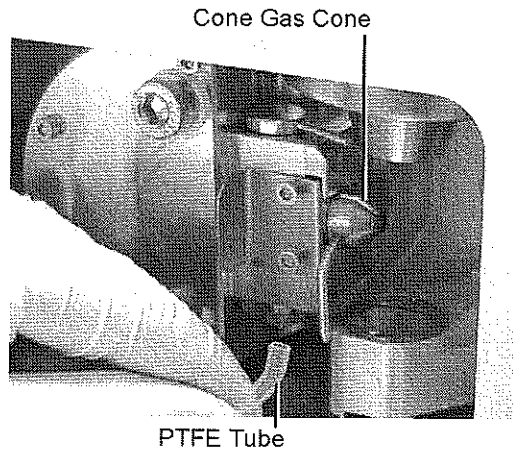
**Warning:** The probe and source components may be contaminated with biohazardous and/or toxic materials. Always wear nitrile gloves while performing this procedure.



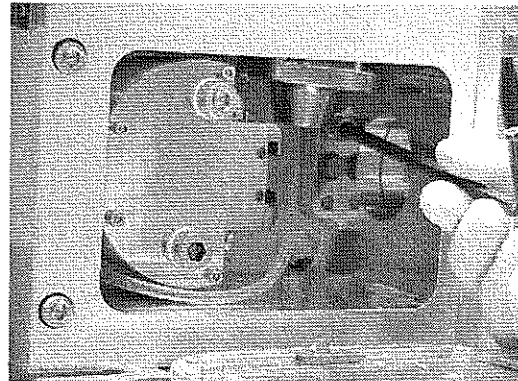
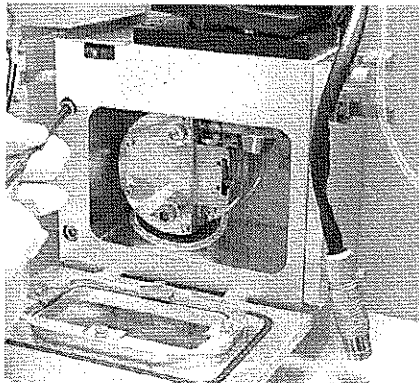
**Warning:** The probe and source may be hot. To avoid burns, take great care while performing this procedure.

1. Follow the procedure for venting the instrument (see Section A.2.3).
2. Remove the probe from the source (see Section 7.9.3).
3. If using an APCI probe, carefully remove the corona discharge pin.

4. Disconnect the PTFE tube from the cone gas cone.



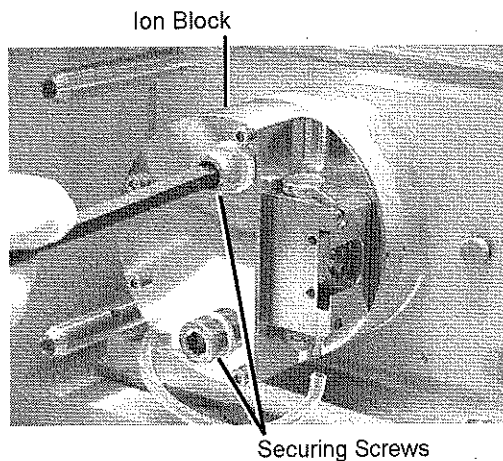
5. Disconnect the Probe electrical connection from the instrument's front panel (see Figure 7-5).
6. Disconnect the PTFE tubing at the Desolvation gas connection from the instrument's front panel (see Figure 7-5).
7. Use a hex (Allen) key to remove the three source enclosure securing bolts.





**Caution:** To avoid damage, do not apply any force to the source enclosure door when removing the source enclosure from the instrument's pumping block.

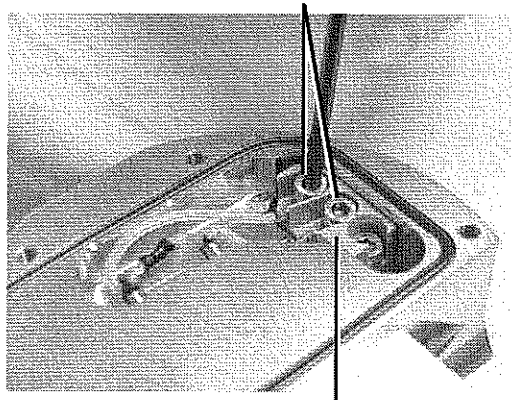
8. Remove the source enclosure from the instrument.
9. Use the 6-mm hex (Allen) key to remove the two ion block securing screws.



10. Remove the ion block from the PEEK ion block support.
11. Use a hex (Allen) key to remove the four ion block cover plate securing screws.
12. Remove the ion block cover plate.

13. Use a hex (Allen) key to remove the two screws securing the heater cartridge wires to the PEEK terminal block.

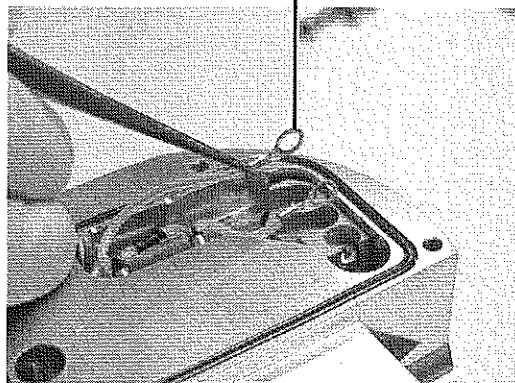
Cartridge Heater Wire  
Securing Screws



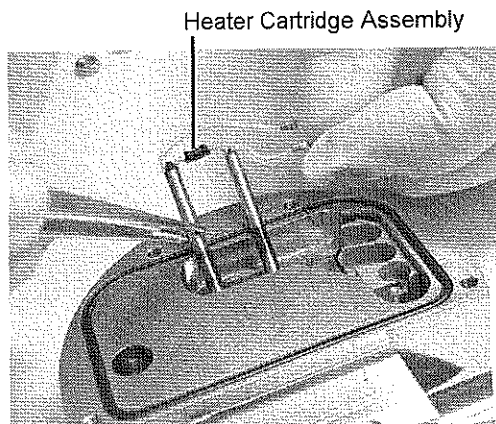
PEEK Terminal Block

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

Ring Terminal Tag



15. Use the needle-nose pliers to gently slide the heater cartridge assembly out of the ion block.



16. Use the needle-nose pliers to slide the new heater cartridges into the ion block.
17. Position the two heater cartridge ring tags onto the PEEK block terminals.
18. Use a hex (Allen) key to fit and tighten the two screws securing the heater cartridge wires to the PEEK terminal block.
19. Fit the ion block cover plate.
20. Fit and tighten the four ion block cover plate securing screws.
21. Check the condition of all O-rings; if any are damaged, replace them.
22. If any of the O-rings detailed in Section 7.3 has been replaced, you must perform a pressure test on the source, as described in the Waters Micromass Source Pressure Test Unit Operator's Guide
23. Ensure that all the O-rings are in position on the ion block.
24. Fit the ion block to the PEEK ion block support.
25. Fit and tighten the two ion block securing screws.
26. Ensure that each of the two source enclosure guide pins is fully tightened into the instrument's pumping block; a suitable lever can be inserted into the hole in each guide pin to achieve this.
27. Ensuring that the wires to the microswitch do not become trapped between the source enclosure and the pumping block (see Figure 7-2), fit the source enclosure to the pumping block.

28. Fit and tighten the three source enclosure securing bolts.

**Note:** *The securing bolts must each be sequentially tightened a small amount until they are all fully tight; this ensures that the source enclosure is uniformly seated on the pumping block.*

29. Close the source enclosure door and fasten the securing clips (see Figure 7-5).
30. Connect the Probe electrical connection at the instrument's front panel (see Figure 7-5).
31. Connect the PTFE tubing to the Desolvation gas connection at the instrument's front panel (see Figure 7-5).



**Warning:** *To avoid possible excessive leakage of solvent into the laboratory atmosphere, if any of the O-rings detailed in Section 7.3 has been replaced, you must perform a pressure test on the source, as described in the Waters Micromass Source Pressure Test Unit Operator's Guide.*

32. If any of the O-rings detailed in Section 7.3 has been replaced, perform a pressure test on the source, as described in the *Waters Micromass Source Pressure Test Unit Operator's Guide*.

## 7.14 Replacing the ESI Probe Sample Capillary

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

### 7.14.1 Required Materials

- 7-mm wrench
- ¼-inch (6-mm) wrench
- 5/16-inch wrench
- Needle-nose pliers
- Hex (Allen) key

## 7.14.2 Removing the Existing Capillary



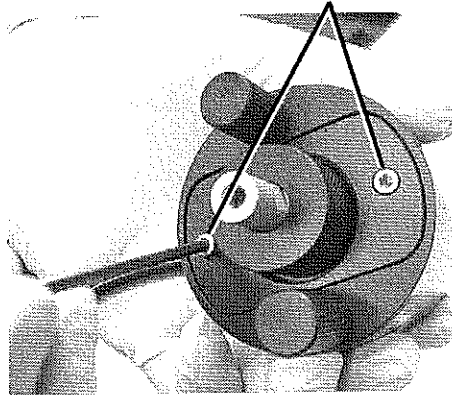
**Warning:** The probe and source components may be contaminated with biohazardous and/or toxic materials. Always wear nitrile gloves while performing this procedure.



**Warning:** The probe and source may be hot. To avoid burns, take great care while performing this procedure.

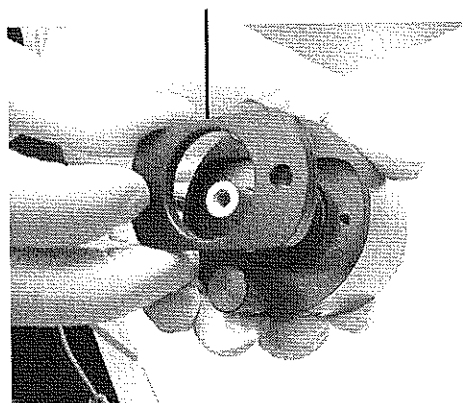
1. Follow the procedure in Section 7.9.3 to remove the probe from the source.
2. Use the hex (Allen) key to remove the two probe end-cover retaining screws.

End-cover Retaining Screws



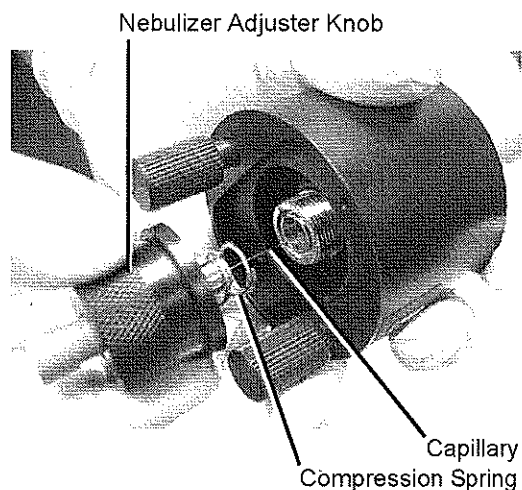
3. Remove the end-cover.

End-cover

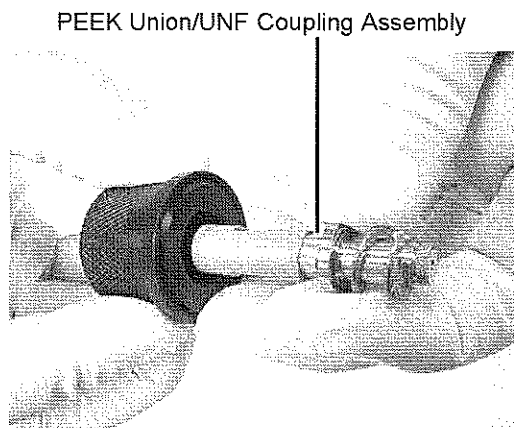




4. Unscrew and remove the nebulizer adjuster knob to reveal a PEEK union/UNF coupling assembly, compression spring, and the capillary.

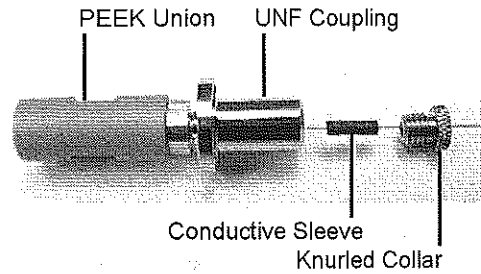


5. Remove the nebulizer adjuster knob, PEEK union/UNF coupling assembly, compression spring, and capillary from the probe.
6. Remove the PEEK union/UNF coupling assembly, compression spring, and capillary from the nebulizer adjuster knob.

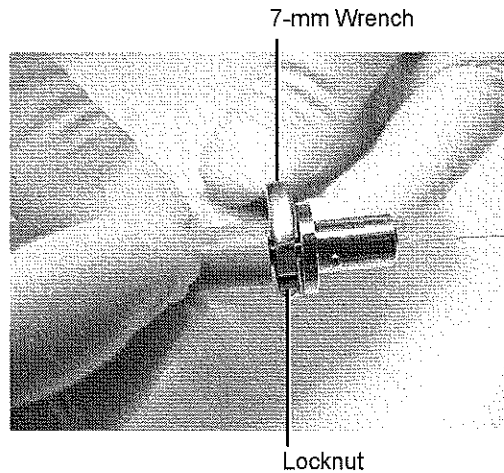


7. Remove the compression spring from the PEEK union/UNF coupling assembly and capillary.

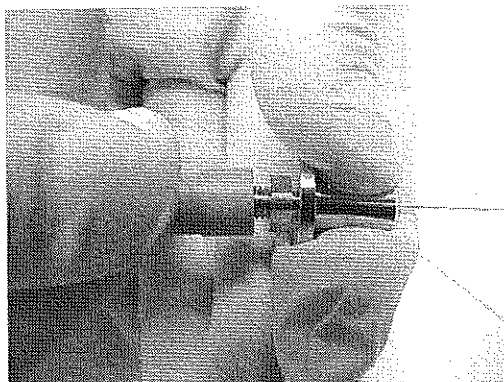
8. Unscrew and remove the knurled collar from the UNF coupling to reveal a conductive sleeve on the capillary.



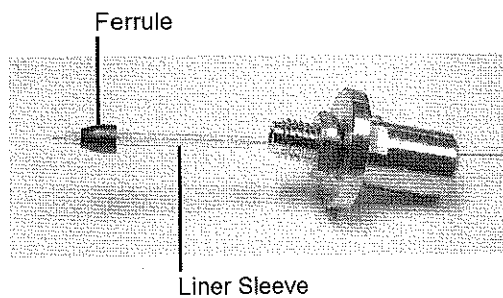
9. Remove the knurled collar and conductive sleeve from the capillary.
10. A locknut is used to secure the PEEK union and UNF coupling. Use the 7-mm wrench to loosen the locknut.



11. Unscrew the PEEK union from the UNF coupling (this connection is finger-tight only).



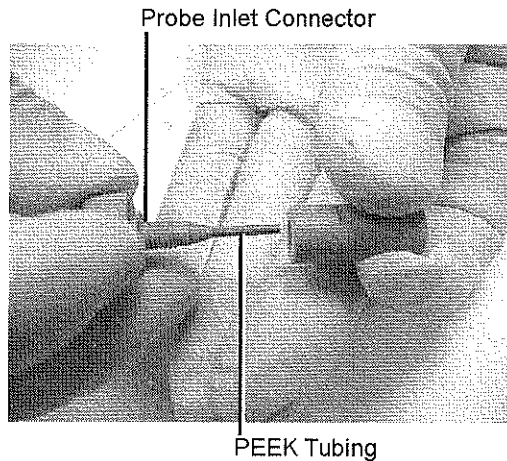
This reveals a ferrule and liner sleeve:



12. Remove the ferrule and liner sleeve from the capillary.
13. Remove the capillary from the UNF coupling.

### 7.14.3 Installing the New Capillary

1. Insert a square-cut length of red PEEK tubing in the probe inlet connector, and screw the connector, finger-tight, into the PEEK union. This ensures a minimum dead volume when fitting the capillary.

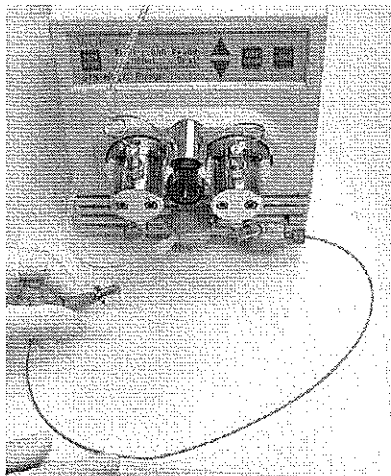


2. Fit the UNF coupling to the new capillary.
3. Use the needle-nose pliers to slide a new liner sleeve and ferrule onto the capillary.
4. Insert the capillary in the PEEK union, and ensure that it is fully seated.
5. Screw the UNF coupling into the PEEK union, finger-tight only.
6. Pull on the capillary gently, testing to ensure that it stays in place.
7. Use the 7-mm wrench to tighten the locknut against the PEEK union until the union can no longer be twisted.
8. Slide a new conductive sleeve and the knurled collar over the capillary.
9. Tighten the knurled collar to the UNF coupling.

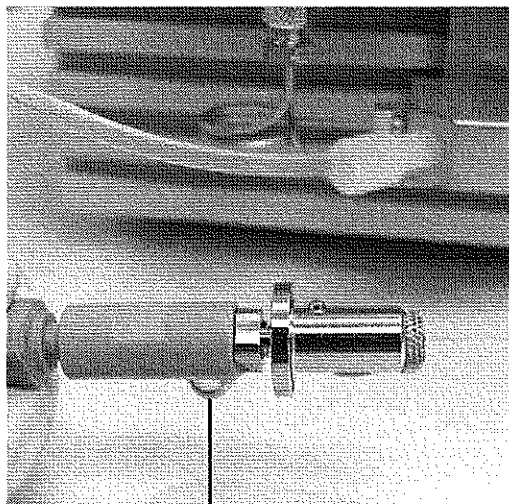


**Warning:** To avoid high-pressure liquid jet spray, wear safety goggles when performing the leak test.

10. Check for leaks in the assembly by attaching the free end of the PEEK tubing to an LC pump and pumping 50:50 acetonitrile/water through it, at 1 mL/min.

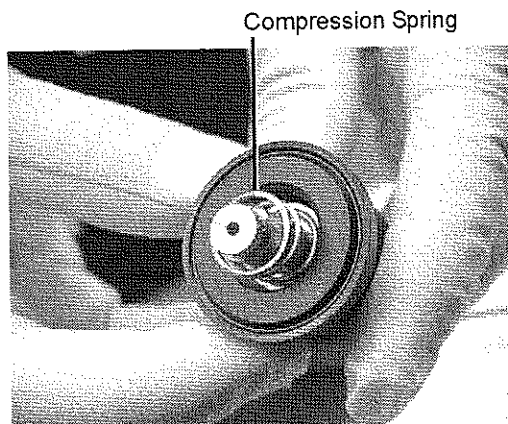


If leakage occurs, disassemble and remake the connection, and repeat the leak test.

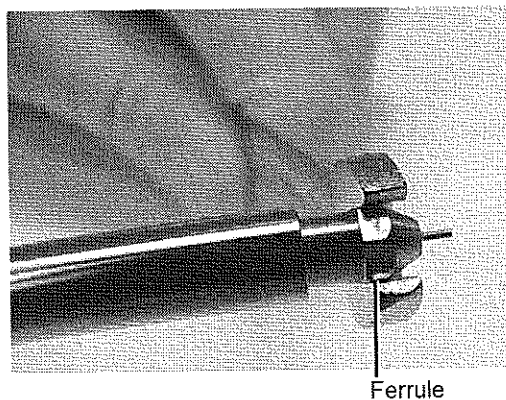


Leaking Liquid

11. When performing the leak test, check the backpressure on the LC pump, which will be high if the capillary is blocked. If this is the case, replace the capillary.
12. When the leak test has been performed successfully, disconnect the PEEK tubing from the LC pump.
13. Remove the probe inlet connector and PEEK tubing from the PEEK union.
14. Fit the PEEK union/UNF coupling assembly to the nebulizer adjuster knob.
15. Fit the compression spring to the capillary and PEEK union/UNF coupling assembly.



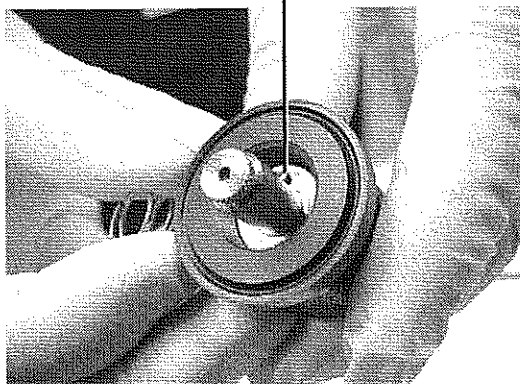
16. Use the 1/4-inch (6-mm) wrench to remove the probe tip from the probe.



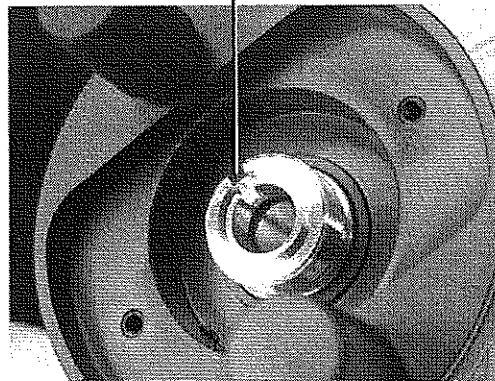
17. Carefully thread the capillary through the probe assembly.

18. Depress the PEEK union so that the locating pin on the UNF coupling is fully engaged in the locating slot at the head of the probe assembly. When the union is fully depressed, tighten the nebulizer adjuster knob. Do not tighten the knob fully.

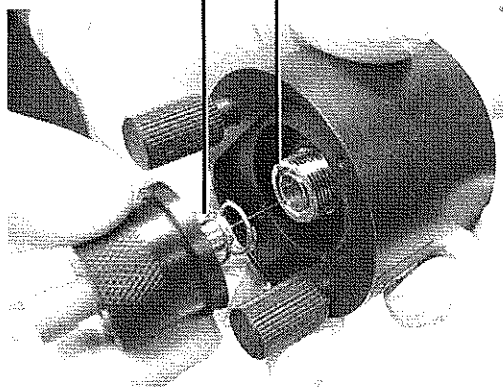
Locating Pin  
(compression spring removed for clarity)



Locating Slot

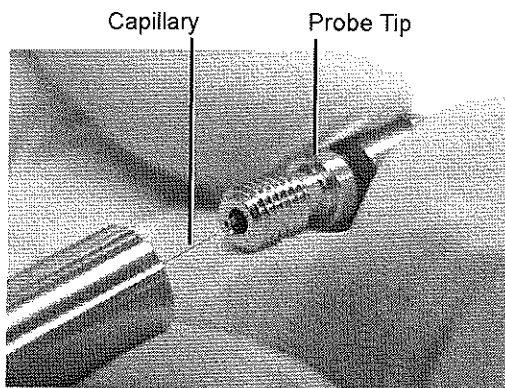



Locating Pin      Locating Slot



19. Fit the probe end-cover to the probe assembly.  
20. Fit and tighten the two end-cover securing screws.

21. Fit the probe tip over the capillary, and screw the tip onto the probe assembly.



22. If necessary, adjust the probe tip so that the fully extended capillary (when the nebulizer adjuster knob is fully screwed down) protrudes by approximately 1 to 1.5 mm.
23. Use the nebulizer adjuster knob to adjust the capillary so that the capillary protrudes by approximately 0.5 mm from the end of the probe.
24. Attach the nebulizer gas connection, and start the nitrogen flow by clicking  in the MassLynx Tune window.
25. Check the probe tip for nitrogen leaks. If a leak is found, replace the probe tip assembly and its O-ring (see Section 7.10).
26. Fit the probe to the instrument.

## 7.15 Replacing the APCI Probe Sample Capillary

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

### 7.15.1 Required Materials

- 7-mm wrench
- ¼-inch (6-mm) wrench
- 5/16-inch wrench
- Needle-nose pliers



- Jeweller's screwdriver
- Hex (Allen) key

## 7.15.2 Removing the Existing Capillary

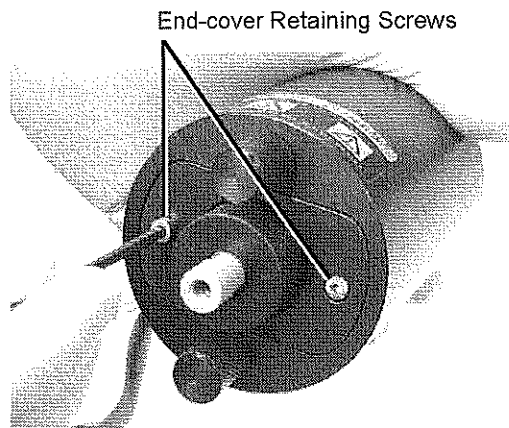


**Warning:** The probe and source components may be contaminated with biohazardous and/or toxic materials. Always wear nitrile gloves while performing this procedure.

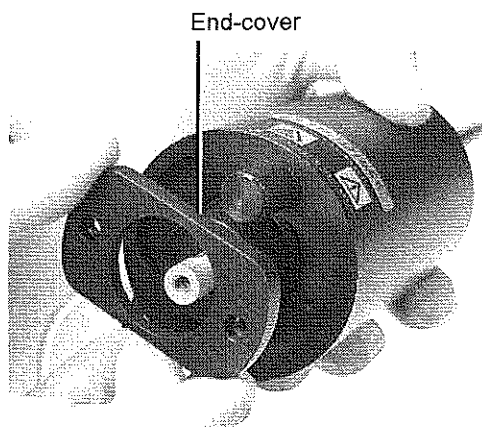


**Warning:** The probe and source may be hot. To avoid burns, take great care while performing this procedure.

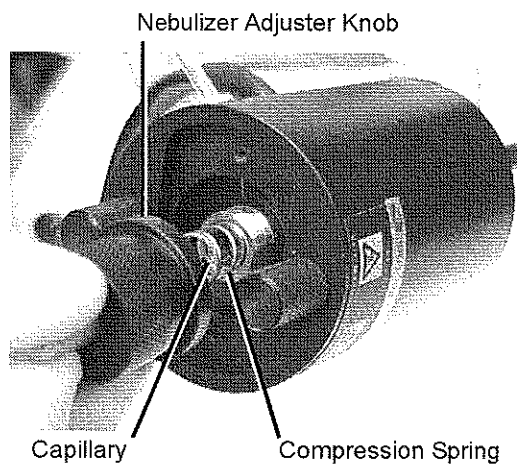
1. Follow the procedure detailed in Section 7.9.3, to remove the probe from the source.
2. Use the hex (Allen) key to remove the two probe end-cover retaining screws.



3. Remove the end-cover.



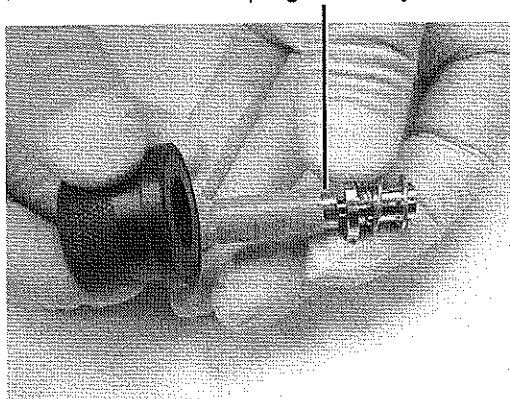
4. Unscrew and remove the nebulizer adjuster knob to reveal a PEEK union/UNF coupling assembly, compression spring, and the capillary.



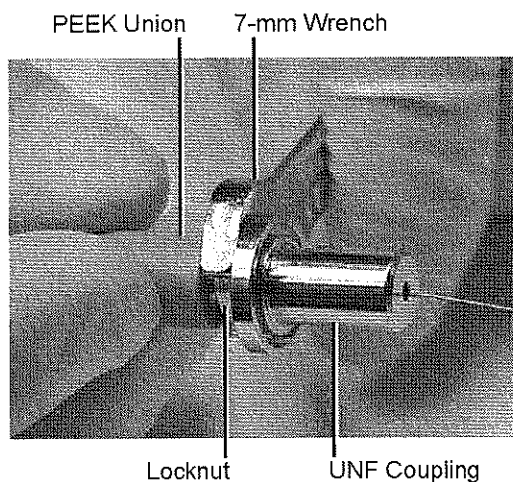
5. Remove the nebulizer adjuster knob, PEEK union/UNF coupling assembly, compression spring, and capillary from the probe.

6. Remove the PEEK union/UNF coupling assembly, compression spring, and capillary from the nebulizer adjuster knob.

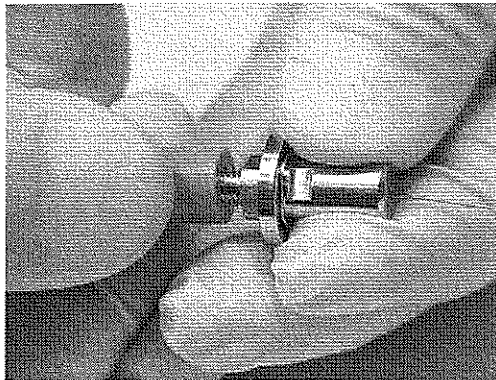
PEEK Union/UNF Coupling Assembly



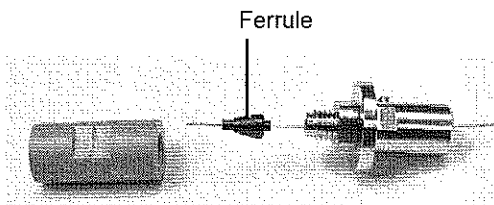
7. Remove the compression spring from the PEEK union/UNF coupling assembly and capillary.
8. A locknut is used to secure the PEEK union and UNF coupling. Use the 7-mm wrench to loosen the locknut.



9. Unscrew the PEEK union from the UNF coupling (this connection is finger-tight only).



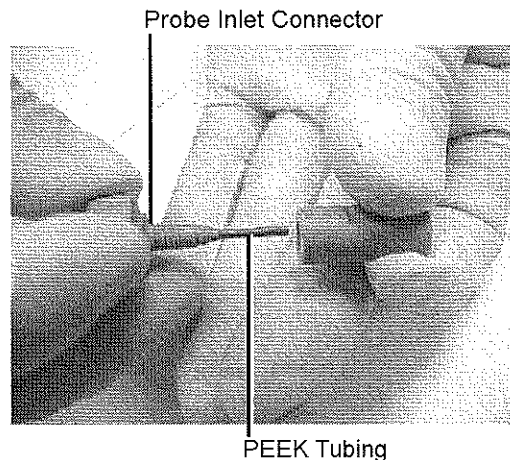
This reveals a ferrule.



10. Remove the ferrule from the capillary.
11. Remove the capillary from the UNF coupling.

### 7.15.3 Installing the New Capillary

1. Insert a square-cut length of red PEEK tubing in the probe inlet connector, and screw the connector, finger-tight, into the PEEK union. This ensures a minimum dead volume when fitting the capillary.

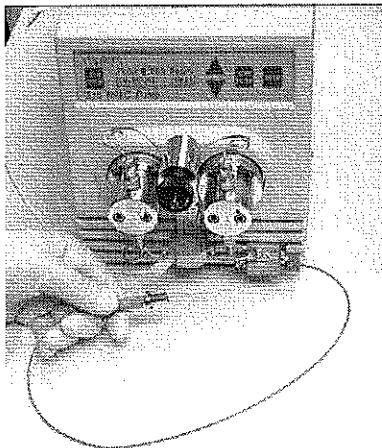


2. Fit the UNF coupling to the new capillary.
3. Use the needle-nose pliers to slide a new ferrule onto the capillary.
4. Insert the capillary in the PEEK union, and ensure that it is fully seated.
5. Screw the UNF coupling into the PEEK union, finger-tight only.
6. Pull on the capillary gently, testing to ensure that it stays in place.
7. Use the 7-mm wrench to tighten the locknut against the PEEK union.

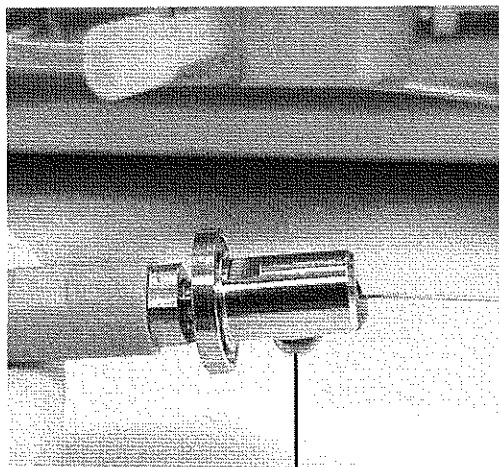


**Warning:** To avoid high-pressure liquid jet spray, wear safety goggles when performing the leak test.

8. Check for leaks in the assembly by attaching the free end of the PEEK tubing to an LC pump and pumping 50:50 acetonitrile/water through, at 1 mL/min.

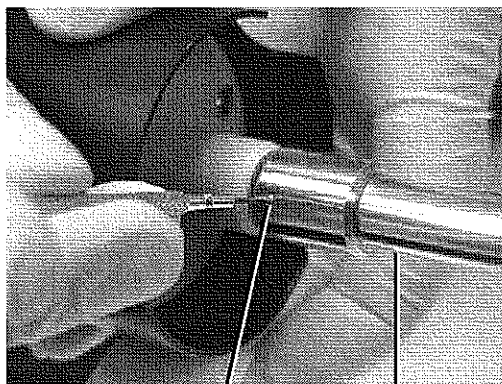


If leakage occurs, disassemble and remake the connection, and repeat the leak test.



Leaking Liquid

9. When performing the leak test, check the LC pump's backpressure, which will be high if the capillary is blocked. If this is the case, replace the capillary.
10. When the leak test has been performed successfully, disconnect the PEEK tubing from the LC pump.
11. Remove the probe inlet connector and PEEK tubing from the PEEK union.
12. Use the jeweller's screwdriver to loosen the two set screws securing the probe heater cover to the probe.



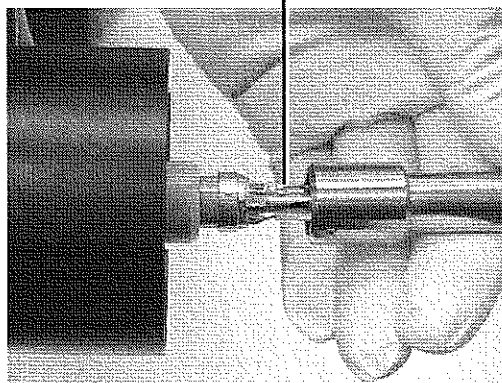
Set Screw      Probe Heater Cover



**Caution:** Take great care not to damage the probe heater's electrical wiring when removing the probe heater cover, or while the probe heater is exposed.

13. Carefully pull the probe heater cover off the probe, revealing the probe heater.

Probe Heater Electrical Wiring





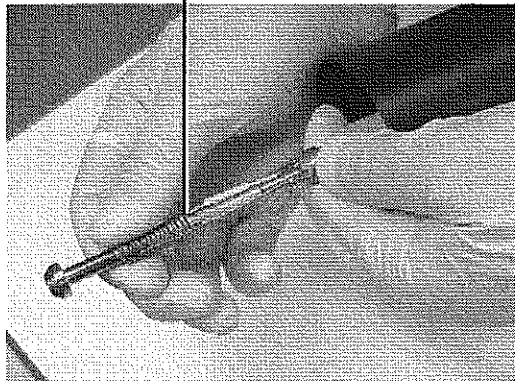
**Caution:** When handling the probe heater, take great care to grip the heater so as not to damage its electrical wiring.



**Caution:** To avoid damaging the electrical connections to the probe heater, do not twist the heater when removing it from the probe assembly.

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

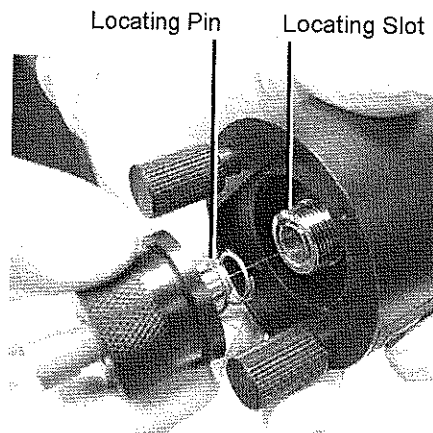
Probe Heater



15. Fit the PEEK union/UNF coupling assembly to the nebulizer adjuster knob.
16. Fit the compression spring to the capillary and PEEK union/UNF coupling assembly.
17. Carefully thread the capillary through the probe assembly.



18. Depress the PEEK union so that the locating pin on the UNF coupling is fully engaged in the locating slot at the head of the probe assembly. When the union is fully depressed, tighten the nebulizer adjuster knob. Do not tighten the knob fully.



19. Fit the probe end-cover to the probe assembly.  
20. Fit and tighten the two end-cover securing screws.

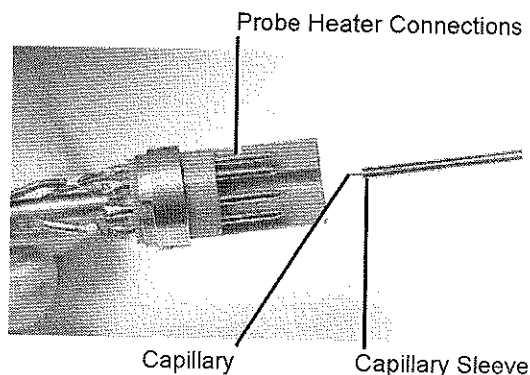


**Caution:** When handling the probe heater, take great care to grip the heater so as not to damage its electrical wiring.



**Caution:** Take great care not to damage the probe heater's electrical connections, capillary sleeve, or capillary when fitting the heater over the capillary sleeve.

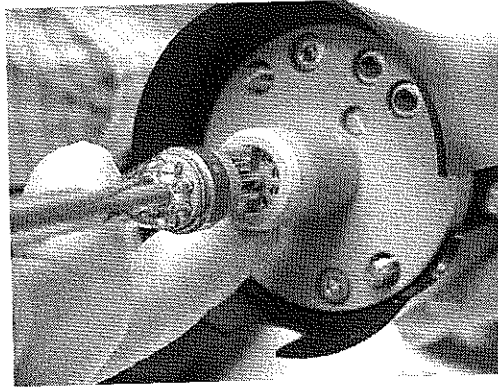
21. Carefully slide the probe heater over the capillary sleeve on the probe assembly.





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

22. Fit the probe heater to the probe assembly, ensuring that the heater is fully seated on the probe assembly.



23. Fit the probe heater cover to the probe assembly.
24. Use the jeweller's screwdriver to tighten the two set screws securing the probe heater cover to the probe.
25. Use the nebulizer adjuster knob to adjust the capillary so that the capillary protrudes by approximately 0.5 mm from the end of the probe.
26. Fit the probe to the instrument.

## 7.16 Replacing the APCI Probe Heater

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Replace the APCI probe heater if it fails to heat.

### 7.16.1 Required Materials

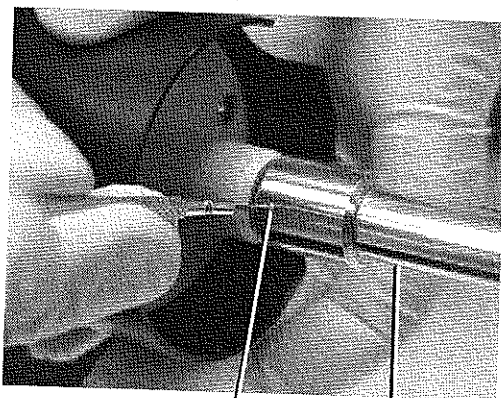
Jeweller's screwdriver

## 7.16.2 Procedure



**Warning:** The probe may be contaminated with biohazardous and/or toxic materials. Always wear nitrile gloves while performing this procedure.

1. Use the jeweller's screwdriver to loosen the two set screws securing the probe heater cover to the probe.



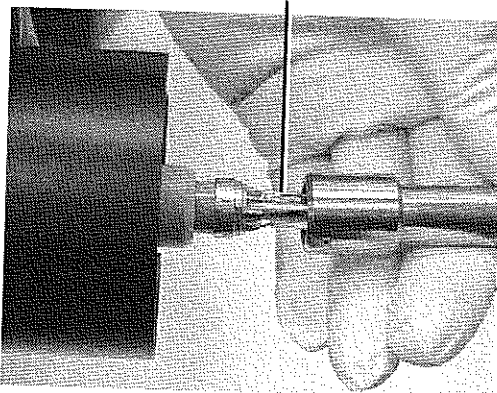
Set Screw      Probe Heater Cover



**Caution:** Take great care not to damage the probe heater's electrical wiring when removing the probe heater cover, or while the probe heater is exposed.

2. Carefully pull the probe heater cover off the probe, revealing the probe heater.

Probe Heater Electrical Wiring





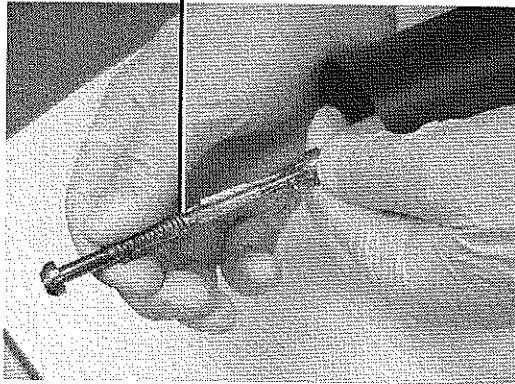
**Caution:** When handling the probe heater, take great care to grip the heater so as not to damage its electrical wiring.



**Caution:** To avoid damaging the electrical connections to the probe heater, do not twist the heater when removing it from the probe assembly.

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

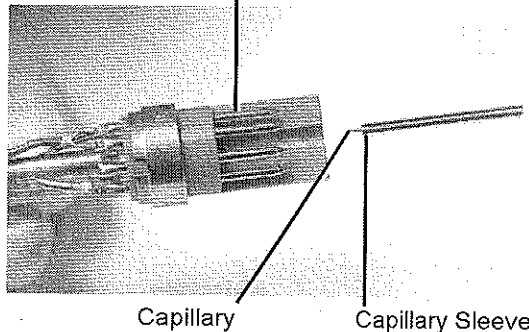
Probe Heater



**Caution:** Take great care not to damage the probe heater's electrical connections, capillary sleeve, or capillary when fitting the heater over the capillary sleeve.

4. Carefully slide the new probe heater over the capillary sleeve on the probe assembly.

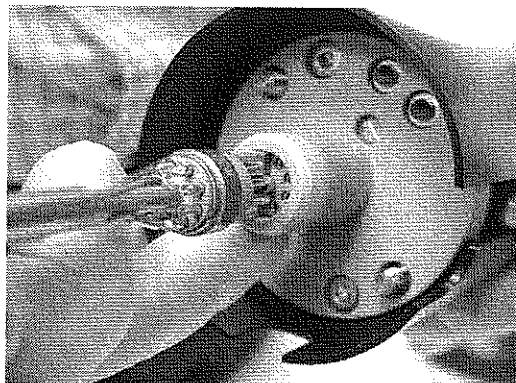
Probe Heater Connections





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

5. Fit the probe heater to the probe assembly, ensuring that the heater is fully seated on the probe assembly.



6. Fit the probe heater cover to the probe assembly.
7. Use the jeweller's screwdriver to tighten the two set screws securing the probe heater cover to the probe.
8. Use the nebulizer adjuster knob to adjust the capillary so that the capillary protrudes by approximately 0.5 mm from the end of the probe.
9. Fit the probe to the instrument.