Agilent 7890A
Gas Chromatograph

Maintaining Your GC
Notices

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Safety Notices

CAUTION

A CAUTION 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 damage to the product or loss of important data. Do not proceed beyond a CAUTION notice until the indicated conditions are fully understood and met.

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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This section provides an overview of the maintenance procedures included in this document. It also lists the tools needed for routine maintenance and the safety information one should be aware of before performing a maintenance task.
Overview of Maintenance

This manual details the routine tasks needed to maintain the 7890A Gas Chromatograph (GC). The procedures assume a basic knowledge of tool use and of GC operation. Readers are, for example, expected to know how to:

- Safely turn devices on and off
- Load methods
- Change component temperatures, flows, and pressures
- Make typical pneumatic connections using Swagelok and other standard fittings
- Reset GC service counters

Where to find a procedure

Included in this manual are chapters on maintaining the following GC components:

- Capillary Columns
- Split/Splitless Inlet
- Purged Packed Inlet
- COC Inlet
- Multimode Inlet
- PTV Inlet
- Volatiles Inlet (VI)
- FID
- TCD
- uECD
- NPD
- FPD
- Auxiliary EPC
- PCM
- Valves

Each chapter includes:

- A list of the most commonly used consumables and parts for the component
- An exploded parts view of the component
Detailed procedures for routine maintenance tasks associated with the component

**Early Maintenance Feedback feature**

Both the GC and Agilent Instrument Utilities software include the capability to alert users of upcoming maintenance needs. This feature, called Early Maintenance Feedback, notifies users when a counter (such as a septum counter, liner counter, jet cleaning counter, injection counter, or uECD wipe test counter) has reached the specified maintenance point. After performing the required maintenance, reset the applicable counter to resume using the Early Maintenance Feedback feature. Refer to the Instrument Utilities help and the Advanced User Guide for more information.
Tools and Materials Required for Maintenance

Table 1 lists the tools needed for most GC maintenance procedures. The specific tools required to perform a maintenance procedure are listed in step 1 of the procedure.

Table 1  Tools and materials for GC maintenance

<table>
<thead>
<tr>
<th>Common tools</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Wrench, angled, septum nut (19251-00100)*</td>
<td></td>
</tr>
<tr>
<td>Wrench, open-end, 1/4-inch and 5/16-inch (8710-0510)*</td>
<td></td>
</tr>
<tr>
<td>Wrench, open-end, 9/16-inch and 7/16-inch (8710-0803)*</td>
<td></td>
</tr>
<tr>
<td>Wrench, capillary inlet (G3452-20512)*</td>
<td></td>
</tr>
<tr>
<td>Flathead screwdriver</td>
<td></td>
</tr>
<tr>
<td>Column cutter, wafer (5181-8836, 4/pk)*</td>
<td></td>
</tr>
<tr>
<td>Driver, nut, 1/4-inch (8710-1561)*</td>
<td></td>
</tr>
<tr>
<td>T-20 Torx key (8710-1807) or screwdriver*</td>
<td></td>
</tr>
<tr>
<td>T-10 Torx key (8710-2140) or screwdriver*</td>
<td></td>
</tr>
<tr>
<td>3-mm hex key wrench (8710-2411)</td>
<td></td>
</tr>
<tr>
<td>Electronic flow meter(s) or bubble meter(s) capable of calibrated measurements at 1, 10, and 100 mL/min flow ranges.</td>
<td></td>
</tr>
<tr>
<td>Electronic leak detector</td>
<td></td>
</tr>
<tr>
<td>Magnifying loupe, 20X (430-1020)</td>
<td></td>
</tr>
<tr>
<td>Metric ruler</td>
<td></td>
</tr>
<tr>
<td>Bench vise (for setting Swagelok fittings)</td>
<td></td>
</tr>
<tr>
<td>Razor or sharp knife</td>
<td></td>
</tr>
<tr>
<td>Tweezers (8710-0007) or thin needle-nose pliers (8710-0004)</td>
<td></td>
</tr>
<tr>
<td>Needle-nose pliers</td>
<td></td>
</tr>
<tr>
<td>ESD wrist strap (for installing new components)</td>
<td></td>
</tr>
<tr>
<td>Gloves, heat-resistant (for handling hot parts)</td>
<td></td>
</tr>
<tr>
<td>Wooden cotton swab (for removing FID filters)</td>
<td></td>
</tr>
</tbody>
</table>

Tools and materials for cleaning procedures

Cleaning brushes—The FID cleaning kit (9301-0985) contains appropriate brushes for cleaning detectors and inlets

Cleaning brushes—(8710-1346) For cleaning split/splitless inlet split vent fitting, FID and collectors
### Table 1  Tools and materials for GC maintenance (continued)

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jet cleaning wire (.010 inch)</td>
<td></td>
</tr>
<tr>
<td>Clean, lint-free cloth (to protect contamination-sensitive detector parts)</td>
<td></td>
</tr>
<tr>
<td>Small ultrasonic cleaning bath with aqueous detergent (for cleaning detector and inlet parts)</td>
<td></td>
</tr>
<tr>
<td>Gloves, clean, lint-free, nylon (large: 8650-0030, small: 8650-0029) (for handling contamination-sensitive parts)</td>
<td></td>
</tr>
<tr>
<td>Steel wool, 0- or 00-grade (for cleaning an inlet’s septum seating surfaces)</td>
<td></td>
</tr>
</tbody>
</table>

* Included with the GC ship kits
Maintenance Methods for the 7890A GC

Before most maintenance procedures, the GC must be made ready. Agilent recommends that you create and store the following maintenance methods into the GC. The methods below will:

- Prevent damage to the instrument (electronics, columns, etc.)
- Avoid injury to the user (burns, shocks, etc.)
- Allow you to perform maintenance on specific areas while leaving the rest of the GC components at operating temperature

**NOTE**

Inlets and detectors at operating temperature may require 12 hours or longer to reach the maintenance method setpoints below.

For information regarding programming, saving, and loading methods, refer to the 7890A Advanced User Guide or your data system help.

**General GC Maintenance Method**

Create this method for instrument column maintenance, detector maintenance, and general GC maintenance tasks.

- Set the oven temperature to **35 °C**. This allows the oven fan to assist cooling.
- Set all inlet temperatures to **35 °C** and set inlet gas pressures to **0.0**.
  - If performing column maintenance, remember to wait for the oven and column to cool down before turning off column carrier gas flow at the source. Also remember to cap both ends of the column to keep air out once it is removed.
  - If you are not performing column maintenance, keep inert carrier gas (helium or nitrogen) flowing to protect the column.
- Set all detector temperatures to **35 °C**.
  - If performing FPD maintenance, turn off the GC and unplug the power cord.
  - Some detectors (FID, NPD) use high voltages. For these detectors, turn the electrometer **Off** to disable the high voltage.
• The filament in the TCD will be damaged if exposed to air while hot. To protect the filament, turn it Off.

• Set all detector flows to Off.

Once the zones reach < 70 °C, you can perform general GC maintenance.

**WARNING**

Be careful! The oven, inlet, and/or detector may be hot enough to cause burns. If the oven, inlet, or detector is hot, wear heat-resistant gloves to protect your hands.

### Inlet Maintenance Method

This method prepares the inlet for maintenance while leaving the detector at operating temperature.

• Set the oven temperature to **35°C**. This allows the oven fan to assist cooling.

• Set all inlet temperatures to Off and set inlet gas pressures to **0.0**.
  
  • If performing column maintenance, remember to wait for the oven and column to cool down before turning off column carrier gas flow at the source. Also remember to cap both ends of the column to keep air out once it is removed.

  • If you are not performing column maintenance, keep inert carrier gas (helium or nitrogen) flowing to protect the column.

• Maintain all temperature setpoints for installed detectors, if desired.

  • The filament in the TCD will be damaged if exposed to air while hot. To protect the filament, turn it Off.

Once the zones reach < 70 °C, you can perform general GC maintenance.

**WARNING**

Be careful! The oven, inlet, and/or detector may be hot enough to cause burns. If the oven, inlet, or detector is hot, wear heat-resistant gloves to protect your hands.
Safety Information

Before performing a maintenance task, read the important safety and regulatory information found in the 7890A Safety and Regulatory Information book.
2

Removing Covers

To Remove the Detector Top Cover 18
To Remove the Pneumatics Cover 19
To Remove the Electronics Cover 20

This section describes how to remove covers as needed for routine maintenance.

Only the covers listed in this chapter should be removed. Removing other GC covers can compromise the safety features of the GC, leading to personal injury or damage to the instrument.
To Remove the Detector Top Cover

This cover protects the detectors, valve box, and valve assembly. To remove the detector top cover:

1. Raise it to a vertical position
2. Lift the right side and disengage the pin on the lower left side.

**CAUTION**

Do not force the cover, either when installing it or closing it. This could break the plastic parts.

To replace the cover, make certain that the slot in the brass bushing (lower right corner) is vertical and that the bushing is fully seated. Installation is then the reverse of removal.
To Remove the Pneumatics Cover

The pneumatics cover protects the flow manifolds in the back top of the GC.

1. Disconnect any vent tubing connected to the split and septum purge vents.
2. Two large buttons on each side of the GC secure the cover to the detector frame. Press both buttons and lift the cover off.
To Remove the Electronics Cover

You may need to raise the electronics cover to perform NPD maintenance.

CAUTION

Raising the electronics cover exposes the GC electronics.

1. Raise or remove the detector top cover.
2. Loosen the screw on the left side of the electronics cover.
3. Raise the cover to the vertical position.
3
Maintaining Capillary Columns

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To Disconnect Fused Silica Tubing From a SilTite Fitting  34
Maintaining Capillary Columns

Consumables and Parts for Columns

See the Agilent catalog for consumables and supplies for a more complete listing, or visit the Agilent Web site for the latest information (www.agilent.com/chem/supplies).

Table 2  Nuts, ferrules, and hardware for capillary columns

<table>
<thead>
<tr>
<th>Column id (mm)</th>
<th>Description</th>
<th>Typical use</th>
<th>Part number/quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>.530</td>
<td>Ferrule, Vespel/graphite, 0.8-mm id</td>
<td>0.45-mm and 0.53-mm capillary columns</td>
<td>5062-3512 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Ferrule, graphite, 1.0-mm id</td>
<td>0.53-mm capillary columns</td>
<td>5080-8773 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Column nut, finger-tight (for 0.53-mm columns)</td>
<td>Connect column to inlet or detector</td>
<td>5020-8293</td>
</tr>
<tr>
<td>.320</td>
<td>Ferrule, Vespel/graphite, 0.5-mm id</td>
<td>0.32-mm capillary columns</td>
<td>5062-3514 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Ferrule, graphite, 0.5-mm id</td>
<td>0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns</td>
<td>5080-8853 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Column nut, finger-tight (for .100- to .320-mm columns)</td>
<td>Connect column to inlet or detector</td>
<td>5020-8292</td>
</tr>
<tr>
<td>.250</td>
<td>Ferrule, Vespel/graphite, 0.4-mm id</td>
<td>0.1-mm, 0.2-mm, and 0.25-mm capillary columns</td>
<td>5181-3323 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Ferrule, graphite, 0.5-mm id</td>
<td>0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns</td>
<td>5080-8853 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Column nut, finger-tight (for .100- to .320-mm columns)</td>
<td>Connect column to inlet or detector</td>
<td>5020-8292</td>
</tr>
<tr>
<td>.100 and .200</td>
<td>Ferrule, Vespel/graphite, 0.37-mm id</td>
<td>0.1-mm and 0.2-mm capillary columns</td>
<td>5062-3516 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Ferrule, Vespel/graphite, 0.4-mm id</td>
<td>0.1-mm, 0.2-mm, and 0.25-mm capillary columns</td>
<td>5181-3323 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Ferrule, graphite, 0.5-mm id</td>
<td>0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns</td>
<td>5080-8853 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Column nut, finger-tight (for .100- to .320-mm columns)</td>
<td>Connect column to inlet or detector</td>
<td>5020-8292</td>
</tr>
<tr>
<td>All</td>
<td>Ferrule, no-hole</td>
<td>Testing</td>
<td>5181-3308 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Capillary column blanking nut</td>
<td>Testing—use with any ferrule</td>
<td>5020-8294</td>
</tr>
<tr>
<td></td>
<td>Column nut, universal</td>
<td>Connect column to inlet or detector</td>
<td>5181-8830 (2/pk)</td>
</tr>
<tr>
<td></td>
<td>Column cutter, ceramic wafer</td>
<td>Cutting capillary columns</td>
<td>5181-8836 (4/pk)</td>
</tr>
</tbody>
</table>
### Table 3  Capillary column hangers

<table>
<thead>
<tr>
<th>Description</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Column hanger</td>
<td>1460-1914</td>
</tr>
<tr>
<td>Capillary column clip kit, for 7-inch column basket</td>
<td>G1530-61580</td>
</tr>
</tbody>
</table>
To Install a Capillary Column Hanger

**WARNING** Be careful! The oven may be hot enough to cause burns. If the oven is hot, wear heat-resistant gloves to protect your hands.

**WARNING** Wear safety glasses to protect your eyes from flying particles while handling, cutting, or installing glass or fused silica capillary columns. Use care in handling these columns to prevent puncture wounds.

1. Select either the front or back hanger position. (Hanger is shown in back position.)

2. Insert the ends of the hanger into the slots in the selected position.
To Condition a Capillary Column

1  Gather the following:
   • One 7/16-inch, and 1/4-inch wrenches
   • No-hole ferrule (See “Consumables and Parts for Columns” on page 22.)
   • Column nut

   WARNING  Do not use hydrogen as the carrier for conditioning! It could vent into the oven and present an explosion hazard.

2  Load the GC maintenance method and wait for the GC to become ready.

   WARNING  Be careful! The oven and/or detector may be hot enough to cause burns. If the detector is hot, wear gloves to protect your hands.

   WARNING  Wear safety glasses to protect your eyes from flying particles while handling, cutting, or installing glass or fused silica capillary columns. Use care in handling these columns to prevent puncture wounds.

3  Install the column into the inlet using the new ferrules. See:
   • To Install a Capillary Column with the Split/Splitless Inlet
   • “To Install a Capillary Column with the Multimode Inlet”
   • To Install a Capillary Column with the Purged Packed Inlet
   • To Install a Capillary Column with the COC Inlet
   • To Install a Capillary Column with the PTV Inlet
   • To Install a Capillary Column with the VI
4 Cap the detector column fitting.

5 Set a minimum velocity of 30 cm/s, or as recommended by the column manufacturer. Let gas flow through the column at room temperature for 15 to 30 minutes to remove air.

6 Program the oven from room temperature to the maximum temperature limit for the column. Increase the temperature at a rate of 10 to 15 °C/min. Hold at the maximum temperature for 30 minutes.

7 Load the GC maintenance method and wait for the GC to become ready.

**WARNING** Be careful! The oven and/or detector may be hot enough to cause burns. If the detector is hot, wear gloves to protect your hands.

**WARNING** Wear safety glasses to protect your eyes from flying particles while handling, cutting, or installing glass or fused silica capillary columns. Use care in handling these columns to prevent puncture wounds.

8 Attach the column to the detector. For details, select your specific detector from the following list:
   - To Install a Capillary Column in the FID
   - To Install a Capillary Column in the NPD
   - To Install a Capillary Column in the TCD
   - To Install a Capillary Column in the uECD
   - To Install a Capillary Column Adapter in the FPD
9 Restore the analytical method.
   • For FID or FPD, immediately turn off the flame.
   • For NPD, immediately turn off the bead.
10 After the GC becomes ready, wait 10 minutes, then ignite the detector flame or bead.
To Cut a Loop from a Column

1. Gather the following:
   - New ferrule(s) for the column inlet connection
   - Column cutter

2. Load the inlet maintenance method and wait for the GC to become ready.

**WARNING**

Be careful! The oven and/or inlet may be hot enough to cause burns. If the inlet is hot, wear heat-resistant gloves to protect your hands.

**WARNING**

Wear safety glasses to protect your eyes from flying particles while handling, cutting, or installing glass or fused silica capillary columns. Use care in handling these columns to prevent puncture wounds.

3. Loosen the inlet column nut and remove the column from the inlet.

4. Uncoil one loop of column from the column hanger.

5. Cut the unwanted loop from the column.

6. Install the column into the inlet using the new ferrules. See:
   - To Install a Capillary Column with the Split/Splitless Inlet
   - To Install a Capillary Column with the Multimode Inlet
   - To Install a Capillary Column with the Purged Packed Inlet
   - To Install a Capillary Column with the COC Inlet
   - To Install a Capillary Column with the PTV Inlet
   - To Install a Capillary Column with the VI
To Reverse a Column and Bakeout Contaminants

1 Gather the following:
   • 1/4-inch wrench
   • Column cutter

2 Load the maintenance method and wait for the GC to become ready.

**WARNING** Be careful! The oven and/or detector may be hot enough to cause burns. If the detector is hot, wear gloves to protect your hands.

**WARNING** Wear safety glasses to protect your eyes from flying particles while handling, cutting, or installing glass or fused silica capillary columns. Use care in handling these columns to prevent puncture wounds.

3 Disconnect the column from the inlet and detector.

4 If necessary, cut a loop from the column. (See “To Cut a Loop from a Column” on page 28.) Do not attach the column to the inlet.

5 Remove the column from the hanger and reverse its position (inlet and detector ends) and place the column back on the hanger.

6 Attach the column to the inlet.

Select your specific inlet from the following list:

• To Install a Capillary Column with the Split/Splitless Inlet
• To Install a Capillary Column with the Purged Packed Inlet
• To Install a Capillary Column with the COC Inlet
• To Install a Capillary Column with the Multimode Inlet
• To Install a Capillary Column with the PTV Inlet
• To Install a Capillary Column with the VI

7 Attach your column to the detector.

Select your specific detector from the following list:

• To Install a Capillary Column in the FID
• To Install a Capillary Column in the NPD
• To Install a Capillary Column in the TCD
• To Install a Capillary Column in the uECD
• To Install a Capillary Column Adapter in the FPD

8 Set the column flow to the normal operating value, or set the capillary column gas velocity to 30 cm/s.

For Multimode, Split/Splitless, PTV, and VI inlets, select split mode and set the split vent flow to 200 mL/min.

9 Purge the column with carrier flow for at least 10 minutes before heating the oven.

10 Set the inlet temperature to 300 °C or 25 °C above the normal operating temperature.

11 Set the column oven 25 °C above the GC method final oven temperature to bake contaminants out of the inlet, mostly through the split vent. Do not exceed the column manufacturer’s maximum temperature limit.

12 Bakeout for 30 minutes.
To Attach a Capillary Column Using SilTite Metal Fittings

This procedure is used to attach a capillary column to a splitter or switch or an Ultimate Union.

1 Gather the following:
   - SilTite ferrules (see Table 4)
   - Swaging nut for SilTite ferrules (G2855-20555)
   - Two 1/4-inch open-end wrenches
   - One 7/16-inch open-end wrench
   - Column cutting tool (5181-8836)
   - Internal nut (G2855-20530)
   - Lint free gloves

Table 4  Available SilTite metal ferrule packages

<table>
<thead>
<tr>
<th>Part number</th>
<th>SilTite ferrule description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5188-5361</td>
<td>For 0.2- to 0.25-mm columns</td>
</tr>
<tr>
<td>5188-5362</td>
<td>For 0.32-mm columns</td>
</tr>
<tr>
<td>5188-5363</td>
<td>For 0.53-mm columns</td>
</tr>
</tbody>
</table>

CAUTION Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.

2 Pass the tubing end through the internal nut and SilTite ferrule leaving approximately 1 cm of fused silica tubing protruding beyond the ferrule. Thread the swaging nut onto the internal nut with the tube protruding.
3 Using two wrenches against each other, tighten the two nuts together a little at a time, occasionally checking to see if the ferrule is gripping the tube. When the ferrule just starts to grip, notice position of the nuts and then tighten one of the nuts by turning 45 to 60 degrees of rotation, but no more than 60 degrees (one flat).

4 Remove the swaging nut.
5 Using a wafer column cutter, trim the tubing at the small end of the ferrule, leaving approximately 0.3 mm of tubing extending beyond the ferrule.

Check the end of the tube with a magnifier. The end of the tube need not be perfectly square, but should not have cracks that extend under the ferrule.

**NOTE**

It is important that the tube end does not extend beyond 0.5 mm from the end of the ferrule.

6 Insert the assembled ferrule and nut into the SilTite fitting. Tighten with a wrench by only 15 to 20 degrees of rotation.
To Disconnect Fused Silica Tubing From a SilTite Fitting

Loosen and remove the internal nut. If tubing and ferrule do not come free, insert a pointed object (pen, paper clip) into the ferrule release hole and press firmly. You will hear a click as the ferrule releases.

The SilTite ferrule seal should remain leak-free for many disconnections and reconnections.
4 Maintaining the Split/Splitless Inlet

Consumables and Parts for the Split/Splitless Inlet  36
Exploded Parts View of the Split/Splitless Inlet  39
To Install a Capillary Column with the Split/Splitless Inlet  40
To Change the Septum on the Split/Splitless Inlet  44
To Clean the Septum Seat in the Insert Assembly of the Split/Splitless Inlet  46
To Change the Liner and O-Ring on the Split/Splitless Inlet  48
To Replace the Gold Seal on the Split/Splitless Inlet  51
To Replace the Filter in the Split Vent Line for the Split/Splitless Inlet  53
To Clean the Split/Splitless Inlet  56
To Bakeout Contaminants from the Split/Splitless Inlet  58
Consumables and Parts for the Split/Splitless Inlet

See the Agilent catalog for consumables and supplies for a more complete listing, or visit the Agilent Web site for the latest information (www.agilent.com/chem/supplies).

### Table 5  Split, splitless, direct, and direct connect inlet liners

<table>
<thead>
<tr>
<th>Mode</th>
<th>Description</th>
<th>Deactivated</th>
<th>Part number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Split</td>
<td>Low-pressure drop, glass wool, single taper, 870 µL</td>
<td>Yes</td>
<td>5183-4647</td>
</tr>
<tr>
<td>Split</td>
<td>Glass wool, 990 µL</td>
<td>No</td>
<td>19251-60540</td>
</tr>
<tr>
<td>Split—Manual only</td>
<td>Empty pin and cup, 800 µL</td>
<td>No</td>
<td>18740-80190</td>
</tr>
<tr>
<td>Split—Manual only</td>
<td>Packed pin and cup, 800 µL</td>
<td>No</td>
<td>18740-80840</td>
</tr>
<tr>
<td>Splitless</td>
<td>Single taper, glass wool, 900 µL</td>
<td>Yes</td>
<td>5062-3587</td>
</tr>
<tr>
<td>Splitless</td>
<td>Single taper, no glass wool, 900 µL</td>
<td>Yes</td>
<td>5181-3316</td>
</tr>
<tr>
<td>Splitless</td>
<td>Dual taper, no glass wool, 800 µL</td>
<td>Yes</td>
<td>5181-3315</td>
</tr>
<tr>
<td>Splitless—Direct inject</td>
<td>2-mm id, quartz, 250 µL</td>
<td>No</td>
<td>18740-80220</td>
</tr>
<tr>
<td>Splitless—Direct inject</td>
<td>2-mm id, 250 µL</td>
<td>Yes</td>
<td>5181-8818</td>
</tr>
<tr>
<td>Direct inject—Headspace or purge and trap</td>
<td>1.5-mm id, 140 µL</td>
<td>No</td>
<td>18740-80200</td>
</tr>
<tr>
<td>Direct column connect</td>
<td>Single taper, splitless 4-mm id</td>
<td>Yes</td>
<td>G1544-80730</td>
</tr>
<tr>
<td>Direct column connect</td>
<td>Dual taper, splitless 4-mm id</td>
<td>Yes</td>
<td>G1544-80700</td>
</tr>
</tbody>
</table>

### Table 6  Nuts, ferrules, and hardware for capillary columns

<table>
<thead>
<tr>
<th>Column id (mm)</th>
<th>Description</th>
<th>Typical use</th>
<th>Part number/quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>.530</td>
<td>Ferrule, Vespel/graphite, 0.8-mm id</td>
<td>0.45-mm and 0.53-mm capillary columns</td>
<td>5062-3512 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Ferrule, graphite, 1.0-mm id</td>
<td>0.53-mm capillary columns</td>
<td>5080-8773 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Column nut, finger-tight (for 0.53-mm columns)</td>
<td>Connect column to inlet or detector</td>
<td>5020-8293</td>
</tr>
<tr>
<td>.320</td>
<td>Ferrule, Vespel/graphite, 0.5-mm id</td>
<td>0.32-mm capillary columns</td>
<td>5062-3514 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Ferrule, graphite, 0.5-mm id</td>
<td>0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns</td>
<td>5080-8853 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Column nut, finger-tight (for .100- to .320-mm columns)</td>
<td>Connect column to inlet or detector</td>
<td>5020-8292</td>
</tr>
</tbody>
</table>
Table 6  Nuts, ferrules, and hardware for capillary columns (continued)

<table>
<thead>
<tr>
<th>Column id (mm)</th>
<th>Description</th>
<th>Typical use</th>
<th>Part number/quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>.250</td>
<td>Ferrule, Vespel/graphite, 0.4-mm id</td>
<td>0.1-mm, 0.2-mm, and 0.25-mm capillary columns</td>
<td>5181-3323 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Ferrule, graphite, 0.5-mm id</td>
<td>0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns</td>
<td>5080-8853 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Column nut, finger-tight (for .100- to .320-mm columns)</td>
<td>Connect column to inlet or detector</td>
<td>5020-8292</td>
</tr>
<tr>
<td>.100 and .200</td>
<td>Ferrule, Vespel/graphite, 0.37-mm id</td>
<td>0.1-mm and 0.2-mm capillary columns</td>
<td>5062-3516 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Ferrule, Vespel/graphite, 0.4-mm id</td>
<td>0.1-mm, 0.2-mm, and 0.25-mm capillary columns</td>
<td>5181-3323 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Ferrule, graphite, 0.5-mm id</td>
<td>0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns</td>
<td>5080-8853 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Column nut, finger-tight (for .100- to .320-mm columns)</td>
<td>Connect column to inlet or detector</td>
<td>5020-8292</td>
</tr>
<tr>
<td>All</td>
<td>Ferrule, no-hole</td>
<td>Testing</td>
<td>5181-3308 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Capillary column blanking nut</td>
<td>Testing–use with any ferrule</td>
<td>5020-8294</td>
</tr>
<tr>
<td></td>
<td>Column nut, universal</td>
<td>Connect column to inlet or detector</td>
<td>5181-8830 (2/pk)</td>
</tr>
<tr>
<td></td>
<td>Column cutter, ceramic wafer</td>
<td>Cutting capillary columns</td>
<td>5181-8836 (4/pk)</td>
</tr>
</tbody>
</table>

Table 7  Other consumables and parts for the split/splitless inlet

<table>
<thead>
<tr>
<th>Description/quantity</th>
<th>Part number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Septum retainer nut for headspace</td>
<td>18740-60830</td>
</tr>
<tr>
<td>Septum retainer nut</td>
<td>18740-60835</td>
</tr>
<tr>
<td>11-mm septum, high-temperature, low-bleed, 50/pk</td>
<td>5183-4757</td>
</tr>
<tr>
<td>11-mm septum, prepierced, long life, 50/pk</td>
<td>5183-4761</td>
</tr>
<tr>
<td>Merlin Microseal septum (high-pressure)</td>
<td>5182-3444</td>
</tr>
<tr>
<td>Merlin Microseal septum (30 psi)</td>
<td>5181-8815</td>
</tr>
<tr>
<td>Nonstick fluorocarbon liner O-ring (for temperatures up to 350 °C), 10/pk</td>
<td>5188-5365</td>
</tr>
<tr>
<td>Graphite O-ring for split liner (for temperatures above 350 °C), 10/pk</td>
<td>5180-4168</td>
</tr>
<tr>
<td>Graphite O-ring for splitless liner (for temperatures above 350 °C), 10/pk</td>
<td>5180-4173</td>
</tr>
</tbody>
</table>
### Table 7  Other consumables and parts for the split/splitless inlet

<table>
<thead>
<tr>
<th>Description/quantity</th>
<th>Part number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Split vent trap PM kit, single cartridge</td>
<td>5188-6495</td>
</tr>
<tr>
<td>Retaining nut</td>
<td>G1544-20590</td>
</tr>
<tr>
<td>Gold-plated seal (standard application)</td>
<td>5188-5367</td>
</tr>
<tr>
<td>Gold-plated seal with cross (high split flows) (includes SS washer)</td>
<td>5182-9652</td>
</tr>
<tr>
<td>Stainless steel washer (0.375-inch od), 12/pk</td>
<td>5061-5869</td>
</tr>
<tr>
<td>Reducing nut</td>
<td>18740-20800</td>
</tr>
<tr>
<td>Column nut, blanking plug</td>
<td>5020-8294</td>
</tr>
<tr>
<td>Capillary inlet preventative maintenance kit, split</td>
<td>5188-6496</td>
</tr>
<tr>
<td>Capillary inlet preventative maintenance kit, splitless</td>
<td>5188-6497</td>
</tr>
</tbody>
</table>
Exploded Parts View of the Split/Splitless Inlet

- Merlin cap
- Merlin Microseal
- Insert assembly
- O-ring
- Liner
- Split vent line
- Split/splitless inlet body
- Retaining nut
- Inlet gold seal
- Washer
- Reducing nut
- Insulation
- Insulation cup
- Ferrule
- Column nut
- Septum retainer nut
- Septum
To Install a Capillary Column with the Split/Splitless Inlet

**WARNING** Do not use hydrogen as the carrier for conditioning! It could vent into the oven and present an explosion hazard.

1. Gather the following (see “Consumables and Parts for the Split/Splitless Inlet” on page 36):
   - Column
   - Ferrule(s)
   - Column nut
   - Septum
   - Column cutter
   - Isopropanol
   - Lab tissue
   - Metric ruler
   - 1/4-inch open-end wrench
   - Lint-free gloves

2. Load the GC maintenance method and wait for the GC to become ready.

**WARNING** Be careful! The oven and/or inlet may be hot enough to cause burns. If either is hot, wear heat-resistant gloves to protect your hands.

**WARNING** Wear safety glasses to protect your eyes from flying particles while handling, cutting, or installing glass or fused silica capillary columns. Use care in handling these columns to prevent puncture wounds.

3. Verify that the correct glass liner is installed. (See “Consumables and Parts for the Split/Splitless Inlet” on page 36.)

4. Place the column on the hanger with the ends pointing up and the label to the front.
**CAUTION**

Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.

5 Place a septum, capillary column nut, and ferrule on the column.

![Diagram](image)

6 Score the column using a glass scribing tool. The score must be square to ensure a clean break.

![Diagram](image)

7 Break off the column end by supporting it against the column cutter opposite the scribe. Inspect the end with a magnifying loupe to make certain there are no burrs or jagged edges.

![Diagram](image)

8 Wipe the column walls with a tissue dampened with isopropanol to remove fingerprints and dust.

9 Position the column so it extends 4 to 6 mm above the end of the ferrule. Slide the septum up the column to hold the column nut at this position.

![Diagram](image)
Thread the column nut into the inlet but do not tighten.

Adjust the column position so that the septum contacts the bottom of the column nut. Finger-tighten the column nut until it begins to grip the column.

Tighten the column nut an additional 1/4 to 1/2 turn with a wrench so that the column cannot be pulled from the fitting with gentle pressure.

Configure the new column.

Condition the column per the manufacturer’s recommendation. (See To Condition a Capillary Column.)

Install the column into the detector. See:
- To Install a Capillary Column in the FID
- To Install a Capillary Column in the NPD
- To Install a Capillary Column in the TCD
- To Install a Capillary Column in the uECD
- To Install a Capillary Column Adapter in the FPD

After the column is installed at both inlet and detector, establish a flow of carrier gas and purge as recommended by the column manufacturer.

Restore the analytical method.
- For FID or FPD, immediately turn off the flame.
- For NPD, immediately turn off the bead.

After the GC becomes ready, wait 10 minutes then ignite the detector flame or bead.

**WARNING**

Be careful! The oven, inlet, and/or detector may be hot enough to cause burns. If they are hot, wear heat-resistant gloves to protect your hands.
Allow the oven, inlet, and detector to equilibrate at operating temperature, then retighten the fittings.
To Change the Septum on the Split/Splitless Inlet

1 Gather the following:
   - Replacement septum. (See “Consumables and Parts for the Split/Splitless Inlet” on page 36.)
   - Wrench, hex for changing septum
   - 0- or 00-grade steel wool (optional)
   - Tweezers
   - Wrench, capillary inlet (optional)

2 Load the inlet maintenance method and wait for the GC to become ready.

**WARNING**
Be careful! The oven and/or inlet may be hot enough to cause burns. If the inlet is hot, wear heat-resistant gloves to protect your hands.

3 Remove the septum retainer nut or Merlin cap.

4 Use tweezers to remove the septum or Merlin Microseal from the insert assembly. Do not gouge or scratch the interior of the insert assembly.

5 Firmly press the new septum or Merlin Microseal into the fitting. The metal parts side of the Merlin Microseal should face down (toward the oven).

6 Install the septum retainer nut or Merlin cap and finger-tighten. Tighten the septum retainer nut until the C-ring is about 1 mm above the nut.
Overtightening the septum nut can cause contamination.

7 Restore the analytical method.
8 Reset the septum counter.
To Clean the Septum Seat in the Insert Assembly of the Split/Splitless Inlet

1 Gather the following:
   - Replacement septum (See “Consumables and Parts for the Split/Splitless Inlet” on page 36.)
   - Wrench, hex for changing septum
   - 0- or 00-grade steel wool (optional)
   - Tweezers
   - Compressed, filtered, dry air or nitrogen
   - Wrench, capillary inlet (optional)

2 Load the inlet maintenance method and wait for the GC to become ready.

   **WARNING**
   Be careful! The oven and/or inlet may be hot enough to cause burns. If either is hot, wear heat-resistant gloves to protect your hands.

3 Slide the locking tab forward (counterclockwise). Lift the septum assembly straight up and away from the inlet to avoid chipping or breaking the liner.

4 Remove the septum retainer nut or Merlin cap.
5 Use tweezers to remove the septum or Merlin Microseal from the retainer nut. (See “To Change the Septum on the Split/Splitless Inlet” on page 44.)

6 Scrub the residue from the retainer nut and septum holder with a small piece of rolled-up steel wool and tweezers. Do not do this over the inlet.

7 Use compressed air or nitrogen to blow away the pieces of steel wool and septum.

8 Line up the tab on the bottom of the septum assembly with the slot on the insert assembly and push down to connect. Slide the locking tab to the left.

9 Firmly press the new septum or Merlin Microseal into the fitting. (See “To Change the Septum on the Split/Splitless Inlet” on page 44.)

10 Replace the septum retainer nut or Merlin cap and finger-tighten. (See “To Change the Septum on the Split/Splitless Inlet” on page 44.)

11 Restore the analytical method.

12 Reset the septum counter.
48 Maintaining Your GC

4 Maintaining the Split/Splitless Inlet

To Change the Liner and O-Ring on the Split/Splitless Inlet

1 Gather the following:
   - Replacement O-ring (See “Consumables and Parts for the Split/Splitless Inlet” on page 36.)
   - Replacement liner
   - Tweezers
   - Wrench, hex for changing septum
   - Wrench, capillary inlet (optional)
   - Lint-free gloves

2 Load the inlet maintenance method and wait for the GC to become ready.

**WARNING** Be careful! The oven and/or inlet may be hot enough to cause burns. If either is hot, wear heat-resistant gloves to protect your hands.

3 Slide the locking tab forward (counterclockwise). Lift the septum assembly straight up and away from the inlet to avoid chipping or breaking the liner.

4 Loosen the O-ring from the sealing surface with tweezers.
5 Grasp the liner with tweezers and pull it out.

6 Inspect the surface of the gold seal for graphite or rubber septum contamination. If required, replace the gold seal. (See “To Replace the Gold Seal on the Split/Splitless Inlet” on page 51.)
Clean the inlet if there is visible or suspected contamination. (See “To Clean the Split/Splitless Inlet” on page 56.)

Clean O-ring residue from sealing surface.

**CAUTION** Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.

7 Slide a new O-ring onto the replacement liner.

8 Return the liner to the inlet, pushing it all the way in until the liner contacts the gold seal.

9 Line up the tab on the bottom of the septum assembly with the slot on the insert assembly and push down to connect. Slide the locking tab to the back.

10 Turn on the inlet. Allow the inlet and column to purge with carrier gas for 15 minutes before heating the inlet or the column oven.

11 Bakeout contaminants. (See “To Bakeout Contaminants from the Split/Splitless Inlet” on page 58.)

12 Restore the analytical method.

13 Reset the liner counter.

14 Check for leaks.
To Replace the Gold Seal on the Split/Splitless Inlet

1 Gather the following:
   - Replacement gold seal (See “Consumables and Parts for the Split/Splitless Inlet” on page 36.)
   - Replacement washer
   - 1/4-inch wrench (for column)
   - 1/2-inch wrench
   - Lint-free gloves

2 Load the inlet maintenance method and wait for the GC to become ready.

   **WARNING**
   Be careful! The oven and/or inlet may be hot enough to cause burns. If either is hot, wear heat-resistant gloves to protect your hands.

3 Remove the inlet liner.

4 Remove the column from the inlet. Cap the open end of the column to prevent contamination. Remove the insulation cup around the base of the inlet.

5 Loosen and remove the reducing nut. Remove the washer and seal inside the reducing nut.
Put on gloves to protect the new gold seal and washer from contamination. Put a new washer in the reducing nut and place the new gold seal on top of it (raised portion facing down).

Replace the reducing nut and tighten securely with a wrench.

Replace the inlet liner.

Install the column and the insulation cup.

Bakeout contaminants. (See “To Bakeout Contaminants from the Split/Splitless Inlet” on page 58.)

Restore the analytical method.

Reset the EMF counter.

Check for leaks.
To Replace the Filter in the Split Vent Line for the Split/Splitless Inlet

1 Gather the following:
   - New filter cartridge. (See “Consumables and Parts for the Split/Splitless Inlet” on page 36.)
   - T-20 Torx screwdriver

2 Load the inlet maintenance method and wait for the GC to become ready.

   **WARNING**
   Be careful! The oven and/or inlet may be hot enough to cause burns. If either is hot, wear heat-resistant gloves to protect your hands.

   **WARNING**
   The split vent trap may contain residual amounts of any samples or other chemicals you have injected into the GC. Follow your company’s safety procedures for handling these types of substances while replacing the trap filter cartridge.

3 Remove the pneumatics cover (top, back of GC).
4 Remove the retaining clip.
5 Completely loosen the two screws that secure the split vent valve in place.

6 Lift the filter trap assembly and split vent valve from the mounting bracket together and unscrew the split vent front weldment on the filter trap assembly. Be careful not to stress the tubing between the split vent valve and the trap.

7 Remove the old filter cartridge and two O-rings.

8 Verify the new O-rings are seated properly on the new filter cartridge.

9 Install the new filter cartridge then reassemble the trap. Do not fully tighten yet.

10 Place the filter trap assembly in the mounting bracket and install the retaining clip.

11 Install the split vent valve.

12 Fully tighten the split vent front weldment onto the trap.

13 Check for leaks.
14 Restore the analytical method.
15 Reset the split vent trap counter.
16 Install the pneumatics cover.
To Clean the Split/Splitless Inlet

1 Gather the following:
   • Replacement septum (See “Consumables and Parts for the Split/Splitless Inlet” on page 36.)
   • Replacement liner
   • Replacement O-ring
   • Replacement gold seal
   • Replacement washer
   • Solvent that will clean the type of deposits in your inlet
   • Compressed, filtered, dry air or nitrogen
   • Beaker
   • Cleaning brushes—The FID cleaning kit (part number 9301-0985) contains appropriate brushes
   • Lint-free gloves

2 Load the inlet maintenance method and wait for the GC to become ready.

**WARNING**

Be careful! The oven and/or inlet may be hot enough to cause burns. If the inlet is hot, wear heat-resistant gloves to protect your hands.

3 Remove the inlet liner. (See “To Change the Liner and O-Ring on the Split/Splitless Inlet” on page 48.)

4 Disconnect the column from the inlet.

5 Remove the reducing nut and gold seal. (See “To Replace the Gold Seal on the Split/Splitless Inlet” on page 51.)

6 Place a beaker in the oven under the inlet to catch the solvent.

**CAUTION**

Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.

7 Soak a cleaning brush in the solvent and scrub the inside of the inlet weldment. Repeat 10 times.

8 Rinse the inlet with the solvent.
9 Blow the inside of the inlet dry with compressed air or nitrogen.
10 Install the gold seal and reducing nut.
11 Install the liner and O-ring.
12 Install the column. (See “To Install a Capillary Column with the Split/Splitless Inlet” on page 40.)
13 Check for leaks.
14 Bakeout contaminants. (See “To Bakeout Contaminants from the Split/Splitless Inlet” on page 58.)
15 Restore the analytical method.
16 Reset the septum and liner EMF counters.
To Bakeout Contaminants from the Split/Splitless Inlet

1. Put the inlet into split mode.
2. Set the column flow to the normal operating value, or set the capillary column gas velocity to 30 cm/s.
3. Set the inlet split vent flow to 200 mL/min.
4. Purge the column with carrier flow for at least 10 minutes before heating the oven.
5. If the column is attached to the detector, set the detector 25 °C above normal operating temperature.

**WARNING**
Be careful! The oven, inlet, and/or detector may be hot enough to cause burns. If they are hot, wear heat-resistant gloves to protect your hands.

6. If the column is not attached to the detector, cap the detector fitting.
7. Set the inlet temperature to 300 °C or 25 °C above the normal operating temperature to bakeout contaminants from the inlet, mostly through the split vent.
8. Set the column oven 25 °C above the GC method final oven temperature to bake contaminants from the column. Do not exceed the column manufacturer’s maximum temperature limit.
9. Bakeout for 30 minutes or until the detector baseline is free of contamination peaks.
Maintaining the Purged Packed Inlet

Consumables and Parts for the Purged Packed Inlet
Exploded Parts View of the Purged Packed Inlet
To Install a Capillary Column with the Purged Packed Inlet
To Change the Septum on the Purged Packed Inlet
To Clean the Septum Seat in the Purged Packed Inlet
To Install an Adapter on the Purged Packed Inlet
To Change the O-Ring on the Purged Packed Inlet
To Change the Glass Liner on the Purged Packed Inlet
To Install an Insulation Cup on the Purged Packed Inlet
To Clean the Purged Packed Inlet
To Bakeout Contaminants from the Purged Packed Inlet
To Install a Packed Metal Column
To Install a Packed Column Adapter on a Detector Fitting
To Install a Packed Glass Column
To Condition a Packed Column
To Install Ferrules on a Packed Metal Column
Maintaining Your GC

Consumables and Parts for the Purged Packed Inlet

See the Agilent catalog for consumables and supplies for a more complete listing, or visit the Agilent Web site for the latest information (www.agilent.com/chem/supplies).

Table 8  Purged packed inlet parts

<table>
<thead>
<tr>
<th>Description</th>
<th>Part number/quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preventative maintenance kit</td>
<td>5188-6498</td>
</tr>
<tr>
<td><strong>Purged packed glass liners and column adapters</strong></td>
<td></td>
</tr>
<tr>
<td>Glass liner</td>
<td>5080-8732 (25/pack) or 5181-3382 deactivated (5/pack)</td>
</tr>
<tr>
<td>0.53-mm column adapter</td>
<td>19244-80540</td>
</tr>
<tr>
<td>1/8-inch column adapter</td>
<td>19243-80530</td>
</tr>
<tr>
<td>1/4-inch column adapter</td>
<td>19243-80540</td>
</tr>
<tr>
<td><strong>Recommended septa and O-rings for the purged packed inlet</strong></td>
<td></td>
</tr>
<tr>
<td>11-mm solid septum, low-bleed, red</td>
<td>5181-1263 (50/pk)</td>
</tr>
<tr>
<td>11-mm septum with partial through-hole, low-bleed, red</td>
<td>5181-3383 (50/pk)</td>
</tr>
<tr>
<td>11-mm septum, low-bleed, gray</td>
<td>5080-8896 (50/pk)</td>
</tr>
<tr>
<td>Merlin Microseal septum (30 psi)</td>
<td>5181-8815</td>
</tr>
<tr>
<td>11-mm high-temperature silicone septum (350 °C and higher)</td>
<td>5182-0739 (50/pk)</td>
</tr>
<tr>
<td>Viton O-ring (Top insert weldment)</td>
<td>5080-8898 (12/pk)</td>
</tr>
</tbody>
</table>

Table 9  Nuts and ferrules for packed columns

<table>
<thead>
<tr>
<th>Description</th>
<th>Typical use</th>
<th>Part number/quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/8-inch id Swagelok stainless steel nut, front ferrule, back ferrule</td>
<td>1/8-inch column</td>
<td>5080-8751 (20 each/pk)</td>
</tr>
<tr>
<td>1/8-inch id Swagelok brass nut, front ferrule, back ferrule</td>
<td>1/8-inch column</td>
<td>5080-8750 (20 each/pk)</td>
</tr>
<tr>
<td>1/8-inch id Vespel/graphite ferrule</td>
<td>1/8-inch column</td>
<td>0100-1332 (10/pk)</td>
</tr>
</tbody>
</table>
### Table 9  Nuts and ferrules for packed columns (continued)

<table>
<thead>
<tr>
<th>Description</th>
<th>Typical use</th>
<th>Part number/quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/8-inch id brass tubing nut</td>
<td>1/8-inch column</td>
<td>5180-4103 (10/pk)</td>
</tr>
<tr>
<td>1/4-inch id Swagelok stainless steel nut, front ferrule, back ferrule</td>
<td>1/4-inch column</td>
<td>5080-8753 (20 each/pk)</td>
</tr>
<tr>
<td>1/4-inch id Swagelok brass nut, front ferrule, back ferrule</td>
<td>1/4-inch column</td>
<td>5080-8752 (20 each/pk)</td>
</tr>
<tr>
<td>1/4-inch id Vespel/graphite ferrule</td>
<td>Inlet/detector liner/adapters 1/4-inch column</td>
<td>5080-8774 (10/pk)</td>
</tr>
<tr>
<td>1/4-inch id brass tubing nut</td>
<td>1/4-inch column</td>
<td>5180-4105 (10/pk)</td>
</tr>
</tbody>
</table>

### Table 10  Nuts, ferrules, and hardware for capillary columns

<table>
<thead>
<tr>
<th>Column id (mm)</th>
<th>Description</th>
<th>Typical use</th>
<th>Part number/quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>.530</td>
<td>Ferrule, Vespel/graphite, 0.8-mm id</td>
<td>0.45-mm and 0.53-mm capillary columns</td>
<td>5062-3512 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Ferrule, graphite, 1.0-mm id</td>
<td>0.53-mm capillary columns</td>
<td>5080-8773 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Column nut, finger-tight (for 0.53-mm columns)</td>
<td>Connect column to inlet or detector</td>
<td>5020-8293</td>
</tr>
<tr>
<td>.320</td>
<td>Ferrule, Vespel/graphite, 0.5-mm id</td>
<td>0.32-mm capillary columns</td>
<td>5062-3514 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Ferrule, graphite, 0.5-mm id</td>
<td>0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns</td>
<td>5080-8853 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Column nut, finger-tight (for .100- to .320-mm columns)</td>
<td>Connect column to inlet or detector</td>
<td>5020-8292</td>
</tr>
<tr>
<td>.250</td>
<td>Ferrule, Vespel/graphite, 0.4-mm id</td>
<td>0.1-mm, 0.2-mm, and 0.25-mm capillary columns</td>
<td>5181-3323 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Ferrule, graphite, 0.5-mm id</td>
<td>0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns</td>
<td>5080-8853 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Column nut, finger-tight (for .100- to .320-mm columns)</td>
<td>Connect column to inlet or detector</td>
<td>5020-8292</td>
</tr>
<tr>
<td>.100 and .200</td>
<td>Ferrule, Vespel/graphite, 0.37-mm id</td>
<td>0.1-mm and 0.2-mm capillary columns</td>
<td>5062-3516 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Ferrule, Vespel/graphite, 0.4-mm id</td>
<td>0.1-mm, 0.2-mm, and 0.25-mm capillary columns</td>
<td>5181-3323 (10/pk)</td>
</tr>
</tbody>
</table>
Table 10  Nuts, ferrules, and hardware for capillary columns (continued)

<table>
<thead>
<tr>
<th>Column id (mm)</th>
<th>Description</th>
<th>Typical use</th>
<th>Part number/quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ferrule, graphite, 0.5-mm id</td>
<td>0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns</td>
<td>5080-8853 (10/pk)</td>
</tr>
<tr>
<td>Column nut, finger-tight (for .100- to .320-mm columns)</td>
<td>Connect column to inlet or detector</td>
<td>5020-8292</td>
<td></td>
</tr>
<tr>
<td>All</td>
<td>Ferrule, no-hole</td>
<td>Testing</td>
<td>5181-3308 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Capillary column blanking nut</td>
<td>Testing—use with any ferrule</td>
<td>5020-8294</td>
</tr>
<tr>
<td></td>
<td>Column nut, universal</td>
<td>Connect column to inlet or detector</td>
<td>5181-8830 (2/pk)</td>
</tr>
<tr>
<td></td>
<td>Column cutter, ceramic wafer</td>
<td>Cutting capillary columns</td>
<td>5181-8836 (4/pk)</td>
</tr>
</tbody>
</table>
Exploded Parts View of the Purged Packed Inlet

- Merlin cap
- Merlin Microseal
- Top insert weldment
- O-ring
- Glass liner
- Septum nut
- Septum
- Adapter nut
- Adapter
- Insulation
- Insulation cup
- Ferrule
- Column nut
To Install a Capillary Column with the Purged Packed Inlet

1. Gather the following:
   - Column
   - Ferrule (See “Consumables and Parts for the Purged Packed Inlet” on page 60.)
   - Column nut
   - Glass liner
   - Viton O-ring
   - 0.53-mm column adapter
   - Septum
   - 1/4-inch wrench
   - Metric ruler
   - Lint-free gloves

2. Load the inlet maintenance method and wait for the GC to become ready.

   **WARNING** Be careful! The oven and/or inlet may be hot enough to cause burns. If the inlet is hot, wear heat-resistant gloves to protect your hands.

   **WARNING** Wear safety glasses to protect your eyes from flying particles while handling, cutting, or installing glass or fused silica capillary columns. Use care in handling these columns to prevent puncture wounds.

3. Install a 0.53-mm column adapter. (See “To Install an Adapter on the Purged Packed Inlet” on page 72.)

   **CAUTION** Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.

4. Install a new Viton O-ring. (See “To Change the O-Ring on the Purged Packed Inlet” on page 74.)

5. Place a septum, capillary column nut, and ferrule on the column.
6 Score the column using a glass scribing tool. The score must be square to ensure a clean break.

7 Break off the column end by supporting it against the column cutter opposite the scribe. Inspect the end with a magnifying loupe to make certain there are no burrs or jagged edges.

8 Wipe the column walls with a tissue dampened with isopropanol to remove fingerprints and dust.

9 Position the column so it extends 1 to 2 mm above the end of the ferrule. Slide the septum up the column to hold the column nut at this fixed position.
10 Thread the column nut into the inlet adapter but do not tighten.

11 Adjust the column position so that the septum is even with the bottom of the column nut. Finger-tighten the column nut until it begins to grip the column.

12 Tighten the column nut an additional 1/4 to 1/2 turn with a wrench so that the column cannot be pulled from the fitting with gentle pressure.

13 Configure the new column.

14 Condition the column per the manufacturer's recommendation. (See To Condition a Capillary Column.)

15 Install the column into the detector. See:
   - To Install a Capillary Column in the FID
   - To Install a Capillary Column in the NPD
   - To Install a Capillary Column in the TCD
   - To Install a Capillary Column in the uECD
   - To Install a Capillary Column Adapter in the FPD

16 After the column is installed at both inlet and detector, establish a flow of carrier gas and purge as recommended by the column manufacturer.

17 Restore the analytical method.
   - For FPD, immediately turn off the flame.
   - For NPD, immediately set the bead voltage to 0.0.

18 After the GC becomes ready, wait 10 minutes then ignite the detector flame or adjust offset on the NPD bead.
19 Allow the oven, inlet, and detector to equilibrate at operating temperature, then retighten the fittings.
To Change the Septum on the Purged Packed Inlet

1 Gather the following:
   - Replacement septum (See “Consumables and Parts for the Purged Packed Inlet” on page 60.)
   - Septum nut wrench
   - 0- or 00-grade steel wool (optional)
   - Tweezers

2 Load the inlet maintenance method and wait for the GC to become ready.

   **WARNING**
   Be careful! The oven and/or inlet may be hot enough to cause burns. If the inlet is hot, wear heat-resistant gloves to protect your hands.

3 Remove the septum retainer nut or Merlin cap.

4 Use tweezers to remove the septum or Merlin Microseal from the retainer nut. Do not gouge or scratch the interior of the septum head.

5 Firmly press the new septum or Merlin Microseal into the fitting. The metal parts side of the Merlin Microseal should face down (toward the oven).
6 Replace the septum retainer nut or Merlin cap and finger-tighten. Tighten the septum retainer nut until the C-ring is about 1 mm above the nut.

**CAUTION**

Overtightening the septum nut can cause contamination.

7 Restore the analytical method.

8 Reset the septum counter.
To Clean the Septum Seat in the Purged Packed Inlet

1. Gather the following:
   - Replacement septum (See “Consumables and Parts for the Purged Packed Inlet” on page 60.)
   - Septum nut wrench
   - 0- or 00-grade steel wool (optional)
   - Tweezers
   - Compressed, filtered, dry air or nitrogen
   - Ultrasonic cleaning bath
   - Lint-free gloves

2. Load the inlet maintenance method and wait for the GC to become ready.

**WARNING**

Be careful! The oven and/or inlet may be hot enough to cause burns. If the inlet is hot, wear heat-resistant gloves to protect your hands.

3. Remove the septum retainer nut or Merlin cap.
4. Loosen the top insert weldment and remove.

**CAUTION**

Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.

5. Use tweezers to remove the septum or Merlin Microseal from the top insert weldment. Do not gouge or scratch the interior of the septum head.

6. Scrub the residue from the top insert weldment and septum nut with a small piece of rolled-up steel wool and tweezers. Ultrasonically clean the retainer nut and top insert weldment.

7. Use compressed air or nitrogen to blow away the pieces of steel wool and septum.

8. Wearing gloves, inspect the O-ring and replace, if necessary. (See “To Change the O-Ring on the Purged Packed Inlet” on page 74.)

9. Install the top insert weldment and hand-tighten firmly.
10 Firmly press the new septum or Merlin Microseal into the fitting.

11 Install the septum retainer nut or Merlin cap and finger-tighten. Tighten the septum retainer nut until the C-ring is about 1 mm above the nut.

**CAUTION**

Overtightening the septum nut can cause contamination.

12 Restore the analytical method.

13 Reset the septum counter.
To Install an Adapter on the Purged Packed Inlet

1 Gather the following:
   - Brass tubing nut (see “Consumables and Parts for the Purged Packed Inlet” on page 60.)
   - Adapter (0.53 mm, 1/8-inch packed, or 1/4-inch packed)
   - 7/16-inch and 9/16-inch wrench
   - Vespel/graphite ferrule
   - Methanol
   - Lint-free gloves

2 Load the inlet maintenance method and wait for the GC to become ready.

**WARNING** Be careful! The oven and/or inlet may be hot enough to cause burns. If the inlet is hot, wear heat-resistant gloves to protect your hands.

**CAUTION** Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.

3 Clean the end of the adapter with a lint-free cloth and methanol to remove contamination such as fingerprints.

4 Place the tubing nut and Vespel/graphite ferrule on the adapter.
5 Insert the adapter straight into the inlet base as far as possible.

6 Hold the adapter in this position and finger-tighten the nut.

7 Tighten an additional 1/4 turn with a wrench.
To Change the O-Ring on the Purged Packed Inlet

1 Gather the following:
   - Replacement O-ring (See “Consumables and Parts for the Purged Packed Inlet” on page 60.)
   - Septum nut wrench
   - Tweezers
   - Lint-free gloves

2 Load the inlet maintenance method and wait for the GC to become ready.

**WARNING** Be careful! The oven and/or inlet may be hot enough to cause burns. If the inlet is hot, wear heat-resistant gloves to protect your hands.

3 Loosen the top insert weldment to remove the top portion of the inlet.

**CAUTION** Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.

4 Use tweezers to remove the old O-ring.

5 Insert a new O-ring.

6 Install and tighten the top insert weldment.

7 Restore the analytical method.
To Change the Glass Liner on the Purged Packed Inlet

1 Gather the following:
   - Replacement glass liner (See “Consumables and Parts for the Purged Packed Inlet” on page 60.)
   - 9/16-inch wrench
   - Lint-free gloves

2 Load the inlet maintenance method and wait for the GC to become ready.

   **WARNING**
   Be careful! The oven and/or inlet may be hot enough to cause burns. If the inlet is hot, wear heat-resistant gloves to protect your hands.

3 Loosen the top insert weldment to remove the top portion of the inlet.

4 Use a thin wire or wood splint to carefully lift and remove the old glass liner.

   **CAUTION**
   Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.
5 Wearing gloves, inspect the O-ring and replace, if necessary. (See “To Change the O-Ring on the Purged Packed Inlet” on page 74.)

6 Wearing gloves, grasp the flared end (top) of the replacement glass liner with tweezers and install it in the inlet. If the glass liner does not seat properly because a capillary column is installed, remove the column, install the glass liner, and replace the column. (See “To Install a Capillary Column with the Purged Packed Inlet” on page 64.)

7 Install the top insert weldment and hand-tighten firmly.

8 Restore the analytical method.

9 Set the liner counter.
To Install an Insulation Cup on the Purged Packed Inlet

1. Gather the following:
   - No-hole ferrule
   - Column nut

2. Install a plug (for example, a column nut with no-hole ferrule) in the inlet capillary adapter.

3. Push the cup spring to the right. Slide the cup over the inlet fitting so that the insulation at the top of the cup is flush against the oven roof.

4. Place the spring into the groove in the inlet liner. Remove the column nut and no-hole ferrule.
To Clean the Purged Packed Inlet

1 Gather the following:
   - Replacement O-ring (See “Consumables and Parts for the Purged Packed Inlet” on page 60.)
   - Replacement glass liner
   - Replacement septum
   - Solvent that will clean the type of deposits in your inlet
   - Compressed, filtered, dry air or nitrogen
   - Beaker
   - Cleaning brushes—The FID cleaning kit (part number 9301-0985) contains appropriate brushes
   - Lint-free gloves

2 Load the inlet maintenance method and wait for the GC to become ready.

   **WARNING**
   Be careful! The oven and/or inlet may be hot enough to cause burns. If the inlet is hot, wear heat-resistant gloves to protect your hands.

3 Remove the column.
4 Remove the septum nut and septum.
5 Remove the top insert weldment.
6 Remove the glass liner and O-ring.
7 If used, remove the adapter.
8 Ultrasonically clean the septum nut, top insert weldment, and adapter (if used) in a suitable solvent.
9 Place a beaker in the oven under the inlet to catch the solvent.

   **CAUTION**
   Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.

10 Soak a cleaning brush with the solvent and vigorously scrub the interior walls of the inlet.
11 Blow the inside of the inlet dry with compressed air or nitrogen.

12 Install the adapter, if used. (See “To Install an Adapter on the Purged Packed Inlet” on page 72.)

13 Install the glass liner and O-ring. (See “To Change the Glass Liner on the Purged Packed Inlet” on page 75.)

14 Install the top insert weldment and finger-tighten.

15 Install the septum and septum nut. (See “To Change the Septum on the Purged Packed Inlet” on page 68.)

16 Attach the column. (See “To Install a Capillary Column with the Purged Packed Inlet” on page 64.)

17 Check for leaks.

18 Restore the analytical method.

19 Set the septum and glass liner counters.
To Bakeout Contaminants from the Purged Packed Inlet

1. Set the column flow to the normal operating value, or set the capillary column gas velocity to 30 cm/s.

2. Purge the column with carrier flow for at least 10 minutes before heating the oven.

3. If the column is attached to the detector, set the detector 25 °C above normal operating temperature.
   - If the column is not attached to the detector, cap the detector fitting.

4. Set the inlet temperature to 300 °C or 25 °C above the normal operating temperature.

5. Set the column oven 25 °C above the GC method final oven temperature to bake contaminants out of the inlet. Do not exceed the column manufacturer’s maximum temperature limit.

6. Bakeout for 30 minutes or until the detector baseline is free of contamination peaks.
To Install a Packed Metal Column

1 Gather the following:
   - 7/16-inch, 9/16-inch, and 1/2-inch wrenches
   - Lint-free gloves

2 Load the GC maintenance method and wait for the GC to become ready.

3 Prepare the packed metal column. (See “To Install Ferrules on a Packed Metal Column” on page 90.)

4 Install the 1/8-inch or 1/4-inch packed column inlet adapter, if necessary. (See “To Install an Adapter on the Purged Packed Inlet” on page 72.)

**WARNING**

Be careful! The oven, inlet, and/or detector may be hot enough to cause burns. If the oven, inlet, or detector is hot, wear heat-resistant gloves to protect your hands.

**CAUTION**

Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.

5 Attach the column to the inlet adapter. Finger-tighten the nut.

6 Tighten the nut an additional 1/4 turn with a wrench (for a 1/8-inch column) or an additional 3/4 turn (for a 1/4-inch column).

   Use two wrenches, one on the column nut and the other on the adapter, to prevent the adapter from rotating.

7 Press [Config], [Column 1] or [Column 2], enter 0.00 in either Length or Diameter, and identify the inlet and detector to which the column is attached.

**WARNING**

Do not use hydrogen as the carrier for conditioning! It could vent into the oven and present an explosion hazard.

8 Condition the column, if necessary. (See “To Condition a Packed Column” on page 88.)
9 Load the GC maintenance method and wait for the GC to become ready.

**WARNING** Be careful! The oven, inlet, and/or detector may be hot enough to cause burns. If the oven, inlet, or detector is hot, wear heat-resistant gloves to protect your hands.

10 If required, install the detector adapter. (See “To Install a Packed Column Adapter on a Detector Fitting” on page 83.)

11 Attach the column to the detector or detector adapter. Finger-tighten the nut.

12 Tighten the nut an additional 1/4 turn with a wrench (for a 1/8-inch column) or an additional 3/4 turn (for a 1/4-inch column).

13 Establish a flow of carrier gas and purge as recommended by the packing manufacturer. Generally:
   - 20 to 30 mL/min for 2-mm id glass or 1/8-inch od metal columns
   - 50 to 60 mL/min for 4-mm id glass or 1/4-inch od metal columns

14 Restore the analytical method.
   - For FPD, immediately turn off the flame.
   - For NPD, immediately set the bead voltage to 0.0.

15 After the GC becomes ready, wait 10 minutes then ignite the detector flame or adjust offset on the NPD bead.

**WARNING** Be careful! The oven, inlet, and/or detector may be hot enough to cause burns. If the oven, inlet, or detector is hot, wear heat-resistant gloves to protect your hands.

16 Allow the oven, inlet, and detector to equilibrate at operating temperature, then retighten the fittings.
To Install a Packed Column Adapter on a Detector Fitting

1 Gather the following:
   - 7/16-inch, 9/16-inch, and 1/2-inch wrenches
   - Vespel/graphite ferrule (See “Consumables and Parts for the Purged Packed Inlet” on page 60.)
   - Brass column nut
   - Lint-free gloves
   - Adapter.

Select the appropriate adapter from one of the parts lists shown below:
   - Consumables and Parts for the FID (Packed columns can only be installed on an adaptable FID.)
   - Consumables and Parts for the TCD
   - Consumables and Parts for the NPD
   - Consumables and Parts for the FPD

2 Load the GC maintenance method and wait for the GC to become ready.

**WARNING**
Be careful! The detector may be hot enough to cause burns. If the detector is hot, wear heat-resistant gloves to protect your hands.

**CAUTION**
Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.

3 Assemble a nut and a ferrule onto the adapter.

4 Insert the adapter straight into the detector base as far as possible.
5 Hold the adapter in this position and finger-tighten the nut.

6 Tighten an additional 1/4 turn with a wrench (for a 1/8-inch column) or an additional 3/4 turn (for a 1/4-inch column).
To Install a Packed Glass Column

1 Gather the following:
   - 9/16-inch wrench
   - Two 1/4-inch brass nuts (See “Consumables and Parts for the Purged Packed Inlet” on page 60.)
   - Two 1/4-inch Vespel/graphite ferrules
   - Lint-free gloves

2 Load the GC maintenance method and wait for the GC to become ready.

**WARNING**
Be careful! The oven, inlet, and/or detector may be hot enough to cause burns. If the oven, inlet, or detector is hot, wear heat-resistant gloves to protect your hands.

**CAUTION**
Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.

3 Assemble a brass nut and Vespel/graphite ferrule on each end of the column.

Glass columns must be simultaneously inserted into the inlet and detector and installed parallel to the oven door. When conditioning the column, do not attach the column to the detector.

4 If conditioning the column, insert the column into the purged packed inlet until it bottoms. Withdraw the column 1 to 2 mm. Finger-tighten the inlet column nut. (See “To Condition a Packed Column” on page 88.)

**CAUTION**
Overtightening the column nut or forcing it to bottom in either the inlet or detector may shatter the column.
5 Tighten the inlet column nut 1/4 turn with a wrench.

**WARNING**

*Do not use hydrogen as the carrier for conditioning! It could vent into the oven and present an explosion hazard.*

6 After conditioning, remove the column from the inlet.

7 Simultaneously insert the column into the inlet and detector fittings but *do not* force it. It may be necessary to start the long end of the column in the inlet at an angle to clear the oven floor.

8 Withdraw the column 1 to 2 mm from both the inlet and detector. Finger-tighten both column nuts.

**CAUTION**

Overtightening the column nut or forcing it to bottom in either the inlet or detector may shatter the column.

9 Tighten both column nuts 1/4 turn with a wrench.

10 Press [Config], [Column 1] or [Column 2], enter **0.00** in either **Length** or **Diameter**, and identify the inlet and detector to which the column is connected.

11 Establish a flow of carrier gas and purge as recommended by the packing manufacturer. Generally:
   - 20 to 30 mL/min for 2-mm id glass or 1/8-inch od metal columns
   - 50 to 60 mL/min for 4-mm id glass or 1/4-inch od metal columns

12 Restore the analytical method.
   - For FPD, immediately turn off the flame.
• For NPD, immediately set the bead voltage to 0.0.

13 After the GC becomes ready, wait 10 minutes then ignite the detector flame or adjust offset on the NPD bead.

**WARNING**

Be careful! The oven, inlet, and/or detector may be hot enough to cause burns. If the oven, inlet, or detector is hot, wear heat-resistant gloves to protect your hands.

14 Allow the oven, inlet, and detector to equilibrate at operating temperature, then retighten the fittings.
To Condition a Packed Column

1. Gather the following:
   - Capillary adapter, column nut, and no-hole ferrule (for FID and NPD), or 1/8-inch Swagelok cap (for TCD and FPD)
   - Two 7/16-inch wrenches
   - 1/4-inch open-end wrench
   - Lint-free gloves

**WARNING** Do not use hydrogen as the carrier for conditioning! It could vent into the oven and present an explosion hazard.

2. Load the GC maintenance method and wait for the GC to become ready.

**WARNING** Be careful! The oven, inlet, and/or detector may be hot enough to cause burns. If the oven, inlet, or detector is hot, wear heat-resistant gloves to protect your hands.

**CAUTION** Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.

3. Install the proper liner in the inlet and attach the column. (See “To Install a Packed Metal Column” on page 81.)

4. Cap the detector(s) fittings with the capillary adapter, no-hole ferrule and column nut (FID and NPD) or 1/8-inch cap (FPD and TCD).

5. Enter a column flow as recommended by the packing manufacturer or an appropriate flow as follows:
   - 20 to 30 mL/min for 2-mm id glass or 1/8-inch od metal columns
   - 50 to 60 mL/min for 4-mm id glass or 1/4-inch od metal columns

6. Raise the oven temperature slowly to the conditioning temperature for the column. The conditioning temperature
is never higher than the maximum temperature limit for the column; 30 °C less than the maximum is usually sufficient.

7 Continue conditioning overnight at the final temperature. Cool the oven to room temperature with carrier flow on.

8 Attach the column to the detector and maintain established flow. (See “To Install a Packed Metal Column” on page 81.)
To Install Ferrules on a Packed Metal Column

1. Gather the following:
   - Wrenches
   - Stainless steel male Swagelok fitting, 1/4- or 1/8-inch od
   - Brass Swagelok nut and ferrule set (See “Consumables and Parts for the Purged Packed Inlet” on page 60.)
   - Lint-free gloves

2. Verify that the column end is cut square and is free of burns and deformation.

3. Secure the fitting in a bench vise.

   **CAUTION** Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.

4. Assemble a Swagelok nut and ferrules onto the column.

   Front ferrule  
   Back ferrule  
   Column nut

5. Fully insert the column into the vise-held fitting, then withdraw 1–2 mm. Finger-tighten the nut.

6. Tighten the nut an additional 3/4 turn with a wrench (for a 1/8-inch column) or an additional 1-1/4 turn (for a 1/4-inch column).

7. Unscrew the column nut from the vise-held fitting and remove the column. Ferrules should now be set in place on the column with the column end correctly positioned.
# Maintaining the COC Inlet

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Consumables and Parts for the COC Inlet

See the Agilent catalog for consumables and supplies for a more complete listing, or visit the Agilent Web site for the latest information (www.agilent.com/chem/supplies).

Table 11  Recommended septum nut and inserts for injections onto 0.53-mm columns

<table>
<thead>
<tr>
<th>Column type</th>
<th>Part number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insert, fused silica, 0.53-mm id</td>
<td>19245-20580 (no rings)</td>
</tr>
<tr>
<td>Insert, aluminum-clad, 0.53-mm id</td>
<td>19245-20780 (4 rings)</td>
</tr>
<tr>
<td>Septum nut, 530 µm</td>
<td>G1545-80520</td>
</tr>
<tr>
<td>Needle support assembly, 530 µm, for 7683B injector</td>
<td>G2913-60977</td>
</tr>
</tbody>
</table>

Table 12  Recommended parts for injections onto 0.25-mm and 0.32-mm columns

<table>
<thead>
<tr>
<th>Column type</th>
<th>Part number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insert, fused silica, 0.32-mm id</td>
<td>19245-20525 (5 rings)</td>
</tr>
<tr>
<td>Insert, 0.25-mm id</td>
<td>19245-20515 (6 rings)</td>
</tr>
<tr>
<td>Septum nut, 250/320 µm</td>
<td>19245-80521</td>
</tr>
<tr>
<td>Syringe barrel, removable needle, 5 µL</td>
<td>5182-0836</td>
</tr>
<tr>
<td>Needle, 250 µm (3/pk)</td>
<td>5182-0833</td>
</tr>
<tr>
<td>Needle, 320 µm (3/pk)</td>
<td>5182-0831</td>
</tr>
<tr>
<td>Needle support assembly, 250/320 µm, for 7683B injector</td>
<td>G2913-60978</td>
</tr>
</tbody>
</table>

Table 13  Recommended parts for injections onto 0.2-mm columns

<table>
<thead>
<tr>
<th>Description</th>
<th>Part number/quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insert, fused silica, 0.20-mm id</td>
<td>19245-20510</td>
</tr>
<tr>
<td>Cooling tower assembly</td>
<td>19230-80625</td>
</tr>
<tr>
<td>Syringe barrel, for fused silica needle, 10 µL</td>
<td>9301-0658</td>
</tr>
<tr>
<td>Replacement needles, fused silica, 0.18 mm</td>
<td>19091-63000 (6/pk)</td>
</tr>
<tr>
<td>Replacement PTFE ferrule for fused silica syringe</td>
<td>0100-1389</td>
</tr>
<tr>
<td>Removable stainless steel needle syringe, 10 µL</td>
<td>5182-9633</td>
</tr>
</tbody>
</table>
### Table 13  
Recommended parts for injections onto 0.2-mm columns

<table>
<thead>
<tr>
<th>Description</th>
<th>Part number/quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Replacement stainless steel needles, 0.23 mm</td>
<td>5182-9645 (3/pk)</td>
</tr>
</tbody>
</table>

### Table 14  
Recommended septa for the COC inlet

<table>
<thead>
<tr>
<th>Description</th>
<th>Part number/quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>For 0.53-mm and 0.25/0.32-mm septum nuts</strong></td>
<td></td>
</tr>
<tr>
<td>5-mm solid septum for manual and automatic injection</td>
<td>5181-1261</td>
</tr>
<tr>
<td>5-mm long-life septum</td>
<td>5183-4762 (50/pk)</td>
</tr>
<tr>
<td>5-mm advanced green septum</td>
<td>5183-4760 (50/pk)</td>
</tr>
<tr>
<td>5-mm, high-temperature, low-bleed septum</td>
<td>5183-4758 (50/pk)</td>
</tr>
<tr>
<td>5-mm through-hole septum for automatic injection</td>
<td>5181-1260 (25/pk)</td>
</tr>
<tr>
<td><strong>For the duckbill septum</strong></td>
<td></td>
</tr>
<tr>
<td>Duckbill septum for manual injection only (must use cooling</td>
<td>19245-40050 (10/pk)</td>
</tr>
<tr>
<td>tower with duckbill)</td>
<td></td>
</tr>
</tbody>
</table>

### Table 15  
Nuts, ferrules, and hardware for capillary columns

<table>
<thead>
<tr>
<th>Column id (mm)</th>
<th>Description</th>
<th>Typical use</th>
<th>Part number/quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>.530</td>
<td>Ferrule, Vespel/graphite, 0.8-mm id</td>
<td>0.45-mm and 0.53-mm capillary columns</td>
<td>5062-3512 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Ferrule, graphite, 1.0-mm id</td>
<td>0.53-mm capillary columns</td>
<td>5080-8773 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Column nut, finger-tight (for 0.53-mm columns)</td>
<td>Connect column to inlet or detector</td>
<td>5020-8293</td>
</tr>
<tr>
<td>.320</td>
<td>Ferrule, Vespel/graphite, 0.5-mm id</td>
<td>0.32-mm capillary columns</td>
<td>5062-3514 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Ferrule, graphite, 0.5-mm id</td>
<td>0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns</td>
<td>5080-8853 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Column nut, finger-tight (for .100- to .320-mm columns)</td>
<td>Connect column to inlet or detector</td>
<td>5020-8292</td>
</tr>
<tr>
<td>.250</td>
<td>Ferrule, Vespel/graphite, 0.4-mm id</td>
<td>0.1-mm, 0.2-mm, and 0.25-mm capillary columns</td>
<td>5181-3323 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Ferrule, graphite, 0.5-mm id</td>
<td>0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns</td>
<td>5080-8853 (10/pk)</td>
</tr>
</tbody>
</table>
### Table 15  Nuts, ferrules, and hardware for capillary columns (continued)

<table>
<thead>
<tr>
<th>Column id (mm)</th>
<th>Description</th>
<th>Typical use</th>
<th>Part number/quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>.100 and .200</td>
<td>Ferrule, Vespel/graphite, 0.37-mm id</td>
<td>0.1-mm and 0.2-mm capillary columns</td>
<td>5062-3516 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Ferrule, Vespel/graphite, 0.4-mm id</td>
<td>0.1-mm, 0.2-mm, and 0.25-mm capillary columns</td>
<td>5181-3323 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Ferrule, graphite, 0.5-mm id</td>
<td>0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns</td>
<td>5080-8853 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Column nut, finger-tight (for .100- to .320-mm columns)</td>
<td>Connect column to inlet or detector</td>
<td>5020-8292</td>
</tr>
<tr>
<td>All</td>
<td>Ferrule, no-hole</td>
<td>Testing</td>
<td>5181-3308 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Capillary column blanking nut</td>
<td>Testing—use with any ferrule</td>
<td>5020-8294</td>
</tr>
<tr>
<td></td>
<td>Column nut, universal</td>
<td>Connect column to inlet or detector</td>
<td>5181-8830 (2/pk)</td>
</tr>
<tr>
<td></td>
<td>Column cutter, ceramic wafer</td>
<td>Cutting capillary columns</td>
<td>5181-8836 (4/pk)</td>
</tr>
</tbody>
</table>
Exploded Parts View of the COC Inlet

- Septum nut (0.53 mm)
- Septum nut (0.25-mm and 0.32-mm columns)
- Septum
- Spring
- Insert
- Ferrule
- Cooling tower assembly
- Duckbill septum
- Column nut
To Install a Capillary Column with the COC Inlet

1. Gather the following:
   - Column nut and ferrule. (See “Consumables and Parts for the COC Inlet” on page 92.)
   - Column cutter
   - 1/4-inch and 5/16-inch wrenches
   - Lint-free gloves

2. Load the inlet maintenance method and wait for the GC to become ready.

**WARNING**
Be careful! The oven and/or inlet may be hot enough to cause burns. If either is hot, wear heat-resistant gloves to protect your hands.

**WARNING**
Wear safety glasses to protect your eyes from flying particles while handling, cutting, or installing glass or fused silica capillary columns. Use care in handling these columns to prevent puncture wounds.

**CAUTION**
Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.

3. Before installing the column, be sure the correct insert is installed for the needle and column. (See “To Install an Insert on the COC Inlet” on page 103.)

4. Place a capillary column nut and ferrule on the column.

5. Score the column using a glass scribing tool. The score must be square to ensure a clean break.
6 Break off the column end by supporting it against the column cutter opposite the scribe. Inspect the end with a magnifying loupe to make certain there are no burrs or jagged edges.

7 Wipe the column walls with a tissue dampened with isopropanol to remove fingerprints and dust.

8 Gently insert the column into the inlet until it bottoms.

9 Insert the column nut into the inlet fitting and finger-tighten.

WARNING
To avoid bending the inlet, always use two wrenches. Use a 5/16-inch wrench to support the inlet while tightening the column nut with a 1/4-inch wrench.

10 Tighten the column nut an additional 1/4 turn with a wrench or until the column does not move.

11 If using an automatic injection system with a 0.25-mm or 0.32-mm column, verify that the column installation by manually pushing the syringe into the inlet.

12 Configure the new column.

13 Condition the column per the manufacturer’s recommendation. (See To Condition a Capillary Column.)
14 Install the column into the detector. See:
   • To Install a Capillary Column in the FID
   • To Install a Capillary Column in the NPD
   • To Install a Capillary Column in the TCD
   • To Install a Capillary Column in the uECD
   • To Install a Capillary Column Adapter in the FPD
15 After the column is installed at both inlet and detector, establish a flow of carrier gas and purge as recommended by the column manufacturer.
16 Restore the analytical method.
   • For FPD, immediately turn off the flame.
   • For NPD, immediately set the bead voltage to 0.0.
17 After the GC becomes ready, wait 10 minutes then ignite the detector flame or adjust offset on the NPD bead.

**WARNING**

Be careful! The oven, inlet, and/or detector may be hot enough to cause burns. If they are hot, wear heat-resistant gloves to protect your hands.

18 Allow the oven, inlet, and detector to equilibrate at operating temperature, then retighten the fittings.
To Check the Needle-to-Column Size on the COC Inlet

1. Gather the following:
   - Insert (See “Consumables and Parts for the COC Inlet” on page 92.)
   - Syringe needle

2. Load the inlet maintenance method and wait for the GC to become ready.

**WARNING**

Be careful! The oven and/or inlet may be hot enough to cause burns. If either is hot, wear heat-resistant gloves to protect your hands.

**WARNING**

Wear safety glasses to protect your eyes from flying particles while handling, cutting, or installing glass or fused silica capillary columns. Use care in handling these columns to prevent puncture wounds.

3. Check the needle-to-column size to make certain that the needle fits in the column.

4. Identify the correct insert for the column size. (See “Consumables and Parts for the COC Inlet” on page 92.) Use the insert that is the same size as the syringe needle to verify that the column you plan to use is the correct size.

5. Insert the column into one end of the insert.

6. Insert the syringe needle through the other end of the insert and into the column. If the needle cannot pass
easily into the column, reverse the insert to try the needle and column in the other end.
To Change a Septum on the COC Inlet

1. Gather the following:
   - Replacement septum. (See “Consumables and Parts for the COC Inlet” on page 92.)
   - Tweezers
   - A thin wire (0.2-inch diameter) for removing septum from inlet
   - Lint-free gloves

2. Load the inlet maintenance method and wait for the GC to become ready.

   **WARNING**
   Be careful! The oven and/or inlet may be hot enough to cause burns. If either is hot, wear heat-resistant gloves to protect your hands.

   **CAUTION**
   Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.

3. Replace the septum.
   - If you are using a septum nut, grasp the knurling and unscrew. Remove the old septum with tweezers. Use tweezers to install a new septum. Push the septum into the septum nut until properly seated. Firmly tighten the nut.

For 250/320-µm automated injections

For 530-µm automated injections
• If you are using a cooling tower, grasp the three rings and unscrew. The spring and duckbill septum may pop out of the inlet when you remove the cooling tower. Be careful not to lose them. If they do not pop out, use a thin wire to remove them from the inlet. Insert the replacement duckbill septum into the spring and place in the inlet. Reattach the cooling tower assembly, then finger-tighten.

For manual 200-µm injections with fused silica needle

4 Before making an injection, check the alignment of the entire assembly using the proper size syringe.

5 Restore the analytical method.

6 Reset the septum counter.
To Install an Insert on the COC Inlet

1. Gather the following:
   - Lint-free gloves
   - Replacement insert. (See “Consumables and Parts for the COC Inlet” on page 92.)

2. Load the inlet maintenance method and wait for the GC to become ready.

**WARNING**

Be careful! The oven and/or inlet may be hot enough to cause burns. If either is hot, wear heat-resistant gloves to protect your hands.

**CAUTION**

Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.

3. Remove the column from the inlet.

4. Locate the septum nut or cooling tower assembly at the top of the inlet and remove it. If the septum remains in the septum nut, do not remove it unless you want to change it. If necessary, replace the existing septum or duckbill with a new one. (See “To Change a Septum on the COC Inlet” on page 101.)

5. Remove the spring from the inlet with an extraction wire and set it aside. Be careful not to lose or damage it because you will use the spring to keep the new insert in position.

6. Remove the existing insert from the inlet by gently pushing it out from below with a wire or piece of column. Store the insert for possible later use.
Maintaining the COC Inlet

7 Check that the insert is the correct size for both the
   needle and column. (See “To Check the Needle-to-Column
   Size on the COC Inlet” on page 99.)

8 Lower the new insert straight into the inlet from the top.

9 Install the spring on top of the insert.

10 Install the septum and septum nut or duckbill septum and
    cooling tower assembly and finger-tighten.

11 Install the column. (See “To Install a Capillary Column
    with the COC Inlet” on page 96.)
To Clean the COC Inlet

1. Gather the following:
   - 1/4-inch and 5/16-inch wrenches
   - Cleansing bath
   - Aqueous detergent
   - Distilled water
   - Methanol
   - Compressed, filtered, dry air or nitrogen
   - Lint-free gloves

2. Load the inlet maintenance method and wait for the GC to become ready.

**WARNING**
Be careful! The oven and/or inlet may be hot enough to cause burns. If either is hot, wear heat-resistant gloves to protect your hands.

**WARNING**
Wear safety glasses to protect your eyes from flying particles while handling, cutting, or installing glass or fused silica capillary columns. Use care in handling these columns to prevent puncture wounds.

**CAUTION**
Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.

3. Remove the column.

4. Remove the septum nut or cooling tower and then remove the septum.

5. Remove the existing insert from the inlet by gently pushing it out from below with a wire or piece of column. Store the insert for possible later use.
6 Fill an ultrasonic cleansing bath with aqueous detergent and place the spring and insert into it. Sonicate for 1 minute.

7 Drain the aqueous detergent and fill the bath with distilled water. Sonicate for 1 minute.

8 Remove the spring and insert from the bath and rinse thoroughly with water and methanol.

9 Dry the spring and insert with compressed air or nitrogen.

10 Install the insert. (See “To Install an Insert on the COC Inlet” on page 103.)

11 Install the column. (See “To Install a Capillary Column with the COC Inlet” on page 96.)
To Replace the Needle Support Assembly in a 7683B Injector

1 Gather a 7683B needle support assembly for injections onto 530-µm or 250/320-µm columns.

2 Remove all vials and bottles from the turret, and disconnect the injector cable from the GC.

3 Open the injector door.

4 Remove the syringe.

5 With your finger under the shaft near the bearing on the needle support assembly, pull gently to release the bearing from the bearing clip in the syringe carriage.
6 Carefully use the bearing to pull the rod down until you can lift the assembly out of the syringe carriage.

7 To install the needle support assembly, use your right hand to insert the upper end of the rod into the plastic guide to the right of the plunger carrier loop.

CAUTION Do not pull the assembly by its metal shaft, as it is easily bent.
8 Turn the needle support assembly so that the flat surface of the slide slides up and down the syringe carriage tracks.

9 Align the bearing on the needle support assembly with the plastic bearing clip to the right of the syringe latch and push gently on the bearing until the assembly snaps into place.

**CAUTION**

Be careful not to bend the needle during installation.

Do not operate the injector without a syringe or align the probe in place because the free-swinging syringe latch may interfere with the motor and jam the syringe carriage.

10 Install the syringe.
To Replace a Needle in a Syringe

1. Gather the following (see Table 12, “Recommended parts for injections onto 0.25-mm and 0.32-mm columns,” on page 92):
   - Syringe barrel
   - Needle, 250-µm or 320-µm

2. Unscrew the syringe barrel cap and remove the spring.

3. Make sure that the needle has the PTFE disk as shown below. If the syringe barrel does not have the PTFE disk, use the instructions in the syringe box to wrap the needle.

4. Slide the spring and the cap over the needle.

5. Insert the needle into the syringe barrel.

6. Screw the cap back on the syringe barrel.
To Replace the Fused Silica Needle in a Syringe for the COC Inlet

**NOTE**
The fused silica needle and syringe are only used with the cooling tower and duckbill septum for manual, on-column injections onto 200-µm columns.

1. Gather the following:
   - New fused silica syringe needle (See “Consumables and Parts for the COC Inlet” on page 92.)
   - Solvent

**WARNING**
Wear safety glasses to protect your eyes from flying particles while handling, cutting, or installing glass or fused silica capillary columns. Use care in handling these columns to prevent puncture wounds.

2. Loosen the retaining nut and remove the old needle.

3. Hold the syringe vertically and insert the new fused silica needle so it is visible inside the syringe barrel. If the needle cannot be inserted into the syringe barrel, the PTFE ferrule may be blocked. You may need to replace the ferrule.

4. Push the plunger down until it bottoms. The needle will be flush with the plunger end.

5. Finger-tighten the retaining nut. Pull the needle gently to be sure the PTFE ferrule has formed a tight seal with the needle. Tighten the retaining nut further, if necessary.
6 Loosen the retaining nut just enough so the needle is again free.

7 Depress the syringe plunger slowly until it pushes the needle to the end of the barrel, then finger-tighten the retaining nut.

8 Use a solvent to rinse the syringe and check for leaks or blocks. Leaks may be fixed by further tightening the retaining nut. Blocks or serious leaks require repeating this procedure.
To Bakeout Contaminants from the COC Inlet

1. Set the column flow to the normal operating value, or set the capillary column gas velocity to 30 cm/s.
2. Purge the column with carrier flow for at least 10 minutes before heating the oven.
3. Set the inlet mode to **Oven Track**.
4. If the column is attached to the detector, set the detector 25 °C above normal operating temperature.
   
   If the column is not attached to the detector, cap the detector fitting.
5. Set the column oven 25 °C above the GC method final oven temperature to bake contaminants out of the inlet. Do not exceed the column manufacturer's maximum temperature limit.
6. Bakeout for 30 minutes or until the detector baseline is free of contamination peaks.
6  Maintaining the COC Inlet
7

Maintaining the MMI

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To Install the Column Nut Adapter  124
To Change the Septum on the MMI  125
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To Change the Liner and O-Ring on the MMI  129
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Maintaining Your GC

7 Maintaining the MMI

Consumables and Parts for the MMI

See the Agilent catalog for consumables and supplies for a more complete listing, or visit the Agilent Web site for the latest information (www.agilent.com/chem/supplies).

Table 16  Split, splitless, direct, and direct connect inlet liners

<table>
<thead>
<tr>
<th>Mode</th>
<th>Description</th>
<th>Deactivated</th>
<th>Part number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Split</td>
<td>Low-pressure drop, glass wool, single taper, 870 µL</td>
<td>Yes</td>
<td>5183-4647</td>
</tr>
<tr>
<td>Split</td>
<td>Glass wool, 990 µL</td>
<td>No</td>
<td>19251-60540</td>
</tr>
<tr>
<td>Split—Manual only</td>
<td>Empty pin and cup, 800 µL</td>
<td>No</td>
<td>18740-80190</td>
</tr>
<tr>
<td>Split—Manual only</td>
<td>Packed pin and cup, 800 µL</td>
<td>No</td>
<td>18740-60840</td>
</tr>
<tr>
<td>Splitless</td>
<td>Single taper, glass wool, 900 µL</td>
<td>Yes</td>
<td>5062-3587</td>
</tr>
<tr>
<td>Splitless</td>
<td>Single taper, no glass wool, 900 µL</td>
<td>Yes</td>
<td>5181-3316</td>
</tr>
<tr>
<td>Splitless</td>
<td>Dual taper, no glass wool, 800 µL</td>
<td>Yes</td>
<td>5181-3315</td>
</tr>
<tr>
<td>Splitless—Direct inject</td>
<td>2-mm id, quartz, 250 µL</td>
<td>No</td>
<td>18740-80220</td>
</tr>
<tr>
<td>Splitless—Direct inject</td>
<td>2-mm id, 250 µL</td>
<td>Yes</td>
<td>5181-8818</td>
</tr>
<tr>
<td>Direct inject —Headspace or purge and trap</td>
<td>1.5-mm id, 140 µL</td>
<td>No</td>
<td>18740-80200</td>
</tr>
<tr>
<td>Direct column connect</td>
<td>Single taper, splitless 4-mm id</td>
<td>Yes</td>
<td>G1544-80730</td>
</tr>
<tr>
<td>Direct column connect</td>
<td>Dual taper, splitless 4-mm id</td>
<td>Yes</td>
<td>G1544-80700</td>
</tr>
</tbody>
</table>

Table 17  Nuts, ferrules, and hardware for capillary columns

<table>
<thead>
<tr>
<th>Column id (mm)</th>
<th>Description</th>
<th>Typical use</th>
<th>Part number/quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>.530</td>
<td>Ferrule, Vespel/graphite, 0.8-mm id</td>
<td>0.45-mm and 0.53-mm capillary columns</td>
<td>5062-3512 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Ferrule, graphite, 1.0-mm id</td>
<td>0.53-mm capillary columns</td>
<td>5080-8773 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Column nut, finger-tight (for 0.53-mm columns)</td>
<td>Connect column to inlet or detector</td>
<td>5020-8293</td>
</tr>
<tr>
<td>.320</td>
<td>Ferrule, Vespel/graphite, 0.5-mm id</td>
<td>0.32-mm capillary columns</td>
<td>5062-3514 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Ferrule, graphite, 0.5-mm id</td>
<td>0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns</td>
<td>5080-8853 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Column nut, finger-tight (for .100- to .320-mm columns)</td>
<td>Connect column to inlet or detector</td>
<td>5020-8292</td>
</tr>
</tbody>
</table>
### Table 17  
Nuts, ferrules, and hardware for capillary columns (continued)

<table>
<thead>
<tr>
<th>Column id (mm)</th>
<th>Description</th>
<th>Typical use</th>
<th>Part number/quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>.250</td>
<td>Ferrule, Vespel/graphite, 0.4-mm id</td>
<td>0.1-mm, 0.2-mm, and 0.25-mm capillary columns</td>
<td>5181-3323 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Ferrule, graphite, 0.5-mm id</td>
<td>0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns</td>
<td>5080-8853 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Column nut, finger-tight (for .100- to .320-mm columns)</td>
<td>Connect column to inlet or detector</td>
<td>5020-8292</td>
</tr>
<tr>
<td>.100 and .200</td>
<td>Ferrule, Vespel/graphite, 0.37-mm id</td>
<td>0.1-mm and 0.2-mm capillary columns</td>
<td>5062-3516 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Ferrule, graphite, 0.5-mm id</td>
<td>0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns</td>
<td>5080-8853 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Column nut, finger-tight (for .100- to .320-mm columns)</td>
<td>Connect column to inlet or detector</td>
<td>5020-8292</td>
</tr>
<tr>
<td>All</td>
<td>Ferrule, no-hole</td>
<td>Testing</td>
<td>5181-3308 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Capillary column blanking nut</td>
<td>Testing—use with any ferrule</td>
<td>5020-8294</td>
</tr>
<tr>
<td></td>
<td>Column nut, universal</td>
<td>Connect column to inlet or detector</td>
<td>5181-8830 (2/pk)</td>
</tr>
<tr>
<td></td>
<td>Column cutter, ceramic wafer</td>
<td>Cutting capillary columns</td>
<td>5181-8836 (4/pk)</td>
</tr>
</tbody>
</table>

### Table 18  
Other consumables and parts for the multimode inlet (MMI)

<table>
<thead>
<tr>
<th>Description/quantity</th>
<th>Part number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Septum retainer nut for headspace</td>
<td>18740-60830</td>
</tr>
<tr>
<td>Septum retainer nut</td>
<td>18740-60835</td>
</tr>
<tr>
<td>11-mm septum, high-temperature, low-bleed, 50/pk</td>
<td>5183-4757</td>
</tr>
<tr>
<td>11-mm septum, prepierced, long life, 50/pk</td>
<td>5183-4761</td>
</tr>
<tr>
<td>Merlin Microseal septum (high-pressure)</td>
<td>5182-3444</td>
</tr>
<tr>
<td>Merlin Microseal septum (30 psi)</td>
<td>5181-8815</td>
</tr>
<tr>
<td>Nonstick fluorocarbon liner O-ring (for temperatures up to 350 °C), 10/pk</td>
<td>5188-5365</td>
</tr>
<tr>
<td>Graphite O-ring for split liner (for temperatures above 350 °C), 10/pk</td>
<td>5180-4168</td>
</tr>
<tr>
<td>Graphite O-ring for splitless liner (for temperatures above 350 °C), 10/pk</td>
<td>5180-4173</td>
</tr>
</tbody>
</table>
### Table 18  Other consumables and parts for the multimode inlet (MMI)

<table>
<thead>
<tr>
<th>Description/quantity</th>
<th>Part number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Split vent trap PM kit, single cartridge</td>
<td>5188-6495</td>
</tr>
<tr>
<td>Column nut, blanking plug</td>
<td>5020-8294</td>
</tr>
<tr>
<td>Cleaning kit, multimode inlet. (Contains 5 each abrasive swabs and 5 each cotton swabs.)</td>
<td>G3510-60820</td>
</tr>
<tr>
<td>Column nut adapter</td>
<td>G3510-20018</td>
</tr>
</tbody>
</table>
Exploded Parts View of the MMI

- Merlin cap
- Merlin Microseal
- Insert assembly
- O-ring
- Liner
- Cryo
- Split vent line
- Inlet base
- Insulation
- Foil
- Insulation cup
- Ferrule
- Septum retainer nut
- Septum
- Column nut
To Install a Capillary Column with the MMI

**WARNING** Do not use hydrogen as the carrier for conditioning! It could vent into the oven and present an explosion hazard.

1. Gather the following (see “Consumables and Parts for the MMI” on page 116):
   - Column
   - Ferrule(s)
   - Column nut
   - Septum
   - Column cutter
   - Isopropanol
   - Lab tissue
   - Metric ruler
   - 1/4-inch open-end wrenches
   - Lint-free gloves

2. Load the GC maintenance method and wait for the GC to become ready.

**WARNING** Be careful! The oven and/or inlet may be hot enough to cause burns. If either is hot, wear heat-resistant gloves to protect your hands.

**WARNING** Wear safety glasses to protect your eyes from flying particles while handling, cutting, or installing glass or fused silica capillary columns. Use care in handling these columns to prevent puncture wounds.

3. Verify that the correct glass liner is installed. (See “Consumables and Parts for the MMI” on page 116.)

4. Place the column on the hanger with the ends pointing up and the label to the front.

**CAUTION** Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.
5. Place a septum, capillary column nut, and ferrule on the column.

6. Score the column using a glass scribing tool. The score must be square to ensure a clean break.

7. Break off the column end by supporting it against the column cutter opposite the scribe. Inspect the end with a magnifying loupe to make certain there are no burrs or jagged edges.

8. Wipe the column walls with a tissue dampened with isopropanol to remove fingerprints and dust.

9. Position the column so it extends 10 to 12 mm above the end of the ferrule. Slide the septum up the column to hold the column nut at this position.
While holding the inlet base with a wrench thread the column nut into the inlet (but do not tighten).

Adjust the column position so that the septum contacts the bottom of the column nut. Finger-tighten the column nut until it begins to grip the column.

While holding the inlet base with one wrench, use the second wrench to tighten the column nut an additional 1/4 to 1/2 turn so that the column cannot be pulled from the fitting with gentle pressure.

Configure the new column.

Condition the column per the manufacturer's recommendation. (See To Condition a Capillary Column.)

Install the column into the detector. See:
- To Install a Capillary Column in the FID
- To Install a Capillary Column in the NPD
- To Install a Capillary Column in the TCD
- To Install a Capillary Column in the uECD
- To Install a Capillary Column Adapter in the FPD

After the column is installed at both inlet and detector, establish a flow of carrier gas and purge as recommended by the column manufacturer.
17 Restore the analytical method.
   • For FID or FPD, immediately turn off the flame.
   • For NPD, immediately turn off the bead.

18 After the GC becomes ready, wait 10 minutes then ignite the detector flame or bead.

**WARNING**
Be careful! The oven, inlet, and/or detector may be hot enough to cause burns. If they are hot, wear heat-resistant gloves to protect your hands.

19 Allow the oven, inlet, and detector to equilibrate at operating temperature, then retighten the fittings.
To Install the Column Nut Adapter

1. Gather the following (see “Consumables and Parts for the MMI” on page 116):
   - Column nut adapter

2. Load the GC maintenance method and wait for the GC to become ready.

   **WARNING**
   
   **Be careful! The oven and/or inlet may be hot enough to cause burns. If either is hot, wear heat-resistant gloves to protect your hands.**

3. When the GC becomes ready, open the GC oven door.

4. Thread the column adapter nut onto the base of the inlet.

   ![Diagram of Column Nut Adapter Oriented as Shown]

   **Column nut adapter**

   Orient as shown.

   The nut must spin freely before it can be used to install a column.
To Change the Septum on the MMI

1 Gather the following:
   - Replacement septum. (See “Consumables and Parts for the MMI” on page 116.)
   - Wrench, hex for changing septum
   - 0- or 00-grade steel wool (optional)
   - Tweezers

2 Load the inlet maintenance method and wait for the GC to become ready.

**WARNING** Be careful! The oven and/or inlet may be hot enough to cause burns. If the inlet is hot, wear heat-resistant gloves to protect your hands.

3 Remove the septum retainer nut or Merlin cap.

4 Use tweezers to remove the septum or Merlin Microseal from the insert assembly. Do not gouge or scratch the interior of the insert assembly.

5 Firmly press the new septum or Merlin Microseal into the fitting. The metal parts side of the Merlin Microseal should face down (toward the oven).

6 Install the septum retainer nut or Merlin cap and finger-tighten. Tighten the septum retainer nut until the C-ring is about 1 mm above the nut.
Overtightening the septum nut can cause contamination.

7 Restore the analytical method.
8 Reset the septum counter.
To Clean the Septum Seat in the Insert Assembly of the MMI

1 Gather the following:
   • Replacement septum (See “Consumables and Parts for the MMI” on page 116.)
   • Wrench, hex for changing septum
   • 0- or 00-grade steel wool (optional)
   • Tweezers
   • Compressed, filtered, dry air or nitrogen

2 Load the inlet maintenance method and wait for the GC to become ready.

**WARNING**
Be careful! The oven and/or inlet may be hot enough to cause burns. If either is hot, wear heat-resistant gloves to protect your hands.

3 Slide the locking tab forward (counterclockwise). Lift the septum assembly straight up and away from the inlet to avoid chipping or breaking the liner.

4 Remove the septum retainer nut or Merlin cap.
5 Use tweezers to remove the septum or Merlin Microseal from the retainer nut. (See “To Change the Septum on the MMI” on page 125.)

6 Scrub the residue from the retainer nut and septum holder with a small piece of rolled-up steel wool and tweezers. Do not do this over the inlet.

7 Use compressed air or nitrogen to blow away the pieces of steel wool and septum.

8 Line up the tab on the bottom of the septum assembly with the slot on the insert assembly and push down to connect. Slide the locking tab to the left.

9 Firmly press the new septum or Merlin Microseal into the fitting. (See “To Change the Septum on the MMI” on page 125.)

10 Replace the septum retainer nut or Merlin cap and finger-tighten. (See “To Change the Septum on the MMI” on page 125.)

11 Restore the analytical method.

12 Reset the septum counter.
To Change the Liner and O-Ring on the MMI

1 Gather the following:
   - Replacement O-ring (See “Consumables and Parts for the MMI” on page 116.)
   - Replacement liner
   - Tweezers
   - Wrench, hex for changing septum
   - Lint-free gloves

2 Load the inlet maintenance method and wait for the GC to become ready.

   **WARNING** Be careful! The oven and/or inlet may be hot enough to cause burns. If either is hot, wear heat-resistant gloves to protect your hands.

3 Slide the locking tab forward (counterclockwise). Lift the septum assembly straight up and away from the inlet to avoid chipping or breaking the liner.

4 Loosen the O-ring from the sealing surface with tweezers.
5 Grasp the liner with tweezers and pull it out.

6 Inspect the surface of the seal for contamination. If required, clean with cotton swabs.
Clean the inlet if there is visible or suspected contamination. (See “To Clean the Multimode Inlet” on page 135.)

Clean O-ring residue from sealing surface.

**CAUTION** Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.

7 Slide a new O-ring onto the replacement liner.

8 Return the liner to the inlet, pushing it all the way in until the liner contacts the seal.

9 Line up the tab on the bottom of the septum assembly with the slot on the insert assembly and push down to connect. Slide the locking tab to the back.

10 Turn on the inlet. Allow the inlet and column to purge with carrier gas for 15 minutes before heating the inlet or the column oven.

11 Bakeout contaminants. (See “To Bakeout Contaminants from the MMI” on page 137.)

12 Restore the analytical method.

13 Reset the liner counter.

14 Check for leaks.
To Replace the Filter in the Split Vent Line for the MMI

1. Gather the following:
   - New filter cartridge. (See “Consumables and Parts for the MMI” on page 116.)
   - T-20 Torx screwdriver

2. Load the inlet maintenance method and wait for the GC to become ready.

**WARNING**

Be careful! The oven and/or inlet may be hot enough to cause burns. If either is hot, wear heat-resistant gloves to protect your hands.

**WARNING**

The split vent trap may contain residual amounts of any samples or other chemicals you have injected into the GC. Follow your company’s safety procedures for handling these types of substances while replacing the trap filter cartridge.

3. Remove the pneumatics cover (top, back of GC).

4. Remove the retaining clip.
5  Completely loosen the two screws that secure the split vent valve in place.

6  Lift the filter trap assembly and split vent valve from the mounting bracket together and unscrew the split vent front weldment on the filter trap assembly. Be careful not to stress the tubing between the split vent valve and the trap.

7  Remove the old filter cartridge and two O-rings.

8  Verify the new O-rings are seated properly on the new filter cartridge.

9  Install the new filter cartridge then reassemble the trap. Do not fully tighten yet.

10 Place the filter trap assembly in the mounting bracket and install the retaining clip.

11 Install the split vent valve.

12 Fully tighten the split vent front weldment onto the trap.

13 Check for leaks.
14 Restore the analytical method.
15 Reset the split vent trap counter.
16 Install the pneumatics cover.
To Clean the Multimode Inlet

This procedure explains how to clean the Multi Mode Inlet (MMI). Depending on the inlet mode used, the liner installed, and the cleanliness of the sample, the frequency of cleaning may range from weekly to monthly. Start with a visual inspection of the inlet bottom whenever changing the liner. A small ring of material will collect at the bottom of the inlet when injecting dirty samples such as food extracts or solid waste. Try an initial cleaning schedule of every two weeks for dirty samples and every two months for clean samples and adjust as needed.

1 Gather the following:
   - Cleaning kit, multimode inlet (G3510-60820). Contains 5 each abrasive swabs and 5 each cotton swabs.
   - Solvent for cleaning (at least 25 mL of acetone, isopropanol, or hexane, whichever is most appropriate for your sample matrix).
   - 100 mL beaker or similar container to the catch solvent rinse.

2 Load the inlet maintenance method and wait for the GC to become ready.

**WARNING**
Be careful! The oven and/or inlet may be hot enough to cause burns. If the inlet is hot, wear heat-resistant gloves to protect your hands.

3 Turn off the GC.

**CAUTION**
Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.

4 Remove the inlet liner. (See “To Change the Liner and O-Ring on the MMI” on page 129.)

5 Remove the column from the inlet. (See “To Install a Capillary Column with the MMI” on page 120.)

6 Place the glass beaker or other container in the GC oven, below the MMI inlet, so it will catch any solvent that drips through the inlet body.
7 Moisten a cotton swab with solvent and wipe the inside bottom seal of the inlet repeatedly to remove any loose material from the MMI. If desired, the cotton swab can be used to clean the bore of the inlet. For most samples, this is not necessary. Dispose of the swab after a single use.

8 Using a dry abrasive swab, place the swab all the way to the bottom of the inlet and with moderate pressure, twist the swab forwards and backwards while it is in contact with the bottom of the MMI (approximately 20 cycles should be sufficient). The abrasive swab can be used multiple times.

9 Using a second solvent moistened cotton swab, wipe the bottom of the inlet to remove any residue. Depending on the amount of use and maximum temperature used, the bottom of the inlet may still show some oxidation (light brown color). This is normal and will not affect inlet performance. Repeat steps 3-5 (if necessary) to remove any remaining deposits.

10 Using clean solvent, rinse the inlet volume several times but never overfill the inlet bore. Position a container under the column opening in the inlet to catch the used solvent exiting the bottom of the MMI.

11 Allow the inlet to dry.

12 Install the liner and O-ring.

13 Reinstall the column.

14 Turn on the GC.

15 Check for leaks.

16 Restore the analytical method.
To Bakeout Contaminants from the MMI

1. Put the inlet into split mode.
2. Set the column flow to the normal operating value, or set the capillary column gas velocity to 30 cm/s.
3. Set the inlet split vent flow to 200 mL/min.
4. Purge the column with carrier flow for at least 10 minutes before heating the oven.
5. If the column is attached to the detector, set the detector 25 °C above normal operating temperature.

**WARNING**

Be careful! The oven, inlet, and/or detector may be hot enough to cause burns. If they are hot, wear heat-resistant gloves to protect your hands.

If the column is not attached to the detector, cap the detector fitting.

6. Set the inlet temperature to 300 °C or 25 °C above the normal operating temperature to bakeout contaminants from the inlet, mostly through the split vent.
7. Set the column oven 25 °C above the GC method final oven temperature to bake contaminants from the column. Do not exceed the column manufacturer’s maximum temperature limit.
8. Bakeout for 30 minutes or until the detector baseline is free of contamination peaks.
7  Maintaining the MMI
8
Maintaining the PTV Inlet

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To Replace the Inlet Adapter for the PTV Inlet  158
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Consumables and Parts for the PTV Inlet

See the Agilent catalog for consumables and supplies for a more complete listing, or visit the Agilent Web site for the latest information (www.agilent.com/chem/supplies).

**Table 19  PTV liners and ferrules**

<table>
<thead>
<tr>
<th>Description</th>
<th>Part number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single baffle, 2-mm id, 180-µL, deactivated, glass wool</td>
<td>5183-2038</td>
</tr>
<tr>
<td>Single baffle, 2-mm id, 200-µL, deactivated</td>
<td>5183-2036</td>
</tr>
<tr>
<td>Multi-baffle, 1.5-mm id, 150-µL, deactivated</td>
<td>5183-2037</td>
</tr>
<tr>
<td>Fritted glass, 1.5-mm id, 150-µL, deactivated</td>
<td>5183-2041</td>
</tr>
<tr>
<td>Graphpak 3D ferrules for liner</td>
<td>5182-9749 (5/pk)</td>
</tr>
<tr>
<td>Installation tool for 3D ferrules</td>
<td>G2617-80540</td>
</tr>
</tbody>
</table>

**Table 20  Other consumables and parts for the PTV inlet**

<table>
<thead>
<tr>
<th>Description</th>
<th>Part number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Syringe, 5-µL, 23-gauge fixed-needle</td>
<td>9301-0892</td>
</tr>
<tr>
<td>Syringe, 10-µL, 23-gauge fixed-needle</td>
<td>9301-0713</td>
</tr>
<tr>
<td>Syringe, 50-µL, 23-gauge fixed-needle, for large volume injections</td>
<td>5183-0318</td>
</tr>
<tr>
<td>Syringe, 100-µL, 23-gauge fixed-needle, for large volume injections</td>
<td>5183-2058</td>
</tr>
<tr>
<td>Split vent trap PM kit, single cartridge</td>
<td>5188-6495</td>
</tr>
<tr>
<td><strong>Septumless head</strong></td>
<td></td>
</tr>
<tr>
<td>Septumless head</td>
<td>G2617-60507</td>
</tr>
<tr>
<td>PTFE ferrules (needle seal)</td>
<td>5182-9748 (10/pk)</td>
</tr>
<tr>
<td>Septumless head rebuild kit (includes Viton seal, Kalrez seal, and pressure spring)</td>
<td>5182-9747</td>
</tr>
<tr>
<td>Carrier gas tube for septumless head</td>
<td>G2617-80550</td>
</tr>
<tr>
<td>Ferrule, 1/16-inch PTFE, for septumless head carrier gas tube</td>
<td>0100-1375</td>
</tr>
<tr>
<td><strong>Septum head</strong></td>
<td></td>
</tr>
<tr>
<td>Merlin Microseal septum (high-pressure)</td>
<td>5182-3444</td>
</tr>
<tr>
<td>11-mm septa, red</td>
<td>5181-1263 (50/pk)</td>
</tr>
<tr>
<td>Description</td>
<td>Part number</td>
</tr>
<tr>
<td>--------------------------------------------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>Column adapter parts</td>
<td></td>
</tr>
<tr>
<td>Silver seal</td>
<td>5182-9763 (5/pk)</td>
</tr>
<tr>
<td>Graphpak 2M inlet adapter, 0.20-mm id*</td>
<td>5182-9754</td>
</tr>
<tr>
<td>Graphpak 2M inlet adapter, 0.25- to 0.33-mm id*</td>
<td>5182-9761</td>
</tr>
<tr>
<td>Graphpak 2M inlet adapter, 0.53-mm id*</td>
<td>5182-9762</td>
</tr>
<tr>
<td>Ferrules for Graphpak 2M inlet, 0.20-mm id</td>
<td>5182-9756 (10/pk)</td>
</tr>
<tr>
<td>Ferrules for Graphpak 2M inlet, 0.25-mm id</td>
<td>5182-9768 (10/pk)</td>
</tr>
<tr>
<td>Ferrules for Graphpak 2M inlet, 0.32-mm id</td>
<td>5182-9769 (10/pk)</td>
</tr>
<tr>
<td>Ferrules for Graphpak 2M inlet, 0.53-mm id</td>
<td>5182-9770 (10/pk)</td>
</tr>
<tr>
<td>Split nut for Graphpak adapter</td>
<td>5062-3525</td>
</tr>
</tbody>
</table>

* Includes (1) adapter, (1) silver seal, and (1) split column nut.
Exploded Parts View of the PTV Inlet

- Guide cap
- PTFE ferrule
- Septumless head assembly
- Carrier gas tube
- Ferrule
- Graphpak 3D ferrule
- Liner
- PTV inlet assembly
- Merlin cap
- Merlin Microseal
- Kalrez seal
- Valve body
- Pressure spring
- Viton seal
- Sealing element
- Septum nut
- Septum
- Septum head
- Silver seal
- Graphpak inlet adapter
- Ferrule for Graphpak adapter
- Column nut
To Install a Capillary Column with the PTV Inlet

1. Gather the following (see “Consumables and Parts for the PTV Inlet” on page 140):
   - Column
   - Graphpak 2M ferrule
   - Column nut
   - Column cutter
   - Septum
   - Isopropanol
   - Lab tissue
   - Metric ruler
   - 5-mm and 6-mm wrenches
   - Typewriter correction fluid or a marker
   - Lint-free gloves

2. Load the GC maintenance method and wait for the GC to become ready.

**WARNING**
Be careful! The oven and/or inlet may be hot enough to cause burns. If either is hot, wear heat-resistant gloves to protect your hands.

**WARNING**
Wear safety glasses to protect your eyes from flying particles while handling, cutting, or installing glass or fused silica capillary columns. Use care in handling these columns to prevent puncture wounds.

3. Before installing the column, install the correct column adapter. (See “To Replace the Inlet Adapter for the PTV Inlet” on page 158.)

**CAUTION**
Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.

4. Place the column on the hanger with the ends pointing up and the label to the front.

5. Place a Graphpak 2M ferrule onto the column, with the graphite facing up towards the inlet.
6 Score the column using a glass scribing tool. The score must be square to ensure a clean break.

7 Break off the column end by supporting it against the column cutter opposite the scribe. Inspect the end with a magnifying loupe to make certain that there are no burrs or jagged edges.

8 Wipe the column walls with a tissue dampened with isopropanol to remove fingerprints and dust.

9 Position the column so it extends 17 mm above the end of the ferrule. Mark the column behind the ferrule with typewriter correction fluid or a marker. Slide the nut over the column.

10 Insert the column into the adapter and finger-tighten the column nut. Looking through the slot in the nut, adjust the column until the mark is correctly positioned below the Graphpak 2M ferrule.

11 Tighten the column nut an additional 1/8 to 1/4 turn with a wrench. Do not overtighten.

12 Configure the new column.

13 Condition the column per the manufacturer’s recommendation. (See To Condition a Capillary Column.)

14 Install the column into the detector. See:
   - To Install a Capillary Column in the FID
   - To Install a Capillary Column in the NPD
• To Install a Capillary Column in the TCD
• To Install a Capillary Column in the uECD
• To Install a Capillary Column Adapter in the FPD

15 After the column is installed at both inlet and detector, establish a flow of carrier gas and purge as recommended by the column manufacturer.

16 Restore the analytical method.
  • For FPD, immediately turn off the flame.
  • For NPD, immediately set the bead voltage to 0.0.

17 After the GC becomes ready, wait 10 minutes then ignite the detector flame or adjust offset on the NPD bead.

**WARNING**

Be careful! The oven, inlet, and/or detector may be hot enough to cause burns. If they are hot, wear heat-resistant gloves to protect your hands.

18 Allow the oven, inlet, and detector to equilibrate at operating temperature, then retighten the fittings.
To Clean the Septumless Head on the PTV Inlet

1 Gather the following:
   - Syringe with 23-gauge needle (See “Consumables and Parts for the PTV Inlet” on page 140.)
   - Septumless head rebuild kit
   - Hexane
   - Clean, lint-free gloves
   - 5/16-inch wrench
   - Lint-free gloves

2 Load the inlet maintenance method and wait for the GC to become ready.

3 Disconnect the carrier gas line.

**WARNING**
Be careful! The oven and/or inlet may be hot enough to cause burns. If either is hot, wear heat-resistant gloves to protect your hands.

4 Unscrew and remove the septumless head assembly from the inlet.

5 Unscrew the sealing element from the head assembly and carefully remove the Viton seal and the pressure spring.
Unscrew the guide cap from the head and remove the PTFE ferrule.

Carefully insert a syringe with a 23-gauge needle into the head to press the valve body and Kalrez seal slightly out of the head.

Gently tap the head on a soft, smooth surface so that the valve body falls out completely or slips out far enough to grasp with fingers.

Remove the Kalrez seal from the valve body.

Clean all components in hexane.

Wearing clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.

Replace the PTFE ferrule. (See “To Replace the Septumless Head PTFE Ferrule on the PTV Inlet” on page 149.)

Wearing clean lint-free gloves, reassemble the head in reverse order. Be sure that the seals and the pressure spring are not damaged.

Finger-tighten the septumless head, then tighten an additional 1/8 turn with a wrench.

Reconnect the carrier gas line.

Check for leaks; if necessary, slightly tighten the guide cap with the syringe needle inserted.

- If the head leaks with the syringe inserted, replace the PTFE ferrule.
• If the head leaks without the syringe inserted, replace the Kalrez and Viton seals.

16 Restore the analytical method.
To Replace the Septumless Head PTFE Ferrule on the PTV Inlet

1. Gather the following:
   - Syringe with 23-gauge needle (See “Consumables and Parts for the PTV Inlet” on page 140.)
   - Replacement PTFE ferrule

2. Load the inlet maintenance method and wait for the GC to become ready.

**WARNING** Be careful! The oven and/or inlet may be hot enough to cause burns. If either is hot, wear heat-resistant gloves to protect your hands.

3. Unscrew the guide cap from the septumless head and remove the PTFE ferrule.

4. Push the guide cap and replacement ferrule over the syringe needle so that at least 10 mm of the needle tip is exposed.

5. Guide the end of the needle into the septumless head until the ferrule meets the septumless head.

6. Loosely install the guide cap.

7. If not configured, configure the column.

8. Put the inlet into **Splitless** mode.

9. Set the column flow to 5 mL/min and the purge flow to 60 mL/min.
10 After the inlet pressurizes, press [Prep Run] twice.

11 Observe the inlet Total Flow. Tighten the guide cap until the Total Flow stops decreasing (typically near 8 mL/min).

12 Remove the syringe from the inlet and press [Stop].

13 Restore the analytical method.
To Change the Septum on the PTV Inlet

1 Gather the following:
   - Replacement septum. (See “Consumables and Parts for the PTV Inlet” on page 140.)
   - 5/8-inch wrench

2 Load the inlet maintenance method and wait for the GC to become ready.

**WARNING**

Be careful! The oven and/or inlet may be hot enough to cause burns. If either is hot, wear heat-resistant gloves to protect your hands.

3 Remove the septum retainer nut or Merlin cap. If the septum head begins to turn during removal, support it manually while removing the cap.

4 Use tweezers to remove the septum or Merlin Microseal from the retainer nut. Do not gouge or scratch the interior of the septum head.

5 Firmly press the new septum or Merlin Microseal into the fitting. The metal parts side of the Merlin Microseal should face down (toward the oven).

6 Replace the septum retainer nut or Merlin cap and finger-tighten. Tighten the septum retainer nut until the C-ring is about 1 mm above the nut.

**CAUTION**

Overtightening the septum nut can cause contamination.
7 Restore the analytical method.
8 Reset the septum counter.
To Clean the Septum Seat in the Septum Head Assembly of the PTV Inlet

1. Gather the following:
   - Replacement septum (See “Consumables and Parts for the PTV Inlet” on page 140.)
   - 5/8-inch wrench
   - Tweezers
   - Compressed, filtered, dry air or nitrogen
   - Lint-free gloves

2. Load the inlet maintenance method and wait for the GC to become ready.

**WARNING**
Be careful! The oven and/or inlet may be hot enough to cause burns. If either is hot, wear heat-resistant gloves to protect your hands.

**CAUTION**
Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.

3. Remove the septum retainer nut or Merlin cap. If the septum head begins to turn during removal, support it manually while removing the cap.

4. Unscrew the septum head assembly from the inlet and move it up and away from the inlet.

5. Use tweezers to remove the septum or Merlin Microseal from the retainer nut. Do not gouge or scratch the interior of the septum head.

6. Scrub the residue from the retainer nut and septum holder with a small piece of rolled-up steel wool and tweezers. Do not do this over the inlet.

7. Use compressed air or nitrogen to blow away the pieces of steel wool and septum.

8. Replace the septum head assembly on the inlet. Finger-tighten the septum head and then tighten an additional 1/2 turn with a wrench.

9. Firmly press the new septum or Merlin Microseal into the fitting. (See “To Change the Septum on the PTV Inlet” on page 151.)
10 Replace the septum retainer nut or Merlin cap and finger-tighten. (See “To Change the Septum on the PTV Inlet” on page 151.)

11 Restore the analytical method.

12 Reset the septum counter.
To Change the Liner on the PTV Inlet

1 Gather the following:
   • Installation tool for 3D ferrules (See “Consumables and Parts for the PTV Inlet” on page 140.)
   • Assembly tool (part number G2617-80540)
   • Replacement liner
   • Graphpak 3D ferrule
   • 5/16-inch wrench
   • Lint-free gloves

2 Load the inlet maintenance method and wait for the GC to become ready.

**WARNING** Be careful! The oven and/or inlet may be hot enough to cause burns. If either is hot, wear heat-resistant gloves to protect your hands.

**CAUTION** Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.

3 Remove the head from the inlet:
   • For septumless head, disconnect the carrier gas line and unscrew and remove the septumless head assembly from the inlet.
   • For septum head, loosen the septum head assembly from the inlet. Lift the head to clear the inlet and push to either side. Do not bend the 1/16-inch lines too much.

4 Grasp the liner by the Graphpak 3D ferrule. Remove the liner from the inlet.
5 Unscrew the assembly tool into two pieces: the ferrule guide and the compression fitting.

6 Slide the compression fitting onto the longer, straight end of the new liner with the threads pointing toward the end of the liner.

7 Place a Graphpak 3D ferrule on the same end of the liner with the recessed graphite end towards the compression fitting. Slide the ferrule so that about 2 mm of the liner is exposed beyond the ferrule.

8 Slide the compression fitting up to meet the ferrule. Finger-tighten the ferrule guide onto the compression fitting.

9 Unscrew and remove the ferrule guide.

10 Slide the compression fitting off the other end of the liner. The ferrule should now be set with 1 mm of the liner exposed. Check that the graphite within the ferrule is flush with the top of the metal collar.
11 Insert the glass liner into the inlet from above until the unpacked side of the ferrule rests on the top of the inlet.

12 Replace the head:
   - For septumless head, screw the head onto the inlet and tighten 1/8 turn past finger-tight with a wrench. Reconnect the carrier gas line.
   - For septum head, align the head with the inlet and manually engage the free-spinning nut to the inlet. Tighten 1/2 turn past finger-tight with a wrench.

13 Check all connections for leaks. If necessary, tighten them again by hand.

14 Restore the analytical method.

15 Reset the liner counter.
To Replace the Inlet Adapter for the PTV Inlet

1. Select from the following list an adapter with the smallest hole diameter that will accept the column. The adapter number is stamped on the side of the adapter. (Also see “Consumables and Parts for the PTV Inlet” on page 140.)

2. Gather the following:
   - Replacement adapter
   - Replacement silver seal
   - 6-mm wrench
   - 5-mm wrench
   - Lint-free gloves

3. Load the inlet maintenance method and wait for the GC to become ready.

**WARNING**
Be careful! The oven and/or inlet may be hot enough to cause burns. If either is hot, wear heat-resistant gloves to protect your hands.

**CAUTION**
Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.

4. Unscrew the column nut from the adapter. Remove the nut and the column from the inlet.
5 Remove the inlet adapter and discard the old silver seal.

6 Insert a new silver seal into the adapter and finger-tighten the adapter onto the inlet. Tighten an additional 1/16 to 1/8 turn with a wrench; overtightening will damage the inlet.

7 Install the column. (See “To Install a Capillary Column with the PTV Inlet” on page 143.)

8 Check the adapter for leaks.

9 Restore the analytical method.
To Replace the Filter in the Split Vent Line for the PTV Inlet

1. Gather the following:
   - New filter cartridge. (See “Consumables and Parts for the PTV Inlet” on page 140.)
   - T-20 Torx screwdriver

2. Load the inlet maintenance method and wait for the GC to become ready.

   **WARNING**
   Be careful! The oven and/or inlet may be hot enough to cause burns. If either is hot, wear heat-resistant gloves to protect your hands.

   **WARNING**
   The split vent trap may contain residual amounts of any samples or other chemicals you have injected into the GC. Follow your company’s safety procedures for handling these types of substances while replacing the trap filter cartridge.

3. Remove the pneumatics cover (top, back of GC).

4. Remove the retaining clip.

Split vent valve

Split vent trap

Retaining clip
5 Completely loosen the two screws that secure the split vent valve in place.

6 Lift the filter trap assembly and split vent valve from the mounting bracket together and unscrew the split vent front weldment on the filter trap assembly. Be careful not to stress the tubing between the split vent valve and the trap.

7 Remove the old filter cartridge and two O-rings.

8 Verify the new O-rings are seated properly on the new filter cartridge.

9 Install the new filter cartridge then reassemble the trap. Do not fully tighten yet.

10 Place the filter trap assembly in the mounting bracket and install the retaining clip.

11 Install the split vent valve.

12 Fully tighten the split vent front weldment onto the trap.

13 Check for leaks.
14 Restore the analytical method.
15 Reset the split vent trap counter.
16 Install the pneumatics cover.
To Bakeout Contaminants from the PTV Inlet

1 Put the inlet into split mode.
2 Set the column flow to the normal operating value, or set the capillary column gas velocity to 30 cm/s.
3 Set the inlet split vent flow to 200 mL/min.
4 Purge the column with carrier flow for at least 10 minutes before heating the oven.
5 If the column is attached to the detector, set the detector 25 °C above normal operating temperature.

**WARNING**

Be careful! The oven, inlet, and/or detector may be hot enough to cause burns. If they are hot, wear heat-resistant gloves to protect your hands.

If the column is not attached to the detector, cap the detector fitting.

6 Set the inlet temperature to 300 °C or 25 °C above the normal operating temperature to bakeout contaminants from the inlet, mostly through the split vent.
7 Set the column oven 25 °C above the GC method final oven temperature to bake contaminants from the column. Do not exceed the column manufacturer’s maximum temperature limit.
8 Bakeout for 30 minutes or until the detector baseline is free of contamination peaks.
Maintaining the PTV Inlet
9

Maintaining the VI

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To Remove the VI Interface  173
To Clean the VI  175
To Install the VI Interface  177
To Replace the Filter in the Split Vent Line for the VI  178
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Consumables and Parts for the VI

See the Agilent catalog for consumables and supplies for a more complete listing, or visit the Agilent Web site for the latest information (www.agilent.com/chem/supplies).

Table 22  Parts for the VI

<table>
<thead>
<tr>
<th>Description</th>
<th>Part number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clamping plate</td>
<td>G2319-20540</td>
</tr>
<tr>
<td>Volatiles interface</td>
<td>G2319-60505</td>
</tr>
<tr>
<td>Long column nut (65 mm)</td>
<td>G3504-20504</td>
</tr>
<tr>
<td>Nut, for transfer, pressure sensing, or split vent line</td>
<td>19258-20830</td>
</tr>
<tr>
<td>Ferrule, for transfer, pressure sensing, or split vent line</td>
<td>19258-20870</td>
</tr>
<tr>
<td>Split vent trap PM kit, single cartridge</td>
<td>5188-6495</td>
</tr>
</tbody>
</table>

Table 23  Nuts, ferrules, and hardware for capillary columns

<table>
<thead>
<tr>
<th>Column id (mm)</th>
<th>Description</th>
<th>Typical use</th>
<th>Part number/quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>.530</td>
<td>Ferrule, Vespel/graphite, 0.8-mm id</td>
<td>0.45-mm and 0.53-mm capillary columns</td>
<td>5062-3512 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Ferrule, graphite, 1.0-mm id</td>
<td>0.53-mm capillary columns</td>
<td>5080-8773 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Column nut, finger-tight (for 0.53-mm columns)</td>
<td>Connect column to inlet or detector</td>
<td>5020-8293</td>
</tr>
<tr>
<td>.320</td>
<td>Ferrule, Vespel/graphite, 0.5-mm id</td>
<td>0.32-mm capillary columns</td>
<td>5062-3514 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Ferrule, graphite, 0.5-mm id</td>
<td>0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns</td>
<td>5080-8853 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Column nut, finger-tight (for .100- to .320-mm columns)</td>
<td>Connect column to inlet or detector</td>
<td>5020-8292</td>
</tr>
<tr>
<td>.250</td>
<td>Ferrule, Vespel/graphite, 0.4-mm id</td>
<td>0.1-mm, 0.2-mm, and 0.25-mm capillary columns</td>
<td>5181-3323 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Ferrule, graphite, 0.5-mm id</td>
<td>0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns</td>
<td>5080-8853 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Column nut, finger-tight (for .100- to .320-mm columns)</td>
<td>Connect column to inlet or detector</td>
<td>5020-8292</td>
</tr>
<tr>
<td>.100 and .200</td>
<td>Ferrule, Vespel/graphite, 0.37-mm id</td>
<td>0.1-mm and 0.2-mm capillary columns</td>
<td>5062-3516 (10/pk)</td>
</tr>
</tbody>
</table>
Table 23  Nuts, ferrules, and hardware for capillary columns (continued)

<table>
<thead>
<tr>
<th>Column id (mm)</th>
<th>Description</th>
<th>Typical use</th>
<th>Part number/quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ferrule, Vespel/graphite, 0.4-mm id</td>
<td>0.1-mm, 0.2-mm, and 0.25-mm capillary columns</td>
<td>5181-3323 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Ferrule, graphite, 0.5-mm id</td>
<td>0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns</td>
<td>5080-8853 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Column nut, finger-tight (for .100- to .320-mm columns)</td>
<td>Connect column to inlet or detector</td>
<td>5020-8292</td>
</tr>
<tr>
<td></td>
<td>All</td>
<td>Testing</td>
<td>5181-3308 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Ferrule, no-hole</td>
<td>Testing</td>
<td>5020-8294</td>
</tr>
<tr>
<td></td>
<td>Capillary column blanking nut</td>
<td>Testing–use with any ferrule</td>
<td>5181-8830 (2/pk)</td>
</tr>
<tr>
<td></td>
<td>Column nut, universal</td>
<td>Connect column to inlet or detector</td>
<td>5181-8836 (4/pk)</td>
</tr>
<tr>
<td></td>
<td>Column cutter, ceramic wafer</td>
<td>Cutting capillary columns</td>
<td></td>
</tr>
</tbody>
</table>
Exploded Parts View of the VI

Nut
Ferrule
Clamping plate
Volatile interface
Ferrule, column
Column nut, long
To Install a Capillary Column with the VI

1 Gather the following:
   - Long (65 mm) column nut
   - Column
   - Ferrule
   - Column cutter
   - Isopropanol
   - Septum
   - 1/4-inch wrench
   - Lab tissue
   - Metric ruler
   - Lint-free gloves

2 Load the inlet maintenance method and wait for the GC to become ready.

**WARNING**
Be careful! The oven and/or inlet may be hot enough to cause burns. If either is hot, wear heat-resistant gloves to protect your hands.

**WARNING**
Wear safety glasses to protect your eyes from flying particles while handling, cutting, or installing glass or fused silica capillary columns. Use care in handling these columns to prevent puncture wounds.

**CAUTION**
Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.

3 Place the column on the hanger with the ends pointing up and the label to the front.

4 Place a septum, long capillary column nut, and ferrule on the column.

   Use a long column nut. (See “Consumables and Parts for the VI” on page 166.)
If you are using a standard column nut, you must remove the interface. For this reason it is recommended that you use the long column nut. (See “To Remove the VI Interface” on page 173.)

5 Score the column using a glass scribing tool. The score must be square to ensure a clean break.

6 Break off the column end by supporting it against the column cutter opposite the scribe. Inspect the end with a magnifying loupe to make certain that there are no burrs or jagged edges.

7 Wipe the column walls with a tissue dampened with isopropanol to remove fingerprints and dust.

8 Position the column so it extends 6 mm above the end of the ferrule. Slide the septum up the column to hold the column nut at this fixed position.

Ferrule

Column nut

Septum

6 mm
9 Insert the column into the interface and finger-tighten the column nut.

10 Adjust the column (not the septum) position until the septum is snug against the bottom of the nut.

11 Tighten the column nut an additional 1/4 to 1/2 turn with a wrench so that the column cannot be pulled from the fitting with gentle pressure.

12 Configure the new column.

13 With the sample transfer line attached and the column attached to the inlet and detector, establish a flow of carrier gas through the transfer line. Purge as recommended by the column manufacturer.

14 Condition the column per the manufacturer's recommendation. (See To Condition a Capillary Column.)

15 Install the column into the detector. See:
   - To Install a Capillary Column in the FID
   - To Install a Capillary Column in the NPD
   - To Install a Capillary Column in the TCD
   - To Install a Capillary Column in the uECD
   - To Install a Capillary Column Adapter in the FPD

16 After the column is installed at both inlet and detector, establish a flow of carrier gas and purge as recommended by the column manufacturer.

17 Restore the analytical method.
   - For FPD, immediately turn off the flame.
   - For NPD, immediately set the bead voltage to 0.0.

18 After the GC becomes ready, wait 10 minutes then ignite the detector flame or adjust offset on the NPD bead.

**WARNING**

Be careful! The oven, inlet, and/or detector may be hot enough to cause burns. If the oven, inlet, or detector is hot, wear heat-resistant gloves to protect your hands.

19 Allow the oven, inlet, and detector to equilibrate at operating temperature, then retighten the fittings.
To Attach a Sample Transfer Line to the VI

1 Gather one 7/16-inch, two 5/16-inch, and one 7-mm wrenches.

2 Attach the transfer line from the gas sampler by finger-tightening the preattached transfer line nut and ferrule. Tighten an additional 1/4 turn with a wrench.

If the transfer line is from a G1900A Purge and Trap, install the transfer line support nut assembly up and inside the metal sleeve of the heated line assembly to prevent damage to the fused silica line.

3 With the column installed, establish a flow of carrier gas through the transfer line and check for leaks. If the transfer line nut leaks, tighten an additional 1/8 turn with a wrench. Purge as recommended by the column manufacturer.

4 Heat the interface to operating temperature.

5 Retighten the fittings, if necessary.
To Remove the VI Interface

1 Gather the following:
   - 1/4-inch and 7-mm wrench
   - T-20 Torx screwdriver

2 Load the inlet maintenance method and wait for the GC to become ready.

**WARNING** Be careful! The interface may be hot enough to cause burns. If the interface is hot, wear gloves to protect your hands.

3 Remove the column.

4 Remove the transfer line by loosening the nut, then lift it from the interface.

5 Loosen the five inlet cover screws and remove the inlet cover.

6 Remove the clamping plate from the interface by loosening the captive screw.

7 Lift the interface out of the heater block.
9 Maintaining the VI
To Clean the VI

1. Gather the following:
   - 1/4-inch and 7-mm wrench
   - T-20 Torx screwdriver
   - Lint-free gloves

2. Load the inlet maintenance method and wait for the GC to become ready.

3. Remove the interface. (See “To Remove the VI Interface” on page 173.)

**WARNING**
Be careful! The oven and/or inlet may be hot enough to cause burns. If either is hot, wear heat-resistant gloves to protect your hands.

**WARNING**
The split vent trap and line may contain residual amounts of any samples or other chemicals you have injected into the GC. Follow your company’s safety procedures for handling these types of substances.

4. Remove the split vent and pressure sensing lines by loosening the nuts.

**CAUTION**
Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.

5. Clean the interface using an ultrasonic bath. Sonicate twice, then rinse and air dry.

6. Inspect the split vent line. If clogged, contact Agilent for service.
7 Install the interface. (See “To Install the VI Interface” on page 177.)
To Install the VI Interface

1. Gather the following:
   - 1/4-inch and 7-mm wrench
   - T-20 Torx screwdriver

2. Attach the split vent line and pressure sensing lines and finger-tighten the nuts. Tighten an additional 1/4 turn with a wrench.

3. Place the interface into the heater block and reseat the tubing as needed.

4. Install the clamping plate and tighten the screw.

5. Install the inlet cover. Be sure the cover does not damage any tubing.

6. Attach the sample transfer line. (See “To Attach a Sample Transfer Line to the VI” on page 172.)

7. Install the column. (See “To Install a Capillary Column with the VI” on page 169.)
To Replace the Filter in the Split Vent Line for the VI

1 Gather the following:
   • New filter cartridge. (See “Consumables and Parts for the VI” on page 166.)
   • T-20 Torx screwdriver

2 Load the inlet maintenance method and wait for the GC to become ready.

**WARNING**
Be careful! The oven and/or inlet may be hot enough to cause burns. If either is hot, wear heat-resistant gloves to protect your hands.

**WARNING**
The split vent trap may contain residual amounts of any samples or other chemicals you have injected into the GC. Follow your company’s safety procedures for handling these types of substances while replacing the trap filter cartridge.

3 Remove the pneumatics cover (top, back of GC).
4 Remove the retaining clip.
5 Completely loosen the two screws that secure the split vent valve in place.

6 Lift the filter trap assembly and split vent valve from the mounting bracket together and unscrew the split vent front weldment on the filter trap assembly. Be careful not to stress the tubing between the split vent valve and the trap.

7 Remove the old filter cartridge and two O-rings.

8 Verify the new O-rings are seated properly on the new filter cartridge.

9 Install the new filter cartridge then reassemble the trap. Do not fully tighten yet.

10 Place the filter trap assembly in the mounting bracket and install the retaining clip.

11 Install the split vent valve.

12 Fully tighten the split vent front weldment onto the trap.

13 Check for leaks.
14 Restore the analytical method.
15 Reset the split vent trap counter.
16 Install the pneumatics cover.
To Bakeout Contaminants from the VI Inlet

1. Put the inlet into split mode.
2. Set the column flow to the normal operating value, or set the capillary column gas velocity to 30 cm/s.
3. Set the inlet split vent flow to 200 mL/min.
4. Purge the column with carrier flow for at least 10 minutes before heating the oven.
5. If the column is attached to the detector, set the detector 25 °C above normal operating temperature.

**WARNING**
Be careful! The oven, inlet, and/or detector may be hot enough to cause burns. If they are hot, wear heat-resistant gloves to protect your hands.

6. If the column is not attached to the detector, cap the detector fitting.
7. Set the inlet temperature to 300 °C or 25 °C above the normal operating temperature to bakeout contaminants from the inlet, mostly through the split vent.
8. Set the column oven 25 °C above the GC method final oven temperature to bake contaminants from the column. Do not exceed the column manufacturer’s maximum temperature limit.
9. Bakeout for 30 minutes or until the detector baseline is free of contamination peaks.
10
Maintaining the FID

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Selecting an FID Jet 189
To Attach a Capillary Column Adapter on an Adaptable FID 191
To Install a Capillary Column in the FID 193
To Replace the FID Collector Assembly 196
To Replace an FID Jet 198
To Perform Maintenance on the FID Collector Assembly 202
To Check the FID Leakage Current 210
To Check the FID Baseline 211
To Install the FID Insulation Cup Assembly (Adaptable FID Only) 212
To Install the Optional FID PTFE Chimney Insert 214
To Bakeout the FID 215
### Consumables and Parts for the FID

See the Agilent catalog for consumables and supplies for a more complete listing, or visit the Agilent Web site for the latest information ([www.agilent.com/chem/supplies](http://www.agilent.com/chem/supplies)).

#### Table 24  
Nuts, ferrules, and hardware for capillary columns

<table>
<thead>
<tr>
<th>Column id (mm)</th>
<th>Description</th>
<th>Typical use</th>
<th>Part number/quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>.530</td>
<td>Ferrule, Vespel/graphite, 0.8-mm id</td>
<td>0.45-mm and 0.53-mm capillary columns</td>
<td>5062-3512 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Ferrule, graphite, 1.0-mm id</td>
<td>0.53-mm capillary columns</td>
<td>5080-8773 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Column nut, finger-tight (for 0.53-mm columns)</td>
<td>Connect column to inlet or detector</td>
<td>5020-8293</td>
</tr>
<tr>
<td>.320</td>
<td>Ferrule, Vespel/graphite, 0.5-mm id</td>
<td>0.32-mm capillary columns</td>
<td>5062-3514 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Ferrule, graphite, 0.5-mm id</td>
<td>0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns</td>
<td>5080-8853 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Column nut, finger-tight (for .100- to .320-mm columns)</td>
<td>Connect column to inlet or detector</td>
<td>5020-8292</td>
</tr>
<tr>
<td>.250</td>
<td>Ferrule, Vespel/graphite, 0.4-mm id</td>
<td>0.1-mm, 0.2-mm, and 0.25-mm capillary columns</td>
<td>5181-3323 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Ferrule, graphite, 0.5-mm id</td>
<td>0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns</td>
<td>5080-8853 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Column nut, finger-tight (for .100- to .320-mm columns)</td>
<td>Connect column to inlet or detector</td>
<td>5020-8292</td>
</tr>
<tr>
<td>.100 and .200</td>
<td>Ferrule, Vespel/graphite, 0.37-mm id</td>
<td>0.1-mm and 0.2-mm capillary columns</td>
<td>5062-3516 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Ferrule, Vespel/graphite, 0.4-mm id</td>
<td>0.1-mm, 0.2-mm, and 0.25-mm capillary columns</td>
<td>5181-3323 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Ferrule, graphite, 0.5-mm id</td>
<td>0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns</td>
<td>5080-8853 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Column nut, finger-tight (for .100- to .320-mm columns)</td>
<td>Connect column to inlet or detector</td>
<td>5020-8292</td>
</tr>
<tr>
<td>All</td>
<td>Ferrule, no-hole</td>
<td>Testing</td>
<td>5181-3308 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Capillary column blanking nut</td>
<td>Testing—use with any ferrule</td>
<td>5020-8294</td>
</tr>
<tr>
<td></td>
<td>Column nut, universal</td>
<td>Connect column to inlet or detector</td>
<td>5181-8830 (2/pk)</td>
</tr>
<tr>
<td></td>
<td>Column cutter, ceramic wafer</td>
<td>Cutting capillary columns</td>
<td>5181-8836 (4/pk)</td>
</tr>
</tbody>
</table>
### Table 25  FID parts and subassemblies

<table>
<thead>
<tr>
<th>Description</th>
<th>Part number/quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screw, M4 × 25 mm, Torx, T20</td>
<td>0515-2712 (3/pk)</td>
</tr>
<tr>
<td>PTFE chimney (optional)</td>
<td>19231-21050</td>
</tr>
<tr>
<td>Collector assembly</td>
<td>G1531-60690</td>
</tr>
<tr>
<td>FID/NPD capillary column adapter</td>
<td>19244-80610</td>
</tr>
<tr>
<td>FID/NPD 1/8-inch packed column adapter</td>
<td>19231-80520</td>
</tr>
<tr>
<td>FID/NPD 1/4-inch packed column adapter</td>
<td>19231-80530</td>
</tr>
<tr>
<td>Insulation</td>
<td>19234-60715 (3/pk)</td>
</tr>
<tr>
<td>Insulation cup assembly</td>
<td>19234-60700</td>
</tr>
<tr>
<td>Nut, 1/4-inch, brass, for packed column adapters</td>
<td>5180-4105 (10/pk)</td>
</tr>
<tr>
<td>Ferrule, Vespel, 1/4-inch, for packed column adapters</td>
<td>5080-8774 (10/pk)</td>
</tr>
</tbody>
</table>

### Table 26  Jets for capillary adaptable fittings

<table>
<thead>
<tr>
<th>Jet type</th>
<th>Part number</th>
<th>Jet tip id</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capillary</td>
<td>19244-80560</td>
<td>0.29 mm (0.011 inch)</td>
<td>61.5 mm</td>
</tr>
<tr>
<td>Capillary, high-temperature (use with simulated distillation)</td>
<td>19244-80620</td>
<td>0.47 mm (0.018 inch)</td>
<td>61.5 mm</td>
</tr>
<tr>
<td>Packed</td>
<td>18710-20119</td>
<td>0.46 mm (0.018 inch)</td>
<td>63.6 mm</td>
</tr>
<tr>
<td>Packed, wide-bore (use with high-bleed applications)</td>
<td>18789-80070</td>
<td>0.76 mm (0.030 inch)</td>
<td>63.6 mm</td>
</tr>
</tbody>
</table>

### Table 27  Jets for capillary optimized fittings

<table>
<thead>
<tr>
<th>Jet type</th>
<th>Part number</th>
<th>Jet tip ID</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capillary</td>
<td>G1531-80560</td>
<td>0.29 mm (0.011 inch)</td>
<td>48 mm</td>
</tr>
<tr>
<td>High-temperature (use with simulated distillation)</td>
<td>G1531-80620</td>
<td>0.47 mm (0.018 inch)</td>
<td>48-mm</td>
</tr>
</tbody>
</table>

### Table 28  FID collector assembly parts

<table>
<thead>
<tr>
<th>Description</th>
<th>Part number/quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screw, M4 × 25 mm, Torx, T20</td>
<td>0515-2712 (3/pk)</td>
</tr>
<tr>
<td>Collector assembly</td>
<td>G1531-60690</td>
</tr>
<tr>
<td>Collector nut</td>
<td>19231-20940</td>
</tr>
</tbody>
</table>
## Table 28  FID collector assembly parts (continued)

<table>
<thead>
<tr>
<th>Description</th>
<th>Part number/quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spring washer</td>
<td>3050-1246</td>
</tr>
<tr>
<td>Ignitor castle</td>
<td>19231-20910</td>
</tr>
<tr>
<td>Ignitor castle, Hastelloy</td>
<td>19231-21060</td>
</tr>
<tr>
<td>Upper/lower collector insulator</td>
<td>G1531-20700</td>
</tr>
<tr>
<td>Collector body</td>
<td>G1531-20690</td>
</tr>
<tr>
<td>Collector body, Hastelloy</td>
<td>G1531-21090</td>
</tr>
<tr>
<td>Spanner nut (collector)</td>
<td>19231-20980</td>
</tr>
<tr>
<td>Collector mount</td>
<td>G1531-20550</td>
</tr>
<tr>
<td>Collector housing</td>
<td>G1531-20740</td>
</tr>
<tr>
<td>Gasket</td>
<td>5180-4165 (12/pk)</td>
</tr>
<tr>
<td>Ignitor (glow plug) assembly with O-ring</td>
<td>19231-60680</td>
</tr>
</tbody>
</table>
Exploded Parts Views of the FID

- PTFE chimney
- 25-mm screws
- Collector assembly
- Gasket
- Jet
- Spring, FID interconnect
- Mounting pallet
- Ferrule
- Column adapter
- Ferrule
- Column nut
Maintaining Your GC

10 Maintaining the FID

Jet

FID column adapter
(Adaptable FID only; capillary adapter shown)

Insulation
(Adaptable FID only)

Insulation cup assembly
(Adaptable FID only)

25-mm screws
Collector assembly

Collector nut
Spring washer
Ignitor
Upper collector insulator
Collector body
Spanner nut (collector)
Collector mount
Lower collector insulator
Collector housing
Gasket

Ignitor (glow plug) assembly with O-ring
Ignitor cable assembly
Selecting an FID Jet

Open the oven door and locate the column connection fitting at the base of the detector. It will look like either a capillary optimized fitting or an adaptable fitting.

- If you have an application that tends to clog the jet, select a jet with a wider tip id.
- When using packed columns in high column-bleed applications, the jet tends to clog with silicon dioxide.
- In simulated distillation applications, the high-boiling hydrocarbons tend to clog the jet.

For capillary optimized fittings, select a jet from Table 29. For adaptable fittings, select a jet from Table 30.

### Table 29  Jets for capillary optimized fittings

<table>
<thead>
<tr>
<th>Figure 1 ID</th>
<th>Jet type</th>
<th>Part number</th>
<th>Jet tip id</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Capillary</td>
<td>G1531-80560</td>
<td>0.29 mm (0.011 inch)</td>
<td>48 mm</td>
</tr>
<tr>
<td>2</td>
<td>High-temperature (use with simulated distillation)</td>
<td>G1531-80620</td>
<td>0.47 mm (0.018 inch)</td>
<td>48 mm</td>
</tr>
</tbody>
</table>

**Figure 1** Capillary optimized jets
Table 30  Jets for capillary adaptable fittings

<table>
<thead>
<tr>
<th>Figure 2 ID</th>
<th>Jet type</th>
<th>Part number</th>
<th>Jet tip id</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Capillary</td>
<td>19244-80560</td>
<td>0.29 mm (0.011 inch)</td>
<td>61.5 mm</td>
</tr>
<tr>
<td>2</td>
<td>Capillary, high-temperature</td>
<td>19244-80620</td>
<td>0.47 mm (0.018 inch)</td>
<td>61.5 mm</td>
</tr>
<tr>
<td></td>
<td>high-temperature (use with simulated distillation)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Packed</td>
<td>18710-20119</td>
<td>0.46 mm (0.018 inch)</td>
<td>63.6 mm</td>
</tr>
<tr>
<td>4</td>
<td>Packed, wide-bore (use with high-bleed applications)</td>
<td>18789-80070</td>
<td>0.76 mm (0.030 inch)</td>
<td>63.6 mm</td>
</tr>
</tbody>
</table>

Figure 2  Capillary adaptable jets
To Attach a Capillary Column Adapter on an Adaptable FID

1 Gather the following materials:
   - Adapter (See “Consumables and Parts for the FID” on page 184.)
   - 1/4-inch brass nut
   - 1/4-inch Vespel/graphite ferrule
   - Column cutter
   - 1/4-inch wrench
   - 9/16-inch open-end wrench
   - Lint-free gloves

2 Load the GC maintenance method and wait for the GC to become ready.

WARNING Be careful! The oven, inlet, and/or detector may be hot enough to cause burns. If the oven, inlet, or detector is hot, wear heat-resistant gloves to protect your hands.

CAUTION Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.

3 Assemble the nut and ferrule onto the adapter.

4 Insert the adapter straight into the detector base as far as possible.

5 Hold the adapter in this position and finger-tighten the nut.
6. Tighten an additional 1/4 turn with a wrench.
To Install a Capillary Column in the FID

1 Gather the following materials (see “Consumables and Parts for the FID” on page 184):
   - Column
   - Ferrule(s)
   - Column nut
   - Column cutter
   - 1/4-inch open-end wrench
   - Septum
   - Isopropanol
   - Lab tissue
   - Lint-free gloves

2 Load the GC maintenance method and wait for the GC to become ready.

**WARNING**
Be careful! The oven, inlet, and/or detector may be hot enough to cause burns. If the oven, inlet, or detector is hot, wear heat-resistant gloves to protect your hands.

**WARNING**
Wear safety glasses to protect your eyes from flying particles while handling, cutting, or installing glass or fused silica capillary columns. Use care in handling these columns to prevent puncture wounds.

3 If using the adaptable detector, verify that the adapter is installed. (See “To Attach a Capillary Column Adapter on an Adaptable FID” on page 191.)
4 Place a septum (if the column id is \(\leq 0.1\) mm), capillary column nut, and ferrule on the column.

5 Score the column using a glass scribing tool. The score must be square to ensure a clean break.

6 Break off the column end by supporting it against the column cutter opposite the scribe. Inspect the end with a magnifying loupe to make certain there are no burrs or jagged edges.

7 Wipe the column walls with a tissue dampened with isopropanol to remove fingerprints and dust.

8 Install the capillary column.

   If the column id is greater than 0.1 mm:
   a Gently insert the column into the detector until it bottoms; do not attempt to force it further.
   b Finger-tighten the column nut, then withdraw the column about 1 mm. Tighten the nut an additional 1/4 turn with a wrench.

CAUTION

Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.
If the column id is 0.1 mm or less position the column so it extends above the ferrule by 48 mm (capillary optimized fitting) or 68 mm (adaptable fitting). Slide the septum up to hold the column nut and ferrule at this fixed position.

c Insert the column into the detector. Slide the nut and ferrule up the column to the detector base. Finger-tighten the column nut until it grips the column.

d Adjust the column (not the septum) position so that the septum is even with the bottom of the column nut. Tighten the nut an additional 1/4 turn with a wrench.
To Replace the FID Collector Assembly

1. Gather the following:
   - New FID collector assembly. (See “Consumables and Parts for the FID” on page 184.)
   - T-20 Torx screwdriver
   - 1/4-inch nut driver
   - Tweezers
   - Lint-free gloves

**CAUTION** To avoid contaminating the FID, wear clean, lint-free gloves when handling the collector assembly.

2. Load the GC maintenance method and wait for the GC to become ready.

3. Disconnect the ignitor cable assembly.

4. Remove the three screws holding the collector assembly to the mounting pallet.
5 Lift and remove the assembly from the pallet.

6 Remove the ignitor cable assembly from the new collector assembly, if present.

7 Remove any protective caps from the new collector assembly, if present.

8 Lower the new collector assembly into the housing.

9 Insert the three screws and tighten (to 18 inch-pounds).

10 Connect the ignitor extension cable.

11 Verify assembly:
   a Check the FID leakage current. (See “To Check the FID Leakage Current” on page 210.)
   b Check the FID baseline. (See “To Check the FID Baseline” on page 211.)

CAUTION This step exposes the interconnect spring. Be careful not to touch or disfigure the spring while working on the FID. Any dirt or bending will reduce the sensitivity of your detector.
To Replace an FID Jet

1 Gather the following:
   - Replacement jet (See “Selecting an FID Jet” on page 189.)
   - T-20 Torx screwdriver
   - 1/4-inch nut driver
   - Tweezers
   - Compressed, filtered, dry air or nitrogen
   - Solvent that will clean the type of deposits in your detector
   - Clean cloth
   - Cotton swab
   - Lint-free gloves

2 Load the GC maintenance method and wait for the GC to become ready.

---

**WARNING**

Be careful! The oven and/or detector may be hot enough to cause burns. If the detector is hot, wear gloves to protect your hands.

---

**WARNING**

Wear safety glasses to protect your eyes from flying particles while handling, cutting, or installing glass or fused silica capillary columns. Use care in handling these columns to prevent puncture wounds.

---

3 If installed, remove the capillary column from the detector.

**CAUTION**

Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.

---

4 Remove the FID collector assembly and place it on a clean cloth. (See “To Replace the FID Collector Assembly” on page 196.)
5 Locate the jet inside the housing.

Handle the clean or new jet only with tweezers, or wear gloves.

6 Loosen the jet, then lift it out of the housing with tweezers.

7 Clean the detector base cavity using solvent, a swab, and compressed air or nitrogen.

8 Use tweezers to lower the new jet into the housing.
9 Carefully screw the jet into the housing. Tighten 1/6-turn past finger-tight (1/6-turn is one “flat” on a typical screwdriver handle, or the jet head).

10 Install the collector assembly. (See “To Replace the FID Collector Assembly” on page 196.)

11 Reset the jet counter.

12 Attach the capillary column to the detector.
   a Install the column in the detector. (See “To Install a Capillary Column in the FID” on page 193.)
   b After the column is installed at both inlet and detector, establish a flow of carrier gas and purge as recommended by the column manufacturer.
   c Check the FID leakage current. (See “To Check the FID Leakage Current” on page 210.)
   d Bakeout the detector. (See “To Bakeout the FID” on page 215.)
   e Restore the analytical method.

**WARNING** Be careful! The oven, inlet, and/or detector may be hot enough to cause burns. If the oven, inlet, or detector is hot, wear heat-resistant gloves to protect your hands.

f Allow the oven, inlet, and detector to equilibrate at operating temperature, then retighten the fittings.
Check the FID baseline. (See “To Check the FID Baseline” on page 211.)
To Perform Maintenance on the FID Collector Assembly

1. Gather the following:
   - Replacement ignitor assembly (See “Consumables and Parts for the FID” on page 184.)
   - Replacement ignitor castle
   - Two collector insulators
   - Collector
   - Spring washer
   - Gasket
   - T-20 Torx screwdriver
   - 1/4-inch nut driver
   - Tweezers
   - 5/16-inch wrench
   - Lint-free gloves
   - Clean cloth

   **CAUTION** To avoid contaminating the FID, wear clean, lint-free gloves when handling the collector assembly.

2. Load the GC maintenance method and wait for the GC to become ready.

   **WARNING** Be careful! The oven and/or detector may be hot enough to cause burns. If the detector is hot, wear gloves to protect your hands.
3 Remove the FID ignitor.
   a Disconnect the ignitor cable assembly.
   b Loosen the ignitor with a wrench.
   c Turn the nut counterclockwise by hand. Remove the ignitor and copper washer.

4 If replacing only the FID ignitor assembly with copper washer, skip to step 16 for assembly.

5 Remove the three screws that hold the collector mount to the FID thermal strap.
6 Remove the collector assembly. Place it on a clean cloth for additional disassembly.

7 Remove the gasket from the bottom of the assembly, if necessary.

8 Remove the FID ignitor castle.
   a Loosen the collector nut.
   b Remove the collector nut and the spring washer.

   c Lift the castle out of the collector housing. When removing the castle, some of the collector parts may be attached. Set these on a clean cloth to protect from scratches or dirt.

CAUTION This step exposes the interconnect spring. Be careful not to touch or disfigure the spring while working on the FID. Any dirt or bending will reduce the sensitivity of your detector.
9 If only replacing the FID castle, skip to step 15 for reassembly.

10 Remove the collector and insulators.

a If needed, remove the collector and upper insulator from the FID housing. The lower insulator may come out with the collector, but often remains in the FID housing. Place the parts on a clean cloth.

b Remove the lower insulator with tweezers and place the parts on a clean cloth.
11 Remove the collector housing from the mount, if necessary.

12 Use tweezers to remove the gasket from the bottom of the housing.

The collector assembly is now completely disassembled. Reassemble as follows:

13 Use tweezers to install a new gasket onto the housing, being sure that it lays flat on the brass surface.

14 Install the collector insulators.

a Insert one of the insulators into the base of the housing. Seat the insulator with the flat surface facing out of the housing.

b Insert the long end of collector into the housing and lower insulator.
c Insert the other insulator onto the top of the collector, with the flat surface facing towards the housing.

15 Install the FID ignitor castle.

a Orient the castle so that the threaded hole for the ignitor faces toward the electronics.

b Insert the FID castle into the collector housing.

c Install the spring washer over the castle.
d Install the collector nut over the castle and tighten firmly. The seal should be airtight. Maintain the orientation of the ignitor hole with the base as shown below.

16 Install the FID ignitor.

a Insert the ignitor and copper seal into the threaded hole of the castle. Keep the mating threads clean.

b Tighten the ignitor with a wrench. Ignition requires a good electrical contact that is free of any dirt.
17 Lower the collector assembly into the housing.
18 Insert the three screws and tighten (to 18 inch-pounds).

19 Connect the ignitor extension cable.

20 Verify assembly:
   a Check the FID leakage current. (See “To Check the FID Leakage Current” on page 210.)
   b Bakeout the detector. (See “To Bakeout the FID” on page 215.)
   c Check the FID baseline. (See “To Check the FID Baseline” on page 211.)
To Check the FID Leakage Current

1 Load the analytical method.
   • Make sure flows are acceptable for ignition.
   • Heat the detector to operating temperature or 300 °C.

2 Turn off the FID flame.

3 Press [Front Detector] or [Back Detector], then scroll to Output.

4 Verify that the output is stable and < 1.0 pA.
   
   If the output is unstable or > 1.0 pA, turn off the GC and check for proper assembly of the upper FID parts and contamination. If this contamination is confined to the detector, bakeout the FID. (See “To Bakeout the FID” on page 215.)

5 Turn on the flame.
To Check the FID Baseline

1. With the column installed, load your checkout method.
2. Set the oven temperature to 35 °C.
3. Press [Front Detector] or [Back Detector], then scroll to Output.
4. When the flame is lit and the GC is ready, verify that the output is stable and < 20 pA.
   
   If the output is not stable or > 20 pA, the system or gas may be contaminated. If this contamination is isolated to the detector, then bakeout the FID. (See “To Bakeout the FID” on page 215.)
To Install the FID Insulation Cup Assembly (Adaptable FID Only)

1 Gather the following:
   - Insulation (See “Consumables and Parts for the FID” on page 184.)
   - Insulation cup assembly

2 Load the GC maintenance method and wait for the GC to become ready.

**WARNING** Be careful! The detector may be hot enough to cause burns. If the detector is hot, wear heat-resistant gloves to protect your hands.

3 Assemble the insulation in the cup. Line up the slots in the insulation with the slot in the cup.

   Capillary columns should be attached to the detector before installing the cup. When attaching a packed column to the detector, cap the detector fitting before installing the cup to prevent insulation contamination of the detector.
4 Push the wire spring lever to the right to uncover the hole.

5 From inside the oven with the column installed, pass the column through the slot in the cup. Move the cup up over the detector fitting so that the cup touches the top of the oven. You should be able to see the groove in the fitting.

6 Release the spring into the groove of the fitting.
To Install the Optional FID PTFE Chimney Insert

**WARNING** Be careful! The detector may be hot enough to cause burns. If the detector is hot, wear heat-resistant gloves to protect your hands.

1. Light the FID flame.
2. Insert the PTFE chimney into the FID castle.

**NOTE** When installed, the PTFE chimney insert prevents ignition.
To Bakeout the FID

**WARNING** If using hydrogen as a carrier gas, turn off the hydrogen supply and cap the end of the column to prevent an oven explosion.

1 Bakeout the FID with the column installed or uninstalled. If uninstalled, gather the following (see “Consumables and Parts for the FID” on page 184):
   - Capillary adapter (adaptable FID only)
   - Column nut
   - No-hole ferrule

2 Load the GC maintenance method and wait for the GC to become ready.

**WARNING** Be careful! The detector may be hot enough to cause burns. If the detector is hot, wear heat-resistant gloves to protect your hands.

3 If the column is uninstalled, plug the detector connection with the capillary adapter, column nut, and no-hole ferrule.
   Maintain inert carrier gas flow through the column, or remove the column from the GC.

4 Set the detector temperature at 350 to 375 °C.

5 Set normal operating flows.

6 Light the FID flame.

7 Set the oven temperature to 250 °C or 25 °C above the normal maximum operating temperature. Do not exceed the column’s temperature limit.
8 Hold at temperature for 30 minutes or until the baseline settles at a lower value. The baseline will typically rise, then fall to a final value lower than the initial baseline.

9 Restore the analytical method and allow the FID to equilibrate.

10 Check the FID output value. It should be lower than the first reading. If it is not, contact your Agilent service representative.

Without a column installed, a clean system baseline should be <20 pA.

11 If the column is not installed in the FID, install it. (See “To Install a Capillary Column in the FID” on page 193.)
11

Maintaining the TCD

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To Install the Optional TCD Capillary Column Adapter   222
To Install a Capillary Column with the Optional TCD Capillary Column Adapter   223
To Bakeout Contaminants from the TCD   225
Consumables and Parts for the TCD

See the Agilent catalog for consumables and supplies for a more complete listing, or visit the Agilent Web site for the latest information (www.agilent.com/chem/supplies).

### Standard TCD column hardware

**Table 31** Standard parts for attaching columns to the TCD

<table>
<thead>
<tr>
<th>Column</th>
<th>Description</th>
<th>Unit</th>
<th>Part number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capillary</td>
<td>Nut, 1/8-inch id, brass Swagelok</td>
<td>10/pk</td>
<td>5180-4103</td>
</tr>
<tr>
<td></td>
<td>Back ferrule, for 0.1-mm to 0.53-mm capillary columns</td>
<td>10/pk</td>
<td>5182-3477</td>
</tr>
<tr>
<td></td>
<td>Front ferrule, 0.53-mm capillary columns</td>
<td>10/pk</td>
<td>5182-9673</td>
</tr>
<tr>
<td></td>
<td>Front ferrule, 0.32-mm capillary columns</td>
<td>10/pk</td>
<td>5182-9676</td>
</tr>
<tr>
<td></td>
<td>Front ferrule, 0.1-mm, 0.2-mm, and 0.25-mm capillary columns</td>
<td>10/pk</td>
<td>5182-9677</td>
</tr>
<tr>
<td></td>
<td>1/8-inch Swagelok plug</td>
<td></td>
<td>5180-4124</td>
</tr>
<tr>
<td>1/4-inch packed</td>
<td>1/4-inch packed column adapter</td>
<td></td>
<td>G1532-20710</td>
</tr>
<tr>
<td></td>
<td>1/8-inch id Vespel/graphite ferrule</td>
<td>10/pk</td>
<td>0100-1332</td>
</tr>
<tr>
<td></td>
<td>Nut, 1/8-inch id, brass</td>
<td>10/pk</td>
<td>5180-4103</td>
</tr>
<tr>
<td></td>
<td>Ferrule, Vespel, 1/4-inch</td>
<td>10/pk</td>
<td>5080-8774</td>
</tr>
<tr>
<td></td>
<td>1/4-inch id tubing nut, brass</td>
<td>10/pk</td>
<td>5180-4105</td>
</tr>
<tr>
<td></td>
<td>1/8-inch Swagelok plug</td>
<td></td>
<td>5180-4124</td>
</tr>
<tr>
<td>1/8-inch packed</td>
<td>Ferrule, 1/8-inch Vespel/graphite</td>
<td>10/pk</td>
<td>0100-1332</td>
</tr>
<tr>
<td></td>
<td>Nut, 1/8-inch id, brass</td>
<td>10/pk</td>
<td>5180-4103</td>
</tr>
<tr>
<td></td>
<td>1/8-inch Swagelok plug</td>
<td></td>
<td>5180-4124</td>
</tr>
</tbody>
</table>

### Optional TCD capillary column hardware

**Table 32** Optional TCD capillary column adapter hardware

<table>
<thead>
<tr>
<th>Description</th>
<th>Unit</th>
<th>Part number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capillary adapter</td>
<td></td>
<td>G1532-80540</td>
</tr>
<tr>
<td>Ferrule, Vespel, 1/8-inch</td>
<td>10/pk</td>
<td>0100-1332</td>
</tr>
<tr>
<td>Nut, brass, 1/8-inch</td>
<td>10/pk</td>
<td>5180-4103</td>
</tr>
</tbody>
</table>
### Table 33  Nuts, ferrules, and hardware for capillary columns

<table>
<thead>
<tr>
<th>Column id (mm)</th>
<th>Description</th>
<th>Typical use</th>
<th>Part number/quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>.530</td>
<td>Ferrule, Vespel/graphite, 0.8-mm id</td>
<td>0.45-mm and 0.53-mm capillary columns</td>
<td>5062-3512 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Ferrule, graphite, 1.0-mm id</td>
<td>0.53-mm capillary columns</td>
<td>5080-8773 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Column nut, finger-tight (for 0.53-mm columns)</td>
<td>Connect column to inlet or detector</td>
<td>5020-8293</td>
</tr>
<tr>
<td>.320</td>
<td>Ferrule, Vespel/graphite, 0.5-mm id</td>
<td>0.32-mm capillary columns</td>
<td>5062-3514 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Ferrule, graphite, 0.5-mm id</td>
<td>0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns</td>
<td>5080-8853 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Column nut, finger-tight (for .100- to .320-mm columns)</td>
<td>Connect column to inlet or detector</td>
<td>5020-8292</td>
</tr>
<tr>
<td>.250</td>
<td>Ferrule, Vespel/graphite, 0.4-mm id</td>
<td>0.1-mm, 0.2-mm, and 0.25-mm capillary columns</td>
<td>5181-3323 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Ferrule, graphite, 0.5-mm id</td>
<td>0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns</td>
<td>5080-8853 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Column nut, finger-tight (for .100- to .320-mm columns)</td>
<td>Connect column to inlet or detector</td>
<td>5020-8292</td>
</tr>
<tr>
<td>.100 and .200</td>
<td>Ferrule, Vespel/graphite, 0.37-mm id</td>
<td>0.1-mm and 0.2-mm capillary columns</td>
<td>5062-3516 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Ferrule, Vespel/graphite, 0.4-mm id</td>
<td>0.1-mm, 0.2-mm, and 0.25-mm capillary columns</td>
<td>5181-3323 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Ferrule, graphite, 0.5-mm id</td>
<td>0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns</td>
<td>5080-8853 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Column nut, finger-tight (for .100- to .320-mm columns)</td>
<td>Connect column to inlet or detector</td>
<td>5020-8292</td>
</tr>
<tr>
<td>All</td>
<td>Ferrule, no-hole</td>
<td>Testing</td>
<td>5181-3308 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Capillary column blanking nut</td>
<td>Testing–use with any ferrule</td>
<td>5020-8294</td>
</tr>
<tr>
<td></td>
<td>Column nut, universal</td>
<td>Connect column to inlet or detector</td>
<td>5181-8830 (2/pk)</td>
</tr>
<tr>
<td></td>
<td>Column cutter, ceramic wafer</td>
<td>Cutting capillary columns</td>
<td>5181-8836 (4/pk)</td>
</tr>
</tbody>
</table>
To Install a Capillary Column in the TCD

1 Gather the following:
   - Front ferrule (See “Consumables and Parts for the TCD” on page 218.)
   - Back ferrule
   - Column nut
   - Column cutter
   - 7/16-inch wrench
   - Lab tissue
   - Lint-free gloves

2 Load the GC maintenance method and wait for the GC to become ready.

**WARNING** Be careful! The oven and/or inlet may be hot enough to cause burns. If the inlet is hot, wear heat-resistant gloves to protect your hands.

**WARNING** Wear safety glasses to protect your eyes from flying particles while handling, cutting, or installing glass or fused silica capillary columns. Use care in handling these columns to prevent puncture wounds.

**CAUTION** Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.

3 Assemble the ferrules and 1/8-inch brass Swagelok nut on the column.

1. Front ferrule
2. Back ferrule
3. Nut
4 Score the column using a glass scribing tool. The score must be square to ensure a clean break.

5 Break off the column end by supporting it against the column cutter opposite the scribe. Inspect the end with a magnifying loupe to make certain that there are no burrs or jagged edges.

6 Wipe the column walls with a tissue dampened with isopropanol to remove fingerprints and dust.

7 Insert the column into the detector until it bottoms.

8 Slide the column nut and ferrules up the column to the detector and finger-tighten the nut.

9 Pull out 1 mm of column. Tighten the nut an additional 1/4 turn with a wrench or until the column does not move.
To Install the Optional TCD Capillary Column Adapter

1 Gather the following:
   - Capillary column adapter (See “Consumables and Parts for the TCD” on page 218.)
   - 1/4-inch and 7/16-inch wrenches
   - 1/8-inch brass nut
   - 1/8-inch Vespel ferrule
   - Lint-free gloves

2 Load the GC maintenance method and wait for the GC to become ready.

   CAUTION Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.

3 Assemble the brass nut and ferrule onto the capillary column adapter.

   Ferrule, 1/8-inch

   Nut, 1/8-inch

   Capillary column adapter

4 Install the adapter assembly into the detector fitting and tighten finger-tight. Use a wrench to tighten until snug.
To Install a Capillary Column with the Optional TCD Capillary Column Adapter

1. Gather the following:
   - Ferrule (See “Consumables and Parts for the TCD” on page 218.)
   - Column cutter
   - Column nut
   - 1/4-in. and 7/16-in. wrenches
   - Lint-free gloves

2. Load the GC maintenance method and wait for the GC to become ready.

**WARNING**
Be careful! The detector may be hot enough to cause burns. If the detector is hot, wear heat-resistant gloves to protect your hands.

**WARNING**
Wear safety glasses to protect your eyes from flying particles while handling, cutting, or installing glass or fused silica capillary columns. Use care in handling these columns to prevent puncture wounds.

**CAUTION**
Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.

3. Place a capillary column nut and ferrule on the column.

4. Score the column using a glass scribing tool. The score must be square to ensure a clean break.
5 Break off the column end by supporting it against the column cutter opposite the scribe. Inspect the end with a magnifying loupe to make certain there are no burrs or jagged edges.

6 Wipe the column walls with a tissue dampened with isopropanol to remove fingerprints and dust.

7 Gently insert the column into the detector until it bottoms. Do not attempt to force it further.

8 Slide the column nut and ferrule up the column to the adapter and tighten the nut finger tight.

9 Pull the column out 1 mm. Use a wrench to tighten the nut an additional 1/4-turn. The column should not move.
To Bakeout Contaminants from the TCD

The bakeout can be performed with the column installed or the detector capped.

**CAUTION**

If the column is not installed, you must turn off the TCD filament and cap the detector column fitting to prevent irreparable damage to the filament caused by oxygen entering the detector.

1. If the column is not installed, cap the detector.

**WARNING**

Be careful! The detector may be hot enough to cause burns. If the detector is hot, wear heat-resistant gloves to protect your hands.

2. Turn off the TCD filament.
3. If the column is attached to the inlet, maintain inert carrier gas flow through the column.

**WARNING**

If using hydrogen as a carrier gas, turn off the hydrogen supply and cap the end of the column to prevent an oven explosion.

4. Set the reference gas flow rate between 20 and 30 mL/min.
5. Set the detector temperature to 375 °C.
6. Hold at 375 °C for several hours.
7. If the column is uninstalled, install it. (See “To Install a Capillary Column in the TCD” on page 220.)
8. Load the analytical method.

**WARNING**

Be careful! The oven or detector fittings may be hot enough to cause burns.

9. Allow the oven, inlet, and detector to equilibrate at operating temperature, then re-tighten the fittings.
12
Maintaining the uECD

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Exploded Parts View of the uECD  232
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To Install the Insulating Cup for the uECD  240
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This section describes the routine maintenance tasks for the micro-Electron Capture Detector (uECD). For important regulatory and safety information for this detector, refer to the general information booklet and CD provided with the detector.
Important Safety Information About the uECD

The uECD contains a cell plated with $^{63}$Ni, a radioactive isotope. The beta particles released at the energy level in the detector have little penetrating power—the surface layer of the skin or a few sheets of paper will stop most of them—but they may be hazardous if the isotope is ingested or inhaled. For this reason, handle the cell with care. Cap the detector inlet and outlet fittings when the detector is not in use. Never introduce corrosive chemicals into the detector. Vent detector exhaust outside the laboratory environment.

Refer to the safety documentation provided with the detector for important details about safety, maintenance, and compliance with local government regulation.

**WARNING**

Materials that may react with the $^{63}$Ni source, either to form volatile products or to cause physical degradation of the plated film, must be avoided. These materials include oxidizing compounds, acids, wet halogens, wet nitric acid, ammonium hydroxide, hydrogen sulfide, PCBs, and carbon monoxide. This list is not exhaustive but indicates the kinds of compounds that may cause damage to $^{63}$Ni detectors.

**WARNING**

In the extremely unlikely event that both the oven and the detector-heated zone should go into thermal runaway (maximum, uncontrolled heating in excess of 400 °C) at the same time and the detector remains exposed to this condition for more than 12 hours, take the following steps:

1. After turning off the main power and allowing the instrument to cool, cap the detector inlet and exhaust vent openings. Wear disposable plastic gloves and observe normal laboratory safety precautions.

2. Return the cell for disposal, following directions included with the License Verification Form (part number 19233-90750).

3. Include a letter stating the condition of abuse.

It is unlikely, even in this very unusual situation, that radioactive material will escape the cell. However, permanent damage to the $^{63}$Ni plating within the cell is possible; therefore, the cell must be returned for exchange.
When handling uECDs:

- Never eat, drink, or smoke.
- Always wear safety glasses when working with or near open uECDs.
- Wear protective clothing such as laboratory jackets, safety glasses, and gloves, and follow good laboratory practices. Wash hands thoroughly with a mild nonabrasive cleaner after handling uECDs.
- Cap the inlet and outlet fittings when the uECD is not in use.
- Connect the uECD exhaust vent to a fume hood or vent it to the outside. See the latest revision of 10 CFR Part 20 (including Appendix B), or the applicable state regulation. For other countries, consult with the appropriate agency for equivalent requirements.

Agilent Technologies recommends a vent line internal diameter of 6 mm (1/4-inch) or greater. With a line of this diameter, the length is not critical.
Consumables and Parts for the uECD

See the Agilent catalog for consumables and supplies for a more complete listing, or visit the Agilent Web site for the latest information (www.agilent.com/chem/supplies).

<table>
<thead>
<tr>
<th>Table 34</th>
<th>uECD consumables and parts</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description</strong></td>
<td><strong>Part number/quantity</strong></td>
</tr>
<tr>
<td>Fused silica indented mixing liner</td>
<td>G2397-20540</td>
</tr>
<tr>
<td>Makeup gas adapter</td>
<td>G3433-63000</td>
</tr>
<tr>
<td>ECD wipe test kit</td>
<td>18713-60050</td>
</tr>
<tr>
<td>Insulation</td>
<td>19234-60715 (3/pk)</td>
</tr>
<tr>
<td>Insulation cup assembly</td>
<td>19234-60700</td>
</tr>
<tr>
<td>Nut, 1/4-inch Swagelok adapter</td>
<td>5180-4105 (10/pk)</td>
</tr>
<tr>
<td>Ferrule, graphitized Vespel, 1/4-inch</td>
<td>5080-8774 (10/pk)</td>
</tr>
<tr>
<td>Capillary column blanking nut</td>
<td>5020-8294</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 35</th>
<th>Nuts, ferrules, and hardware for capillary columns</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Column id (mm)</strong></td>
<td><strong>Description</strong></td>
</tr>
<tr>
<td>.530</td>
<td>Ferrule, Vespel/graphite, 0.8-mm id</td>
</tr>
<tr>
<td></td>
<td>Ferrule, graphite, 1.0-mm id</td>
</tr>
<tr>
<td></td>
<td>Column nut, finger-tight (for 0.53-mm columns)</td>
</tr>
<tr>
<td>.320</td>
<td>Ferrule, Vespel/graphite, 0.5-mm id</td>
</tr>
<tr>
<td></td>
<td>Ferrule, graphite, 0.5-mm id</td>
</tr>
<tr>
<td></td>
<td>Column nut, finger-tight (for .100- to .320-mm columns)</td>
</tr>
<tr>
<td>.250</td>
<td>Ferrule, Vespel/graphite, 0.4-mm id</td>
</tr>
<tr>
<td></td>
<td>Ferrule, graphite, 0.5-mm id</td>
</tr>
<tr>
<td></td>
<td>Column nut, finger-tight (for .100- to .320-mm columns)</td>
</tr>
</tbody>
</table>
### Table 35  Nuts, ferrules, and hardware for capillary columns (continued)

<table>
<thead>
<tr>
<th>Column id (mm)</th>
<th>Description</th>
<th>Typical use</th>
<th>Part number/quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>.100 and .200</td>
<td>Ferrule, Vespel/graphite, 0.37-mm id</td>
<td>0.1-mm and 0.2-mm capillary columns</td>
<td>5062-3516 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Ferrule, Vespel/graphite, 0.4-mm id</td>
<td>0.1-mm, 0.2-mm, and 0.25-mm capillary columns</td>
<td>5181-3323 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Ferrule, graphite, 0.5-mm id</td>
<td>0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns</td>
<td>5080-8853 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Column nut, finger-tight (for .100- to .320-mm columns)</td>
<td>Connect column to inlet or detector</td>
<td>5020-8292</td>
</tr>
<tr>
<td>All</td>
<td>Ferrule, no-hole</td>
<td>Testing</td>
<td>5181-3308 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Capillary column blanking nut</td>
<td>Testing—use with any ferrule</td>
<td>5020-8294</td>
</tr>
<tr>
<td></td>
<td>Column nut, universal</td>
<td>Connect column to inlet or detector</td>
<td>5181-8830 (2/pk)</td>
</tr>
<tr>
<td></td>
<td>Column cutter, ceramic wafer</td>
<td>Cutting capillary columns</td>
<td>5181-8836 (4/pk)</td>
</tr>
</tbody>
</table>
Exploded Parts View of the uECD

- Vent line
- Warning tag
- Perforated cover
- Electrometer
- Ferrule
- Adapter nut
- Cap
- Liner
- Makeup gas adapter
- Insulation
- Insulation cup
- Ferrule
- Column nut
To Replace the uECD Fused Silica Indented Mixing Liner and Install the Makeup Gas Adapter

1 Gather the following:
   • Fused silica indented mixing liner (See “Consumables and Parts for the uECD” on page 230.)
   • 1/4-inch Swagelok nut
   • 1/4-inch Vespel/graphite ferrule
   • 9/16-inch wrench
   • Methanol
   • Lint-free gloves

2 Load the GC maintenance method and wait for the GC to become ready.

   **WARNING**
   Be careful! The oven and/or detector may be hot enough to cause burns. If the detector is hot, wear gloves to protect your hands.

   **WARNING**
   Wear safety glasses to protect your eyes from flying particles while handling, cutting, or installing glass or fused silica capillary columns. Use care in handling these columns to prevent puncture wounds.

3 Remove the insulating cup from the detector base.
4 Remove the column from the makeup gas adapter.

   **CAUTION**
   To prevent damage avoid flexing/bending the tubing on the makeup gas adapter.

5 Remove the makeup gas adapter.
   a Loosen the adapter nut with a wrench and slide out the makeup gas adapter from the uECD. Remove the ferrule.
The makeup gas adapter will remain attached to the supply tubing and hang suspended in the oven.

6 Adjust the adapter’s position so that maintenance can be performed on the adapter easily and without obstruction.

6 Unscrew and remove the adapter cap.

**CAUTION**
Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.

7 Remove the fused silica indented mixing liner and inspect. Replace it if it is broken or contaminated with sample or graphite.

8 Ultrasonically clean the adapter cap in methanol. Clean the outer surfaces of the makeup gas adapter with methanol.

9 Install the fused silica indented mixing liner into the makeup gas adapter, then install the cap. The indentation on the fused silica indented mixing liner must be at the cap end of the adapter.
10 Place a new 1/4-inch Swagelok nut and ferrule onto the makeup gas adapter.

11 Slowly install the adapter straight into the detector fitting. Jiggle the adapter, if necessary, to make sure it is seated all the way into the detector fitting. Be careful not to break the column end.

12 Tighten the nut finger-tight and then use a 9/16-inch wrench to tighten until snug.

If the adapter is properly installed, the distance between the 1/4-inch nut and the bottom of the adapter will be $19 \pm 1$ mm. If the distance is 22 to 23 mm, install the adapter into the detector fitting.
13 Attach the column. (See “To Install a Capillary Column in the uECD” on page 237.)
To Install a Capillary Column in the uECD

1 Gather the following:
   - Ferrule (See “Consumables and Parts for the uECD” on page 230.)
   - Column nut
   - Septum
   - Column
   - 1/4-inch, 5/16-inch, and 9/16-inch wrenches
   - Column cutter
   - Lint-free gloves

2 Load the GC maintenance method and wait for the GC to become ready.

   **WARNING** Be careful! The oven and/or detector may be hot enough to cause burns. If the detector is hot, wear gloves to protect your hands.

   **WARNING** Wear safety glasses to protect your eyes from flying particles while handling, cutting, or installing glass or fused silica capillary columns. Use care in handling these columns to prevent puncture wounds.

3 Load the inlet maintenance method and wait for the GC to become ready.

   **CAUTION** Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.

4 Place a septum (if the column id is ≤0.2 mm), capillary column nut, and ferrule on the column.
5 Score the column using a glass scribing tool. The score must be square to ensure a clean break.

6 Break off the column end by supporting it against the column cutter opposite the scribe. Inspect the end with a magnifying loupe to make certain there are no burrs or jagged edges.

7 Wipe the column walls with a tissue dampened with isopropanol to remove fingerprints and dust.

8 Install the column.

If the column id is 200 um or more, push the column into the adapter until it stops at the indentation. Pull it back 1 to 2 mm and tighten the column nut with one 5/16-inch wrench on the adapter and another 1/4-inch wrench on the column nut.

If the id is less the 200 um, mark the column with a septum 70 ± 1 mm from the end. Insert column and nut into the adapter with the septum at the rear of the column nut, and tighten the column nut with one 5/16-inch wrench on the adapter and another 1/4-inch wrench on the column nut.
9 After heating the detector, retighten the 9/16-inch makeup adapter nut and 1/4-inch column nut.
To Install the Insulating Cup for the uECD

1 Gather the following:
   - Nut warmer insulation (See “Consumables and Parts for the uECD” on page 230.)
   - Insulation cup assembly

2 Load the GC maintenance method and wait for the GC to become ready.

   **WARNING**
   Be careful! The oven and/or detector may be hot enough to cause burns. If the detector is hot, wear gloves to protect your hands.

3 Install the insulation in the cup. Line up the slots in the insulation with the slot in the cup.

4 Push the wire spring lever to the right to uncover the hole.

5 With a capillary column installed to prevent insulation contamination of the detector, slide the column into the slot on the insulation cup and place the cup over the makeup gas adapter.
6 Slide the cup up so that the cup touches the top of the oven and you can see the groove in the makeup gas adapter.

7 Release the spring into the groove of the makeup gas adapter.
To Bakeout the uECD

**WARNING** Detector disassembly and/or cleaning procedures other than thermal should be performed only by personnel trained and licensed appropriately to handle radioactive materials. Trace amounts of radioactive $^{63}\text{Ni}$ may be removed during other procedures, causing possible hazardous exposure to β- and x-radiation.

**CAUTION** To prevent possible hazardous contamination of the area with radioactive material, the detector exhaust vent always must be connected to a fume hood or otherwise vented in compliance with the latest revision of 10 CFR Part 20, or with state regulations with which the Nuclear Regulatory Commission has entered into an agreement (USA only). For other countries, consult with the appropriate agency for equivalent requirements.

1 Gather the following:
   - Column nut and no-hole ferrule (See “Consumables and Parts for the uECD” on page 230.)
   - Blanking nut with any column ferrule

2 With the detector and oven at normal operating temperatures, show the detector output. Press [Front Det] or [Back Det]. Note the value of Output for later comparison.

3 Load the GC maintenance method and wait for the GC to become ready.

**WARNING** Be careful! The oven and/or detector may be hot enough to cause burns. If the detector is hot, wear gloves to protect your hands.

**WARNING** Wear safety glasses to protect your eyes from flying particles while handling, cutting, or installing glass or fused silica capillary columns. Use care in handling these columns to prevent puncture wounds.

4 If the column maximum temperature is < 250 °C, remove the column from the detector.
5 If the column is uninstalled, plug the detector connection with the column nut and no-hole ferrule. Maintain inert carrier gas flow through the column, or remove the column from the GC.

6 Set the uECD temperature to 350 to 375 °C, the makeup gas flow to 60 mL/min, and the oven temperature to 250 °C. If the column is uninstalled, leave the oven off to protect the column.

7 If the column is installed in the uECD, set the oven temperature to 250 °C. If the column is uninstalled, leave the oven off to protect the column.

8 Allow thermal cleaning to continue for several hours and then cool the system to normal operating temperatures. The figure below shows detector output during a typical cleaning cycle.

9 Check the uECD output value on the control table. It should be lower than the first reading. If it is not, contact your Agilent service representative.

10 Reinstall the column.

11 Restore the analytical method.
13
Maintaining the NPD

Consumables and Parts for the NPD  246
Exploded Parts View of the NPD  249
Selecting an NPD Jet  250
To Attach a Capillary Column Adapter on an Adaptable NPD  252
To Install a Capillary Column in the NPD  254
To Replace the NPD Bead Assembly  257
To Maintain the NPD Collector, Ceramic Insulators, and Jet  264
To Check the NPD Leakage Current  270
Consumables and Parts for the NPD

See the Agilent catalog for consumables and supplies for a more complete listing, or visit the Agilent Web site for the latest information (www.agilent.com/chem/supplies).

Before selecting a jet, see “Selecting an NPD Jet” on page 250.

**Table 36  NPD parts**

<table>
<thead>
<tr>
<th>Description</th>
<th>Part number/quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collector</td>
<td>G1534-20530</td>
</tr>
<tr>
<td>Screw, M3 × 0.5 × 8 mm</td>
<td>0515-0655</td>
</tr>
<tr>
<td>NPD white ceramic bead assembly</td>
<td>G1534-60570</td>
</tr>
<tr>
<td>NPD black ceramic bead assembly</td>
<td>5183-2007</td>
</tr>
<tr>
<td>NPD Blos bead assembly</td>
<td>G3434-60806</td>
</tr>
<tr>
<td>Screw, M4 × 10 mm</td>
<td>0515-2495</td>
</tr>
<tr>
<td>J-clamp</td>
<td>1400-0015</td>
</tr>
<tr>
<td>NPD ceramic insulator kit</td>
<td>5182-9722</td>
</tr>
<tr>
<td>• Metal C-rings, top and bottom</td>
<td></td>
</tr>
<tr>
<td>• Ceramic insulators, upper and lower</td>
<td></td>
</tr>
<tr>
<td>Insulation cup</td>
<td>19234-60720</td>
</tr>
<tr>
<td>NPD chemical sample kit solution of 0.65 ppm azobenzene, 1000 ppm octadecane, 1 ppm malathion in isooctane, 3 ampoules</td>
<td>18789-60060</td>
</tr>
<tr>
<td>NPD lid standoff</td>
<td>G1534-20590</td>
</tr>
<tr>
<td><strong>Column adapters, for adaptable NPD only</strong></td>
<td></td>
</tr>
<tr>
<td>FID/NPD capillary column adapter</td>
<td>19244-80610</td>
</tr>
<tr>
<td>1/8-inch packed column adapter</td>
<td>19231-80520</td>
</tr>
<tr>
<td>1/4-inch packed column adapter</td>
<td>19231-80530</td>
</tr>
<tr>
<td>1/4-inch packed glass column adapter</td>
<td>G1532-20710</td>
</tr>
<tr>
<td>1/4-inch column nut</td>
<td>5180-4105 10/pk</td>
</tr>
<tr>
<td>1/4-inch Vespel/graphite ferrule</td>
<td>5080-8774 10/pk</td>
</tr>
</tbody>
</table>
### Table 37  Jets for capillary optimized fittings

<table>
<thead>
<tr>
<th>Jet type</th>
<th>Part number</th>
<th>Jet tip id</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capillary with extended jet (recommended)</td>
<td>G1534-80580</td>
<td>0.29 mm (0.011 inch)</td>
<td>51.5 mm</td>
</tr>
<tr>
<td>Capillary</td>
<td>G1531-80560</td>
<td>0.29 mm (0.011 inch)</td>
<td>43 mm</td>
</tr>
<tr>
<td>High-temperature</td>
<td>G1531-80620</td>
<td>0.47 mm (0.018 inch)</td>
<td>43 mm</td>
</tr>
</tbody>
</table>

### Table 38  Jets for adaptable fittings

<table>
<thead>
<tr>
<th>Jet type</th>
<th>Part number</th>
<th>Jet tip id</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capillary with extended jet (recommended)</td>
<td>G1534-80590</td>
<td>0.29 mm (0.11 inch)</td>
<td>70.5 mm</td>
</tr>
<tr>
<td>Capillary</td>
<td>19244-80560</td>
<td>0.29 mm (0.011 inch)</td>
<td>61.5 mm</td>
</tr>
<tr>
<td>Capillary, high-temperature</td>
<td>19244-80620</td>
<td>0.47 mm (0.018 inch)</td>
<td>61.5 mm</td>
</tr>
<tr>
<td>Packed</td>
<td>18710-20119</td>
<td>0.46 mm (0.018 inch)</td>
<td>63.6 mm</td>
</tr>
</tbody>
</table>

### Table 39  Nuts, ferrules, and hardware for capillary columns

<table>
<thead>
<tr>
<th>Column id (mm)</th>
<th>Description</th>
<th>Typical use</th>
<th>Part number/quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>.530</td>
<td>Ferrule, Vespel/graphite, 0.8-mm id</td>
<td>0.45-mm and 0.53-mm capillary columns</td>
<td>5062-3512 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Ferrule, graphite, 1.0-mm id</td>
<td>0.53-mm capillary columns</td>
<td>5080-8773 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Column nut, finger-tight (for 0.53-mm columns)</td>
<td>Connect column to inlet or detector</td>
<td>5020-8293</td>
</tr>
<tr>
<td>.320</td>
<td>Ferrule, Vespel/graphite, 0.5-mm id</td>
<td>0.32-mm capillary columns</td>
<td>5062-3514 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Ferrule, graphite, 0.5-mm id</td>
<td>0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns</td>
<td>5080-8853 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Column nut, finger-tight (for .100- to .320-mm columns)</td>
<td>Connect column to inlet or detector</td>
<td>5020-8292</td>
</tr>
<tr>
<td>.250</td>
<td>Ferrule, Vespel/graphite, 0.4-mm id</td>
<td>0.1-mm, 0.2-mm, and 0.25-mm capillary columns</td>
<td>5181-3323 (10/pk)</td>
</tr>
</tbody>
</table>
Table 39  Nuts, ferrules, and hardware for capillary columns (continued)

<table>
<thead>
<tr>
<th>Column id (mm)</th>
<th>Description</th>
<th>Typical use</th>
<th>Part number/quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ferrule, graphite, 0.5-mm id</td>
<td>0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns</td>
<td>5080-8853 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Column nut, finger-tight (for .100- to .320-mm columns)</td>
<td>Connect column to inlet or detector</td>
<td>5020-8292</td>
</tr>
<tr>
<td>.100 and .200</td>
<td>Ferrule, Vespel/graphite, 0.37-mm id</td>
<td>0.1-mm and 0.2-mm capillary columns</td>
<td>5062-3516 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Ferrule, Vespel/graphite, 0.4-mm id</td>
<td>0.1-mm, 0.2-mm, and 0.25-mm capillary columns</td>
<td>5181-3323 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Ferrule, graphite, 0.5-mm id</td>
<td>0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns</td>
<td>5080-8853 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Column nut, finger-tight (for .100- to .320-mm columns)</td>
<td>Connect column to inlet or detector</td>
<td>5020-8292</td>
</tr>
<tr>
<td>All</td>
<td>Ferrule, no-hole</td>
<td>Testing</td>
<td>5181-3308 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Capillary column blanking nut</td>
<td>Testing–use with any ferrule</td>
<td>5020-8294</td>
</tr>
<tr>
<td></td>
<td>Column nut, universal</td>
<td>Connect column to inlet or detector</td>
<td>5181-8830 (2/pk)</td>
</tr>
<tr>
<td></td>
<td>Column cutter, ceramic wafer</td>
<td>Cutting capillary columns</td>
<td>5181-8836 (4/pk)</td>
</tr>
</tbody>
</table>
Exploded Parts View of the NPD

- Bead assembly
- Lid
- Metal C-ring, top
- Ceramic insulator, upper
- Collector
- Metal C-ring, bottom
- Ceramic insulator
- Metal C-ring, bottom
- Jet
- NPD cover
- Column adapter
- Insulation
- Insulation
- Insulation cup
- Ferrule
- Column nut
- Bead assembly cable
- NPD lid standoff
- J-clamp
- Electrometer
Selecting an NPD Jet

Open the oven door and locate the column connection fitting at the base of the detector. It will look like either a capillary optimized fitting or an adaptable fitting.

- If you have an application that tends to clog the jet, select a jet with a wider tip id.
- When using packed columns in high column-bleed applications, the jet tends to clog with silicon dioxide.

For capillary optimized fittings, select one of the following from Table 40.

Table 40  Jets for capillary optimized fittings

<table>
<thead>
<tr>
<th>Figure 3 ID</th>
<th>Jet type</th>
<th>Part number</th>
<th>Jet tip id</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Capillary with extended jet</td>
<td>G1534-80580</td>
<td>0.29 mm (0.011 inch)</td>
<td>51.5 mm</td>
</tr>
<tr>
<td></td>
<td>(recommended)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Capillary</td>
<td>G1531-80560</td>
<td>0.29 mm (0.011 inch)</td>
<td>43 mm</td>
</tr>
<tr>
<td>3</td>
<td>High-temperature</td>
<td>G1531-80620</td>
<td>0.47 mm (0.018 inch)</td>
<td>43 mm</td>
</tr>
</tbody>
</table>

Figure 3  Capillary optimized NPD jets

For adaptable fittings, select one of the following from Table 41.
Table 41  Jets for adaptable fittings

<table>
<thead>
<tr>
<th>Figure 4 ID</th>
<th>Jet type</th>
<th>Part number</th>
<th>Jet tip id</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Capillary with extended jet (recommended)</td>
<td>G1534-80590</td>
<td>0.29 mm (0.11 inch)</td>
<td>70.5 mm</td>
</tr>
<tr>
<td>2</td>
<td>Capillary</td>
<td>19244-80560</td>
<td>0.29 mm (0.011 inch)</td>
<td>61.5 mm</td>
</tr>
<tr>
<td>3</td>
<td>Capillary, high-temperature</td>
<td>19244-80620</td>
<td>0.47 mm (0.018 inch)</td>
<td>61.5 mm</td>
</tr>
<tr>
<td>4</td>
<td>Packed</td>
<td>18710-20119</td>
<td>0.46 mm (0.018 inch)</td>
<td>63.6 mm</td>
</tr>
</tbody>
</table>

**Figure 4**  Adaptable NPD jets
To Attach a Capillary Column Adapter on an Adaptable NPD

1. Gather the following materials:
   - Adapter (See “Consumables and Parts for the NPD” on page 246.)
   - 1/4-inch nut
   - 1/4-inch ferrule
   - Column cutter
   - 1/4-inch wrench
   - 9/16-inch open-end wrench
   - Lint-free gloves

2. Load the GC maintenance method and wait for the GC to become ready.

**WARNING**
Be careful! The oven, inlet, and/or detector may be hot enough to cause burns. If the oven, inlet, or detector is hot, wear heat-resistant gloves to protect your hands.

**WARNING**
Wear safety glasses to protect your eyes from flying particles while handling, cutting, or installing glass or fused silica capillary columns. Use care in handling these columns to prevent puncture wounds.

**CAUTION**
Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.

3. Assemble a brass nut and Vespel/graphite ferrule onto the adapter.
4 Insert the adapter straight into the detector base as far as possible.

5 Hold the adapter in this position and finger-tighten the nut.

6 Tighten an additional 1/4 turn with a wrench.
To Install a Capillary Column in the NPD

1. Gather the following materials:
   - Column
   - Ferrule(s) (See “Consumables and Parts for the NPD” on page 246.)
   - Column nut
   - Column cutter
   - 1/4-inch open-end wrench
   - Septum
   - Isopropanol
   - Lab tissue
   - Lint-free gloves

2. Load the GC maintenance method and wait for the GC to become ready.

**WARNING**
Be careful! The oven, inlet, and/or detector may be hot enough to cause burns. If the oven, inlet, or detector is hot, wear heat-resistant gloves to protect your hands.

**WARNING**
Wear safety glasses to protect your eyes from flying particles while handling, cutting, or installing glass or fused silica capillary columns. Use care in handling these columns to prevent puncture wounds.

If using the adaptable detector, verify that the adapter is installed. (See “To Attach a Capillary Column Adapter on an Adaptable NPD” on page 252.)
3 Place a septum (if the column id is ≤0.1 mm), capillary column nut, and ferrule on the column.

4 Score the column using a glass scribing tool. The score must be square to ensure a clean break.

5 Break off the column end by supporting it against the column cutter opposite the scribe. Inspect the end with a magnifying loupe to make certain there are no burrs or jagged edges.

6 Wipe the column walls with a tissue dampened with isopropanol to remove fingerprints and dust.

7 Install the capillary column.

   If the column id is greater than 0.1 mm:
   a Gently insert the column into the detector until it bottoms; do not attempt to force it further.
   b Finger-tighten the column nut, then withdraw the column about 1 mm. Tighten the nut an additional 1/4 turn with a wrench.

CAUTION Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.
If the column id is 0.1 mm or less position the column so it extends above the ferrule by 48 mm (capillary optimized fitting) or 68 mm (adaptable fitting). Slide the septum up to hold the column nut and ferrule at this fixed position.

c Insert the column into the detector. Slide the nut and ferrule up the column to the detector base. Finger-tighten the column nut until it grips the column.

d Adjust the column (not the septum) position so that the septum is even with the bottom of the column nut. Tighten the nut an additional 1/4 turn with a wrench.
To Replace the NPD Bead Assembly

1 Gather the following:
   - Replacement NPD bead assembly. (See “Consumables and Parts for the NPD” on page 246.)
   - Lint-free gloves
   - T-10 Torx screwdriver

CAUTION

The bead is delicate. Be careful not to break or crack the bead. When performing maintenance on the NPD, avoid touching the bead with your fingers, and prevent it from coming in contact with other surfaces.

2 Set the NPD bead voltage to 0.0, then turn it off. (Setting the bead voltage to zero first makes sure that when you turn the bead back on, the voltage is safe. Otherwise, turning off the bead voltage will save a high setpoint that can damage a new bead.)

Agilent data system users: After setting the bead voltage to 0.0, save the data system method and shut down the instrument session. (Note that in some data system versions, you may need to use the GC keypad to set the voltage. To do this, the keypad must be unlocked and you must close the GC parameters screen of the data system. Upload the revised setting, then save the method and shut down the instrument session.)

3 Set **Adjust Offset** to **Off**.

4 Cool the detector to 60 °C or lower. Leave all gas flows on. To cool the detector faster, raise the GC detector cover and open the hinged NPD cover.

5 Remove the GC detector top cover.

WARNING

Hazardous voltages are present when the electronics top cover is open.

6 Remove the electronics cover. See “To Remove the Electronics Cover”.
7 Put on lint-free gloves before touching any of the detector parts.

**WARNING** Be careful! The oven or detector fittings may be hot enough to cause burns.

**CAUTION** Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.
8 Twist the ring to disconnect the bead assembly cable. Push and twist the lock so that the button slides up in the groove, then pull the cable ends apart.
9 Remove the 3 T-10 Torx screws from the bead assembly.

10 Gently lift up and remove the old bead assembly. Avoid bumping the bead on the sides of the collector.

11 Remove the protective cap covering the new bead.

12 Mount the new bead assembly on the NPD lid. Be careful not to bump the bead on the sides of the lid or collector.

13 Replace the screws. Finger-tighten the first screw; tighten the remaining screws normally and then completely tighten the first screw. Do not overtighten the screws.
14 Carefully bend the bead assembly cable 90 °.

15 Reconnect the bead assembly cable to the NPD cable and twist the ring to lock the connection.
16 Close the NPD cover, install the GC detector top cover, and install the electronics top cover. All covers must be closed to get a stable NPD baseline.

17 Configure the new bead.
   - Set the bead type.
   - Review the Maximum Bead Voltage setting and adjust, if necessary.
   - Review the Dry Bead and Auto Adjust Bead settings.

18 Restore normal NPD operating gas flows.

19 With all gases on, heat the detector to 150 °C and hold for about 15 minutes, then increase the temperature to 250 °C and hold for 15 minutes.

20 Increase the temperature to operating value (310 to 320 °C recommended). Allow 15 minutes for equilibration.

21 Check the NPD leakage current. (See “To Check the NPD Leakage Current” on page 270.) If > 2.0 pA, verify bead installation or see the Troubleshooting manual.

22 If using an Agilent data system, connect to the instrument.

23 Restore the analytical method. Confirm the detector hydrogen, air, makeup gas flow rates.
24 Set equilibration time to **0.0**. Start the **Adjust offset** process. Enter the desired offset in the **Target offset** field. The default offset is 20 pA for Blos beads, and 30 pA for white or black beads. For white and black beads, an offset of 25 to 30 pA is sufficient for most applications. The bead life may be shortened at a higher offset.

25 Reset the bead counter.
To Maintain the NPD Collector, Ceramic Insulators, and Jet

When replacing the jet, always install a new collector, ceramic insulators, and metal C-rings.

When replacing the collector, Agilent recommends replacing the ceramic insulators and metal C-rings.

1. Gather the following:
   - NPD ceramic insulator kit (see “Consumables and Parts for the NPD” on page 246.)
   - Collector
   - Cap for the bead
   - T-10 and T-20 Torx screwdrivers
   - Tweezers
   - Cotton swab
   - Solvent
   - Methanol
   - Jet (see “Selecting an NPD Jet” on page 250)
   - Lint-free gloves
   - Compressed, filtered dry air or nitrogen

**CAUTION**
The bead is delicate. Be careful not to break or crack the bead. When performing maintenance on the NPD, avoid touching the bead with your fingers, and prevent it from coming in contact with other surfaces.

2. Set the bead voltage to **0.0** and **Adjust Offset** to **Off**.

3. Check and note the NPD leakage current for reference. (See “To Check the NPD Leakage Current” on page 270.)

4. Load the GC maintenance method and wait for the GC to become ready.

**WARNING**
Be careful! The oven or detector fittings may be hot enough to cause burns.

5. Remove the bead. (See “To Replace the NPD Bead Assembly” on page 257.)
6 Remove the screws that secure the lid, and remove it. The top metal C-ring and upper ceramic insulator may be attached to the lid.

7 Remove the screws that secure the electrometer and the interconnect.

8 Pull the electrometer away from the detector to free the interconnect. Turn the electrometer to the right to obtain working space. Be careful not to touch or bend the spring. Be careful not to lose the EMI suppressor.

**CAUTION** This step exposes the interconnect spring. Be careful not to touch or disfigure the spring while working on the FID. Any dirt or bending will reduce the sensitivity of your detector.

**CAUTION** Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.
9 Remove the large metal C-ring and the upper ceramic insulator if they were not attached to the lid.

10 Remove the collector. If the detector is operated at high temperatures, the collector parts may stick inside the detector. Gently push and wiggle them to break the seal.

11 Use tweezers to remove the lower ceramic insulator and the two small metal C-rings located above and below the collector. If these parts are stuck together, do not separate them. If they are not stuck, remember which metal ring was on top of the insulator and which was below it. The pieces must be reassembled in the same orientation.

12 If not replacing the jet, skip to step 19.

13 Remove the column from the detector.
14 Loosen the jet with a nut driver.

15 Pull the jet straight out of the detector. Use tweezers, if necessary.

**CAUTION**

The adaptable NPD jet is longer than the capillary optimized NPD extended jet and should never be installed in a capillary optimized detector.

16 Place the jet in the detector body.

17 Using a nut driver, tighten the jet 1/6 turn past finger-tight. *Do not overtighten.*

18 Attach the column to the detector. (See “To Attach a Capillary Column Adapter on an Adaptable NPD” on page 252.)

19 Use a cotton swab wetted with solvent to clean the residue from the inside of the collector and around the jet. If the collector appears very dirty, replace it with a new one.

20 Install the bottom metal C-ring, the lower ceramic insulator, and the top metal C-ring. See Figure 5.

21 Install the collector.
22 Install the upper ceramic insulator and top metal C-ring above the collector. See Figure 6.

23 Install the lid, making sure that the NPD lid standoffs are in their slots. Hold the lid flat while each of the screws is tightened until they touch the lid. Tighten each screw evenly, 1/2 turn at a time, until tight. Do not overtighten.

24 Slide the electrometer interconnect into the slot on the lid and lower the electrometer into the mounting tray. Be careful not to touch or bend the spring.

25 Install the J-clamp and screws to secure the electrometer to the pallet.
Install the bead assembly and restore normal operating conditions. (See “To Replace the NPD Bead Assembly” on page 257.) (Do not reset the bead counter unless replaced.)

After installing new collector parts, the NPD leakage current should be lower. (See “To Check the NPD Leakage Current” on page 270.) If the leakage current is abnormal, check for proper reassembly of the detector (especially where the electrometer interconnect contacts the collector assembly) and for leaks.
To Check the NPD Leakage Current

1. Load the analytical method.
2. Set the **NPD Adjust Offset** to **Off** and the **Bead Voltage** to **0.00 V**.
   - Leave the NPD at operating temperature
   - Leave flows on or off
3. Press [Front Detector] or [Back Detector], then scroll to **Output**.
4. Verify that the output (leakage current) is stable and < 2.0 pA.

   The output should slowly drop towards 0.0 pA, and should stabilize in the tenths of a picoamp. Current > 2.0 pA indicates a problem.
14
Maintaining the FPD

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To Install a Capillary Column Adapter in the FPD  275
To Attach a Capillary Column to the FPD  277
To Change the FPD Wavelength Filter  279
To Remove the FPD Vent Tube  282
To Replace the FPD Ignitor  284
To Install the FPD Vent Tube and Cover  286
Consumables and Parts for the FPD

See the Agilent catalog for consumables and supplies for a more complete listing, or visit the Agilent Web site for the latest information (www.agilent.com/chem/supplies).

**Table 42** FPD supplies

<table>
<thead>
<tr>
<th>Description</th>
<th>Part number/quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulfur filter</td>
<td>1000-1437</td>
</tr>
<tr>
<td>Sulfur filter spacer</td>
<td>19256-20910</td>
</tr>
<tr>
<td>Phosphorus filter</td>
<td>19256-80010</td>
</tr>
<tr>
<td>Exit tube assembly, aluminum</td>
<td>19256-60700</td>
</tr>
<tr>
<td>Exit tube assembly, stainless steel</td>
<td>19256-20705</td>
</tr>
<tr>
<td>Vespel ferrule, 1/4-inch id</td>
<td>0100-1061</td>
</tr>
<tr>
<td>Ignitor replacement kit</td>
<td>19256-60800</td>
</tr>
<tr>
<td>O-ring</td>
<td></td>
</tr>
<tr>
<td>Spacer</td>
<td></td>
</tr>
<tr>
<td>Glow plug</td>
<td></td>
</tr>
<tr>
<td>Screw, M3 × 66 mm, T-10</td>
<td>0515-0680</td>
</tr>
<tr>
<td>Collar</td>
<td>19256-20690</td>
</tr>
<tr>
<td>Capillary adapter nut</td>
<td>19256-21150</td>
</tr>
<tr>
<td>Capillary adapter seat</td>
<td>19256-21140</td>
</tr>
<tr>
<td>1/4-inch packed adapter</td>
<td>G1532-20710</td>
</tr>
<tr>
<td>Column measuring tool</td>
<td>19256-80640</td>
</tr>
<tr>
<td>Spring to secure photomultiplier tube</td>
<td>1460-1160</td>
</tr>
<tr>
<td>1/8-inch packed adapter nut</td>
<td>0100-0057</td>
</tr>
<tr>
<td>1/8-inch Vespel ferrule for packed adapter</td>
<td>0100-1332</td>
</tr>
</tbody>
</table>

**Table 43** Nuts, ferrules, and hardware for capillary columns

<table>
<thead>
<tr>
<th>Column id (mm)</th>
<th>Description</th>
<th>Typical use</th>
<th>Part number/quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>.530</td>
<td>Ferrule, Vespel/graphite, 0.8-mm id</td>
<td>0.45-mm and 0.53-mm capillary columns</td>
<td>5062-3512 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Ferrule, graphite, 1.0-mm id</td>
<td>0.53-mm capillary columns</td>
<td>5080-8773 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Column nut, finger-tight (for 0.53-mm columns)</td>
<td>Connect column to inlet or detector</td>
<td>5020-8293</td>
</tr>
</tbody>
</table>
### Table 43  Nuts, ferrules, and hardware for capillary columns (continued)

<table>
<thead>
<tr>
<th>Column id (mm)</th>
<th>Description</th>
<th>Typical use</th>
<th>Part number/quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>.320</td>
<td>Ferrule, Vespel/graphite, 0.5-mm id</td>
<td>0.32-mm capillary columns</td>
<td>5062-3514 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Ferrule, graphite, 0.5-mm id</td>
<td>0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns</td>
<td>5080-8853 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Column nut, finger-tight (for .100- to .320-mm columns)</td>
<td>Connect column to inlet or detector</td>
<td>5020-8292</td>
</tr>
<tr>
<td>.250</td>
<td>Ferrule, Vespel/graphite, 0.4-mm id</td>
<td>0.1-mm, 0.2-mm, and 0.25-mm capillary columns</td>
<td>5181-3323 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Ferrule, graphite, 0.5-mm id</td>
<td>0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns</td>
<td>5080-8853 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Column nut, finger-tight (for .100- to .320-mm columns)</td>
<td>Connect column to inlet or detector</td>
<td>5020-8292</td>
</tr>
<tr>
<td>.100 and .200</td>
<td>Ferrule, Vespel/graphite, 0.37-mm id</td>
<td>0.1-mm and 0.2-mm capillary columns</td>
<td>5062-3516 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Ferrule, Vespel/graphite, 0.4-mm id</td>
<td>0.1-mm, 0.2-mm, and 0.25-mm capillary columns</td>
<td>5181-3323 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Ferrule, graphite, 0.5-mm id</td>
<td>0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns</td>
<td>5080-8853 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Column nut, finger-tight (for .100- to .320-mm columns)</td>
<td>Connect column to inlet or detector</td>
<td>5020-8292</td>
</tr>
<tr>
<td>All</td>
<td>Ferrule, no-hole</td>
<td>Testing</td>
<td>5181-3308 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Capillary column blanking nut</td>
<td>Testing–use with any ferrule</td>
<td>5020-8294</td>
</tr>
<tr>
<td></td>
<td>Column nut, universal</td>
<td>Connect column to inlet or detector</td>
<td>5181-8830 (2/pk)</td>
</tr>
<tr>
<td></td>
<td>Column cutter, ceramic wafer</td>
<td>Cutting capillary columns</td>
<td>5181-8836 (4/pk)</td>
</tr>
</tbody>
</table>
Exploded Parts View of the FPD

- Vent tube assembly
- Single wavelength FPD cover
- Ignitor replacement kit
  - O-ring (Kalrez)
  - Spacer
  - Glow plug
- Collar
- Screw
- Ignitor cable assembly
- Capillary adapter
- Capillary column nut
- Adapter ferrule
- Adapter nut
- Packed column adapter
- Dual FPD cover
- Filter
- Spacer (for sulfur filter)
- PMT assembly
To Install a Capillary Column Adapter in the FPD

1 Gather the following:
   - FPD capillary column adapter (See “Consumables and Parts for the FPD” on page 272.)
   - Column cutter
   - 1/4-inch wrench
   - 9/16-inch wrench
   - Metric ruler
   - 1/8-inch nut
   - Lint-free gloves

2 Load the GC maintenance method and wait for the GC to become ready.

WARNING Be careful! The oven and/or detector may be hot enough to cause burns. If the detector is hot, wear gloves to protect your hands.

WARNING Wear safety glasses to protect your eyes from flying particles while handling, cutting, or installing glass or fused silica capillary columns. Use care in handling these columns to prevent puncture wounds.

CAUTION Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.

3 Insert the capillary adapter into the 1/8-inch nut as shown, then thread the nut onto the detector fitting.
4 Finger-tighten the nut, then tighten an additional 1/8 turn with a wrench.
To Attach a Capillary Column to the FPD

1 Gather the following:
   - Column measuring tool (See “Consumables and Parts for the FPD” on page 272.)
   - Column cutter
   - 1/4-inch and 7/16-inch wrenches
   - Column nut
   - Ferrule
   - Capillary column
   - Lint-free gloves

2 Load the GC maintenance method and wait for the GC to become ready.

**WARNING** Be careful! The oven and/or detector may be hot enough to cause burns. If the detector is hot, wear gloves to protect your hands.

**WARNING** Wear safety glasses to protect your eyes from flying particles while handling, cutting, or installing glass or fused silica capillary columns. Use care in handling these columns to prevent puncture wounds.

**CAUTION** Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.

3 Assemble a septum, column nut, and ferrule on the end of the column.

4 Insert the end of the column through the column measuring tool so that the end protrudes beyond the tool.
5. Tighten the column nut until it grips the column. Tighten the nut an additional 1/8 to 1/4 turn with a pair of wrenches. Snug the septum against the base of the column nut.

6. Use a wafer cutter at 45° to score the column.

7. Snap off the column end. The column may protrude about 1 mm beyond the end of the tool. Inspect the end with a magnifying loupe to make certain that there are no burrs or jagged edges.

8. Remove the column, nut, and swaged ferrule from the tool.

9. Wipe the column walls with a tissue dampened with isopropanol to remove fingerprints and dust.

10. Verify that a capillary adapter is installed in the detector fitting. (See “To Install a Capillary Column Adapter in the FPD” on page 275.)

11. Carefully thread the swaged column up into the adapter. Finger-tighten the column nut, then use a wrench to tighten an additional 1/8 turn.
To Change the FPD Wavelength Filter

**CAUTION**
Do not touch the filter with your bare hands. For optimum performance and to avoid scratches, use lint-free gloves for assembling and inserting the filter into the assembly.

1. Gather the following:
   - Sulfur filter with filter spacer (See “Consumables and Parts for the FPD” on page 272.)
   - Phosphorus filter
   - Cotton swab
   - Lens tissue
   - Lint-free gloves

2. Load the GC maintenance method and wait for the GC to become ready.

3. Turn off the photomultiplier tube (PMT).
   a. Select [Front Det] or [Back Det].
   b. Scroll to PMT voltage.
   c. Press Off.

**WARNING**
Be careful! The detector may be hot enough to cause burns. If the detector is hot, wear heat-resistant gloves to protect your hands.

**CAUTION**
The photomultiplier tube (PMT) is extremely sensitive to light. Always turn off the electrometer (which turns off the high voltage to the PMT) before removing the PMT housing or opening the emissions chamber. Failing to do this can destroy the PMT.

Even with the electrometer off, protect the PMT from room light. Cap the housing after it is removed, place it end down to exclude light, or reduce the room light level before exposing the PMT. A brief exposure (always with the electrometer turned off) will not damage it, but prolonged exposure will cause a gradual loss of sensitivity.
4 Disconnect the retaining spring that holds the PMT assembly to the bracket. With a rotating motion, pull the assembly away from the filter housing.

5 To prevent light from damaging the PMT, cap the end or place it face down.

6 Place a clean cloth under the filter housing to catch the filter.
   - For phosphorus filter, use the sharpened wooden tip of a toothpick or cotton swab to dislodge the filter from the housing.
   - For sulfur filter (shown below), use the wooden tip of the cotton swab to remove the filter spacer. Then dislodge the filter from the housing.
7  Clean the new filter with lens tissue.

**CAUTION**

Filters are designed for the light of the flame to pass through in a specific direction. The triangle (on the edge of the phosphorus filter) and the arrow (on the edge of the sulfur filter) should face away from the flame and toward the PMT.

8  Install the filter in the filter housing. Install the sulfur filter spacer, if necessary.
9  Replace the PMT assembly and secure with the spring.
10 Restore the analytical method.
To Remove the FPD Vent Tube

1  Gather the following:
   • T-20 Torx screwdriver
   • 9/16-inch wrench
2  Load the GC maintenance method and wait for the GC to become ready.

CAUTION  When turning off the GC, first turn off the flame to prevent condensation from dripping into the jet and column.

WARNING  Be careful! The detector may be hot enough to cause burns. If the detector is hot, wear heat-resistant gloves to protect your hands.

3  Drain any water from the flexible vent tubing and discard.
4  Open the FPD cover.
5  Remove the flexible tubing from the FPD vent tube.
6  Loosen and remove the vent tube assembly with a wrench.

7  Remove the screws securing the FPD cover:
   • The single-wavelength detector has two screws at the bottom of the left side (top photo below) and two screws at the top of the right side (bottom photo below).
   • The dual-wavelength detector has two screws at the top of the right side (bottom photo below).
8 Lift the cover off the detector.
To Replace the FPD Ignitor

1 Gather the following:
   - Ignitor replacement kit. (See “Consumables and Parts for the FPD” on page 272.)
   - Torx screwdrivers, T-20 and T-10
   - 9/16-inch wrench
   - Tweezers

2 Load the GC maintenance method and wait for the GC to become ready.

**WARNING**
Be careful! The detector may be hot enough to cause burns. If the detector is hot, wear heat-resistant gloves to protect your hands.

3 Remove the vent tube assembly and cover. (See “To Remove the FPD Vent Tube” on page 282.)

4 Loosen the collar screw (some have two screws) holding the cable assembly to the ignitor. Remove the collar and cable assembly.

5 Use a wrench to loosen and remove the glow plug.
6 Remove the O-ring with tweezers.

7 Assemble the parts for the new ignitor.

8 Install the new ignitor assembly and tighten with a wrench. Do not overtighten.

9 Replace the ignitor collar and cable assembly and tighten the screw.

10 Replace the cover and the vent tube assembly. (See “To Install the FPD Vent Tube and Cover” on page 286.)

11 Restore the analytical method.

12 Wait 20 minutes for the detector to heat up, then ignite the flame.
To Install the FPD Vent Tube and Cover

1  Gather the following:
   • T-20 Torx screwdriver
   • 9/16-inch wrench

2  Install the cover.

   Single-wavelength detector:
   a  Start the two screws on the right side of the cover.
   b  Start and tighten the screws at the base on the left side.
   c  Tighten the screws on the right side.

   Dual-wavelength detector: Install the cover (two screws).

3  Install the vent tube assembly.

4  Reconnect the flexible tubing to the vent tube assembly and route the open end to waste.

5  Close the FPD cover.
15
Maintaining the Aux EPC

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Installing or Replacing Frits in the Aux EPC  289
Consumables and Parts for the Aux EPC

See the Agilent catalog for consumables and supplies for a more complete listing, or visit the Agilent Web site for the latest information (www.agilent.com/chem/supplies).

Table 44  Aux EPC consumables

<table>
<thead>
<tr>
<th>Description</th>
<th>Part number</th>
</tr>
</thead>
<tbody>
<tr>
<td>O-rings, package of 6</td>
<td>5181-3344</td>
</tr>
<tr>
<td>Blue dot frit, high flow resistance</td>
<td>G3430-80063</td>
</tr>
<tr>
<td>Red dot frit, medium flow resistance</td>
<td>G3430-80062</td>
</tr>
<tr>
<td>Brown dot frit, low flow resistance</td>
<td>G3430-80061</td>
</tr>
<tr>
<td>No frit (brass tube), zero flow resistance</td>
<td>G3430-20011</td>
</tr>
</tbody>
</table>
Installing or Replacing Frits in the Aux EPC

To install or replace a frit in the Aux EPC block:

1. Gather the following:
   - T-10 Torx screwdriver
   - Appropriate O-ring and frit
   - Tweezers
2. Turn off the gas supply to the channel.
3. Select the appropriate frit. For information on selecting auxiliary channel frits, refer to the 7890A Advanced User Guide.
4. Loosen the captured screw for the channel that you want to change.
5. Lift up the pneumatic tubing block. Remove the frit and O-ring using the tweezers. Be careful to avoid scratching the metal surfaces.
6. Place a new O-ring on the new frit and press it down into the block.
7. Place the pneumatic tubing block on the new frit and tighten the captured screw firmly.
8. Restore the gas supply.
When hydrogen is used, dangerously high flows are possible if insufficient flow resistance is provided downstream of the supply tube. Always use either the High (Blue dot) or Medium (Red dot) frit with hydrogen.

After installing or replacing a frit, be sure to update the PIDs used with your Aux EPC. For more information, refer to the 7890A Advanced User Guide.
16
Maintaining the PCM

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Calibrating the PCM Interface  293
Installing or Replacing Frits in the PCM  294
Consumables and Parts for the PCM

See the Agilent catalog for consumables and supplies for a more complete listing, or visit the Agilent Web site for the latest information (www.agilent.com/chem/supplies).

<table>
<thead>
<tr>
<th>Description</th>
<th>Part number</th>
</tr>
</thead>
<tbody>
<tr>
<td>O-rings, package of 12</td>
<td>5180-4181</td>
</tr>
<tr>
<td>Proportional valve, Carrier</td>
<td>G3430-67013</td>
</tr>
<tr>
<td>Proportional valve, AUX</td>
<td>G3430-67016</td>
</tr>
</tbody>
</table>
Calibrating the PCM Interface

The interface's flow module contains a pressure sensor that must be zeroed after it is installed on the GC. Calibration ensures an accurate interface pressure display.

Do not connect the carrier gas to the flow module until you have zeroed the interface's pressure sensor. For more information on zeroing the pressure sensor, refer to the 7890A Advanced User Guide.

1. If the gas supply is connected to the GC, turn off the supply at the source, then disconnect the supply line from the PCM inlet fitting.

2. Turn on the GC and wait 15 minutes to allow it to reach thermal equilibrium.

3. When the GC has reached thermal equilibrium, press [Options], scroll to Calibration and press [Enter].

4. Scroll to the module to be zeroed and press [Enter].

5. Scroll to a zero line and press [Info]. The GC will remind you of the conditions necessary for zeroing that specific sensor.

   Flow sensors. Verify that the gas is connected and flowing (turned on).

   Pressure sensors. Disconnect the gas supply line at the back of the GC. Turning it off is not adequate; the valve may leak.


7. Turn off the GC.

8. Plumb the carrier gas to the flow module.

9. Turn on the GC.

If you were calibrating the flow sensor after replacing the PCM, check for leaks.
Installing or Replacing Frits in the PCM

To install or replace a frit:

1 Gather the following:
   - O-rings, package of 12, 5180-4181
   - Restrictor
   - Tweezers

2 Turn off the gas supply to the channel.

3 Select the appropriate frit. For information on selecting PCM channel frits, refer to the 7890A Advanced User Guide.

4 Remove the screw holding the tubing block with the output tubing.

5 Remove the tubing block. Remove the frit and O-ring using the tweezers. Be careful to avoid scratching the metal surfaces.

6 Remove the other O-ring as well. Replace it with a new O-ring.
7 Place a new O-ring on the new frit and press it down into the block.

8 Place the block on the module and tighten the screw firmly.

9 Restore the gas supply.

**WARNING**

When hydrogen is used, dangerously high flows are possible if insufficient flow resistance is provided downstream of the supply tube. Always use either the High (Blue dot) or Medium (Red dot) frit with hydrogen.

After installing or replacing a frit, be sure to update the PIDs used with your PCM. For more information, refer to the 7890A Advanced User Guide.
17
Maintaining a Valve

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To Align a Rotary Valve Rotor  302
To Replace a Rotary Valve in the Valve Box  303
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To Install the Upper Valve Box  308
Consumables and Parts for Valves

See the Agilent catalog for consumables and supplies for a more complete listing, or visit the Agilent Web site for the latest information (www.agilent.com/chem/supplies).

Table 46  Valve supplies

<table>
<thead>
<tr>
<th>Description</th>
<th>Part number</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Valves, gas sampling</strong></td>
<td></td>
</tr>
<tr>
<td>6-port, 300 psi</td>
<td>0101-0584</td>
</tr>
<tr>
<td>6-port, 400 psi, 225 °C maximum temperature</td>
<td>5062-9508</td>
</tr>
<tr>
<td>6-port, 300 °C maximum temperature</td>
<td>0101-0460</td>
</tr>
<tr>
<td>6-port Hastelloy, 400 psi, 225 °C maximum temperature</td>
<td>5062-9509</td>
</tr>
<tr>
<td>10-port, 400 psi, 225 °C maximum temperature</td>
<td>5062-9510</td>
</tr>
<tr>
<td>10-port Nitronic 60, 300 psi, 350 °C maximum temperature</td>
<td>0101-0585</td>
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<tr>
<td>10-port Hastelloy, 400 psi, 225 °C maximum temperature</td>
<td>5062-9511</td>
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<tr>
<td><strong>Valves, liquid sampling</strong></td>
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<tr>
<td>0.2-µL, 1000 psi stainless steel, 175 °C maximum temperature</td>
<td>0101-0636</td>
</tr>
<tr>
<td>0.5-µL, 5000 psi, 175 °C maximum temperature</td>
<td>0101-0639</td>
</tr>
<tr>
<td>0.5-µL, 1000 psi stainless steel, 175 °C maximum temperature</td>
<td>0101-0637</td>
</tr>
<tr>
<td>1.0-µL, 1000 psi stainless steel, 175 °C maximum temperature</td>
<td>0101-0638</td>
</tr>
<tr>
<td><strong>Gas sampling valve sample loops</strong></td>
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<tr>
<td>0.25-cc</td>
<td>0101-0303</td>
</tr>
<tr>
<td>0.50-cc</td>
<td>0101-0282</td>
</tr>
<tr>
<td>1.00-cc</td>
<td>0101-0299</td>
</tr>
<tr>
<td>2.00-cc</td>
<td>0101-0300</td>
</tr>
<tr>
<td>2.0-mL nickel loop, 1/16-inch</td>
<td>0101-0955</td>
</tr>
<tr>
<td>5.00-cc</td>
<td>0101-0301</td>
</tr>
<tr>
<td>10.00-cc</td>
<td>0101-0302</td>
</tr>
<tr>
<td>Ferrule, 1/16 inch stainless steel (10/pk)</td>
<td>5181-1291</td>
</tr>
<tr>
<td>Nut, 1/16 inch (10/pk)</td>
<td>5181-1292</td>
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Exploded Parts View of GC Rotary Valves

- Valve actuator
- Upper valve box assembly
- Valve body
- Rotor index pin
- Valve rotor
- Preload assembly
To Replace a Gas Sampling Valve Loop

1 Gather the following:
   - Replacement sample loop. (See “Consumables and Parts for Valves” on page 298.)
   - 1/4-inch wrench
   - Vacuum cleaner

2 Load the GC maintenance method and wait for the GC to become ready.

3 Turn off the detector.

**WARNING**

The oven, inlet, detector, and valve box may be very hot.
Sample and/or harmful gases may be present. Refer to your company’s standard operating procedures for purging the chemicals from the sample line.

4 Set all valve box valves to Off.

5 Leave on the GC and valve actuator air.

6 Turn off the carrier gas and sample line flows and relieve any back pressure to the valve.

**WARNING**

The valve box insulation is made of refractory ceramic fibers (RCFs). To avoid inhaling RCF particles, we recommend these safety procedures:

1. Ventilate your work area
2. Wear long sleeves, gloves, safety glasses, and a disposable dust/mist respirator
3. Dispose of insulation in a sealed plastic bag
4. Vacuum any residual particles and discard
5. Wash your hands with mild soap and cold water after handling RCFs.

7 Remove the upper valve box. (See “To Remove the Upper Valve Box” on page 306.)

8 Vacuum any loose particulate insulation.

9 When the valve is cool, loosen the sample loop’s two 1/4-inch fittings on the valve head and remove the loop.
10 Install the new sample loop.
11 Repressurize the sample loop and check for leaks.
12 Install the upper valve box. (See “To Install the Upper Valve Box” on page 308.)
13 Restore the analytical method.
To Align a Rotary Valve Rotor

1. Gather the following:
   - Flathead screwdriver
   - 3-mm hex key wrench
   - T-20 Torx screwdriver

2. Set the oven and valve box heated zones to a safe handling temperature (25 °C).

3. Set all valves to Off.

**WARNING**
The oven, inlet, detector, and valve box may be very hot. If they are hot, wear heat-resistant gloves to protect your hands.

4. Loosen the adjustment set screw.

5. Locate the rotor adjustment shaft on top of the actuator. Using a flathead screwdriver, rotate the valve rotor counterclockwise until it stops, then back it off a small amount to set one end of the rotor’s motion (< 1 mm).

6. Tighten the adjustment set screw.

7. Turn the valve On, turn Off to check for smooth operation.

8. Restore the analytical method.
To Replace a Rotary Valve in the Valve Box

**WARNING** Do not install a liquid sampling valve (LSV) in the valve box if you plan to heat the box above 75 °C. Heating an LSV over 75 °C can cause a leak and subsequent explosion. LSVs should be mounted in the side location to avoid potential explosions.

1. Gather the following:
   - Replacement valve (See “Consumables and Parts for Valves” on page 298.)
   - T-10 Torx screwdriver
   - 1/4-inch wrench
   - Needle-nosed pliers
   - Vacuum

2. Load the GC maintenance method and wait for the GC to become ready.

**WARNING** The oven, inlet, detector, and valve box may be very hot.
Sample and/or harmful gases may be present. Refer to your company’s standard operating procedures for purging the chemicals from the sample line.

3. Set all valves to Off.
4. Leave on the GC and valve actuator air.
5. Turn off the carrier gas and sample line flows and relieve any back pressure to the valve.
The valve box insulation is made of refractory ceramic fibers (RCFs). To avoid inhaling RCF particles, we recommend these safety procedures:

1. Ventilate your work area
2. Wear long sleeves, gloves, safety glasses, and a disposable dust/mist respirator
3. Dispose of insulation in a sealed plastic bag
4. Vacuum any residual particles and discard
5. Wash your hands with mild soap and cold water after handling RCFs.

6. Remove the upper valve box. (See “To Remove the Upper Valve Box” on page 306.) Vacuum any RCF insulation particulates from the valve box area.

7. Note the tubing connections to the existing valve and label if desired.

8. Disconnect the existing valve fittings.

9. Remove the two T-10 Torx screws attaching the valve to the valve box, then remove the valve from the valve box.

10. Place the new valve in the valve box. The gap in the index ring on top of a 6-port valve points toward the back of the GC if installed correctly. This is the **On** position. Install and tighten the two screws with a screwdriver.

11. Use needle-nosed pliers to move the valve rotor index pin of the valve counterclockwise until the pin touches the valve stop **Off** position.
12 Plumb the new valve using the existing fittings.

**WARNING**

Hazardous sample gases may be present.

13 Turn on the carrier and sample gases, then check for leaks at the valve fittings.

- Using the needle-nosed pliers to toggle the valve, check both the **On** and **Off** positions.
- When leak free, set the valve to **Off** (see step 11).

14 Install the upper valve box assembly. (See “To Install the Upper Valve Box” on page 308.)

15 Restore the analytical method.
To Remove the Upper Valve Box

1. Gather a T-20 Torx screwdriver.
2. Set the valve box to a safe handling temperature (25 °C), or load the GC maintenance method.

**WARNING** The oven, inlet, detector, and valve box may be very hot. If they are hot, wear heat-resistant gloves to protect your hands.

3. Lift and remove the detector cover.
4. Remove the mounting screws from the upper valve box.

5. Lift up and set aside.
The valve box insulation is made of refractory ceramic fibers (RCFs). To avoid inhaling RCF particles, we recommend these safety procedures:

1. Ventilate your work area
2. Wear long sleeves, gloves, safety glasses, and a disposable dust/mist respirator
3. Dispose of insulation in a sealed plastic bag
4. Vacuum any residual particles and discard
5. Wash your hands with mild soap and cold water after handling RCFs.
To Install the Upper Valve Box

1. Gather the following:
   - T-20 Torx screwdriver
   - 3-mm hex key wrench
   - Flathead screwdriver

2. Verify that all valve rotors are in the full counterclockwise position (valve Off).

3. For each actuator that mates with a newly installed valve:
   a. Loosen the adjustment set screw.

   b. Locate the rotor adjustment shaft on top of the actuator. Use a screwdriver to rotate the valve rotor counterclockwise until it stops.

4. Locate the two half-moon cutouts at the bottom back of the upper valve box. Place the upper valve box on top of the lower valve assembly, routing the heater/sensor wires through the cutouts. Secure with two T-20 mounting screws.

5. Push each coupling/shaft assembly downward with a flathead screwdriver until the slot on the coupling engages the rotor index pin.

   If the coupling and valve do not engage, check that both are fully counterclockwise and try again. If necessary, turn the shaft slightly to engage the coupling.
6 For each newly installed valve:
   a Using a flathead screwdriver, turn the rotor adjustment shaft counterclockwise until it stops, then back it off a small amount (< 1 mm) to set one end of the rotor’s motion.
   b Tighten the adjustment set screw.
7 Install the detector cover.
8 Restore normal operating condition.
Swagelok Connections

Making Swagelok Connections  312
Using a Swagelok Tee  316

The gas supply tubing is attached with Swagelok fittings. If you are not familiar with Swagelok connections, review the following procedures.
Making Swagelok Connections

Objective

To make a tubing connection that does not leak and that can be taken apart without damaging the fitting

Materials needed:

- 1/8-inch (or 1/4-inch, if used) preconditioned copper tubing
- 1/8-inch (or 1/4-inch, if used) Swagelok nuts
- Front and back ferrules
- Two 7/16-inch (for 1/8-inch nuts) or 9/16-inch (for 1/4-inch nuts) wrenches

1 Place a Swagelok nut, back ferrule, and front ferrule to the tubing as shown in Figure 7.

![Figure 7 - Swagelok nuts and ferrules](image)

2 Clamp a stainless steel plug or similar fitting in a bench vise.

**CAUTION**

Use a separate stainless steel fitting in a vise for initial tightening of the nut. Do not use an inlet or detector fitting. Strong forces are required to properly set the ferrules, and damage to an inlet or detector fitting is very costly to repair.

3 Push the tubing into the stainless steel plug (Figure 8).

4 Make sure that the front ferrule is touching the plug. Slide the Swagelok nut over the ferrule and thread it onto the plug.
Assembling the fitting

5 Push the tube fully into the plug, then withdraw it approximately 1 to 2 mm (Figure 9).

Insert the tubing

6 Finger-tighten the nut.

7 Mark the nut with a pencil line (Figure 10).
8 For **1/8-inch Swagelok fittings**, use a pair of 7/16-inch wrenches to tighten the fitting 3/4 of a turn (Figure 11). **For 1/4-inch fittings**, use a pair of 9/16-inch wrenches to tighten them 1-1/4 turn (Figure 11).

9 Remove the plug from the fitting. To connect the tubing, with nut and ferrules, to another fitting, finger-tighten the nut, then use a wrench to tighten it 3/4 (1/8-inch fittings) or 1-1/4 (1/4-inch fittings) of a turn.

10 Both correctly- and incorrectly-swaged connections are shown in Figure 12. Note that the end of the tubing in a correctly-swaged fitting is not crushed and does not interfere with the action of the ferrules.
Figure 12  Completed fitting
Using a Swagelok Tee

To supply gas from a single source to more than one input, use a Swagelok Tee.

**NOTE**
Do not combine valve actuator air with flame ionization air. The valve action will cause major upsets in the detector signal.

**Materials needed:**
- 1/8-inch preconditioned copper tubing
- Tubing cutter
- 1/8-inch Swagelok nuts and front and back ferrules
- 1/8-inch Swagelok Tee
- Two 7/16-inch wrenches
- 1/8-inch Swagelok cap (optional)

1. Cut the tubing where you want to install the Tee. Connect the tubing and Tee with a Swagelok fitting. See Figure 13.

![Swagelok tee](image)

**Figure 13** Swagelok tee

2. Measure the distance from the Tee to the GC inlets. Attach copper tubing to the open Tee ends with Swagelok fittings.