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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.
To Replace the Filter in the Split Vent Trap for the Split/Splitless Inlet 58
To Clean the Split/Splitless Inlet 60
To Bakeout Contaminants from the Split/Splitless Inlet 62

6 Maintaining the Purged Packed Inlet
Consumables and Parts for the Purged Packed Inlet 65
Exploded Parts View of the Purged Packed Inlet 68
To Install a Capillary Column with the Purged Packed Inlet 69
To Change the Septum on the Purged Packed Inlet 72
To Clean the Septum Seat in the Purged Packed Inlet 74
To Install an Adapter on the Purged Packed Inlet 76
To Change the O-Ring on the Purged Packed Inlet 77
To Change the Glass Liner on the Purged Packed Inlet 78
To Clean the Purged Packed Inlet 80
To Bakeout Contaminants from the Purged Packed Inlet 82
To Install a Packed Metal Column 83
To Install a Packed Column Adapter onto a Detector 85
To Install a Packed Glass Column 87
To Condition a Packed Column 89
To Install Ferrules on a Packed Metal Column 90

7 Maintaining the Packed Column Inlet
Consumables and Parts for the Packed Column Inlet 93
Exploded Parts View of the Packed Column Inlet 95
To Change the Septum on the Packed Column Inlet 96
To Clean the Septum Seat in the Packed Column Inlet 98
To Install an Adapter on the Packed Column Inlet 100
To Change the O-Ring on the Packed Column Inlet 101
To Change the Glass Liner on the Packed Column Inlet 102
To Install an Insulation Cup on the Packed Column Inlet 104
To Clean the Packed Column Inlet 105
To Bakeout Contaminants from the Packed Column Inlet 107
To Install a Packed Metal Column 108
To Install a Packed Column Adapter on a Detector Fitting 110
To Install a Packed Glass Column 112
To Condition a Packed Column 114
To Install Ferrules on a Packed Metal Column 115

8 Maintaining the COC Inlet
Consumables and Parts for the Cool On-Column Inlet 117
Exploded Parts View of the Cool On-Column Inlet 120
To Install a Capillary Column with the Cool On-Column Inlet 121
To Check the Needle-to-Column Size on the COC Inlet 124
To Change a Septum on the COC Inlet 125
To Install an Insert on the COC Inlet 127
To Clean the COC Inlet 129
To Replace the 7693A Injector Needle Support Guide 131
To Replace a Needle in a Syringe 132
To Replace the Fused Silica Needle in a Syringe for the COC Inlet 133
To Bakeout Contaminants from the COC Inlet 134

9 Maintaining the FID
Consumables and Parts for the FID 137
Exploded Parts Views of the Flame Ionization Detector 139
To Install a Capillary Column in the FID 141
To Replace an FID Jet 144
To Perform Maintenance on the FID Collector Assembly 147
To Check the FID Leakage Current 154
To Check the FID Baseline 155
To Install the Optional FID PTFE Chimney Insert 156
To Bakeout the FID 157

10 Maintaining the TCD
Consumables and Parts for the Thermal Conductivity Detector 159
To Install a Capillary Column in the TCD 161
To Bakeout Contaminants from the TCD 164
11 Maintaining the ECD

- Important Safety Information About the ECD 167
- Consumables and Parts for the ECD 169
- Exploded Parts View of the Electron Capture Detector 171
- To Replace the ECD Fused Silica Indented Mixing Liner and Install the Makeup Gas Adapter 172
- To Install a Capillary Column in the ECD 175
- To Bakeout the ECD 177

12 Maintaining the NPD

- Consumables and Parts for the NPD 181
- Exploded Parts View of the Nitrogen-Phosphorus Detector 183
- To Install a Capillary Column in the NPD 184
- To Replace the NPD Bead Assembly 187
- To Maintain the NPD Collector, Ceramic Insulators, and Jet 191
- To Check the NPD Leakage Current 196
- To Bakeout the NPD 197

13 Maintaining the FPD+

- Consumables and Parts for the FPD+ 199
- Exploded Parts View of the Flame Photometric Detector Plus 201
- To Install a Capillary Column to the FPD+ 202
- To Change the FPD+ Wavelength Filter 204
- To Remove the FPD+ Cover 207
- To Replace the FPD+ Ignitor 208
- To Install the FPD+ Cover 210
- Cleaning the FPD+ Brazement 211

14 Maintaining EPC Modules

- Consumables and Parts for the Aux EPC 213
- Installing or Replacing Frits in the Aux EPC 215
- Consumables and Parts for the PCM 217
- Calibrating the PCM Interface 218
- Installing or Replacing Frits in the PCM 219
15 Maintaining a Valve

Consumables and Parts for Valves 223
Exploded Parts View of GC Rotary Valves 224
To Replace a Gas Sampling Valve Loop 225
To Align a Rotary Valve Rotor 227
To Replace a Rotary Valve in the Valve Box 228
To Remove the Upper Valve Box 231
To Install the Upper Valve Box 232

A Swagelok Connections

Making Swagelok Connections 235
Using a Swagelok Tee 238
About Maintaining the GC

Overview of Maintenance  10
Tools and Materials Required for Maintenance  11
Preparing for Maintenance  13
Viewing Status Data  14
Finding a Replacement Part Number  15

This section provides an overview of the maintenance procedures included in this document. It also lists the tools needed for routine maintenance and the information needed to safely perform the various maintenance tasks.
Overview of Maintenance

This manual details the routine tasks needed to maintain the Agilent 8860 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
• Use the browser interface

Where to find a procedure

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

• Capillary Columns
• Split/Splitless Inlet (SSL)
• Purged Packed Inlet (PPI)
• Packed Column Inlet (PCI)
• Cool On-Column Inlet (COC)
• Flame Ionization Detector (FID)
• Thermal Conductivity Detector (TCD)
• Electron Capture Detector (ECD)
• Nitrogen-Phosphorus Detector (NPD)
• Flame Photometric Detector Plus (FPD+)
• Auxiliary Electronic Pressure Control Module (Aux EPC)
• Pneumatics Control Module (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 each procedure.

**Table 1  Tools and materials for GC maintenance**

<table>
<thead>
<tr>
<th>Common tools</th>
<th>Part number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wrench, angled, septum nut</td>
<td>19251-00100</td>
</tr>
<tr>
<td>Wrench, open-end, 1/4-inch and 5/16-inch</td>
<td>8710-0510*</td>
</tr>
<tr>
<td>Wrench, open-end, 9/16-inch and 7/16-inch</td>
<td>8710-0803</td>
</tr>
<tr>
<td>Wrench, capillary inlet</td>
<td>G3452-20512*</td>
</tr>
<tr>
<td>Flathead screwdriver</td>
<td></td>
</tr>
<tr>
<td>Column cutter, wafer, 4/pk</td>
<td>5181-8836*</td>
</tr>
<tr>
<td>Driver, nut, 1/4-inch</td>
<td>8710-1561*</td>
</tr>
<tr>
<td>T-20 Torx key or screwdriver</td>
<td>8710-1807</td>
</tr>
<tr>
<td>T-10 Torx key or screwdriver</td>
<td>8710-2140</td>
</tr>
<tr>
<td>3-mm hex key wrench</td>
<td>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>
<td></td>
</tr>
<tr>
<td>Electronic leak detector</td>
<td></td>
</tr>
<tr>
<td>Magnifying loupe, 20X</td>
<td>430-1020</td>
</tr>
<tr>
<td>Metric ruler</td>
<td></td>
</tr>
<tr>
<td>Bench vise (for setting Swagelok fittings)</td>
<td></td>
</tr>
<tr>
<td>Razor or sharp knife</td>
<td></td>
</tr>
<tr>
<td>Tweezers, or thin needle-nose pliers</td>
<td>8710-0007</td>
</tr>
<tr>
<td></td>
<td>8710-0004</td>
</tr>
<tr>
<td>Needle-nose pliers</td>
<td></td>
</tr>
<tr>
<td>ESD wrist strap (for installing new components)</td>
<td>9300-1408</td>
</tr>
<tr>
<td>Gloves, heat-resistant (for handling hot parts)</td>
<td></td>
</tr>
<tr>
<td>Wooden cotton swab (for removing FID filters)</td>
<td></td>
</tr>
<tr>
<td><strong>Tools and materials for cleaning procedures</strong></td>
<td></td>
</tr>
<tr>
<td>Cleaning brushes—The FID cleaning kit contains appropriate brushes for cleaning detectors and inlets</td>
<td>9301-0985</td>
</tr>
<tr>
<td>Cleaning brushes—for cleaning split/plitless inlet split vent fitting, FID and collectors</td>
<td>8710-1346</td>
</tr>
<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>
</tbody>
</table>
Table 1  Tools and materials for GC maintenance

<table>
<thead>
<tr>
<th>Common tools</th>
<th>Part number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gloves, clean, lint-free, nylon (for handling contamination-sensitive parts)</td>
<td>large: 8650-0030</td>
</tr>
<tr>
<td></td>
<td>small: 8650-0029</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
Preparing for Maintenance

Before routine maintenance procedures, the GC must be made ready. This process can include:

- Setting low temperatures to avoid burns and other injuries
- Setting reduced flows to avoid safety hazards and to prevent damage to the instrument
- Turning off the GC and disconnecting the GC from power
- Venting a mass selective detector (MSD)
- Making other settings to prevent damage to the instrument (electronics, columns, and so forth) or to connected instruments (MSD)

To put the GC in a general standby state suitable for most maintenance, open the browser interface. From the browser interface, go to Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Start Maintenance. Follow the prompts. To exit maintenance mode and restore the previous GC settings, click Finished.

If you turned off the GC or changed other settings, return to the Maintenance Mode screen as needed. Note that the Maintenance Mode ends when the GC is turned off.

For automated maintenance procedures available through the GC, the GC will make the instrument safe to work on, and walk you through the steps required to replace the part selected.

**WARNING**

If you choose to perform maintenance without using the GC's built-in features, first cool all heated zones in the instrument, including auxiliary heaters or other heated devices you might contact during maintenance. Then turn off the GC and unplug the power cord.
Viewing Status Data

The GC can display signal and other data that can be very useful during maintenance. For example:

- Instrument status: Readiness state, running state.
- Instrument status details: Not ready modules, error modules, warnings.
- Module status details: **Actual/Setpoint** pairs for each module, quick **On/Off** for certain modules, firmware version and instrument IP address.

<table>
<thead>
<tr>
<th>Sequence</th>
<th>Method</th>
<th>Sample</th>
<th>Run Time</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th></th>
<th>On/Off</th>
<th>Actual</th>
<th>Setpoint</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oven Temperature</td>
<td></td>
<td>35.2</td>
<td>35.0</td>
</tr>
<tr>
<td>Inlet 2 Pressure(ψ)</td>
<td></td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Inlet 2 Temperature</td>
<td></td>
<td>127.3</td>
<td>250.0</td>
</tr>
<tr>
<td>Inlet 2 Total Flow</td>
<td></td>
<td>-2.4</td>
<td>25.0</td>
</tr>
<tr>
<td>Inlet 1 Pressure(ψ)</td>
<td></td>
<td>0.01</td>
<td>11.00</td>
</tr>
</tbody>
</table>
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.

Part numbers are also included in this manual.
About Maintaining the GC
Finding a Replacement Part Number
2 Removing Covers

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

This section describes how to remove covers as needed for routine maintenance. Only the covers listed in this chapter should be removed. Removing other GC covers can compromise the safety features of the GC, leading to personal injury or damage to the instrument.
To Remove the Detector Top Cover

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

1. Turn off the GC and unplug the power cord.
2. Remove the detector cover by raising the cover up, then firmly lift up on the right side of the cover to free it from the GC. Set the cover aside.
3. When finished with the maintenance procedure, place the detector cover vertically on the GC and insert the left side first, then gently snap in the right side onto the GC.

**WARNING**
Be careful! With the power switch on, potentially dangerous voltages also exist:

- All electronics boards in the instrument.
- The internal wires and cables connected to these boards.
- The wires for the oven heater.

The covers shield these parts as the parts may be hot enough to cause burns. Never remove a cover unless the instrument is unplugged.

**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. Press the buttons located on each side of the pneumatics cover and lift up to remove it from the GC.
To Remove the Electronics Cover

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

**WARNING**

Be careful! With the power switch on, potentially dangerous voltages also exist:
- All electronics boards in the instrument.
- The internal wires and cables connected to these boards.
- The wires for the oven heater.

The covers shield these parts as the parts may be hot enough to cause burns. Never remove a cover unless the instrument is unplugged.

**CAUTION**

Raising the electronics cover exposes the GC electronics.

Without FPD+ installed:
1. Turn off the GC and unplug the power cord.
2. Raise or remove the detector top cover.
3. Loosen the captive screws on the right side cover, slide the cover backwards, then remove.
4. Loosen the captive screw located on the left side of the electronics cover.
5. Reach under the back of the electronics cover to release the clip holding it in place, then raise the electronics cover and remove.

With FPD+ installed:
1. Turn off the GC and unplug the power cord.
2. Raise or remove the detector top cover.
To Remove the Electronics Cover

3. Loosen the two captive screws on the right side cover, slide the cover backwards, then remove.
4. Loosen the captive screw located on the left side of the electronics cover.
5. Reach under the back of the electronics cover to release the clip holding it in place, then raise the electronics cover and remove.
6. Loosen the two thumbscrews in the tray below the PMT, and remove the two screws in the back of the tray.
7. Remove the tray from the electronics cover.
2 Removing Covers
To Remove the Electronics Cover
3 Maintaining the GC

Consumables and Parts for General GC Maintenance  24
Parts Identification  26
To Change the Hydrogen Sensor Calibration Gas Cylinder  27
3  **Maintaining the GC**  
Consumables and Parts for General GC Maintenance

**Consumables and Parts for General GC Maintenance**

*Table 2* lists consumable parts for the hydrogen sensor module accessory and for general GC maintenance.

<table>
<thead>
<tr>
<th>Description</th>
<th>Part number</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hydrogen sensor parts</strong></td>
<td></td>
</tr>
<tr>
<td>Calibration gas cylinder, 2 percent hydrogen gas in 17 L compressed air</td>
<td>5190-6890</td>
</tr>
<tr>
<td>Cylinder stand with locking screw</td>
<td>1400-3583</td>
</tr>
<tr>
<td>Pressure regulator, with gage</td>
<td>G3440-80153</td>
</tr>
<tr>
<td><strong>Fittings and hardware</strong></td>
<td></td>
</tr>
<tr>
<td>Fittings kit, 1/8-inch brass, 20/pk</td>
<td>5080-8750</td>
</tr>
<tr>
<td>Plug, 1/8-inch brass 6/pk</td>
<td>5180-4124</td>
</tr>
<tr>
<td>Tee, 1/8-inch brass 2/pk</td>
<td>5180-4160</td>
</tr>
<tr>
<td>Union, 1/8-inch brass 2/pk</td>
<td>5180-4127</td>
</tr>
<tr>
<td>Cross, union 1/8-inch brass</td>
<td>0100-0161</td>
</tr>
<tr>
<td>GC Supply Gas Installation Kit with Gas Purifiers</td>
<td></td>
</tr>
<tr>
<td>Installation kit for GCs without gas purifiers</td>
<td>19199N</td>
</tr>
<tr>
<td>PTFE tape</td>
<td>0460-1266</td>
</tr>
<tr>
<td>Copper tubing, 1/8-inch 12 ft.</td>
<td>5021-7107</td>
</tr>
<tr>
<td>Copper tubing, 1/8-inch od, 50 ft</td>
<td>5180-4196</td>
</tr>
<tr>
<td><strong>Gas regulators</strong></td>
<td></td>
</tr>
<tr>
<td>Regulator, 2-stage, brass body, stainless steel diaphragms, 125 psi max, CGA350, hydrogen, argon/methane, with 1/8-inch fitting. For 1/4-inch tubing purchase a 1/4-inch adapter.</td>
<td>5183-4642</td>
</tr>
<tr>
<td>Regulator, 2-stage, brass body, stainless steel diaphragms, 125 psi max, CGA346, air, with 1/8-inch fitting. For 1/4-inch tubing purchase a 1/4-inch adapter.</td>
<td>5183-4641</td>
</tr>
<tr>
<td>Regulator, 2-stage, brass body, stainless steel diaphragms, 125 psi max, CGA590, industrial air, with 1/8-inch fitting. For 1/4-inch tubing purchase a 1/4-inch adapter.</td>
<td>5183-4645</td>
</tr>
<tr>
<td>Regulator, 2-stage, brass body, stainless steel diaphragms, 125 psi max, CGA580, helium, argon, nitrogen, 1/8-inch fitting. For 1/4-inch tubing purchase a 1/4-inch adapter.</td>
<td>5183-4644</td>
</tr>
<tr>
<td>Regulator, 2-stage, brass body, stainless steel diaphragms, 125 psi max, CGA540, oxygen, 1/8-inch fitting. For 1/4-inch tubing purchase a 1/4-inch adapter.</td>
<td>5183-4643</td>
</tr>
<tr>
<td><strong>Gas Clean Filters</strong></td>
<td></td>
</tr>
<tr>
<td>Gas Clean connecting unit, 1-position), 1/4-inch</td>
<td>CP7980</td>
</tr>
<tr>
<td>Gas Clean connecting unit, 1-position), 1/8-inch</td>
<td>CP7988</td>
</tr>
<tr>
<td>Gas Clean connecting unit, 2-position), 1/4-inch</td>
<td>CP738406</td>
</tr>
</tbody>
</table>
### Table 2 Consumables and parts for general GC maintenance (continued)

<table>
<thead>
<tr>
<th>Description</th>
<th>Part number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gas Clean connecting unit, 2-position), 1/8-inch</td>
<td>CP738407</td>
</tr>
<tr>
<td>Gas Clean Smart Sensor for 8890 (replacement sensor)</td>
<td>CP179885</td>
</tr>
<tr>
<td><strong>Gas Clean kit (connecting unit for one filter, one carrier gas filter, 1/8-inch connections, mounting bracket, and Smart Sensor) for new GC</strong></td>
<td></td>
</tr>
<tr>
<td>Connect unit, Gas Clean, 4 filter, 1/4-inch, 1/pk</td>
<td>CP7989</td>
</tr>
<tr>
<td>Gas Clean connecting unit, 4-position), 1/8-inch fittings</td>
<td>CP736520</td>
</tr>
<tr>
<td>Gas Clean high-flow connecting unit, 2-position), with 1/4-inch fittings, for high-flow applications such as ICP-MS or ICP-OES</td>
<td>CP17984</td>
</tr>
<tr>
<td>High flow connecting unit 1/8-inch</td>
<td>CP17985</td>
</tr>
<tr>
<td>Gas Clean filter GC-MS, 1/pk</td>
<td>CP17973</td>
</tr>
<tr>
<td>Gas Clean filter oxygen, 1/pk</td>
<td>CP17970</td>
</tr>
<tr>
<td>Gas Clean filter moisture, 1/pk</td>
<td>CP17971</td>
</tr>
<tr>
<td>Gas Clean filter charcoal, 1/pk</td>
<td>CP17972</td>
</tr>
<tr>
<td>Gas Clean filter kit for TCD</td>
<td>CP738408</td>
</tr>
<tr>
<td>Gas Clean Filter kit (connecting unit for one filter, including one carrier gas filter, 1/8-inch connections, a smart sensor, and mounting bracket for the GC) for carrier gas only</td>
<td>CP179880</td>
</tr>
<tr>
<td>Gas Clean Filter kit (connecting unit for four filters, including four filters, 1/4-inch connections) for FID, FPD, NPD</td>
<td>CP7995</td>
</tr>
<tr>
<td>Gas Clean Filter kit (connecting unit for four filters, including four filters, 1/8-inch connections) for FID, FPD, NPD</td>
<td>CP736530</td>
</tr>
<tr>
<td>GC/MS Gas Clean Filter kit (includes one connecting unit and two GC/MS filters, 1/8-inch connections) for ECD, GC/MS</td>
<td>CP17976</td>
</tr>
<tr>
<td>GC/MS Gas Clean Filter kit (includes one connecting unit and two GC/MS filters, 1/4-inch connections) for ECD, GC/MS</td>
<td>CP17977</td>
</tr>
<tr>
<td>GC/MS Gas Clean Filter installation kit (includes CP17976, 1 m copper tubing, and two 1/8-inch nuts and ferrules) for ECD, GC/MS</td>
<td>CP17978</td>
</tr>
<tr>
<td>TCD filter kit (with oxygen and moisture filters) for TCD</td>
<td>CP738408</td>
</tr>
<tr>
<td>Flush head, Gas Clean connecting unit, used to purge gas lines after installing connecting unit</td>
<td>CP7987</td>
</tr>
<tr>
<td>Gas Clean wall-mounting bracket for 1-position) connecting unit only</td>
<td>CP7981</td>
</tr>
</tbody>
</table>

For additional general and filters, refer to the Agilent web site and Parts Finder software. For additional information about choosing the correct gas line filters, see the *GC, GC/MS, and ALS Site Preparation Guide* and visit the Agilent web site.
Parts Identification

Figure 5. Hydrogen sensor calibration gas cylinder parts identification
To Change the Hydrogen Sensor Calibration Gas Cylinder

Replace the calibration gas cylinder when you cannot adjust it to provide the correct flow rate during calibration, or if it expires.

**WARNING**

Connect only the Agilent calibration gas to the hydrogen sensor fitting. The calibration gas is 2% hydrogen in air and is not potentially explosive. Gases with higher concentrations of hydrogen can create a dangerous condition in the oven or damage the hydrogen sensor.

**WARNING**

Be careful! The oven and/or detector may be hot enough to cause burns. While hydrogen sensor calibration can be performed at any temperature, cool the oven and detector to safe handling temperatures, < 40 °C, before continuing.

1. Make sure the old cylinder is empty.
2. Turn the pressure regulator completely off and set the output pressure as low as possible (full CCW).
3. Remove the pressure regulator from the old cylinder and install it onto the new cylinder.
4. Install the new cylinder into the stand.
5. Turn on the pressure in the new cylinder.
6. Open the GC oven door and connect a flowmeter tube to the sensor tube in the oven.

7. Select Settings > Calibration > Hydrogen Sensor > Start Calibration Cycle? > On/Yes. The calibration cycle begins. The hydrogen sensor module will wait to stabilize, then will begin to send calibration gas across the sensor.
8. While continuing to measure the flow rate from the tube, adjust the pressure regulator on the calibration gas cylinder until the flow rate is approximately 30 mL/min. Remove the flowmeter and close the oven door.
9. Allow the calibration cycle to complete (approximately 5 minutes total).
10. Check for leaks.
3 Maintaining the GC
To Change the Hydrogen Sensor Calibration Gas Cylinder
4 Maintaining Capillary Columns

Consumables and Parts for Columns  30
To Install a Capillary Column Hanger  32
To Install Capillary Column Clips  33
To Condition a Capillary Column  34
To Cut a Loop from a Column  36
To Reverse a Column and Bakeout Contaminants  37
Consumables and Parts for Columns

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

Table 3  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>
### Table 4  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.

2. Select either the front or back hanger position. (Hanger is shown in back position.)
3. 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 30.
   - T-20 Torx screwdriver


3. Loosen the four corner mounting screws, but do not remove.

4. Slip each corner screw through the large hole on the clip.

5. Slide the clip so that the screw is positioned in the slot.

6. 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 30.
   - Column nut

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

2. Manually set the inlet and oven temperature to < 40 °C, and wait for the inlet, oven, and other parts you might come into contact with inside the oven, to cool before continuing. Alternately, place the GC in maintenance mode: Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Start Maintenance.

   **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.

3. Install the column into the inlet using the new ferrules.
   - “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 Cool On-Column Inlet”

4. Cap the open column fitting, for example, the detector column fitting.


6. Turn off all detectors.
7. 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.

8. 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.


**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.

10. Attach the column to the detector. For details, select your specific detector.

   - 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 ECD
   - To Install a Capillary Column to the FPD+


12. Restore the analytical method.

   - For FID or any FPD+, immediately turn off the flame.
   - For NPD, immediately turn off the bead.

13. 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. Place GC in maintenance mode: Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Start Maintenance 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.
   - “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 Cool On-Column Inlet”

To Reverse a Column and Bakeout Contaminants

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

2. Place GC in maintenance mode: Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Start Maintenance 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 36. 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.
   - “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 Cool On-Column Inlet”
7. Attach your column to the detector.
   - 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 ECD
   - To Install a Capillary Column to the FPD+
9. 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.
10. Purge the column with carrier flow for at least 10 minutes before heating the oven.
11. Set the inlet temperature to 300 °C or 25 °C above the normal operating temperature.
12. 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.
4 Maintaining Capillary Columns
To Reverse a Column and Bakeout Contaminants

13 Bakeout for 30 minutes.

Maintaining the Split/Splitless Inlet

Consumables and Parts for the Split/Splitless Inlet  41
Exploded Parts View of the Split/Splitless Inlet  44
To Install a Capillary Column with the Split/Splitless Inlet  45
To Change the Septum on the Split/Splitless Inlet  49
To Clean the Septum Seat in the Insert Assembly of the Split/Splitless Inlet  51
To Change the Liner and O-Ring on the Split/Splitless Inlet  53
To Replace the Gold Seal on the Split/Splitless Inlet  56
To Replace the Filter in the Split Vent Trap for the Split/Splitless Inlet  58
To Clean the Split/Splitless Inlet  60
To Bakeout Contaminants from the Split/Splitless Inlet  62
See the Agilent catalog for consumables and supplies for a more complete listing, or visit the Agilent Web site for the latest information (www.agilent.com/chem/supplies).

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

<table>
<thead>
<tr>
<th>Mode</th>
<th>Description</th>
<th>Deactivated</th>
<th>Part number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Split</td>
<td>Low-pressure drop, glass wool, single taper, 870 µL</td>
<td>Yes</td>
<td>5183-4647</td>
</tr>
<tr>
<td>Split</td>
<td>Glass wool, 990 µL</td>
<td>No</td>
<td>19251-60540</td>
</tr>
<tr>
<td>Split</td>
<td>MS Certified, single taper, glass wool</td>
<td>Yes</td>
<td>5188-6576</td>
</tr>
<tr>
<td>Split—Manual only</td>
<td>Empty pin and cup, 800 µL</td>
<td>No</td>
<td>18740-60190</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>Split or splitless</td>
<td>Ultra Inert, low pressure drop, glass wool</td>
<td>Yes</td>
<td>5190-2295</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</td>
<td>MS Certified, single taper, glass wool</td>
<td>Yes</td>
<td>5188-6568</td>
</tr>
<tr>
<td>Splitless—Direct inject</td>
<td>2-mm id, quartz, 250 µL</td>
<td>No</td>
<td>18740-80220</td>
</tr>
<tr>
<td>Splitless—Direct inject</td>
<td>2-mm id, 250 µL</td>
<td>Yes</td>
<td>5181-8818</td>
</tr>
<tr>
<td>Direct inject—Headspace or purge and trap</td>
<td>1.5-mm id, 140 µL</td>
<td>No</td>
<td>18740-80200</td>
</tr>
<tr>
<td>Direct column connect</td>
<td>Single taper, splitless 4-mm id</td>
<td>Yes</td>
<td>G1544-80730</td>
</tr>
<tr>
<td>Direct column connect</td>
<td>Dual taper, splitless 4-mm id</td>
<td>Yes</td>
<td>G1544-80700</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Column id (mm)</th>
<th>Description</th>
<th>Typical use</th>
<th>Part number/quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>.530</td>
<td>Ferrule, Vespel/graphite, 0.9-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>
Maintaining the Split/Splitless Inlet

Consumables and Parts for the Split/Splitless Inlet

Table 6  Nuts, ferrules, and hardware for capillary columns (continued)

<table>
<thead>
<tr>
<th>Column id (mm)</th>
<th>Description</th>
<th>Typical use</th>
<th>Part number/quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>.250</td>
<td>Ferrule, Vespel/graphite, 0.4-mm id</td>
<td>0.1-mm, 0.2-mm, and 0.25-mm capillary columns</td>
<td>5181-3323 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Ferrule, graphite, 0.5-mm id</td>
<td>0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns</td>
<td>5080-8853 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Column nut, finger-tight (for .100- to .320-mm columns)</td>
<td>Connect column to inlet or detector</td>
<td>5020-8292</td>
</tr>
<tr>
<td>.100 and .200</td>
<td>Ferrule, Vespel/graphite, 0.37-mm id</td>
<td>0.1-mm and 0.2-mm capillary columns</td>
<td>5062-3516 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Ferrule, graphite, 0.5-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, 0.4-mm id</td>
<td>0.1-mm, 0.2-mm, and 0.25-mm capillary columns</td>
<td>5080-8853 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Column nut, finger-tight (for .100- to .320-mm columns)</td>
<td>Connect column to inlet or detector</td>
<td>5020-8292</td>
</tr>
<tr>
<td>All</td>
<td>Ferrule, no-hole</td>
<td>Testing</td>
<td>5181-3308 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Capillary column blanking nut</td>
<td>Testing—use with any ferrule</td>
<td>5020-8294</td>
</tr>
<tr>
<td></td>
<td>Column nut, universal</td>
<td>Connect column to inlet or detector</td>
<td>5181-8830 (2/pk)</td>
</tr>
<tr>
<td></td>
<td>Column cutter, ceramic wafer</td>
<td>Cutting capillary columns</td>
<td>5181-8836 (4/pk)</td>
</tr>
<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 7  Other consumables and parts for the split/splitless inlet

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

<table>
<thead>
<tr>
<th>Description/quantity</th>
<th>Part number</th>
</tr>
</thead>
<tbody>
<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

Figure 6. Split/splitless inlet exploded parts
To Install a Capillary Column with the Split/Splitless Inlet

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 41:
   • Column
   • Ferrule(s)
   • Column nut
   • Septum
   • Column cutter
   • Isopropanol
   • Lab tissue
   • Metric ruler
   • Two 1/4-inch open-end wrenches
   • Lint-free gloves

2  Place GC in maintenance mode: Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Start Maintenance. Wait for the GC to become ready.

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.

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 41.

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

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.
To Install a Capillary Column with the Split/Splitless Inlet

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

7. Break off the column end by supporting it against the column cutter opposite the scribe. Inspect the end with a magnifying loupe to make certain 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.
5 Maintaining the Split/Splitless Inlet
To Install a Capillary Column with 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.
5  Maintaining the Split/Splitless Inlet
To Install a Capillary Column with the Split/Splitless Inlet

15 Install the column into the detector.
   • 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 ECD
   • To Install a Capillary Column to the FPD+

16 Exit maintenance mode. Select Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Finished.

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

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

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

20 Allow the oven, inlet, and detector to equilibrate at operating temperature, then retighten the fittings.

21 Perform an inlet Leak & Restriction test and reset the maintenance counters.
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 41.
   - Wrench, hex for changing septum
   - 0- or 00-grade steel wool (optional)
   - Tweezers
   - Wrench, capillary inlet (optional)


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

3. Remove the septum retainer nut or Merlin cap.

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

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

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

   **CAUTION**
   Overtightening the septum nut can cause contamination.
5 Maintaining the Split/Splitless Inlet
To Change the Septum on the Split/Splitless Inlet

7 Select Maintenance > Inlets > Septum injections, then touch Reset Counter.
8 Perform an inlet Leak & Restriction test and reset the maintenance counters.
9 Select Finished, then select OK to exit
10 Restore the analytical method.
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 41.
   - Wrench, hex for changing septum
   - 0- or 00-grade steel wool (optional)
   - Tweezers
   - Compressed, filtered, dry air or nitrogen
   - Wrench, capillary inlet (optional)

2. Manually set the inlet and oven temperature to < 40 °C, and wait for the inlet, oven, and other parts you might come into contact with inside the oven, to cool before continuing. Alternately, place the GC in maintenance mode: Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Start Maintenance.

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

3. Slide the locking tab forward (counterclockwise). Lift the insert 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 49.
6 Scrub the residue from the retainer nut and septum holder with a small piece of rolled-up steel wool and tweezers. Do not do this over the inlet.

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

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

9 Firmly press the new septum or Merlin Microseal into the fitting. See “To Change the Septum on the Split/Splitless Inlet” on page 49.

10 Replace the septum retainer nut or Merlin cap and finger-tighten. See “To Change the Septum on the Split/Splitless Inlet” on page 49.

11 Perform an inlet Leak & Restriction test and reset the maintenance counters.


13 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 41.
   - Replacement liner
   - Tweezers
   - Wrench, hex for changing septum (optional)
   - Wrench, capillary inlet (optional)
   - Lint-free gloves


   **WARNING**

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

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

4. Loosen the O-ring from the sealing surface with tweezers.
5 Maintaining the Split/Splitless Inlet
To Change the Liner and O-Ring on the Split/Splitless Inlet

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 56.
7. Clean the inlet if there is visible or suspected contamination. See “To Clean the Split/Splitless Inlet” on page 60.

8. Clean O-ring residue from sealing surface.

**CAUTION**

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

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

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

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

12. 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.


14. Configure the new column.

15. Perform an inlet Leak & Restriction test and reset the maintenance counters.

16. Select Finished, then select OK to exit.

17. Restore the analytical method.
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 41.
   • Replacement washer
   • 1/4-inch wrench (for column)
   • 1/2-inch wrench
   • Lint-free gloves


   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.

   Remove insulation cup

   Disconnected, capped column

5. Loosen and remove the reducing nut. Remove the washer and seal inside the reducing nut.

   Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.
5 Maintaining the Split/Splitless Inlet
To Replace the Gold Seal on the Split/Splitless Inlet

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).

7 Replace the reducing nut and tighten securely with a wrench.

8 Replace the inlet liner.

9 Install the column and the insulation cup.

10 Bakeout contaminants. See “To Bakeout Contaminants from the Split/Splitless Inlet” on page 62.

11 Perform an inlet Leak & Restriction test and reset the maintenance counters.


13 Restore the analytical method.
To Replace the Filter in the Split Vent Trap for the Split/Splitless Inlet

1. Gather the following:
   - New split vent filter cartridge. See "Consumables and Parts for the Split/Splitless Inlet" on page 41.


   **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). See "To Remove the Pneumatics Cover" on page 19.

4. Completely loosen the knurled nut that secures the split vent trap in place as shown in Figure 7.

5. Slide the trap assembly back from the guided mounting bracket and tilt up to expose the filter as shown in Figure 8.
5 Maintaining the Split/Splitless Inlet
   To Replace the Filter in the Split Vent Trap for the Split/Splitless Inlet

6 Remove the old filter cartridge and two O-rings.
7 Verify the new O-rings are seated properly on the new filter cartridge.
8 Install the new filter cartridge then reassemble the trap using your fingers to fully tighten the knurled nut. The nut should thread easily.
   If the knurled nut does not thread easily, loosen, reassemble the 2 parts of the trap, and thread again. Do not force it.
9 Perform an inlet **Leak & Restriction** test and reset the maintenance counters.
10 Install the pneumatics cover.
11 Select **Finished**, then select **OK** to exit.
To Clean the Split/Splitless Inlet

1. Gather the following:
   - Replacement septum, see "Consumables and Parts for the Split/Splitless Inlet" on page 41.
   - 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. Manually set the inlet and oven temperature to < 40 °C, and wait for the inlet, oven, and other parts you might come into contact with inside the oven, to cool before continuing. Alternately, place the GC in maintenance mode: Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Start Maintenance.

   **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, O-ring, and septum. See “To Change the Liner and O-Ring on the Split/Splitless Inlet” on page 53.

4. Disconnect the column from the inlet.

5. Remove the reducing nut, gold seal, and washer. See “To Replace the Gold Seal on the Split/Splitless Inlet” on page 56.

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 insert assembly. 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, washer, and reducing nut.

11. Install the liner, O-ring, and septum.

12. Install the column. See “To Install a Capillary Column with the Split/Splitless Inlet” on page 45.
To Clean the Split/Splitless Inlet

13 Perform an inlet **Leak & Restriction** test and reset the maintenance counters.

14 Bakeout contaminants. See “To Bakeout Contaminants from the Split/Splitless Inlet” on page 62.

15 Exit maintenance mode. Select **Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Finished**.

16 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.
5 Maintaining the Split/Splitless Inlet
To Bakeout Contaminants from the Split/Splitless Inlet
Maintaining the Purged Packed Inlet

Consumables and Parts for the Purged Packed Inlet  65
Exploded Parts View of the Purged Packed Inlet  68
To Install a Capillary Column with the Purged Packed Inlet  69
To Change the Septum on the Purged Packed Inlet  72
To Clean the Septum Seat in the Purged Packed Inlet  74
To Install an Adapter on the Purged Packed Inlet  76
To Change the O-Ring on the Purged Packed Inlet  77
To Change the Glass Liner on the Purged Packed Inlet  78
To Clean the Purged Packed Inlet  80
To Bakeout Contaminants from the Purged Packed Inlet  82
To Install a Packed Metal Column  83
To Install a Packed Column Adapter onto a Detector  85
To Install a Packed Glass Column  87
To Condition a Packed Column  89
To Install Ferrules on a Packed Metal Column  90
Consumables and Parts for the Purged Packed Inlet

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

Table 8 Purged packed inlet parts

<table>
<thead>
<tr>
<th>Description</th>
<th>Part number/quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preventative maintenance kit</td>
<td>5188-6498</td>
</tr>
<tr>
<td><strong>Purged packed glass liners and column adapters</strong></td>
<td></td>
</tr>
<tr>
<td>Glass liner</td>
<td>5080-8732 (25/pack) or</td>
</tr>
<tr>
<td></td>
<td>5181-3382 deactivated (5/pack)</td>
</tr>
<tr>
<td>0.53-mm column adapter</td>
<td>19244-80540</td>
</tr>
<tr>
<td>1/8-inch column adapter</td>
<td>19243-80530</td>
</tr>
<tr>
<td>1/4-inch column adapter</td>
<td>19243-80540</td>
</tr>
<tr>
<td><strong>Recommended septa and O-rings for the purged packed inlet</strong></td>
<td></td>
</tr>
<tr>
<td>11-mm solid septum, low-bleed, red</td>
<td>5181-1263 (50/pk)</td>
</tr>
<tr>
<td>11-mm septum with partial through-hole, low-bleed, red</td>
<td>5181-3383 (50/pk)</td>
</tr>
<tr>
<td>11-mm septum, low-bleed, gray</td>
<td>5080-8896 (50/pk)</td>
</tr>
<tr>
<td>Merlin Microseal septum (30 psi)</td>
<td>5181-8815</td>
</tr>
<tr>
<td>11-mm high-temperature silicone septum (350 °C and higher)</td>
<td>5182-0739 (50/pk)</td>
</tr>
<tr>
<td>Viton O-ring (Top insert weldment)</td>
<td>5080-8898 (12/pk)</td>
</tr>
<tr>
<td><strong>Packed column adapters for detectors</strong></td>
<td></td>
</tr>
<tr>
<td>1/8-inch Packed column adapter assembly</td>
<td>G3435-81340</td>
</tr>
<tr>
<td>1/4-inch Packed column adapter assembly</td>
<td>G3435-81330</td>
</tr>
</tbody>
</table>

Table 9 Nuts and ferrules for packed columns

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

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

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

<table>
<thead>
<tr>
<th>Column id (mm)</th>
<th>Description</th>
<th>Typical use</th>
<th>Part number/quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>.530</td>
<td>Ferrule, Vespel/graphite, 0.8-mm id</td>
<td>0.45-mm and 0.53-mm capillary columns</td>
<td>5062-3512 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Ferrule, graphite, 1.0-mm id</td>
<td>0.53-mm capillary columns</td>
<td>5080-8773 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>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>
<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>
</tbody>
</table>
Table 10  Nuts, ferrules, and hardware for capillary columns (continued)

<table>
<thead>
<tr>
<th>Column id (mm)</th>
<th>Description</th>
<th>Typical use</th>
<th>Part number/quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ferrule tool kit</td>
<td>Ferrule installation</td>
<td>440-1000</td>
</tr>
</tbody>
</table>
Exploded Parts View of the Purged Packed Inlet

Figure 9. Purged packed inlet exploded parts
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 65.
   - Column nut
   - Glass liner
   - Viton O-ring
   - 0.53-mm column adapter
   - Septum
   - Two 1/4-inch wrenches
   - Metric ruler
   - Lint-free gloves


   **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 76.

   **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 77.

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

---

Ferrule

Column nut

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

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

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

9  Position the column so it extends 1 to 2 mm above the end of the ferrule. Slide the septum up the column to hold the column nut at this fixed position.

10 Thread the column nut into the inlet adapter but do not tighten.
11 Adjust the column position so that the septum is even with the bottom of the column nut. Finger-tighten the column nut until it begins to grip the column.

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

13 Configure the new column.

14 Condition the column per the manufacturer’s recommendation. See “To Condition a Capillary Column”.

15 Install the column into the detector.
   - 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 ECD
   - To Install a Capillary Column to the FPD+

16 Exit maintenance mode. Select Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Finished.

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

18 Restore the analytical method.
   - For FPD+, immediately turn off the flame.
   - For NPD, immediately turn off the bead.

19 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.

20 Allow the oven, inlet, and detector to equilibrate at operating temperature, then retighten the fittings.

21 Perform an inlet Leak & Restriction test and reset the maintenance counters.
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 65.
   - Septum nut wrench
   - 0- or 00-grade steel wool (optional)
   - Tweezers


   **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 Perform an inlet **Leak & Restriction** test and reset the maintenance counters.

8 Select **Finished**, then select **OK** to exit.

9 Restore the analytical method.
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 65.
   - Septum nut wrench
   - 0- or 00-grade steel wool (optional)
   - Tweezers
   - Compressed, filtered, dry air or nitrogen
   - Ultrasonic cleaning bath
   - Lint-free gloves

2. Manually set the inlet and oven temperature to < 40 °C, and wait for the inlet, oven, and other parts you might come into contact with inside the oven, to cool before continuing. Alternately, place the GC in maintenance mode: Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Start Maintenance.

   **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 assembly 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 assembly. Do not gouge or scratch the interior of the septum head.

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

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 77.

9. Install the top insert assembly 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.
To Clean the Septum Seat in the Purged Packed Inlet

12 Perform an inlet **Leak & Restriction** test and reset the maintenance counters.

13 Exit maintenance mode. Select **Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Finished**.

14 Restore the analytical method.
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 65.
   • 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 Place GC in maintenance mode: Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Start Maintenance. 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.

8 Exit maintenance mode. Select Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Finished.
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 65.
   - Septum nut wrench
   - Tweezers
   - Lint-free gloves


   **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 assembly 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 assembly.

7. Perform an inlet **Leak & Restriction** test and reset the maintenance counters.

8. Select **Finished**, then select **OK** to exit.

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

1. Gather the following:
   • Replacement glass liner, see “Consumables and Parts for the Purged Packed Inlet” on page 65.
   • 9/16-inch wrench
   • Lint-free gloves


   **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 assembly 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 77.
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 69.

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

8  Configure the new liner.

9  Perform an inlet Leak & Restriction test and reset the maintenance counters.

10 Select Finished, then select OK to exit.

11 Restore the analytical method.
To Clean the Purged Packed Inlet

1. Gather the following:
   - Replacement O-ring, see “Consumables and Parts for the Purged Packed Inlet” on page 65.
   - 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. Manually set the inlet and oven temperature to < 40 °C, and wait for the inlet, oven, and other parts you might come into contact with inside the oven, to cool before continuing. Alternately, place the GC in maintenance mode: Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Start Maintenance.

   **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 assembly.

6. Remove the glass liner and O-ring.

7. If used, remove the adapter.

8. Ultrasonically clean the septum nut, top insert assembly, 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 76.

13. Install the glass liner and O-ring. See “To Change the Glass Liner on the Purged Packed Inlet” on page 78.

14. Install the top insert assembly and finger-tighten.
15 Install the septum and septum nut. See “To Change the Septum on the Purged Packed Inlet” on page 72.

16 Attach the column. See “To Install a Capillary Column with the Purged Packed Inlet” on page 69.

17 Set the septum and glass liner counters.

18 Perform the inlet Leak & Restriction test and reset the maintenance counters.


20 Restore the analytical method.
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.

**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.

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


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 76.

   **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 89.


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

10. If required, install a packed column adapter onto the detector column fitting. See “To Install a Packed Column Adapter onto a Detector” on page 85.

11. Place a nut and ferrule onto the packed column.

12. Attach the column to the detector or detector adapter. Finger-tighten the nut.
13 Using two wrenches, one on the adapter and one on the column nut, tighten the column nut an additional 1/4 turn (for a 1/8-inch column) or an additional 3/4 turn (for a 1/4-inch column).

14 Exit maintenance mode. Select Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Finished.

15 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

16 Heat the oven to 200 °C, cool it to a safe handling temperature, then re-tighten the column connection. (Re-tighten until snug, only about 15 degrees rotation.) Repeat two more times. This process will set the Vespel/graphite ferrule to help prevent leaks.

17 Restore the analytical method.
   - For 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 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 Perform the inlet Leak & Restriction test and reset the maintenance counters.
To Install a Packed Column Adapter onto a Detector

This procedure applies to the FID, FPD+, NPD, and TCD.

1. Gather the following:
   - Packed column adapter, see “Consumables and Parts for the Purged Packed Inlet” on page 65.
   - Ferrule, Vespel/graphite, 0.8-mm id
   - 7/16-inch wrench (for the packed column adapter and 1/8-inch packed column nuts)
   - 9/16-inch wrench (for 1/4-inch packed column nuts)
   - 1/8-inch nut and ferrule for a 1/8-inch packed column, or a 1/4-inch nut and ferrule for a 1/4-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.

3. Place a ferrule onto the packed column 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. Finger-tighten the adapter into the detector base, then tighten an additional 1/8 turn using a wrench.
Exit maintenance mode. Select Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Finished.

After installation, heat the oven to 200 °C, cool it to a safe handling temperature, then re-tighten the column connection. (Re-tighten until snug, only about 15 degrees rotation.) Repeat two more times. This process will set the Vespel/graphite ferrule to help prevent leaks.
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 65.
   - Two 1/4-inch Vespel/graphite ferrules
   - Lint-free gloves


   **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 89.

   **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.
To Install a Packed Glass Column

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 Exit maintenance mode. Select **Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Finished**.

12 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

13 Restore the analytical method.
   - For FPD+, immediately turn off the flame.
   - For NPD, immediately turn off the bead.

14 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.

15 Allow the oven, inlet, and detector to equilibrate at operating temperature, then retighten the fittings.

16 Perform the inlet **Leak & Restriction** test and reset the maintenance counters.
To Condition a Packed Column

1 Gather the following:
   • Capillary adapter
   • Column nut and no-hole ferrule or blanking nut
   • 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 Place GC in maintenance mode: Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Start Maintenance. 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 83.

4 If present, remove the packed column adapter from the detector base. (If it is installed to the column, it can be conditioned with the column.)

5 Cap the detector fitting with the no-hole ferrule and column nut, or with a blanking nut.

6 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

7 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.

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

9 Attach the column to the detector and maintain established flow. See "To Install a Packed Metal Column" on page 83.

10 Perform the inlet Leak & Restriction test and reset the maintenance counters.

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 65.
   - Lint-free gloves

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

3. Secure the fitting in a bench vise.

**CAUTION**

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

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

   Front ferrule  
   Back ferrule  
   Column nut

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

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

7. Unscrew the column nut from the vise-held fitting and remove the column. Ferrules should now be set in place on the column with the column end correctly positioned.
6  Maintaining the Purged Packed Inlet
   To Install Ferrules on a Packed Metal Column
Maintaining the Packed Column Inlet

Consumables and Parts for the Packed Column Inlet  93
Exploded Parts View of the Packed Column Inlet  95
To Change the Septum on the Packed Column Inlet  96
To Clean the Septum Seat in the Packed Column Inlet  98
To Install an Adapter on the Packed Column Inlet  100
To Change the O-Ring on the Packed Column Inlet  101
To Change the Glass Liner on the Packed Column Inlet  102
To Install an Insulation Cup on the Packed Column Inlet  104
To Clean the Packed Column Inlet  105
To Bakeout Contaminants from the Packed Column Inlet  107
To Install a Packed Metal Column  108
To Install a Packed Column Adapter on a Detector Fitting  110
To Install a Packed Glass Column  112
To Condition a Packed Column  114
To Install Ferrules on a Packed Metal Column  115
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 11  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>
</tbody>
</table>

**Packed column glass liners and column adapters**

<table>
<thead>
<tr>
<th>Description</th>
<th>Part number/quantity</th>
</tr>
</thead>
<tbody>
<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>
</tbody>
</table>

**Recommended septa and O-rings for the packed column inlet**

<table>
<thead>
<tr>
<th>Description</th>
<th>Part number/quantity</th>
</tr>
</thead>
<tbody>
<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>

**Packed column adapters for detectors**

<table>
<thead>
<tr>
<th>Description</th>
<th>Part number/quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/8-inch Packed column adapter assembly</td>
<td>G3435-81340</td>
</tr>
<tr>
<td>1/4-inch Packed column adapter assembly</td>
<td>G3435-81330</td>
</tr>
</tbody>
</table>

### Table 12  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>
<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>
</tbody>
</table>
## Table 12  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 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

Figure 10. Packed column inlet exploded parts
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 93.
   • Septum nut wrench
   • 0- or 00-grade steel wool (optional)
   • Tweezers

2 Place GC in maintenance mode: Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Start Maintenance. 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.

![Septum retainer nut and septum diagram]

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).

![Merlin Microseal and cap diagram]

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  Reset the septum counter.

8  Perform an inlet **Leak & Restriction** test and reset the maintenance counters.

9  Exit maintenance mode. Select **Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Finished**.

10 Restore the analytical method.
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 93.
   - Septum nut wrench
   - 0- or 00-grade steel wool (optional)
   - Tweezers
   - Compressed, filtered, dry air or nitrogen
   - Ultrasonic cleaning bath
   - Lint-free gloves

2. Manually set the inlet and oven temperature to < 40 °C, and wait for the inlet, oven, and other parts you might come into contact with inside the oven, to cool before continuing. Alternately, place the GC in maintenance mode: Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Start Maintenance.

   **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 Reset the septum counter.

13 Perform an inlet **Leak & Restriction** test and reset the maintenance counters.

14 Exit maintenance mode. Select **Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Finished**.

15 Restore the analytical method.
7  Maintaining the Packed Column Inlet
To Install an Adapter on the Packed Column Inlet

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 93.
   • 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  Place GC in maintenance mode: Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Start Maintenance. 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.

   ![Diagram of Adapter Components]

   Inlet fitting  
   Ferrule  
   Tubing nut  
   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.

8  Exit maintenance mode. Select Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Finished.
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 93.
   - Septum nut wrench
   - Tweezers
   - Lint-free gloves


   **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. Reset the EMF counter.

8. Perform an inlet Leak & Restriction test and reset the maintenance counters.


10. Restore the analytical method.
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 93.
   - 9/16-inch wrench
   - Lint-free gloves


   **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 Reset the EMF counter.

9 Perform an inlet **Leak & Restriction** test and reset the maintenance counters.

10 Exit maintenance mode. Select **Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Finished**.

11 Restore the analytical method.
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 93.
   • 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 Manually set the inlet and oven temperature to < 40 °C, and wait for the inlet, oven, and other parts you might come into contact with inside the oven, to cool before continuing. Alternately, place the GC in maintenance mode: Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Start Maintenance.

**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 100.
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 96.

16 Attach the column.

17 Set the septum and glass liner counters.

18 Perform an inlet Leak & Restriction test and reset the maintenance counters.


20 Restore the analytical method.
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.

**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.

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. Place GC in maintenance mode: **Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Start Maintenance.** Wait for the GC to become ready.

3. Prepare the packed metal column. See “To Install Ferrules on a Packed Metal Column” on page 115.

   **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 100.

   **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 114.


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

10. If required, install a packed column adapter onto the detector column fitting. See “To Install a Packed Column Adapter on a Detector Fitting” on page 110.

11. Place a nut and ferrule onto the packed column.

12. Attach the column to the detector or detector adapter. Finger-tighten the nut.
13 Using two wrenches, one on the adapter and one on the column nut, tighten the column nut an additional 1/4 turn (for a 1/8-inch column) or an additional 3/4 turn (for a 1/4-inch column).

14 Exit maintenance mode. Select **Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Finished**.

15 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

16 Heat the oven to 200 °C, cool it to a safe handling temperature, then re-tighten the column connection. (Re-tighten until snug, only about 15 degrees rotation.) Repeat two more times. This process will set the Vespel/graphite ferrule to help prevent leaks.

17 Restore the analytical method.
   - For 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 adjust offset on the NPD bead.

**WARNING**
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 Perform the inlet **Leak & Restriction** test and reset the maintenance counters.
To Install a Packed Column Adapter on a Detector Fitting

This procedure applies to the FID, FPD+, NPD, and TCD.

1. Gather the following:
   - Packed column adapter, see “Consumables and Parts for the Packed Column Inlet” on page 93.
   - Ferrule, Vespel/graphite, 0.8-mm id
   - 7/16-inch wrench (for the packed column adapter and 1/8-inch packed column nuts)
   - 9/16-inch wrench (for 1/4-inch packed column nuts)
   - 1/8-inch nut and ferrule for a 1/8-inch packed column, or a 1/4-inch nut and ferrule for a 1/4-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.

3. Place a ferrule onto the packed column 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. Finger-tighten the adapter into the detector base, then tighten an additional 1/8 turn using a wrench.
To Install a Packed Column Adapter on a Detector Fitting

5  Exit maintenance mode. Select Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Finished.

After installation, heat the oven to 200 °C, cool it to a safe handling temperature, then re-tighten the column connection. (Re-tighten until snug, only about 15 degrees rotation.) Repeat two more times. This process will set the Vespel/graphite ferrule to help prevent leaks.
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 93.
   - Two 1/4-inch Vespel/graphite ferrules
   - Lint-free gloves


   **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.

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 114.

   **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.
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.

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.

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

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

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

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.

Allow the oven, inlet, and detector to equilibrate at operating temperature, then retighten the fittings.

Exit maintenance mode. Select Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Finished.

Restore the analytical method.
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.


**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 93.
   - 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 of column components]

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

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

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

Consumables and Parts for the Cool On-Column Inlet  117
Exploded Parts View of the Cool On-Column Inlet  120
To Install a Capillary Column with the Cool On-Column Inlet  121
To Check the Needle-to-Column Size on the COC Inlet  124
To Change a Septum on the COC Inlet  125
To Install an Insert on the COC Inlet  127
To Clean the COC Inlet  129
To Replace the 7693A Injector Needle Support Guide  131
To Replace a Needle in a Syringe  132
To Replace the Fused Silica Needle in a Syringe for the COC Inlet  133
To Bakeout Contaminants from the COC Inlet  134
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 13  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>G1545-80530</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 0.53-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>G1545-80530</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 15  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>
</tbody>
</table>
Maintaining Your GC

Table 15  Recommended parts for injections onto 0.32-mm fused silica columns (continued)

<table>
<thead>
<tr>
<th>Column type</th>
<th>Part number</th>
</tr>
</thead>
<tbody>
<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 0.25-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 17  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>
<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 18  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>
### Table 18  **Recommended septa for the COC inlet (continued)**

<table>
<thead>
<tr>
<th>Description</th>
<th>Part number/quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>For the duckbill septum</strong></td>
<td></td>
</tr>
<tr>
<td>Duckbill septum for manual injection only (must use cooling tower with duckbill)</td>
<td>19245-40050 (10/pk)</td>
</tr>
</tbody>
</table>

### 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>
<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 Cool On-Column 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

Figure 11. Cool on-column inlet exploded parts
To Install a Capillary Column with the Cool On-Column Inlet

1. Gather the following:
   - Column nut and ferrule, see "Consumables and Parts for the Cool On-Column Inlet" on page 117.
   - Column cutter
   - 1/4-inch and 5/16-inch wrenches
   - Lint-free gloves


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.

WARNING

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

CAUTION

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 127.

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.
To Install a Capillary Column with the Cool On-Column Inlet

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.

![Image showing good and bad column ends]

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.

![Image of hand inserting column]

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

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

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

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

14 Install the column into the detector.
   • 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 ECD
   • To Install a Capillary Column to the FPD+

15 Exit maintenance mode. Select Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Finished.

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 turn off the bead

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 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.

20 Perform an inlet Leak & Restriction test and reset the maintenance counters.
To Check the Needle-to-Column Size on the COC Inlet

1. Gather the following:
   - Insert, see “Consumables and Parts for the Cool On-Column Inlet” on page 117.
   - Syringe needle


   **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, replace the needle with one of the correct size. See “Consumables and Parts for the Cool On-Column Inlet” on page 117, and “To Replace a Needle in a Syringe” on page 132 or “To Replace the Fused Silica Needle in a Syringe for the COC Inlet” on page 133.

4. Identify the correct insert for the column size. See “Consumables and Parts for the Cool On-Column Inlet” on page 117. 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 Cool On-Column Inlet” on page 121.

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

7. 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 Cool On-Column Inlet” on page 117.
   - Tweezers
   - A thin wire (0.2-inch diameter) for removing septum from inlet
   - Lint-free gloves


   **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

   ![Septum Nut](image)
   ![Cooling Tower](image)

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

5 Perform an inlet **Leak & Restriction** test and reset the maintenance counters.

6 Select **Finished**, then select **OK** to exit.

7 Restore the analytical method.

For manual 200-µm injections with fused silica needle
To Install an Insert on the COC Inlet

1. Gather the following:
   - Lint-free gloves
   - Replacement insert, see “Consumables and Parts for the Cool On-Column Inlet” on page 117.


   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 125.

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.
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 124.

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

Install the spring on top of the insert.

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

Install the column. See “To Install a Capillary Column with the Cool On-Column Inlet” on page 121.

Exit maintenance mode. Select Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Finished.
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. Manually set the inlet and oven temperature to < 40 °C, and wait for the inlet, oven, and other parts you might come into contact with inside the oven, to cool before continuing. Alternately, place the GC in maintenance mode: Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Start Maintenance.

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

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

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

3. Remove the column.
4. Remove the septum nut or cooling tower and then remove the septum.
5. Remove the existing insert from the inlet by gently pushing it out from below with a wire or piece of column. Store the insert for possible later use.

6. Fill an ultrasonic cleansing bath with aqueous detergent and place the spring and insert into it. Sonicate for 1 minute.
7. Drain the aqueous detergent and fill the bath with distilled water. Sonicate for 1 minute.
8  **Maintaining the COC Inlet**

To Clean the COC Inlet

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

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

10 Install the insert. See “To Install an Insert on the COC Inlet” on page 127.

11 Install the column. See “To Install a Capillary Column with the Cool On-Column Inlet” on page 121.

12 Exit maintenance mode. Select **Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Finished**.
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 a Needle in a Syringe

1. Gather the following, see Table 16, “Recommended parts for injections onto 0.25-mm fused silica columns,” on page 118:
   - 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 Cool On-Column Inlet” on page 117.
   - Solvent

WARNING

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

2. Loosen the retaining nut and remove the old needle.
3. Hold the syringe vertically and insert the new fused silica needle so it is visible inside the syringe barrel. If the needle cannot be inserted into the syringe barrel, the PTFE ferrule may be blocked. You may need to replace the ferrule.
4. Push the plunger down until it bottoms. The needle will be flush with the plunger end.

5. Finger-tighten the retaining nut. Pull the needle gently to be sure the PTFE ferrule has formed a tight seal with the needle. Tighten the retaining nut further, if necessary.
6. Loosen the retaining nut just enough so the needle is again free.
7. Depress the syringe plunger slowly until it pushes the needle to the end of the barrel, then finger-tighten the retaining nut.
8. Use a solvent to rinse the syringe and check for leaks or blocks. Leaks may be fixed by further tightening the retaining nut. Blocks or serious leaks require repeating this procedure.
To Bakeout Contaminants from the COC Inlet

1. Set the column flow to the normal operating value, or set the capillary column gas velocity to 30 cm/s.
2. Purge the column with carrier flow for at least 10 minutes before heating the oven.
3. Set the inlet mode to Oven Track.
4. If the column is attached to the detector, set the detector 25 °C above normal operating temperature.
   If the column is not attached to the detector, cap the detector fitting.

**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.

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.
8  Maintaining the COC Inlet
   To Bakeout Contaminants from the COC Inlet
Maintaining the FID

Consumables and Parts for the FID  137
Exploded Parts Views of the Flame Ionization Detector  139
To Install a Capillary Column in the FID  141
To Replace an FID Jet  144
To Perform Maintenance on the FID Collector Assembly  147
To Check the FID Leakage Current  154
To Check the FID Baseline  155
To Install the Optional FID PTFE Chimney Insert  156
To Bakeout the FID  157
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 20  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>0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns</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 21  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>G4591-60691</td>
</tr>
<tr>
<td>1/8-inch Packed column adapter assembly</td>
<td>G3435-81340</td>
</tr>
<tr>
<td>1/4-inch Packed column adapter assembly</td>
<td>G3435-81330</td>
</tr>
<tr>
<td>Jet, FID, 0.011-inch id</td>
<td>G4591-20320</td>
</tr>
</tbody>
</table>

Table 22  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>G4591-60691</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, base</td>
<td>19231-20990</td>
</tr>
<tr>
<td>Collector mount</td>
<td>G4591-20690</td>
</tr>
<tr>
<td>Collector housing</td>
<td>19231-21010</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 Flame Ionization Detector

Figure 12. Flame ionization detector (FID) assembly exploded parts
9 Maintaining the FID
Exploded Parts Views of the Flame Ionization Detector

Figure 13. FID exploded parts view

Figure 14. FID collector assembly exploded parts view
To Install a Capillary Column in the FID

1. Gather the following materials, see “Consumables and Parts for the FID” on page 137:
   - Column
   - Ferrule(s)
   - Column nut
   - Column cutter
   - 1/4-inch open-end wrench
   - Septum
   - Isopropanol
   - Lab tissue
   - Lint-free gloves


   **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. Place a septum (if the column id is ≤0.1 mm), capillary column nut, and ferrule on the column.

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

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

7. Install the capillary column.
   - If the column id is greater than 0.1 mm:
     a. Gently insert the column into the detector until it bottoms; do not attempt to force it further.
     b. Finger-tighten the column nut, then withdraw the column about 2 mm. Tighten the nut an additional 1/4 turn with a wrench.
To Install a Capillary Column in the FID

If the column id is 0.1 mm or less position the column so it extends above the ferrule by 48 mm. 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.

8 Exit maintenance mode. Select Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Finished.
To Replace an FID Jet

1. Gather the following:
   • Replacement jet
   • 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


   **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 castle assembly and place it on a clean cloth.

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.

**CAUTION**

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 castle assembly.

11 Select Finished, then select OK to exit.

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 141.
   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 154.
   d Bakeout the detector. See “To Bakeout the FID” on page 157.
   e Restore the analytical method.

**WARNING**

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

   f Allow the oven, inlet, and detector to equilibrate at operating temperature, then retighten the fittings.

13 Check the FID baseline. See “To Check the FID Baseline” on page 155.
To Perform Maintenance on the FID Collector Assembly

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 137.
   - 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.


   **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. If you are not replacing the ignitor, skip to step 5.
   a. Disconnect the ignitor cable assembly.
   b. Loosen the ignitor with a wrench.
9 Maintaining the FID
To Perform Maintenance on the FID Collector Assembly

3. 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 secure the collector assembly to the FID mounting pallet.

**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.

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.
Maintaining Your GC

Maintaining the FID

To Perform Maintenance on the FID Collector Assembly

1. Remove the lower insulator with tweezers and place the parts on a clean cloth.

2. Remove the collector housing from the mount, if necessary.

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

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

4. 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 Exit maintenance mode. Select Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Finished.

21 Verify assembly:
   a Check the FID leakage current. See “To Check the FID Leakage Current” on page 154.
   b Bakeout the detector. See “To Bakeout the FID” on page 157.
   c Check the FID baseline. See “To Check the FID Baseline” on page 155.
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. 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 157.

4. 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. 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 157.
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

1. Bakeout the FID with the column installed or uninstalled. If uninstalled, gather the following, see “Consumables and Parts for the FID” on page 137:
   - Capillary adapter (adaptable FID only)
   - Column nut
   - No-hole ferrule

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

2. If the column is uninstalled:
   a. Cool the GC oven and detector
   b. Plug the detector connection with the capillary adapter, column nut, and no-hole ferrule

   **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.

3. 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 141.
10 Maintaining the TCD

Consumables and Parts for the Thermal Conductivity Detector 159
To Install a Capillary Column in the TCD 161
To Bakeout Contaminants from the TCD 164
Consumables and Parts for the Thermal Conductivity Detector

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 23  Nuts, ferrules, and hardware for capillary columns

<table>
<thead>
<tr>
<th>Column id (mm)</th>
<th>Description</th>
<th>Typical use</th>
<th>Part number/quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>.530</td>
<td>Ferrule, Vespel/graphite, 0.8-mm id</td>
<td>0.45-mm and 0.53-mm capillary columns</td>
<td>5062-3512 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>Ferrule, graphite, 1.0-mm id</td>
<td>0.53-mm capillary columns</td>
<td>5080-8773 (10/pk)</td>
</tr>
<tr>
<td></td>
<td>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>
### Table 24  Packed column adapters

<table>
<thead>
<tr>
<th>Description</th>
<th>Part number/quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/8-inch Packed column adapter assembly</td>
<td>G3435-81340</td>
</tr>
<tr>
<td>1/4-inch Packed column adapter assembly</td>
<td>G3435-81330</td>
</tr>
</tbody>
</table>
To Install a Capillary Column in the TCD

1. Gather the following materials, see “Consumables and Parts for the Thermal Conductivity Detector” on page 159:
   - Column
   - Ferrule(s)
   - Column nut
   - Column cutter
   - 1/4-inch open-end wrench
   - Septum
   - Isopropanol
   - Lab tissue
   - Lint-free gloves


   **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. Place a septum (if the column id is ≤ 0.1 mm), capillary column nut, and ferrule on the column.

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

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

7 Install the capillary column.
   If the column id is greater than 0.1 mm:
   a Gently insert the column into the detector until it bottoms; do not attempt to force it further.
   b Finger-tighten the column nut, then withdraw the column about 2 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). 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.

8 Exit maintenance mode. Select Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Finished.
To Bakeout Contaminants from the TCD

The bakeout can be performed with the column installed or the detector capped.

**CAUTION**
If the column is not installed, you must turn off the TCD filament and cap the detector column fitting to prevent irreparable damage to the filament caused by oxygen entering the detector.

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

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

2. Turn off the TCD filament.
3. If the column is attached to the inlet, maintain inert carrier gas flow through the column.

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

4. Set the reference gas flow rate between 20 and 30 mL/min.
5. Set the detector temperature to 375 °C.
6. Hold at 375 °C for several hours.
7. If the column is uninstalled, install it. See “To Install a Capillary Column in the TCD” on page 161.
8. Load the analytical method.

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

9. Allow the oven, inlet, and detector to equilibrate at operating temperature, then re-tighten the fittings.
10 Maintaining the TCD
To Bakeout Contaminants from the TCD
Maintaining the ECD

Important Safety Information About the ECD  167
Consumables and Parts for the ECD  169
Exploded Parts View of the Electron Capture Detector  171
To Replace the ECD Fused Silica Indented Mixing Liner and Install the Makeup Gas Adapter  172
To Install a Capillary Column in the ECD  175
To Bakeout the ECD  177

This section describes the routine maintenance tasks for the Electron Capture Detector (ECD). 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 ECD

The ECD 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:

- 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.
- Return the cell for disposal, following directions included with the License Verification Form (part number 19233-90750).
- 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.

**WARNING**

Do not use solvents to clean the ECD.

**WARNING**

You may not open the ECD cell unless authorized to do so by your local nuclear regulatory agency. Do not disturb the four socket-head bolts. These hold the cell halves together. United States customers removing or disturbing them is a violation of the terms of the exemption and could create a safety hazard.
When handling ECDs:

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

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 25 ECD 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>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 26 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>
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<tr>
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<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>
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</table>
## Table 26  Nuts, ferrules, and hardware for capillary columns (continued)

<table>
<thead>
<tr>
<th>Column id (mm)</th>
<th>Description</th>
<th>Typical use</th>
<th>Part number/quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ferrule, graphite, 0.4-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 Electron Capture Detector

Figure 15. Electron Capture Detector (ECD) exploded parts
To Replace the ECD 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 ECD" on page 169.
   - 1/4-inch Swagelok nut
   - 1/4-inch Vespel/graphite ferrule
   - 9/16-inch wrench
   - Methanol
   - Lint-free gloves

2. Place GC in maintenance mode: Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Start Maintenance. Wait for the GC to become ready to continue (all zones cooled to safe handling temperatures).

   **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 column from the makeup gas adapter.

   **CAUTION**
   To prevent damage avoid flexing/bending the tubing on the makeup gas adapter.

4. Remove the makeup gas adapter.
   a. Loosen the adapter nut with a wrench and slide out the makeup gas adapter from the ECD. 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.
5 Unscrew and remove the adapter cap.

**CAUTION**

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

6 Remove the fused silica indented mixing liner and inspect. Replace it if it is broken or contaminated with sample or graphite.

7 Ultrasonically clean the adapter cap in methanol. Clean the outer surfaces of the makeup gas adapter with methanol.

8 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.

9 Place a new 1/4-inch Swagelok nut and ferrule onto the makeup gas adapter.
To Replace the ECD Fused Silica Indented Mixing Liner and Install the Makeup Gas Adapter

10 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.

11 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.

12 Attach the column. See “To Install a Capillary Column in the ECD” on page 175.
13 Perform an inlet Leak & Restriction test and reset the maintenance counters.
14 Exit maintenance mode. Select Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Finished.
To Install a Capillary Column in the ECD

1. Gather the following:
   - Ferrule, see "Consumables and Parts for the ECD" on page 169.
   - Column nut
   - Septum
   - Column
   - 1/4-inch, 5/16-inch, and 9/16-inch wrenches
   - Column cutter
   - 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.

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

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

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

4. Place a septum (if the column id is ≤0.2 mm), capillary column nut, and ferrule on the column.

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

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

8. Install the column.

   If the column id is 200 um or more, push the column into the adapter until it stops at the indentation. Pull it back 1 to 2 mm and tighten the column nut with one 5/16-inch wrench on the adapter and another 1/4-inch wrench on the column nut.

   If the id is less the 200 um, mark the column with a septum 70 ± 1 mm from the end. Insert column and nut into the adapter with the septum at the rear of the column nut, and tighten the column nut with one 5/16-inch wrench on the adapter and another 1/4-inch wrench on the column nut.

9. After heating the detector, retighten the 9/16-inch makeup adapter nut and 1/4-inch column nut.

To Bakeout the ECD

Detector disassembly and/or cleaning procedures other than thermal should be performed only by personnel trained and licensed appropriately to handle radioactive materials. Trace amounts of radioactive $^{63}\text{Ni}$ may be removed during other procedures, causing possible hazardous exposure to $\beta$- and $\alpha$-radiation.

WARNING

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.

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 ECD” on page 169.
   • Blanking nut with any column ferrule

2 Place GC in maintenance mode: Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Start Maintenance. Wait for the GC to become ready to continue (all zones cooled to safe handling temperatures).

3 With the detector oven at normal operating temperatures, show the detector output signal in Status. Note the value of the Output for later comparison.
   a On the GC touchscreen go to Home > Status listing > +Add.
   b Select Detector 1 Output (or Detector 2 Output) from the drop-down list.
   c Touch Add.

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 ECD 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 ECD, set the oven temperature to 250 °C. If the column is uninstalled, leave the oven off to protect the column.
8 Allow thermal cleaning to continue for several hours and then cool the system to normal operating temperatures. The figure below shows detector output during a typical cleaning cycle.

9 Check the ECD 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.


12 Restore the analytical method.
To Bakeout the ECD
Maintaining the NPD

Consumables and Parts for the NPD  181
Exploded Parts View of the Nitrogen-Phosphorus Detector  183
To Install a Capillary Column in the NPD  184
To Replace the NPD Bead Assembly  187
To Maintain the NPD Collector, Ceramic Insulators, and Jet  191
To Check the NPD Leakage Current  196
To Bakeout the NPD  197
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).

Table 27  NPD parts

<table>
<thead>
<tr>
<th>Description</th>
<th>Part number/quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collector</td>
<td>G1534-20530</td>
</tr>
<tr>
<td>Screw, M3 × 0.5 × 8 mm</td>
<td>0515-0655</td>
</tr>
<tr>
<td>NPD Blos bead assembly</td>
<td>G3434-60806</td>
</tr>
<tr>
<td>Screw, M4 × 10 mm</td>
<td>0515-2495</td>
</tr>
<tr>
<td>J-clamp</td>
<td>1400-0015</td>
</tr>
<tr>
<td>NPD ceramic insulator kit</td>
<td>5182-9722</td>
</tr>
<tr>
<td>• Metal C-rings, top and bottom</td>
<td></td>
</tr>
<tr>
<td>• Ceramic insulators, upper and lower</td>
<td></td>
</tr>
<tr>
<td>NPD chemical sample kit solution of 0.65 ppm azobenzene, 1000 ppm octadecane, 1 ppm malathion in isooctane, 3 ampoules</td>
<td>18789-60060</td>
</tr>
<tr>
<td>NPD lid standoff</td>
<td>G1534-20590</td>
</tr>
<tr>
<td>NPD raised jet weldment</td>
<td>G4594-81000</td>
</tr>
<tr>
<td>Nut, 1/8-inch, brass, for packed column adapters</td>
<td>5180-4103 (10/pk)</td>
</tr>
<tr>
<td>Ferrule, Vespel/graphite, 1/8-inch, for packed column adapters</td>
<td>0100-1332 (10/pk)</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>
<tr>
<td>1/8-inch Packed column adapter assembly</td>
<td>G3435-81340</td>
</tr>
<tr>
<td>1/4-inch Packed column adapter assembly</td>
<td>G3435-81330</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>
</tbody>
</table>
Maintaining Your GC

<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>
Exploded Parts View of the Nitrogen-Phosphorus Detector

Figure 16. Nitrogen-Phosphorus Detector (NPD) exploded parts
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 181.
   - Column nut
   - Column cutter
   - 1/4-inch open-end wrench
   - Septum
   - Isopropanol
   - Lab tissue
   - Lint-free gloves


   **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. Place a septum (if the column id is ≤0.1 mm), capillary column nut, and ferrule on the column.

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

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

7 Install the capillary column.
   If the column id is greater than 0.1 mm:
   a Gently insert the column into the detector until it bottoms; do not attempt to force it further.
   b Finger-tighten the column nut, then withdraw the column about 2 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). 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.

8 Exit maintenance mode. Select Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Finished.
To Replace the NPD Bead Assembly

1. Gather the following:
   - Replacement NPD bead assembly, see “Consumables and Parts for the NPD” on page 181.
   - Lint-free gloves
   - T-10 Torx screwdriver

2. Set GC options for a new bead.
   a. On the GC touchscreen, go to Settings > Configuration > Detectors to enable Dry Bead and Auto Adjust.
   b. Then go to Methods > Detectors, scroll to Detectors Specifics, turn off the bead.

   Agilent data system users: Make the same changes noted above, apply them to the GC, and then save the data system method and shut down the instrument session.

3. Place GC in maintenance mode: Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Start Maintenance. Wait for the GC to become ready to continue (all zones cooled to safe handling temperatures).

   **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.

4. Turn off the NPD bead, and enable the Dry Bead and Auto Adjust settings.
   Agilent data system users: After turning off the bead, save the data system method and shut down the instrument session.

5. Remove the GC detector top cover. See “To Remove the Detector Top Cover” on page 18.

   **WARNING**
   Hazardous voltages are present when the electronics top cover is open.

6. Remove the electronics cover. See “To Remove the Electronics Cover” on page 20.

7. Put on lint-free gloves before touching any of the detector parts.

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

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

8. Remove the screw from the NPD cover then lift up and set aside. See Figure 17.
To Replace the NPD Bead Assembly

9 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.
10 Remove the 3 T-10 Torx screws from the bead assembly.

11 Gently lift up and remove the old bead assembly. Avoid bumping the bead on the sides of the collector.

12 Remove the protective cap covering the new bead.

13 Mount the new bead assembly on the NPD lid. Be careful not to bump the bead on the sides of the lid or collector.

14 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.

15 Carefully bend the bead assembly so it will mate with the bead power cable.

16 Reconnect the bead assembly cable to the NPD cable and twist the ring to lock the connection.
17 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.

18 Exit maintenance mode. Select Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Finished.

19 Restore normal NPD operating gas flows.

20 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.

21 Increase the temperature to operating value (310 to 320 °C recommended). Allow 15 minutes for equilibration.

22 Check the NPD leakage current. See “To Check the NPD Leakage Current” on page 196. If > 2.0 pA, verify bead installation or see the Troubleshooting manual.

23 If using an Agilent data system, connect to the instrument.

24 Restore the analytical method. Confirm the detector hydrogen, air, makeup gas flow rates.

25 Start the Adjust offset process. Enter the desired offset in the Target offset field. An offset of 25 to 30 pA is sufficient for most applications. The bead life may be shortened at a higher offset.

26 Reset the bead counter.
To Maintain the NPD Collector, Ceramic Insulators, and Jet

When replacing the jet, always install a new collector, ceramic insulators, and metal C-rings.

When replacing the collector, Agilent recommends replacing the ceramic insulators and metal C-rings.

**WARNING**

The insulation around the inlets, detectors, valve box, and the insulation cups is made of refractory ceramic fibers. To avoid inhaling fiber particles, we recommend the following safety procedures: ventilate your work area; wear long sleeves, gloves, safety glasses, and a disposable dust/mist respirator; dispose of insulation in a sealed plastic bag; wash your hands with mild soap and cold water after handling the insulation.

1. Gather the following:
   - NPD ceramic insulator kit, see “Consumables and Parts for the NPD” on page 181.
   - Collector
   - Cap for the bead
   - T-10 and T-20 Torx screwdrivers
   - Tweezers
   - Cotton swab
   - Solvent
   - Methanol
   - Jet
   - Lint-free gloves
   - Compressed, filtered dry air or nitrogen

**CAUTION**

The bead is delicate. Be careful not to break or crack the bead. When performing maintenance on the NPD, avoid touching the bead with your fingers, and prevent it from coming in contact with other surfaces.

2. Turn off the bead and disable Adjust Offset.

3. Check and note the NPD leakage current for reference. See “To Check the NPD Leakage Current” on page 196.

4. Place GC in maintenance mode: Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Start Maintenance. Wait for the GC to become ready to continue (all zones cooled to safe handling temperatures).

**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 187.
To Maintain the NPD Collector, Ceramic Insulators, and Jet

**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, then lift up the lid and set aside. The top metal C-ring and upper ceramic insulator may be attached to the lid.

7. Remove the screws that secure the cover base, then lift up the cover base and set aside.
8 Remove the screws that secure the interconnect cover, then lift up the cover and set aside.

9 Remove the screws that secure the electrometer, then lift up and set aside.

10 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.

11 Remove the large metal C-ring and the upper ceramic insulator if they were not attached to the lid.

12 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.
12 Maintaining the NPD
To Maintain the NPD Collector, Ceramic Insulators, and Jet

13 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.

14 If not replacing the jet, skip to step 21.
15 Remove the column from the detector.
16 Loosen the jet with a nut driver.
17 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.

18 Place the jet in the detector body.

19 Using a nut driver, tighten the jet 1/6 turn past finger-tight. *Do not overtighten.*

20 Attach the column to the detector.

21 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.

22 Install the bottom metal C-ring, the lower ceramic insulator, and the top metal C-ring. See Figure 19.

23 Install the collector.

24 Install the upper ceramic insulator and top metal C-ring above the collector. See Figure 18.

25 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.

26 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.

27 Install the J-clamp and screws to secure the electrometer to the pallet.


29 Install the bead assembly and restore normal operating conditions. See “To Replace the NPD Bead Assembly” on page 187. 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 196. If the leakage current is abnormal, check for proper reassembly of the detector (especially where the electrometer interconnect contacts the collector assembly) and for leaks.
To Check the NPD Leakage Current

1. Load the analytical method.
2. Turn Off the Bead.
   - Leave the NPD at operating temperature
   - Leave flows on or off
3. Show the detector output signal in Status.
4. Verify that the output (leakage current) is stable and < 2.0 pA.
   
The output should slowly drop towards 0.0 pA, and should stabilize in the tenths of a picoamp. Current > 2.0 pA indicates a problem.
Warning

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

1. Bakeout the NPD with the column installed or uninstalled. If uninstalled, gather the following, see “Consumables and Parts for the NPD” on page 181:
   - Column nut
   - No-hole ferrule

2. Place GC in maintenance mode: Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Start Maintenance. Wait for the GC to become ready to continue (all zones cooled to safe handling temperatures).

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. Turn off the bead.

4. 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.

5. Set normal operating flows.

6. Set the detector temperature at 25 °C above the typical method set-point 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 184.

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 196.

12. Start the NPD bead Auto Adjust process.

   Allow 1 to 2 hours for a new Blos bead to equilibrate.
13 Maintaining the FPD+

Consumables and Parts for the FPD+ 199
Exploded Parts View of the Flame Photometric Detector Plus 201
To Install a Capillary Column to the FPD+ 202
To Change the FPD+ Wavelength Filter 204
To Remove the FPD+ Cover 207
To Replace the FPD+ Ignitor 208
To Install the FPD+ Cover 210
Cleaning the FPD+ Brazement 211
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 29  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>Collet</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>Nut, 1/8-inch, brass, for packed column adapters</td>
<td>5180-4103 (10/pkg)</td>
</tr>
<tr>
<td>Ferrule, Vespel/graphite, 1/8-inch, for packed column adapters</td>
<td>0100-1332 (10/pkg)</td>
</tr>
<tr>
<td>Nut, 1/4-inch, brass, for packed column adapters</td>
<td>5180-4105 (10/pkg)</td>
</tr>
<tr>
<td>Ferrule, Vespel, 1/4-inch, for packed column adapters</td>
<td>5080-8774 (10/pkg)</td>
</tr>
<tr>
<td>1/8-inch Packed column adapter assembly</td>
<td>G3435-81340</td>
</tr>
<tr>
<td>1/4-inch Packed column adapter assembly</td>
<td>G3435-81330</td>
</tr>
<tr>
<td>Preventive maintenance kit, single FPD+</td>
<td>G3435-67000</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/pkg)</td>
</tr>
<tr>
<td></td>
<td>Ferrule, graphite, 1.0-mm id</td>
<td>0.53-mm capillary columns</td>
<td>5080-8773 (10/pkg)</td>
</tr>
<tr>
<td></td>
<td>Ferrule, graphite, 0.8-mm id</td>
<td>0.53-mm capillary columns</td>
<td>500-2118 (10/pkg)</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/pkg)</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>5080-8855 (10/pkg)</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 Flame Photometric Detector Plus

Figure 20. Flame Photometric Detector Plus (FPD+) single wavelength exploded parts
To Install a Capillary Column to the FPD+

1. Gather the following:
   - Column measuring tool, see “Consumables and Parts for the FPD+” on page 199.
   - Column cutter
   - 1/4-inch and 7/16-inch wrenches
   - Column nut
   - Ferrule
   - Capillary 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.

   **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.
To Install a Capillary Column to the FPD+

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.

11 Exit maintenance mode. Select **Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Finished.**
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 199.
   - Phosphorus filter
   - Cotton swab
   - Lens tissue
   - Lint-free gloves


3. Verify that the PMT voltage is 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.
To Change the FPD+ Wavelength Filter

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.

   CAUTION
   Do not use cleaning fluids. Cleaning fluids will damage lens coatings.

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 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).


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

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

2. Turn off the flame, then turn off the GC.

   **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 199.
   - Torx screwdrivers, T-20 and T-10
   - 5/16-inch nut driver (or wrench)


   **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 207.

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.
To Replace the FPD+ Ignitor

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 210.


10. Restore the analytical method.

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

12. Perform an inlet Leak & Restriction test and reset the maintenance counters.
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 brazement uses an inert coating layer. Abrasives may scratch this layer. Hard scrubbing can scratch this layer. Solutions or soaps with a pH > 8 can also damage this layer. Do not steam clean.

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 use the MMI inlet abrasive cleaning swab, G3510-80829.)
Maintaining EPC Modules

Consumables and Parts for the Aux EPC  213
Installing or Replacing Frits in the Aux EPC  215
Consumables and Parts for the PCM  217
Calibrating the PCM Interface  218
Installing or Replacing Frits in the PCM  219

This chapter describes the maintenance procedures for Auxiliary EPC (Aux) and Pneumatics Control Module (PCM). Pneumatic Switching Devices (PSD) do not have any required routine maintenance.
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 31 Aux EPC consumables

<table>
<thead>
<tr>
<th>Description</th>
<th>Part number</th>
</tr>
</thead>
<tbody>
<tr>
<td>O-rings, package of 6</td>
<td>5181-3344</td>
</tr>
<tr>
<td>Blue dot frit, high flow resistance</td>
<td>G3430-80063</td>
</tr>
<tr>
<td>Red dot frit, medium flow resistance</td>
<td>G3430-80062</td>
</tr>
<tr>
<td>Brown dot frit, low flow resistance</td>
<td>G3430-80061</td>
</tr>
<tr>
<td>No frit (brass tube), zero flow resistance</td>
<td>G3430-20011</td>
</tr>
</tbody>
</table>

### Table 32 Auxiliary channel frits

<table>
<thead>
<tr>
<th>Frit marking</th>
<th>Flow resistance</th>
<th>Flow characteristic</th>
<th>Often used with</th>
</tr>
</thead>
<tbody>
<tr>
<td>Three rings</td>
<td>High</td>
<td>3.33 ± 0.3 SCCM @ 15 PSIG</td>
<td>NPD Hydrogen</td>
</tr>
<tr>
<td>Blue</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Two rings</td>
<td>Medium</td>
<td>30 ± 1.5 SCCM H2 @ 15 PSIG</td>
<td>FID Hydrogen</td>
</tr>
<tr>
<td>Red</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>One ring</td>
<td>Low</td>
<td>400 ± 30 SCCM AIR @ 40 PSIG</td>
<td>FID Air, QuickSwap, Purged splitters, Deans Switch</td>
</tr>
<tr>
<td>Brown</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 32  Auxiliary channel frits (continued)

<table>
<thead>
<tr>
<th>Frit marking</th>
<th>Flow resistance</th>
<th>Flow characteristic</th>
<th>Often used with</th>
</tr>
</thead>
<tbody>
<tr>
<td>None (brass tube)</td>
<td>Zero</td>
<td>No restriction</td>
<td>Headspace vial pressurization, purged splitter and Deans Switch when using backflush</td>
</tr>
</tbody>
</table>
Installing or Replacing Frits in the Aux EPC

To install or replace a frit in the Aux EPC block:

1. Gather the following:
   • T-10 Torx screwdriver
   • Appropriate O-ring and frit
   • Tweezers

**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.

2. Turn off the gas supply to the channel.

3. To select the appropriate auxiliary channel frit. See Table 32.

4. Identify which frit needs to be changed. Trace the tubing as needed to confirm.

5. Remove the screw to the molded partner fitting.

6. Lift the molded partner fitting away from the Aux EPC module.

7. Remove the tubing weldment for the desired channel. This will expose the frit and its O-ring.

8. Gently remove the frit and O-ring using the tweezers. Be careful to avoid scratching the metal surfaces.

9. Place a new O-ring onto the end of the new frit, and insert the frit into the open end of the tubing weldment.
10 Place the tubing weldment into the Aux EPC module, and secure in place using the molded partner fitting and screw.

11 Restore gas flows and check for leaks at the fitting.

After installing or replacing a frit, be sure to update the Aux EPC module PIDs used with your module. If needed, update the Aux EPC module PIDs using the GC Firmware Update Tool available on www.agilent.com. To download the GC Firmware Update Tool, open a web browser, navigate to www.agilent.com, then in the search box type in "GC Firmware Update" to search for the tool.
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 33  PCM consumables

<table>
<thead>
<tr>
<th>Description</th>
<th>Part number</th>
</tr>
</thead>
<tbody>
<tr>
<td>O-rings, package of 12</td>
<td>5180-4181</td>
</tr>
<tr>
<td>Proportional valve, Carrier</td>
<td>G3430-67013</td>
</tr>
<tr>
<td>Proportional valve, AUX</td>
<td>G3430-67016</td>
</tr>
</tbody>
</table>
Calibrating the PCM Interface

The interface's flow module contains a pressure sensor that must be zeroed after it is installed on the GC. Calibration ensures an accurate interface pressure display.

Do not connect the carrier gas to the flow module until you have zeroed the interface's pressure sensor.

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).
6. Press On/Yes to zero or Clear to cancel.
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, p/n 5180-4181
   - Frit
   - Tweezers

2. Turn off the gas supply to the channel.

3. Select the appropriate frit.

4. Remove the screw holding the partner fitting 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.
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 PID's used with your PCM.
14 Maintaining EPC Modules
Installing or Replacing Frits in the PCM
Maintaining a Valve

Consumables and Parts for Valves  223
Exploded Parts View of GC Rotary Valves  224
To Replace a Gas Sampling Valve Loop  225
To Align a Rotary Valve Rotor  227
To Replace a Rotary Valve in the Valve Box  228
To Remove the Upper Valve Box  231
To Install the Upper Valve Box  232
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 34 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>
<td></td>
</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>
</tr>
<tr>
<td>2.0-mL nickel loop, 1/16-inch</td>
<td>0101-0955</td>
</tr>
<tr>
<td>5.00-cc</td>
<td>0101-0301</td>
</tr>
<tr>
<td>10.00-cc</td>
<td>0101-0302</td>
</tr>
<tr>
<td>Ferrule, 1/16-inch stainless steel (10/pk)</td>
<td>5181-1291</td>
</tr>
<tr>
<td>Nut, 1/16-inch (10/pk)</td>
<td>5181-1292</td>
</tr>
</tbody>
</table>
Exploded Parts View of GC Rotary Valves

Figure 22. GC rotary valve exploded parts
To Replace a Gas Sampling Valve Loop

1. Gather the following:
   - Replacement sample loop, see "Consumables and Parts for Valves" on page 223.
   - 1/4-inch wrench
   - Vacuum cleaner


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:
   - Ventilate your work area
   - Wear long sleeves, gloves, safety glasses, and a disposable dust/mist respirator
   - Dispose of insulation in a sealed plastic bag
   - Vacuum any residual particles and discard
   - 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 231.

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 232.


14 Restore the analytical method.
To Align a Rotary Valve Rotor

1. Gather the following:
   - Flathead screwdriver
   - 3-mm hex key wrench
   - T-20 Torx screwdriver

2. Set the oven and valve box heated zones to a safe handling temperature (25 °C).

3. Set all valves to Off.

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

4. Loosen the adjustment set screw.

5. Locate the rotor adjustment shaft on top of the actuator. Using a flathead screwdriver, rotate the valve rotor counterclockwise until it stops, then back it off a small amount to set one end of the rotor’s motion (< 1 mm).

6. Tighten the adjustment set screw.

7. Turn the valve On, turn Off to check for smooth operation.

8. Restore the analytical method.
To Replace a Rotary Valve in the Valve Box

**WARNING**

Do not install a liquid sampling valve (LSV) in the valve box if you plan to heat the box above 75 °C. Heating an LSV over 75 °C can cause a leak and subsequent explosion. LSVs should be mounted in the side location to avoid potential explosions.

1. Gather the following:
   - Replacement valve, see “Consumables and Parts for Valves” on page 223.
   - T-10 Torx screwdriver
   - 1/4-inch wrench
   - Needle-nosed pliers
   - Vacuum


**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.

**WARNING**

The valve box insulation is made of refractory ceramic fibers (RCFs). To avoid inhaling RCF particles, we recommend these safety procedures:

- Ventilate your work area
- Wear long sleeves, gloves, safety glasses, and a disposable dust/mist respirator
- Dispose of insulation in a sealed plastic bag
- Vacuum any residual particles and discard
- 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 231. 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 232.

15 Perform an inlet **Leak & Restriction** test and reset the maintenance counters.
15 Maintaining a Valve
To Replace a Rotary Valve in the Valve Box

16 Exit maintenance mode. Select Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Finished.

17 Restore the analytical method.
To Remove the Upper Valve Box

1. Gather a T-20 Torx screwdriver.
2. Set the valve box to a safe handling temperature (25 °C), or prepare for maintenance: Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Start Maintenance. Wait for the GC to become ready.

**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:

- Ventilate your work area
- Wear long sleeves, gloves, safety glasses, and a disposable dust/mist respirator
- Dispose of insulation in a sealed plastic bag
- Vacuum any residual particles and discard
- Wash your hands with mild soap and cold water after handling RCFs.
15 Maintaining a Valve
To Install the Upper Valve Box

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.
Maintaining a Valve
To Install the Upper Valve Box
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 23.

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. See Figure 24.

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 23. Swagelok nuts and ferrules

Figure 24. Assemble the fitting
5. Push the tube fully into the plug, then withdraw it approximately 1 to 2 mm as shown in Figure 25.

6. Finger-tighten the nut.

7. Mark the nut with a pencil line. See Figure 26.

8. For 1/8-inch Swagelok fittings, use a pair of 7/16-inch wrenches to tighten the fitting 3/4 of a turn. See Figure 27.

For 1/4-inch fittings, use a pair of 9/16-inch wrenches to tighten them 1-1/4 turn, as shown in Figure 27.
9 Remove the plug from the fitting. To connect the tubing, with nut and ferrules, to another fitting, finger-tighten the nut, then use a wrench to tighten it 3/4 (1/8-inch fittings) or 1-1/4 (1/4-inch fittings) of a turn.

10 Both correctly- and incorrectly-swaged connections are shown in Figure 28. 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 28. 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 29**.

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