Agilent 7820A
Gas Chromatograph

Maintaining Your GC
Warranty

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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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About Maintaining the GC

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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 7820A 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
- Packed Column Inlet
- COC Inlet
- FID
- TCD
- µECD
- NPD
- FPD+
- FPD
- 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
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>
</tr>
</thead>
<tbody>
<tr>
<td>Wrench, angled, septum nut (19251-00100)</td>
</tr>
<tr>
<td>Wrench, open-end, 1/4-inch and 5/16-inch (8710-0510)</td>
</tr>
<tr>
<td>Wrench, open-end, 9/16-inch and 7/16-inch (8710-0803)</td>
</tr>
<tr>
<td>Wrench, capillary inlet (G3452-20512)</td>
</tr>
<tr>
<td>Flathead screwdriver</td>
</tr>
<tr>
<td>Column cutter, wafer (5181-8836, 4/pk)</td>
</tr>
<tr>
<td>Driver, nut, 1/4-inch (8710-1561)</td>
</tr>
<tr>
<td>T-20 Torx key (8710-1807) or screwdriver</td>
</tr>
<tr>
<td>T-10 Torx key (8710-2140) or screwdriver</td>
</tr>
<tr>
<td>3-mm hex key wrench (8710-2411)</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>
</tr>
<tr>
<td>Electronic leak detector</td>
</tr>
<tr>
<td>Magnifying loupe, 20X (430-1020)</td>
</tr>
<tr>
<td>Metric ruler</td>
</tr>
<tr>
<td>Bench vise (for setting Swagelok fittings)</td>
</tr>
<tr>
<td>Razor or sharp knife</td>
</tr>
<tr>
<td>Tweezers (8710-0007) or thin needle-nose pliers (8710-0004)</td>
</tr>
<tr>
<td>Needle-nose pliers</td>
</tr>
<tr>
<td>ESD wrist strap (for installing new components)</td>
</tr>
<tr>
<td>Gloves, heat-resistant (for handling hot parts)</td>
</tr>
<tr>
<td>Wooden cotton swab (for removing FID filters)</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
About Maintaining the GC

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 7820A 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

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

You can use the software keyboard or your Agilent data system to create, save, and load these methods.

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.
About Maintaining the GC

- 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 Safety and Regulatory Information book.
Finding a Replacement Part Number

Agilent now provides the Parts Finder tool to help you locate replacement and consumable part numbers. If using an Agilent data system, Parts Finder will be installed. If you want to install the tool on another computer, Parts Finder is included on the Agilent GC and GC/MS User Manuals & Tools DVD.

To find a consumable or replacement part using Parts Finder, navigate to the part graphically, based on the part’s location in the GC.

![Image of Parts Finder tool navigating to GC components](image)

**Figure 1** Quickly navigate to replacement parts by clicking on images of GC components

Part numbers are also included in this manual.
2

Removing Covers

To Remove the Detector Top Cover  18
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To Remove the Electronics Cover    21

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 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. Raise and remove the detector top cover.

3. Remove the screw on the left side of the pneumatics cover that secures the cover to the GC.

4. Loosen the one or two screws on the back of the GC that secure the pneumatics cover to the GC. (Depending on the date of manufacture, the number of screws securing the pneumatics cover to the GC varies.)

5. Lift and remove the cover.
To Remove the Side Cover

The side cover protects the GC main board and detector boards.

1. Remove the screw on the right side of the GC that secures the side cover to the GC.

2. Remove the one or two screws on the back of the GC that secure the side cover to the GC. (Depending on the date of manufacture, the number of screws securing the side cover to the GC varies.)

3. Slide the side cover toward the back of the GC.

4. Tilt the top of the side cover away from the GC and then lift the side cover off of the GC.
To Remove the Electronics Cover

You may need to remove the electronics cover to perform NPD maintenance. The steps required depend on whether or not an FPD* is installed.

**CAUTION**

Raising the electronics cover exposes the GC electronics.

Without FPD*/FPD installed:
1. Raise or remove the detector top cover.
2. Remove the side cover.
3. Remove the screw on the left side of the electronics cover.
4. Loosen the screw on the back of the electronics cover.
5. Remove the cover.

With FPD*/FPD installed:
1. Raise or remove the detector top cover.
2. Remove the PMT tube. See To Change the FPD* Wavelength Filter or To Change the FPD Wavelength Filter as applicable.
3. Remove the heat shield (the metal “bracket” below the PMT tube) by removing the four screws that secure it to the front bracket/support.
4. Remove the side cover.
5. Remove the screw on the left side of the electronics cover.
6. Loosen the screw on the back of the electronics cover.
7. Remove the cover.
Removing Covers
3

Maintaining Capillary Columns

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## 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](http://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>Ferrule, graphite, 0.8-mm id</td>
<td>0.53-mm capillary columns</td>
<td>500-2118 (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>Ferrule, graphite, 0.4-mm id</td>
<td></td>
<td>500-2114 (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>
</tbody>
</table>
Table 2  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>Column cutter, ceramic wafer</td>
<td>Cutting capillary columns</td>
<td>5181-8836 (4/pk)</td>
</tr>
<tr>
<td></td>
<td>Pencil, diamond tipped</td>
<td>Cutting capillary columns</td>
<td>420-1000</td>
</tr>
<tr>
<td></td>
<td>Ferrule tool kit</td>
<td>Ferrule installation</td>
<td>440-1000</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 Install Capillary Column Clips

**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. Gather the following:
   - Capillary column clip kit (see “Consumables and Parts for Columns” on page 24.)
   - T-20 Torx screwdriver
2. Loosen the four corner mounting screws, but do not remove.
3. Slip each corner screw through the large hole on the clip.
4. Slide the clip so that the screw is positioned in the slot.
5. Tighten the screws enough to hold the clips in place. Once the column is installed, fully tighten the four corner screws to secure the clips and column to the oven wall.
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 24.)
   - 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 Purged Packed Inlet
   - To Install a Capillary Column with the COC Inlet
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 µECD
- To Attach a Capillary Column to the FPD+
9 Restore the analytical method.
   • For FID or any 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 Purged Packed Inlet
   - To Install a Capillary Column with the COC Inlet
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 31.) 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

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 µECD
   • To Attach a Capillary Column to the FPD+
8 Set the column flow to the normal operating value, or set the capillary column gas velocity to 30 cm/s.

   For Split/Splitless 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.

**CAUTION**

Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.
3 Maintaining Capillary Columns
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  50
Check for leaks.  51
To Replace the Filter in the Split Vent Line  52
To Clean the Split/Splitless Inlet  55
To Bakeout Contaminants from the Split/Splitless Inlet  57
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 4  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 5  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>Ferrule, graphite, 0.8-mm id</td>
<td>0.53-mm capillary columns</td>
<td>500-2118 (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 5  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, 0.4-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>Ferrule, graphite, 0.4-mm id</td>
<td></td>
<td>500-2114 (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>
<tr>
<td></td>
<td>Pencil, diamond tipped</td>
<td>Cutting capillary columns</td>
<td>420-1000</td>
</tr>
<tr>
<td></td>
<td>Ferrule tool kit</td>
<td>Ferrule installation</td>
<td>440-1000</td>
</tr>
</tbody>
</table>

### Table 6  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>
</tbody>
</table>
### Table 6 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>Nonstick fluorocarbon liner O-ring for Flip Top Inlet Sealing System, 10/pk</td>
<td>5188-5366</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>
<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
- O-ring
- Split vent line
- Split/splitless inlet body
- Retaining nut
- Inlet base seal
- Insulation cup
- Septum retainer nut
- Septum
- Insert assembly
- Liner
- Insulation
- Washer
- Reducing nut
- Insulation
- Ferrule
- Column nut
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.

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 4 to 6 mm above the end of the ferrule. Slide the septum up the column to hold the column nut at this position.
Maintaining the Split/Splitless Inlet

10 Thread the column nut into the inlet but do not tighten.

11 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.

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 µECD
   - To Attach a Capillary Column to 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 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 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.)
   - 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 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.

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.)
   • 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 Unscrew the insert nut from the inlet body. 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 Replace the insert retainer nut, tightening it to firm finger-tightness. Do not overtighten.

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.
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
   - 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. Unscrew the insert nut from the inlet body. Lift the septum assembly straight up and away from the inlet to avoid chipping or breaking the liner.

   If using a Flip-Top inlet, lift the lever arm.

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 50.)
Clean the inlet if there is visible or suspected contamination. (See “To Clean the Split/Splitless Inlet” on page 55.)

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  Replace the insert retainer nut, tightening it to firm finger-tightness. Do not overtighten.

   If using the Flip-Top inlet, close the lever arm.

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 57.)

12  Restore the analytical method.

13  Check for leaks.

14  Reset the liner counter.
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.

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

6 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 57.)

Restore the analytical method.

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

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.
4 Maintaining the Split/Splitless Inlet

14 Reset the EMF counter. See To reset an EMF counter.
15 Restore the analytical method.
16 Reset the split vent trap counter.
17 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 50.)

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 57.)
15. Restore the analytical method.
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.
4 Maintaining the Split/Splitless Inlet
5

Maintaining the Purged Packed Inlet

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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](http://www.agilent.com/chem/supplies)).

### Table 7  
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>Purged packed glass liners and column adapters</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>Recommended septa and O-rings for the purged packed inlet</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 8  
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, 1/8-inch column</td>
<td>5080-8751 (20 each/pk)</td>
<td></td>
</tr>
<tr>
<td>1/8-inch id Swagelok brass nut, 1/8-inch column</td>
<td>5080-8750 (20 each/pk)</td>
<td></td>
</tr>
<tr>
<td>1/8-inch id Vespel/graphite ferrule</td>
<td>0100-1332 (10/pk)</td>
<td></td>
</tr>
</tbody>
</table>
### Table 8  
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</td>
<td>5080-8774 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>1/4-inch column</td>
<td>5180-4105 (10/pk)</td>
</tr>
</tbody>
</table>

### Table 9  
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>Ferrule, graphite, 0.8-mm id</td>
<td>0.53-mm capillary columns</td>
<td>500-2118 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Column nut, finger-tight (for .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 9  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>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>
<td></td>
</tr>
<tr>
<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>
<td></td>
</tr>
<tr>
<td>Ferrule, graphite, 0.4-mm id</td>
<td></td>
<td>500-2114 (10/pk)</td>
<td></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>Capillary column blanking nut</td>
<td>Testing—use with any ferrule</td>
<td>5020-8294</td>
<td></td>
</tr>
<tr>
<td>Column nut, universal</td>
<td>Connect column to inlet or detector</td>
<td>5181-8830 (2/pk)</td>
<td></td>
</tr>
<tr>
<td>Column cutter, ceramic wafer</td>
<td>Cutting capillary columns</td>
<td>5181-8836 (4/pk)</td>
<td></td>
</tr>
<tr>
<td>Pencil, diamond tipped</td>
<td>Cutting capillary columns</td>
<td>420-1000</td>
<td></td>
</tr>
<tr>
<td>Ferrule tool kit</td>
<td>Ferrule installation</td>
<td>440-1000</td>
<td></td>
</tr>
</tbody>
</table>
Exploded Parts View of the Purged Packed Inlet

Merlin cap — Septum nut
Merlin Microseal — Septum
Top insert weldment
O-ring
Glass liner
Ferrule
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.
Thread the column nut into the inlet adapter but do not tighten.

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.

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 µECD
- To Attach a Capillary Column to 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.

20 Reset the column EMF counters. See To Reset an EMF Counter in the *Operation Manual*. 
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.

8 Reset the EMF counter. See To Reset an EMF Counter in the Operation Manual.
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 Reset the EMF counter. See To Reset an EMF Counter in the Operation Manual.
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.)

**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.

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.)

**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 Configure the new packed column (make sure either column length or diameter is zero).

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

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

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).

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

Restore the analytical method.

- For NPD, immediately set the bead voltage to 0.0.

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

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*
   • For µECD, 1/4-inch packed columns require no adapter. For 1/8-inch packed columns, see Consumables and Parts for the µECD.

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 Configure the new packed column (make sure either column length or diameter is zero).

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 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.
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)
   - 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 (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.

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.
6
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Consumables and Parts for the Packed Column 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 10  Packed column 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>Packed column 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>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 packed column 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 11  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>
<tr>
<td>1/8-inch id brass tubing nut</td>
<td>1/8-inch column</td>
<td>5180-4103 (10/pk)</td>
</tr>
</tbody>
</table>
### Table 11  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>1/4-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>
Exploded Parts View of the Packed Column Inlet

Merlin cap ——— Septum nut
Merlin Microseal ——— Septum
Top insert weldment ——— O-ring
Glass liner
Ferrule
Adapter nut
Adapter
Insulation
Insulation cup
Front ferrule
Column nut
Back ferrule
To Change the Septum on the Packed Column Inlet

1 Gather the following:
   - Replacement septum (See “Consumables and Parts for the Packed Column Inlet” on page 92.)
   - 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 Packed Column Inlet

1 Gather the following:
   - Replacement septum (See “Consumables and Parts for the Packed Column Inlet” on page 92.)
   - 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 Packed Column Inlet” on page 101.)
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 Packed Column Inlet

1 Gather the following:
   - Brass tubing nut (see “Consumables and Parts for the Packed Column Inlet” on page 92.)
   - Adapter (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 Packed Column Inlet

1. Gather the following:
   - Replacement O-ring (See “Consumables and Parts for the Packed Column Inlet” on page 92.)
   - 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.

8. Reset the EMF counter. See To Reset an EMF Counter in the Operation Manual.
To Change the Glass Liner on the Packed Column Inlet

1 Gather the following:
   - Replacement glass liner (See “Consumables and Parts for the Packed Column Inlet” on page 92.)
   - 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 Packed Column Inlet” on page 101.)

6 Wearing gloves, grasp the flared end (top) of the replacement glass liner with tweezers and install it in the inlet.

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

8 Restore the analytical method.

9 Reset the EMF counter. See To Reset an EMF Counter in the Operation Manual.
To Install an Insulation Cup on the Packed Column Inlet

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

2. Install a plug (for example, a column nut with no-hole ferrule).

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 Packed Column Inlet

1 Gather the following:
   - Replacement O-ring (See “Consumables and Parts for the Packed Column Inlet” on page 92.)
   - 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 Packed Column Inlet” on page 99.)

13 Install the glass liner and O-ring. (See “To Change the Glass Liner on the Packed Column Inlet” on page 102.)

14 Install the top insert weldment and finger-tighten.

15 Install the septum and septum nut. (See “To Change the Septum on the Packed Column Inlet” on page 95.)

16 Attach the column.

17 Check for leaks.

18 Restore the analytical method.

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

1. Set the column flow to the normal operating value.
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 117.)

**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.

4. Install the 1/8-inch or 1/4-inch packed column inlet adapter, if necessary. (See “To Install an Adapter on the Packed Column Inlet” on page 99.)

**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. Configure the new packed column (make sure either column length or diameter is zero).

**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 115.)

9. Load the GC maintenance method and wait for the GC to become ready.
10 If required, install the detector adapter. (See “To Install a Packed Column Adapter on a Detector Fitting” on page 110.)

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.

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

**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 Packed Column Inlet” on page 92.)
   - 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

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 Packed Column Inlet” on page 92.)
   - 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 packed column 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 115.)

   **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 Configure the new packed column (make sure either column length or diameter is zero).

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.

13 After the GC becomes ready, wait 10 minutes then ignite the detector flame.
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), or 1/8-inch Swagelok cap (for TCD)
   - 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 108.)

4 Cap the detector(s) fittings with the capillary adapter, no-hole ferrule and column nut (FID) or 1/8-inch cap (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 108.)
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 Packed Column Inlet” on page 92.)
   - 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.

   ![Diagram](attachment:image.png)

   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.
7

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To Replace the Fused Silica Needle in a Syringe for the COC Inlet  141
To Bakeout Contaminants from the COC Inlet  143
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 12  Recommended parts for injections onto 0.53-mm fused silica 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>Septum nut, 530 µm</td>
<td>G1545-80520</td>
</tr>
<tr>
<td>Syringe barrel, removable needle, 5 µL</td>
<td>5182-0836</td>
</tr>
<tr>
<td>Needle, 530 µm (3/pk)</td>
<td>5182-0832</td>
</tr>
<tr>
<td>Plunger button, 10/pk, for manual injections using syringe barrel 5182-0836</td>
<td>5181-8866</td>
</tr>
<tr>
<td>On-column insert spring</td>
<td>19245-60760</td>
</tr>
<tr>
<td>Needle support assembly, 530 µm, for 7683B injector</td>
<td>G2913-60977</td>
</tr>
</tbody>
</table>

Table 13  Recommended parts for injections onto 0.53-mm aluminum-clad columns

<table>
<thead>
<tr>
<th>Column type</th>
<th>Part number</th>
</tr>
</thead>
<tbody>
<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>Syringe barrel, removable needle, 5 µL</td>
<td>5182-0836</td>
</tr>
<tr>
<td>Needle, 530 µm (3/pk)</td>
<td>5182-0832</td>
</tr>
<tr>
<td>Plunger button, 10/pk, for manual injections using syringe barrel 5182-0836</td>
<td>5181-8866</td>
</tr>
<tr>
<td>On-column insert spring</td>
<td>19245-60760</td>
</tr>
<tr>
<td>Needle support assembly, 530 µm, for 7683B injector</td>
<td>G2913-60977</td>
</tr>
</tbody>
</table>
### Table 14  Recommended parts for injections onto 0.32-mm fused silica 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>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, 320 µm (3/pk)</td>
<td>5182-0831</td>
</tr>
<tr>
<td>Plunger button, 10/pk, for manual injections using syringe barrel 5182-0836</td>
<td>5181-8866</td>
</tr>
<tr>
<td>On-column insert spring</td>
<td>19245-60760</td>
</tr>
<tr>
<td>Needle support assembly, 250/320 µm, for 7683B injector</td>
<td>G2913-60978</td>
</tr>
</tbody>
</table>

### Table 15  Recommended parts for injections onto 0.25-mm fused silica columns

<table>
<thead>
<tr>
<th>Column type</th>
<th>Part number</th>
</tr>
</thead>
<tbody>
<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>Plunger button, 10/pk, for manual injections using syringe barrel 5182-0836</td>
<td>5181-8866</td>
</tr>
<tr>
<td>On-column insert spring</td>
<td>19245-60760</td>
</tr>
<tr>
<td>Needle support assembly, 250/320 µm, for 7683B injector</td>
<td>G2913-60978</td>
</tr>
</tbody>
</table>

### Table 16  Recommended parts for injections onto 0.2-mm fused silica 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>19320-80625</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>
</tbody>
</table>
Table 16  Recommended parts for injections onto 0.2-mm fused silica columns (continued)

<table>
<thead>
<tr>
<th>Description</th>
<th>Part number/quantity</th>
</tr>
</thead>
<tbody>
<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>
<tr>
<td>Replacement stainless steel needles, 0.23 mm</td>
<td>5182-9645 (3/pk)</td>
</tr>
<tr>
<td>On-column insert spring</td>
<td>19245-60760</td>
</tr>
</tbody>
</table>

Table 17  Recommended septa for the COC inlet

<table>
<thead>
<tr>
<th>Description</th>
<th>Part number/quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>For 0.53-mm and 0.25/0.32-mm septum nuts</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>
</tbody>
</table>

| For the duckbill septum                                                      |                      |
| Duckbill septum for manual injection only (must use cooling tower with duckbill) | 19245-40050 (10/pk)  |

Table 18  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>Ferrule, graphite, 0.8-mm id</td>
<td>0.53-mm capillary columns</td>
<td>500-2118 (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>Column id (mm)</td>
<td>Description</td>
<td>Typical use</td>
<td>Part number/quantity</td>
</tr>
<tr>
<td>---------------</td>
<td>-------------</td>
<td>-------------</td>
<td>---------------------</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>Ferrule, graphite, 0.4-mm id</td>
<td></td>
<td>500-2114 (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>
<tr>
<td></td>
<td>Pencil, diamond tipped</td>
<td>Cutting capillary columns</td>
<td>420-1000</td>
</tr>
<tr>
<td></td>
<td>Ferrule tool kit</td>
<td>Ferrule installation</td>
<td>440-1000</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
- Column nut
- Cooling tower assembly
- Duckbill septum
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 120.)
   - 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 132.)

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. You should feel spring tension as you push up on the column. (Do not withdraw the column.)

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

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.

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.

19 Reset the column EMF counters. See To Reset an EMF Counter in the Operation Manual.
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 120.)
   - 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 that the needle is the correct size for the desired column id. If needed, replaced the needle with one of the correct size. See “Consumables and Parts for the COC Inlet” on page 120, and “To Replace a Needle in a Syringe” on page 140 or “To Replace the Fused Silica Needle in a Syringe for the COC Inlet” on page 141.

4 Identify the correct insert for the column size. (See “Consumables and Parts for the COC Inlet” on page 120.) 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 Make a clean cut on the end of the column. (See “To Install a Capillary Column with the COC Inlet” on page 125.)

6 Insert the column into one end of the insert.
Insert the syringe needle through the other end of the insert and into the column. The needle should visibly enter the column without any obstruction. 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 120.)
   - 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
Maintaining the COC Inlet

- 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 EMF counter. See To Reset an EMF Counter in the Operation Manual.
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 120.)

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 130.)

5. Remove the spring from the inlet with an extraction wire (or tweezers) 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.

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 128.)

8 Lower the new insert straight into the inlet from the top. The insert can be installed either end up.

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 125.)
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.
Fill an ultrasonic cleansing bath with aqueous detergent and place the spring and insert into it. Sonicate for 1 minute.

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

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

Dry the spring and insert with compressed air or nitrogen.

Install the insert. (See “To Install an Insert on the COC Inlet” on page 132.)

Install the column. (See “To Install a Capillary Column with the COC Inlet” on page 125.)
To Replace the 7693A Injector Needle Support Guide

Before using a 7693A ALS to make injections onto the COC inlet, install the on-column needle support guide.

Refer to the 7693A ALS documentation for complete details.

1. Open the injector door.
2. Remove the syringe.
3. Slide the syringe carriage up to the top position.
4. Completely remove the T-10 Torx screw from the support foot. Be careful to not let the screw fall into the turret assembly.
5. Slide off the support foot.
6. Slide on the new support foot.
7. Replace the T-10 Torx screw and tighten.
8. Install the appropriate syringe.
9. Close the injector door.
10. Align the injector.
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 glides 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 15, “Recommended parts for injections onto 0.25-mm fused silica columns,” on page 121):
   - 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. Check the new needle for a small wire inserted for shipment. Remove the wire if present.

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

6. Insert the needle into the syringe barrel.

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

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 120.)
   • Solvent

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.
Maintaining the COC Inlet
8
Maintaining the FID

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To Bakeout the FID  178
### 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 19**  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>Ferrule, graphite, 0.8-mm id</td>
<td>0.53-mm capillary columns</td>
<td>500-2118 (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>Ferrule, graphite, 0.4-mm id</td>
<td></td>
<td>500-2114 (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>
</tbody>
</table>
Table 19  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>Column cutter, ceramic wafer</td>
<td>Cutting capillary columns</td>
<td>5181-8836 (4/pk)</td>
</tr>
<tr>
<td></td>
<td>Pencil, diamond tipped</td>
<td>Cutting capillary columns</td>
<td>420-1000</td>
</tr>
<tr>
<td></td>
<td>Ferrule tool kit</td>
<td>Ferrule installation</td>
<td>440-1000</td>
</tr>
</tbody>
</table>

Table 20  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 (1/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 21  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</td>
<td>19244-80620</td>
<td>0.47 mm (0.018 inch)</td>
<td>61.5 mm</td>
</tr>
<tr>
<td>(use with simulated distillation)</td>
<td></td>
<td></td>
<td></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</td>
<td>18789-80070</td>
<td>0.76 mm (0.030 inch)</td>
<td>63.6 mm</td>
</tr>
<tr>
<td>(use with high-bleed applications)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 22  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>43 mm</td>
</tr>
<tr>
<td>High-temperature</td>
<td>G1531-80620</td>
<td>0.47 mm (0.018 inch)</td>
<td>48 mm</td>
</tr>
<tr>
<td>(use with simulated distillation)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Table 23  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>
<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 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 24. For adaptable fittings, select a jet from Table 25.

**Table 24** 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>43 mm</td>
</tr>
<tr>
<td>2</td>
<td>High-temperature</td>
<td>G1531-80620</td>
<td>0.47 mm (0.018 inch)</td>
<td>48 mm</td>
</tr>
</tbody>
</table>

*Figure 2* Capillary optimized jets
### Table 25  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>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>

![Capillary adaptable jets](image)

**Figure 3**  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 146.)
   - 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 146.):
   - 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 153.)
4. Place a septum, 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.

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

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 146.)
   - 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 173.)
   b Check the FID baseline. (See “To Check the FID Baseline” on page 174.)

**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.
12 Reset the EMF counter. See To Reset an EMF Counter in the Operation Manual.
To Replace an FID Jet

1. Gather the following:
   - Replacement jet (See “Selecting an FID Jet” on page 151.)
   - 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 158.)
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.
Do not overtighten the jet! Overtightening may permanently deform and damage the jet, the detector base, or both. The torque specification is 10 inch-pounds.

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 158.)

11 Reset the jet counter. See To Reset an EMF Counter in the Operation Manual.

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 155.)
   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 173.)
   d Bakeout the detector. (See “To Bakeout the FID” on page 178.)
   e Restore the analytical method.

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.
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 174.)
To Perform Maintenance on the FID Collector Assembly

NOTE
Perform only the steps and gather only the parts that apply to the desired maintenance task(s).

1  Gather the following:
   - Replacement ignitor assembly (See “Consumables and Parts for the FID” on page 146.)
   - 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.
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 173.)  
   b Bakeout the detector. (See “To Bakeout the FID” on page 178.)  
   c Check the FID baseline. (See “To Check the FID Baseline” on page 174.)  
21 Reset the EMF counters. See To Reset an EMF Counter in the Operation Manual.
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 Using the software keyboard, press [Front Det] or [Back Det], then scroll to Output. Alternately, use the arrows keys on the GC to 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 178.)

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. Using the software keyboard, press [Front Det] or [Back Det], then scroll to Output. Alternately, use the arrows keys on the GC to 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 178.)
To Install the FID Insulation Cup Assembly (Adaptable FID Only)

1. Gather the following:
   - Insulation (See “Consumables and Parts for the FID” on page 146.)
   - 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

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 146):
   - 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 155.)
Maintaining the TCD

Consumables and Parts for the TCD  182
To Install a Capillary Column in the TCD   184
To Install the Optional TCD Capillary Column Adapter  186
To Install a Capillary Column with the Optional TCD Capillary Column Adapter  187
To Bakeout Contaminants from the TCD  190
## 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](http://www.agilent.com/chem/supplies)).

### Standard TCD column hardware

**Table 26** 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 27** 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 28  
### 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>Ferrule, graphite, 0.8-mm id</td>
<td>0.53-mm capillary columns</td>
<td>500-2118 (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>Ferrule, graphite, 0.4-mm id</td>
<td></td>
<td>500-2114 (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>
<tr>
<td></td>
<td>Pencil, diamond tipped</td>
<td>Cutting capillary columns</td>
<td>420-1000</td>
</tr>
<tr>
<td></td>
<td>Ferrule tool kit</td>
<td>Ferrule installation</td>
<td>440-1000</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 182.)
   - 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.
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 182.)
   - 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.

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 182.)
   - 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.

1. If the column is not installed, cap the detector.

2. Turn off the TCD filament.

3. If the column is attached to the inlet, maintain inert carrier gas flow through the column.

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 184.)

8. Load the analytical method.

9. Allow the oven, inlet, and detector to equilibrate at operating temperature, then re-tighten the fittings.

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.

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 If using hydrogen as a carrier gas, turn off the hydrogen supply and cap the end of the column to prevent an oven explosion.

WARNING Be careful! The oven or detector fittings may be hot enough to cause burns.

WARNING Be careful! The oven or detector fittings may be hot enough to cause burns.
This section describes the routine maintenance tasks for the micro-Electron Capture Detector (μECD). 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 µECD

The µECD 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 μECDs:

- Never eat, drink, or smoke.
- Always wear safety glasses when working with or near open μECDs.
- 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 μECDs.
- Cap the inlet and outlet fittings when the μECD is not in use.
- Connect the μECD 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 µECD

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 29  µECD consumables and parts

<table>
<thead>
<tr>
<th>Description</th>
<th>Part number/quantity</th>
</tr>
</thead>
<tbody>
<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 (1/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>
<tr>
<td>1/4-inch Detector adapter, for 1/8-inch packed columns</td>
<td>19301-80530</td>
</tr>
</tbody>
</table>

Table 30  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>Ferrule, graphite, 0.8-mm id</td>
<td>0.53-mm capillary columns</td>
<td>500-2118 (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 30  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>Ferrule, graphite, 0.4-mm id</td>
<td></td>
<td>500-2114 (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>
<tr>
<td></td>
<td>Pencil, diamond tipped</td>
<td>Cutting capillary columns</td>
<td>420-1000</td>
</tr>
<tr>
<td></td>
<td>Ferrule tool kit</td>
<td>Ferrule installation</td>
<td>440-1000</td>
</tr>
</tbody>
</table>
Exploded Parts View of the µECD

- Vent line
- Warning tag
- Perforated cover
- Electrometer
- Ferrule
- Adapter nut
- Cap
- Liner
- Makeup gas adapter
- Insulation
- Insulation cup
- Ferrule
- Column nut
To Replace the µECD 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 µECD” on page 194.)
   - 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 µECD. Remove the ferrule.

   The makeup gas adapter will remain attached to the supply tubing and hang suspended in the oven.

   b 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 ± 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 µECD” on page 200.)

14 Reset the EMF counter. See To Reset an EMF Counter in the Operation Manual.
To Install a Capillary Column in the µECD

1. Gather the following:
   - Ferrule (See “Consumables and Parts for the µECD” on page 194.)
   - 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, 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.

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 µECD

1 Gather the following:
   • Nut warmer insulation (See “Consumables and Parts for the µECD” on page 194.)
   • 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 µECD

**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 $^{63}$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 µECD” on page 194.)
   - Blanking nut with any column ferrule

2. With the detector and oven at normal operating temperatures, show the detector output. Using the software keyboard, press [Front Det] or [Back Det], then scroll to Output. Alternately, use the arrows keys on the GC to scroll Output. 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 µECD 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 µECD, 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.

![Detector Output during Cleaning Cycle]

9 Check the µECD 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.
11
Maintaining the NPD

Consumables and Parts for the NPD  208
Exploded Parts View of the NPD  211
Selecting an NPD Jet  212
To Attach a Capillary Column Adapter on an Adaptable NPD  214
To Install a Capillary Column in the NPD  216
To Replace the NPD Bead Assembly  219
To Maintain the NPD Collector, Ceramic Insulators, and Jet  224
To Check the NPD Leakage Current  230
To Bakeout the NPD  231
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 212.

<table>
<thead>
<tr>
<th>Table 31</th>
<th>NPD parts</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description</strong></td>
<td><strong>Part number/quantity</strong></td>
</tr>
<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>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>
</tbody>
</table>

**Column adapters, for adaptable NPD only**

| **FID/NPD capillary column adapter** | 19244-80610 |
| **1/8-inch packed column adapter** | 19231-80520 |
| **1/4-inch packed column adapter** | 19231-80530 |
| **1/4-inch packed glass column adapter** | G1532-20710 |
| **1/4-inch column nut** | 5180-4105 10/pk |
| **1/4-inch Vespel/graphite ferrule** | 5080-8774 10/pk |

<table>
<thead>
<tr>
<th>Table 32</th>
<th>Jets for capillary optimized fittings</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Jet type</strong></td>
<td><strong>Part number</strong></td>
</tr>
<tr>
<td>Capillary with extended jet (recommended)</td>
<td>G1534-80580</td>
</tr>
</tbody>
</table>
Table 32  Jets for capillary optimized fittings (continued)

<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>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 33  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</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 34  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>Ferrule, graphite, 0.8-mm id</td>
<td>0.53-mm capillary columns</td>
<td>500-2118 (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 34  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>Ferrule, graphite, 0.4-mm id</td>
<td></td>
<td>500-2114 (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>
<tr>
<td></td>
<td>Pencil, diamond tipped</td>
<td>Cutting capillary columns</td>
<td>420-1000</td>
</tr>
<tr>
<td></td>
<td>Ferrule tool kit</td>
<td>Ferrule installation</td>
<td>440-1000</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
- 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 35.

Table 35  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>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>

For adaptable fittings, select one of the following from Table 36.
### Table 36  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</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 5  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 208.)
   - 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 208.)
   - 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 214.)
Maintaining Your GC

3 Place a septum, 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.

CAUTION

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

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 208.)
   - 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 Using the Software Keypad or data system, 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.

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.
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.

CAUTION Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.
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 230.) 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. **Start the **Adjust offset** process. Enter the desired offset in the **Target offset** field. The default offset is 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. See **To Reset an EMF Counter** in the **Operation Manual**.**
1 Gather the following:
   • NPD ceramic insulator kit (see “Consumables and Parts for the NPD” on page 208.)
   • 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 212)
   • Lint-free gloves
   • Compressed, filtered dry air or nitrogen

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 230.)
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 219.)

**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.

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.

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.
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 214.)
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 6.

21 Install the collector.

22 Install the upper ceramic insulator and top metal C-ring above the collector. See Figure 7.

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.

26 Install the bead assembly and restore normal operating conditions. (See “To Replace the NPD Bead Assembly” on page 219.) (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 230.) 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.

27 Reset the EMF counters. See To Reset an EMF Counter in the Operation Manual.
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. Using the software keyboard, press [Front Det] or [Back Det], then scroll to Output. Alternately, use the arrows keys on the GC to 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 > 2.0pA indicates a problem.
To Bakeout the NPD

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 NPD with the column installed or uninstalled. If uninstalled, gather the following (see “Consumables and Parts for the NPD” on page 208):
   - Capillary adapter (adaptable NPD only)
   - Column nut
   - No-hole ferrule

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

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 Set the bead voltage to 0, then turn it Off.

4 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.

5 Set normal operating flows.

6 Set the detector temperature at 25 °C above the typical method setpoint temperature.

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 15 to 30 minutes.

9 If the column is not installed in the NPD, install it. (See “To Install a Capillary Column in the NPD” on page 216.)

10 Restore the analytical method and allow the NPD to equilibrate at operating temperatures and flows for 10 to 30 minutes.

11 Check the NPD leakage current. See “To Check the NPD Leakage Current” on page 230.

12 Start the NPD bead Auto Adjust process. See the 7820 Series Advanced User Guide for details.
Maintaining the NPD

Allow 4 to 24 hours for a new ceramic bead to equilibrate, or 1 to 2 hours for a new Blos bead.
12

Maintaining the FPD+

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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 37  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</td>
<td>G3435-60330</td>
</tr>
<tr>
<td>O-ring for exit tube assembly</td>
<td>0905-1014</td>
</tr>
<tr>
<td>Ignitor</td>
<td>19256-60750</td>
</tr>
<tr>
<td>Screw, M3 × 6 mm, T-10</td>
<td>0515-0680</td>
</tr>
<tr>
<td>Collar</td>
<td>19256-20690</td>
</tr>
<tr>
<td>Column measuring tool</td>
<td>G3435-81380</td>
</tr>
<tr>
<td>Spring to secure photomultiplier tube</td>
<td>1460-1160</td>
</tr>
<tr>
<td>1/8-inch Packed column adapter assembly includes:</td>
<td>G3435-60350</td>
</tr>
<tr>
<td>· 1/8-inch Packed column adapter, inert</td>
<td>G3435-60340</td>
</tr>
<tr>
<td>· 1/8-inch Packed column adapter nut</td>
<td>G3435-20375</td>
</tr>
<tr>
<td>· 1/8-inch Packed column adapter ferrule (10/pk)</td>
<td>5062-3538</td>
</tr>
<tr>
<td>Preventive maintenance kit, single FPD⁺</td>
<td>G3435-67000</td>
</tr>
</tbody>
</table>

### Table 38  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 38  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>
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<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^+
To Install a Packed Column Adapter in the FPD⁺

**NOTE** If you do not use a Packed column, ignore this section.

FPD+ packed column adapter view

Installation

This procedure applies to installing the 1/8-inch packed metal column adapter into the FPD⁺ column fitting.

Gather the following:

- 7/16-inch wrench
- 5/16-inch wrench
- 1/8-inch nut and ferrule for a 1/8-inch packed column
- Lint-free gloves

**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.

**CAUTION** Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.
Handle the adapter carefully and install the packed column before installing the adapter into the detector base. The thin-walled capillary tube that carries the sample into the detector can be damaged by rough handling.

1. Install the 1/8-inch packed metal ferrule onto the column adapter using a 1/8-inch nut and ferrule.
2. Finger-tighten the column, then tighten an additional 1/8 turn using the two wrenches.
3. Place the adapter nut and ferrule onto the adapter.
4. Carefully install the adapter assembly into the detector fitting. Align the adapter so the it enters the detector fitting as vertically as possible. Avoid stressing the adapter capillary tube. The adapter nut should turn freely.

After installation, re-tighten as needed for the first few oven cycles.
To Attach a Capillary Column to the FPD^+

1 Gather the following:
   - Column measuring tool (See “Consumables and Parts for the FPD^+” on page 234.)
   - 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 Carefully thread the swaged column up into the detector fitting. 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 234.)
   - 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.
To prevent light from damaging the PMT, cap the end or place it face down.

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.

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 Route the PMT wires through the clips as shown. Avoid placing the wires very near heated areas (such as the emission block or oven top).

11 Restore the analytical method.
To Remove the FPD⁺ Cover

1. Gather the following:
   - T-20 Torx screwdriver

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. Open the FPD⁺ detector top cover.

4. Loosen the screws securing the FPD⁺ cover to the top of the detector.
5 For a single wavelength FPD+, remove the two screws at the bottom left of the cover.

6 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 234.)
   • Torx screwdrivers, T-20 and T-10
   • 5/16-inch nut driver (or wrench)

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 FPD⁺ cover. (See “To Remove the FPD⁺ Cover” on page 244.)

4 Loosen the collet screw holding the cable assembly to the ignitor. Remove the collet and cable assembly.

5 Use a nut driver to loosen and remove the glow plug.
   • If using a 5/16-inch wrench, you may need to remove the exit tube assembly using a T-10 Torx driver
6 Install the new ignitor assembly and tighten with the nut driver. Do not overtighten. (If the ignitor comes with a copper washer, discard the copper washer.)

7 Replace the ignitor collet and cable assembly and tighten the screw. Align the collet set screw as shown. Do not let the collet screw touch metal parts, such as the emission block or PMT bracket (dual wavelength detector).

8 Replace the FPD+ cover. (See “To Install the FPD+ Cover” on page 248.)

9 Restore the analytical method.

10 Wait 20 min. for the detector to heat up, then ignite the flame.

11 Reset the EMF counter. See To Reset an EMF Counter in the Operation Manual.
To Install the FPD⁺ Cover

1 Gather the following:
   • T-20 Torx screwdriver

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 Close the FPD⁺ detector top cover.
Cleaning the FPD⁺ Brazement

The FPD⁺ brazement, which consists of the transfer line and emission block assemblies, uses an inert coating layer to provide better performance. Normally, manually cleaning the brazement is not required. However, if it becomes necessary to clean the brazement to remove contamination, note that exposing the inert coating to abrasives or certain solvents will degrade the coating. If cleaning is needed, follow the recommendations below for best results:

- Rinse with a solvent appropriate to dissolve the expected contaminants. Avoid abrasive or highly basic solutions (see the caution above). Recommended solvents: dichloromethane, acetone, or methanol.
- Mildly sonicate if needed, but excessive sonication can damage the coating layer.
- Gently remove solids using a soft, nylon bristle brush. Do not scrub hard. Recommended brush: Use the MMI inlet cleaning brush from the MMI cleaning kit (G3510-80820). (Do NOT used the MMI inlet abrasive cleaning swab, G3510-80829.)
13
Maintaining the G3435A/G3436A FPD

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To Install the FPD Vent Tube and Cover  266

This section describes how to maintain the Agilent G3435A/G3436A Single or Dual Flame Photometric detector. To determine the FPD version, lift the detector top cover and locate the metal FPD cover (see “Exploded Parts View of the FPD” on page 254). If the cover is solid, the FPD is a G3435A or G3436A. Refer to the maintenance procedures in this section. If the cover is perforated (has round vent holes), the detector is an FPD+ (see “Maintaining the FPD+” on page 233).
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>
<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>Ferrule, Vespel, 1/4-inch id, 10/pk</td>
<td>5080-8774</td>
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<tr>
<td>Ferrule, 1/4-inch id, front, 10/pk</td>
<td>5180-4111</td>
</tr>
<tr>
<td>Ferrule, 1/4-inch id, back, 10/pk</td>
<td>5180-4117</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>
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<tr>
<td>Column measuring tool</td>
<td>19256-80640</td>
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<tr>
<td>Spring to secure photomultiplier tube</td>
<td>1460-1160</td>
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<td>1/8-inch packed adapter nut</td>
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<tr>
<td>1/8-inch Vespel ferrule for packed adapter</td>
<td>0100-1332</td>
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### Table 40  
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>
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<td>Ferrule, graphite, 1.0-mm id</td>
<td>0.53-mm capillary columns</td>
<td>5080-8773 (10/pk)</td>
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<td>Ferrule, graphite, 0.8-mm id</td>
<td>0.53-mm capillary columns</td>
<td>500-2118 (10/pk)</td>
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<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>
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<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>
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<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>
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<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>
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<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>
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<tr>
<td></td>
<td>Ferrule, graphite, 0.4-mm id</td>
<td></td>
<td>500-2114 (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>
<tr>
<td></td>
<td>Pencil, diamond tipped</td>
<td>Cutting capillary columns</td>
<td>420-1000</td>
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<tr>
<td></td>
<td>Ferrule tool kit</td>
<td>Ferrule installation</td>
<td>440-1000</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
- Filter
- Spacer (for sulfur filter)
- PMT assembly
- Adapter ferrule
- Adapter nut
- Packed column adapter
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 252.)
   • 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 252.)
   - 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 255.)

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 252.)
   - 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).
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 252.)
   - 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 262.)

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 266.)

11 Restore the analytical method.

12 Wait 20 minutes for the detector to heat up, then ignite the flame.

13 Reset the EMF counter. See To Reset an EMF Counter in the Operation Manual.
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.

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.
14
Maintaining the PCM

Consumables and Parts for the PCM  268
Calibrating the PCM Interface  269
Installing or Replacing Frits in the PCM  270
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>
</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 Advanced User Guide. Use the Software Keyboard to complete the following steps.

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).


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 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 **Advanced User Guide**.
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Maintaining a Valve

Consumables and Parts for Valves 274
Exploded Parts View of GC Rotary Valves 275
To Replace a Gas Sampling Valve Loop 276
To Align a Rotary Valve Rotor 278
To Replace a Rotary Valve in the Valve Box 279
To Remove the Upper Valve Box 282
To Install the Upper Valve Box 284
## 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](http://www.agilent.com/chem/supplies)).

### Table 42  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>
</tr>
<tr>
<td>10-port Hastelloy, 400 psi, 225 °C maximum temperature</td>
<td>5062-9511</td>
</tr>
<tr>
<td><strong>Gas sampling valve sample loops</strong></td>
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</tr>
<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>
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<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>
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<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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</table>
Exploded Parts View of GC Rotary Valves
To Replace a Gas Sampling Valve Loop

1. Gather the following:
   - Replacement sample loop. (See “Consumables and Parts for Valves” on page 274.)
   - 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 282.)

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 284.)

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.

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.

**WARNING** The oven, inlet, detector, and valve box may be very hot. If they are hot, wear heat-resistant gloves to protect your hands.
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 274.)
   - 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 282.) 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 284.)

15 Restore the analytical method.

16 Reset the valve EMF counters. See To Reset an EMF Counter in the *Operation Manual.*
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.
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.
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.
A

Swagelok Connections

Making Swagelok Connections  288
Using a Swagelok Tee     292

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 8.

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 9).

4. Make sure that the front ferrule is touching the plug. Slide the Swagelok nut over the ferrule and thread it onto the plug.
Figure 9  Assembling the fitting

5  Push the tube fully into the plug, then withdraw it approximately 1 to 2 mm (Figure 10).

Figure 10  Insert the tubing

6  Finger-tighten the nut.
7  Mark the nut with a pencil line (Figure 11).
For 1/8-inch Swagelok fittings, use a pair of 7/16-inch wrenches to tighten the fitting 3/4 of a turn (Figure 12). For 1/4-inch fittings, use a pair of 9/16-inch wrenches to tighten them 1-1/4 turn (Figure 12).

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.

Both correctly- and incorrectly-swaged connections are shown in Figure 13. 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 13  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 14**.

![Cap](image1)
![Tee fitting](image2)
![Nut and ferrules](image3)

**Figure 14**  Swagelok tee

2. Measure the distance from the Tee to the GC inlets. Attach copper tubing to the open Tee ends with Swagelok fittings.