

Agilent 8890 Gas Chromatograph

## Maintaining Your Gas Chromatograph (GC)



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# 1

## About Maintaining the GC

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

## Overview of Maintenance

This manual details the routine tasks needed to maintain the Agilent 8890 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 GC touchscreen

### 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)
- Cool On-Column Inlet (COC)
- Multimode Inlet (MMI)
- Programmable Temperature Vaporization Inlet (PTV)
- Volatiles Interface (VI)
- 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

Common tools	Part number
Wrench, angled, septum nut	19251-00100
Wrench, open-end, 1/4-inch and 5/16-inch	8710-0510*
Wrench, open-end, 9/16-inch and 7/16-inch	8710-0803
Wrench, capillary inlet	G3452-20512*
Flathead screwdriver	
Column cutter, wafer, 4/pk	5181-8836*
Driver, nut, 1/4-inch	8710-1561*
T-20 Torx key or screwdriver	8710-1807
T-10 Torx key or screwdriver	8710-2140
3-mm hex key wrench	8710-2411
Electronic flow meter(s) or bubble meter(s) capable of calibrated measurements at 1, 10, and 100 mL/min flow ranges	
Electronic leak detector	
Magnifying loupe, 20X	430-1020
Metric ruler	
Bench vise (for setting Swagelok fittings)	
Razor or sharp knife	
Tweezers, or thin needle-nose pliers	8710-0007 8710-0004
Needle-nose pliers	
ESD wrist strap (for installing new components)	9300-1408
Gloves, heat-resistant (for handling hot parts)	
Wooden cotton swab (for removing FID filters)	
Tools and materials for cleaning procedures	
Cleaning brushes—The FID cleaning kit contains appropriate brushes for cleaning detectors and inlets	9301-0985
Cleaning brushes—For cleaning split/splitless inlet split vent fitting, FID and collectors	8710-1346
Jet cleaning wire (.010-inch)	
Clean, lint-free cloth (to protect contamination-sensitive detector parts)	
Small ultrasonic cleaning bath with aqueous detergent (for cleaning detector and inlet parts)	

## 1 About Maintaining the GC

### Tools and Materials Required for Maintenance

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

Common tools	Part number
Gloves, clean, lint-free, nylon (for handling contamination-sensitive parts)	large: 8650-0030 small: 8650-0029
Steel wool, 0- or 00-grade (for cleaning an inlet's septum seating surfaces)	

\* 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, use the touchscreen: **Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Start Maintenance**. Follow the prompts. To exit maintenance mode and restore the previous GC settings, select **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**

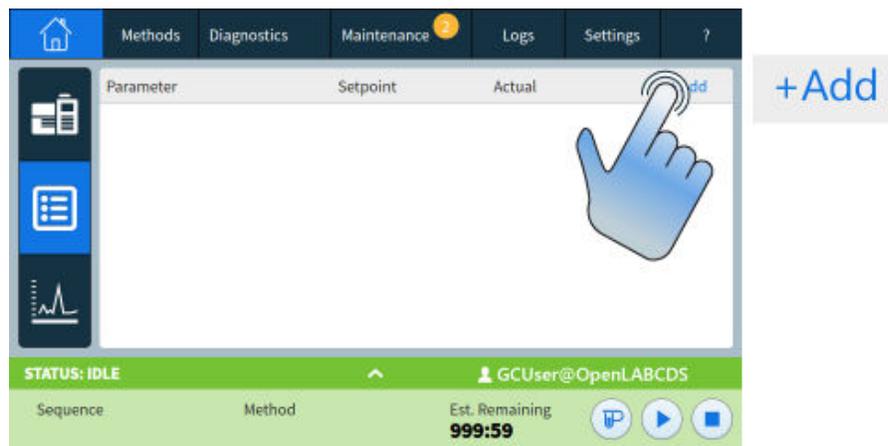
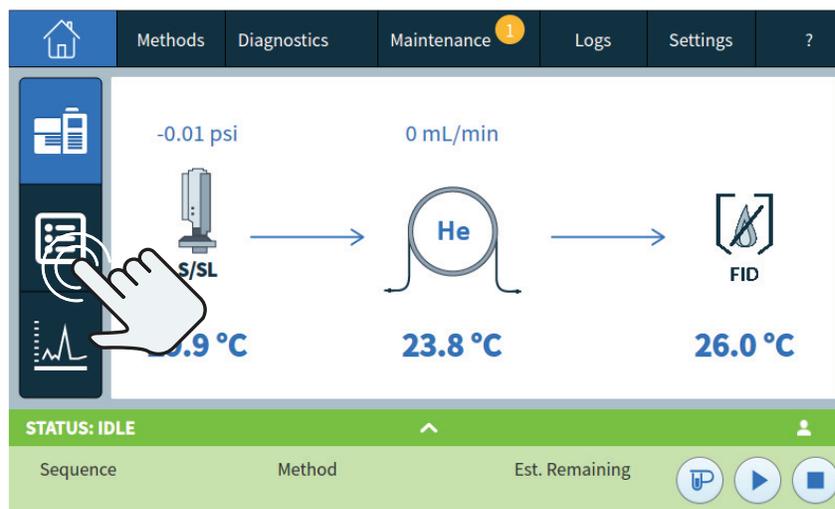
**If you choose to perform maintenance without using the GC's built-in features, first cool all heated zones in the instrument, including auxiliary heaters or other heated devices you might contact during maintenance. Then turn off the GC and unplug the power cord. If using cryogenic cooling, you will also need to turn off the cryogen supply and safely bleed off any residual backpressure.**

## Viewing Status Data

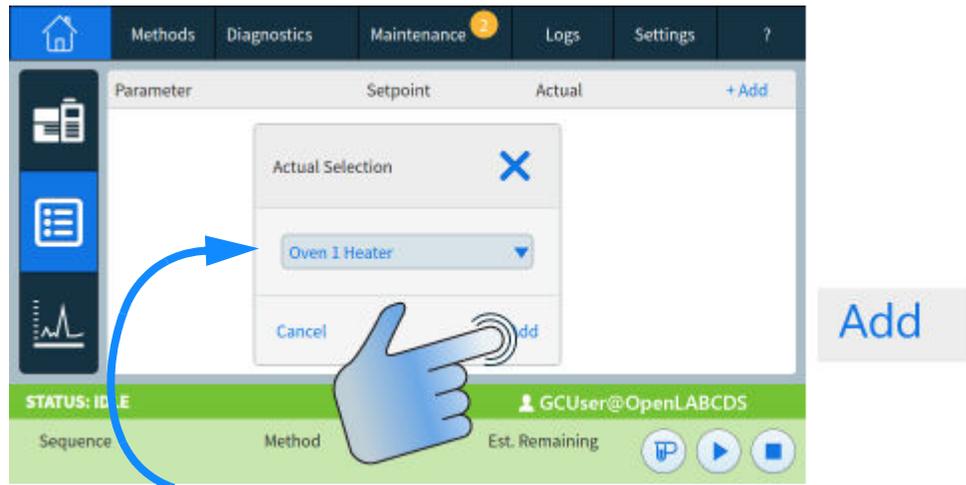
The GC can display signal and other data that can be very useful during maintenance. For example:

- 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.

Add an item to the GC status listing as follows:



1 About Maintaining the GC  
Viewing Status Data



Select the desired item from the drop-down list, then touch Add.

## 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.

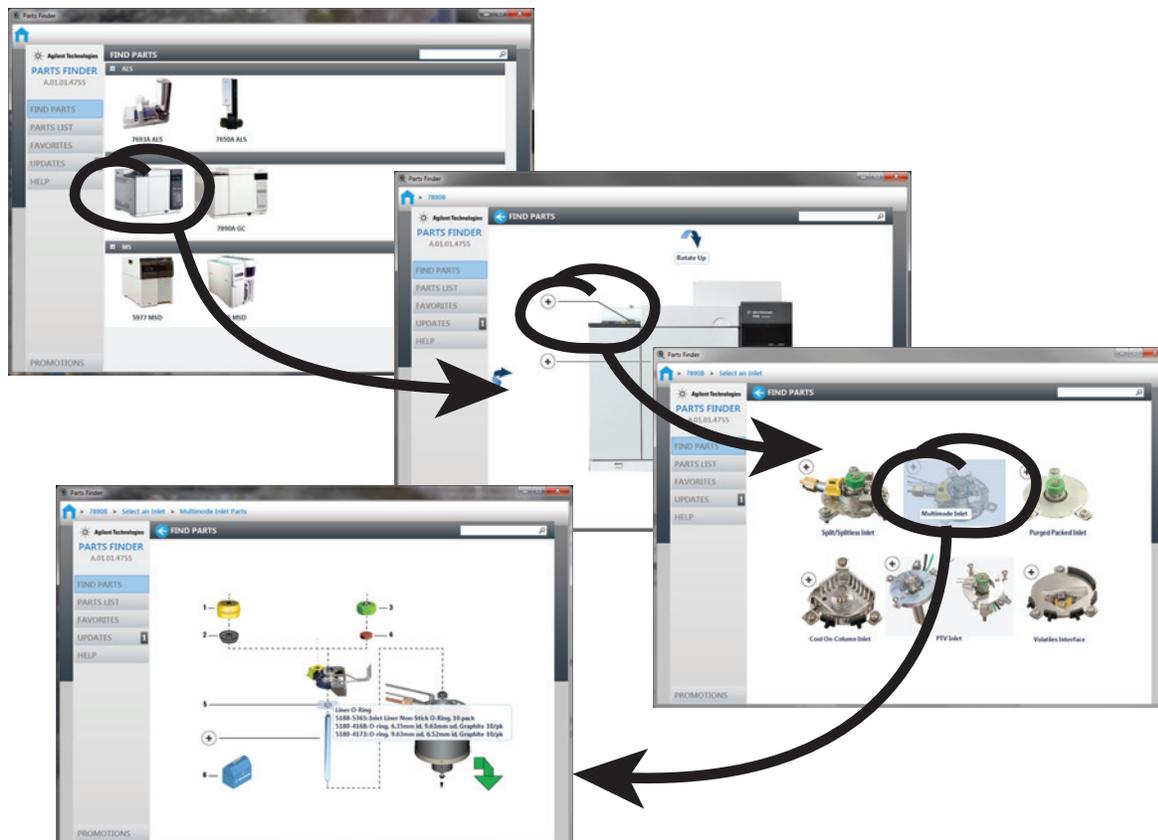


Figure 1. Quickly navigate to replacement parts by clicking on images of GC components

Part numbers are also included in this manual.

## 2

# Removing Covers

To Remove the Detector Top Cover 18

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.



Figure 2. 8890 GC covers

## 2 Removing Covers

### To Remove the Pneumatics Cover

# 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.

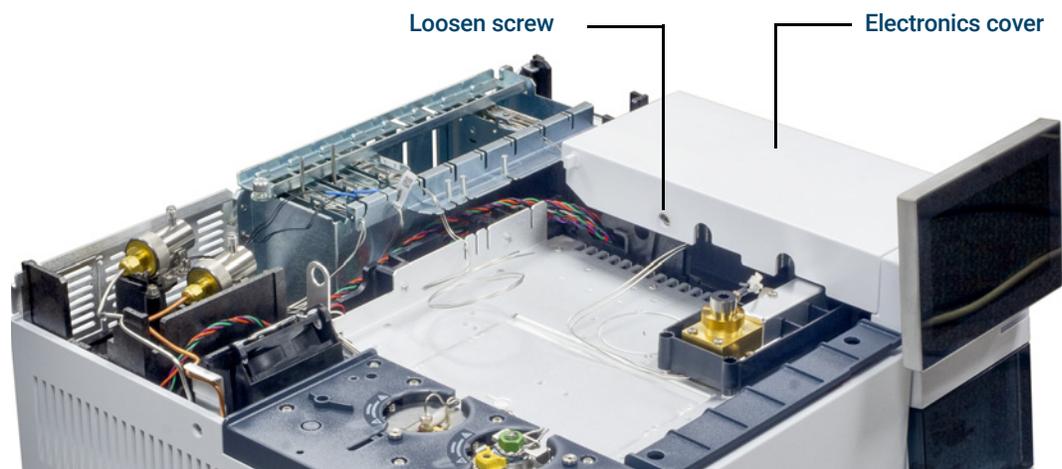


Figure 3. 8890 GC electronics cover

## 2 Removing Covers

### To Remove the Electronics Cover

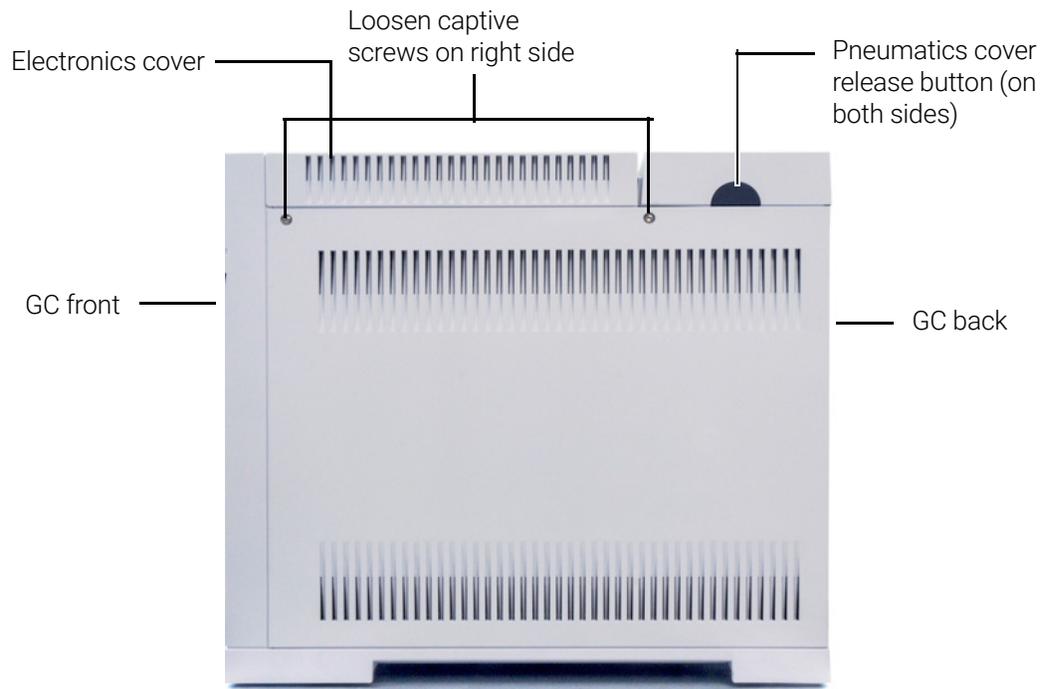


Figure 4. Loosen captive screws located on the right side of the GC

- 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**

# Consumables and Parts for General GC Maintenance

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

**Table 2 Consumables and parts for general GC maintenance**

Description	Part number
<b>Hydrogen sensor parts</b>	
Calibration gas cylinder, 2 percent hydrogen gas in 17 L compressed air	5190-6890
Cylinder stand with locking screw	1400-3583
Pressure regulator, with gage	G3440-80153
<b>Fittings and hardware</b>	
Fittings kit, 1/8-inch brass, 20/pk	5080-8750
Plug, 1/8-inch brass 6/pk	5180-4124
Tee, 1/8-inch brass 2/pk	5180-4160
Union, 1/8-inch brass 2/pk	5180-4127
Cross, union 1/8-inch brass	0100-0161
GC Supply Gas Installation Kit with Gas Purifiers	19199N
Installation kit for GCs without gas purifiers	19199M
PTFE tape	0460-1266
Copper tubing, 1/8-inch 12 ft.	5021-7107
Copper tubing, 1/8-inch od, 50 ft	5180-4196
<b>Gas regulators</b>	
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.	5183-4642
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.	5183-4641
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.	5183-4645
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.	5183-4644
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.	5183-4643
<b>Gas Clean Filters</b>	
Gas Clean connecting unit, 1-position), 1/4-inch	CP7980
Gas Clean connecting unit, 1-position), 1/8-inch	CP7988
Gas Clean connecting unit, 2-position), 1/4-inch	CP738406

### 3 Maintaining the GC

#### Consumables and Parts for General GC Maintenance

**Table 2 Consumables and parts for general GC maintenance (continued)**

Description	Part number
Gas Clean connecting unit, 2-position), 1/8-inch	CP738407
Gas Clean Smart Sensor for 8890 (replacement sensor)	CP179885
Gas Clean kit (connecting unit for one filter, one carrier gas filter, 1/8-inch connections, mounting bracket, and Smart Sensor) for new GC	
Connect unit, Gas Clean, 4 filter, 1/4-inch, 1/pk	CP7989
Gas Clean connecting unit, 4-position), 1/8-inch fittings	CP736520
Gas Clean high-flow connecting unit, 2-position), with 1/4-inch fittings, for high-flow applications such as ICP-MS or ICP-OES	CP17984
High flow connecting unit 1/8-inch	CP17985
Gas Clean filter GC-MS, 1/pk	CP17973
Gas Clean filter oxygen, 1/pk	CP17970
Gas Clean filter moisture, 1/pk	CP17971
Gas Clean filter charcoal, 1/pk	CP17972
Gas Clean filter kit for TCD	CP738408
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	CP179880
Gas Clean Filter kit (connecting unit for four filters, including four filters, 1/4-inch connections) for FID, FPD, NPD	CP7995
Gas Clean Filter kit (connecting unit for four filters, including four filters, 1/8-inch connections) for FID, FPD, NPD	CP736530
GC/MS Gas Clean Filter kit (includes one connecting unit and two GC/MS filters, 1/8-inch connections) for ECD, GC/MS	CP17976
GC/MS Gas Clean Filter kit (includes one connecting unit and two GC/MS filters, 1/4-inch connections) for ECD, GC/MS	CP17977
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	CP17978
TCD filter kit (with oxygen and moisture filters) for TCD	CO738408
Flush head, Gas Clean connecting unit, used to purge gas lines after installing connecting unit	CP7987
Gas Clean wall-mounting bracket for 1-position) connecting unit only	CP7981

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

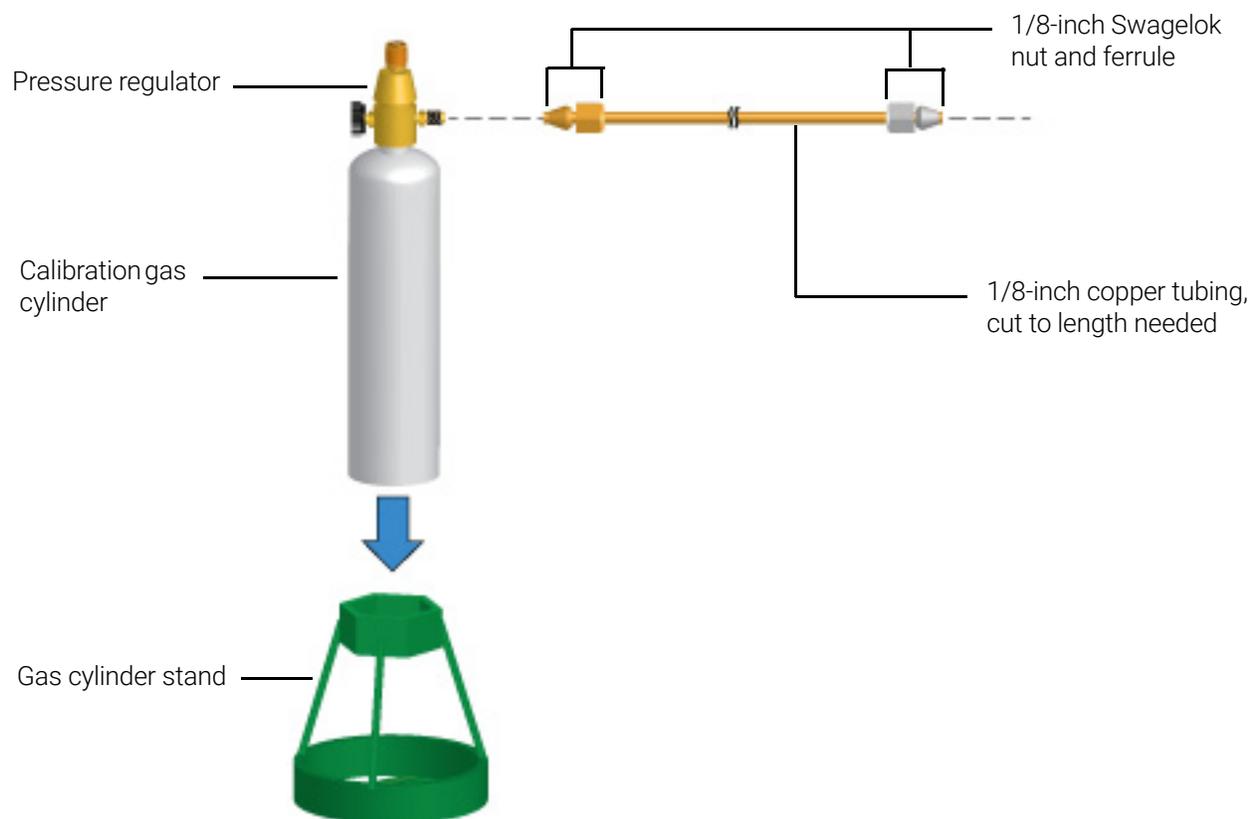


Figure 5. Hydrogen sensor calibration gas cylinder parts identification

## 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

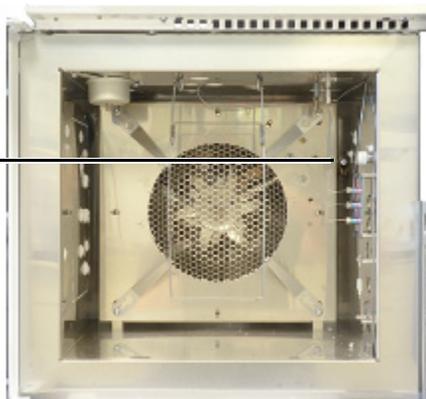
Connect only the Agilent calibration gas to the hydrogen sensor fitting. The calibration gas is 2% hydrogen in air and is not potentially explosive. Gases with higher concentrations of hydrogen can create a dangerous condition in the oven or damage the hydrogen sensor.

### 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.

Connect the flow meter to the hydrogen sensor tube next to the oven heater



- 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

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## Consumables and Parts for Columns

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

**Table 3 Nuts, ferrules, and hardware for capillary columns**

Column id (mm)	Description	Typical use	Part number/quantity
.530	Ferrule, Vespel/graphite, 0.8-mm id	0.45-mm and 0.53-mm capillary columns	5062-3512 (10/pk)
	Ferrule, graphite, 1.0-mm id	0.53-mm capillary columns	5080-8773 (10/pk)
	Ferrule, graphite, 0.8-mm id	0.53-mm capillary columns	500-2118 (10/pk)
	Column nut, finger-tight (for 0.53-mm columns)	Connect column to inlet or detector	5020-8293
.320	Ferrule, Vespel/graphite, 0.5-mm id	0.32-mm capillary columns	5062-3514 (10/pk)
	Ferrule, graphite, 0.5-mm id	0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853 (10/pk)
	Column nut, finger-tight (for .100- to .320-mm columns)	Connect column to inlet or detector	5020-8292
.250	Ferrule, Vespel/graphite, 0.4-mm id	0.1-mm, 0.2-mm, and 0.25-mm capillary columns	5181-3323 (10/pk)
	Ferrule, graphite, 0.5-mm id	0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853 (10/pk)
	Column nut, finger-tight (for .100- to .320-mm columns)	Connect column to inlet or detector	5020-8292
.100 and .200	Ferrule, Vespel/graphite, 0.37-mm id	0.1-mm and 0.2-mm capillary columns	5062-3516 (10/pk)
	Ferrule, Vespel/graphite, 0.4-mm id	0.1-mm, 0.2-mm, and 0.25-mm capillary columns	5181-3323 (10/pk)
	Ferrule, graphite, 0.5-mm id	0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853 (10/pk)
	Ferrule, graphite, 0.4-mm id		500-2114 (10/pk)
	Column nut, finger-tight (for .100- to .320-mm columns)	Connect column to inlet or detector	5020-8292
All	Ferrule, no-hole	Testing	5181-3308 (10/pk)
	Capillary column blanking nut	Testing—use with any ferrule	5020-8294
	Column nut, universal	Connect column to inlet or detector	5181-8830 (2/pk)
	Column nut, collared, self-tightening	Connect column to inlet or detector	G3440-81011
	Collar for self-tightening nut	Connect column to inlet or detector	G3440-81012
	Column nut, collared, self-tightening MSD	Connect column to inlet or detector	G3440-81013
	Column cutter, ceramic wafer	Cutting capillary columns	5181-8836 (4/pk)
	Pencil, diamond tipped	Cutting capillary columns	420-1000
	Ferrule tool kit	Ferrule installation	440-1000

## 4 Maintaining Capillary Columns

### Consumables and Parts for Columns

**Table 4** Capillary column hangers

Description	Part Number
Column hanger	1460-1914
Capillary column clip kit, for 7-inch column basket	G1530-61580

## To Install a Capillary Column Hanger

**WARNING**

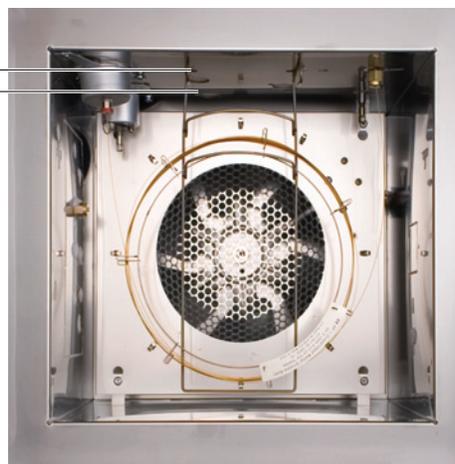
Be careful! The oven may be hot enough to cause burns. If the oven is hot, wear heat-resistant gloves to protect your hands.

**WARNING**

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

- 1 Place GC in maintenance mode: **Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Start Maintenance**. Wait for the GC to become ready.
- 2 Select either the front or back hanger position. (Hanger is shown in back position.)

Front position  
Back position



- 3 Insert the ends of the hanger into the slots in the selected position.

## To Install Capillary Column Clips

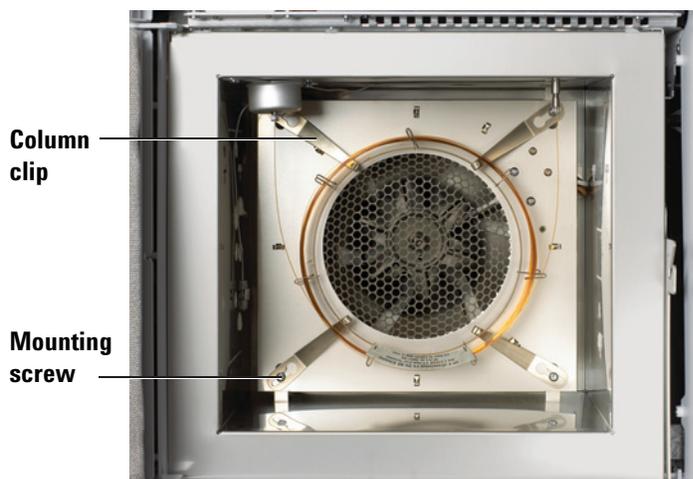
**WARNING**

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

This conditioning procedure provides generic instructions. Always follow the column manufacturer's recommendations.

- 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.**

### WARNING

**Be careful! The oven and all internal GC components 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 Manually set the inlet and oven temperature to  $< 40$  °C, and wait for the inlet, oven, and all other parts you might come into contact with inside the oven to cool before continuing.
- 3 Install the column into the inlet using new ferrules. If the column is already installed, skip this step. An installed column can be conditioned while connected to a detector.

### NOTE

**Perform the column installation procedure manually. Do not use the automated column installation wizard.**

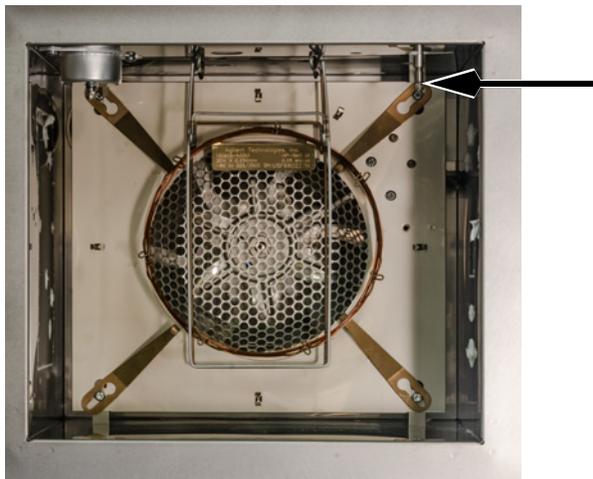
- **"To Install a Capillary Column with the Split/Splitless Inlet"**
- **"To Install a Capillary Column with the Multimode Inlet"**
- **"To Install a Capillary Column with the Purged Packed Inlet"**
- **"To Install a Capillary Column with the Cool On-Column Inlet"**
- **"To Install a Capillary Column with the Programmable Temperature Vaporization Inlet"**

## 4 Maintaining Capillary Columns

### To Condition a Capillary Column

- **“To Install a Capillary Column with the Volatiles Interface”**

- 4 Cap any open column fittings, for example, the detector column fitting.



- 5 Turn off all detectors.
- 6 Set a minimum velocity of 30 cm/s, or as recommended by the column manufacturer.
- 7 Set the oven to 120 °C.
- 8 Let gas flow through the column for 15 to 30 minutes to remove air.
- 9 Program the oven from 120 °C 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.
- 10 Manually set the oven temperature to < 40 °C, and wait for the oven, column and all other parts you might come into contact with inside the oven to cool before continuing.

#### 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.**

- 11 If not already installed, attach the column to the detector. For details, select your specific detector.

#### NOTE

**Perform the installation procedure manually. Do not use the automated installation wizard.**

- **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**

## 4 Maintaining Capillary Columns

### To Condition a Capillary Column

- **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.

### NOTE

Perform the installation procedure manually. Do not use the automated column installation wizard.

- [“To Install a Capillary Column with the Split/Splitless Inlet”](#)
  - [“To Install a Capillary Column with the Multimode Inlet”](#)
  - [“To Install a Capillary Column with the Purged Packed Inlet”](#)
  - [“To Install a Capillary Column with the Cool On-Column Inlet”](#)
  - [“To Install a Capillary Column with the Programmable Temperature Vaporization Inlet”](#)
  - [“To Install a Capillary Column with the Volatiles Interface”](#)
- 7 Exit maintenance mode. Select **Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Finished**.

## 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 37. 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.

### NOTE

Perform the installation procedure manually. Do not use the automated column installation wizard.

- **“To Install a Capillary Column with the Split/Splitless Inlet”**
- **“To Install a Capillary Column with the Multimode Inlet”**
- **“To Install a Capillary Column with the Purged Packed Inlet”**
- **“To Install a Capillary Column with the Cool On-Column Inlet”**
- **“To Install a Capillary Column with the Programmable Temperature Vaporization Inlet”**
- **“To Install a Capillary Column with the Volatiles Interface”**

- 7 Attach your column to the detector.

### NOTE

Perform the installation procedure manually. Do not use the automated column installation wizard.

- **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**

## 4 Maintaining Capillary Columns

### To Reverse a Column and Bakeout Contaminants

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

- 8 Exit maintenance mode. Select **Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Finished**.
- 9 Set the column flow to the normal operating value, or set the capillary column gas velocity to 30 cm/s.  
  
For Multimode, Split/Splitless, PTV, and VI inlets, select split mode and set the split vent flow to 200 mL/min.
- 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.
- 13 Bakeout for 30 minutes.

## To Attach a Capillary Column Using UltiMetal Plus Flexible Metal Fittings

The available UltiMetal Plus Flexible Metal ferrule packages are listed in **Table 5** and **Figure 6**.

**Table 5** Available UltiMetal Plus Flexible Metal ferrule packages

Item	Part number	Ferrule description
1	G3188-27501	0.1 – 0.25 mm column id, 10/pk
2	G3188-27502	0.32 mm column id, 10/pk
3	G3188-27503	0.45 – 0.53 mm column id, 10/pk
4	G3188-27504	Plug, 10/pk
5	G3188-27505	0.25 – 0.32 mm UltiMetal column id, 10/pk
6	G3188-27506	0.53 mm UltiMetal column id, 10/pk



Figure 6. UltiMetal Plus Flexible Metal ferrules

Each UltiMetal Plus Flexible Metal ferrule part number is uniquely designed to prevent inventory mix-ups, and to help you find the ferrule you need quickly. Color variations between ferrules are a normal result of the UltiMetal coating.

### Preparing the column installation to the CFT fitting

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

- 1 Gather the following:
  - UltiMetal Plus Flexible Metal ferrules. See **Table 5**.
  - Swaging tool (G3440-80227)
  - Two 1/4-inch open-end wrenches
  - Column cutting tool (5181-8836)
  - Internal nut (G2855-20530)
  - Lint free gloves
- 2 Check the column end. It should be square and free of cracks. If needed, trim it.
- 3 Pass the column end through the internal nut and the ferrule, as shown in **Figure 7**.

## 4 Maintaining Capillary Columns

### Preparing the column installation to the CFT fitting



Figure 7. Thread the column through the internal nut, ferrule, and swaging tool

- 4 Insert the column into the swaging tool until it bottoms.
- 5 Thread the internal nut into the swaging tool until finger tight. See **Figure 8**.

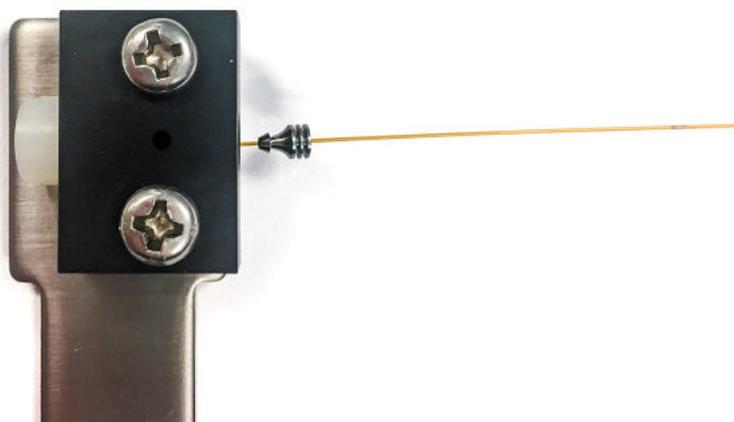


Figure 8. Thread the internal nut into the swaging tool

- 6 Begin to swage the ferrule to the column using a 1/4-inch open-ended wrench.  
The design of UltiMetal Plus Flexible Metal ferrules reduces the probability of column breakage and minimizes the damage to the thread of the corresponding fittings.  
Unlike other ferrule designs, a reliable leak-free seal is best made by tightening the internal nut to a recommended number of degrees, not by applying more force. Applying excessive force will not provide a better seal. Also, compressing the flexible ferrule less minimizes damage to fittings.  
To swage the ferrule to the column:
  - a Find your ferrule type in **Table 6** and note the range of degrees to tighten the internal nut.
  - b Tighten the internal nut clockwise to the lower end of your ferrule's range.
  - c Check if the ferrule is gripping the column. If yes, stop. If not, continue to tighten the internal nut in small 5- to 15-degree increments. Check after each increment to see if the ferrule is gripping the column. Stop as soon as gripping occurs. See **Figure 9**.

#### 4 Maintaining Capillary Columns

Preparing the column installation to the CFT fitting

**Table 6** Degrees to tighten the internal nut for proper swaging

Ferrule part number	Degrees to tighten internal nut
G3188-27501	50 – 100 degrees
G3188-27502	30 – 70 degrees
G3188-27503	20 – 50 degrees
G3188-27504	60 degrees
G3188-27505	40 – 90 degrees
G3188-27506	20 – 50 degrees

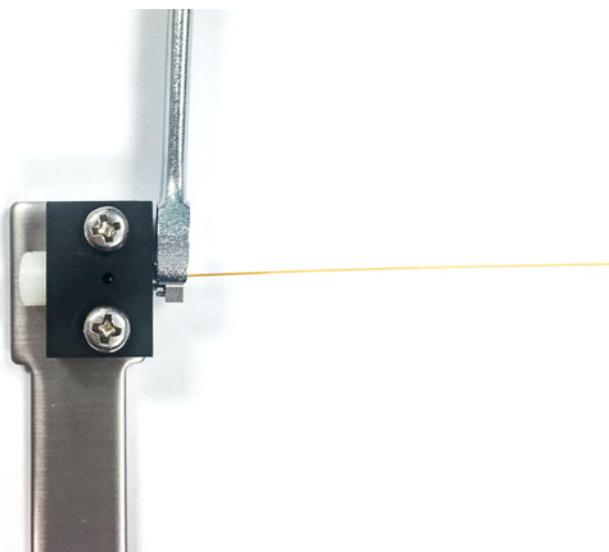


Figure 9. Tighten the internal nut

- Using the 1/4-inch open-ended wrench, turn the internal nut an additional 15 to 20 degrees clockwise to assure the ferrule is properly swaged onto the column. See **Figure 10**.

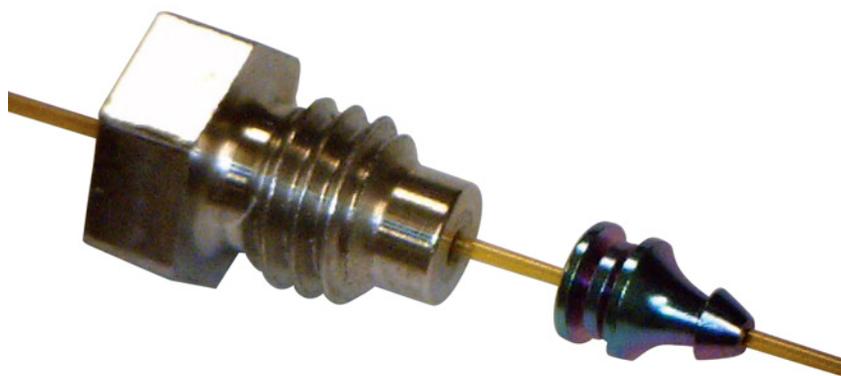


Figure 10. Ferrule swaged to column and internal nut

## 4 Maintaining Capillary Columns

### Preparing the column installation to the inlet

- Using the 1/4-inch open-ended wrench, remove the internal nut from the swaging tool and column.

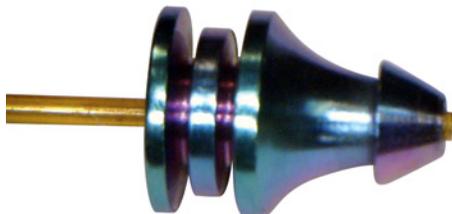


Figure 11. Properly-trimmed column and ferrule

## Preparing the column installation to the inlet

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

- Gather the following:
  - UltiMetal Plus Flexible Metal ferrules. See [Table 5](#).
  - Swaging tool (G3440-80218)
  - Two 1/4-inch open-end wrenches
  - Column cutting tool (5181-8836)
  - Column nut
  - Lint free gloves
- Check the column end. It should be square and free of cracks. If needed, trim it. See [Figure 12](#)

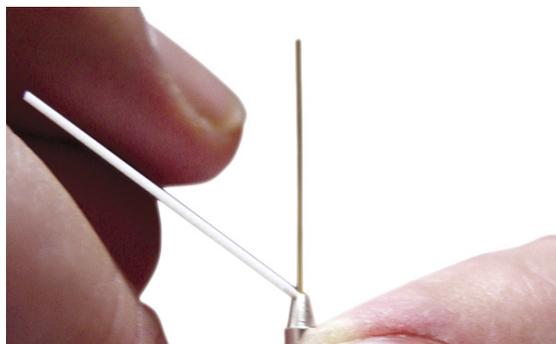


Figure 12.

- Pass the column end through the column nut, the ferrule, and the swaging tool, as shown in [Figure 13](#).

#### 4 Maintaining Capillary Columns

Preparing the column installation to the inlet

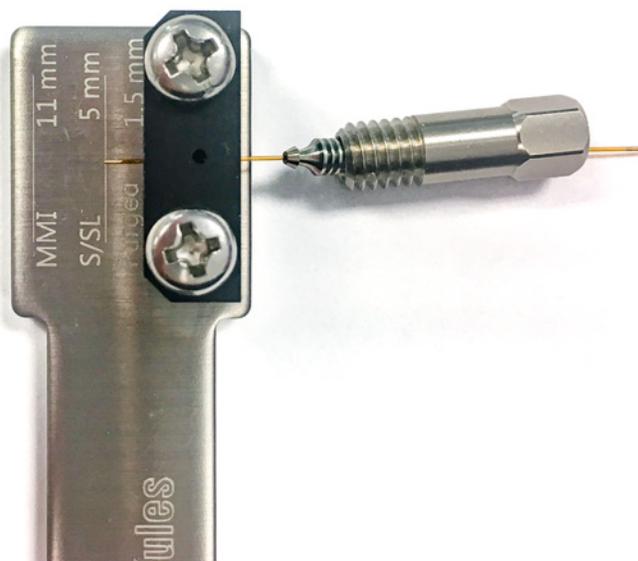


Figure 13. Thread the column through the column nut, ferrule, and swaging tool

- 4 Loosely thread the column nut into the swaging tool until you start to feel resistance. The column should still slide freely. See **Figure 14**.

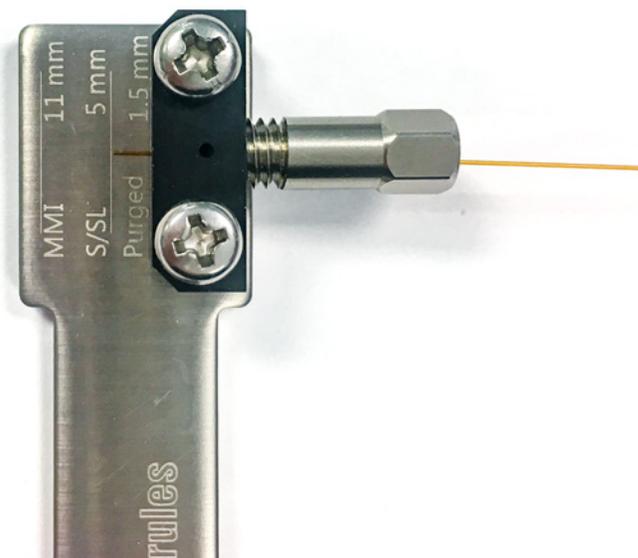


Figure 14. Thread the column nut onto the swaging tool

- 5 Adjust the column position in the tool until the column end aligns with the correct dimension for the inlet. See **Figure 15**.

#### 4 Maintaining Capillary Columns

Preparing the column installation to the inlet

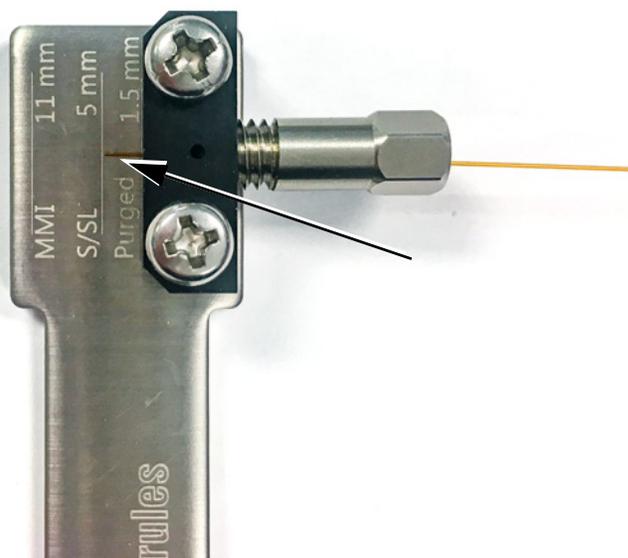


Figure 15. Align column (split/splitless shown)

- 6 Begin to swage the ferrule to the column using a 1/4-inch open-ended wrench.

The design of UltiMetal Plus Flexible Metal ferrules reduces the probability of column breakage and minimizes the damage to the thread of the corresponding fittings.

Unlike other ferrule designs, a reliable leak-free seal is best made by tightening the column nut to a recommended number of degrees, not by applying more force. Applying excessive force will not provide a better seal. Also, compressing the flexible ferrule less minimizes damage to fittings.

To swage the ferrule to the column:

- a Find your ferrule type in **Table 7** and note the range of degrees to tighten the column nut.
- b Tighten the column nut clockwise to the lower end of your ferrule's range.
- c Check if the ferrule is gripping the column. If yes, stop. If not, continue to tighten the column nut in small 5- to 15-degree increments. Check after each increment to see if the ferrule is gripping the column. Stop as soon as gripping occurs. See **Figure 16**.

**Table 7** Degrees to tighten the column nut for proper swaging

Ferrule part number	Degrees to tighten internal nut
G3188-27501	50 – 100 degrees
G3188-27502	30 – 70 degrees
G3188-27503	20 – 50 degrees
G3188-27504	60 degrees
G3188-27505	40 – 90 degrees
G3188-27506	20 – 50 degrees

#### 4 Maintaining Capillary Columns

Preparing the column installation to the inlet

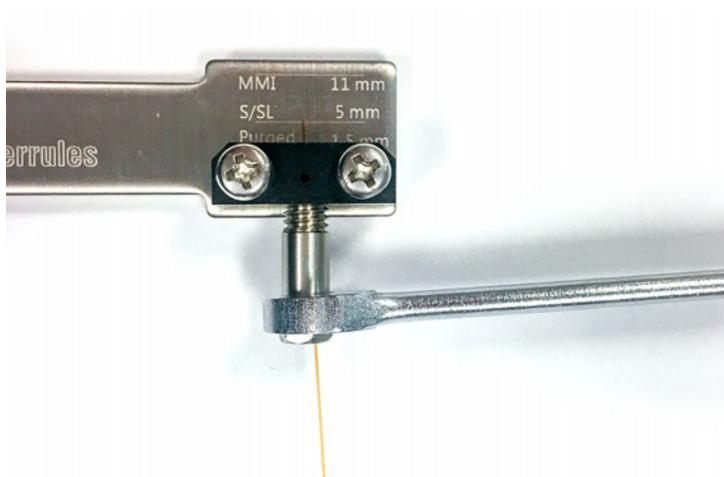


Figure 16. Tighten the column nut

- 7 Using the 1/4-inch open-ended wrench, turn the column nut an additional 15 to 20 degrees clockwise to assure the ferrule is properly swaged onto the column. See **Figure 17**.

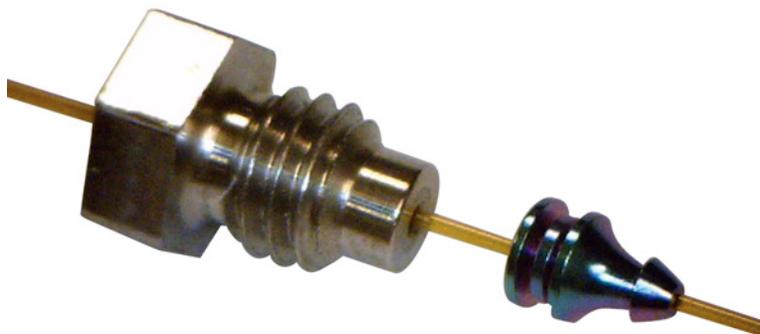


Figure 17. Ferrule swaged to column and column nut

- 8 Using the 1/4-inch open-ended wrench, remove the column nut from the swaging tool and column.

## Swaging Quality Inspection

**Figure 18** shows both an incorrect and correct swaging symmetry.



Figure 18. Incorrect and correct swaging symmetry

If your column and ferrule appear like the incorrect example in **Figure 18** above, it is possible that your swaging wrench is defective or worn out. Try swaging with a new wrench or new nut.

#### 4 Maintaining Capillary Columns To Remove the Ferrule From a CFT Fitting

## To Remove the Ferrule From a CFT Fitting

Loosen and remove the internal nut. If the ferrule does not release from the fitting, do not try to pull the column free. Insert a pointed object (such as a thumb pin or a paper clip) into the ferrule release hole, as **shown** in **Figure 19**, and press firmly. You will hear a click as the ferrule releases.

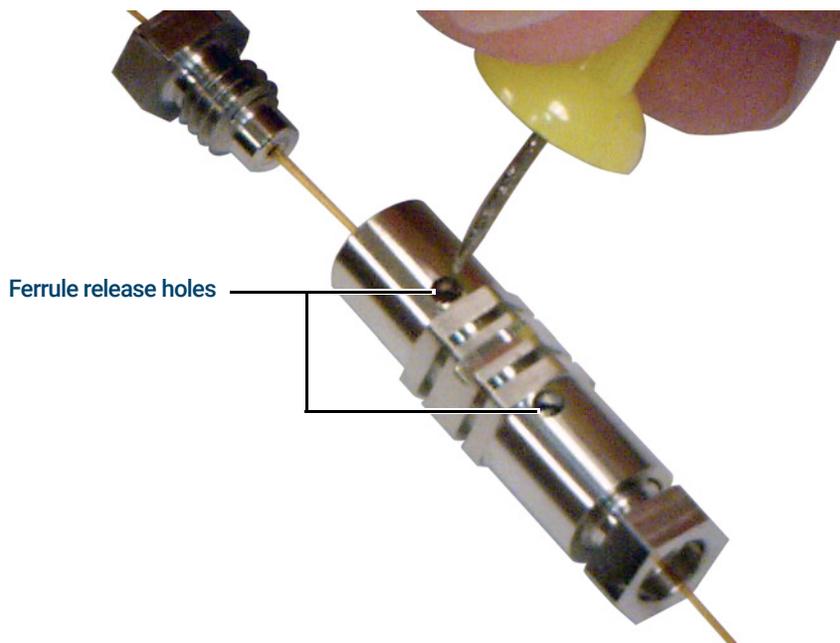


Figure 19. Release the ferrule (Ultimate Union fitting shown)

## 5

# Maintaining the Split/Splitless Inlet

- Consumables and Parts for the Split/Splitless Inlet 50
- Exploded Parts View of the Split/Splitless Inlet 53
- To Install a Capillary Column with the Split/Splitless Inlet 54
- To Change the Septum on the Split/Splitless Inlet 58
- To Clean the Septum Seat in the Insert Assembly of the Split/Splitless Inlet 60
- To Change the Liner and O-Ring on the Split/Splitless Inlet 62
- To Replace the Gold Seal on the Split/Splitless Inlet 65
- To Replace the Filter in the Split Vent Trap for the Split/Splitless Inlet 67
- To Clean the Split/Splitless Inlet 69
- To Bakeout Contaminants from the Split/Splitless Inlet 71

## Consumables and Parts for the Split/Splitless Inlet

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

**Table 8 Split, splitless, direct, and direct connect inlet liners**

Mode	Description	Deactivated	Part number
Split	Low-pressure drop, glass wool, single taper, 870 µL	Yes	5183-4647
Split	Glass wool, 990 µL	No	19251-60540
Split	MS Certified, single taper, glass wool	Yes	5188-6576
Split—Manual only	Empty pin and cup, 800 µL	No	18740-80190
Split—Manual only	Packed pin and cup, 800 µL	No	18740-60840
Split or splitless	Ultra Inert, low pressure drop, glass wool	Yes	5190-2295
Splitless	Single taper, glass wool, 900 µL	Yes	5062-3587
Splitless	Single taper, no glass wool, 900 µL	Yes	5181-3316
Splitless	Dual taper, no glass wool, 800 µL	Yes	5181-3315
Splitless	MS Certified, single taper, glass wool	Yes	5188-6568
Splitless	Ultra Inert, low-frit liner, 4-mm (1/pk)	Yes	5190-5112
Splitless	Ultra Inert, low-frit liner, 4-mm (5/pk)	Yes	5190-5112-005
Splitless—Direct inject	2-mm id, quartz, 250 µL	No	18740-80220
Splitless—Direct inject	2-mm id, 250 µL	Yes	5181-8818
Direct inject —Headspace or purge and trap	1.5-mm id, 140 µL	No	18740-80200
Direct column connect	Single taper, splitless 4-mm id	Yes	G1544-80730
Direct column connect	Dual taper, splitless 4-mm id	Yes	G1544-80700
Universal	Ultra Inert, mid-frit liner, 4-mm (1/pk)	Yes	5190-5105
Universal	Ultra Inert, mid-frit liner, 4-mm (5/pk)	Yes	5190-5105-005

**Table 9 Nuts, ferrules, and hardware for capillary columns**

Column id (mm)	Description	Typical use	Part number/quantity
.530	Ferrule, Vespel/graphite, 0.8-mm id	0.45-mm and 0.53-mm capillary columns	5062-3512 (10/pk)
	Ferrule, graphite, 1.0-mm id	0.53-mm capillary columns	5080-8773 (10/pk)
	Ferrule, graphite, 0.8-mm id	0.53-mm capillary columns	500-2118 (10/pk)
	Column nut, finger-tight (for 0.53-mm columns)	Connect column to inlet or detector	5020-8293

## 5 Maintaining the Split/Splitless Inlet

### Consumables and Parts for the Split/Splitless Inlet

**Table 9 Nuts, ferrules, and hardware for capillary columns (continued)**

Column id (mm)	Description	Typical use	Part number/quantity
.320	Ferrule, Vespel/graphite, 0.5-mm id	0.32-mm capillary columns	5062-3514 (10/pk)
	Ferrule, graphite, 0.5-mm id	0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853 (10/pk)
	Column nut, finger-tight (for .100- to .320-mm columns)	Connect column to inlet or detector	5020-8292
.250	Ferrule, Vespel/graphite, 0.4-mm id	0.1-mm, 0.2-mm, and 0.25-mm capillary columns	5181-3323 (10/pk)
	Ferrule, graphite, 0.5-mm id	0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853 (10/pk)
	Column nut, finger-tight (for .100- to .320-mm columns)	Connect column to inlet or detector	5020-8292
.100 and .200	Ferrule, Vespel/graphite, 0.37-mm id	0.1-mm and 0.2-mm capillary columns	5062-3516 (10/pk)
	Ferrule, Vespel/graphite, 0.4-mm id	0.1-mm, 0.2-mm, and 0.25-mm capillary columns	5181-3323 (10/pk)
	Ferrule, graphite, 0.5-mm id	0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853 (10/pk)
	Ferrule, graphite, 0.4-mm id		500-2114 (10/pk)
	Column nut, finger-tight (for .100- to .320-mm columns)	Connect column to inlet or detector	5020-8292
All	Ferrule, no-hole	Testing	5181-3308 (10/pk)
	Capillary column blanking nut	Testing—use with any ferrule	5020-8294
	Column nut, universal	Connect column to inlet or detector	5181-8830 (2/pk)
	Column nut, collared, self-tightening	Connect column to inlet or detector	G3440-81011
	Collar for self-tightening nut	Connect column to inlet or detector	G3440-81012
	Column nut, collared, self-tightening MSD	Connect column to inlet or detector	G3440-81013
	Column cutter, ceramic wafer	Cutting capillary columns	5181-8836 (4/pk)
	Pencil, diamond tipped	Cutting capillary columns	420-1000
	Ferrule tool kit	Ferrule installation	440-1000

**Table 10 Other consumables and parts for the split/splitless inlet**

Description/quantity	Part number
Septum retainer nut for headspace	18740-60830
Septum retainer nut	18740-60835
11-mm septum, high-temperature, low-bleed, 50/pk	5183-4757
11-mm septum, prepierced, long life, 50/pk	5183-4761
Nonstick fluorocarbon liner O-ring (for temperatures up to 350 °C), 10/pk	5188-5365

## 5 Maintaining the Split/Splitless Inlet

### Consumables and Parts for the Split/Splitless Inlet

**Table 10 Other consumables and parts for the split/splitless inlet (continued)**

Description/quantity	Part number
Graphite O-ring for split liner (for temperatures above 350 °C), 10/pk	5180-4168
Graphite O-ring for splitless liner (for temperatures above 350 °C), 10/pk	5180-4173
Split vent trap PM kit, single cartridge	5188-6495
Retaining nut	G1544-20590
Gold-plated seal (standard application)	5188-5367
Gold-plated seal with cross (high split flows) (includes SS washer)	5182-9652
Stainless steel washer (0.375-inch od), 12/pk	5061-5869
Reducing nut	18740-20800
Column nut, blanking plug	5020-8294
Capillary inlet preventative maintenance kit, split	5188-6496
Capillary inlet preventative maintenance kit, splitless	5188-6497

5 Maintaining the Split/Splitless Inlet  
Exploded Parts View of the Split/Splitless Inlet

# Exploded Parts View of the Split/Splitless Inlet

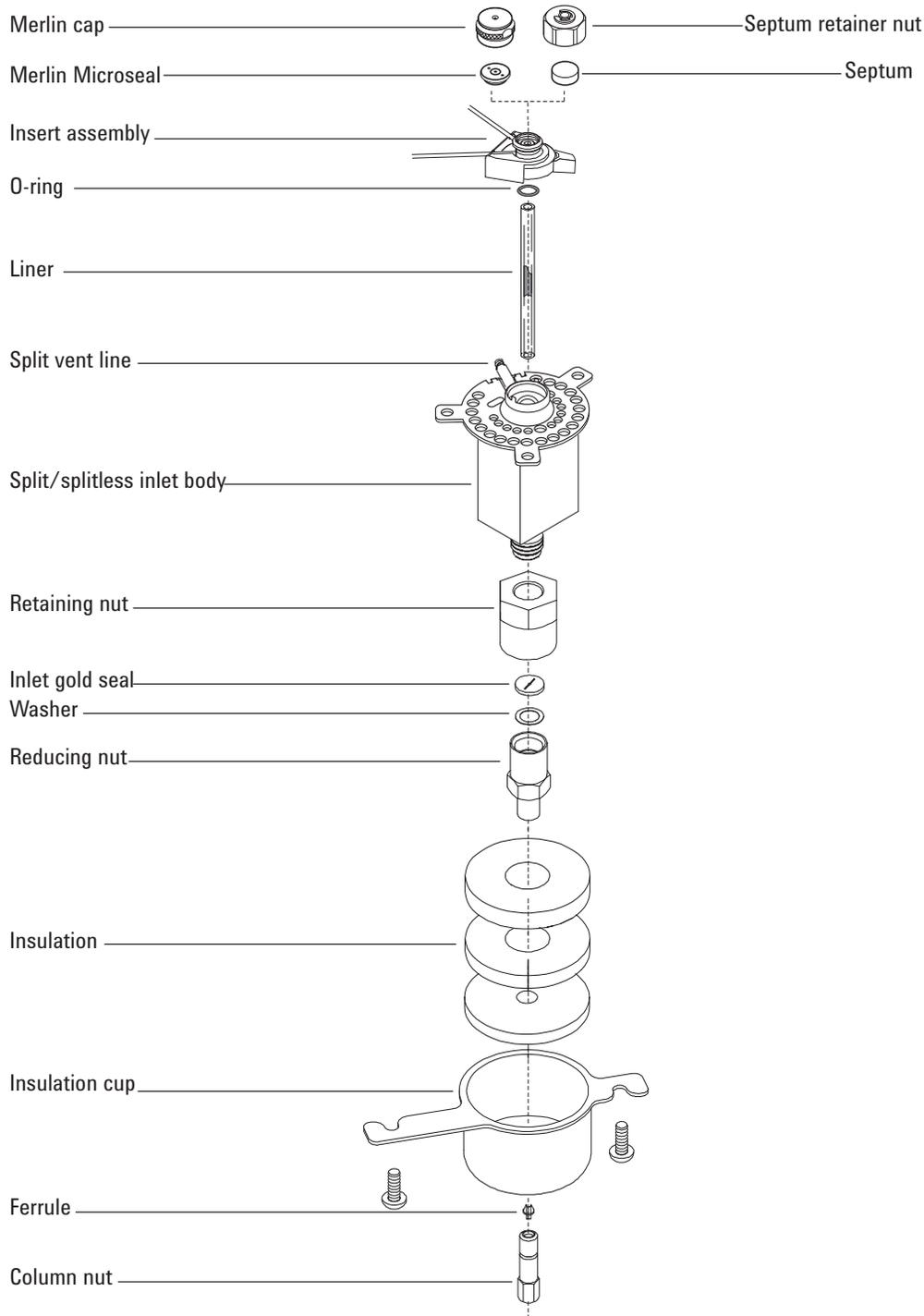


Figure 20. Split/splitless inlet exploded parts

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

## WARNING

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

- 1 Gather the following, see **“Consumables and Parts for the Split/Splitless Inlet”** on page 50:
  - Column
  - Ferrule(s)
  - Column nut
  - Septum
  - Column cutter
  - Isopropanol
  - Lab tissue
  - Metric ruler
  - Two 1/4-inch open-end wrenches
  - Lint-free gloves
- 2 Launch the GC maintenance wizard: **Maintenance > Column > Perform Maintenance > Install Column > Start Maintenance**. Wait for the GC to become ready. The wizard will guide you through the maintenance steps described below.

## WARNING

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

## WARNING

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

- 3 Verify that the correct glass liner is installed. See **“Consumables and Parts for the Split/Splitless Inlet”** on page 50.
- 4 Place the column on the hanger with the ends pointing up and the label to the front.

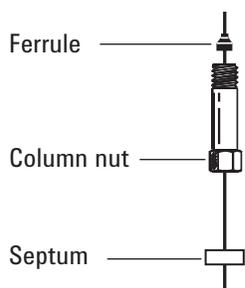
## CAUTION

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

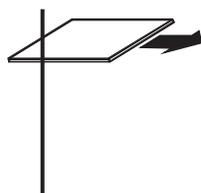
- 5 Place a septum, capillary column nut, and ferrule on the column.

## 5 Maintaining the Split/Splitless Inlet

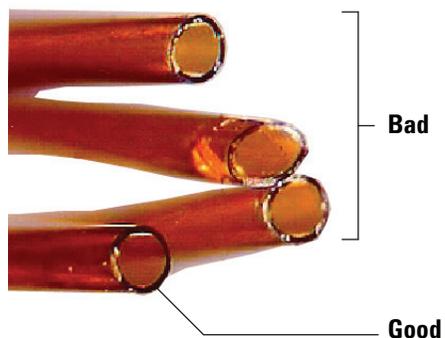
To Install a Capillary Column with the Split/Splitless Inlet



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



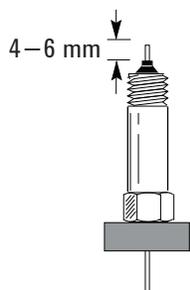
- 7 Break off the column end by supporting it against the column cutter opposite the scribe. Inspect the end with a magnifying loupe to make certain there are no burrs or jagged edges.



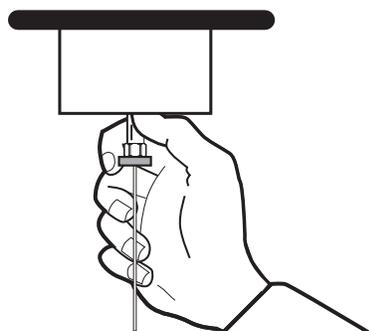
- 8 Wipe the column walls with a tissue dampened with isopropanol to remove fingerprints and dust.
- 9 Position the column so it extends 4 to 6 mm above the end of the ferrule. Slide the septum up the column to hold the column nut at this position.

## 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 Plug in the new column's Smart ID key. See [Figure 21](#).



Figure 21. Insert Smart ID key

14 Configure the new column.

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

16 Install the column into the detector.

## 5 Maintaining the Split/Splitless Inlet

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

- 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+
- 17 The GC maintenance wizard will perform checks at the appropriate times, including **Leak & Restriction** tests, and will automatically reset the maintenance counters.
- 18 Select **Finished**, then select **OK** to exit the GC maintenance wizard.
- 19 After the column is installed at both inlet and detector, establish a flow of carrier gas and purge as recommended by the column manufacturer.
- 20 Restore the analytical method.
- For FID or FPD+, immediately turn off the flame.
  - For NPD, immediately turn off the bead.
- 21 After the GC becomes ready, wait 10 minutes then ignite the detector flame or bead.

#### **WARNING**

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

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

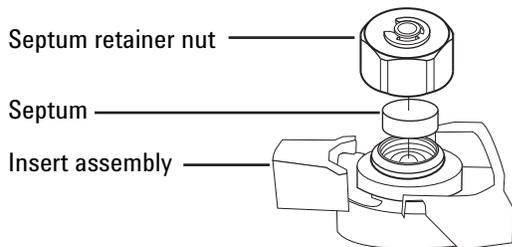
## To Change the Septum on the Split/Splitless Inlet

- 1 Gather the following:
  - Replacement septum, see “**Consumables and Parts for the Split/Splitless Inlet**” on page 50.
  - Wrench, hex for changing septum
  - 0- or 00-grade steel wool (optional)
  - Tweezers
  - Wrench, capillary inlet (optional)
- 2 Launch the GC maintenance wizard: **Maintenance > Inlets**, select the inlet, then select **Perform Maintenance > Replace Septum > Start Maintenance**. The wizard will walk through the steps needed to replace the septum (those same steps are repeated below).

### 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).



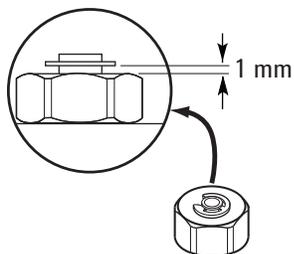
- 6 Install the septum retainer nut or Merlin cap and finger-tighten. Tighten the septum retainer nut until the C-ring is about 1 mm above the nut.

## 5 Maintaining the Split/Splitless Inlet

To Change the Septum on the Split/Splitless Inlet

### CAUTION

Overtightening the septum nut can cause contamination.



- 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 the GC maintenance wizard.
- 10 Restore the analytical method.

## 5 Maintaining the Split/Splitless Inlet

To Clean the Septum Seat in the Insert Assembly of the Split/Splitless Inlet

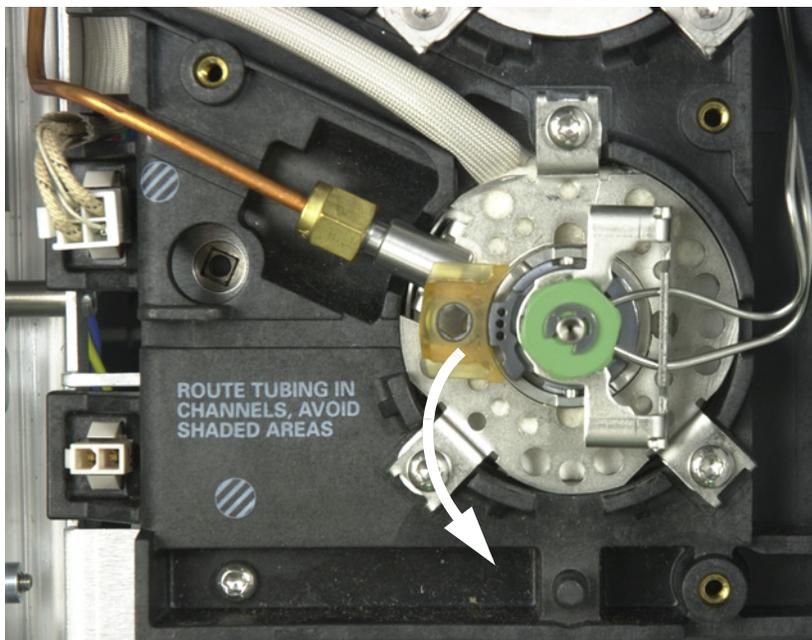
# To Clean the Septum Seat in the Insert Assembly of the Split/Splitless Inlet

- 1 Gather the following:
  - Replacement septum, see “**Consumables and Parts for the Split/Splitless Inlet**” on page 50.
  - 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.

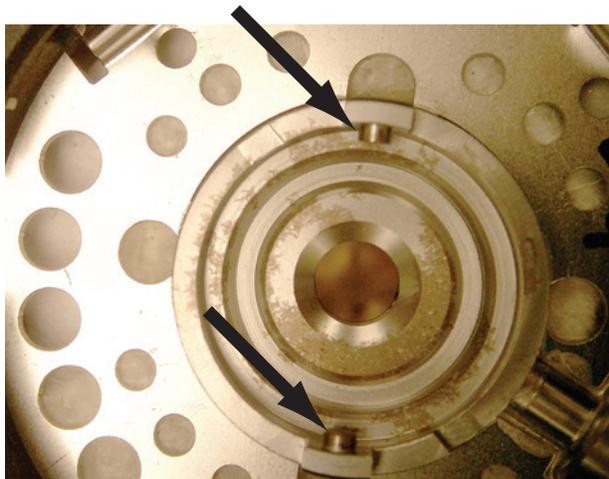


- 4 Remove the septum retainer nut or Merlin cap.
- 5 Use tweezers to remove the septum or Merlin Microseal from the retainer nut. See “**To Change the Septum on the Split/Splitless Inlet**” on page 58.

## 5 Maintaining the Split/Splitless Inlet

### To Clean the Septum Seat in the Insert Assembly of the Split/Splitless Inlet

- 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 58.
- 10 Replace the septum retainer nut or Merlin cap and finger-tighten. See **"To Change the Septum on the Split/Splitless Inlet"** on page 58.
- 11 Exit maintenance mode. Select **Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Finished**.
- 12 Select **Maintenance > Inlet > Septum injections**, then select **Reset**.
- 13 Perform a **Leak & Restriction** test.
- 14 Restore the analytical method.

## 5 Maintaining the Split/Splitless Inlet

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

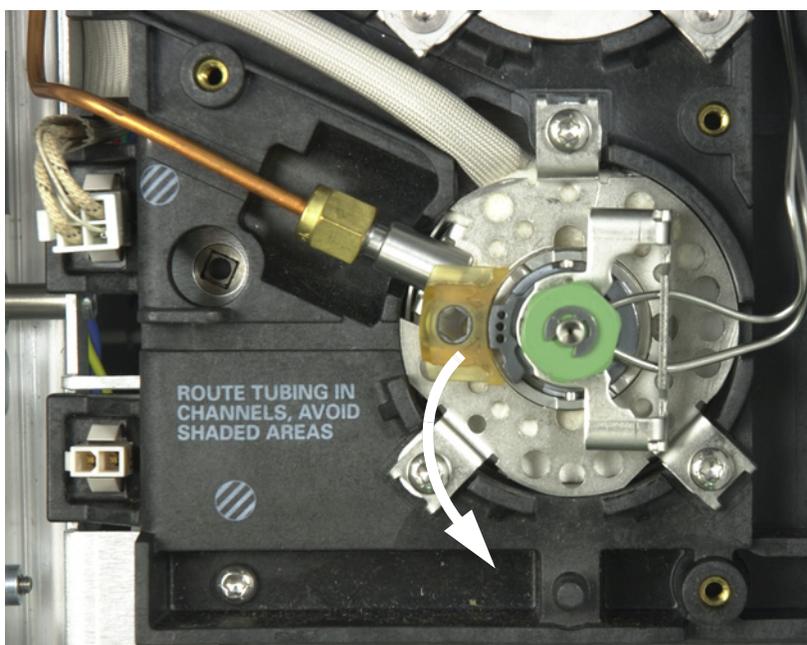
# To Change the Liner and O-Ring on the Split/Splitless Inlet

- 1 Gather the following:
  - Replacement O-ring, see **“Consumables and Parts for the Split/Splitless Inlet”** on page 50.
  - Replacement liner
  - Tweezers
  - Wrench, hex for changing septum (optional)
  - Wrench, capillary inlet (optional)
  - Lint-free gloves
- 2 Launch the GC maintenance wizard: **Maintenance > Inlets**, select the inlet, then select **Perform Maintenance > Replace Liner > Start Maintenance**. The wizard will walk through the steps needed to replace the liner and O-ring (those same steps are repeated below).

### WARNING

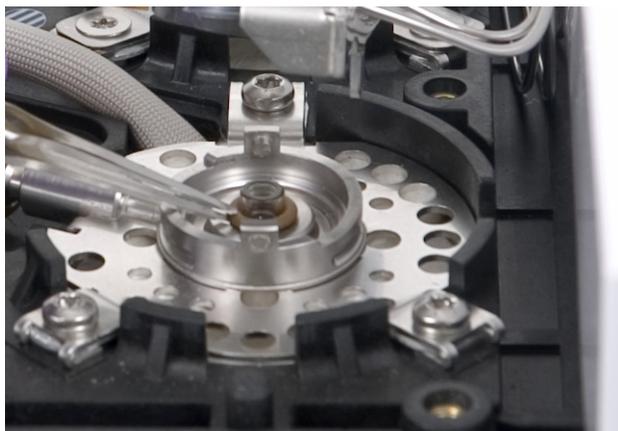
**Be careful! The oven and/or inlet may be hot enough to cause burns. If either is hot, wear heat-resistant gloves to protect your hands.**

- 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.



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

- 4 Loosen the O-ring from the sealing surface with tweezers.



- 5 Grasp the liner with tweezers and pull it out.



- 6 Inspect the surface of the gold seal for graphite or rubber septum contamination. If required, replace the gold seal. See [“To Replace the Gold Seal on the Split/Splitless Inlet”](#) on page 65.



## 5 Maintaining the Split/Splitless Inlet

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

- 7 Clean the inlet if there is visible or suspected contamination. See **“To Clean the Split/Splitless Inlet”** on page 69.
- 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.
- 13 Bakeout contaminants. See **“To Bakeout Contaminants from the Split/Splitless Inlet”** on page 71.
- 14 Configure the new column.
- 15 The GC maintenance wizard will perform checks at the appropriate times, including **Leak & Restriction** tests, and will automatically reset the maintenance counters.
- 16 Select **Finished**, then select **OK** to exit the GC installation wizard.
- 17 Restore the analytical method.

5 **Maintaining the Split/Splitless Inlet**  
To Replace the Gold Seal on the Split/Splitless Inlet

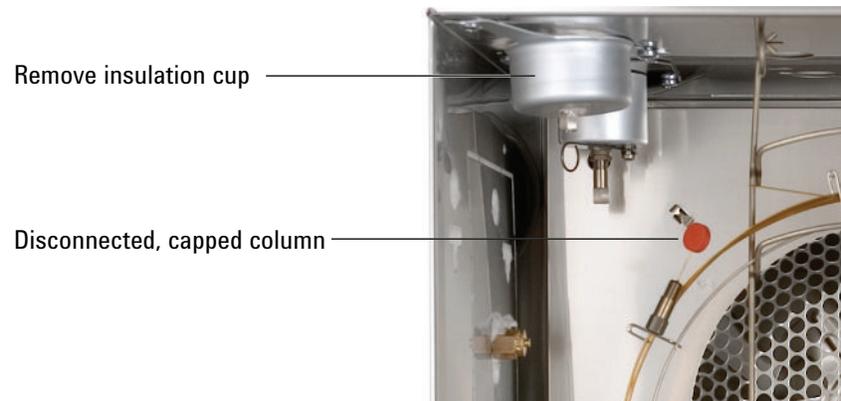
## To Replace the Gold Seal on the Split/Splitless Inlet

- 1 Gather the following:
  - Replacement gold seal, see **“Consumables and Parts for the Split/Splitless Inlet”** on page 50.
  - Replacement washer
  - 1/4-inch wrench (for column)
  - 1/2-inch wrench
  - Lint-free gloves
- 2 Launch the GC maintenance wizard: **Maintenance > Inlets**, select the inlet, then select **Perform Maintenance > Replace Gold Seal (bottom) > Start Maintenance**. The wizard will walk through the steps needed to replace the liner and O-ring (those same steps are repeated below). Wait for the GC to become ready.

**WARNING**

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

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



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



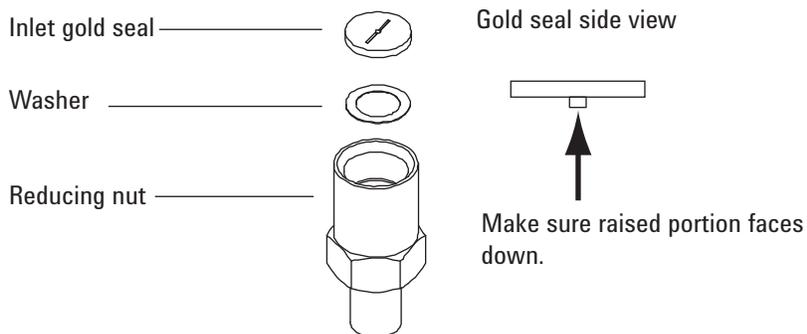
## 5 Maintaining the Split/Splitless Inlet

### To Replace the Gold Seal on the Split/Splitless Inlet

#### CAUTION

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

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



- Replace the reducing nut and tighten securely with a wrench.
- Replace the inlet liner.
- Install the column and the insulation cup.
- Bakeout contaminants. See ["To Bakeout Contaminants from the Split/Splitless Inlet"](#) on page 71.
- Perform an inlet **Leak & Restriction** test and reset the maintenance counters.
- Select **Finished**, then select **OK** to exit the GC installation wizard.
- Restore the analytical method.

## 5 Maintaining the Split/Splitless Inlet

To Replace the Filter in the Split Vent Trap for the Split/Splitless Inlet

# 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 50.
- 2 Launch the GC maintenance wizard: **Maintenance > Inlets**, select the inlet, then select **Perform Maintenance > Replace Split Vent Trap > Start Maintenance**. The wizard will walk through the steps needed to replace the filter (those same steps are repeated below).

### 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 22**.

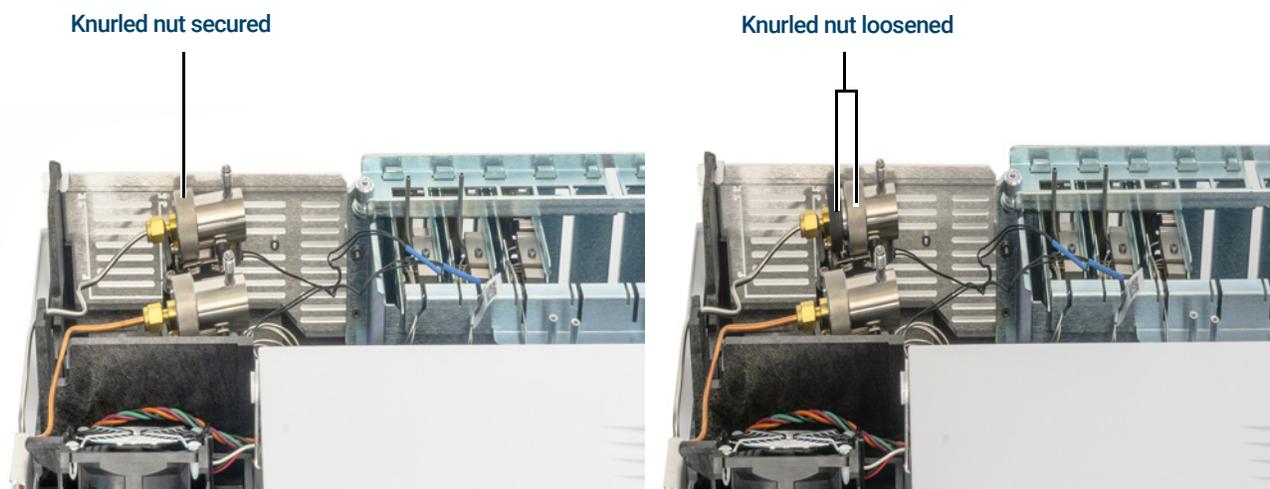


Figure 22. Loosen the knurled nut

- 5 Slide the trap assembly back from the guided mounting bracket and tilt up to expose the filter as shown in **Figure 23**.

## 5 Maintaining the Split/Splitless Inlet

To Replace the Filter in the Split Vent Trap for the Split/Splitless Inlet

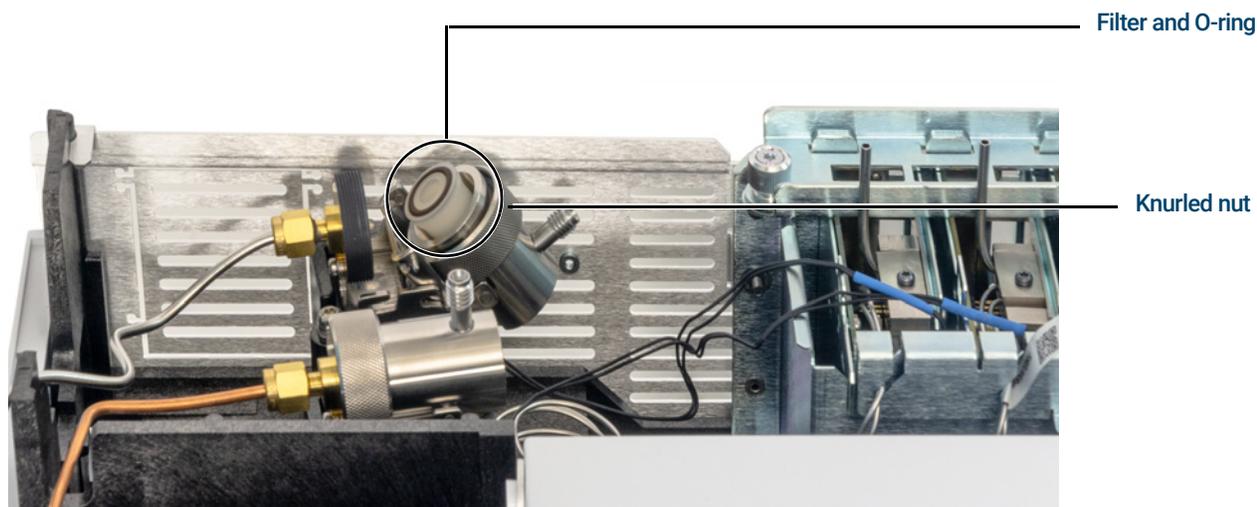


Figure 23. Slide trap assembly to expose the filter

- 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 The GC maintenance wizard will perform checks at the appropriate times, including **Leak & Restriction** tests, and will automatically reset the maintenance counters.
- 10 Select **Finished**, then select **OK** to exit the GC maintenance wizard.
- 11 Install the pneumatics cover.

## To Clean the Split/Splitless Inlet

- 1 Gather the following:
  - Replacement septum, see **“Consumables and Parts for the Split/Splitless Inlet”** on page 50.
  - 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 62.
- 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 65.
- 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 54.

## 5 Maintaining the Split/Splitless Inlet

### To Clean the Split/Splitless Inlet

- 13 Exit maintenance mode. Select **Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Finished**.
- 14 Bakeout contaminants. See **"To Bakeout Contaminants from the Split/Splitless Inlet"** on page 71.
- 15 Perform an inlet **Leak & Restriction** test.
- 16 On the GC, select **Maintenance > Inlets**, then reset the counters for the parts you changed.
- 17 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

## 6

# Maintaining the Purged Packed Inlet

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## Consumables and Parts for the Purged Packed Inlet

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

**Table 11 Purged packed inlet parts**

Description	Part number/quantity
Preventative maintenance kit	5188-6498
<b>Purged packed glass liners and column adapters</b>	
Glass liner	5080-8732 (25/pack) or 5181-3382 deactivated (5/pack)
0.53-mm column adapter	19244-80540
1/8-inch column adapter	19243-80530
1/4-inch column adapter	19243-80540
<b>Recommended septa and O-rings for the purged packed inlet</b>	
11-mm solid septum, low-bleed, red	5181-1263 (50/pk)
11-mm septum with partial through-hole, low-bleed, red	5181-3383 (50/pk)
11-mm septum, low-bleed, gray	5080-8896 (50/pk)
Merlin Microseal septum (30 psi)	5181-8815
11-mm high-temperature silicone septum (350 °C and higher)	5182-0739 (50/pk)
Viton O-ring (Top insert weldment)	5080-8898 (12/pk)
<b>Packed column adapters for detectors</b>	
Pre-swaged 1/8-inch packed column adapter	G3450-60191
Pre-swaged inert 1/8-inch packed column adapter	G3450-60192
Pre-swaged 1/4-inch packed column adapter	G3450-60193
Pre-swaged inert 1/4-inch packed column adapter	G3450-60194

**Table 12 Nuts and ferrules for packed columns**

Description	Typical use	Part number/quantity
1/8-inch id Swagelok stainless steel nut, front ferrule, back ferrule	1/8-inch column	5080-8751 (20 each/pk)
1/8-inch id Swagelok brass nut, front ferrule, back ferrule	1/8-inch column	5080-8750 (20 each/pk)
1/8-inch id Vespel/ graphite ferrule	1/8-inch column	0100-1332 (10/pk)
1/8-inch id brass tubing nut	1/8-inch column	5180-4103 (10/pk)

## 6 Maintaining the Purged Packed Inlet

### Consumables and Parts for the Purged Packed Inlet

**Table 12 Nuts and ferrules for packed columns (continued)**

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

**Table 13 Nuts, ferrules, and hardware for capillary columns**

Column id (mm)	Description	Typical use	Part number/quantity
.530	Ferrule, Vespel/graphite, 0.8-mm id	0.45-mm and 0.53-mm capillary columns	5062-3512 (10/pk)
	Ferrule, graphite, 1.0-mm id	0.53-mm capillary columns	5080-8773 (10/pk)
	Ferrule, graphite, 0.8-mm id	0.53-mm capillary columns	500-2118 (10/pk)
	Column nut, finger-tight (for 0.53-mm columns)	Connect column to inlet or detector	5020-8293
.320	Ferrule, Vespel/graphite, 0.5-mm id	0.32-mm capillary columns	5062-3514 (10/pk)
	Ferrule, graphite, 0.5-mm id	0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853 (10/pk)
	Column nut, finger-tight (for .100 to 320-mm columns)	Connect column to inlet or detector	5020-8292
.250	Ferrule, Vespel/graphite, 0.4-mm id	0.1-mm, 0.2-mm, and 0.25-mm capillary columns	5181-3323 (10/pk)
	Ferrule, graphite, 0.5-mm id	0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853 (10/pk)
	Column nut, finger-tight (for .100 to 320-mm columns)	Connect column to inlet or detector	5020-8292
.100 and .200	Ferrule, Vespel/graphite, 0.37-mm id	0.1-mm and 0.2-mm capillary columns	5062-3516 (10/pk)
	Ferrule, Vespel/graphite, 0.4-mm id	0.1-mm, 0.2-mm, and 0.25-mm capillary columns	5181-3323 (10/pk)
	Ferrule, graphite, 0.5-mm id	0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853 (10/pk)
	Ferrule, graphite, 0.4-mm id		500-2114 (10/pk)
	Column nut, finger-tight (for .100- to .320-mm columns)	Connect column to inlet or detector	5020-8292
All	Ferrule, no-hole	Testing	5181-3308 (10/pk)
	Capillary column blanking nut	Testing—use with any ferrule	5020-8294
	Column nut, universal	Connect column to inlet or detector	5181-8830 (2/pk)
	Column nut, collared, self-tightening	Connect column to inlet or detector	G3440-81011

## 6 Maintaining the Purged Packed Inlet

### Consumables and Parts for the Purged Packed Inlet

Table 13 Nuts, ferrules, and hardware for capillary columns (continued)

Column id (mm)	Description	Typical use	Part number/quantity
	Collar for self-tightening nut	Connect column to inlet or detector	G3440-81012
	Column nut, collared, self-tightening MSD	Connect column to inlet or detector	G3440-81013
	Column cutter, ceramic wafer	Cutting capillary columns	5181-8836 (4/pk)
	Pencil, diamond tipped	Cutting capillary columns	420-1000
	Ferrule tool kit	Ferrule installation	440-1000

# Exploded Parts View of the Purged Packed Inlet

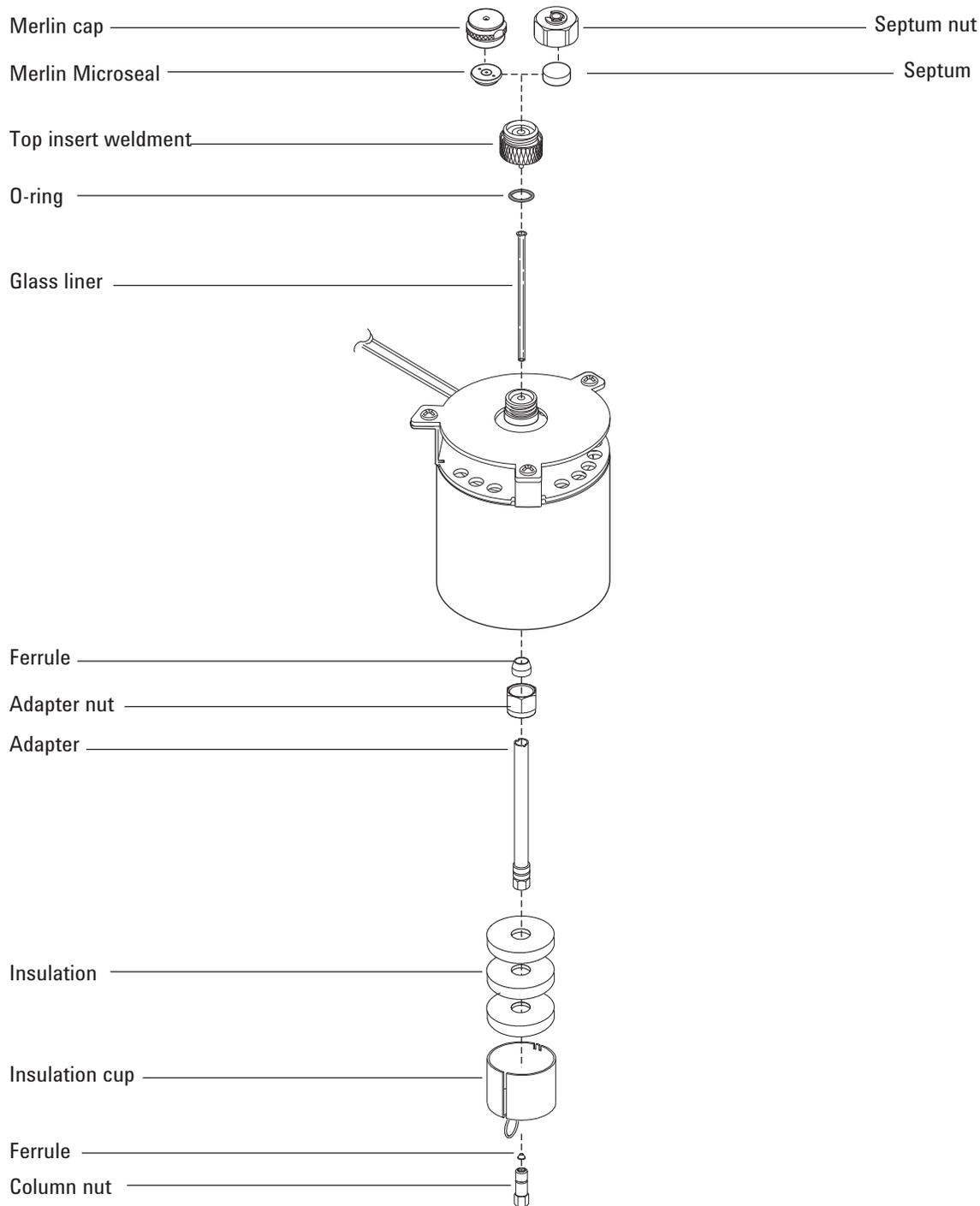


Figure 24. Purged packed inlet exploded parts

## 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 74.
  - Column nut
  - Glass liner
  - Viton O-ring
  - 0.53-mm column adapter
  - Septum
  - Two 1/4-inch wrenches
  - Metric ruler
  - Lint-free gloves
- 2 Launch the GC maintenance wizard: **Maintenance > Column > Perform Maintenance > Install Column > Start Maintenance**. Wait for the GC to become ready.  
The wizard will guide you through the maintenance steps described below.

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**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.**

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**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 86.

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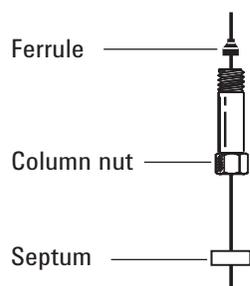
**CAUTION**

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

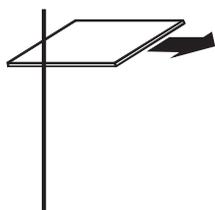
- 4 Install a new Viton O-ring. See **“To Change the O-Ring on the Purged Packed Inlet”** on page 87.
- 5 Place a septum, capillary column nut, and ferrule on the column.

## 6 Maintaining the Purged Packed Inlet

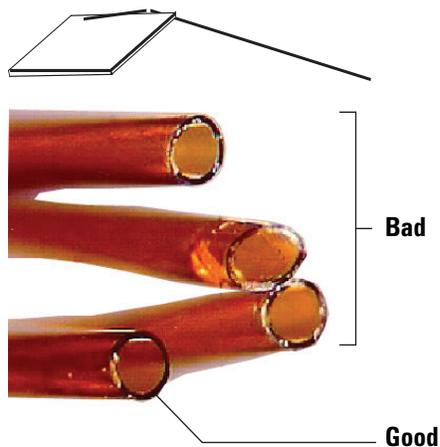
To Install a Capillary Column with the Purged Packed Inlet



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



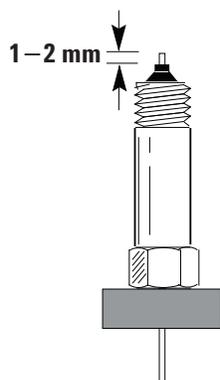
- 7 Break off the column end by supporting it against the column cutter opposite the scribe. Inspect the end with a magnifying loupe to make certain there are no burrs or jagged edges.



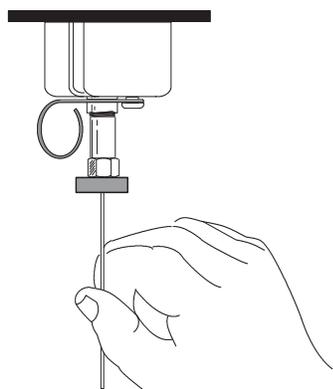
- 8 Wipe the column walls with a tissue dampened with isopropanol to remove fingerprints and dust.
- 9 Position the column so it extends 1 to 2 mm above the end of the ferrule. Slide the septum up the column to hold the column nut at this fixed position.

## 6 Maintaining the Purged Packed Inlet

To Install a Capillary Column with the Purged Packed Inlet



**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** Plug in the new column's Smart ID key. See [Figure 25](#).



Figure 25. Insert Smart ID key

**14** Configure the new column.

## 6 Maintaining the Purged Packed Inlet

### To Install a Capillary Column with the Purged Packed Inlet

- 15 Condition the column per the manufacturer's recommendation. See **"To Condition a Capillary Column"**.
- 16 Install the column into the detector.

#### NOTE

Perform the column installation procedure manually. Do not use the automated column installation wizard.

- **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+**
- 17 The GC maintenance wizard will perform checks at the appropriate times, including **Leak & Restriction** tests, and will automatically reset the maintenance counters.
  - 18 Select **Finished**, then select **OK** to exit the GC maintenance wizard.
  - 19 After the column is installed at both inlet and detector, establish a flow of carrier gas and purge as recommended by the column manufacturer.
  - 20 Restore the analytical method.
    - For FPD+, immediately turn off the flame.
    - For NPD, immediately turn off the bead.
  - 21 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.**

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

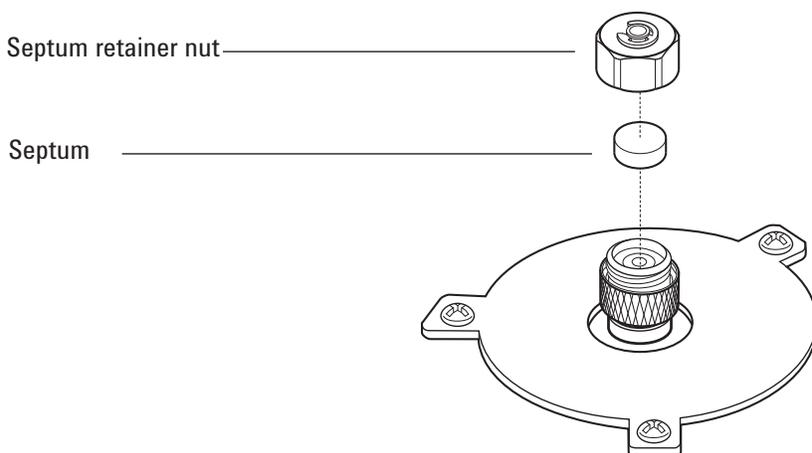
## To Change the Septum on the Purged Packed Inlet

- 1 Gather the following:
  - Replacement septum, see “Consumables and Parts for the Purged Packed Inlet” on page 74.
  - Septum nut wrench
  - 0- or 00-grade steel wool (optional)
  - Tweezers
- 2 Launch the GC maintenance wizard: **Maintenance > Inlets**, select the inlet, then select **Perform Maintenance > Replace Septum > Start Maintenance**. Wait for the GC to become ready. The wizard will guide you through the maintenance steps described below.

### 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.**

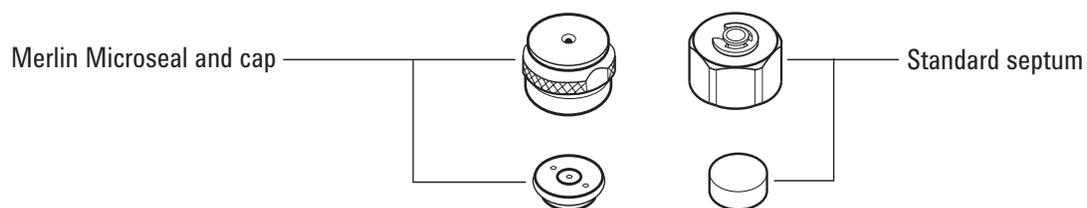
- 3 Remove the septum retainer nut or Merlin cap.
- 4 Use tweezers to remove the septum or Merlin Microseal from the retainer nut. Do not gouge or scratch the interior of the septum head.



- 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 Maintaining the Purged Packed Inlet

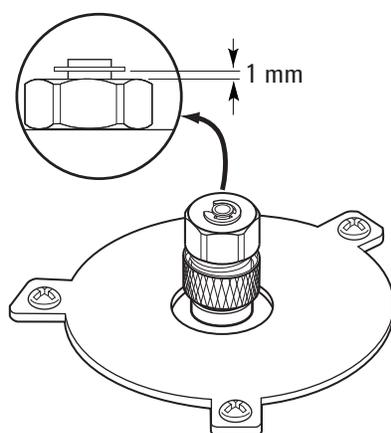
To Change the Septum on the Purged Packed Inlet



- 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 The GC maintenance wizard will perform checks at the appropriate times, including **Leak & Restriction** tests, and will automatically reset the maintenance counters.
- 8 Select **Finished**, then select **OK** to exit the GC maintenance wizard.
- 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 74.
  - 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.**

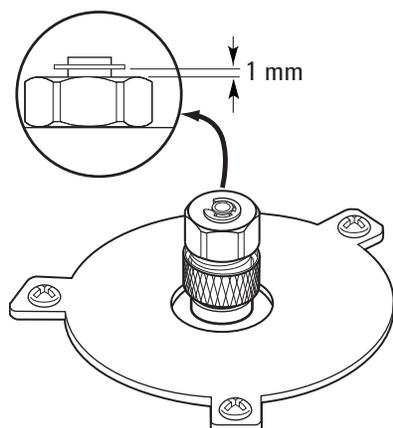
- 5 Use tweezers to remove the septum or Merlin Microseal from the top insert assembly. Do not gouge or scratch the interior of the septum head.
- 6 Scrub the residue from the top insert assembly and septum nut with a small piece of rolled-up steel wool and tweezers. Ultrasonically clean the retainer 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 87.
- 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.**

## 6 Maintaining the Purged Packed Inlet

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 Select **Maintenance > Inlets > Septum injections**, then select **Reset Counter**.

15 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 74.
  - 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.

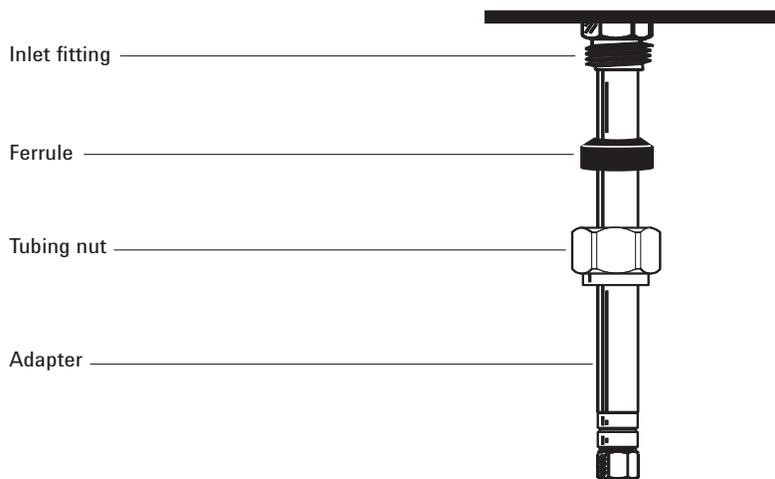
### WARNING

**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 74.
  - Septum nut wrench
  - Tweezers
  - Lint-free gloves
- 2 Launch the GC maintenance wizard: **Maintenance > Inlets**, select the inlet, then select **Perform Maintenance > Replace O-Ring > Start Maintenance**. Wait for the GC to become ready. The wizard will guide you through the maintenance steps described below.

### WARNING

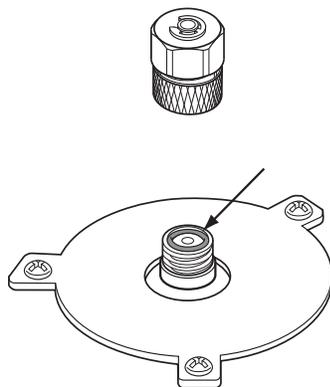
Be careful! The oven and/or inlet may be hot enough to cause burns. If the inlet is hot, wear heat-resistant gloves to protect your hands.

- 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 The GC maintenance wizard will perform checks at the appropriate times, including **Leak & Restriction** tests, and will automatically reset the maintenance counters.
- 8 Select **Finished**, then select **OK** to exit the GC maintenance wizard.
- 9 Restore the analytical method.

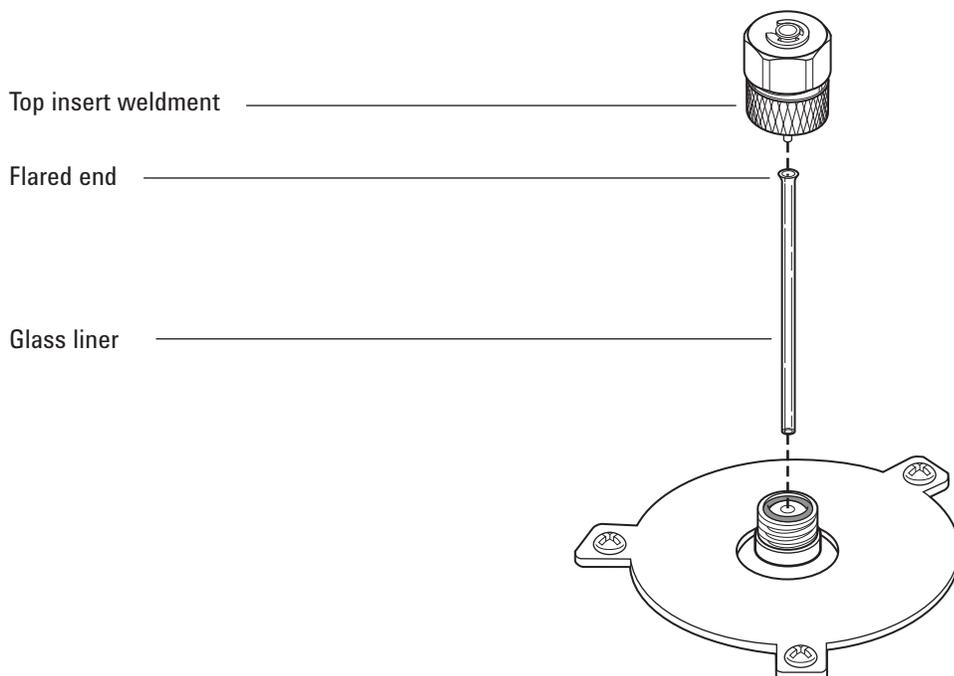
## To Change the Glass Liner on the Purged Packed Inlet

- 1 Gather the following:
  - Replacement glass liner, see “Consumables and Parts for the Purged Packed Inlet” on page 74.
  - 9/16-inch wrench
  - Lint-free gloves
- 2 Launch the GC maintenance wizard: **Maintenance > Inlets**, select the inlet, then select **Perform Maintenance > Replace Liner > Start Maintenance**. Wait for the GC to become ready. The wizard will guide you through the maintenance steps described below.

### 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.

## 6 Maintaining the Purged Packed Inlet

### To Change the Glass Liner on the Purged Packed Inlet

#### CAUTION

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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 87.
- 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 78.
- 7 Install the top insert assembly and hand-tighten firmly.
- 8 Configure the new liner.
- 9 The GC maintenance wizard will perform checks at the appropriate times, including **Leak & Restriction** tests, and will automatically reset the maintenance counters.
- 10 Select **Finished**, then select **OK** to exit the GC maintenance wizard.
- 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 74.
  - 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 86.
- 13 Install the glass liner and O-ring. See **“To Change the Glass Liner on the Purged Packed Inlet”** on page 88.
- 14 Install the top insert assembly and finger-tighten.

## 6 Maintaining the Purged Packed Inlet

### To Clean the Purged Packed Inlet

#### NOTE

Perform the installation procedures manually. Do not use the automated installation wizards.

- 15 Install the septum and septum nut. See [“To Change the Septum on the Purged Packed Inlet”](#) on page 82.
- 16 Attach the column. See [“To Install a Capillary Column with the Purged Packed Inlet”](#) on page 78.
- 17 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
- 2 Launch the GC maintenance wizard: **Maintenance > Column > Perform Maintenance > Install Column > Start Maintenance**. Wait for the GC to become ready. The wizard will guide you through the maintenance steps described below.
- 3 Prepare the packed metal column. See **“To Install Ferrules on a Packed Metal Column”** on page 101.

### 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 86.

### CAUTION

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

- 5 Attach the column to the inlet adapter.
- 6 Finger-tighten the nut.
- 7 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.
- 8 The GC maintenance wizard will perform checks at the appropriate times, including **Leak & Restriction** tests, and will automatically reset the maintenance counters.

Select **Finished**, then select **OK** to exit the GC maintenance wizard.
- 9 On the GC touchscreen, press **Settings > Configuration > Columns**, then select **Columns 1** through **6**. Select **Column Type > Packed**, then choose your **Inlet** and **Outlet Connection** to identify the inlet and detector to which the column is attached.

Alternatively, Select **Method > Configuration > Columns**, then select the Packed column. Select **Column Type > Packed**, then choose your **Inlet** and **Outlet Connection** to identify the inlet and detector to which the column is attached.
- 10 On the GC touchscreen, **Scroll** down to manually set your column temperatures. Alternatively, Double-click the column to manually set your column temperatures.
- 11 Configure the new packed column (make sure either column length or diameter is zero).

## 6 Maintaining the Purged Packed Inlet To Install a Packed Metal Column

### WARNING

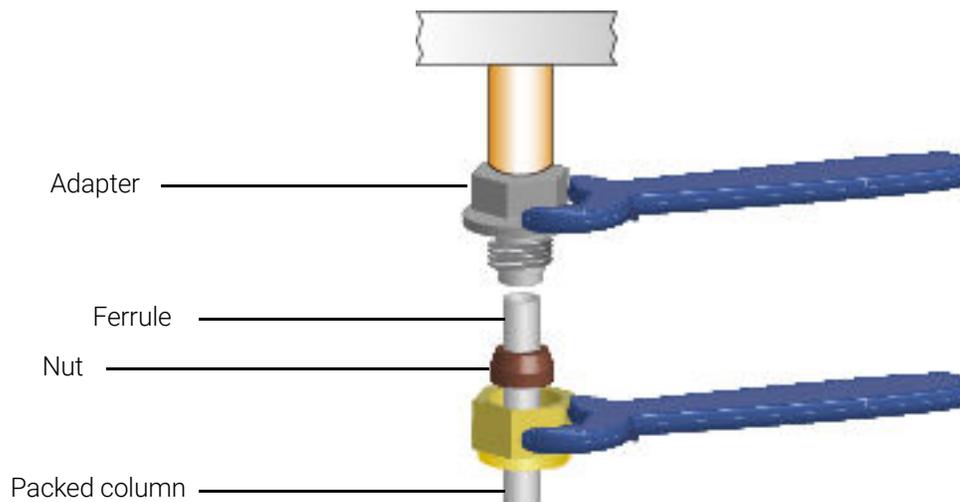
Do not use hydrogen as the carrier for conditioning! It could vent into the oven and present an explosion hazard.

- 12 Condition the column, if necessary. See **“To Condition a Packed Column”** on page 100.
- 13 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.

- 14 If required, install a packed column adapter onto the detector column fitting. See **“To Install a Packed Column Adapter onto a Detector”** on page 96.
- 15 Place a nut and ferrule onto the packed column.
- 16 Attach the column to the detector or detector adapter. Finger-tighten the nut.



- 17 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).
- 18 Exit maintenance mode. Select **Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Finished**.
- 19 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
- 20 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.
- 21 Restore the analytical method.
  - For FPD+, immediately turn off the flame.

## 6 Maintaining the Purged Packed Inlet

### To Install a Packed Metal Column

- For NPD, immediately turn off the bead.

**22** 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.**

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

**24** 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 74.
  - 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
- 2 Place GC in maintenance mode: **Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Start Maintenance**. Wait for the GC to become ready.

### WARNING

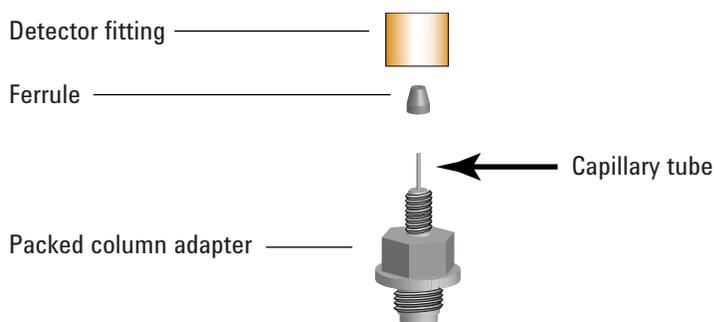
Be careful! The oven and/or detector may be hot enough to cause burns. If the detector is hot, wear gloves to protect your hands.

### 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.

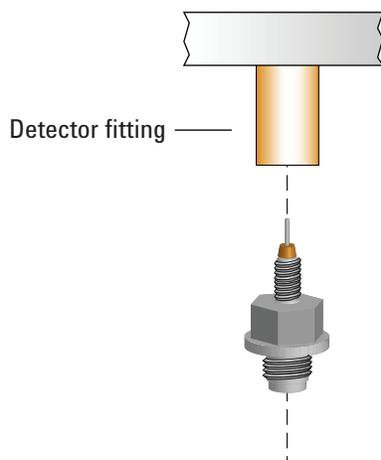
- 3 Place a ferrule onto the packed column adapter.



- 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.

## 6 Maintaining the Purged Packed Inlet

To Install a Packed Column Adapter onto a Detector



- 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 Purged Packed Inlet”** on page 74.
  - Two 1/4-inch Vespel/graphite ferrules
  - Lint-free gloves
- 2 Launch the GC maintenance wizard: **Maintenance > Column > Perform Maintenance > Install Column > Start Maintenance**. Wait for the GC to become ready. The wizard will walk through the steps needed to replace the septum (those same steps are repeated below).

### 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 100.

### CAUTION

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

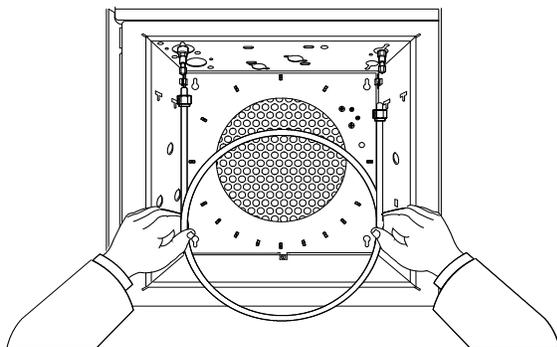
- 5 Tighten the inlet column nut 1/4 turn with a wrench.

### 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.

## 6 Maintaining the Purged Packed Inlet 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 The GC maintenance wizard will perform checks at the appropriate times, including **Leak & Restriction** tests, and will automatically reset the maintenance counters.
- 11 Select **Finished**, then select **OK** to exit the GC maintenance wizard.
- 12 Press **Settings > Configuration > Columns**, then select **Columns 1** through **6**. Select **Column Type > Packed**, then choose your **Inlet** and **Outlet Connection** to identify the inlet and detector to which the column is attached.
- 13 **Scroll** down to manually set your column temperatures.
- 14 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
- 15 Restore the analytical method.
  - For FPD+, immediately turn off the flame.
  - For NPD, immediately turn off the bead.
- 16 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.

- 17 Allow the oven, inlet, and detector to equilibrate at operating temperature, then retighten the fittings.
- 18 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 93.
- 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 93.
- 10 Perform the inlet **Leak & Restriction** test and reset the maintenance counters.
- 11 Exit maintenance mode. Select **Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Finished.**

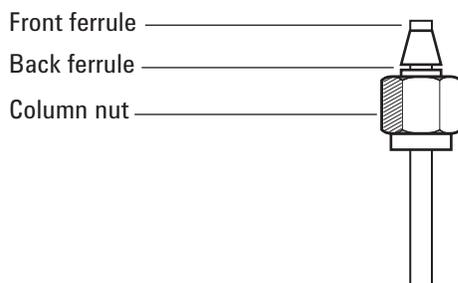
## To Install Ferrules on a Packed Metal Column

- 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 74.
  - Lint-free gloves
- 2 Verify that the column end is cut square and is free of burns and deformation.
- 3 Secure the fitting in a bench vise.

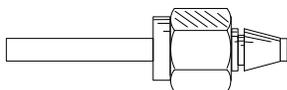
### CAUTION

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

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



- 5 Fully insert the column into the vise-held fitting, then withdraw 1–2 mm. Finger-tighten the nut.
- 6 Tighten the nut an additional 3/4 turn with a wrench (for a 1/8-inch column) or an additional 1-1/4 turn (for a 1/4-inch column).
- 7 Unscrew the column nut from the vise-held fitting and remove the column. Ferrules should now be set in place on the column with the column end correctly positioned.



**6 Maintaining the Purged Packed Inlet**  
To Install Ferrules on a Packed Metal Column

## Maintaining the COC Inlet

- Consumables and Parts for the Cool On-Column Inlet 104
- Exploded Parts View of the Cool On-Column Inlet 107
- To Install a Capillary Column with the Cool On-Column Inlet 108
- To Check the Needle-to-Column Size on the COC Inlet 112
- To Change a Septum on the COC Inlet 113
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- To Replace the 7693A Injector Needle Support Guide 119
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- To Replace the Fused Silica Needle in a Syringe for the COC Inlet 121
- To Bakeout Contaminants from the COC Inlet 122

# Consumables and Parts for the Cool On-Column Inlet

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

**Table 14 Recommended parts for injections onto 0.53-mm fused silica columns**

Column type	Part number
Insert, fused silica, 0.53 mm id	19245-20580 (no rings)
Septum nut, 530 $\mu\text{m}$	G1545-80530
Syringe barrel, removable needle, 5 $\mu\text{L}$	5182-0836
Needle, 530 $\mu\text{m}$ (3/pk)	5182-0832
Plunger button, 10/pk, for manual injections using syringe barrel 5182-0836	5181-8866
On-column insert spring	19245-60760

**Table 15 Recommended parts for injections onto 0.53-mm aluminum-clad columns**

Column type	Part number
Insert, aluminum-clad, 0.53 mm id	19245-20780 (4 rings)
Septum nut, 530 $\mu\text{m}$	G1545-80530
Syringe barrel, removable needle, 5 $\mu\text{L}$	5182-0836
Needle, 530 $\mu\text{m}$ (3/pk)	5182-0832
Plunger button, 10/pk, for manual injections using syringe barrel 5182-0836	5181-8866
On-column insert spring	19245-60760

**Table 16 Recommended parts for injections onto 0.32-mm fused silica columns**

Column type	Part number
Insert, fused silica, 0.32 mm id	19245-20525 (5 rings)
Septum nut, 250/320 $\mu\text{m}$	19245-80521
Syringe barrel, removable needle, 5 $\mu\text{L}$	5182-0836
Needle, 320 $\mu\text{m}$ (3/pk)	5182-0831
Plunger button, 10/pk, for manual injections using syringe barrel 5182-0836	5181-8866
On-column insert spring	19245-60760

## 7 Maintaining the COC Inlet

### Consumables and Parts for the Cool On-Column Inlet

**Table 17 Recommended parts for injections onto 0.25-mm fused silica columns**

Column type	Part number
Insert, 0.25 mm id	19245-20515 (6 rings)
Septum nut, 250/320 $\mu$ m	19245-80521
Syringe barrel, removable needle, 5 $\mu$ L	5182-0836
Needle, 250 $\mu$ m (3/pk)	5182-0833
Plunger button, 10/pk, for manual injections using syringe barrel 5182-0836	5181-8866
On-column insert spring	19245-60760

**Table 18 Recommended parts for injections onto 0.2-mm fused silica columns**

Description	Part number/quantity
Insert, fused silica, 0.20 mm id	19245-20510
Cooling tower assembly	19320-80625
Syringe barrel, for fused silica needle, 10 $\mu$ L	9301-0658
Replacement needles, fused silica, 0.18 mm	19091-63000 (6/pk)
Replacement PTFE ferrule for fused silica syringe	0100-1389
Removable stainless steel needle syringe, 10 $\mu$ L	5182-9633
Replacement stainless steel needles, 0.23 mm	5182-9645 (3/pk)
On-column insert spring	19245-60760

**Table 19 Recommended septa for the COC inlet**

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

## 7 Maintaining the COC Inlet

### Consumables and Parts for the Cool On-Column Inlet

**Table 20 Nuts, ferrules, and hardware for capillary columns**

Column id (mm)	Description	Typical use	Part number/quantity
.530	Ferrule, Vespel/graphite, 0.8-mm id	0.45-mm and 0.53-mm capillary columns	5062-3512 (10/pk)
	Ferrule, graphite, 1.0-mm id	0.53-mm capillary columns	5080-8773 (10/pk)
	Ferrule, graphite, 0.8-mm id	0.53-mm capillary columns	500-2118 (10/pk)
	Column nut, finger-tight (for 0.53-mm columns)	Connect column to inlet or detector	5020-8293
.320	Ferrule, Vespel/graphite, 0.5-mm id	0.32-mm capillary columns	5062-3514 (10/pk)
	Ferrule, graphite, 0.5-mm id	0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853 (10/pk)
	Column nut, finger-tight (for .100- to .320-mm columns)	Connect column to inlet or detector	5020-8292
.250	Ferrule, Vespel/graphite, 0.4-mm id	0.1-mm, 0.2-mm, and 0.25-mm capillary columns	5181-3323 (10/pk)
	Ferrule, graphite, 0.5-mm id	0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853 (10/pk)
	Column nut, finger-tight (for .100- to .320-mm columns)	Connect column to inlet or detector	5020-8292
.100 and 200	Ferrule, Vespel/graphite, 0.37-mm id	0.1-mm and 0.2-mm capillary columns	5062-3516 (10/pk)
	Ferrule, Vespel/graphite, 0.4-mm id	0.1-mm, 0.2-mm, and 0.25-mm capillary columns	5181-3323 (10/pk)
	Ferrule, graphite, 0.5-mm id	0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853 (10/pk)
	Ferrule, graphite, 0.4-mm id		500-2114 (10/pk)
	Column nut, finger-tight (for .100- to .320-mm columns)	Connect column to inlet or detector	5020-8292
All	Ferrule, no-hole	Testing	5181-3308 (10/pk)
	Capillary column blanking nut	Testing—use with any ferrule	5020-8294
	Column nut, universal	Connect column to inlet or detector	5181-8830 (2/pk)
	Column nut, collared, self-tightening	Connect column to inlet or detector	G3440-81011
	Collar for self-tightening nut	Connect column to inlet or detector	G3440-81012
	Column nut, collared, self-tightening MSD	Connect column to inlet or detector	G3440-81013
	Column cutter, ceramic wafer	Cutting capillary columns	5181-8836 (4/pk)
	Pencil, diamond tipped	Cutting capillary columns	420-1000
	Ferrule tool kit	Ferrule installation	440-1000

# Exploded Parts View of the Cool On-Column Inlet

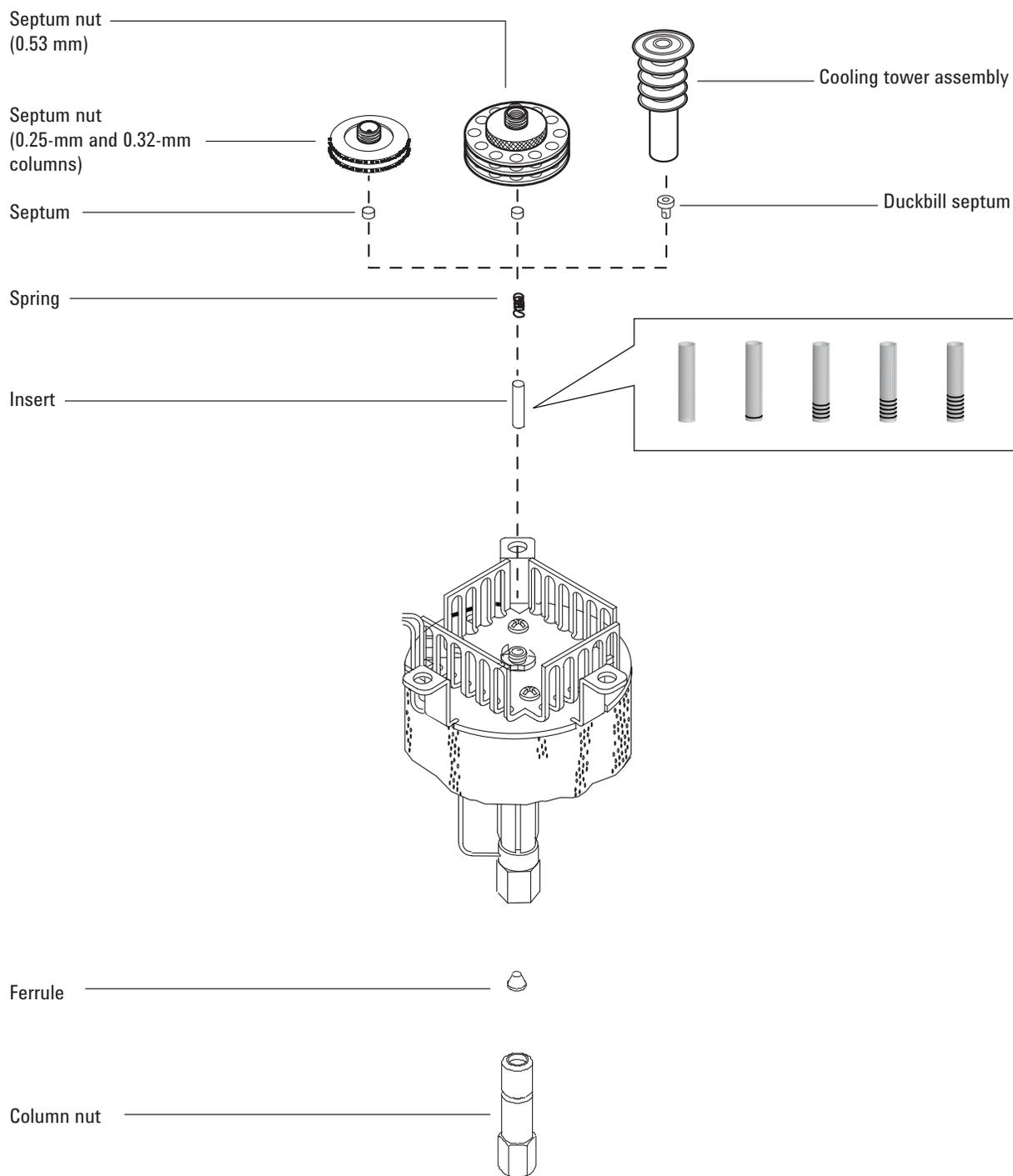


Figure 26. Cool on-column inlet exploded parts

## 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 104.
  - Column cutter
  - 1/4-inch and 5/16-inch wrenches
  - Lint-free gloves
- 2 Launch the GC maintenance wizard: **Maintenance > Column > Perform Maintenance > Install Column > Start Maintenance**. Wait for the GC to become ready. The wizard will guide you through the maintenance steps described below.

### WARNING

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

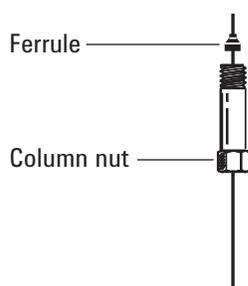
### WARNING

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

### CAUTION

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

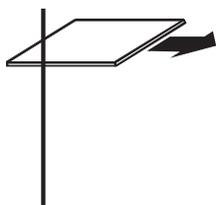
- 3 Before installing the column, be sure the correct insert is installed for the needle and column. See **“To Install an Insert on the COC Inlet”** on page 115.
- 4 Place a capillary column nut and ferrule on the column.



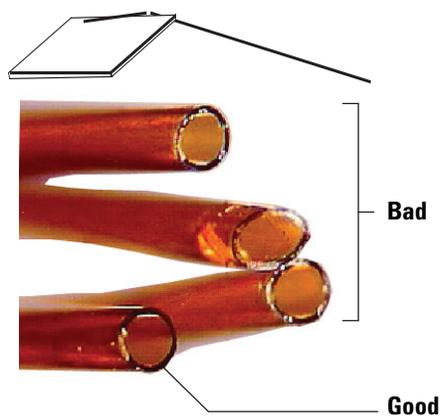
- 5 Score the column using a glass scribing tool. The score must be square to ensure a clean break.

## 7 Maintaining the COC Inlet

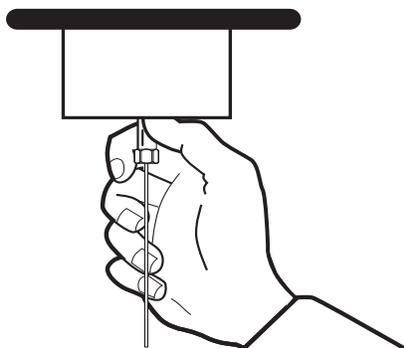
To Install a Capillary Column with the Cool On-Column Inlet



- 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.



- 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.



### **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.

## 7 Maintaining the COC Inlet

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

12 Plug in the new column's Smart ID key. See [Figure 27](#).



Figure 27. Insert Smart ID key

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.

#### NOTE

Execute the column installation procedure manually. Do not use the automated column installation wizard.

- [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 The GC maintenance wizard will perform checks at the appropriate times, including **Leak & Restriction** tests, and will automatically reset the maintenance counters.

17 Select **Finished**, then select **OK** to exit the GC maintenance wizard.

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

19 Restore the analytical method.

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

20 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.

## 7 Maintaining the COC Inlet

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

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

## To Check the Needle-to-Column Size on the COC Inlet

- 1 Gather the following:
  - Insert, see “[Consumables and Parts for the Cool On-Column Inlet](#)” on page 104.
  - Syringe needle
- 2 Place GC in maintenance mode: **Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Start Maintenance**. Wait for the GC to become ready.

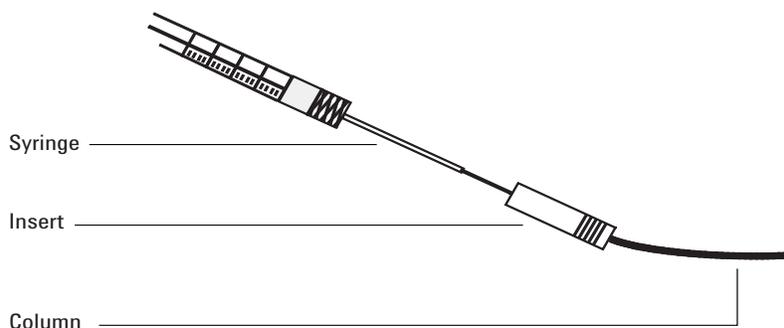
### WARNING

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

### WARNING

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

- 3 Check that the needle is the correct size for the desired column id. If needed, replaced the needle with one of the correct size. See “[Consumables and Parts for the Cool On-Column Inlet](#)” on page 104, and “[To Replace a Needle in a Syringe](#)” on page 120 or “[To Replace the Fused Silica Needle in a Syringe for the COC Inlet](#)” on page 121.
- 4 Identify the correct insert for the column size. See “[Consumables and Parts for the Cool On-Column Inlet](#)” on page 104. 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 108.
- 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.
- 8 Exit maintenance mode. Select **Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Finished**.

## 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 104.
  - Tweezers
  - A thin wire (0.2-inch diameter) for removing septum from inlet
  - Lint-free gloves
- 2 Launch the GC maintenance wizard: **Maintenance > Inlets**, select the inlet, then select **Perform Maintenance > Replace Septum > Start Maintenance**. The wizard will guide you through the maintenance steps described below.

### 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.**

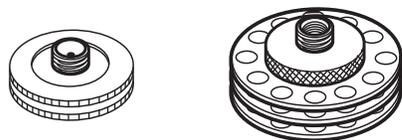
### CAUTION

**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- $\mu\text{m}$   
automated injections

For 530- $\mu\text{m}$  automated  
injections

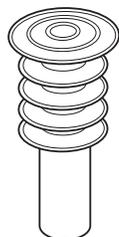


- If you are using a cooling tower, grasp the three rings and unscrew. The spring and duckbill septum may pop out of the inlet when you remove the cooling tower. Be careful not to lose them. If they do not pop out, use a thin wire to remove them from the inlet. Insert the replacement duckbill septum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

## 7 Maintaining the COC Inlet

To Change a Septum on the COC Inlet

For manual 200- $\mu\text{m}$  injections with fused silica needle



- 4 Before making an injection, check the alignment of the entire assembly using the proper size syringe.
- 5 The GC maintenance wizard will perform checks at the appropriate times, including **Leak & Restriction** tests, and will automatically reset the maintenance counters.
- 6 Select **Finished**, then select **OK** to exit the GC maintenance wizard.
- 7 Restore the analytical method.

## 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 104.
- 2 Place GC in maintenance mode: **Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Start Maintenance**. Wait for the GC to become ready.

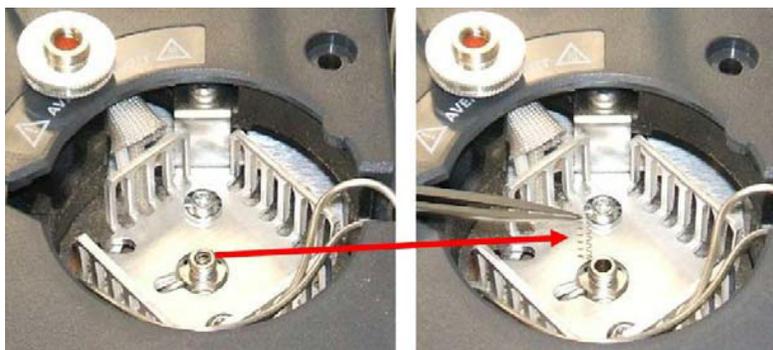
### WARNING

**Be careful! The oven and/or inlet may be hot enough to cause burns. If 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 113.
- 5 Remove the spring from the inlet with an extraction wire (or tweezers) and set it aside. Be careful not to lose or damage it because you will use the spring to keep the new insert in position.



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

## 7 Maintaining the COC Inlet

### To Install an Insert on the COC Inlet



- 7 Check that the insert is the correct size for both the needle and column. See **“To Check the Needle-to-Column Size on the COC Inlet”** on page 112.
- 8 Lower the new insert straight into the inlet from the top. The insert can be installed either end up.
- 9 Install the spring on top of the insert.
- 10 Install the septum and septum nut or duckbill septum and cooling tower assembly and finger-tighten.

#### NOTE

**Execute the column installation procedure manually. Do not use the automated column installation wizard.**

- 11 Install the column. See **“To Install a Capillary Column with the Cool On-Column Inlet”** on page 108.
- 12 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  $< 40\text{ }^{\circ}\text{C}$ , 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.

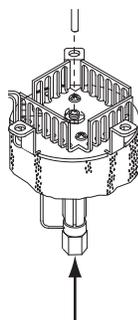
### WARNING

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.

## 7 Maintaining the COC Inlet

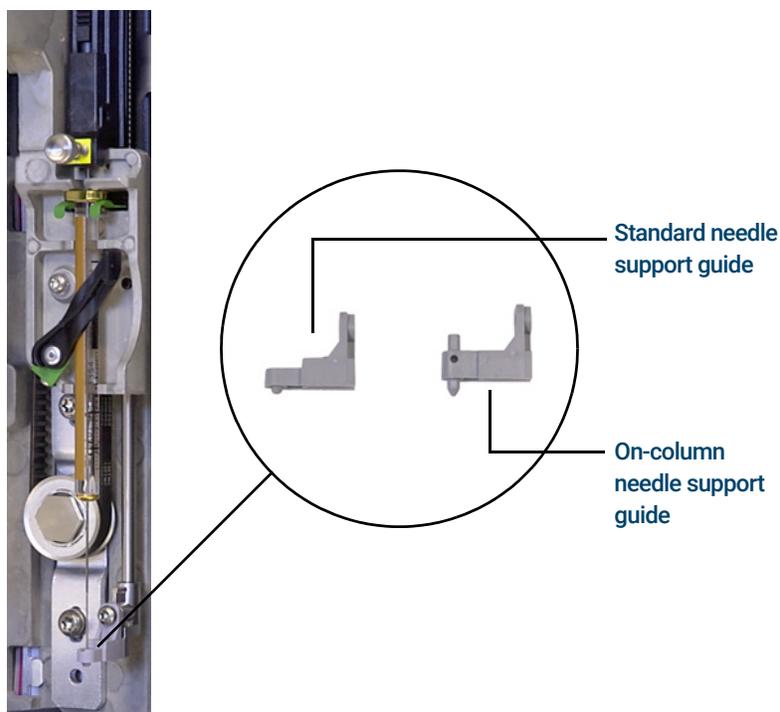
### To Clean the COC Inlet

- 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 115.
- 11 Install the column. See **"To Install a Capillary Column with the Cool On-Column Inlet"** on page 108.
- 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.

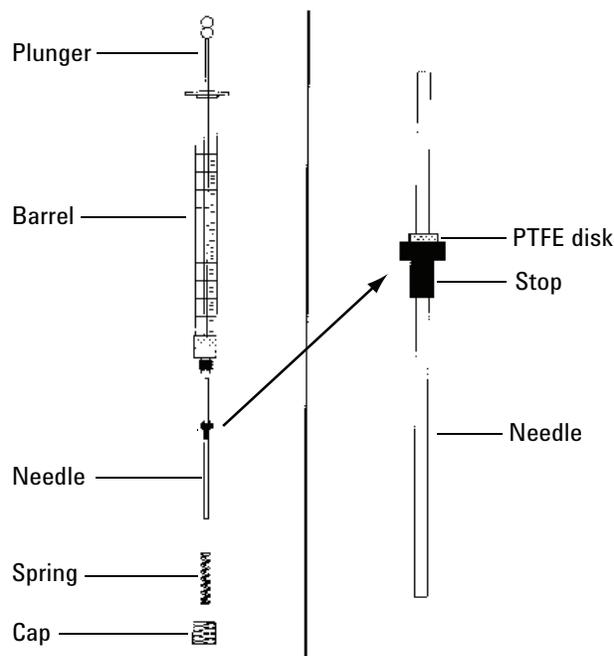
Refer to the 7693A ALS documentation for complete details.



- 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 17**, "Recommended parts for injections onto 0.25-mm fused silica columns," on page 105:
  - Syringe barrel
  - Needle, 250- $\mu\text{m}$  or 320- $\mu\text{m}$
- 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.

## 7 Maintaining the COC Inlet

To Replace the Fused Silica Needle in a Syringe for the COC Inlet

# To Replace the Fused Silica Needle in a Syringe for the COC Inlet

### NOTE

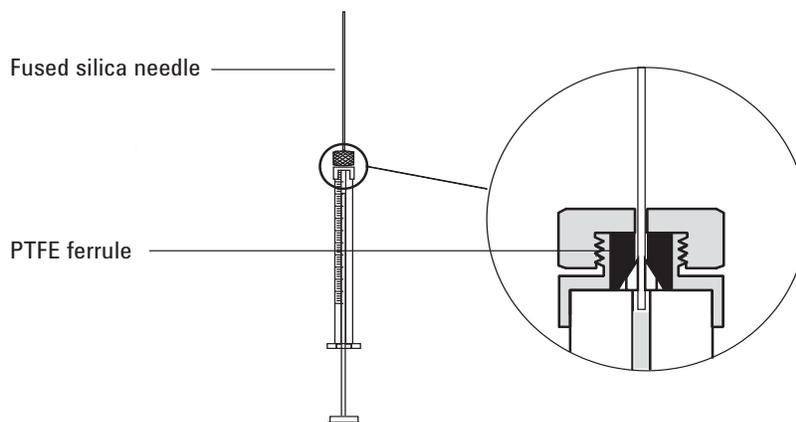
The fused silica needle and syringe are only used with the cooling tower and duckbill septum for manual, on-column injections onto 200- $\mu\text{m}$  columns.

- 1 Gather the following:
  - New fused silica syringe needle, see “[Consumables and Parts for the Cool On-Column Inlet](#)” on page 104.
  - 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 MMI

- Consumables and Parts for the Multimode Inlet 124
- Exploded Parts View of the MMI 127
- To Install the Column Nut Adapter 128
- To Install a Capillary Column with the Multimode Inlet 129
- To Change the Septum on the MMI 133
- To Clean the Septum Seat in the Insert Assembly of the MMI 135
- To Change the Liner and O-Ring on the MMI 137
- To Replace the Filter in the Split Vent Trap for the MMI 140
- To Clean the Multimode Inlet 142
- To Bakeout Contaminants from the MMI 144

## Consumables and Parts for the Multimode Inlet

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

**Table 21 Split, splitless, direct, and direct connect inlet liners**

Mode	Description	Deactivated	Part number
Split	Low-pressure drop, glass wool, single taper, 870 $\mu$ L	Yes	5183-4647
Split	Glass wool, 990 $\mu$ L	No	19251-60540
Split—Manual only	Empty pin and cup, 800 $\mu$ L	No	18740-80190
Split—Manual only	Packed pin and cup, 800 $\mu$ L	No	18740-60840
Splitless	Single taper, glass wool, 900 $\mu$ L	Yes	5062-3587
Splitless	Single taper, no glass wool, 900 $\mu$ L	Yes	5181-3316
Splitless	Dual taper, no glass wool, 800 $\mu$ L	Yes	5181-3315
Splitless—Direct inject	2-mm id, quartz, 250 $\mu$ L	No	18740-80220
Splitless	Ultra Inert, low-frit liner, 4-mm (1/pk)	No	5190-5112
Splitless	Ultra Inert, low-frit liner, 4-mm (5/pk)	No	5190-5112-005
Splitless—Direct inject	2-mm id, 250 $\mu$ L	Yes	5181-8818
Direct inject —Headspace or purge and trap	1.5-mm id, 140 $\mu$ L	No	18740-80200
Direct column connect	Single taper, splitless 4-mm id	Yes	G1544-80730
Direct column connect	Dual taper, splitless 4-mm id	Yes	G1544-80700
Universal	Ultra Inert, mid-frit liner, 4-mm (1/pk)	Yes	5190-5105
Universal	Ultra Inert, mid-frit liner, 4-mm (5/pk)	Yes	5190-5105-005

**Table 22 Nuts, ferrules, and hardware for capillary columns**

Column id (mm)	Description	Typical use	Part number/quantity
.530	Ferrule, Vespel/graphite, 0.8-mm id	0.45-mm and 0.53-mm capillary columns	5062-3512 (10/pk)
	Ferrule, graphite, 1.0-mm id	0.53-mm capillary columns	5080-8773 (10/pk)
	Ferrule, graphite, 0.8-mm id	0.53-mm capillary columns	500-2118 (10/pk)
	Column nut, finger-tight (for 0.53-mm columns)	Connect column to inlet or detector	5020-8293
.320	Ferrule, Vespel/graphite, 0.5-mm id	0.32-mm capillary columns	5062-3514 (10/pk)
	Ferrule, graphite, 0.5-mm id	0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853 (10/pk)
	Column nut, finger-tight (for .100- to .320-mm columns)	Connect column to inlet or detector	5020-8292

## 8 Maintaining the MMI

### Consumables and Parts for the Multimode Inlet

**Table 22 Nuts, ferrules, and hardware for capillary columns (continued)**

Column id (mm)	Description	Typical use	Part number/quantity
.250	Ferrule, Vespel/graphite, 0.4-mm id	0.1-mm, 0.2-mm, and 0.25-mm capillary columns	5181-3323 (10/pk)
	Ferrule, graphite, 0.5-mm id	0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853 (10/pk)
	Column nut, finger-tight (for .100- to .320-mm columns)	Connect column to inlet or detector	5020-8292
.100 and .200	Ferrule, Vespel/graphite, 0.37-mm id	0.1-mm and 0.2-mm capillary columns	5062-3516 (10/pk)
	Ferrule, Vespel/graphite, 0.4-mm id	0.1-mm, 0.2-mm, and 0.25-mm capillary columns	5181-3323 (10/pk)
	Ferrule, graphite, 0.5-mm id	0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853 (10/pk)
	Ferrule, graphite, 0.4-mm id		500-2114 (10/pk)
	Column nut, finger-tight (for .100- to .320-mm columns)	Connect column to inlet or detector	5020-8292
All	Ferrule, no-hole	Testing	5181-3308 (10/pk)
	Capillary column blanking nut	Testing—use with any ferrule	5020-8294
	Column nut, universal	Connect column to inlet or detector	5181-8830 (2/pk)
	Column nut, collared, self-tightening	Connect column to inlet or detector	G3440-81011
	Collar for self-tightening nut	Connect column to inlet or detector	G3440-81012
	Column nut, collared, self-tightening MSD	Connect column to inlet or detector	G3440-81013
	Column cutter, ceramic wafer	Cutting capillary columns	5181-8836 (4/pk)
	Pencil, diamond tipped	Cutting capillary columns	420-1000
	Ferrule tool kit	Ferrule installation	440-1000

**Table 23 Other consumables and parts for the multimode inlet (MMI)**

Description/quantity	Part number
Septum retainer nut for headspace	18740-60830
Septum retainer nut	18740-60835
11-mm septum, high-temperature, low-bleed, 50/pk	5183-4757
11-mm septum, prepierced, long life, 50/pk	5183-4761
Merlin Microseal septum (high-pressure)	5182-3444
Merlin Microseal septum (30 psi)	5181-8815
Nonstick fluorocarbon liner O-ring (for temperatures up to 350 °C), 10/pk	5188-5365
Graphite O-ring for split liner (for temperatures above 350 °C), 10/pk	5180-4168
Graphite O-ring for splitless liner (for temperatures above 350 °C), 10/pk	5180-4173

## 8 Maintaining the MMI

### Consumables and Parts for the Multimode Inlet

**Table 23 Other consumables and parts for the multimode inlet (MMI) (continued)**

Description/quantity	Part number
Split vent trap PM kit, single cartridge	5188-6495
Column nut, blanking plug	5020-8294
Cleaning kit, multimode inlet. (Contains 5 each abrasive swabs and 5 each cotton swabs.)	G3510-60820
Column nut adapter	G3510-20018

# Exploded Parts View of the MMI

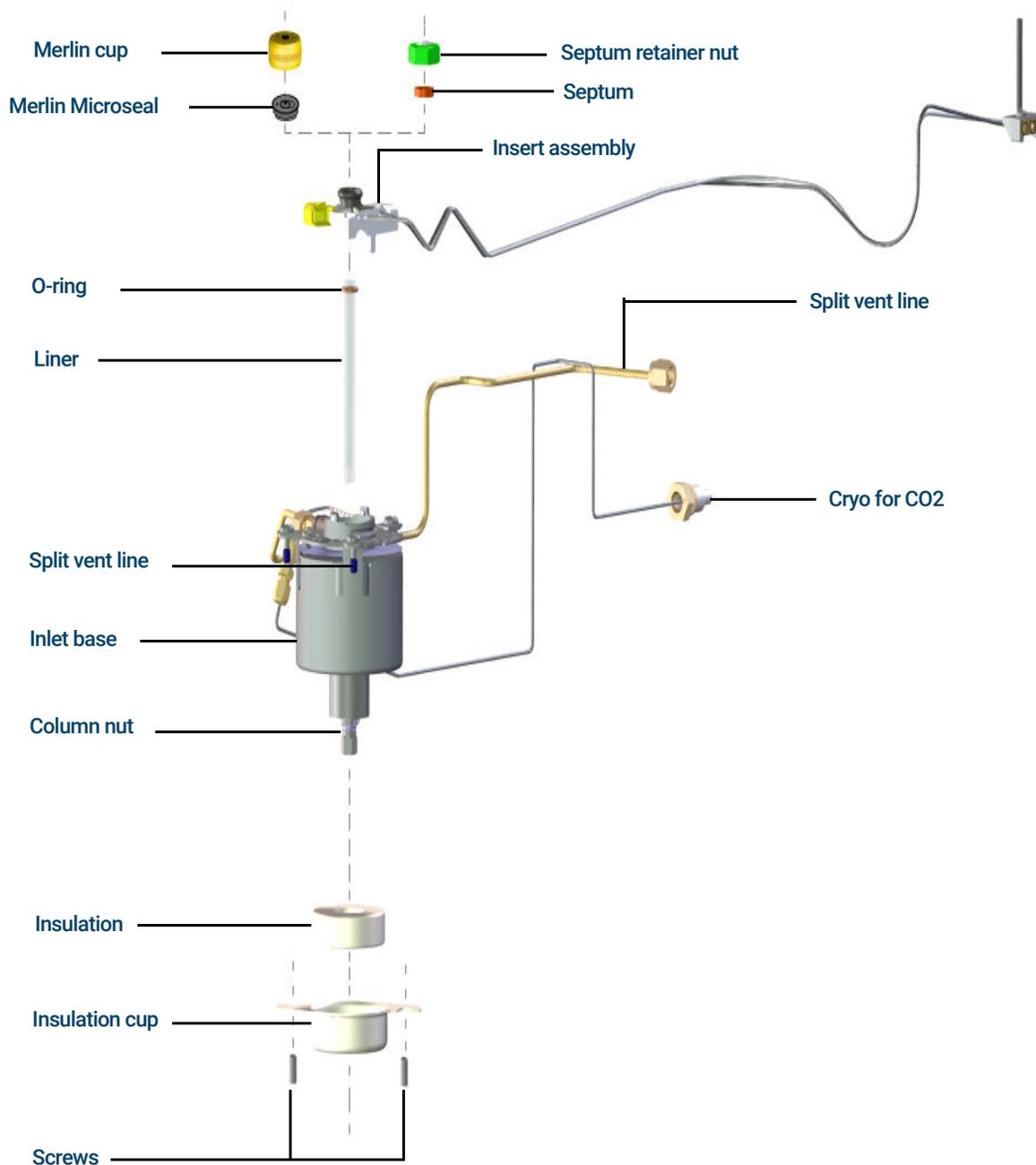


Figure 28. Multimode inlet exploded parts

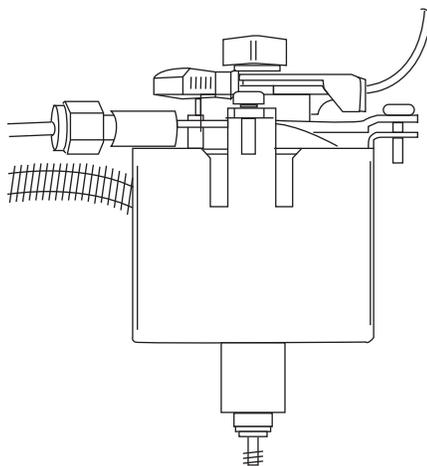
## To Install the Column Nut Adapter

- 1 Gather the following, see “Consumables and Parts for the Multimode Inlet” on page 124:
  - Column nut adapter
- 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 either is hot, wear heat-resistant gloves to protect your hands.**

- 3 When the GC is ready, open the GC oven door.
- 4 Thread the column adapter nut onto the base of the inlet.



Orient as shown.

The nut must spin freely before it can be used to install a column.

# To Install a Capillary Column with the Multimode Inlet

## WARNING

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

- 1 Gather the following, see **“Consumables and Parts for the Multimode Inlet”** on page 124:
  - 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.

## WARNING

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

## WARNING

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

- 3 Verify that the correct glass liner is installed. See **“Consumables and Parts for the Multimode Inlet”** on page 124.
- 4 Place the column on the hanger with the ends pointing up and the label to the front.

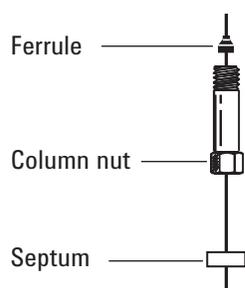
## CAUTION

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

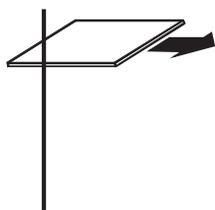
- 5 Place a septum, capillary column nut, and ferrule on the column.

## 8 Maintaining the MMI

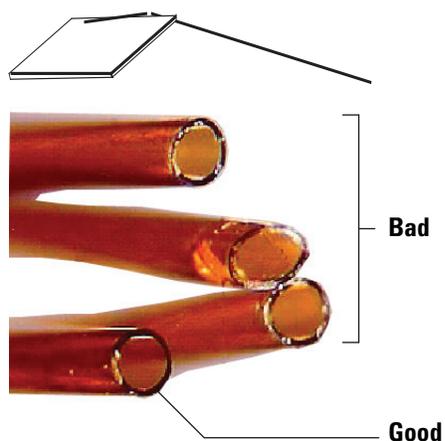
To Install a Capillary Column with the Multimode Inlet



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



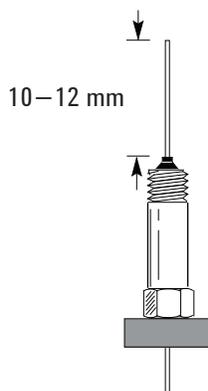
- 7 Break off the column end by supporting it against the column cutter opposite the scribe. Inspect the end with a magnifying loupe to make certain there are no burrs or jagged edges.



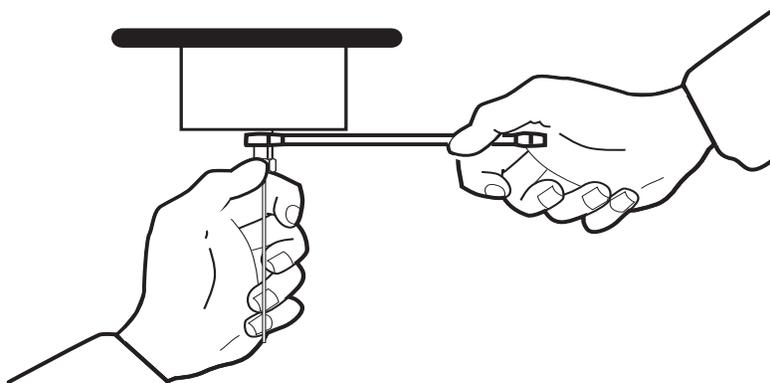
- 8 Wipe the column walls with a tissue dampened with isopropanol to remove fingerprints and dust.
- 9 Position the column so it extends 10 to 12 mm above the end of the ferrule. Slide the septum up the column to hold the column nut at this position.

## 8 Maintaining the MMI

### To Install a Capillary Column with the Multimode Inlet

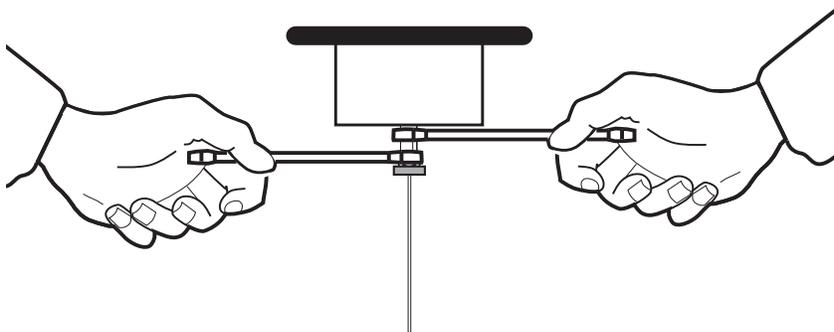


- 10** While holding the inlet base with a wrench thread the column nut into the inlet (but do not tighten).



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



- 13** Plug in the new column's Smart ID key. See [Figure 29](#).

## 8 Maintaining the MMI

### To Install a Capillary Column with the Multimode Inlet



Figure 29. Insert Smart ID key

- 14 Configure the new column.
- 15 Condition the column per the manufacturer's recommendation. See [To Condition a Capillary Column](#).
- 16 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+](#)
- 17 Exit maintenance mode. Select **Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Finished**.
- 18 After the column is installed at both inlet and detector, establish a flow of carrier gas and purge as recommended by the column manufacturer.
- 19 Restore the analytical method.
  - For FID or FPD+, immediately turn off the flame.
  - For NPD, immediately turn off the bead.
- 20 After the GC becomes ready, wait 10 minutes then ignite the detector flame or bead.

### WARNING

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

- 21 Allow the oven, inlet, and detector to equilibrate at operating temperature, then retighten the fittings.
- 22 Perform an inlet **Leak & Restriction** test and reset the maintenance counters.

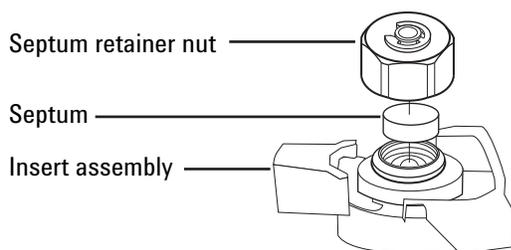
## To Change the Septum on the MMI

- 1 Gather the following:
  - Replacement septum, see “Consumables and Parts for the Multimode Inlet” on page 124.
  - Wrench, hex for changing septum
  - 0- or 00-grade steel wool (optional)
  - Tweezers
- 2 Launch the GC maintenance wizard: **Maintenance > Inlets**, select the multimode inlet, then select **Perform Maintenance > Replace Septum > Start Maintenance**. The wizard will walk through the steps needed to replace the septum (those same steps are repeated below).

### 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).



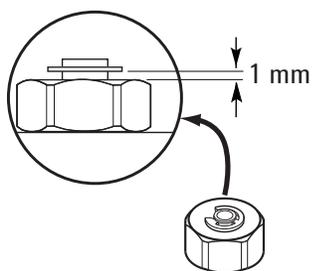
- 6 Install the septum retainer nut or Merlin cap and finger-tighten. Tighten the septum retainer nut until the C-ring is about 1 mm above the nut.

### CAUTION

**Overtightening the septum nut can cause contamination.**

## 8 Maintaining the MMI

To Change the Septum on the MMI



- 7 On the GC touchscreen, select **Maintenance > Inlets > Septum injections**, then touch **Reset Counter**.
- 8 The GC maintenance wizard will perform checks at the appropriate times, including **Leak & Restriction** tests, and will automatically reset the maintenance counters.
- 9 Select **Finished**, then select **OK** to exit the GC maintenance wizard.
- 10 Restore the analytical method.

## 8 Maintaining the MMI

To Clean the Septum Seat in the Insert Assembly of the MMI

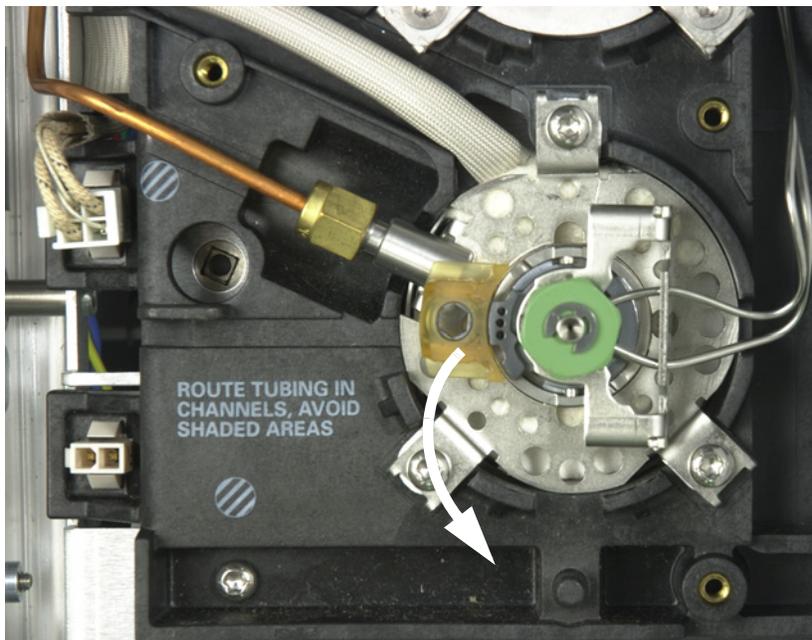
# To Clean the Septum Seat in the Insert Assembly of the MMI

- 1 Gather the following:
  - Replacement septum, see **“Consumables and Parts for the Multimode Inlet”** on page 124.
  - Wrench, hex for changing septum
  - 0- or 00-grade steel wool (optional)
  - Tweezers
  - Compressed, filtered, dry air or nitrogen
- 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.

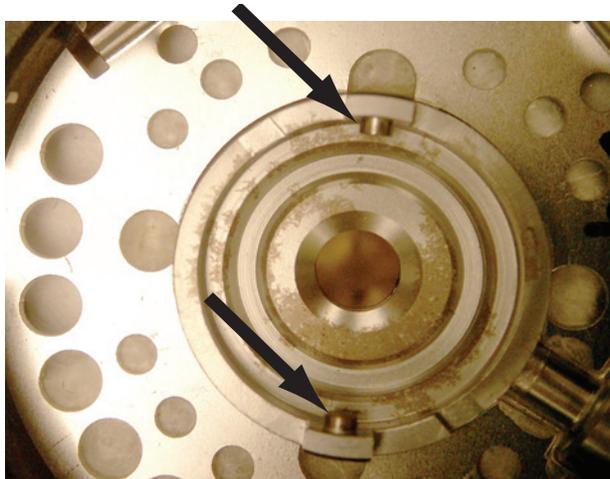


- 4 Remove the septum retainer nut or Merlin cap.
- 5 Use tweezers to remove the septum or Merlin Microseal from the retainer nut. See **“To Change the Septum on the MMI”** on page 133.
- 6 Scrub the residue from the retainer nut and septum holder with a small piece of rolled-up steel wool and tweezers. Do not do this over the inlet.

## 8 Maintaining the MMI

### To Clean the Septum Seat in the Insert Assembly of the MMI

- 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 MMI"** on page 133.
- 10 Replace the septum retainer nut or Merlin cap and finger-tighten. See **"To Change the Septum on the MMI"** on page 133.
- 11 Perform an inlet **Leak & Restriction** test and reset the maintenance counters.
- 12 On the GC touchscreen select **Maintenance > Inlets > Septum injections**, then select **Reset Counter**.
- 13 Exit maintenance mode. Select **Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Finished**.
- 14 Restore the analytical method.

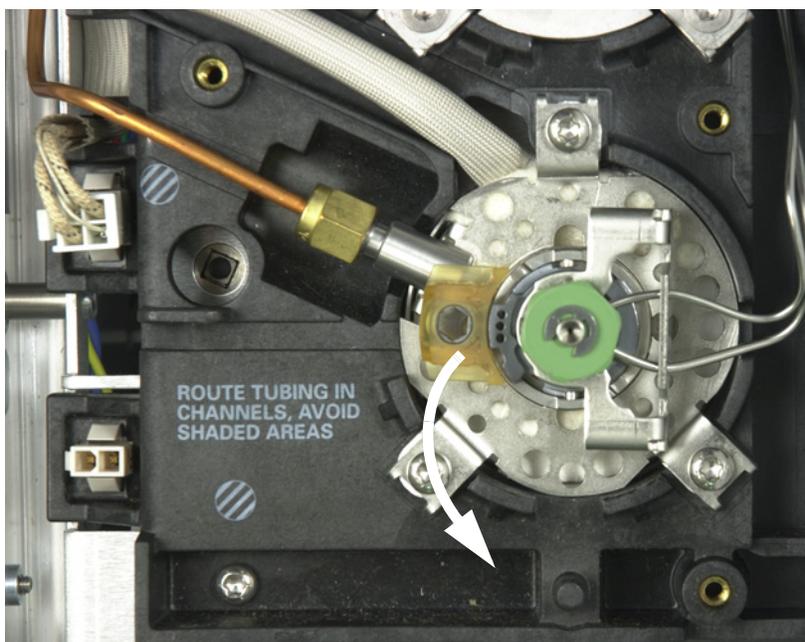
## To Change the Liner and O-Ring on the MMI

- 1 Gather the following:
  - Replacement O-ring, see “**Consumables and Parts for the Multimode Inlet**” on page 124.
  - Replacement liner
  - Tweezers
  - Wrench, hex for changing septum (optional)
  - Wrench, capillary inlet (optional)
  - Lint-free gloves
- 2 Launch the GC maintenance wizard: **Maintenance > Inlets**, select the multimode inlet, then select **Perform Maintenance > Replace Liner > Start Maintenance**. The wizard will walk through the steps needed to replace the liner and O-ring (those same steps are repeated below).

### WARNING

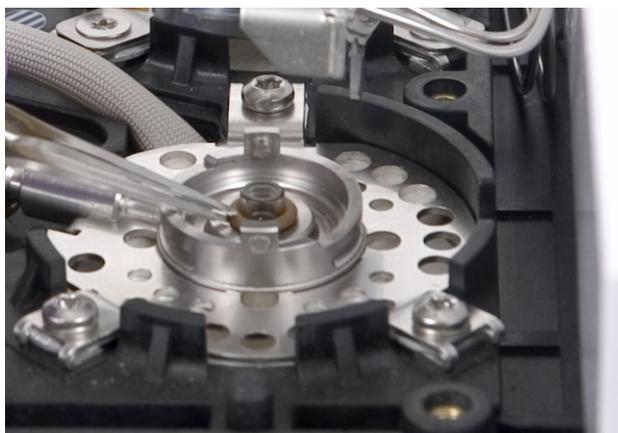
**Be careful! The oven and/or inlet may be hot enough to cause burns. If either is hot, wear heat-resistant gloves to protect your hands.**

- 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.

**8 Maintaining the MMI**  
To Change the Liner and O-Ring on the MMI



5 Grasp the liner with tweezers and pull it out.



6 Inspect the surface of the seal for contamination. If required, clean with cotton swabs.



## 8 Maintaining the MMI

### To Change the Liner and O-Ring on the MMI

Clean the inlet if there is visible or suspected contamination. See [“To Clean the Multimode Inlet”](#) on page 142.

Clean O-ring residue from sealing surface.

#### CAUTION

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

- 7 Slide a new O-ring onto the replacement liner.
- 8 Install the liner to the inlet, pushing it all the way in until the liner contacts the seal.



- 9 Line up the tab on the bottom of the insert assembly with the slot on the inlet body and push down to connect. Slide the locking tab to the back.
- 10 Turn on the inlet. Allow the inlet and column to purge with carrier gas for 15 minutes before heating the inlet or the column oven.
- 11 Bakeout contaminants. See [“To Bakeout Contaminants from the MMI”](#) on page 144.
- 12 The GC maintenance wizard will perform checks at the appropriate times, including **Leak & Restriction** tests, and will automatically reset the maintenance counters.
- 13 Select **Finished**, then select **OK** to exit the GC maintenance wizard.
- 14 Restore the analytical method.

## 8 Maintaining the MMI

To Replace the Filter in the Split Vent Trap for the MMI

# To Replace the Filter in the Split Vent Trap for the MMI

- 1 Gather the following:
  - New split vent filter cartridge, see “**Consumables and Parts for the Multimode Inlet**” on page 124.
- 2 Launch the GC maintenance wizard: **Maintenance > Inlets**, select the multimode inlet, then select **Perform Maintenance > Replace Split Vent Trap > Start Maintenance**. The wizard will walk through the steps needed to replace the filter (those same steps are repeated below).

### 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 “**To Remove the Pneumatics Cover**” on page 19 (top, back of GC).
- 4 Completely loosen the knurled nut that secures the split vent trap in place as shown in **Figure 30**.

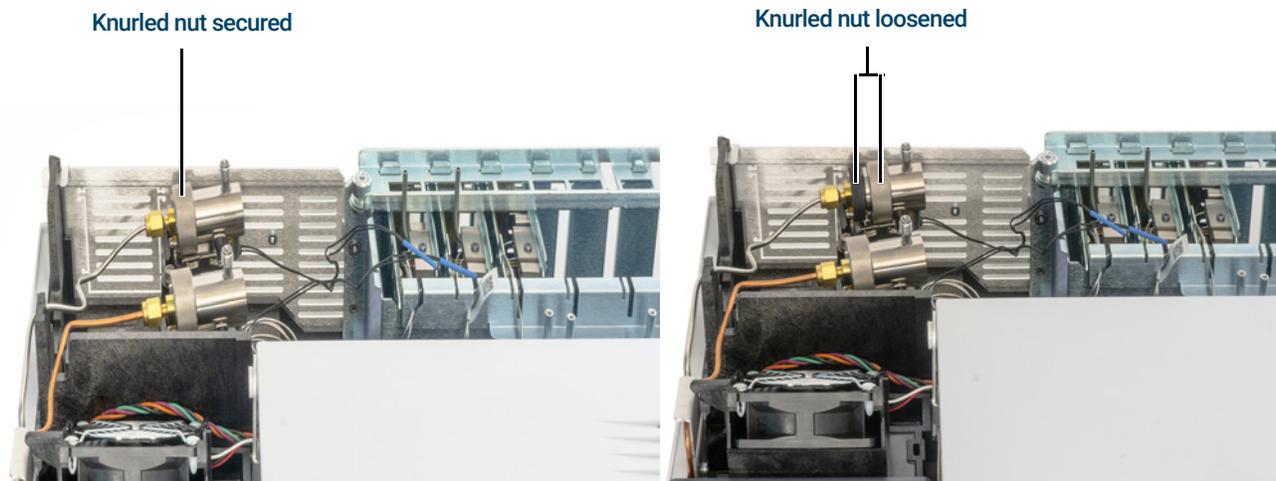


Figure 30. Loosen knurled nut

- 5 Slide the trap assembly back from the guided mounting bracket and tilt up to expose the filter as shown in **Figure 31**.

## 8 Maintaining the MMI

### To Replace the Filter in the Split Vent Trap for the MMI

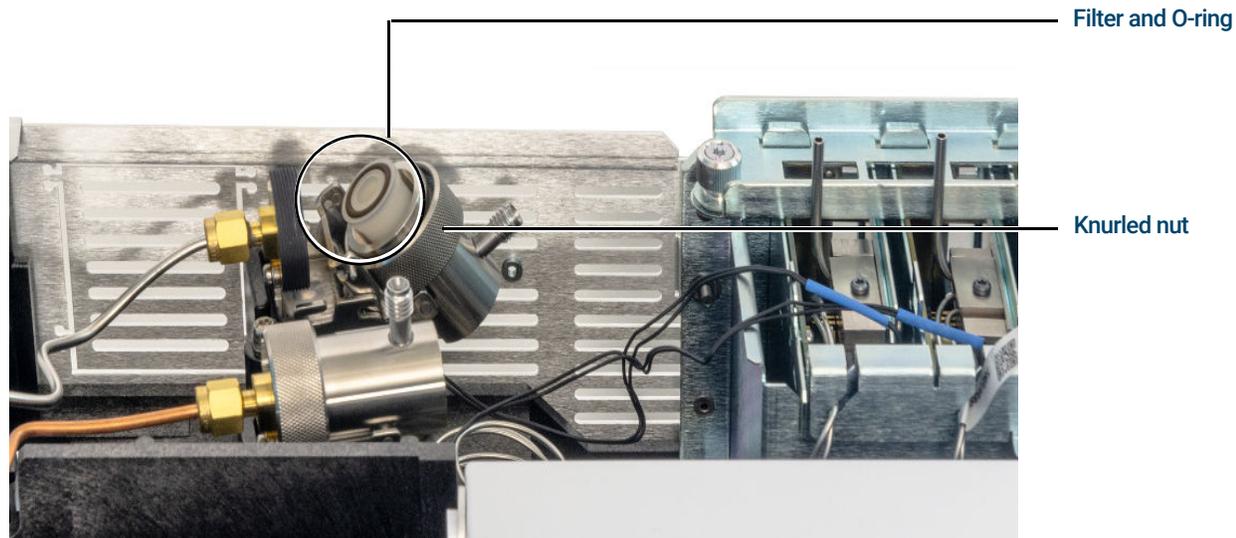


Figure 31. Slide trap assembly to expose the filter

- 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 The GC maintenance wizard will perform checks at the appropriate times, including **Leak & Restriction** tests, and will automatically reset the maintenance counters.
- 10 Install the pneumatics cover.
- 11 Select **Finished**, then select **OK** to exit the GC maintenance wizard.

## To Clean the Multimode Inlet

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

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

### CAUTION

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

- 4 Remove the inlet liner. See **"To Change the Liner and O-Ring on the MMI"** on page 137.
- 5 Remove the column from the inlet. See **"To Install a Capillary Column with the Multimode Inlet"** on page 129.
- 6 Place the glass beaker or other container in the GC oven, below the MMI inlet, so it will catch any solvent that drips through the inlet body.
- 7 Moisten a cotton swab with solvent and wipe the inside bottom seal of the inlet repeatedly to remove any loose material from the MMI. If desired, the cotton swab can be used to clean the bore of the inlet. For most samples, this is not necessary. Dispose of the swab after a single use.
- 8 Using a dry abrasive swab, place the swab all the way to the bottom of the inlet and with moderate pressure, twist the swab forwards and backwards while it is in contact with the bottom of the MMI (approximately 20 cycles should be sufficient). The abrasive swab can be used multiple times.

## 8 Maintaining the MMI

### To Clean the Multimode Inlet

- 9 Using a second solvent moistened cotton swab, wipe the bottom of the inlet to remove any residue. Depending on the amount of use and maximum temperature used, the bottom of the inlet may still show some oxidation (light brown color). This is normal and will not affect inlet performance. Repeat steps 3-5 (if necessary) to remove any remaining deposits.
- 10 Using clean solvent, rinse the inlet volume several times but never overfill the inlet bore. Position a container under the column opening in the inlet to catch the used solvent exiting the bottom of the MMI.
- 11 Allow the inlet to dry.
- 12 Install the liner and O-ring.
- 13 Reinstall the column.
- 14 Turn on the GC.
- 15 Perform an inlet **Leak & Restriction** test and reset the maintenance counters.
- 16 Exit maintenance mode. Select **Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Finished.**
- 17 Restore the analytical method.

## To Bakeout Contaminants from the MMI

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

### **WARNING**

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

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

## Maintaining the PTV Inlet

Consumables and Parts for the Programmable Temperature Vaporization Inlet 146

Exploded Parts View of the PTV Inlet 148

To Install a Capillary Column with the Programmable Temperature Vaporization Inlet 149

To Clean the Septumless Head on the PTV Inlet 152

To Replace the Septumless Head PTFE Ferrule on the PTV Inlet 154

To Change the Septum on the PTV Inlet 156

To Clean the Septum Seat in the Septum Head Assembly of the PTV Inlet 157

To Change the Liner on the PTV Inlet 158

To Replace the Inlet Adapter for the PTV Inlet 160

To Replace the Filter in the Split Vent Trap for the PTV Inlet 162

To Bakeout Contaminants from the PTV Inlet 164

## Consumables and Parts for the Programmable Temperature Vaporization Inlet

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

**Table 24 PTV liners and ferrules**

Description	Part number
Single baffle, 2-mm id, 180- $\mu$ L, deactivated, glass wool	5183-2038
Single baffle, 2-mm id, 200- $\mu$ L, deactivated	5183-2036
Multi-baffle, 1.5-mm id, 150- $\mu$ L, deactivated	5183-2037
Fritted glass, 1.5-mm id, 150- $\mu$ L, deactivated	5183-2041
Graphpak 3D ferrules for liner	5182-9749 (5/pk)
Installation tool for 3D ferrules	G2617-80540

**Table 25 Other consumables and parts for the PTV inlet**

Description	Part number
Split vent trap PM kit, single cartridge	5188-6495
<b>Septumless head</b>	
Septumless head	G2617-60507
PTFE ferrules (needle seal)	5182-9748 (10/pk)
Septumless head rebuild kit (includes Viton seal, Kalrez seal, and pressure spring)	5182-9747
Carrier gas tube for septumless head	G2617-80550
Ferrule, 1/16-inch PTFE, for septumless head carrier gas tube	0100-1375
<b>Septum head</b>	
Merlin Microseal septum (high-pressure)	5182-3444
11-mm septa, red	5181-1263 (50/pk)
<b>Column adapter parts</b>	
Silver seal	5182-9763 (5/pk)
Graphpak 2M inlet adapter, 0.20-mm id*	5182-9754
Graphpak 2M inlet adapter, 0.25- to 0.33-mm id*	5182-9761
Graphpak 2M inlet adapter, 0.53-mm id*	5182-9762
Ferrules for Graphpak 2M inlet, 0.20-mm id	5182-9756 (10/pk)
Ferrules for Graphpak 2M inlet, 0.25-mm id	5182-9768 (10/pk)
Ferrules for Graphpak 2M inlet, 0.32-mm id	5182-9769 (10/pk)

## 9 Maintaining the PTV Inlet

### Consumables and Parts for the Programmable Temperature Vaporization Inlet

Table 25 Other consumables and parts for the PTV inlet (continued)

Description	Part number
Ferrules for Graphpak 2M inlet, 0.53-mm id	5182-9770 (10/pk)
Split nut for Graphpak adapter	5062-3525

\* Includes (1) adapter, (1) silver seal, and (1) split column nut.

# Exploded Parts View of the PTV Inlet

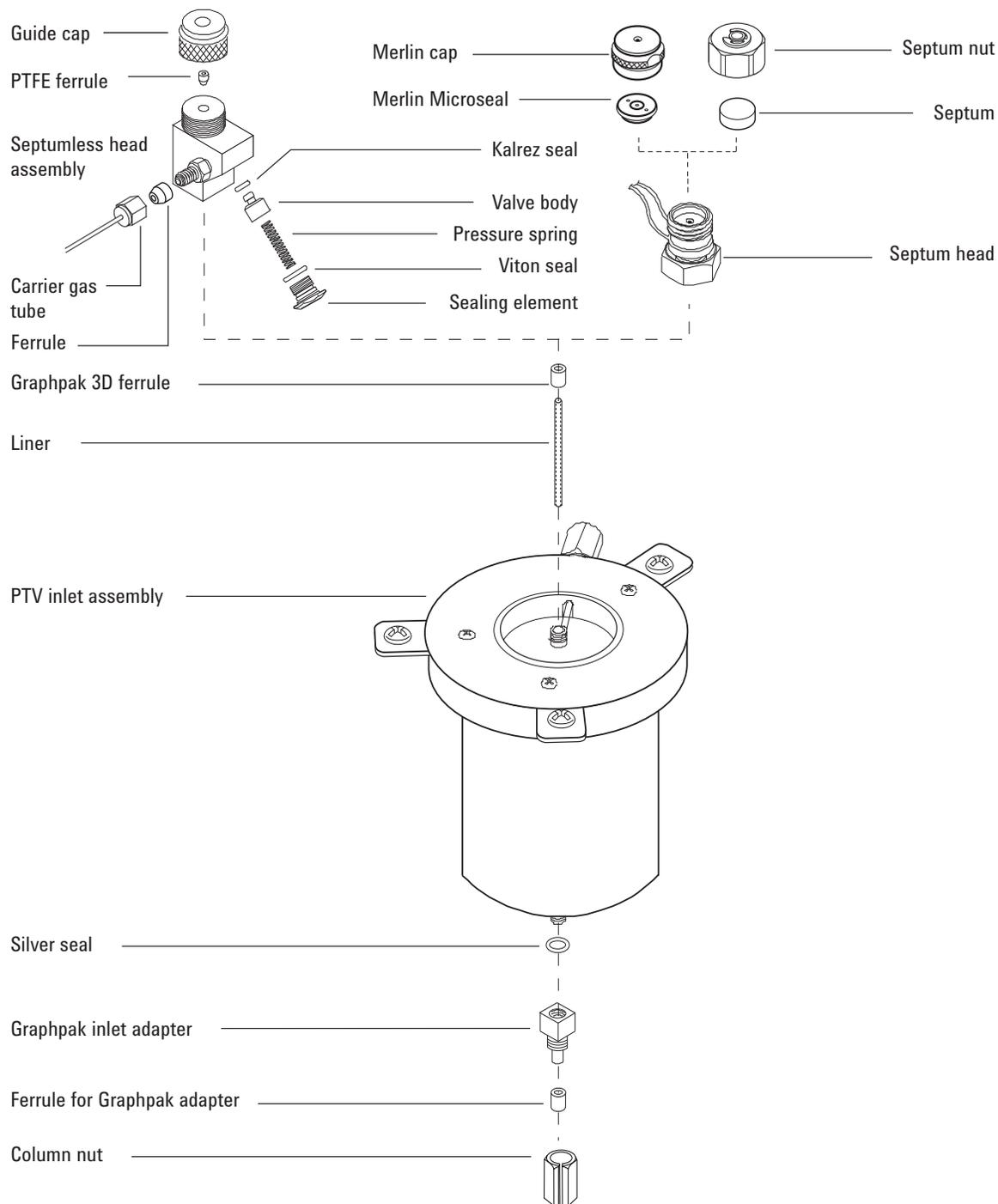


Figure 32. Programmable temperature vaporization inlet exploded parts

## To Install a Capillary Column with the Programmable Temperature Vaporization Inlet

- 1 Gather the following, see **“Consumables and Parts for the Programmable Temperature Vaporization Inlet”** on page 146:
  - Column
  - Graphpak 2M ferrule
  - Column nut
  - Column cutter
  - Septum
  - Isopropanol
  - Lab tissue
  - Metric ruler
  - 5-mm and 6-mm wrenches
  - Typewriter correction fluid or a marker
  - Lint-free gloves
- 2 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 either is hot, wear heat-resistant gloves to protect your hands.

### WARNING

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

- 3 Before installing the column, install the correct column adapter. See **“To Replace the Inlet Adapter for the PTV Inlet”** on page 160.

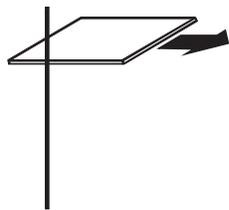
### CAUTION

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

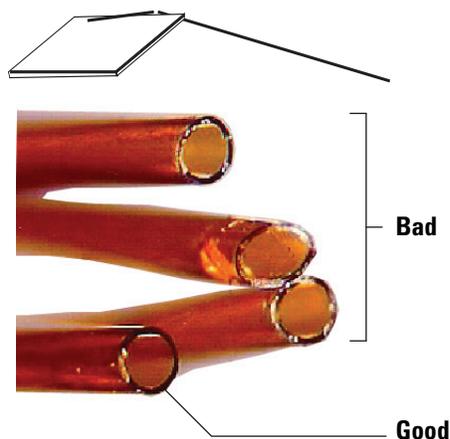
- 4 Place the column on the hanger with the ends pointing up and the label to the front.
- 5 Place a Graphpak 2M ferrule onto the column, with the graphite facing up towards the inlet.
- 6 Score the column using a glass scribing tool. The score must be square to ensure a clean break.

## 9 Maintaining the PTV Inlet

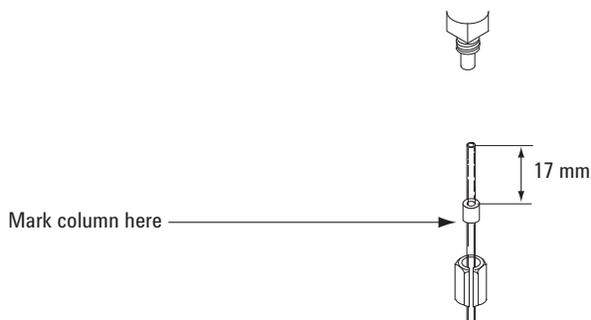
To Install a Capillary Column with the Programmable Temperature Vaporization Inlet



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



- 8 Wipe the column walls with a tissue dampened with isopropanol to remove fingerprints and dust.
- 9 Position the column so it extends 17 mm above the end of the ferrule. Mark the column behind the ferrule with typewriter correction fluid or a marker. Slide the nut over the column.



- 10 Insert the column into the adapter and finger-tighten the column nut. Looking through the slot in the nut, adjust the column until the mark is correctly positioned below the Graphpak 2M ferrule.
- 11 Tighten the column nut an additional 1/8 to 1/4 turn with a wrench. Do not overtighten.
- 12 Plug in the new column's Smart ID key. See [Figure 33](#).

## 9 Maintaining the PTV Inlet

To Install a Capillary Column with the Programmable Temperature Vaporization Inlet



Figure 33. Insert Smart ID key

- 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 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.

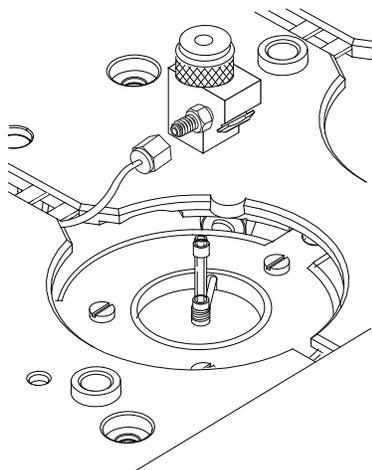
## To Clean the Septumless Head on the PTV Inlet

- 1 Gather the following:
  - Syringe with 23-gauge needle, see **“Consumables and Parts for the Programmable Temperature Vaporization Inlet”** on page 146.
  - Septumless head rebuild kit
  - Hexane
  - Clean, lint-free gloves
  - 5/16-inch wrench
  - Lint-free gloves
- 2 Manually set the inlet and oven temperature to  $< 40\text{ }^{\circ}\text{C}$ , 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.**
- 3 Disconnect the carrier gas line.

### WARNING

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

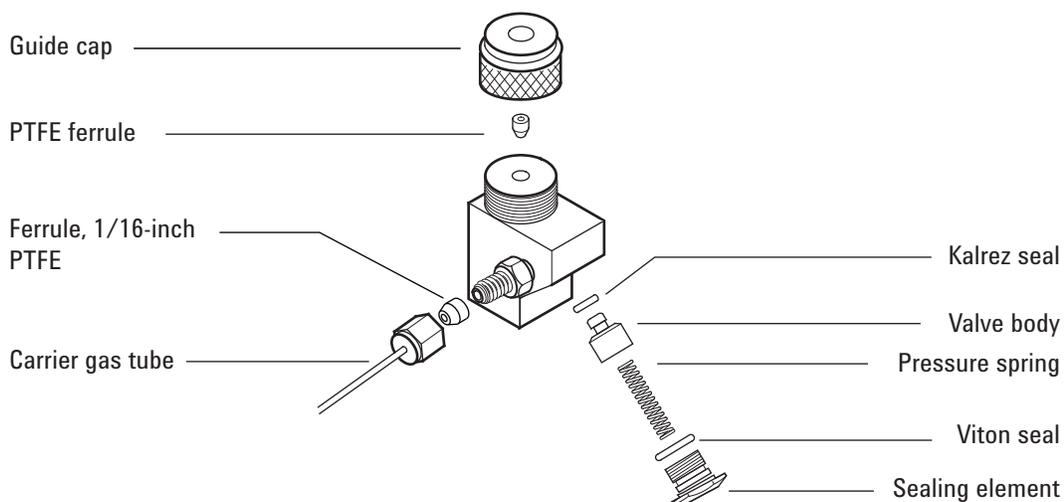
- 4 Unscrew and remove the septumless head assembly from the inlet.



- 5 Unscrew the sealing element from the head assembly and carefully remove the Viton seal and the pressure spring

## 9 Maintaining the PTV Inlet

To Clean the Septumless Head on the PTV Inlet



- 6 Unscrew the guide cap from the head and remove the PTFE ferrule.
- 7 Carefully insert a syringe with a 23-gauge needle into the head to press the valve body and Kalrez seal slightly out of the head.
- 8 Gently tap the head on a soft, smooth surface so that the valve body falls out completely or slips out far enough to grasp with fingers.
- 9 Remove the Kalrez seal from the valve body.
- 10 Clean all components in hexane.

### CAUTION

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

- 11 Replace the PTFE ferrule. See **“To Replace the Septumless Head PTFE Ferrule on the PTV Inlet”** on page 154.
- 12 Wearing clean lint-free gloves, reassemble the head in reverse order. Be sure that the seals and the pressure spring are not damaged.
- 13 Finger-tighten the septumless head, then tighten an additional 1/8 turn with a wrench.
- 14 Reconnect the carrier gas line.
- 15 Check for leaks; if necessary, slightly tighten the guide cap with the syringe needle inserted.
  - If the head leaks with the syringe inserted, replace the PTFE ferrule.
  - If the head leaks without the syringe inserted, replace the Kalrez and Viton seals.
- 16 Perform an inlet **Leak & Restriction** test and reset the maintenance counters.
- 17 Exit maintenance mode. Select **Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Finished**.
- 18 Restore the analytical method.

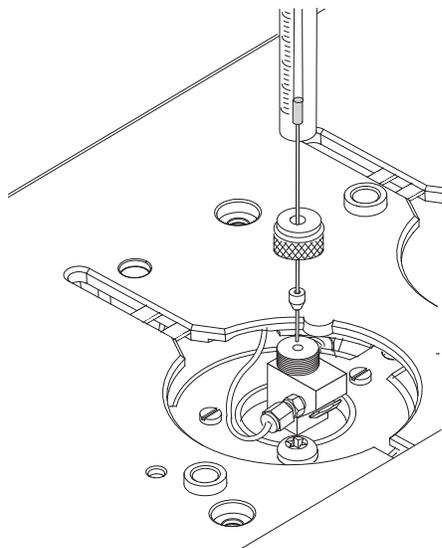
## To Replace the Septumless Head PTFE Ferrule on the PTV Inlet

- 1 Gather the following:
  - Syringe with 23-gauge needle, see **“Consumables and Parts for the Programmable Temperature Vaporization Inlet”** on page 146.
  - Replacement PTFE ferrule
- 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 either is hot, wear heat-resistant gloves to protect your hands.**

- 3 Unscrew the guide cap from the septumless head and remove the PTFE ferrule.
- 4 Push the guide cap and replacement ferrule over the syringe needle so that at least 10 mm of the needle tip is exposed.



- 5 Guide the end of the needle into the septumless head until the ferrule meets the septumless head.
- 6 Loosely install the guide cap.
- 7 If not configured, configure the column.
- 8 Exit maintenance mode. Select **Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Finished**.
- 9 Put the inlet into **Splitless** mode.
- 10 Set the column flow to 5 mL/min and the purge flow to 60 mL/min.
- 11 After the inlet pressurizes, press  once.

## 9 Maintaining the PTV Inlet

### To Replace the Septumless Head PTFE Ferrule on the PTV Inlet

- 12 Observe the inlet **Total Flow**. Tighten the guide cap until the **Total Flow** stops decreasing (typically near 8 mL/min).
- 13 Remove the syringe from the inlet and press .
- 14 Restore the analytical method.
- 15 Perform an inlet **Leak & Restriction** test and reset the maintenance counters.

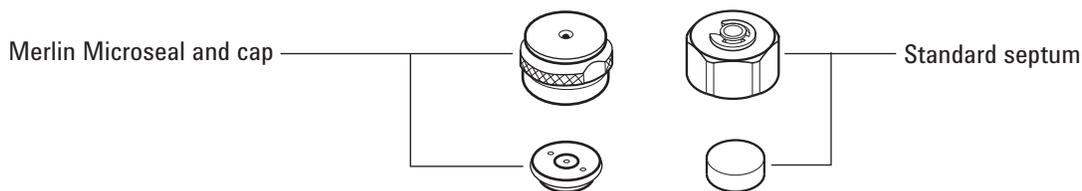
## To Change the Septum on the PTV Inlet

- 1 Gather the following:
  - Replacement septum, see “**Consumables and Parts for the Programmable Temperature Vaporization Inlet**” on page 146.
  - 5/8-inch wrench
- 2 Launch the GC maintenance wizard: **Maintenance > Inlets**, select the inlet, then select **Perform Maintenance > Replace Septum > Start Maintenance**. The wizard will walk through the steps needed to replace the septum (those same steps are repeated below).

### WARNING

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

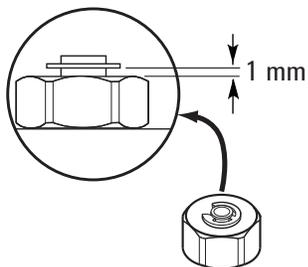
- 3 Remove the septum retainer nut or Merlin cap. If the septum head begins to turn during removal, support it manually while removing the cap.
- 4 Use tweezers to remove the septum or Merlin Microseal from the retainer nut. Do not gouge or scratch the interior of the septum head.
- 5 Firmly press the new septum or Merlin Microseal into the fitting. The metal parts side of the Merlin Microseal should face down (toward the oven).



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

### CAUTION

**Overtightening the septum nut can cause contamination.**



- 7 The GC maintenance wizard will perform checks at the appropriate times, including **Leak & Restriction** tests, and will automatically reset the maintenance counters.
- 8 Select **Finished**, then select **OK** to exit the GC maintenance wizard.
- 9 Restore the analytical method.

# To Clean the Septum Seat in the Septum Head Assembly of the PTV Inlet

- 1 Gather the following:
  - Replacement septum, see “**Consumables and Parts for the Programmable Temperature Vaporization Inlet**” on page 146.
  - 5/8-inch wrench
  - Tweezers
  - 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.**

**CAUTION**

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

- 3 Remove the septum retainer nut or Merlin cap. If the septum head begins to turn during removal, support it manually while removing the cap.
- 4 Unscrew the septum head assembly from the inlet and move it up and away from the inlet.
- 5 Use tweezers to remove the septum or Merlin Microseal from the retainer nut. Do not gouge or scratch the interior of the septum head.
- 6 Scrub the residue from the retainer nut and septum holder with a small piece of rolled-up steel wool and tweezers. Do not do this over the inlet.
- 7 Use compressed air or nitrogen to blow away the pieces of steel wool and septum.
- 8 Replace the septum head assembly on the inlet. Finger-tighten the septum head and then tighten an additional 1/2 turn with a wrench.
- 9 Firmly press the new septum or Merlin Microseal into the fitting. See “**To Change the Septum on the PTV Inlet**” on page 156.
- 10 Replace the septum retainer nut or Merlin cap and finger-tighten. See “**To Change the Septum on the PTV Inlet**” on page 156.
- 11 Perform an inlet **Leak & Restriction** test and reset the maintenance counters.
- 12 Exit maintenance mode. Select **Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Finished.**
- 13 Restore the analytical method.

## To Change the Liner on the PTV Inlet

- 1 Gather the following:
  - Installation tool for 3D ferrules, see “**Consumables and Parts for the Programmable Temperature Vaporization Inlet**” on page 146.
  - Assembly tool (part number G2617-80540)
  - Replacement liner
  - Graphpak 3D ferrule
  - 5/16-inch wrench
  - Lint-free gloves
- 2 Launch the GC maintenance wizard: **Maintenance > Inlets**, select the inlet, then select **Perform Maintenance > Replace Liner and O-Ring > Start Maintenance**. The wizard will walk through the steps needed to replace the liner (those same steps are repeated below).

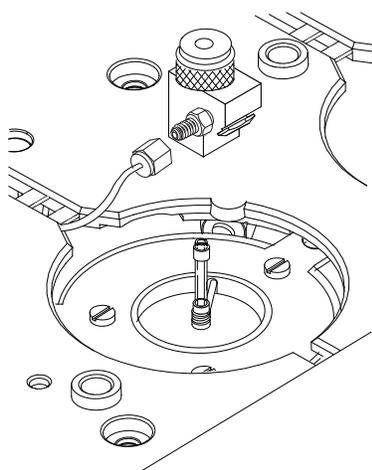
### WARNING

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

### CAUTION

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

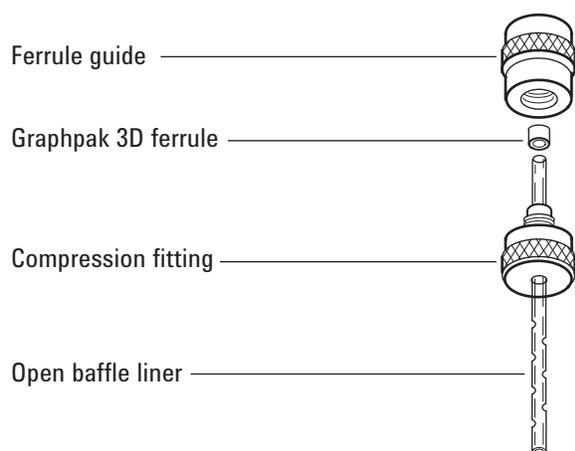
- 3 Remove the head from the inlet:
  - For septumless head, disconnect the carrier gas line and unscrew and remove the septumless head assembly from the inlet.
  - For septum head, loosen the septum head assembly from the inlet. Lift the head to clear the inlet and push to either side. Do not bend the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



- 5 Unscrew the assembly tool into two pieces: the ferrule guide and the compression fitting.

## 9 Maintaining the PTV Inlet

### To Change the Liner on the PTV Inlet



- 6 Slide the compression fitting onto the longer, straight end of the new liner with the threads pointing toward the end of the liner.
- 7 Place a Graphpak 3D ferrule on the same end of the liner with the recessed graphite end towards the compression fitting. Slide the ferrule so that about 2 mm of the liner is exposed beyond the ferrule.
- 8 Slide the compression fitting up to meet the ferrule. Finger-tighten the ferrule guide onto the compression fitting.
- 9 Unscrew and remove the ferrule guide.
- 10 Slide the compression fitting off the other end of the liner. The ferrule should now be set with 1 mm of the liner exposed. Check that the graphite within the ferrule is flush with the top of the metal collar.
- 11 Insert the glass liner into the inlet from above until the unpacked side of the ferrule rests on the top of the inlet.
- 12 Replace the head:
  - For septumless head, screw the head onto the inlet and tighten 1/8 turn past finger-tight with a wrench. Reconnect the carrier gas line.
  - For septum head, align the head with the inlet and manually engage the free-spinning nut to the inlet. Tighten 1/2 turn past finger-tight with a wrench.
- 13 Check all connections for leaks. If necessary, tighten them again by hand.
- 14 Configure the new liner.
- 15 The GC maintenance wizard will perform checks at the appropriate times, including **Leak & Restriction** tests, and will automatically reset the maintenance counters.
- 16 Select **Finished**, then select **OK** to exit the GC maintenance wizard.
- 17 Restore the analytical method.

## To Replace the Inlet Adapter for the PTV Inlet

- 1 Select from the following list an adapter with the smallest hole diameter that will accept the column. The adapter number is stamped on the side of the adapter. Also see **“Consumables and Parts for the Programmable Temperature Vaporization Inlet”** on page 146.

Table 26 PTV inlet adapters

Column id	Inlet adapter number*	Part number
0.20 mm	31	5182-9754
0.25 to 0.33 mm	45	5182-9761
0.53 mm	70	5182-9762

\* Includes (1) adapter, (1) silver seal, and (1) split column nut.

- 2 Gather the following:
  - Replacement adapter
  - Replacement silver seal
  - 6-mm wrench
  - 5-mm wrench
  - Lint-free gloves
- 3 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 either is hot, wear heat-resistant gloves to protect your hands.**

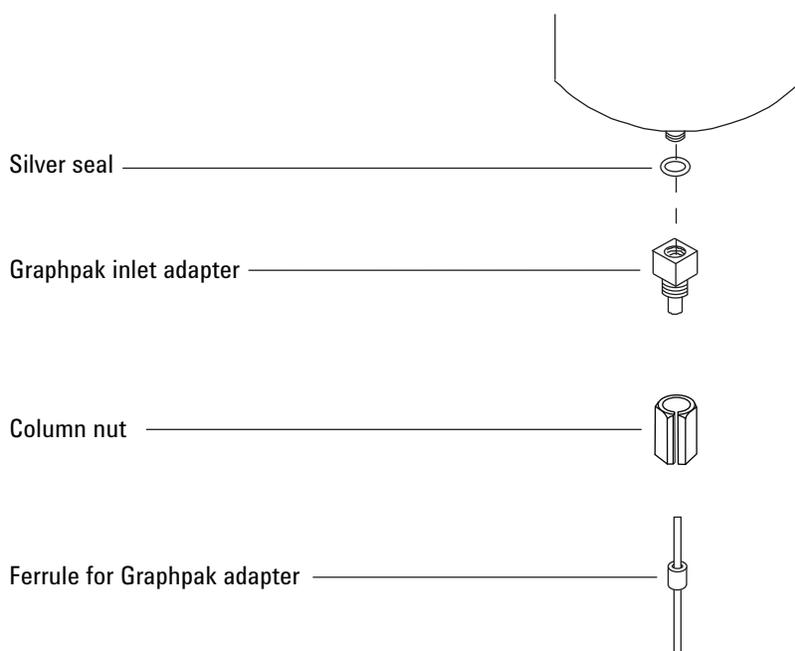
### CAUTION

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

- 4 Unscrew the column nut from the adapter. Remove the nut and the column from the inlet.

## 9 Maintaining the PTV Inlet

To Replace the Inlet Adapter for the PTV Inlet



- 5 Remove the inlet adapter and discard the old silver seal.
- 6 Insert a new silver seal into the adapter and finger-tighten the adapter onto the inlet. Tighten an additional 1/16 to 1/8 turn with a wrench; overtightening will damage the inlet.
- 7 Install the column. See **“To Install a Capillary Column with the Programmable Temperature Vaporization Inlet”** on page 149.
- 8 Check the adapter for leaks.
- 9 Reset the silver seal EMF counter.
- 10 Perform an inlet **Leak & Restriction** test and reset the maintenance counters.
- 11 Exit maintenance mode. Select **Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Finished.**
- 12 Restore the analytical method.

## To Replace the Filter in the Split Vent Trap for the PTV Inlet

- 1 Gather the following:
  - New split vent filter cartridge, see “**Consumables and Parts for the Programmable Temperature Vaporization Inlet**” on page 146.
- 2 Launch the GC maintenance wizard: **Maintenance > Inlets**, select the PTV inlet, then select **Perform Maintenance > Replace Split Vent Trap > Start Maintenance**. The wizard will walk through the steps needed to replace the filter (those same steps are repeated below).

### 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 “**To Remove the Pneumatics Cover**” on page 19 (top, back of GC).
- 4 Completely loosen the knurled nut that secures the split vent trap in place as shown in **Figure 34**.

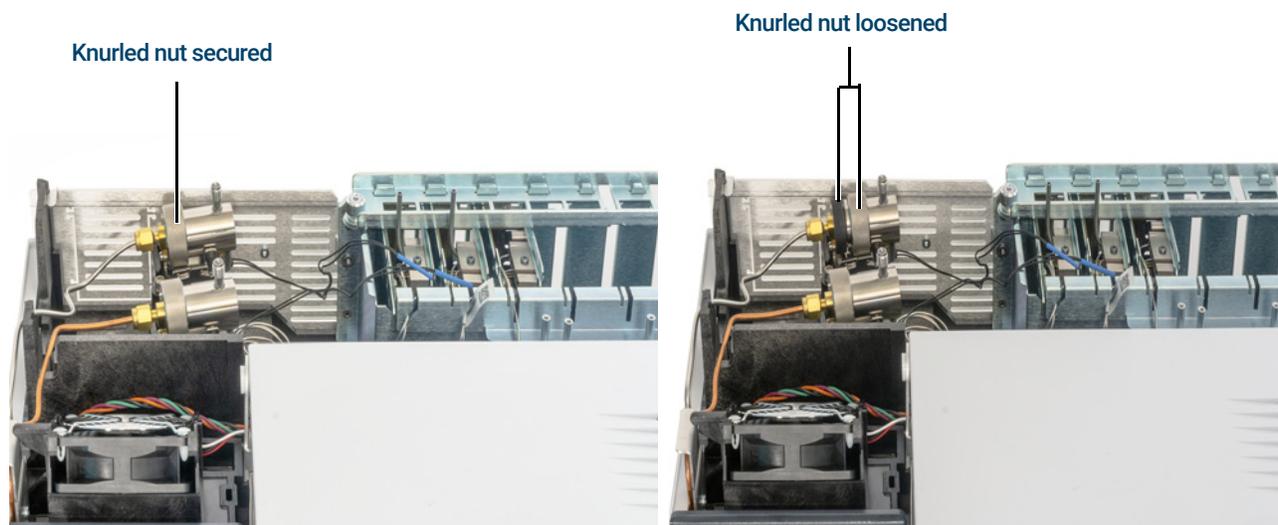


Figure 34. Loosen knurled nut

- 5 Slide the trap assembly back from the guided mounting bracket and tilt up to expose the filter as shown in **Figure 35**.

## 9 Maintaining the PTV Inlet

To Replace the Filter in the Split Vent Trap for the PTV Inlet

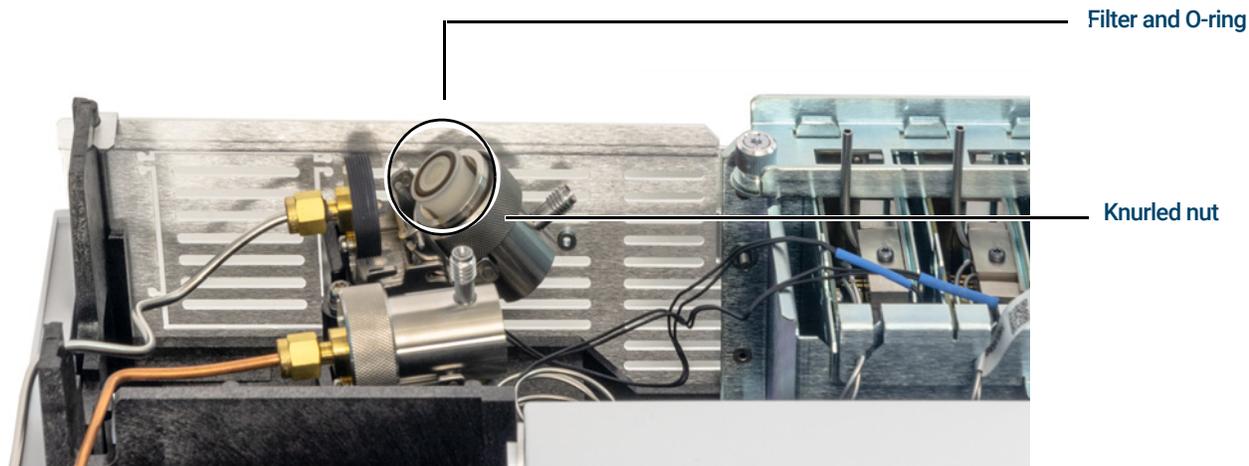


Figure 35. Slide trap assembly to expose the filter

- 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 The GC maintenance wizard will perform checks at the appropriate times, including **Leak & Restriction** tests, and will automatically reset the maintenance counters.
- 10 Install the pneumatics cover.
- 11 Select **Finished**, then select **OK** to exit the GC maintenance wizard.

## To Bakeout Contaminants from the PTV Inlet

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

### **WARNING**

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

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

## Maintaining the VI

- Consumables and Parts for the Volatiles Interface 166
- Exploded Parts View of the VI 168
- To Install a Capillary Column with the Volatiles Interface 169
- To Remove the VI Interface 173
- To Clean the VI 175
- To Install the VI Interface 176
- To Replace the Filter in the Split Vent Trap for the VI 177
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## Consumables and Parts for the Volatiles Interface

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 27 Parts for the VI**

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

**Table 28 Nuts, ferrules, and hardware for capillary columns**

Column id (mm)	Description	Typical use	Part number/quantity
.530	Ferrule, Vespel/graphite, 0.8-mm id	0.45-mm and 0.53-mm capillary columns	5062-3512 (10/pk)
	Ferrule, graphite, 1.0-mm id	0.53-mm capillary columns	5080-8773 (10/pk)
	Ferrule, graphite, 0.8-mm id	0.53-mm capillary columns	500-2118 (10/pk)
	Column nut, finger-tight (for 0.53-mm columns)	Connect column to inlet or detector	5020-8293
.320	Ferrule, Vespel/graphite, 0.5-mm id	0.32-mm capillary columns	5062-3514 (10/pk)
	Ferrule, graphite, 0.5-mm id	0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853 (10/pk)
	Column nut, finger-tight (for .100- to .320-mm columns)	Connect column to inlet or detector	5020-8292
.250	Ferrule, Vespel/graphite, 0.4-mm id	0.1-mm, 0.2-mm, and 0.25-mm capillary columns	5181-3323 (10/pk)
	Ferrule, graphite, 0.5-mm id	0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853 (10/pk)
	Column nut, finger-tight (for .100- to .320-mm columns)	Connect column to inlet or detector	5020-8292
.100 and .200	Ferrule, Vespel/graphite, 0.37-mm id	0.1-mm and 0.2-mm capillary columns	5062-3516 (10/pk)
	Ferrule, Vespel/graphite, 0.4-mm id	0.1-mm, 0.2-mm, and 0.25-mm capillary columns	5181-3323 (10/pk)
	Ferrule, graphite, 0.5-mm id	0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853 (10/pk)
	Ferrule, graphite, 0.4-mm id		500-2114 (10/pk)
	Column nut, finger-tight (for .100- to .320-mm columns)	Connect column to inlet or detector	5020-8292

## 10 Maintaining the VI

### Consumables and Parts for the Volatiles Interface

**Table 28 Nuts, ferrules, and hardware for capillary columns (continued)**

Column id (mm)	Description	Typical use	Part number/quantity
All	Ferrule, no-hole	Testing	5181-3308 (10/pk)
	Capillary column blanking nut	Testing—use with any ferrule	5020-8294
	Column nut, universal	Connect column to inlet or detector	5181-8830 (2/pk)
	Column nut, collared, self-tightening	Connect column to inlet or detector	G3440-81011
	Collar for self-tightening nut	Connect column to inlet or detector	G3440-81012
	Column nut, collared, self-tightening MSD	Connect column to inlet or detector	G3440-81013
	Column cutter, ceramic wafer	Cutting capillary columns	5181-8836 (4/pk)
	Pencil, diamond tipped	Cutting capillary columns	420-1000
	Ferrule tool kit	Ferrule installation	440-1000

## Exploded Parts View of the VI

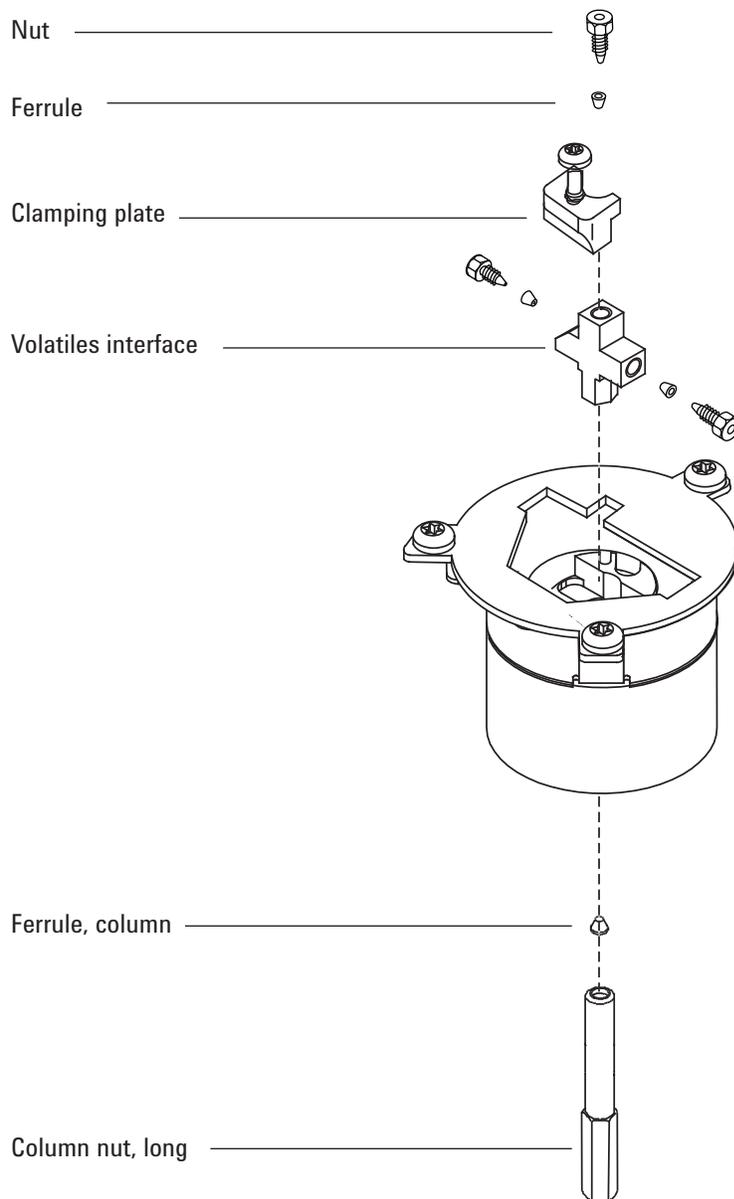


Figure 36. Volatiles interface exploded parts

## To Install a Capillary Column with the Volatiles Interface

- 1 Gather the following:
  - Long (65 mm) column nut
  - Column
  - Ferrule
  - Column cutter
  - Isopropanol
  - Septum
  - Two 1/4-inch wrenches
  - Lab tissue
  - Metric ruler
  - 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 either is hot, wear heat-resistant gloves to protect your hands.**

### WARNING

---

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

### CAUTION

---

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

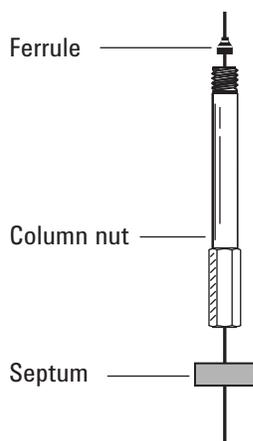
- 3 Place the column on the hanger with the ends pointing up and the label to the front.
- 4 Place a septum, long capillary column nut, and ferrule on the column.

Use a long column nut. See **"Consumables and Parts for the Volatiles Interface"** on page 166.

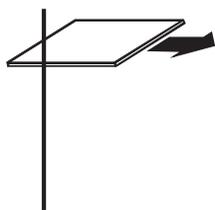
If you are using a standard column nut, you must remove the interface. For this reason it is recommended that you use the long column nut. See **"To Remove the VI Interface"** on page 173.

## 10 Maintaining the VI

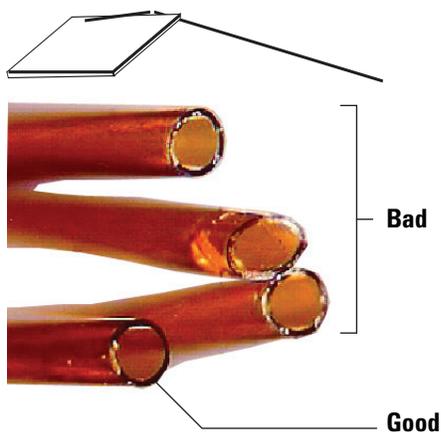
### To Install a Capillary Column with the Volatiles Interface



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



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



- 7 Wipe the column walls with a tissue dampened with isopropanol to remove fingerprints and dust.
- 8 Position the column so it extends 6 mm above the end of the ferrule. Slide the septum up the column to hold the column nut at this fixed position.



## 10 Maintaining the VI

### To Install a Capillary Column with the Volatiles Interface

- 9 Insert the column into the interface and finger-tighten the column nut.
- 10 Adjust the column (*not* the septum) position until the septum is snug against the bottom of the nut.
- 11 Tighten the column nut an additional 1/4 to 1/2 turn with a wrench so that the column cannot be pulled from the fitting with gentle pressure.
- 12 Plug in the new column's Smart ID key. See **Figure 37**.



Figure 37. Insert Smart ID key

- 13 Configure the new column.
- 14 With the sample transfer line attached and the column attached to the inlet and detector, establish a flow of carrier gas through the transfer line. Purge as recommended by the column manufacturer.
- 15 Condition the column per the manufacturer's recommendation. See **To Condition a Capillary Column**.
- 16 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+**
- 17 Exit maintenance mode. Select **Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Finished**.
- 18 After the column is installed at both inlet and detector, establish a flow of carrier gas and purge as recommended by the column manufacturer.
- 19 Restore the analytical method.
  - For FPD+, immediately turn off the flame.
  - For NPD, immediately turn off the bead.

## 10 Maintaining the VI

### To Install a Capillary Column with the Volatiles Interface

- 20 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.**

- 21 Allow the oven, inlet, and detector to equilibrate at operating temperature, then retighten the fittings.
- 22 Reset the EMF counter.
- 23 Perform an inlet **Leak & Restriction** test and reset the maintenance counters.

## To Remove the VI Interface

- 1 Gather the following:
  - 1/4-inch and 7-mm wrench
  - T-20 Torx screwdriver
- 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 interface may be hot enough to cause burns. If the interface is hot, wear gloves to protect your hands.**

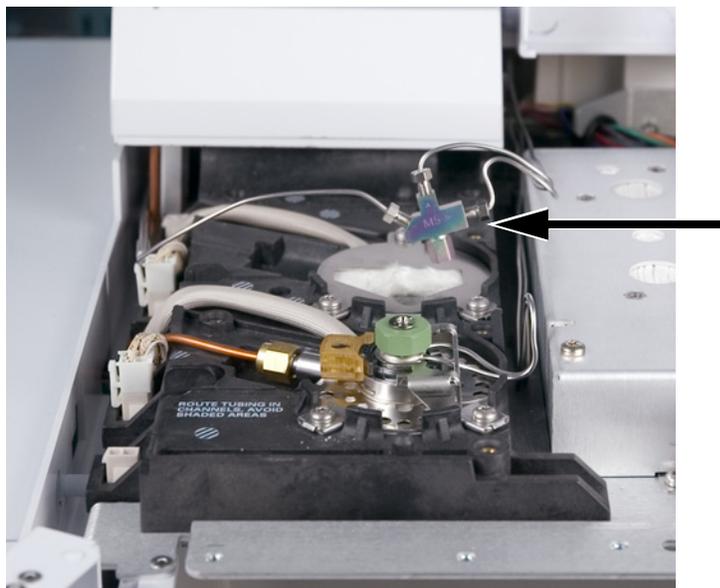
- 3 Remove the column.
- 4 Remove the transfer line by loosening the nut, then lift it from the interface.
- 5 Loosen the five inlet cover screws and remove the inlet cover.
- 6 Remove the clamping plate from the interface by loosening the captive screw.



- 7 Lift the interface out of the heater block.

## 10 Maintaining the VI

To Remove the VI Interface



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

## To Clean the VI

- 1 Gather the following:
  - 1/4-inch and 7-mm wrench
  - T-20 Torx screwdriver
  - 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.**
- 3 Remove the interface. See **"To Remove the VI Interface"** on page 173.

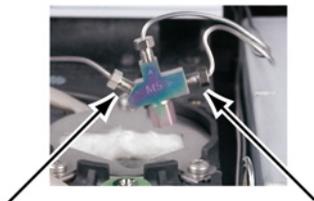
**WARNING**

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

**WARNING**

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

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



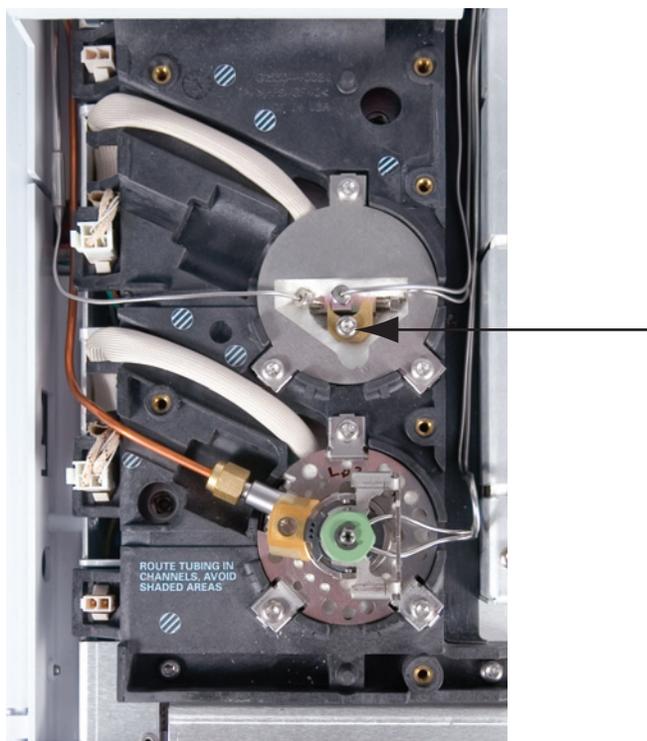
**CAUTION**

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

- 5 Clean the interface using an ultrasonic bath. Sonicate twice, then rinse and air dry.
- 6 Inspect the split vent line. If clogged, contact Agilent for service.
- 7 Install the interface. See **"To Install the VI Interface"** on page 176.
- 8 Exit maintenance mode. Select **Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Finished.**

## To Install the VI Interface

- 1 Gather the following:
  - 1/4-inch and 7-mm wrench
  - T-20 Torx screwdriver
- 2 Attach the split vent line and pressure sensing lines and finger-tighten the nuts. Tighten an additional 1/4 turn with a wrench.
- 3 Place the interface into the heater block and reseal the tubing as needed.
- 4 Install the clamping plate and tighten the screw.



- 5 Install the inlet cover. Be sure the cover does not damage any tubing.
- 6 Attach the sample transfer line.
- 7 Install the column. See **"To Install a Capillary Column with the Volatiles Interface"** on page 169.

## 10 Maintaining the VI

### To Replace the Filter in the Split Vent Trap for the VI

# To Replace the Filter in the Split Vent Trap for the VI

- 1 Gather the following:
  - New split vent filter cartridge, see “[Consumables and Parts for the Volatiles Interface](#)” on page 166.
- 2 Launch the GC maintenance wizard: **Maintenance > Inlets**, select the inlet, then select **Perform Maintenance > Replace Split Vent Trap > Start Maintenance**. The wizard will walk through the steps needed to replace the filter (those same steps are repeated below).

### 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 38](#).

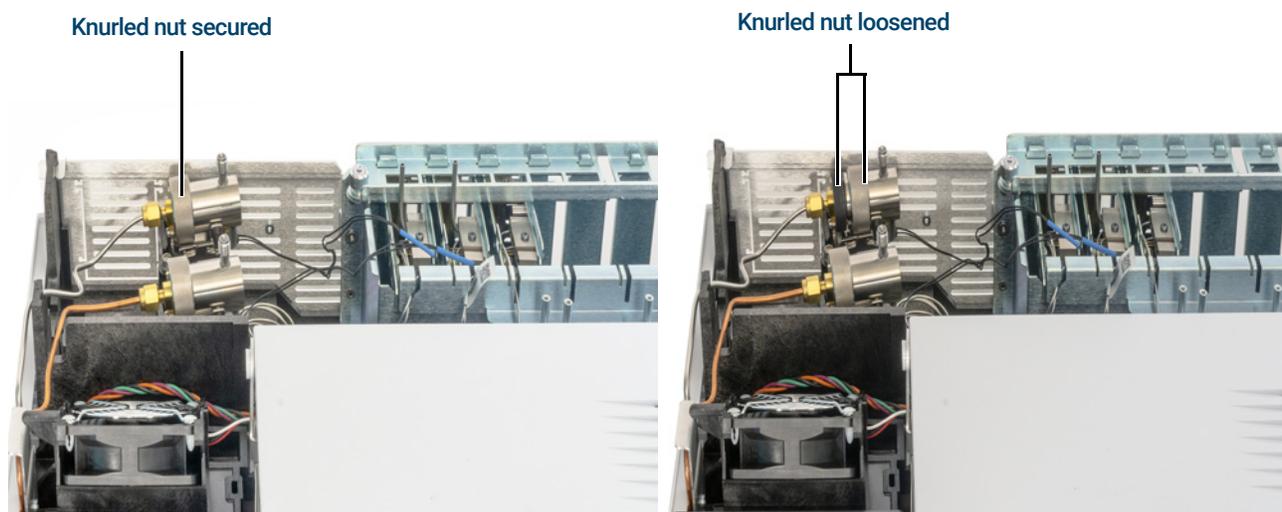


Figure 38. Loosen knurled nut

- 5 Slide the trap assembly back from the guided mounting bracket and tilt up to expose the filter as shown in [Figure 39](#).

## 10 Maintaining the VI

To Replace the Filter in the Split Vent Trap for the VI

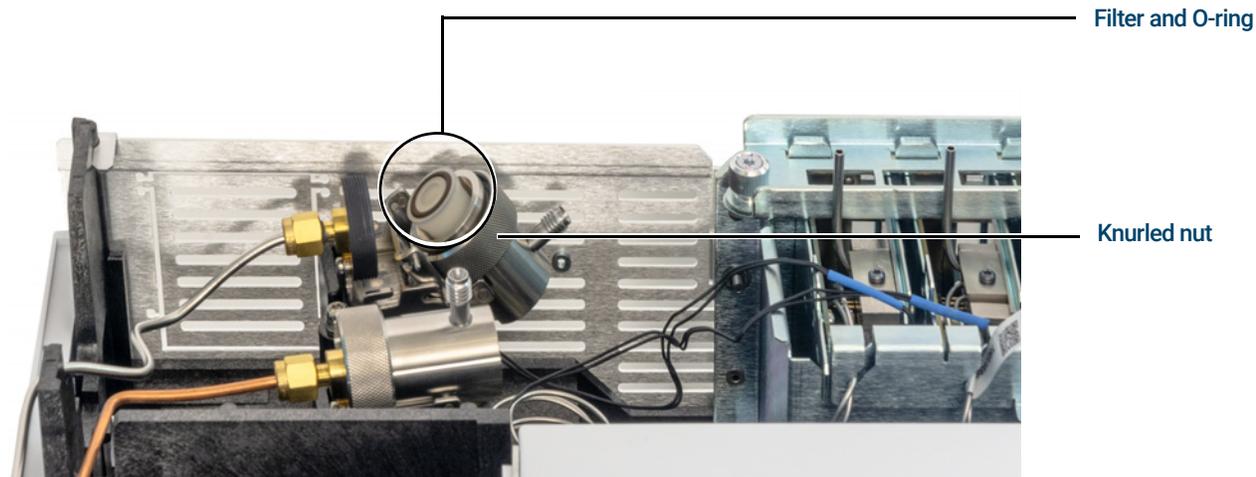


Figure 39. Slide trap assembly to expose the filter

- 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 The GC maintenance wizard will perform checks at the appropriate times, including **Leak & Restriction** tests, and will automatically reset the maintenance counters.
- 10 Install the pneumatics cover.
- 11 Select **Finished**, then select **OK** to exit the GC maintenance wizard.

## To Bakeout Contaminants from the VI Inlet

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

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.**

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

**10 Maintaining the VI**  
To Bakeout Contaminants from the VI Inlet

## Maintaining the FID

Consumables and Parts for the FID	182
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## Consumables and Parts for the FID

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

**Table 29 Nuts, ferrules, and hardware for capillary columns**

Column id (mm)	Description	Typical use	Part number/quantity
.530	Ferrule, Vespel/graphite, 0.8-mm id	0.45-mm and 0.53-mm capillary columns	5062-3512 (10/pk)
	Ferrule, graphite, 1.0-mm id	0.53-mm capillary columns	5080-8773 (10/pk)
	Ferrule, graphite, 0.8-mm id	0.53-mm capillary columns	500-2118 (10/pk)
	Column nut, finger-tight (for 0.53-mm columns)	Connect column to inlet or detector	5020-8293
.320	Ferrule, Vespel/graphite, 0.5-mm id	0.32-mm capillary columns	5062-3514 (10/pk)
	Ferrule, graphite, 0.5-mm id	0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853 (10/pk)
	Column nut, finger-tight (for .100- to .320-mm columns)	Connect column to inlet or detector	5020-8292
.250	Ferrule, Vespel/graphite, 0.4-mm id	0.1-mm, 0.2-mm, and 0.25-mm capillary columns	5181-3323 (10/pk)
	Ferrule, graphite, 0.5-mm id	0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853 (10/pk)
	Column nut, finger-tight (for .100- to .320-mm columns)	Connect column to inlet or detector	5020-8292
.100 and .200	Ferrule, Vespel/graphite, 0.37-mm id	0.1-mm and 0.2-mm capillary columns	5062-3516 (10/pk)
	Ferrule, Vespel/graphite, 0.4-mm id	0.1-mm, 0.2-mm, and 0.25-mm capillary columns	5181-3323 (10/pk)
	Ferrule, graphite, 0.5-mm id	0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853 (10/pk)
	Ferrule, graphite, 0.4-mm id		500-2114 (10/pk)
	Column nut, finger-tight (for .100- to .320-mm columns)	Connect column to inlet or detector	5020-8292
All	Ferrule, no-hole	Testing	5181-3308 (10/pk)
	Capillary column blanking nut	Testing—use with any ferrule	5020-8294
	Column nut, universal	Connect column to inlet or detector	5181-8830 (2/pk)
	Column nut, collared, self-tightening	Connect column to inlet or detector	G3440-81011
	Collar for self-tightening nut	Connect column to inlet or detector	G3440-81012
	Column nut, collared, self-tightening MSD	Connect column to inlet or detector	G3440-81013
	Column cutter, ceramic wafer	Cutting capillary columns	5181-8836 (4/pk)
	Pencil, diamond tipped	Cutting capillary columns	420-1000
	Ferrule tool kit	Ferrule installation	440-1000

## 11 Maintaining the FID

### Consumables and Parts for the FID

**Table 30 FID parts and subassemblies**

Description	Part number/quantity
Screw, M4 × 25 mm, Torx, T20	0515-2712 (3/pk)
PTFE chimney (optional)	19231-21050
Collector assembly	G4591-60691
Pre-swaged 1/8-inch packed column adapter	G3450-60191
Pre-swaged inert 1/8-inch packed column adapter	G3450-60192
Pre-swaged 1/4-inch packed column adapter	G3450-60193
Pre-swaged Inert 1/4-inch packed column adapter	G3450-60194
Jet, FID, 0.011-inch id	G4591-20320
Jet, FID, universal fit, 0.011 inch id	5200-0176
Jet, FID, universal fit, 0.018 inch id	5200-0177
Jet, FID, universal fit, 0.030 inch id	5200-0178

**Table 31 FID collector assembly parts**

Description	Part number/quantity
Screw, M4 × 25 mm, Torx, T20	0515-2712 (3/pk)
Collector assembly	G4591-60691
Collector nut	19231-20940
Spring washer	3050-1246
Ignitor castle	19231-20910
Ignitor castle, Hastelloy	19231-21060
Upper/lower collector insulator	G1531-20700
Collector body	G1531-20690
Collector body, Hastelloy	G1531-21090
Spanner nut, base	19231-20990
Collector mount	G4591-20690
Collector housing	19231-21010
Gasket	5180-4165 (12/pk)
Ignitor (glow plug) assembly with O-ring	19231-60680

# Exploded Parts Views of the Flame Ionization Detector

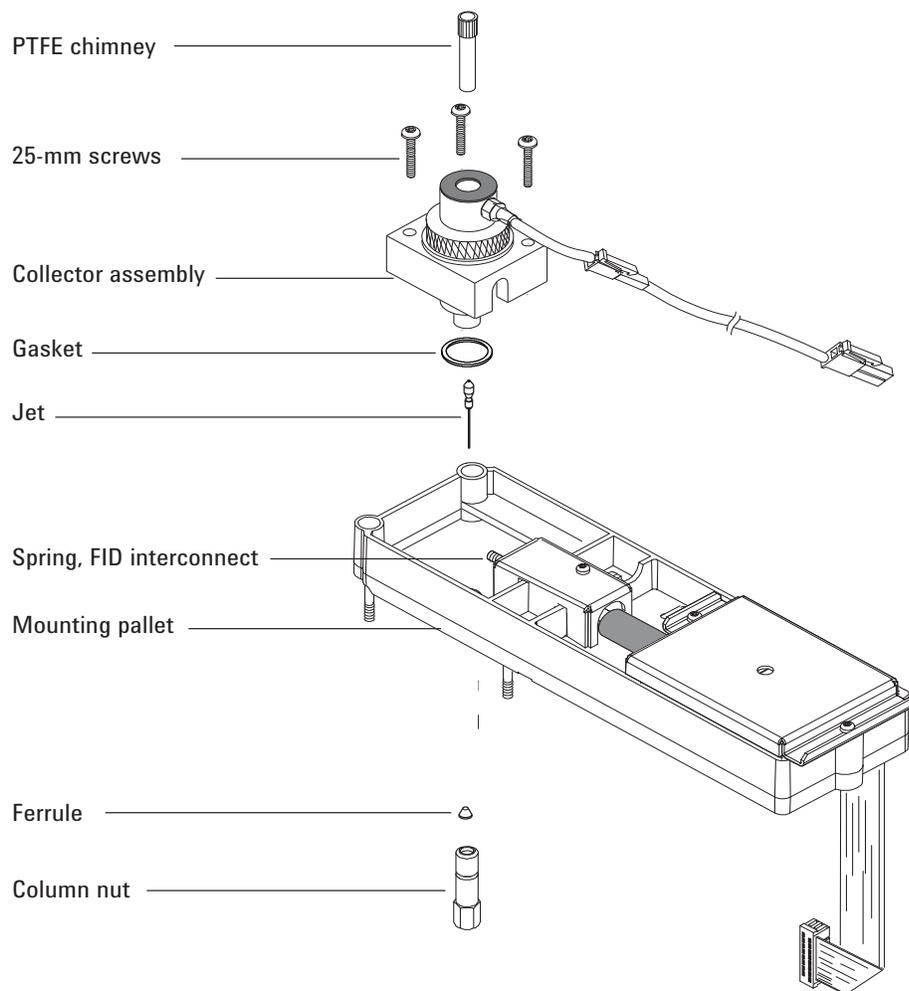


Figure 40. Flame ionization detector (FID) assembly exploded parts

## 11 Maintaining the FID

### Exploded Parts Views of the Flame Ionization Detector

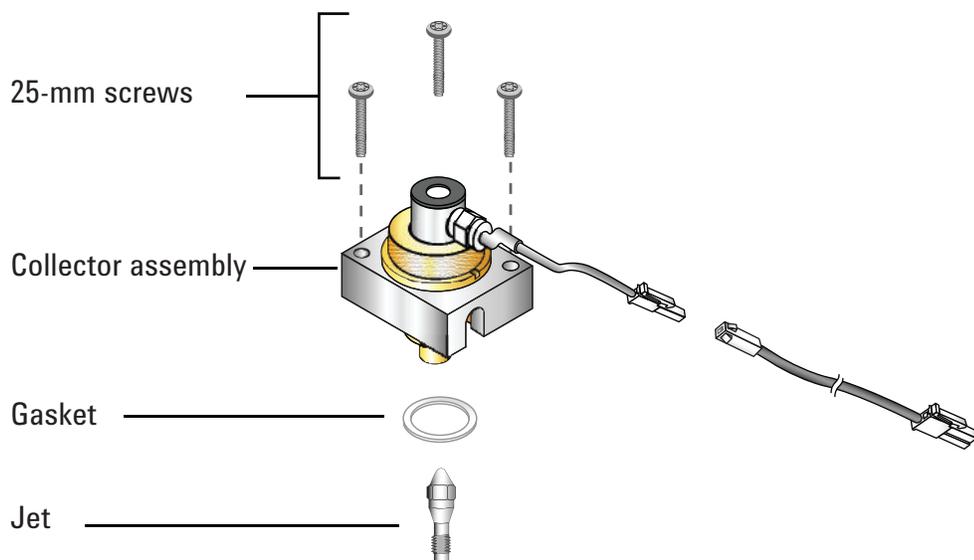


Figure 41. FID exploded parts view

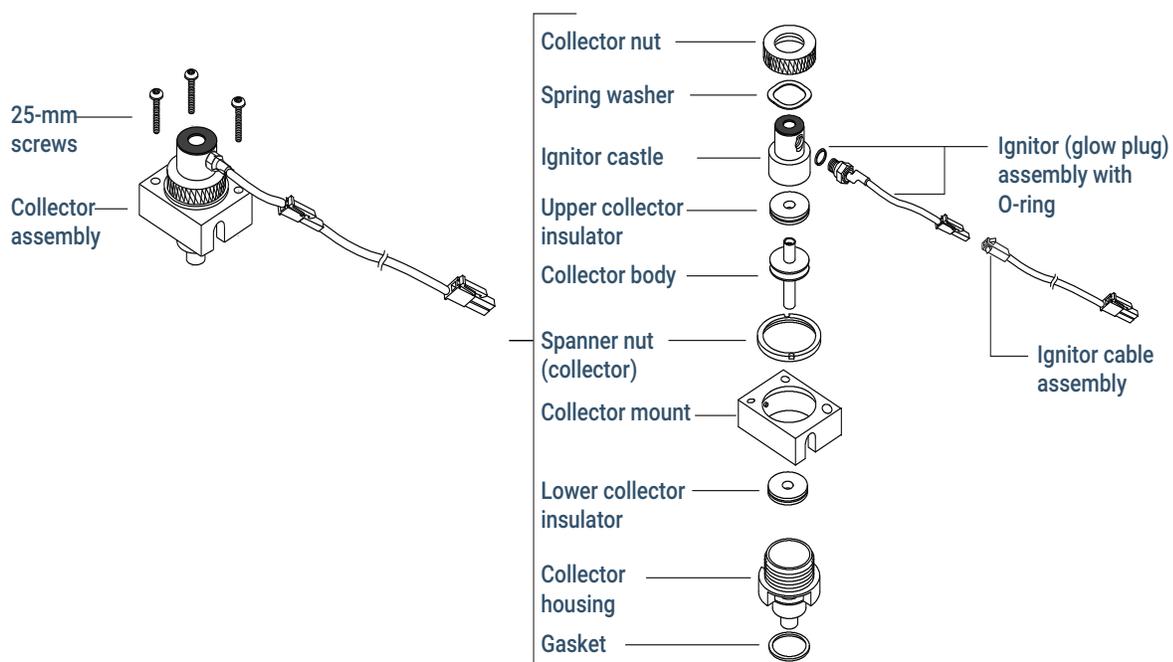


Figure 42. FID collector assembly exploded parts view

## To Install a Capillary Column in the FID

- 1 Gather the following materials, see “**Consumables and Parts for the FID**” on page 182:
  - Column
  - Ferrule(s)
  - Column nut
  - Column cutter
  - 1/4-inch open-end wrench
  - Septum
  - Isopropanol
  - Lab tissue
  - Lint-free gloves
- 2 Launch the GC maintenance wizard: **Maintenance > Column > Perform Maintenance > Install Column > Start Maintenance**. Wait for the GC to become ready. The wizard will guide you through the maintenance steps described below.

**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.

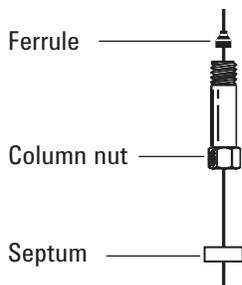
**WARNING**

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.

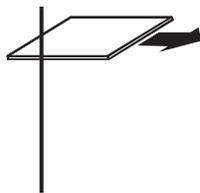
- 3 Place a septum (if the column id is  $\leq 0.1$  mm), capillary column nut, and ferrule on the column.



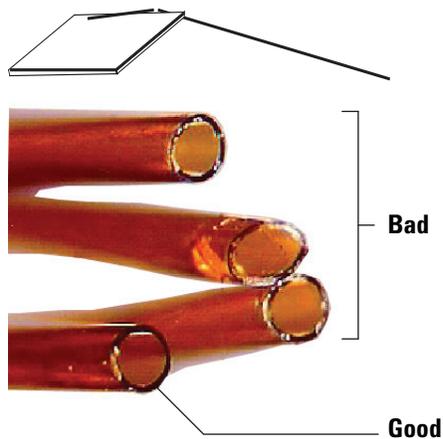
- 4 Score the column using a glass scribing tool. The score must be square to ensure a clean break.

## 11 Maintaining the FID

### To Install a Capillary Column in the FID



- 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.

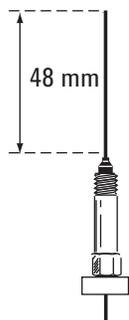


- 6 Wipe the column walls with a tissue dampened with isopropanol to remove fingerprints and dust.
- 7 Install the capillary column.  
If the column id is greater than 0.1 mm:
  - a Gently insert the column into the detector until it bottoms; do not attempt to force it further.
  - b Finger-tighten the column nut, then withdraw the column about 2 mm. Tighten the nut an additional 1/4 turn with a wrench.

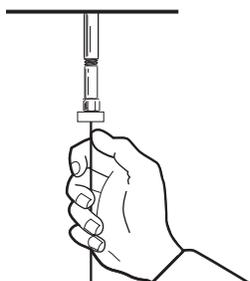
## 11 Maintaining the FID

### 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 The GC maintenance wizard will perform checks at the appropriate times, including **Leak & Restriction** tests, and will automatically reset the maintenance counters.
- 9 Select **Finished**, then select **OK** to exit the GC maintenance wizard.

## 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
- 2 Launch the GC maintenance wizard: **Maintenance > Detectors**, select the detector, then select **Perform Maintenance > Replace FID Jet > Start Maintenance**. The wizard will guide you through the maintenance steps described below.

### WARNING

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**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

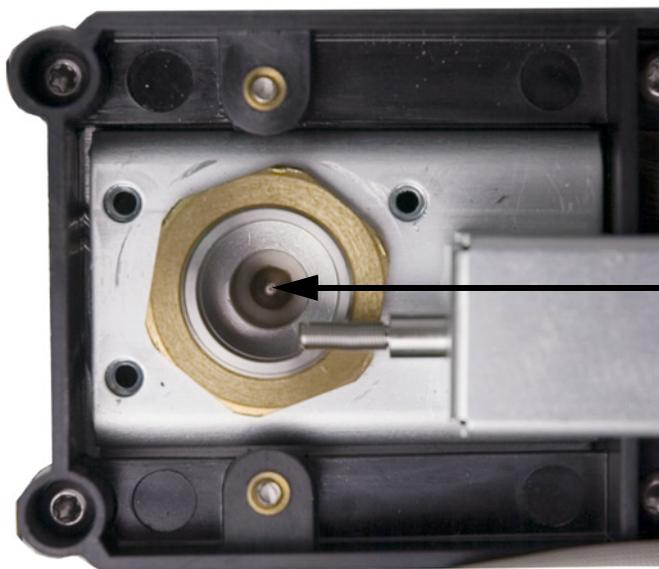
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**Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.**

- 4 Remove the FID castle assembly and place it on a clean cloth.
- 5 Locate the jet inside the housing.

## 11 Maintaining the FID

### To Replace an FID Jet



#### CAUTION

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.



Interconnector  
spring

- 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.

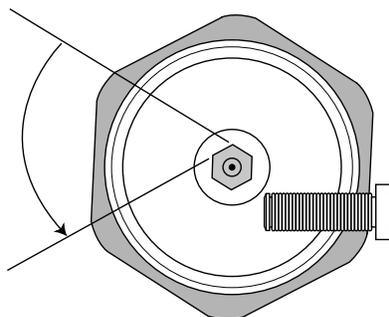
#### CAUTION

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).

## 11 Maintaining the FID

### To Replace an FID Jet



- 10 Install the castle assembly.
- 11 The GC maintenance wizard will perform checks at the appropriate times, including **Leak & Restriction** tests, and will automatically reset the maintenance counters.
- 12 Select **Finished**, then select **OK** to exit the GC maintenance wizard.
- 13 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 186.
  - 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 200.
  - d Bakeout the detector. See **"To Bakeout the FID"** on page 203.
  - 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.
- 14 Check the FID baseline. See **"To Check the FID Baseline"** on page 201.

# To Perform Maintenance on the FID Collector Assembly

#### NOTE

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

- 1 Gather the following:
  - Replacement ignitor assembly, see “**Consumables and Parts for the FID**” on page 182.
  - Replacement ignitor castle
  - Two collector insulators
  - Collector
  - Spring washer
  - Gasket
  - T-20 Torx screwdriver
  - 1/4-inch nut driver
  - Tweezers
  - 5/16-inch wrench
  - Lint-free gloves
  - Clean cloth

#### CAUTION

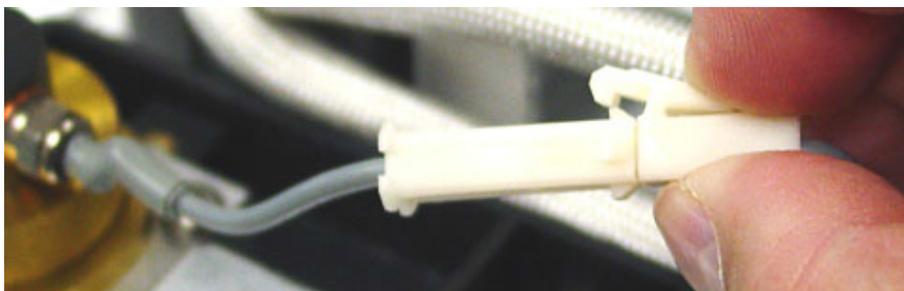
To avoid contaminating the FID, wear clean, lint-free gloves when handling the collector assembly.

- 2 Launch the GC maintenance wizard: **Maintenance > Detectors**, select the detector, then select **Perform Maintenance > Maintain FID Collector > Start Maintenance**. The wizard will guide you through the maintenance steps described below.

#### 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.



## 11 Maintaining the FID

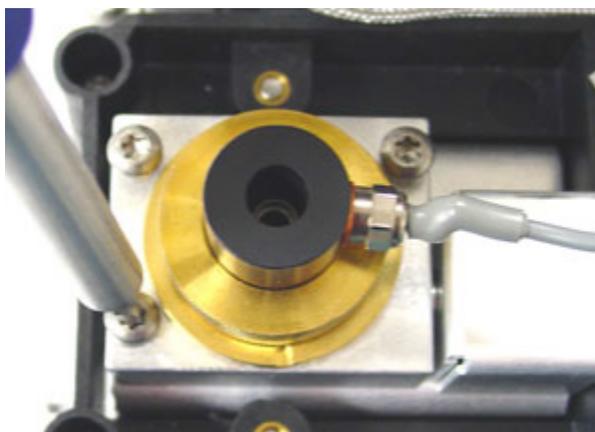
### To Perform Maintenance on the FID Collector Assembly

- b** Loosen the ignitor with a wrench.



- c** Turn the nut counterclockwise by hand. Remove the ignitor and copper washer.

- 4** If replacing only the FID ignitor assembly with copper washer, skip to **step 16** for assembly.  
**5** Remove the three screws that 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.

## 11 Maintaining the FID

### To Perform Maintenance on the FID Collector Assembly



- 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.

## 11 Maintaining the FID

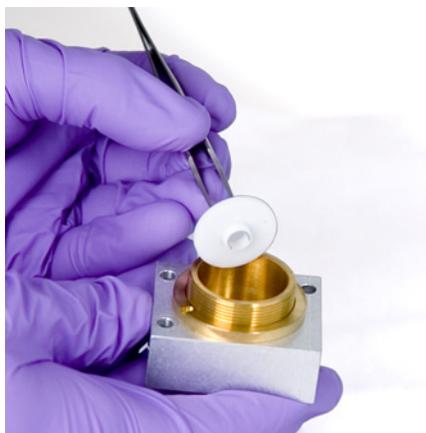
### To Perform Maintenance on the FID Collector Assembly

**10** Remove the collector and insulators.

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



- b** Remove the lower insulator with tweezers and place the parts on a clean cloth.



**11** Remove the collector housing from the mount, if necessary.

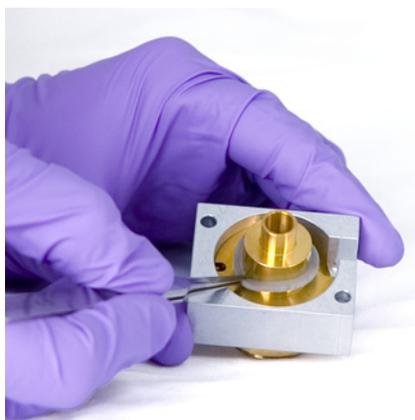
**12** Use tweezers to remove the gasket from the bottom of the housing.

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

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

## 11 Maintaining the FID

### To Perform Maintenance on the FID Collector Assembly



**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.

## 11 Maintaining the FID

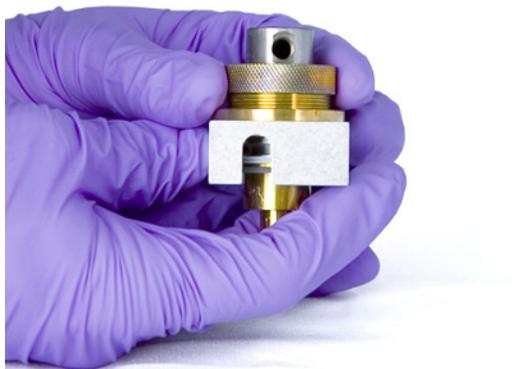
To Perform Maintenance on the FID Collector Assembly



- 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.

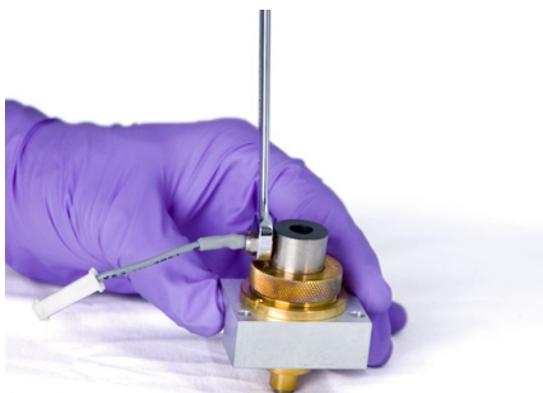
- a** Insert the ignitor and copper seal into the threaded hole of the castle. Keep the mating threads clean.

## 11 Maintaining the FID

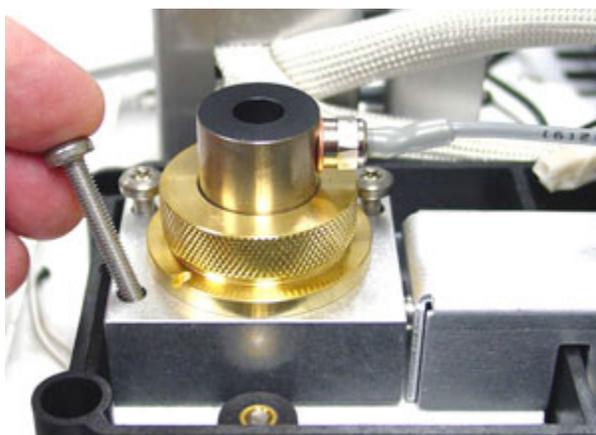
To Perform Maintenance on the FID Collector Assembly



- b** Tighten the ignitor with a wrench. Ignition requires a good electrical contact that is free of any dirt.



- 17** Lower the collector assembly into the housing.  
**18** Insert the three screws and tighten (to 18-inch-pounds).



- 19** Connect the ignitor extension cable.  
**20** Verify assembly:  
**a** Check the FID leakage current. See **"To Check the FID Leakage Current"** on page 200.

## 11 Maintaining the FID

### To Perform Maintenance on the FID Collector Assembly

- b** Bakeout the detector. See **"To Bakeout the FID"** on page 203.
- c** Check the FID baseline. See **"To Check the FID Baseline"** on page 201.
- 21** The GC maintenance wizard will perform checks at the appropriate times, including **Leak & Restriction** tests, and will automatically reset the maintenance counters.
- 22** Select **Finished**, then select **OK** to exit the GC maintenance wizard.

## 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 Perform a Leakage Current Test: **Diagnostics > Diagnostics Tests > select Leakage Current Test** for the detector. Read the **Test Details** screen then press **Start Test**.
- 3 Turn off the FID flame.
- 4 Show the detector output signal in **Status**. Go to **Home > Status listing > +Add**. Select the detector's output from the drop-down list, then touch **Add**.
- 5 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 203.
- 6 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 Show the detector output signal in **Status**. Go to **Home > Status listing > +Add**. Select the detector's output from the drop-down list, then touch **Add**.
- 4 When the flame is lit and the GC is ready, verify that the output is stable and < 20 pA.

If the output is not stable or > 20 pA, the system or gas may be contaminated. If this contamination is isolated to the detector, then bakeout the FID. See **"To Bakeout the FID"** on page 203.

## 11 Maintaining the FID

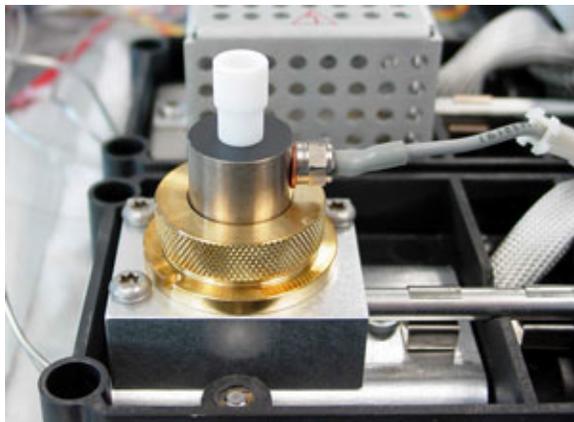
To Install the Optional FID PTFE Chimney Insert

# 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 182:
  - Capillary adapter (adaptable FID only)
  - Column nut
  - No-hole ferrule

### WARNING

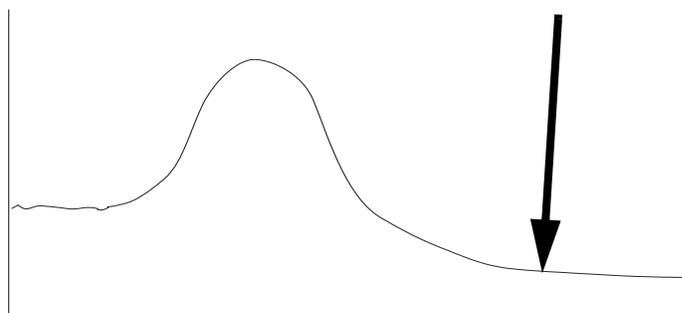
**Be careful! The detector may be hot enough to cause burns. If the detector is hot, wear heat-resistant gloves to protect your hands.**

- 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 186.

## 11 Maintaining the FID

### To Bakeout the FID

## Maintaining the TCD

Consumables and Parts for the Thermal Conductivity Detector 206

To Install a Capillary Column in the TCD 208

To Bakeout Contaminants from the TCD 211

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

## Standard TCD column hardware

**Table 32 Nuts, ferrules, and hardware for capillary columns**

Column id (mm)	Description	Typical use	Part number/quantity
.530	Ferrule, Vespel/graphite, 0.8-mm id	0.45-mm and 0.53-mm capillary columns	5062-3512 (10/pk)
	Ferrule, graphite, 1.0-mm id	0.53-mm capillary columns	5080-8773 (10/pk)
	Ferrule, graphite, 0.8-mm id	0.53-mm capillary columns	500-2118 (10/pk)
	Column nut, finger-tight (for 0.53-mm columns)	Connect column to inlet or detector	5020-8293
.320	Ferrule, Vespel/graphite, 0.5-mm id	0.32-mm capillary columns	5062-3514 (10/pk)
	Ferrule, graphite, 0.5-mm id	0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853 (10/pk)
	Column nut, finger-tight (for .100- to .320-mm columns)	Connect column to inlet or detector	5020-8292
.250	Ferrule, Vespel/graphite, 0.4-mm id	0.1-mm, 0.2-mm, and 0.25-mm capillary columns	5181-3323 (10/pk)
	Ferrule, graphite, 0.5-mm id	0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853 (10/pk)
	Column nut, finger-tight (for .100- to .320-mm columns)	Connect column to inlet or detector	5020-8292
.100 and .200	Ferrule, Vespel/graphite, 0.37-mm id	0.1-mm and 0.2-mm capillary columns	5062-3516 (10/pk)
	Ferrule, Vespel/graphite, 0.4-mm id	0.1-mm, 0.2-mm, and 0.25-mm capillary columns	5181-3323 (10/pk)
	Ferrule, graphite, 0.5-mm id	0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853 (10/pk)
	Ferrule, graphite, 0.4-mm id		500-2114 (10/pk)
	Column nut, finger-tight (for .100- to .320-mm columns)	Connect column to inlet or detector	5020-8292
All	Ferrule, no-hole	Testing	5181-3308 (10/pk)
	Capillary column blanking nut	Testing—use with any ferrule	5020-8294
	Column nut, universal	Connect column to inlet or detector	5181-8830 (2/pk)
	Column nut, collared, self-tightening	Connect column to inlet or detector	G3440-81011
	Collar for self-tightening nut	Connect column to inlet or detector	G3440-81012

## 12 Maintaining the TCD

### Standard TCD column hardware

**Table 32 Nuts, ferrules, and hardware for capillary columns (continued)**

Column id (mm)	Description	Typical use	Part number/quantity
	Column nut, collared, self-tightening MSD	Connect column to inlet or detector	G3440-81013
	Column cutter, ceramic wafer	Cutting capillary columns	5181-8836 (4/pk)
	Pencil, diamond tipped	Cutting capillary columns	420-1000
	Ferrule tool kit	Ferrule installation	440-1000

**Table 33 Packed column adapters**

Description	Part number/quantity
Pre-swaged 1/8-inch packed column adapter	G3450-60191
Pre-swaged inert 1/8-inch packed column adapter	G3450-60192
Pre-swaged 1/4-inch packed column adapter	G3450-60193
Pre-swaged Inert 1/4-inch packed column adapter	G3450-60194

## To Install a Capillary Column in the TCD

- 1 Gather the following materials, see “**Consumables and Parts for the Thermal Conductivity Detector**” on page 206:
  - Column
  - Ferrule(s)
  - Column nut
  - Column cutter
  - 1/4-inch open-end wrench
  - Septum
  - Isopropanol
  - Lab tissue
  - Lint-free gloves
- 2 Launch the GC maintenance wizard: **Maintenance > Column > Perform Maintenance > Install Column > Start Maintenance**. Wait for the GC to become ready. The wizard will guide you through the maintenance steps described below.

**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.

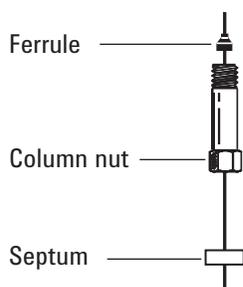
**WARNING**

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.

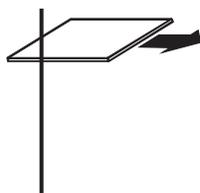
- 3 Place a septum (if the column id is  $\leq 0.1$  mm), capillary column nut, and ferrule on the column.



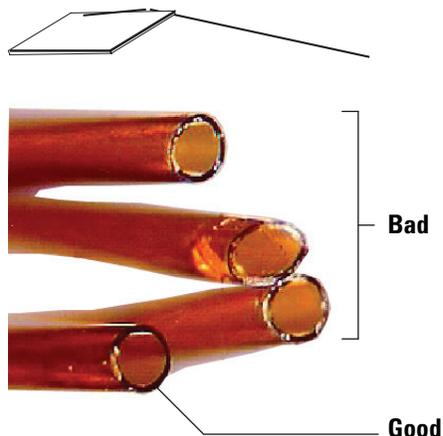
- 4 Score the column using a glass scribing tool. The score must be square to ensure a clean break.

## 12 Maintaining the TCD

### To Install a Capillary Column in the TCD



- 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.

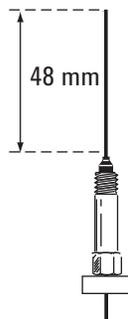


- 6 Wipe the column walls with a tissue dampened with isopropanol to remove fingerprints and dust.
- 7 Install the capillary column.  
If the column id is greater than 0.1 mm:
  - a Gently insert the column into the detector until it bottoms; do not attempt to force it further.
  - b Finger-tighten the column nut, then withdraw the column about 2 mm. Tighten the nut an additional 1/4 turn with a wrench.

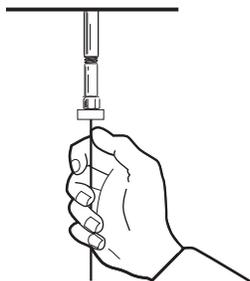
## 12 Maintaining the TCD

### To Install a Capillary Column in the TCD

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 The GC maintenance wizard will perform checks at the appropriate times, including **Leak & Restriction** tests, and will automatically reset the maintenance counters.
- 9 Select **Finished**, then select **OK** to exit the GC maintenance wizard.

## 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 208.
- 8 Load the analytical method.

### WARNING

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

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

## 12 Maintaining the TCD

To Bakeout Contaminants from the TCD

## Maintaining the NPD

- Consumables and Parts for the NPD 214
- Exploded Parts View of the Nitrogen-Phosphorus Detector 216
- To Install a Capillary Column in the NPD 217
- To Replace the NPD Bead Assembly 220
- To Maintain the NPD Collector, Ceramic Insulators, and Jet 224
- To Check the NPD Leakage Current 229
- To Bakeout the NPD 230

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

**Table 34 NPD parts**

Description	Part number/quantity
Collector	G1534-20530
Screw, M3 × 0.5 × 8 mm	0515-0655
NPD Blos bead assembly	G3434-60806
Screw, M4 × 10 mm	0515-2495
J-clamp	1400-0015
NPD ceramic insulator kit <ul style="list-style-type: none"> <li>• Metal C-rings, top and bottom</li> <li>• Ceramic insulators, upper and lower</li> </ul>	5182-9722
NPD chemical sample kit solution of 0.65 ppm azobenzene, 1000 ppm octadecane, 1 ppm malathion in isooctane, 3 ampoules	18789-60060
NPD lid standoff	G1534-20590
NPD raised jet weldment	G4594-81000
NPD Jet, universal fit, 0.011 id	5200-0179
Nut, 1/8-inch, brass, for packed column adapters	5180-4103 (10/pk)
Ferrule, Vespel/graphite, 1/8-inch, for packed column adapters	0100-1332 (10/pk)
Nut, 1/4-inch, brass, for packed column adapters	5180-4105 (10/pk)
Ferrule, Vespel, 1/4-inch, for packed column adapters	5080-8774 (10/pk)
Pre-swaged 1/8-inch packed column adapter	G3450-60191
Pre-swaged inert 1/8-inch packed column adapter	G3450-60192
Pre-swaged 1/4-inch packed column adapter	G3450-60193
Pre-swaged inert 1/4-inch packed column adapter	G3450-60194

**Table 35 Nuts, ferrules, and hardware for capillary columns**

Column id (mm)	Description	Typical use	Part number/quantity
.530	Ferrule, Vespel/graphite, 0.8-mm id	0.45-mm and 0.53-mm capillary columns	5062-3512 (10/pk)
	Ferrule, graphite, 1.0-mm id	0.53-mm capillary columns	5080-8773 (10/pk)
	Ferrule, graphite, 0.8-mm id	0.53-mm capillary columns	500-2118 (10/pk)
	Column nut, finger-tight (for 0.53-mm columns)	Connect column to inlet or detector	5020-8293

## 13 Maintaining the NPD

### Consumables and Parts for the NPD

**Table 35 Nuts, ferrules, and hardware for capillary columns (continued)**

Column id (mm)	Description	Typical use	Part number/quantity
.320	Ferrule, Vespel/graphite, 0.5-mm id	0.32-mm capillary columns	5062-3514 (10/pk)
	Ferrule, graphite, 0.5-mm id	0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853 (10/pk)
	Column nut, finger-tight (for .100- to .320-mm columns)	Connect column to inlet or detector	5020-8292
.250	Ferrule, Vespel/graphite, 0.4-mm id	0.1-mm, 0.2-mm, and 0.25-mm capillary columns	5181-3323 (10/pk)
	Ferrule, graphite, 0.5-mm id	0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853 (10/pk)
	Column nut, finger-tight (for .100- to .320-mm columns)	Connect column to inlet or detector	5020-8292
.100 and .200	Ferrule, Vespel/graphite, 0.37-mm id	0.1-mm and 0.2-mm capillary columns	5062-3516 (10/pk)
	Ferrule, Vespel/graphite, 0.4-mm id	0.1-mm, 0.2-mm, and 0.25-mm capillary columns	5181-3323 (10/pk)
	Ferrule, graphite, 0.5-mm id	0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853 (10/pk)
	Ferrule, graphite, 0.4-mm id		500-2114 (10/pk)
	Column nut, finger-tight (for .100- to .320-mm columns)	Connect column to inlet or detector	5020-8292
All	Ferrule, no-hole	Testing	5181-3308 (10/pk)
	Capillary column blanking nut	Testing—use with any ferrule	5020-8294
	Column nut, universal	Connect column to inlet or detector	5181-8830 (2/pk)
	Column nut, collared, self-tightening	Connect column to inlet or detector	G3440-81011
	Collar for self-tightening nut	Connect column to inlet or detector	G3440-81012
	Column nut, collared, self-tightening MSD	Connect column to inlet or detector	G3440-81013
	Column cutter, ceramic wafer	Cutting capillary columns	5181-8836 (4/pk)
	Pencil, diamond tipped	Cutting capillary columns	420-1000
	Ferrule tool kit	Ferrule installation	440-1000

# Exploded Parts View of the Nitrogen-Phosphorus Detector

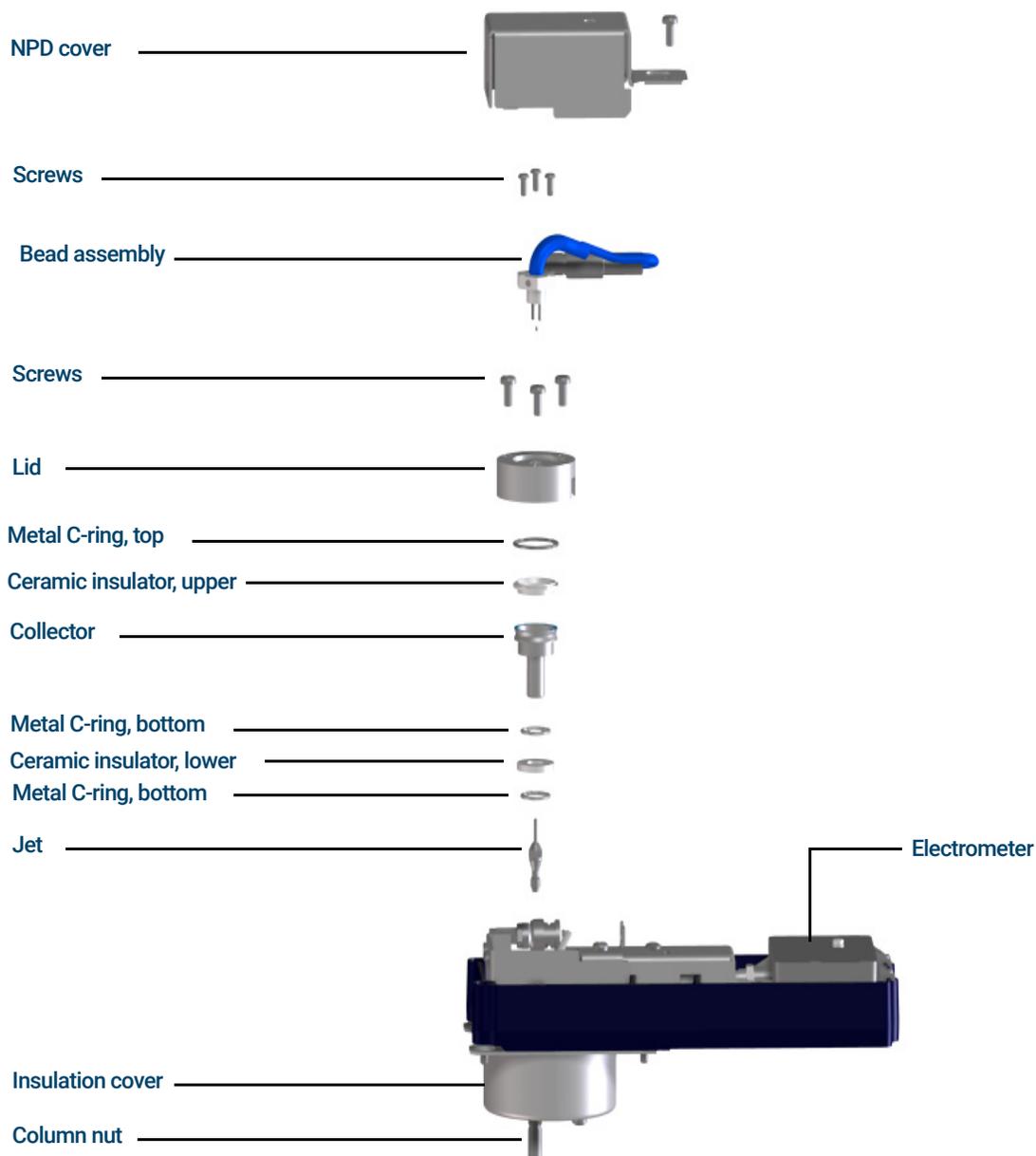


Figure 43. Nitrogen-Phosphorus Detector (NPD) exploded parts

## 13 Maintaining the NPD

### To Install a Capillary Column in the NPD

# 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 214.
  - Column nut
  - Column cutter
  - 1/4-inch open-end wrench
  - Septum
  - Isopropanol
  - Lab tissue
  - 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, 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.

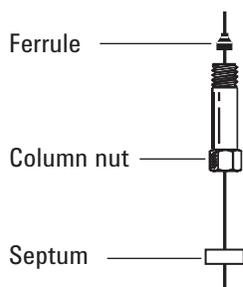
#### WARNING

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.

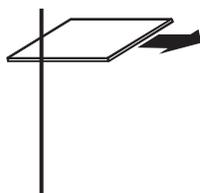
- 3 Place a septum (if the column id is  $\leq 0.1$  mm), capillary column nut, and ferrule on the column.



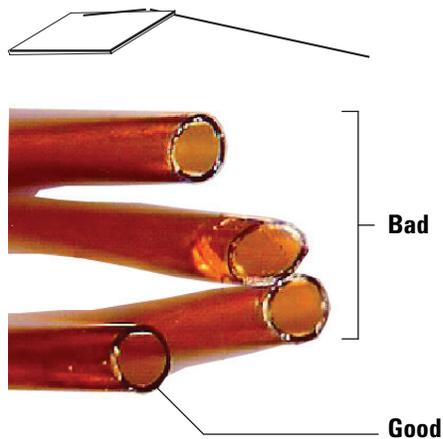
- 4 Score the column using a glass scribing tool. The score must be square to ensure a clean break.

### 13 Maintaining the NPD

To Install a Capillary Column in the NPD



- 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.

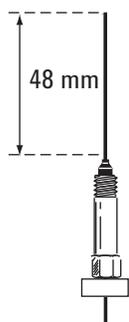


- 6 Wipe the column walls with a tissue dampened with isopropanol to remove fingerprints and dust.
- 7 Install the capillary column.  
If the column id is greater than 0.1 mm:
  - a Gently insert the column into the detector until it bottoms; do not attempt to force it further.
  - b Finger-tighten the column nut, then withdraw the column about 2 mm. Tighten the nut an additional 1/4 turn with a wrench.

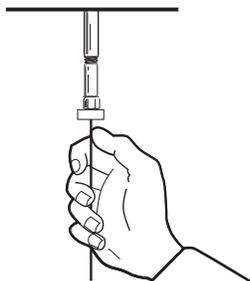
### 13 Maintaining the NPD

#### To Install a Capillary Column in the NPD

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 214.
  - Lint-free gloves
  - T-10 Torx screwdriver
- 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).

### 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.**

- 3 Turn off the NPD bead.

Agilent data system users: After turning off the bead, save the data system method and shut down the instrument session. (Note that in some data system versions, you may need to use the GC touchscreen or browser interface for these settings. To do this, the keypad must be unlocked and you must close the GC parameters screen of the data system. Upload the revised setting, then save the method and shut down the instrument session.)
- 4 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.**

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

- 7 Remove the screw from the NPD cover then lift up and set aside. See **Figure 44**.

### 13 Maintaining the NPD

To Replace the NPD Bead Assembly

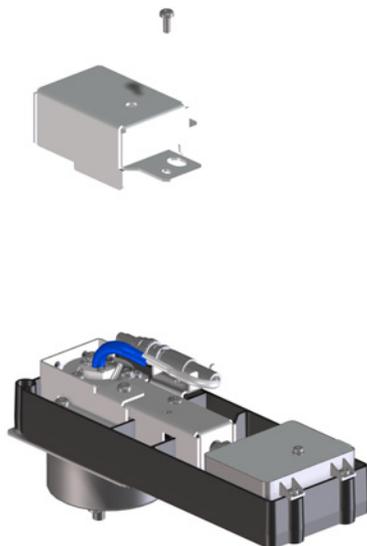
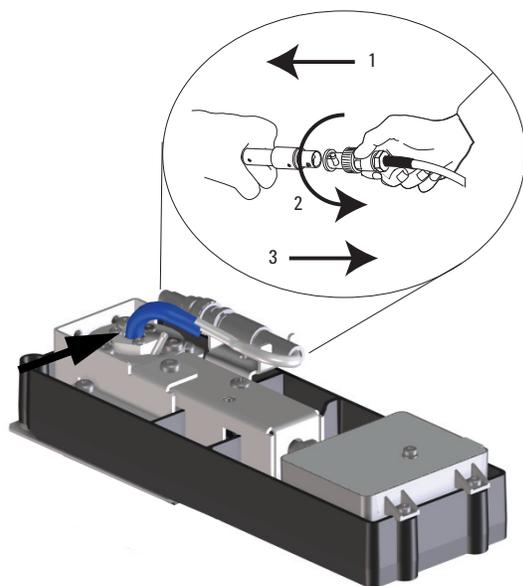


Figure 44. Remove NPD cover

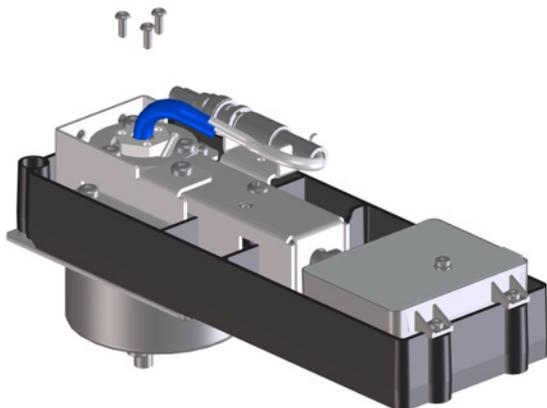
- 8 Twist the ring to disconnect the bead assembly cable. Push and twist the lock so that the button slides up in the groove, then pull the cable ends apart.



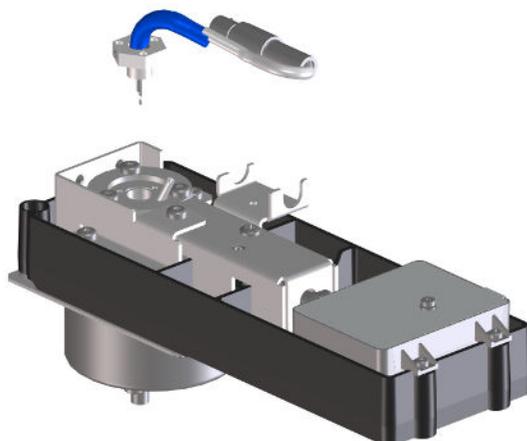
### 13 Maintaining the NPD

To Replace the NPD Bead Assembly

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



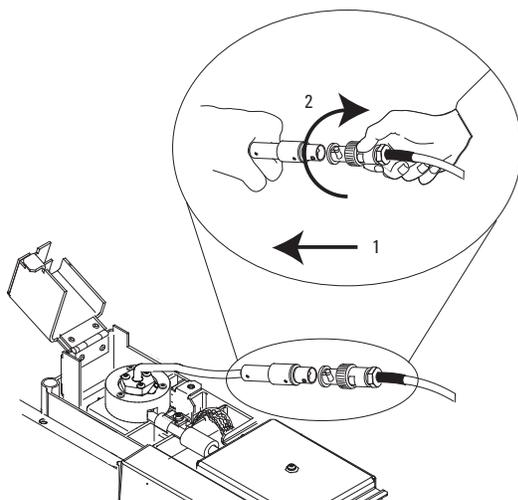
- 10 Gently lift up and remove the old bead assembly. Avoid bumping the bead on the sides of the collector.



- 11 Remove the protective cap covering the new bead.
- 12 Mount the new bead assembly on the NPD lid. Be careful not to bump the bead on the sides of the lid or collector.
- 13 Replace the screws. Finger-tighten the first screw; tighten the remaining screws normally and then completely tighten the first screw. Do not overtighten the screws.
- 14 Carefully bend the bead assembly so it will mate with the bead power cable.
- 15 Reconnect the bead assembly cable to the NPD cable and twist the ring to lock the connection.

### 13 Maintaining the NPD

#### To Replace the NPD Bead Assembly



- 16 Close the NPD cover, install the GC detector top cover, and install the electronics top cover. All covers must be closed to get a stable NPD baseline.
- 17 Exit maintenance mode. Select **Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Finished**.
- 18 Restore normal NPD operating gas flows.
- 19 With all gases on, heat the detector to 150 °C and hold for about 15 minutes, then increase the temperature to 250 °C and hold for 15 minutes.
- 20 Increase the temperature to operating value (310 to 320 °C recommended). Allow 15 minutes for equilibration.
- 21 Check the NPD leakage current. See **“To Check the NPD Leakage Current”** on page 229. If > 2.0 pA, verify bead installation or see the *Troubleshooting* manual.
- 22 If using an Agilent data system, connect to the instrument.
- 23 Restore the analytical method. Confirm the detector hydrogen, air, makeup gas flow rates.
- 24 Start the **Adjust offset** process. Enter the desired offset in the **Target offset** field. The default offset is 20 pA for Blos beads. An offset of 25 to 30 pA is sufficient for most applications. The bead life may be shortened at a higher offset.
- 25 Reset the bead counter.

# To Maintain the NPD Collector, Ceramic Insulators, and Jet

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

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

## 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 214.
  - 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 229.
- 4 Launch the GC maintenance wizard: **Maintenance > Detector > Perform Maintenance > Replace NPD Ceramics > Start Maintenance**. Wait for the GC to become ready. The wizard will guide you through the maintenance steps described below.

### 13 Maintaining the NPD

To Maintain the NPD Collector, Ceramic Insulators, and Jet

#### 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 220.

#### 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.

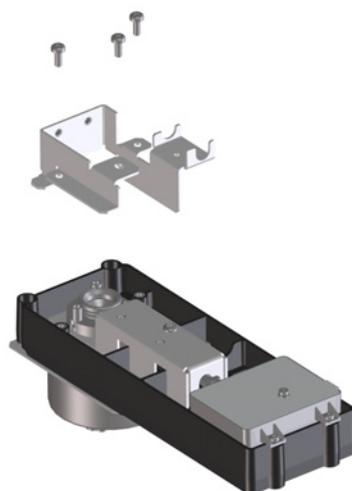
#### CAUTION

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.



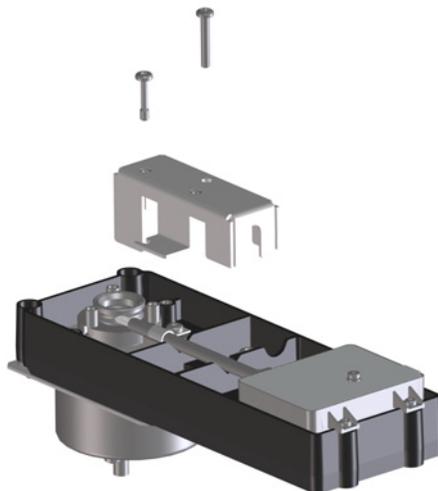
7 Remove the screws that secure the cover base, then lift up the cover base and set aside.



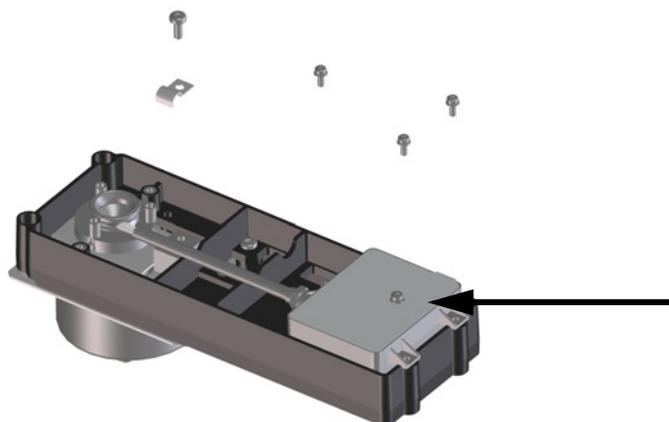
8 Remove the screws that secure the interconnect cover, then lift up the cover and set aside.

### 13 Maintaining the NPD

To Maintain the NPD Collector, Ceramic Insulators, and Jet



- 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.

### 13 Maintaining the NPD

To Maintain the NPD Collector, Ceramic Insulators, and Jet

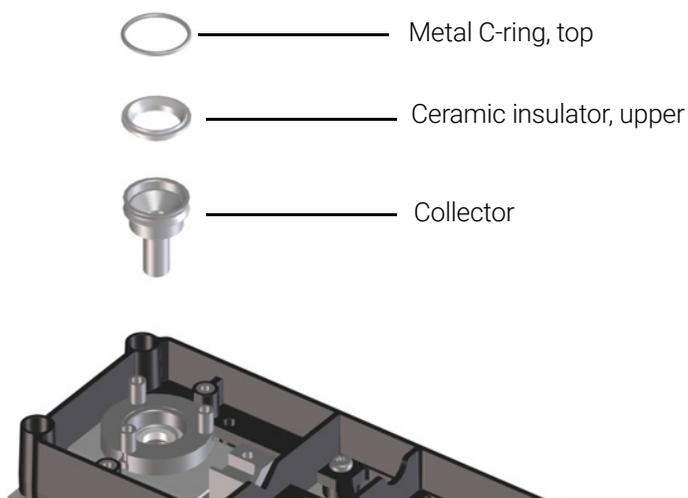


Figure 45. NPD collector, upper insulator, and metal C-ring

- 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.

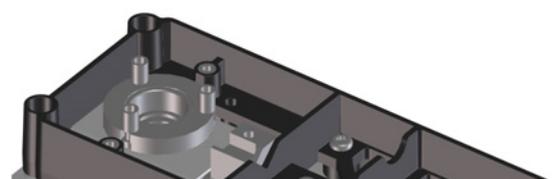
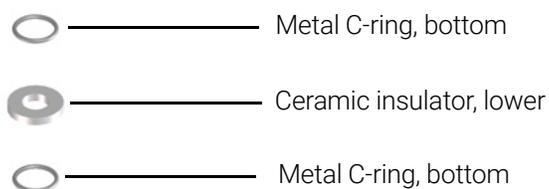
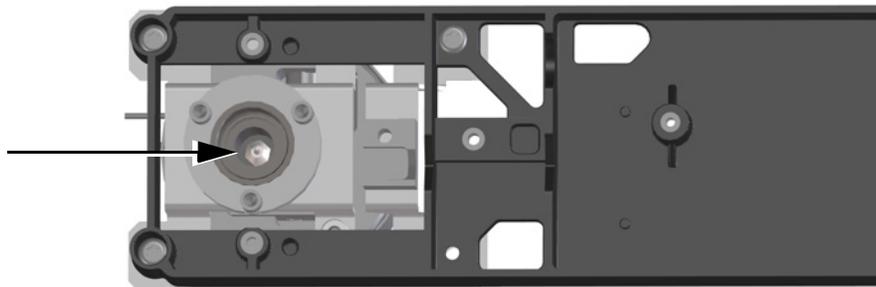


Figure 46. NPD lower ceramic insulator and metal C-ring

- 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.

### 13 Maintaining the NPD

To Maintain the NPD Collector, Ceramic Insulators, and Jet



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 46**.

23 Install the collector.

24 Install the upper ceramic insulator and top metal C-ring above the collector. See **Figure 45**.

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.

28 The GC maintenance wizard will perform checks at the appropriate times, including **Leak & Restriction** tests, and will automatically reset the maintenance counters.

29 Select **Finished**, then select **OK** to exit the GC maintenance wizard.

30 Install the bead assembly and restore normal operating conditions. See **“To Replace the NPD Bead Assembly”** on page 220. 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 229. 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.

## To Bakeout the NPD

### 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 214:
  - 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 217.
- 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 229.
- 12 Start the NPD bead Auto Adjust process.
- 13 Exit maintenance mode. Select **Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Finished**.

Allow 1 to 2 hours for a new Blos bead to equilibrate.

## Maintaining the ECD

Important Safety Information About the ECD 232

Consumables and Parts for the ECD 234

Exploded Parts View of the Electron Capture Detector 236

To Replace the ECD Fused Silica Indented Mixing Liner and Install the Makeup Gas Adapter 237

To Install a Capillary Column in the ECD 240

To Bakeout the ECD 242

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  $^{63}\text{Ni}$ , 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  $^{63}\text{Ni}$  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  $^{63}\text{Ni}$  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  $^{63}\text{Ni}$  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.

## 14 Maintaining the ECD

### Important Safety Information About the ECD

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

**Table 36 ECD consumables and parts**

Description	Part number/quantity
Fused silica indented mixing liner	G2397-20540
Makeup gas adapter	G3433-63000
ECD wipe test kit	18713-60050
Insulation	19234-60715 (1/pk)
Nut, 1/4-inch Swagelok adapter	5180-4105 (10/pk)
Ferrule, graphitized Vespel, 1/4-inch	5080-8774 (10/pk)
Capillary column blanking nut	5020-8294
1/4-inch Detector adapter, for 1/8-inch packed columns	19301-80530

**Table 37 Nuts, ferrules, and hardware for capillary columns**

Column id (mm)	Description	Typical use	Part number/quantity
.530	Ferrule, Vespel/graphite, 0.8-mm id	0.45-mm and 0.53-mm capillary columns	5062-3512 (10/pk)
	Ferrule, graphite, 1.0-mm id	0.53-mm capillary columns	5080-8773 (10/pk)
	Ferrule, graphite, 0.8-mm id	0.53-mm capillary columns	500-2118 (10/pk)
	Column nut, finger-tight (for 0.53-mm columns)	Connect column to inlet or detector	5020-8293
.320	Ferrule, Vespel/graphite, 0.5-mm id	0.32-mm capillary columns	5062-3514 (10/pk)
	Ferrule, graphite, 0.5-mm id	0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853 (10/pk)
	Column nut, finger-tight (for .100- to .320-mm columns)	Connect column to inlet or detector	5020-8292
.250	Ferrule, Vespel/graphite, 0.4-mm id	0.1-mm, 0.2-mm, and 0.25-mm capillary columns	5181-3323 (10/pk)
	Ferrule, graphite, 0.5-mm id	0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853 (10/pk)
	Column nut, finger-tight (for .100- to .320-mm columns)	Connect column to inlet or detector	5020-8292
.100 and .200	Ferrule, Vespel/graphite, 0.37-mm id	0.1-mm and 0.2-mm capillary columns	5062-3516 (10/pk)
	Ferrule, Vespel/graphite, 0.4-mm id	0.1-mm, 0.2-mm, and 0.25-mm capillary columns	5181-3323 (10/pk)
	Ferrule, graphite, 0.5-mm id	0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853 (10/pk)

## 14 Maintaining the ECD

### Consumables and Parts for the ECD

**Table 37 Nuts, ferrules, and hardware for capillary columns (continued)**

Column id (mm)	Description	Typical use	Part number/quantity
	Ferrule, graphite, 0.4-mm id		500-2114 (10/pk)
	Column nut, finger-tight (for .100- to .320-mm columns)	Connect column to inlet or detector	5020-8292
All	Ferrule, no-hole	Testing	5181-3308 (10/pk)
	Capillary column blanking nut	Testing—use with any ferrule	5020-8294
	Column nut, universal	Connect column to inlet or detector	5181-8830 (2/pk)
	Column nut, collared, self-tightening	Connect column to inlet or detector	G3440-81011
	Collar for self-tightening nut	Connect column to inlet or detector	G3440-81012
	Column nut, collared, self-tightening MSD	Connect column to inlet or detector	G3440-81013
	Column cutter, ceramic wafer	Cutting capillary columns	5181-8836 (4/pk)
	Pencil, diamond tipped	Cutting capillary columns	420-1000
	Ferrule tool kit	Ferrule installation	440-1000

# Exploded Parts View of the Electron Capture Detector

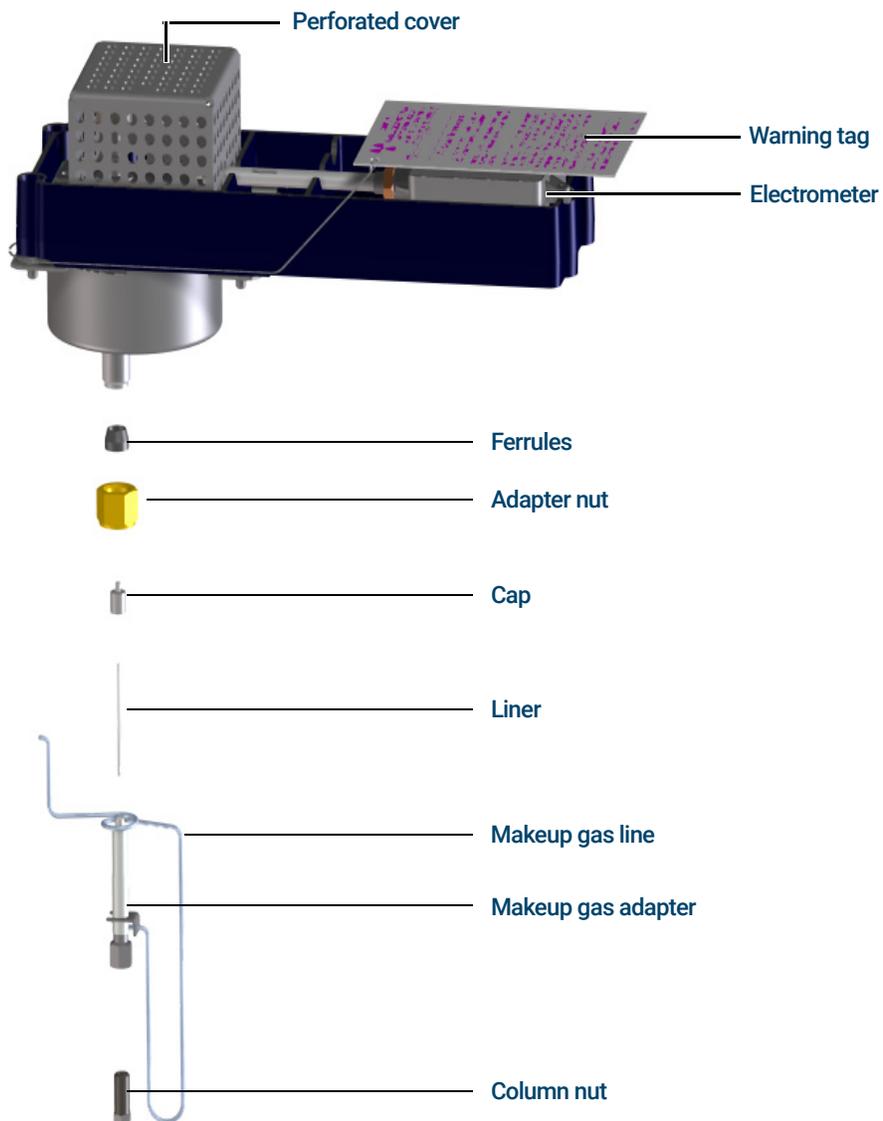


Figure 47. Electron Capture Detector (ECD) exploded parts

# 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 234.
  - 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

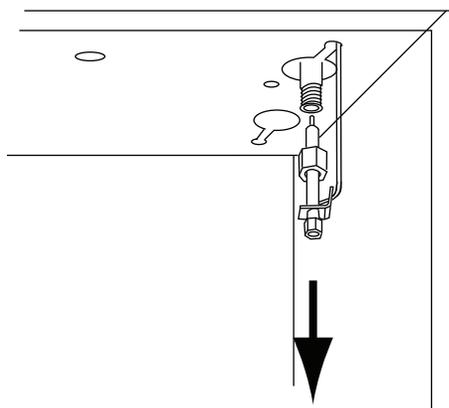
**To prevent damage avoid flexing/bending the tubing on the makeup gas adapter.**

- 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.

## 14 Maintaining the ECD

To Replace the ECD Fused Silica Indented Mixing Liner and Install the Makeup Gas Adapter

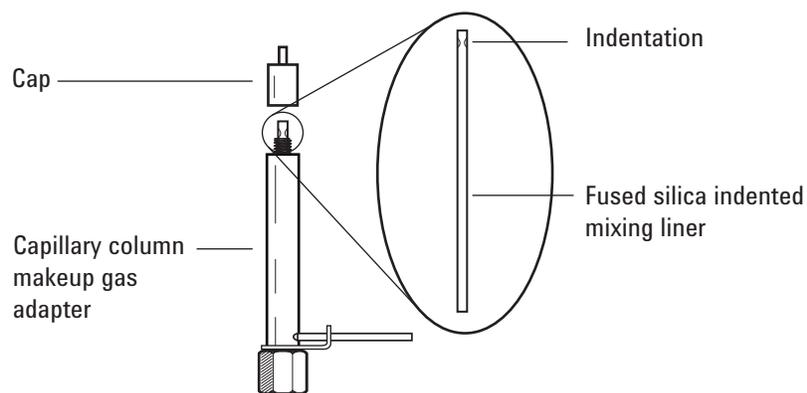


- 5 Unscrew and remove the adapter cap.

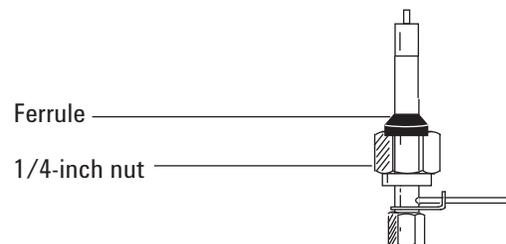
### CAUTION

**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.



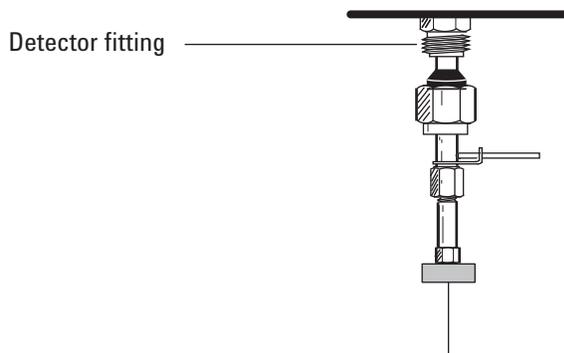
- 9 Place a new 1/4-inch Swagelok nut and ferrule onto the makeup gas adapter.



## 14 Maintaining the ECD

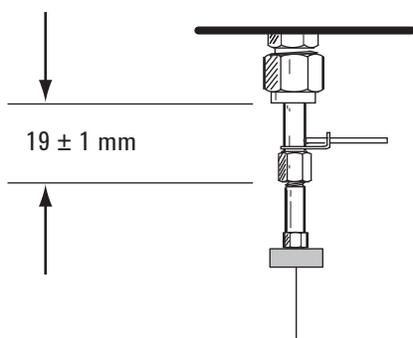
### To Replace the ECD Fused Silica Indented Mixing Liner and Install the Makeup Gas Adapter

- 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  $19 \pm 1$  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 240.

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

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

## 14 Maintaining the ECD

### To Install a Capillary Column in the ECD

# To Install a Capillary Column in the ECD

- 1 Gather the following:
  - Ferrule, see **“Consumables and Parts for the ECD”** on page 234.
  - Column nut
  - Septum
  - Column
  - 1/4-inch, 5/16-inch, and 9/16-inch wrenches
  - Column cutter
  - Lint-free gloves
- 2 Launch the GC maintenance wizard: **Maintenance > Column > Perform Maintenance > Install Column > Start Maintenance**. Wait for the GC to become ready. The wizard will guide you through the maintenance steps described below.

#### 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

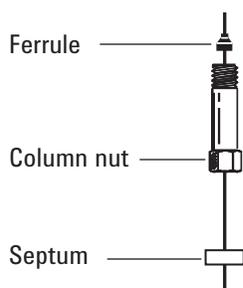
Wear safety glasses to protect your eyes from flying particles while handling, cutting, or installing glass or fused silica capillary columns. Use care in handling these columns to prevent puncture wounds.

- 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.

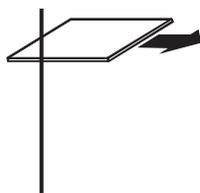
- 4 Place a septum (if the column id is  $\leq 0.2$  mm), capillary column nut, and ferrule on the column.



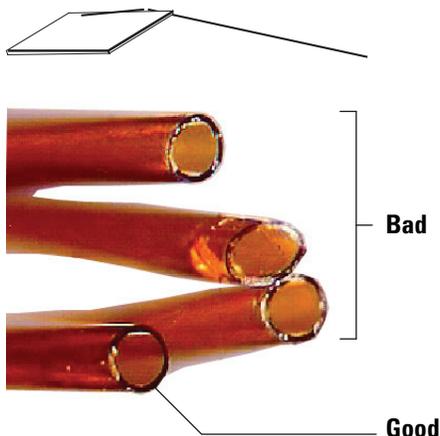
- 5 Score the column using a glass scribing tool. The score must be square to ensure a clean break.

## 14 Maintaining the ECD

### To Install a Capillary Column in the ECD



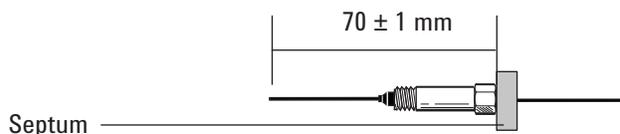
- 6 Break off the column end by supporting it against the column cutter opposite the scribe. Inspect the end with a magnifying loupe to make certain there are no burrs or jagged edges.



- 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  $\mu\text{m}$  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  $\mu\text{m}$ , mark the column with a septum  $70 \pm 1$  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.
- 10 The GC maintenance wizard will perform checks at the appropriate times, including **Leak & Restriction** tests, and will automatically reset the maintenance counters.
- 11 Select **Finished**, then select **OK** to exit the GC maintenance wizard.

## To Bakeout the ECD

### WARNING

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

### CAUTION

To prevent possible hazardous contamination of the area with radioactive material, the detector exhaust vent always must be connected to a fume hood or otherwise vented in compliance with the latest revision of 10 CFR Part 20, or with state regulations with which the Nuclear Regulatory Commission has entered into an agreement (USA only). For other countries, consult with the appropriate agency for equivalent requirements.

- 1 Gather the following:
  - Column nut and no-hole ferrule, see “**Consumables and Parts for the ECD**” on page 234.
  - Blanking nut with any column ferrule
- 2 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 Go to **Home > Status listing > +Add**.
  - b Select **Output** for the ECD 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

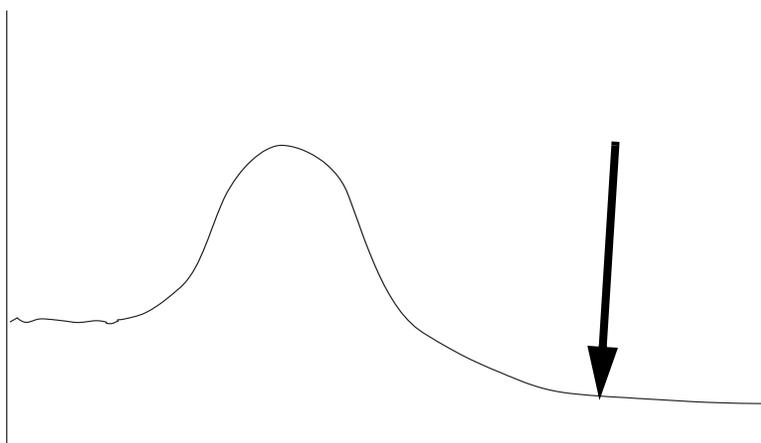
Wear safety glasses to protect your eyes from flying particles while handling, cutting, or installing glass or fused silica capillary columns. Use care in handling these columns to prevent puncture wounds.

- 3 If the column maximum temperature is  $< 250\text{ }^{\circ}\text{C}$ , remove the column from the detector.
- 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 the ECD temperature to 350 to 375  $^{\circ}\text{C}$ , the makeup gas flow to 60 mL/min, and the oven temperature to 250  $^{\circ}\text{C}$ . If the column is uninstalled, leave the oven off to protect the column.
- 6 If the column is installed in the ECD, set the oven temperature to 250  $^{\circ}\text{C}$ . If the column is uninstalled, leave the oven off to protect the column.
- 7 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.

## 14 Maintaining the ECD

### To Bakeout the ECD



- 8 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.
- 9 Reinstall the column.
- 10 Restore the analytical method.

**14 Maintaining the ECD**  
To Bakeout the ECD

## Maintaining the FPD+

- Consumables and Parts for the FPD+ 246
- Exploded Parts View of the Flame Photometric Detector Plus 248
- To Install a Capillary Column to the FPD+ 249
- To Change the FPD+ Wavelength Filter 251
- To Remove the FPD+ Cover 254
- To Replace the FPD+ Ignitor 255
- To Install the FPD+ Cover 257
- Cleaning the FPD+ Brazement 258

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

**Table 38 FPD supplies**

Description	Part number/quantity
Sulfur filter	1000-1437
Sulfur filter spacer	19256-20910
Phosphorus filter	19256-80010
Exit tube assembly	G3435-60330
O-ring for exit tube assembly	0905-1014
Ignitor	19256-60750
Screw, M3 × 6 mm, T-10	0515-0680
Collet	19256-20690
Column measuring tool	G3435-81380
Spring to secure photomultiplier tube	1460-1160
Nut, 1/8-inch, brass, for packed column adapters	5180-4103 (10/pk)
Ferrule, Vespel/graphite, 1/8-inch, for packed column adapters	0100-1332 (10/pk)
Nut, 1/4-inch, brass, for packed column adapters	5180-4105 (10/pk)
Ferrule, Vespel, 1/4-inch, for packed column adapters	5080-8774 (10/pk)
Pre-swaged 1/8-inch packed column adapter	G3450-60191
Pre-swaged inert 1/8-inch packed column adapter	G3450-60192
Pre-swaged 1/4-inch packed column adapter	G3450-60193
Pre-swaged inert 1/4-inch packed column adapter	G3450-60194
Preventive maintenance kit, single FPD+	G3435-67000
Preventive maintenance kit, dual FPD+	G3436-67000

**Table 39 Nuts, ferrules, and hardware for capillary columns**

Column id (mm)	Description	Typical use	Part number/quantity
.530	Ferrule, Vespel/graphite, 0.8-mm id	0.45-mm and 0.53-mm capillary columns	5062-3512 (10/pk)
	Ferrule, graphite, 1.0-mm id	0.53-mm capillary columns	5080-8773 (10/pk)
	Ferrule, graphite, 0.8-mm id	0.53-mm capillary columns	500-2118 (10/pk)
	Column nut, finger-tight (for 0.53-mm columns)	Connect column to inlet or detector	5020-8293

## 15 Maintaining the FPD+ Consumables and Parts for the FPD+

**Table 39 Nuts, ferrules, and hardware for capillary columns (continued)**

Column id (mm)	Description	Typical use	Part number/quantity
.320	Ferrule, Vespel/graphite, 0.5-mm id	0.32-mm capillary columns	5062-3514 (10/pk)
	Ferrule, graphite, 0.5-mm id	0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853 (10/pk)
	Column nut, finger-tight (for .100- to .320-mm columns)	Connect column to inlet or detector	5020-8292
.250	Ferrule, Vespel/graphite, 0.4-mm id	0.1-mm, 0.2-mm, and 0.25-mm capillary columns	5181-3323 (10/pk)
	Ferrule, graphite, 0.5-mm id	0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853 (10/pk)
	Column nut, finger-tight (for .100- to .320-mm columns)	Connect column to inlet or detector	5020-8292
.100 and .200	Ferrule, Vespel/graphite, 0.37-mm id	0.1-mm and 0.2-mm capillary columns	5062-3516 (10/pk)
	Ferrule, Vespel/graphite, 0.4-mm id	0.1-mm, 0.2-mm, and 0.25-mm capillary columns	5181-3323 (10/pk)
	Ferrule, graphite, 0.5-mm id	0.1-mm, 0.2-mm, 0.25-mm, and 0.32-mm capillary columns	5080-8853 (10/pk)
	Ferrule, graphite, 0.4-mm id		500-2114 (10/pk)
	Column nut, finger-tight (for .100- to .320-mm columns)	Connect column to inlet or detector	5020-8292
All	Ferrule, no-hole	Testing	5181-3308 (10/pk)
	Capillary column blanking nut	Testing—use with any ferrule	5020-8294
	Column nut, universal	Connect column to inlet or detector	5181-8830 (2/pk)
	Column nut, collared, self-tightening	Connect column to inlet or detector	G3440-81011
	Collar for self-tightening nut	Connect column to inlet or detector	G3440-81012
	Column nut, collared, self-tightening MSD	Connect column to inlet or detector	G3440-81013
	Column cutter, ceramic wafer	Cutting capillary columns	5181-8836 (4/pk)
	Pencil, diamond tipped	Cutting capillary columns	420-1000
	Ferrule tool kit	Ferrule installation	440-1000

# Exploded Parts View of the Flame Photometric Detector Plus

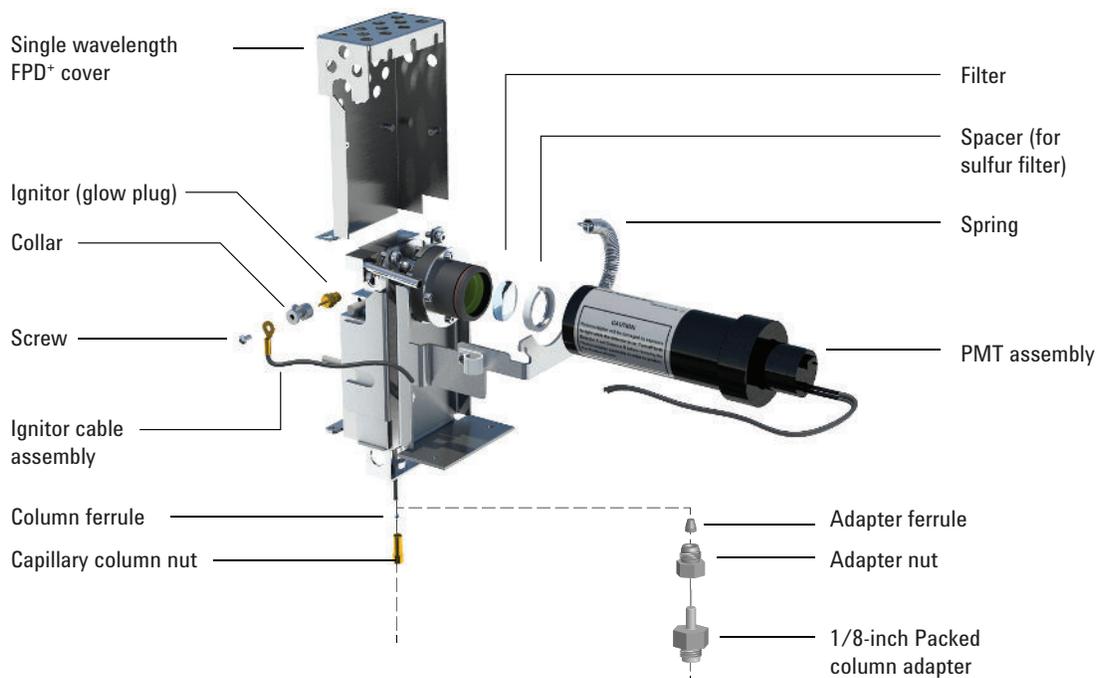


Figure 48. Flame Photometric Detector Plus (FPD+) single wavelength exploded parts

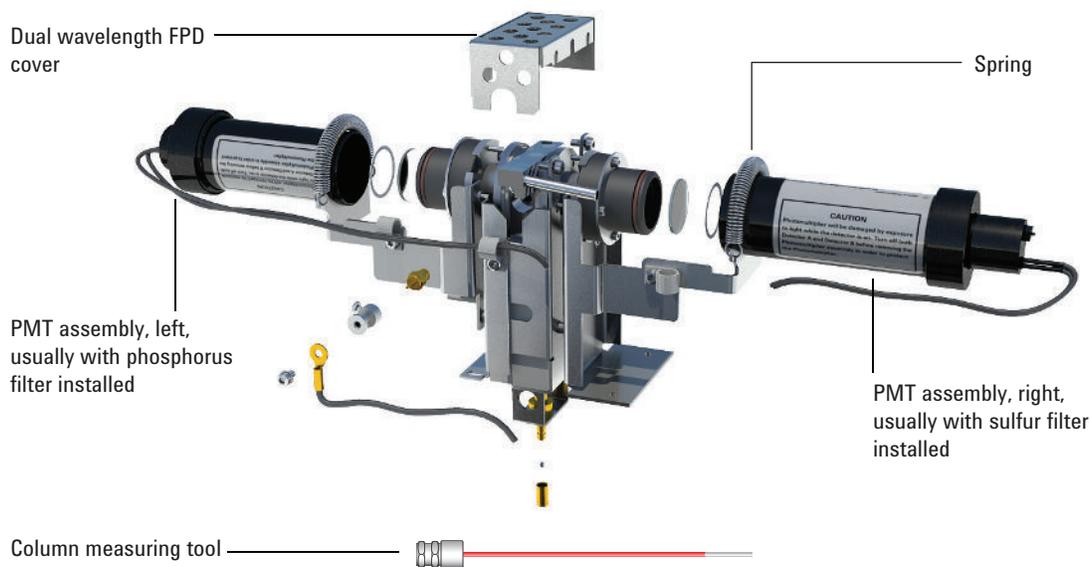


Figure 49. Flame Photometric Detector Plus (FPD+) dual wavelength exploded parts

## To Install a Capillary Column to the FPD+

- 1 Gather the following:
  - Column measuring tool, see “Consumables and Parts for the FPD+” on page 246.
  - Column cutter
  - 1/4-inch and 7/16-inch wrenches
  - Column nut
  - Ferrule
  - Capillary column
  - Lint-free gloves
- 2 Launch the GC maintenance wizard: **Maintenance > Column > Perform Maintenance > Install Column > Start Maintenance**. Wait for the GC to become ready. The wizard will guide you through the maintenance steps described below.

### 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.

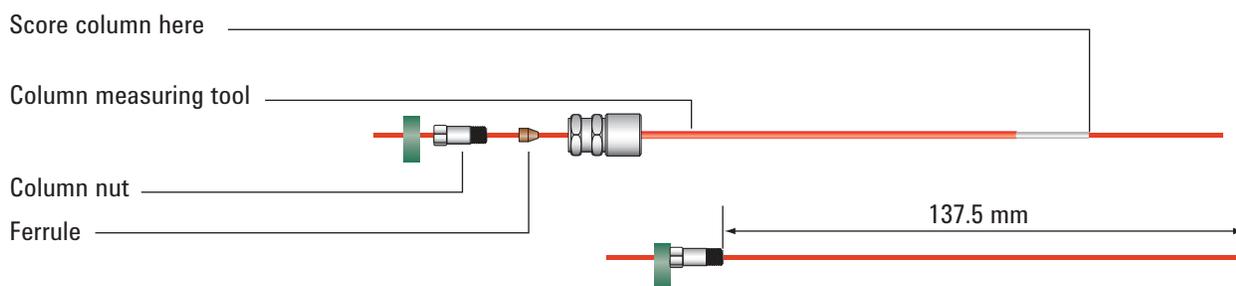
### WARNING

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.

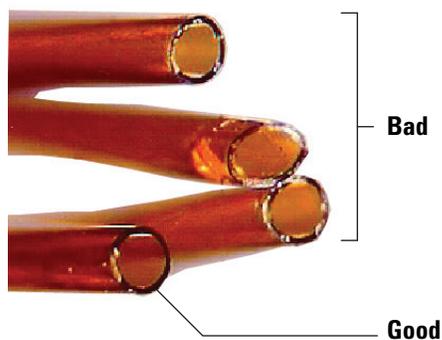
- 3 Assemble a septum, column nut, and ferrule on the end of the column.
- 4 Insert the end of the column through the column measuring tool so that the end protrudes beyond the tool.



- 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.

## 15 Maintaining the FPD+

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 The GC maintenance wizard will perform checks at the appropriate times, including **Leak & Restriction** tests, and will automatically reset the maintenance counters.
- 12 Select **Finished**, then select **OK** to exit the GC maintenance wizard.

## 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 246.
  - Phosphorus filter
  - Cotton swab
  - Lens tissue
  - Lint-free gloves
- 2 Verify that the PMT voltage is off.
  - a Navigate to **Methods > Active Method > Edit > Detectors**, scroll to **Detector Specifics**, then select the **Photomultiplier High Voltage**.
  - b If the voltage is enabled, turn it off and apply the updated method.
- 3 Launch the GC maintenance wizard: **Maintenance > Detector > Perform Maintenance > Replace FPD Filter > Start Maintenance**. Wait for the GC to become ready. The wizard will guide you through the maintenance steps described below.

### 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.



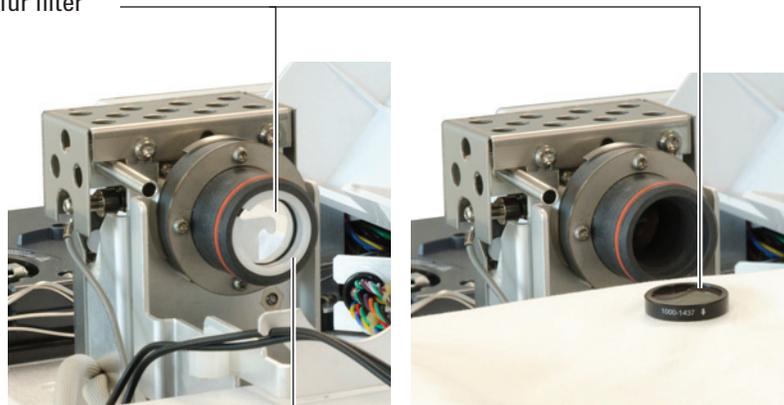
## 15 Maintaining the FPD+ To Change the FPD+ Wavelength Filter

- 5 To prevent light from damaging the PMT, cap the end or place it face down.



- 6 Place a clean cloth under the filter housing to catch the filter.
  - For phosphorus filter, use the sharpened wooden tip of a toothpick or cotton swab to dislodge the filter from the housing.
  - For sulfur filter (shown below), use the wooden tip of the cotton swab to remove the filter spacer. Then dislodge the filter from the housing.

Sulfur filter



Filter spacer

### 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.

## 15 Maintaining the FPD+ To Change the FPD+ Wavelength Filter

- 8 Install the filter in the filter housing. Install the sulfur filter spacer, if necessary.
- 9 Replace the PMT assembly and secure with the spring.
- 10 Route the PMT wires through the clips as shown. Avoid placing the wires very near heated areas (such as the emission block or oven top).



- 11 The GC maintenance wizard will perform checks at the appropriate times, including **Leak & Restriction** tests, and will automatically reset the maintenance counters.
- 12 Select **Finished**, then select **OK** to exit the GC maintenance wizard.
- 13 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.

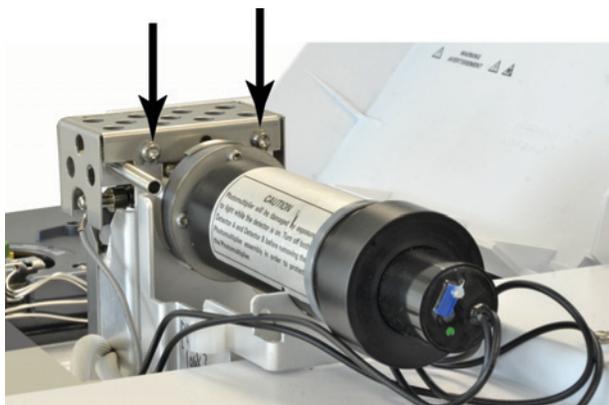
### CAUTION

When turning off the GC, first turn off the flame to prevent condensation from dripping into the jet and column.

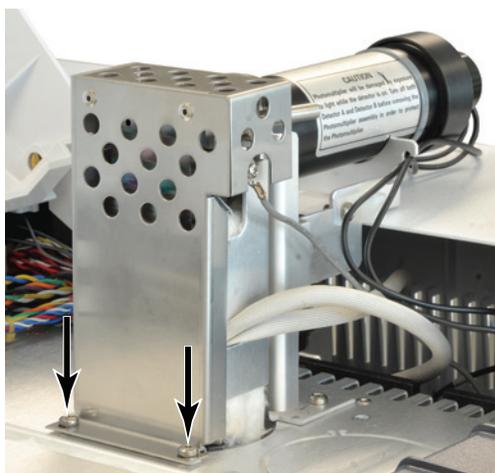
### WARNING

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.

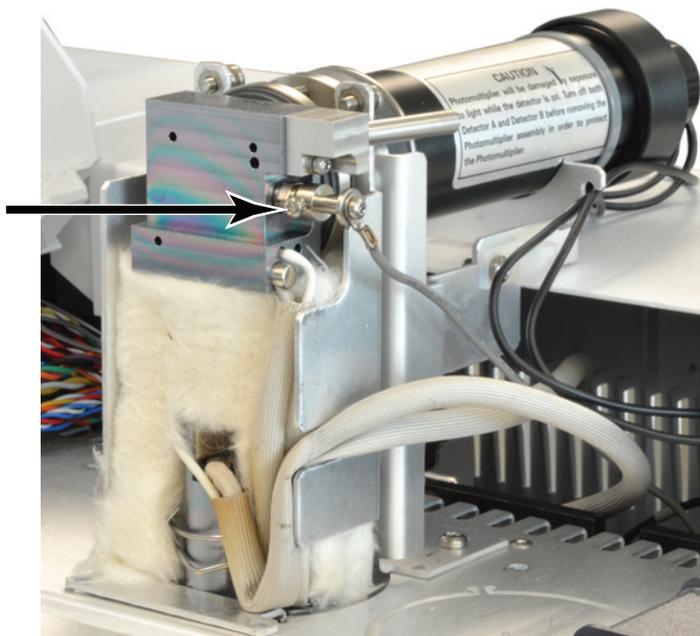
## To Replace the FPD+ Ignitor

- 1 Gather the following:
  - Ignitor replacement kit, see **“Consumables and Parts for the FPD+”** on page 246.
  - Torx screwdrivers, T-20 and T-10
  - 5/16-inch nut driver (or wrench)
- 2 Launch the GC maintenance wizard: **Maintenance > Detector > Perform Maintenance > Replace FPD Ignitor > Start Maintenance**. Wait for the GC to become ready. The wizard will guide you through the maintenance steps described below.

### 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 254.
- 4 Loosen the collet screw holding the cable assembly to the ignitor. Remove the collet and cable assembly.

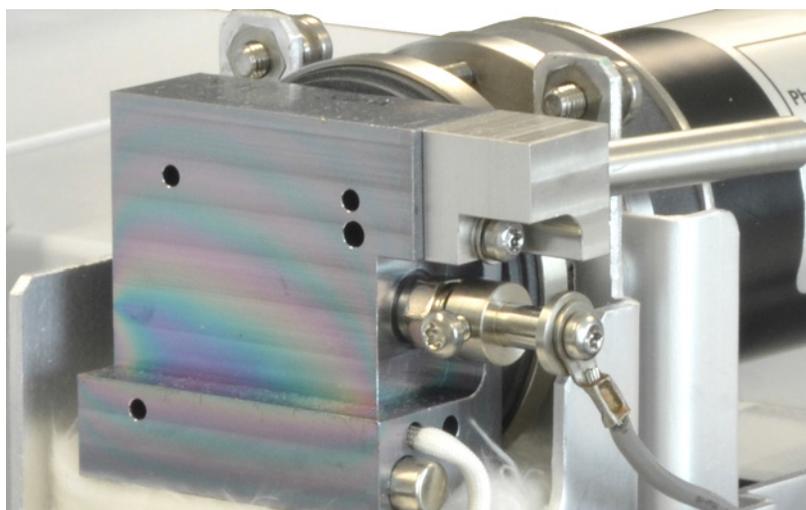


- 5 Use a nut driver to loosen and remove the glow plug.
  - If using a 5/16-inch wrench, you may need to remove the exit tube assembly using a T-10 Torx driver

## 15 Maintaining the FPD+ 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 257.
- 9 The GC maintenance wizard will perform checks at the appropriate times, including **Leak & Restriction** tests, and will automatically reset the maintenance counters.
- 10 Select **Finished**, then select **OK** to exit the GC maintenance wizard.
- 11 Restore the analytical method.
- 12 Wait 20 min. for the detector to heat up, then ignite the flame.

## 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

### CAUTION

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 260

Installing or Replacing Frits in the Aux EPC 262

Consumables and Parts for the PCM 264

Calibrating the PCM Interface 265

Installing or Replacing Frits in the PCM 266

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.

## Consumables and Parts for the Aux EPC

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

**Table 40 Aux EPC consumables**

Description	Part number
O-rings, package of 6	5181-3344
Blue dot frit, high flow resistance	G3430-80063
Red dot frit, medium flow resistance	G3430-80062
Brown dot frit, low flow resistance	G3430-80061
No frit (brass tube), zero flow resistance	G3430-20011

**Table 41 Auxiliary channel frits**

Frit marking		Flow resistance	Flow characteristic	Often used with
Three rings Blue		High	3.33 ± 0.3 SCCM @ 15 PSIG	NPD Hydrogen
Two rings Red		Medium	30 ± 1.5 SCCM H2 @ 15 PSIG	FID Hydrogen
One ring Brown		Low	400 ± 30 SCCM AIR @ 40 PSIG	FID Air, QuickSwap, Purged splitters, Deans Switch

## 16 Maintaining EPC Modules

### Consumables and Parts for the Aux EPC

Table 41 Auxiliary channel frits (continued)

Frit marking		Flow resistance	Flow characteristic	Often used with
None (brass tube)		Zero	No restriction	Headspace vial pressurization, purged splitter and Deans Switch when using backflush

## 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 41**.
- 4 Identify which frit needs to be changed. Trace the tubing as needed to confirm. Markings on top of the partner fitting identify positioning of the flow channels.
- 5 Remove the screw to the partner fitting.
- 6 Lift the partner fitting away from the Aux EPC module. This exposes the frits and O-rings.
- 7 Gently remove the frit and O-ring using the tweezers. Be careful to avoid scratching the metal surfaces.
- 8 Place a new O-ring onto the end of the new frit, and insert the frit into the EPC module.

## 16 Maintaining EPC Modules

### Installing or Replacing Frits in the Aux EPC

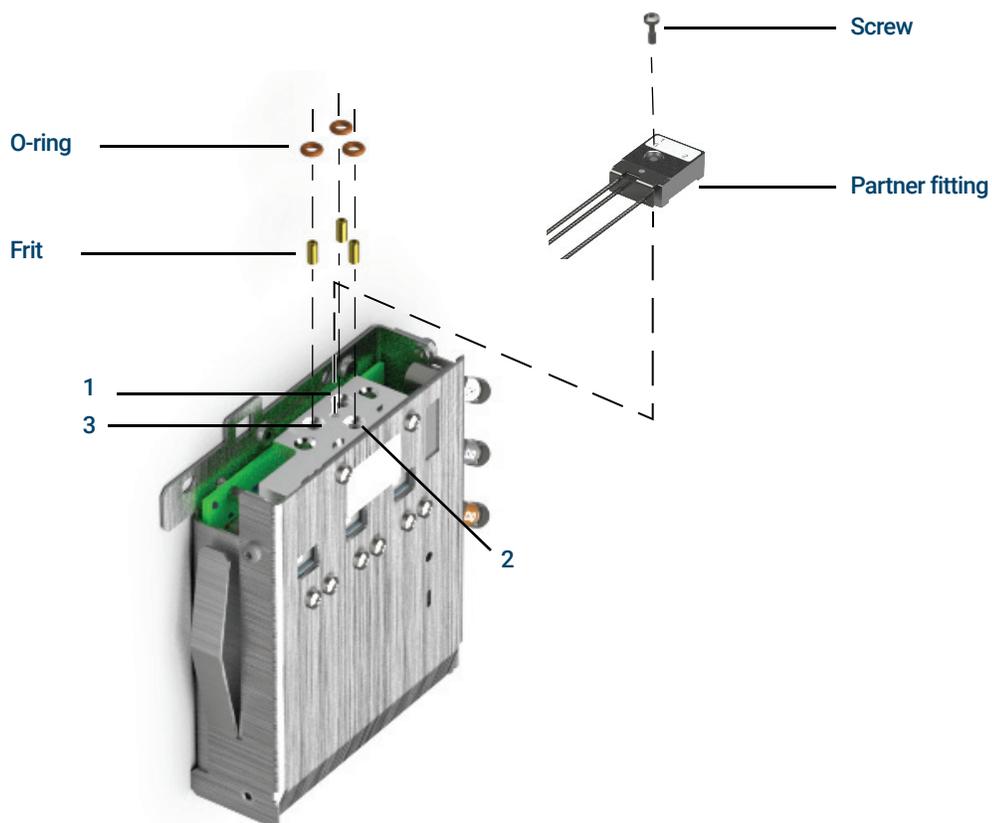


Figure 50. Replace an Aux EPC frit

**9** Place the partner fitting onto the Aux EPC module, and secure in place using the screw.

**10** 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](http://www.agilent.com). To download the GC Firmware Update Tool, open a web browser, navigate to [www.agilent.com](http://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](http://www.agilent.com/chem/supplies)).

**Table 42** PCM consumables

Description	Part number
O-rings, package of 12	5180-4181
Proportional valve, Carrier	G3430-67013
Proportional valve, AUX	G3430-67016

## 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).

Pressure sensors. Disconnect the gas supply line at the back of the GC. Turning it off is not adequate; the valve may leak.

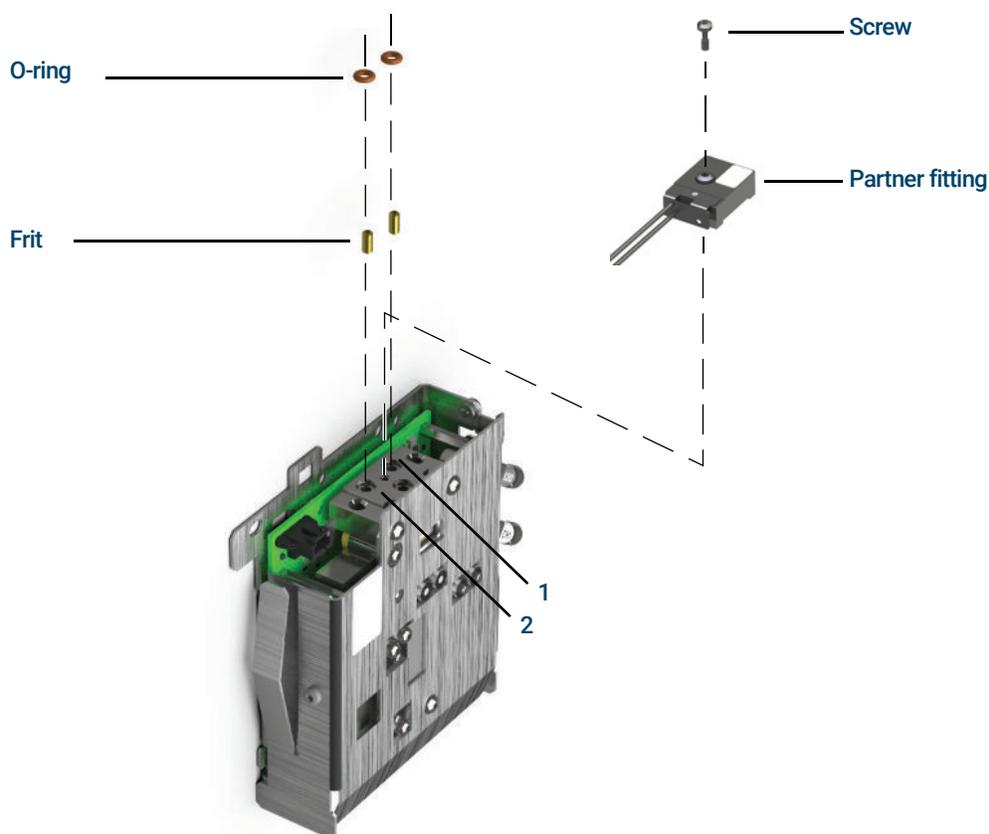
- 6 Press **On/Yes** to zero or **Clear** to cancel.
- 7 Turn off the GC.
- 8 Plumb the carrier gas to the flow module.
- 9 Turn on the GC.

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. Markings on top of the EPC module identify positioning of the flow channels.
- 4 Remove the screw holding the partner fitting onto the EPC module.
- 5 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 partner fitting on the module and tighten the screw firmly.

## 16 Maintaining EPC Modules

### Installing or Replacing Frits in the PCM

- 9 Restore the gas supply.

#### **WARNING**

---

**When hydrogen is used, dangerously high flows are possible if insufficient flow resistance is provided downstream of the supply tube. Always use either the High (Blue dot) or Medium (Red dot) frit with hydrogen.**

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

## 16 Maintaining EPC Modules

### Installing or Replacing Frits in the PCM

## Maintaining a Valve

- Consumables and Parts for Valves 270
- Exploded Parts View of GC Rotary Valves 271
- To Replace a Gas Sampling Valve Loop 272
- To Align a Rotary Valve Rotor 274
- To Replace a Rotary Valve in the Valve Box 275
- To Remove the Upper Valve Box 278
- To Install the Upper Valve Box 279

## Consumables and Parts for Valves

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

**Table 43 Valve supplies**

Description	Part number
<b>Valves, gas sampling</b>	
6-port, 300 psi	0101-0584
6-port, 400 psi, 225 °C maximum temperature	5062-9508
6-port, 300 °C maximum temperature	0101-0460
6-port Hastelloy, 400 psi, 225 °C maximum temperature	5062-9509
10-port, 400 psi, 225 °C maximum temperature	5062-9510
10-port Nitronic 60, 300 psi, 350 °C maximum temperature	0101-0585
10-port Hastelloy, 400 psi, 225 °C maximum temperature	5062-9511
<b>Valves, liquid sampling</b>	
0.2- $\mu$ L, 1000 psi, stainless steel, 175 °C maximum temperature	0101-0636
0.5- $\mu$ L, 5000 psi, 175 °C maximum temperature	0101-0639
0.5- $\mu$ L, 1000 psi, stainless steel, 175 °C maximum temperature	0101-0637
1.0- $\mu$ L, 1000 psi, stainless steel, 175 °C maximum temperature	0101-0638
<b>Gas sampling valve sample loops</b>	
0.25-cc	0101-0303
0.50-cc	0101-0282
1.00-cc	0101-0299
2.00-cc	0101-0300
2.0-mL nickel loop, 1/16-inch	0101-0955
5.00-cc	0101-0301
10.00-cc	0101-0302
Ferrule, 1/16-inch stainless steel (10/pk)	5181-1291
Nut, 1/16-inch (10/pk)	5181-1292

# Exploded Parts View of GC Rotary Valves

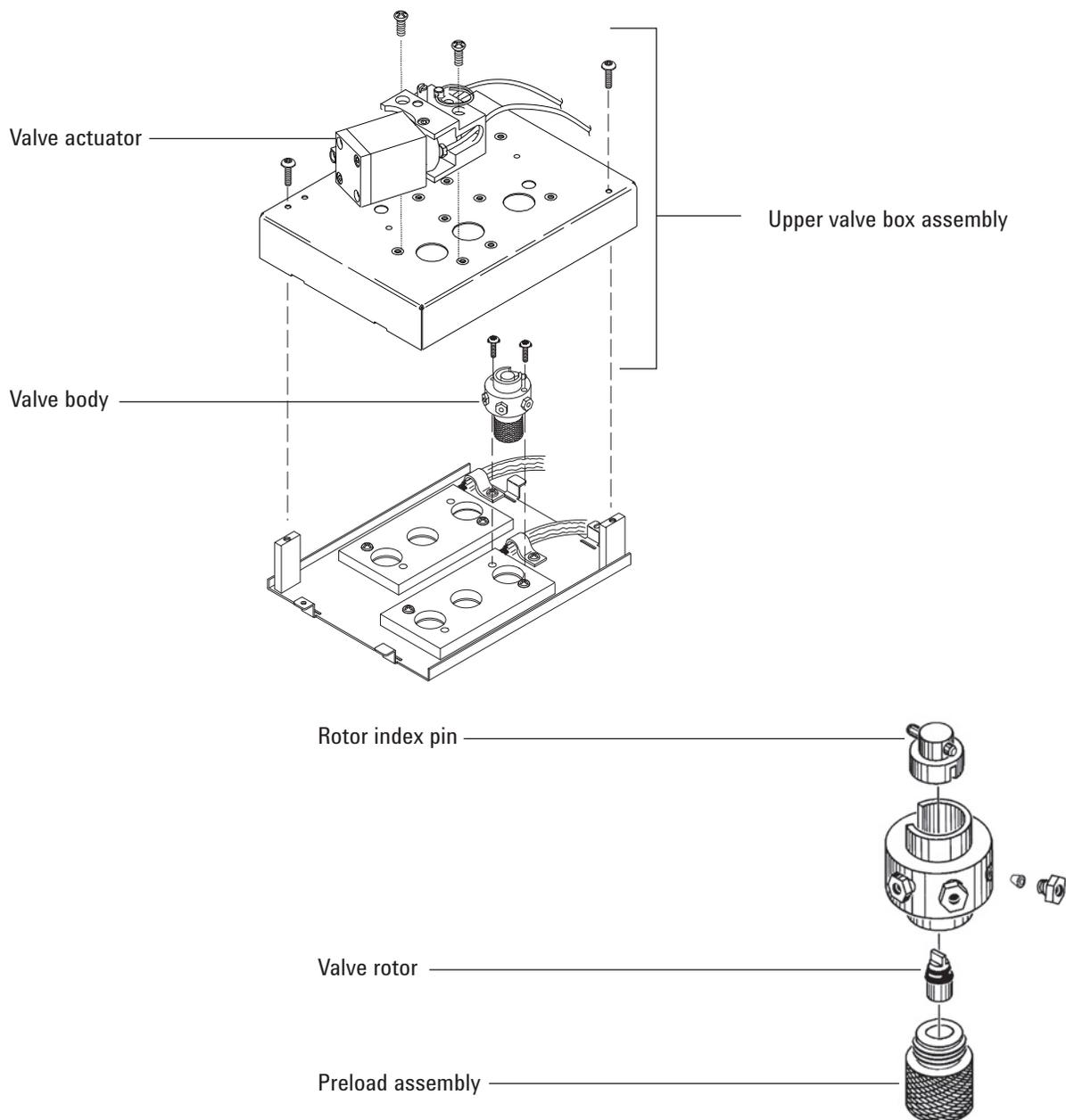


Figure 51. GC rotary valve exploded parts

## To Replace a Gas Sampling Valve Loop

- 1 Gather the following:
  - Replacement sample loop, see **“Consumables and Parts for Valves”** on page 270.
  - 1/4-inch wrench
  - Vacuum cleaner
- 2 Place GC in maintenance mode: **Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Start Maintenance**. Wait for the GC to become ready.
- 3 Turn off the detector.

### WARNING

The oven, inlet, detector, and valve box may be very hot.

Sample and/or harmful gases may be present. Refer to your company’s standard operating procedures for purging the chemicals from the sample line.

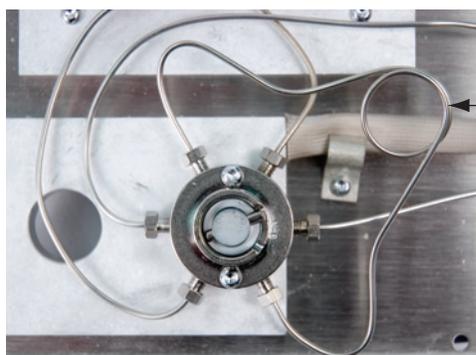
- 4 Set all valve box valves to **Off**.
- 5 Leave on the GC and valve actuator air.
- 6 Turn off the carrier gas and sample line flows and relieve any back pressure to the valve.

### WARNING

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

- **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 278.
- 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.



Sample loop

## 17 Maintaining a Valve

### To Replace a Gas Sampling Valve 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 279.
- 13 Exit maintenance mode: Select **Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Finished.**
- 14 Restore the analytical method.

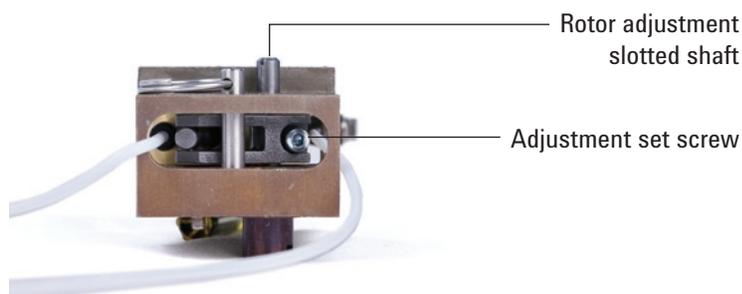
## To Align a Rotary Valve Rotor

- 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 270.
  - T-10 Torx screwdriver
  - 1/4-inch wrench
  - Needle-nosed pliers
  - Vacuum
- 2 Place GC in maintenance mode: **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.

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**

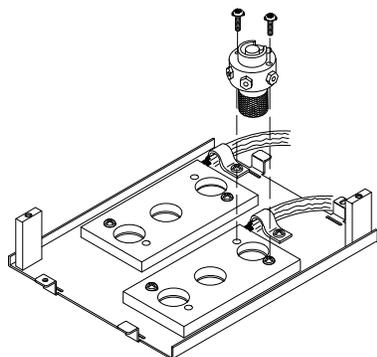
The valve box insulation is made of refractory ceramic fibers (RCFs). To avoid inhaling RCF particles, we recommend these safety procedures:

- **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.**

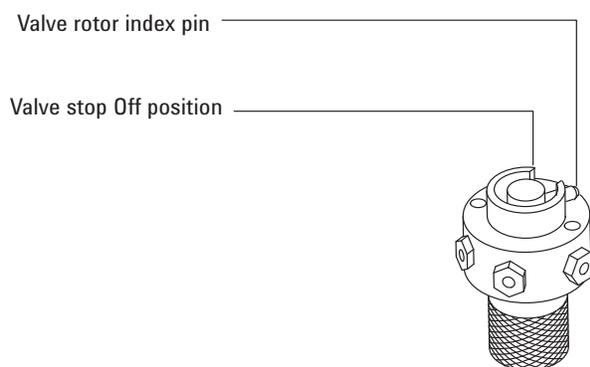
- 6 Remove the upper valve box. See “**To Remove the Upper Valve Box**” on page 278. Vacuum any RCF insulation particulates from the valve box area.
- 7 Note the tubing connections to the existing valve and label if desired.
- 8 Disconnect the existing valve fittings.
- 9 Remove the two T-10 Torx screws 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.

## 17 Maintaining a Valve

To Replace a Rotary Valve in the Valve Box



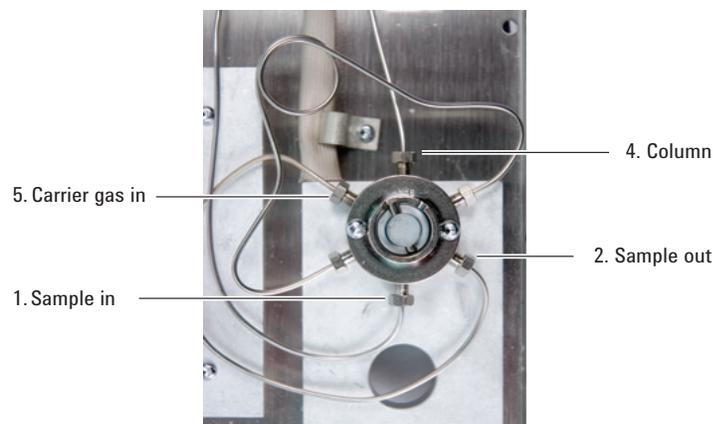
- 11** Use needle-nosed pliers to move the valve rotor index pin of the valve counterclockwise until the pin touches the valve stop **Off** position.



- 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 279.
- 15** Reset the valve EMF counters.

## 17 Maintaining a Valve

To Replace a Rotary Valve in the Valve Box

- 16 Perform an inlet **Leak & Restriction** test and reset the maintenance counters.
- 17 Exit maintenance mode. Select **Maintenance > Instrument > Perform Maintenance > Maintenance Mode > Finished.**
- 18 Restore the analytical method.

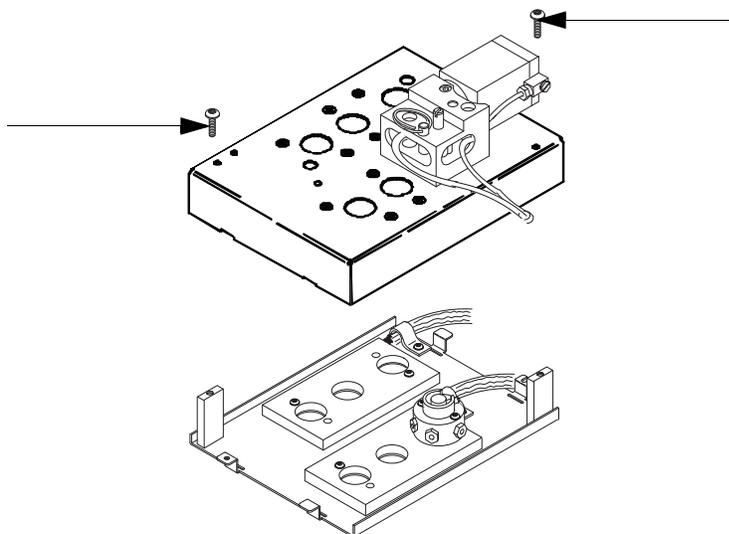
## To Remove the Upper Valve Box

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

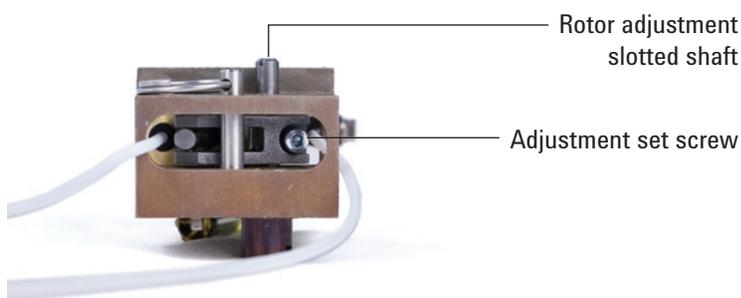
### WARNING

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

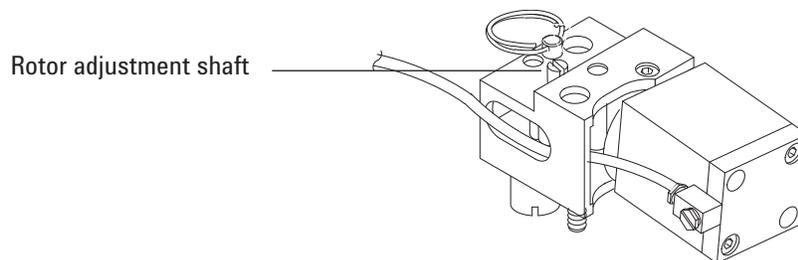
- Ventilate your work area
- Wear long sleeves, gloves, safety glasses, and a disposable dust/mist respirator
- Dispose of insulation in a sealed plastic bag
- Vacuum any residual particles and discard
- Wash your hands with mild soap and cold water after handling RCFs.

## 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.

**17 Maintaining a Valve**  
To Install the Upper Valve Box

# A

## Swagelok Connections

Making Swagelok Connections 282

Using a Swagelok Tee 285

The gas supply tubing is attached with Swagelok fittings. If you are not familiar with Swagelok connections, review the following procedures.

# Making Swagelok Connections

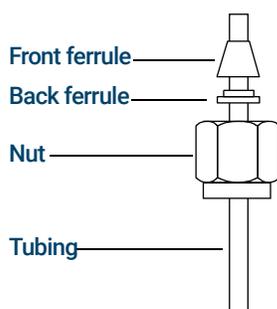
## Objective

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 52**.



**IMPORTANT!**  
The narrow end of the back ferrule fits into the rear of the front ferrule.

Figure 52. Swagelok nuts and ferrules

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 53**.

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

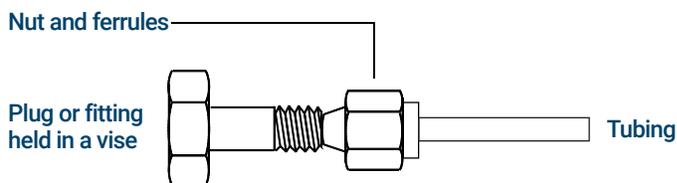


Figure 53. Assemble the fitting

## A Swagelok Connections

### Making Swagelok Connections

- 5 Push the tube fully into the plug, then withdraw it approximately 1 to 2 mm as shown in **Figure 54**.

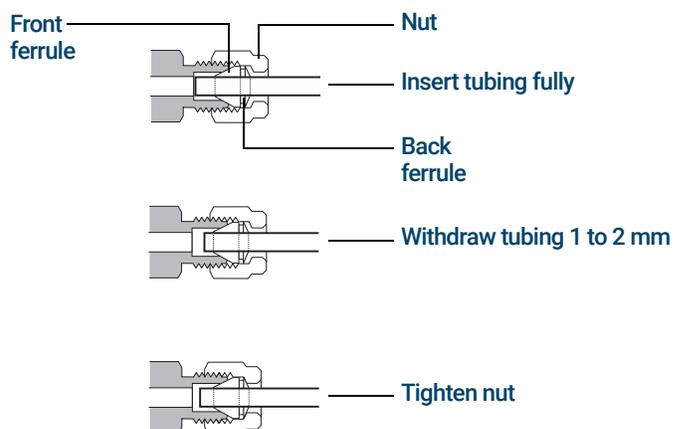


Figure 54. Insert the tubing

- 6 Finger-tighten the nut.
- 7 Mark the nut with a pencil line. See **Figure 55**.

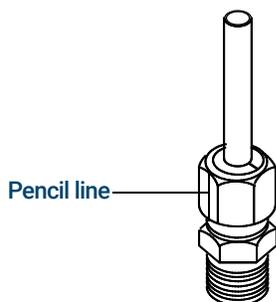


Figure 55. Mark the fitting

- 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 56**.

For 1/4-inch fittings, use a pair of 9/16-inch wrenches to tighten them 1-1/4 turn, as shown in **Figure 56**.

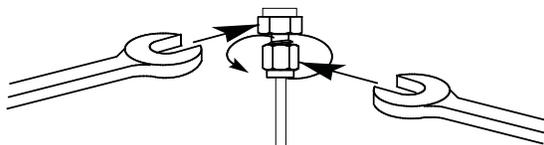


Figure 56. Final tightening

## A Swagelok Connections

### Making Swagelok Connections

- 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 57**. 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.

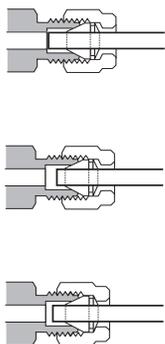


Figure 57. Completed fitting

## 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 58](#).

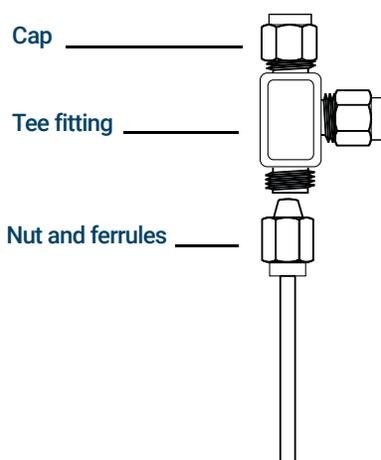


Figure 58. Swagelok tee

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

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