

Agilent Intuvo 9000 Gas Chromatograph

Maintaining Your GC



Notices

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Manual Part Number

G4580-90004

Edition

First edition, September 2016

Printed in USA

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WARNING

A **WARNING** notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a **WARNING** notice until the indicated conditions are fully understood and met.

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This section provides an overview of the maintenance procedures included in this document. It also lists the tools and safety information needed for routine maintenance.



Overview of Maintenance

This manual details the routine tasks needed to maintain the 9000 Series 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 Intuvo GC touchscreen

Where to find a procedure

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

- Intuvo Column and Bus Components
- Split/Splitless Inlet
- Multimode Inlet
- FID
- TCD
- ECD
- NPD
- FPD⁺

Each chapter includes:

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

Tools and Materials Required for Maintenance

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

Table 1 Tools and materials for GC maintenance

Common tools
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
Driver, nut, 1/4-inch (8710-1561)*
T-20 Torx key (8710-1807) or screwdriver
T-10 Torx key (8710-2140) or screwdriver
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
Bench vise (for setting Swagelok fittings)
Razor or sharp knife
Tweezers (8710-0007) or thin needle-nose pliers (8710-0004)
Needle-nose pliers
ESD wrist strap (for installing new components)
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 (9301-0985) contains appropriate brushes for cleaning detectors and inlets
Cleaning brushes—(8710-1346) For cleaning split/splitless inlet split vent fitting, FID and collectors
Jet cleaning wire (.010 inch)
Clean, lint-free cloth (to protect contamination-sensitive detector parts)

Table 1 Tools and materials for GC maintenance (continued)

Small ultrasonic cleaning bath with aqueous detergent (for cleaning detector and inlet parts)

Gloves, clean, lint-free, nylon (large: 8650-0030, small: 8650-0029) (for handling contamination-sensitive parts)

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
- The methods below will:
- Prevent damage to the instrument (electronics, columns, etc.)

To put the GC in a general standby state suitable for most maintenance, use the touchscreen: **Maintenance > Instrument > Perform Maintenance > Maintenance Standby Mode > Start Maintenance.**

For procedures available through the touch screen, the Intuvo 9000 GC provides built-in settings to prepare for maintenance. 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, then turn off the GC and unplug the power cord.

Safety Information

Before performing a maintenance task, read the important safety and regulatory information found in the [9000 Series Safety](#) manual.

Consumables and Parts for General GC Maintenance

Table 2 lists consumable parts for general GC maintenance.

Table 2 Consumables and parts for general GC maintenance

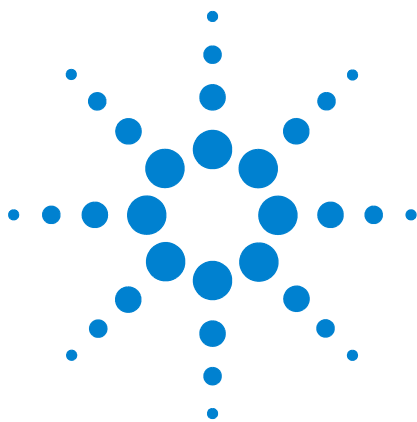
Description	Part number
Fittings and hardware	
Fittings kit, 1/8-in. brass, 20/pk	5080-8750
Plug, 1/8-in. brass 6/pk	5180-4124
Tee, 1/8-in. brass 2/pk	5180-4160
Union, 1/8-in. brass 2/pk	5180-4127
Cross, union 1/8-in. brass	0100-0161
GC Supply Gas Installation Kit with Gas Purifiers	19199N
Installation kit for GCs without gas purifiers	19199M
PTFE tape	0460-1266
Copper tubing, 1/8-in. 12 ft.	5021-7107
Copper tubing, 1/8-in. od, 50 ft	5180-4196
Gas regulators	
Regulator, 2-stage, brass body, stainless steel diaphragms, 125 psi max, CGA350, hydrogen, argon/methane, with 1/8-in. fitting. For 1/4-in. tubing purchase a 1/4-in. adapter.	5183-4642
Regulator, 2-stage, brass body, stainless steel diaphragms, 125 psi max, CGA346, air, with 1/8-in. fitting. For 1/4-in. tubing purchase a 1/4-in. adapter.	5183-4641
Regulator, 2-stage, brass body, stainless steel diaphragms, 125 psi max, CGA590, industrial air, with 1/8-in. fitting. For 1/4-in. tubing purchase a 1/4-in. adapter.	5183-4645
Regulator, 2-stage, brass body, stainless steel diaphragms, 125 psi max, CGA580, helium, argon, nitrogen, 1/8-in. fitting. For 1/4-in. tubing purchase a 1/4-in. adapter.	5183-4644
Regulator, 2-stage, brass body, stainless steel diaphragms, 125 psi max, CGA540, oxygen, 1/8-in. fitting. For 1/4-in. tubing purchase a 1/4-in. adapter.	5183-4643
Gas Clean Filters	
Gas Clean connecting unit, 1-position), 1/4-in.	CP7980
Gas Clean connecting unit, 1-position), 1/8-in.	CP7988
Gas Clean connecting unit, 2-position), 1/4-in.	CP738406
Gas Clean connecting unit, 2-position), 1/8-in.	CP738407
Connect unit, Gas Clean, 4 filter, 1/4-in., 1/pk	CP7989
Gas Clean connecting unit, 4-position), 1/8-in. fittings	CP736520
Gas Clean high-flow connecting unit, 2-position), with 1/4-in. fittings, for high-flow applications such as ICP-MS or ICP-OES	CP17984
High flow connecting unit 1/8-in.	CP17985
Gas Clean filter GC-MS, 1/pk	CP17973

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

Description	Part number
Gas Clean Filters	
Intuvo Gas Clean filter kit	CP17995
Guard and Jumper Chips	
Intuvo Split/splitless inlet Guard Chip	G4587-60565
Intuvo Split/splitless inlet Jumper Chip	G4587-60575
Intuvo Multimode inlet Guard Chip	G4587-60665
Intuvo Multimode inlet Jumper Chip	G4587-60675
Detector Tails	
Intuvo FID-TCD Tail	G4583-60331
Intuvo ECD Tail	G4583-60333
Intuvo NPD Tail	G4583-60334
Intuvo FPD Tail	G4583-60335
Intuvo XCD Tail	G4583-60336
Detector Chip	
Intuvo Inlet Chip	G4581-60031
Intuvo D1 Chip	G4581-60032
Intuvo D2 Chip	G4581-60621
Intuvo D2-MS Chip	G4581-60033
Intuvo D1 Post Column Backflush Chip	G4588-60032
Intuvo D2-MS Post Column Backflush Chip	G4588-60322
Intuvo D1-D2 Splitter Chip, 1:1	G4588-60402
Intuvo D1-MS Splitter Chip, 1:1	G4588-60502
Intuvo D1-MS Splitter Chip, 1:1	G4588-60522
Intuvo Inlet Splitter Chip	G4588-60601
Intuvo mid-column Backflush to D1 Chip	G4588-60701
Intuvo mid-column Backflush to D2 Chip	G4588-60721

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.

1 About Maintaining the GC



Maintaining Columns and Bus Components

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This chapter describes how to remove and install Intuvo columns, chips, gaskets, and detector tails.



Consumables and Replacement Parts

Table 3 below lists the Intuvo 9000 replacement parts for Guard Chips, Jumper Chips, inlet chip, and related parts.

Table 3 Intuvo 9000 replacement parts

Description	Part number
Guard and Jumper Chips	
Split/Splitless Intuvo guard chip (2/pk)	G4587-60565
Split/Splitless Intuvo jumper chip (2/pk)	G4587-60575
Multimode Inlet Intuvo guard chip (2/pk)	G4587-60665
Multimode Inlet Intuvo jumper chip (2/pk)	G4587-60675
Inlet chips	
Intuvo Inlet Chip	G4581-60031
Intuvo Inlet Splitter Chip	G4588-60601
Gaskets	
Intuvo gasket, polyimide, for temperatures <= 350 °C (5/pk)	5190-9072
Intuvo gasket, nickel, for temperatures < 450 °C (2/pk)	5190-9073
Intuvo gasket, polyimide, plug (2/pk)	5190-9074
Detector tails	
Intuvo Swaged MS Tail	G4590-60009
Intuvo Swaged HES MS Tail	G4590-60109
Intuvo FID-TCD Tail	G4583-60331
Intuvo ECD Tail	G4583-60333
Intuvo NPD Tail	G4583-60334
Intuvo FPD Tail	G4583-60335
Tools and hardware	
Intuvo torque driver kit (includes extension and pre-set driver below)	5190-9571
Torque driver extension	G4581-20522
Screw-driver torque, pre-set, adjustable	8710-2790
Detector tail compression bolt	G4583-20005

Table 3 Intuvo 9000 replacement parts

Description	Part number
Intuvo compression bolt	G4581-60260
Guard Chip compression bolt	G4581-20006
S/SL compression bolt	G4582-20085
MMI compression bolt	G4586-20027

For column part numbers, visit the Agilent Web site for the latest information (<http://www.agilent.com>), or see the Agilent catalog for consumables and supplies.

Table 4 below lists part numbers for detector chips. If changing from one chip type to another (for example, to add backflush capability), you will need to order the accessory kit.

Table 4 Intuvo detector chips

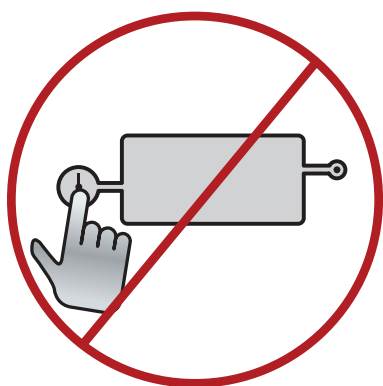
Description	Replacement part number	Accessory kit part number
Intuvo D1 Chip	G4581-60032	
Intuvo D2-MS Chip	G4581-60033	contact Agilent
Intuvo D2 Chip	G4583-60621	contact Agilent
Intuvo Mid Column Backflush to D1 Chip	G4588-60701	G7322A
Intuvo Mid Column Backflush to D2 Chip	G4588-60721	G7323A
Intuvo D1 Post Column Backflush Chip	G4588-60302	G7324A
Intuvo Inlet Splitter Chip	G4588-60601	G7326A

Handling Column and Bus Components

The Intuvo 9000 GC does not use traditional ferrules and nuts for most column and flow path seals. In a traditional gas chromatography connection, the seal is made by deforming a soft ferrule around the periphery of a column or tube, with a second seal made between the ferrule and the fitting. Instead, the Intuvo 9000 GC click and run connections use a sealing system based on contact between flat surfaces. Compared to traditional ferrule seals, these connections are leak-free and easy to make.

When making these seals, follow a few simple guidelines:

- 1 Do not touch the click and run sealing surfaces with bare skin or dirty gloves. Skin oils and dirt can contaminate the surfaces



- 2 Use only the provided Intuvo 9000 GC torque driver to tighten Intuvo compression bolts.
- 3 Avoid scratching or deforming click and run sealing surfaces.
- 4 If you need to clean a sealing surface, use clean, compressed air.
- 5 Use a new gasket each time you install a column or Intuvo chip.

Replace an Intuvo 9000 GC Nickel or Polyimide Gasket

Use Intuvo gaskets when replacing a column, detector chips, and inlet chips.

Use polyimide gaskets for applications with temperatures ≤ 350 °C. For higher temperature applications, use nickel gaskets.

The gasket sits between the Intuvo 9000 GC inlet or detector chip and the GC column or other component.

WARNING

The inlet, detector, bus components, and column can be hot enough to cause burns. Cool heated zones to a safe handling temperature before continuing.

- 1 This procedure assumes you have already removed the column or other item that sits on the gasket. If not, remove it now:
 - a Use the Intuvo 9000 GC torque driver to remove the compression bolts from the fitting.
 - b Remove the column or other component that is on top of the gasket in the fitting.
- 2 Use tweezers to lift the gasket from the click and run fitting.
- 3 If needed, install any inlet or detector chips. All chips must be installed before installing the new gasket.
- 4 Carefully remove the new gasket from its packaging. Inspect the gasket to be sure it is not deformed. The two round lobes are the sealing surfaces.
- 5 Carefully insert the round gasket lobes into the click and run fitting. (Note that the gasket is double-sided.)
- 6 Locate the hole in the gasket, align it over the pin in the bus fitting, and press the gasket body flat against the bus so the pin fits through the alignment hole.
- 7 Check that the gasket's round lobes fit flat against the chip's click and run fitting.

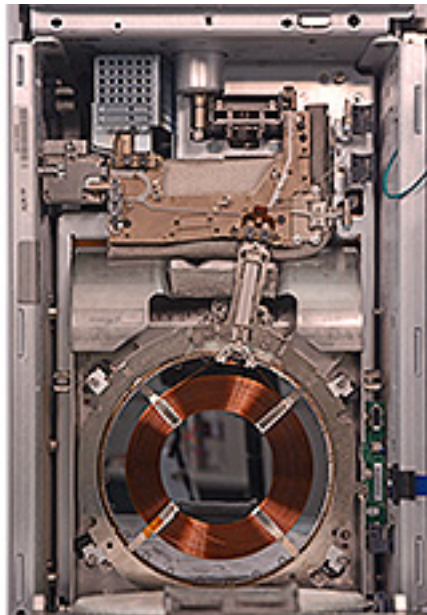
The gasket is ready for use.

Replace a Column

WARNING

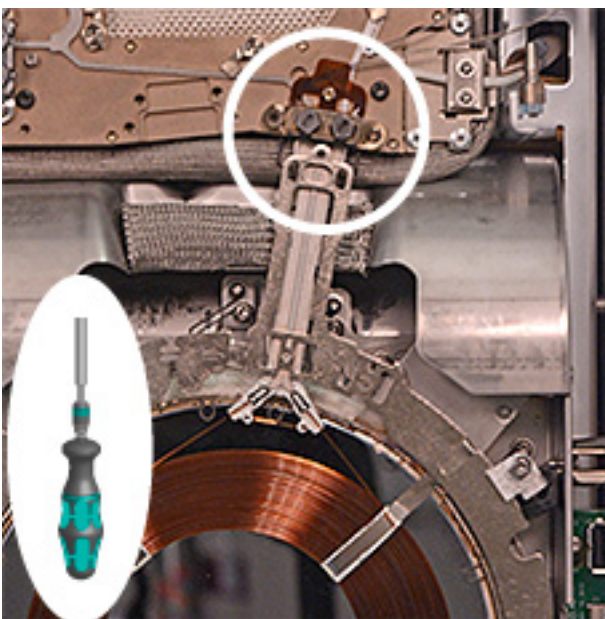
The inlet, detector, bus components, and column can be hot enough to cause burns. Cool heated zones to a safe handling temperature before continuing.

- 1 Launch the GC maintenance wizard: **Maintenance > Columns > Perform Maintenance > Install Column > Start Maintenance**. The wizard will walk through the replacement procedure. These steps are repeated below.
- 2 Open the column oven.

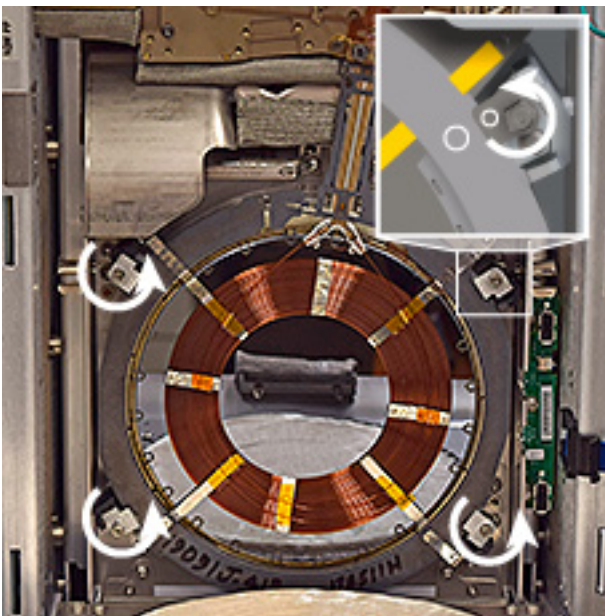


- a Open the GC front door.
- b Remove the bus door.
- c Lower the oven door.

3 Remove the two compression bolts and store for later use.



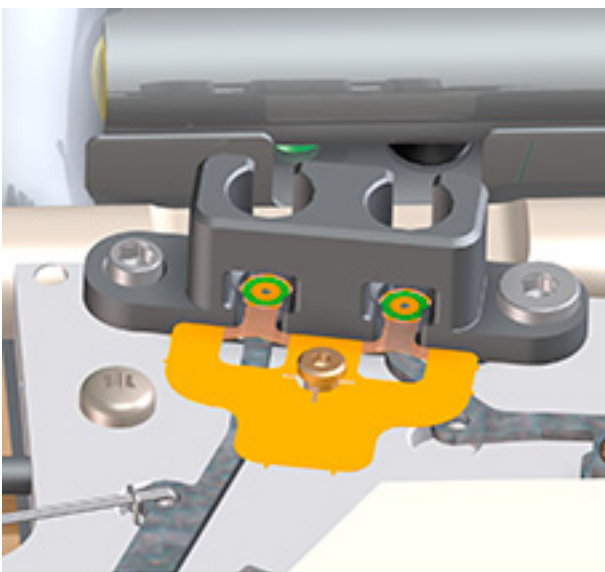
4 Open the column clamps and remove the column.



- a Use the torque driver to open the four column clamps.
- b Unplug the column Smart ID Key tag.
- c Remove the column.

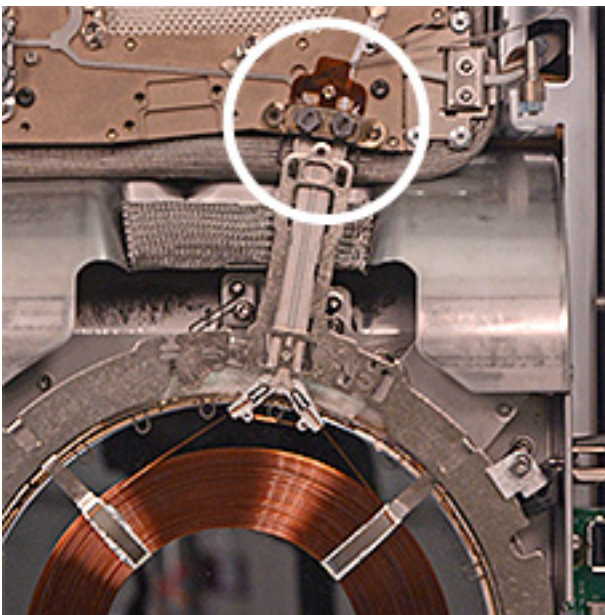
2 Maintaining Columns and Bus Components

5 Replace the gasket.



- a Remove the old gasket using tweezers.
- b Install a new gasket.

6 Place the column.

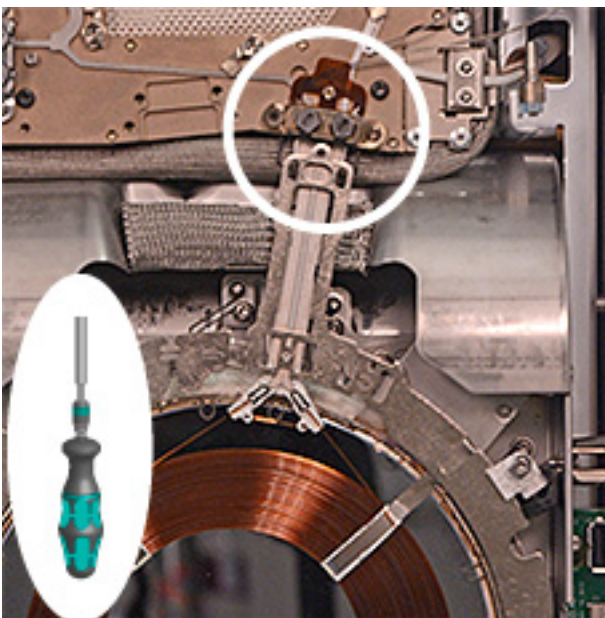


- a Place the column on the bottom clamps.

CAUTION

Hold the column assembly only by the outer ring—do not press or pull on the column itself.

- b Tilt the column up so the click and run connectors mate into the bus fitting.
 - c Loosely install the compression bolts.
- 7 Check column placement and tighten the compression bolts.



- a The click and run connectors should sit flat against the gasket.
 - b Tighten the compression bolts until you hear one click.
- 8 Secure the column.
- a Close the column clamps.
 - b Slide the column's Intuvo Smart ID Key out of its slot in the column support ring and insert it into the lower USB connection along the right side of the oven.
 - c Install the bus door.

Store unused columns in accordance with the column manufacturer's recommendations.

Replace a Column – Two Column GCs

Replacing columns in a two-column GC is similar to replacing a column in a single-column GC, but requires some hardware changes. Also, you must always have both columns installed to run the GC.

- A second column requires a special bus configuration.
- The column support ring for the first, inner column needs to be modified so the second column can fit over the first column.
- The GC uses different column clamps.

If your application requires two columns, contact Agilent to have your GC modified to accept a second column.

To replace two columns, gather the following materials:

- Columns
- New gaskets

WARNING

The inlet, detector, bus components, and column can be hot enough to cause burns. Cool heated zones to a safe handling temperature before continuing.

- 1 Launch the GC maintenance wizard: **Maintenance > Columns > Perform Maintenance > Install Column > Start Maintenance**. The wizard will walk through the replacement procedure. These steps are repeated below.
- 2 Open the GC front door.
- 3 Open the bus door. Remove if desired.

4 Open the oven door.

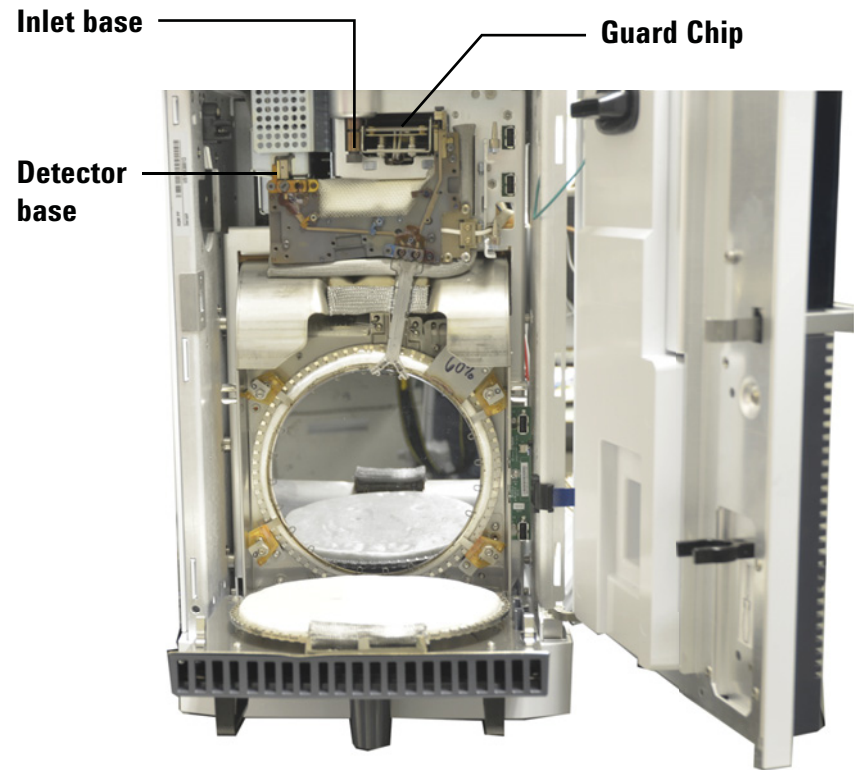
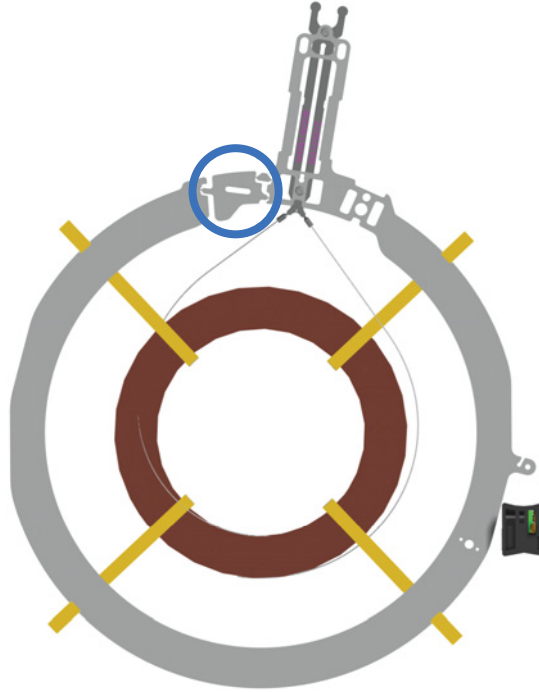


Figure 1 Inside of GC after opening the bus door and column compartment

- 5 If any columns are already installed, remove them. See [“Replace a Column”](#).
- 6 If present, remove any column compression bolts from the bus’s column click and run connections.
- 7 Use the Intuvo 9000 GC torque driver to open the four column clamps. (Rotate each to “Open.”)
- 8 Install a new gasket for each column. See [“Replace an Intuvo 9000 GC Nickel or Polyimide Gasket”](#).

2 Maintaining Columns and Bus Components

- 9 If present, remove the column frame knock-out from the first (inner) column by twisting it back and forth until it breaks loose.



- 10 Slide the first column's Intuvo Smart ID Key out of its slot in the column support ring and insert it into the **lower** USB connection along the right side of the oven.

CAUTION

Hold the column assembly only by the outer ring—do not press or pull on the column itself.

- 11 Insert the bottom of the column support ring into the bottom column clamps, then carefully tilt the column up and seat the click and run connectors into the right-hand side column fitting on the bus.
- 12 Verify that its two click and run connectors are fully seated in the bus fittings.
- 13 Slide the second column's Intuvo Smart ID Key out of its slot in the column support ring and insert it into the **upper** USB connection along the right side of the oven.

CAUTION

Hold the column assembly only by the outer ring—do not press or pull on the column itself.

- 14 Insert the bottom of the column support ring into the bottom column clamps, then carefully tilt the column up and seat the click and run connectors into the left-hand side column fitting on the bus.
- 15 Verify that its click and run connectors are fully seated in the bus fittings.
- 16 Use the torque driver to close the four column clamps.

CAUTION

When installing the column, use only the provided torque driver to tighten the fittings.

- 17 While holding each column's click and run connectors in place, install the four compression bolts in the click and run fittings and tighten each using the torque driver until you hear one click.
- 18 Close the oven door.
- 19 Replace, then close the bus door.
- 20 Close the GC front door.
- 21 If you performed this procedure using the GC's maintenance feature, then the GC will perform checks at the appropriate times, and will automatically reset the maintenance counters.
- 22 If you did not use the GC maintenance wizard, use the GC touch screen to perform any necessary checks and to reset the maintenance counters.

Replace the Intuvo Guard Chip

The Intuvo Guard Chip is a single-use, consumable part. Installation deforms part of the Guard Chip to make a good seal, so that a mis-installed Guard Chip cannot be re-used. The Intuvo Guard Chip cannot be cleaned or conditioned. Agilent recommends replacing the liner and O-ring after you replace the guard chip.

To replace a Guard Chip, do the following:

- 1 Gather the following materials:
 - Intuvo Guard Chip
 - 7/16-inch open-end wrench
 - Lint-free gloves

WARNING

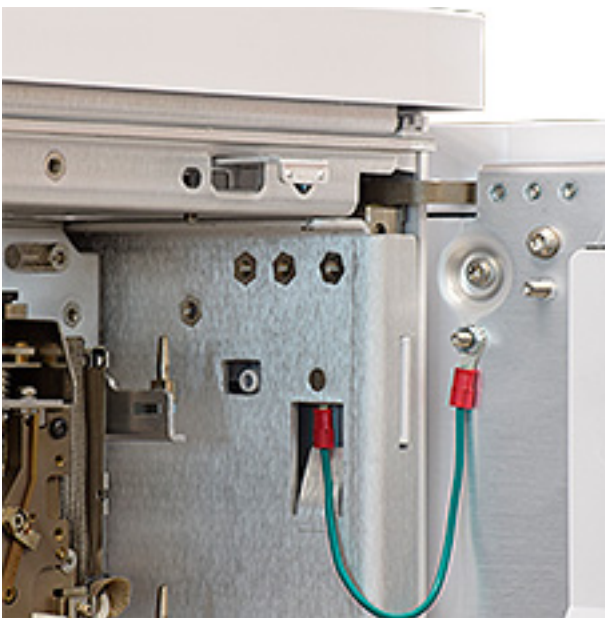
The inlet, detector, bus, and oven can be hot enough to cause burns. Cool heated zones to a safe handling temperature before continuing. If needed wear heat-resistant gloves.

- 2 Launch the GC maintenance wizard: **Maintenance > Inlets > Prepare for Maintenance > Replace Liner and Guard Chip > Start Maintenance**. The wizard will walk through the replacement procedure. These steps are repeated below.
- 3 If present, remove the ALS injector and set aside.



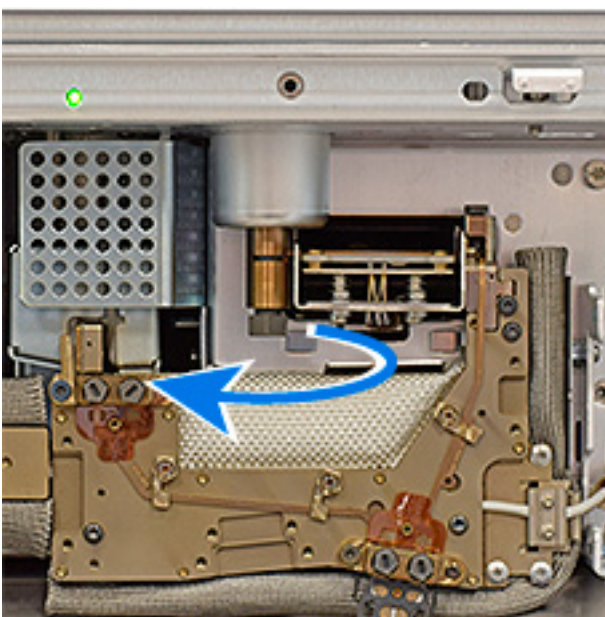
- 4 Remove the inlet cover.

- 5 Open the GC front door.
- 6 Remove the bus door.
- 7 Slide the guard chip cover out to expose the guard chip compression bolt.



- 8 Split-splitless inlet: Use a 7/16-inch open-end wrench to loosen the sealing screw at the base of the inlet.

Multimode inlet: Use a 5/15-inch wrench on the inlet base and a 1/4-inch wrench to loosen the sealing screw at the base of the inlet.



- 9 Using the Intuvo torque driver, loosen the Guard Chip compression bolt. See the simplified diagram below (Figure 2).

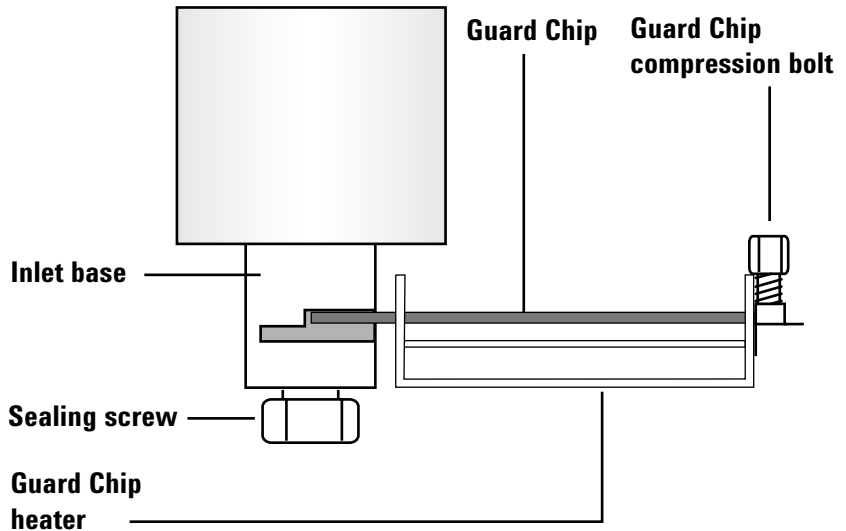


Figure 2 Simplified diagram showing Guard Chip mounting location and orientation (not to scale)

- 10 Remove the Intuvo Guard Chip.
- a Use your finger to gently depress the front of the Guard Chip heater assembly and expose the Guard Chip.
 - b Lift the right side of the Guard Chip then pull the right side out of the GC.
 - c Remove the left side of the Guard Chip from the inlet base.

- 11 Install a new Intuvo Guard Chip. The larger end of the Guard Chip inserts into the inlet base, while the smaller end inserts into the GC flow path.

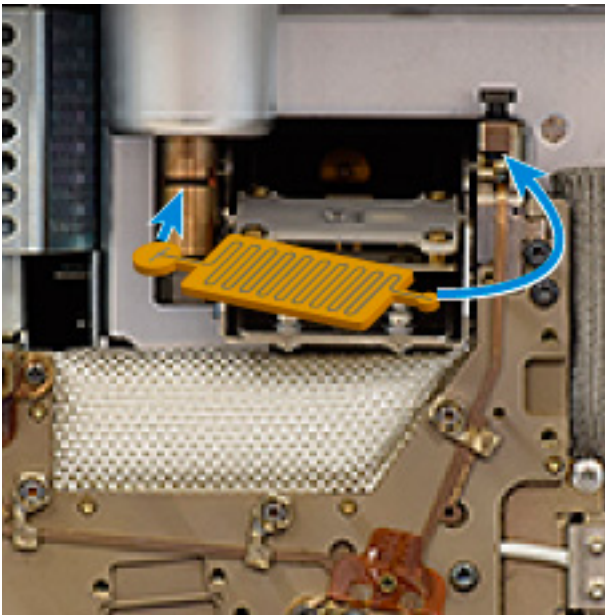
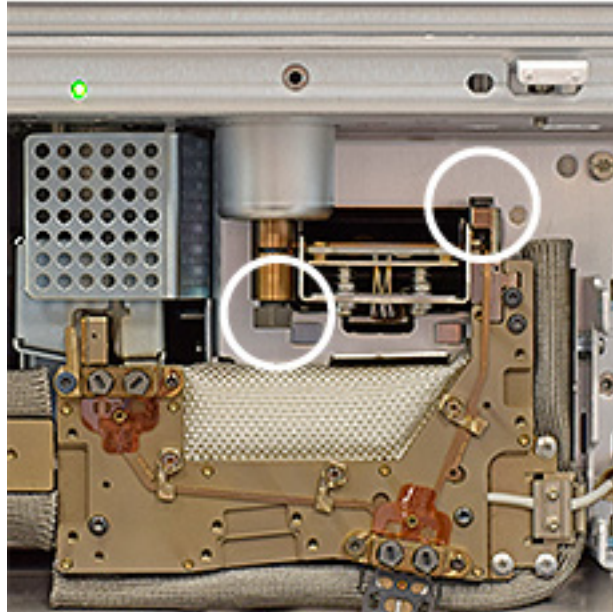


Figure 3 Guard Chip orientation

- a Place the Intuvo Guard Chip left end into the inlet base. For an MMI guard chip, avoid touching the upright tube against the sides of the opening.
- b Rotate the body of the Intuvo Guard Chip into the GC, lifting the Intuvo Guard Chip right end over the boss and into the pocket.
- c Finger-tighten the compression bolt until you feel slight contact on the guard chip.
- d Raise the guard chip heater.
- e Finger-tighten the inlet sealing screw.

2 Maintaining Columns and Bus Components

12 Tighten the inlet sealing screw. **For MMI, use two wrenches.**



13 Tighten the compression bolt using the torque driver until you hear one click.

14 At this point, Agilent strongly recommends replacing the liner and liner O-ring.

15 Install the bus door.

16 Install the inlet cover.

17 Close the GC front door.

18 Reinstall the ALS injector.

Replacing an Intuvo Inlet Chip

Figure 4 shows the Intuvo major bus components.

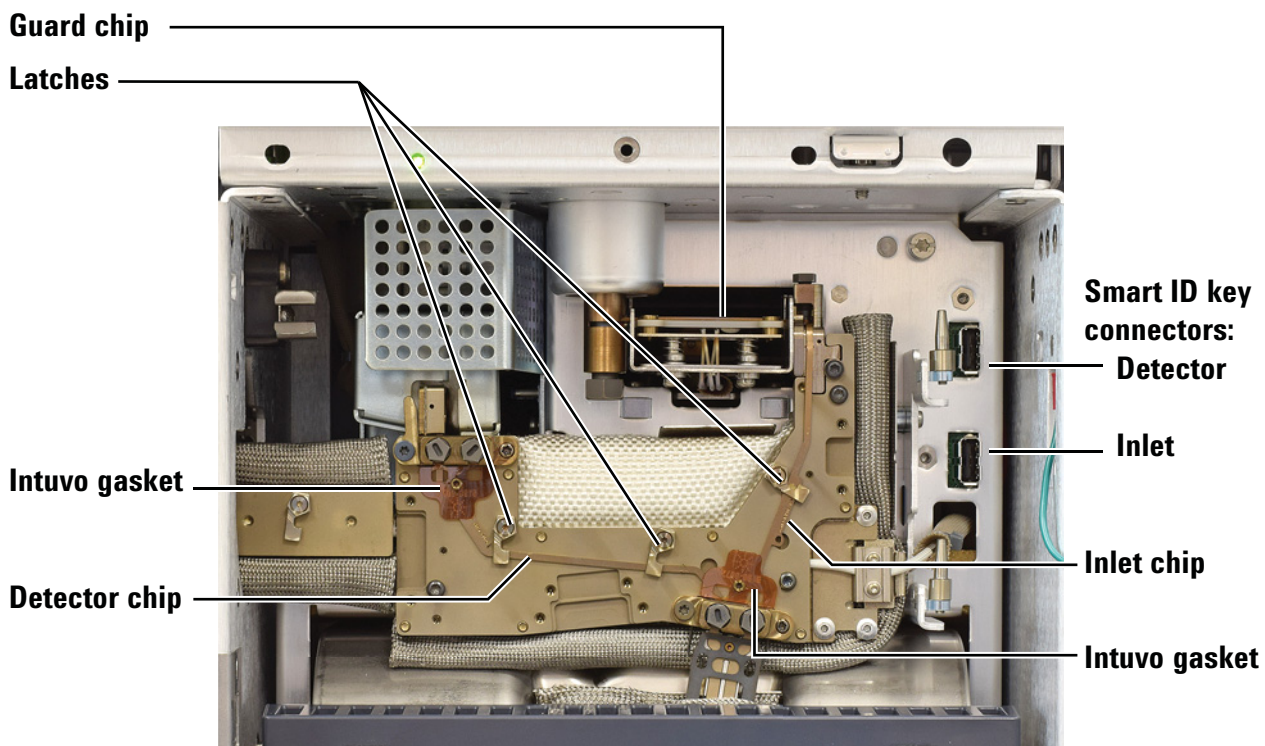


Figure 4 Intuvo bus components

The inlet and detector bus parts (see [Figure 4](#)) must be installed first, before installing a column or detector tail.

1 Gather the following materials:

- Intuvo inlet chip
- 7/16-inch open-end wrench
- Intuvo torque driver

WARNING

The inlet, detector, bus, and oven can be hot enough to cause burns. Cool heated zones to a safe handling temperature before continuing. If needed wear heat-resistant gloves.

- 2** Launch the GC maintenance wizard: **Maintenance > Inlet > Perform Maintenance > Replace Guard Chip > Start Maintenance**. The wizard will walk through the replacement procedure. These steps are repeated below.

- 3 Remove the guard chip. See [“Replace the Intuvo Guard Chip”](#) on page 28.
- 4 Remove the column and the column gasket. See [“Replace a Column”](#) on page 20.
- 5 Remove the inlet cover.
- 6 Slide open the guard chip cover.
- 7 Loosen the guard chip compression bolt.
- 8 Use the torque driver to open the clips that secure the inlet chip to the bus.
- 9 Carefully lift the inlet chip from the bus, and disconnect its Smart ID tag from the GC.
- 10 Orient the new inlet chip so the end with the 90 degree bend is on top, then install the bent end into the pocket at the top right of the bus. This end of the inlet chip fits into a blind hole above the guard chip.
- 11 Place the other end of the inlet chip into the right side of the column click and run fitting. Rotate the clips to hold the inlet chip in place.
- 12 Insert the inlet chip Smart ID tag into the lower socket to the right of the bus.
- 13 Install a new gasket for the column.
- 14 Install a new guard chip.
- 15 Install the column.

Replacing an Intuvo Detector Chip

Figure 5 shows the Intuvo major bus components.

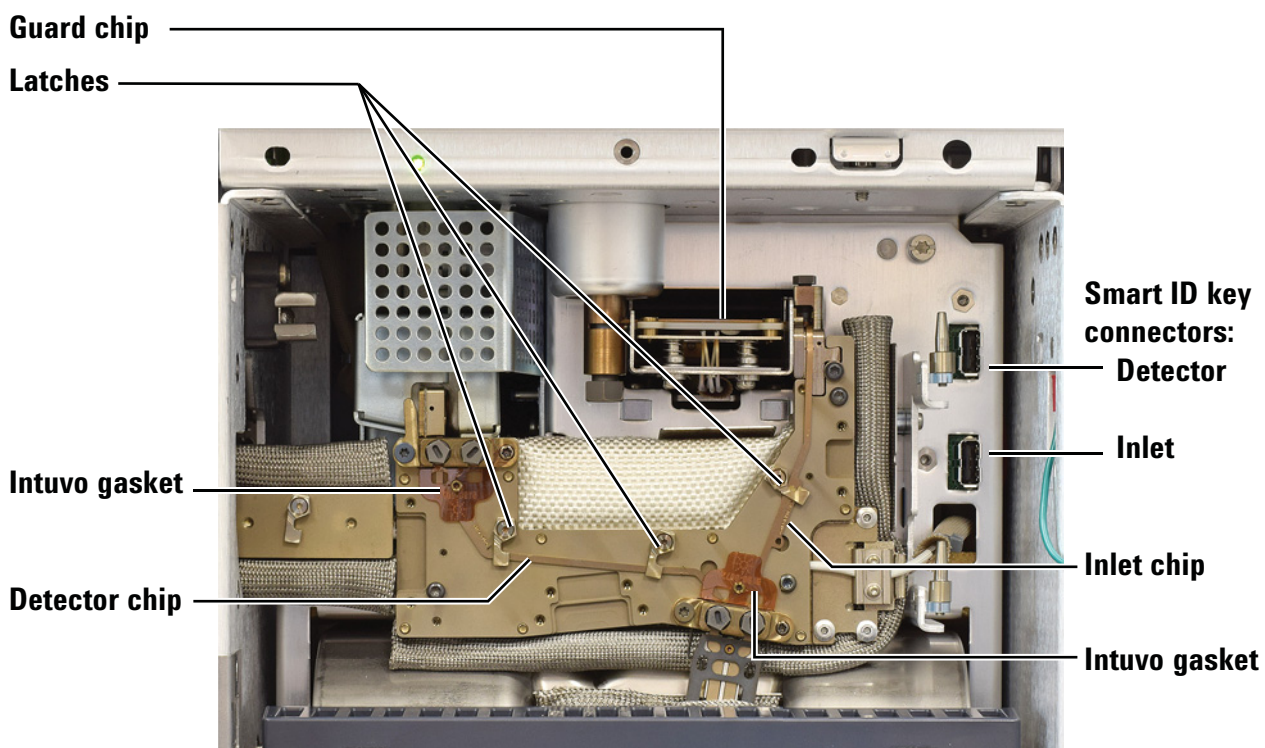


Figure 5 Intuvo bus components

This procedure assumes that a detector is already installed and the detector tail is in place. This procedure describes detector chip replacement. To change the *type* of detector chip installed, contact Agilent to order the appropriate accessory kit.

CAUTION

The detector module must be installed into the instrument so that gases attach to its electronic pneumatic control (EPC) module and the rotational thumb screw is loosened to allow the detector module to rotate up and out of the instrument.

1 Gather the following materials:

- Intuvo detector chip
- 7/16-inch open-end wrench
- Intuvo torque driver

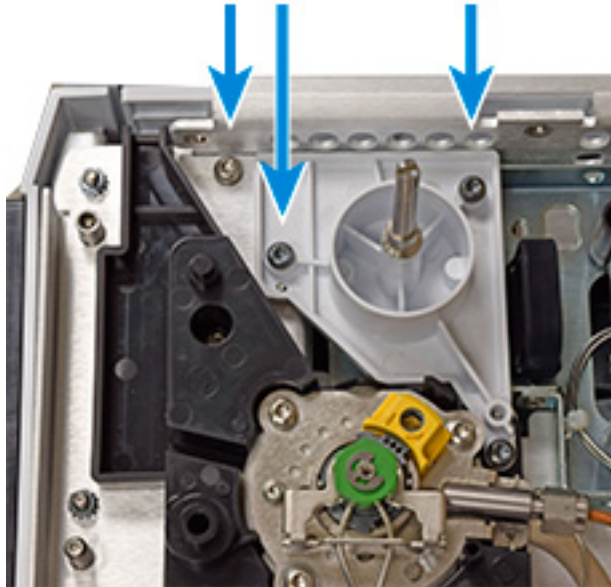
WARNING

The inlet, detector, bus, and oven can be hot enough to cause burns. Cool heated zones to a safe handling temperature before continuing. If needed wear heat-resistant gloves.

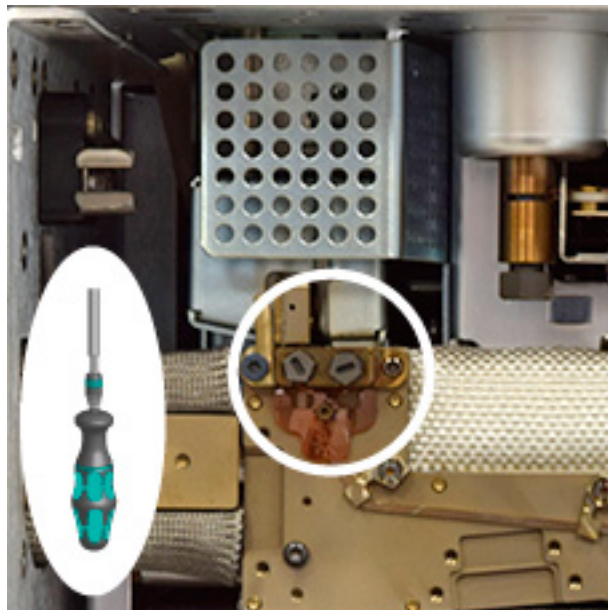
- 2 Prepare the GC for maintenance. **Maintenance > Bus > Perform Maintenance > Replace Chips > Start Maintenance.** (Cool all heated zones to < 40 °C. After everything cools, turn off detector gas flows and set a low column purge flow. If using a flammable carrier gas, instead turn it off.)
- 3 Remove the column and the column gasket. See “[Replace a Column](#)” on page 20.
- 4 Remove the top cover, inlet cover, detector cover, and split vent trap cover. Remove the top cover screws in the order shown.



5 Remove the ALS support bracket.

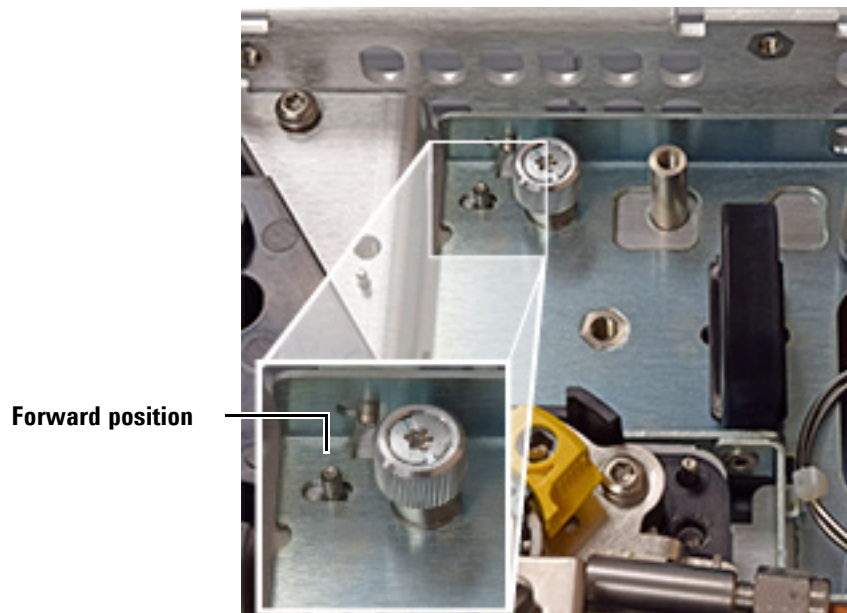


6 Remove the compression bolts in the bus detector fitting.

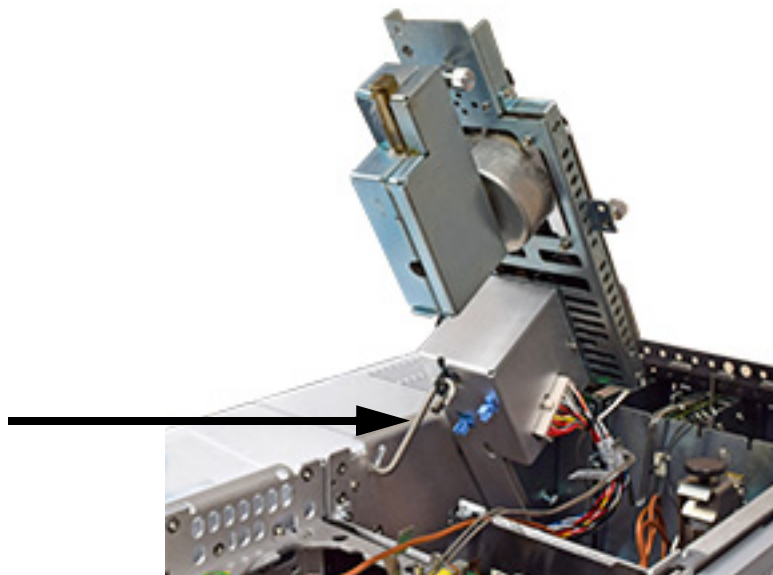


2 Maintaining Columns and Bus Components

- 7 Using the black handle, slide the detector module forward until it stops (about 3 mm).

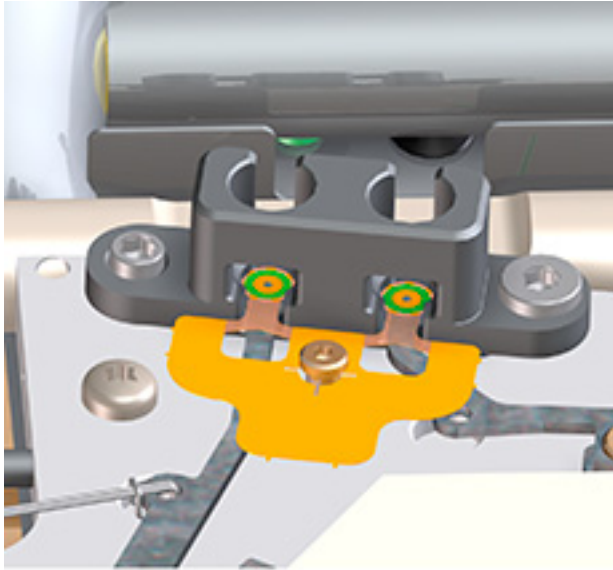


- 8 Raise the detector module and secure in place using the S-hook.



- 9 If the detector chip connects to other devices, remove or disconnect them as applicable so that the detector chip can be removed from all click and run fittings.

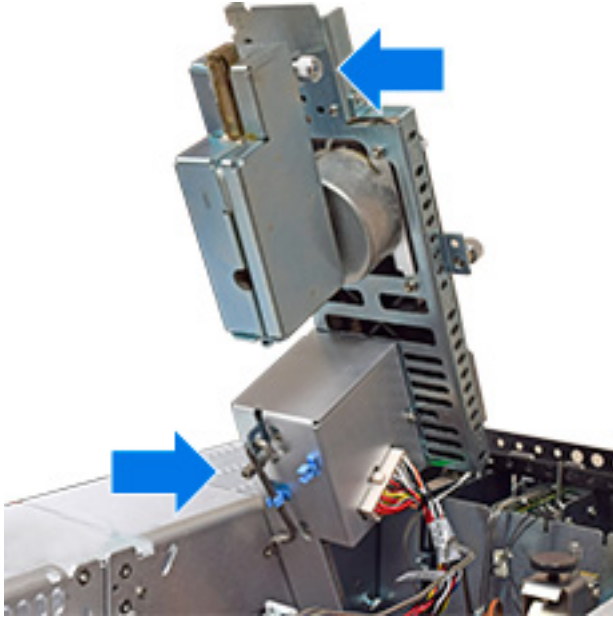
- 10 Remove the old gaskets using tweezers.



- 11 Use a Torx driver to open the clips that hold the detector chip to the bus. See [Figure 5](#).
- 12 Remove the detector chip from the bus and unplug its Smart ID key from the GC.
- 13 Install the new detector chip and its Smart ID key.
- 14 Install a new gasket in each click and run fitting (detector and column). Press the new gasket flat against the bus so the round sealing surfaces rest flat on the click and run connectors.

2 Maintaining Columns and Bus Components

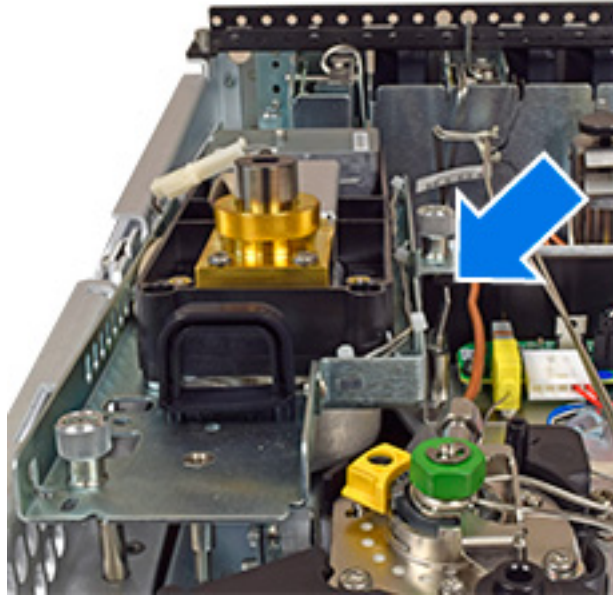
- 15 Reassemble the detector.
 - a Close and secure the tail housing.
 - b While holding the detector by its handle, unclip the S hook.
 - c Store the S hook in its clips.
 - d Gently lower the detector until it rests on the safety catch



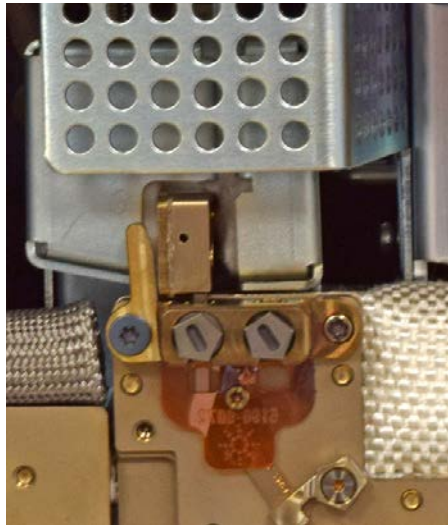
- 16 Release the safety catch and set the detector fully down.
 - a While holding the handle, press the clip and lower the detector. As you lower the detector, check that the detector tail click and run connection fits into the

detector bus fitting. If misaligned, lift the detector and retry.

- b Once the detector tail is correctly seated, slide the detector back until it stops (about 3 mm).



- 17 Install the detector compression bolts. Tighten until you hear one click.



- 18 Reinstall the column.
- 19 Reinstall the bus door.
- 20 Close the GC front door.
- 21 Reinstall the ALS support bracket.

2 Maintaining Columns and Bus Components

- 22 Reinstall the GC covers. When installing the GC top cover, start with the front two screws.
- 23 If you performed this procedure using the GC's maintenance feature, then the GC will perform checks at the appropriate times, and will automatically reset the maintenance counters.

If you did not use the GC maintenance wizard, use the GC touch screen to perform any necessary checks and to reset the maintenance counters.

Replace a Detector Tail

- 1 Gather the following materials:
 - New detector tail
 - Intuvo torque wrench
 - T20 Torx driver
- 2 New gasket (polyimide 5190-9072, or nickel 5190-9073 for temperatures > 350 °C)
- 3 Launch the GC maintenance wizard (Figure 6) and follow the prompts. The wizard will walk through the steps needed to replace the detector tail. These steps are provided below for reference.

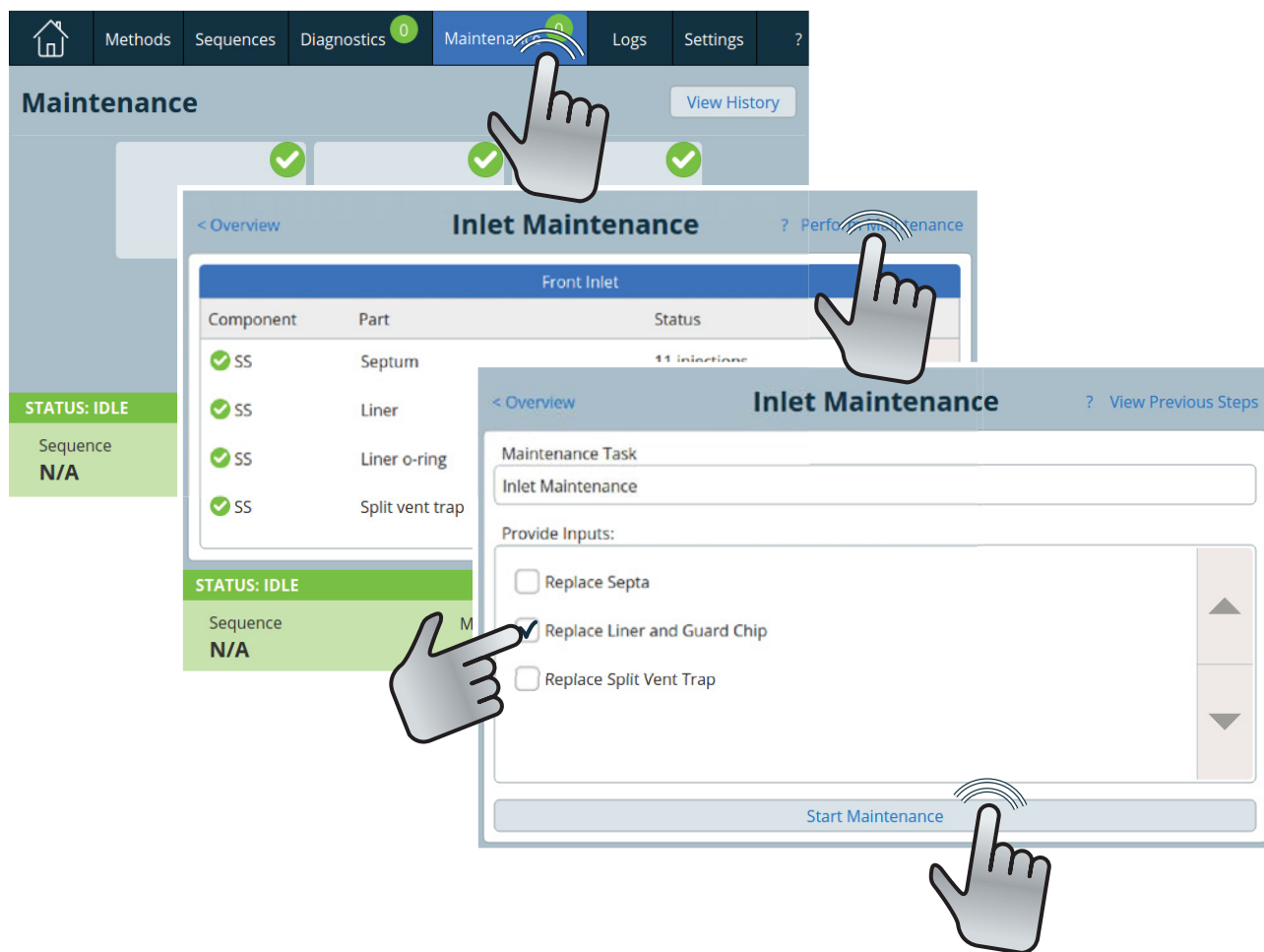


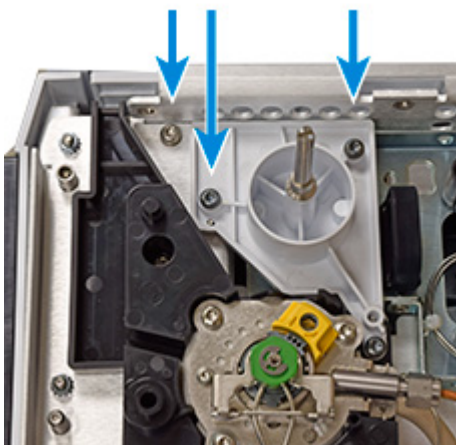
Figure 6 Example of launching a maintenance wizard

2 Maintaining Columns and Bus Components

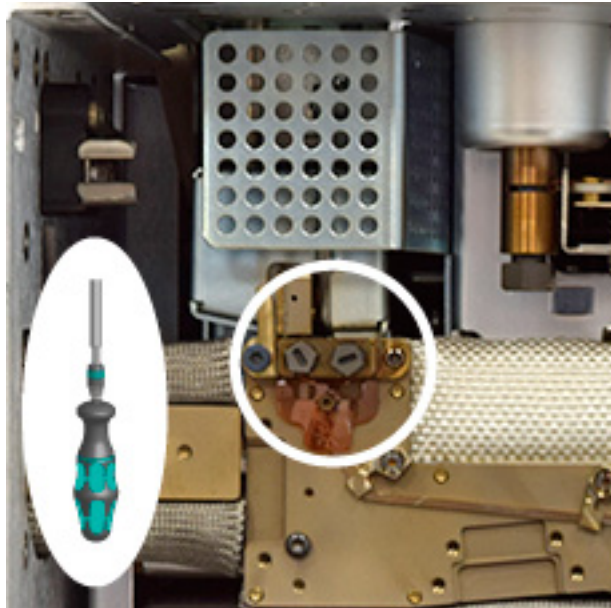
- 4 Cool all heated zones to $< 40\text{ }^{\circ}\text{C}$. After everything cools, turn off detector gas flows and set a low column purge flow. If using a flammable carrier gas, instead turn it off.
- 5 Remove the top cover, inlet cover, detector cover, and split vent trap cover. Remove the top cover screws in the order shown.



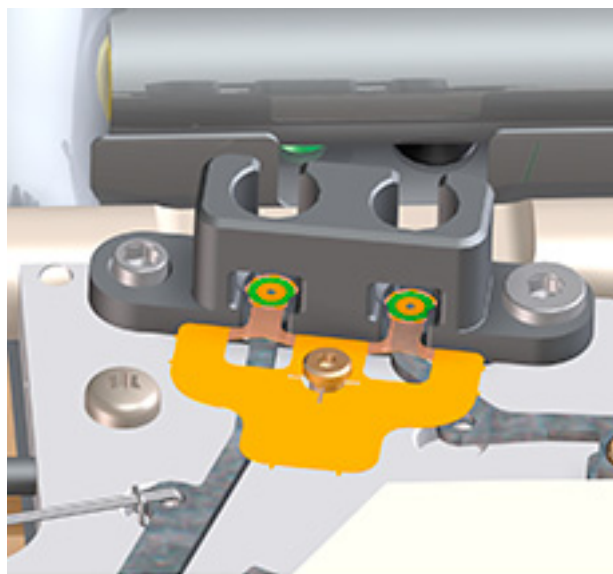
- 6 Remove the ALS support bracket.



- 7 Remove the compression bolts in the bus detector fitting.
 - a Open the GC front door.
 - b Open the bus door 90 °, then lift and remove.
 - c Remove the two compression bolts.

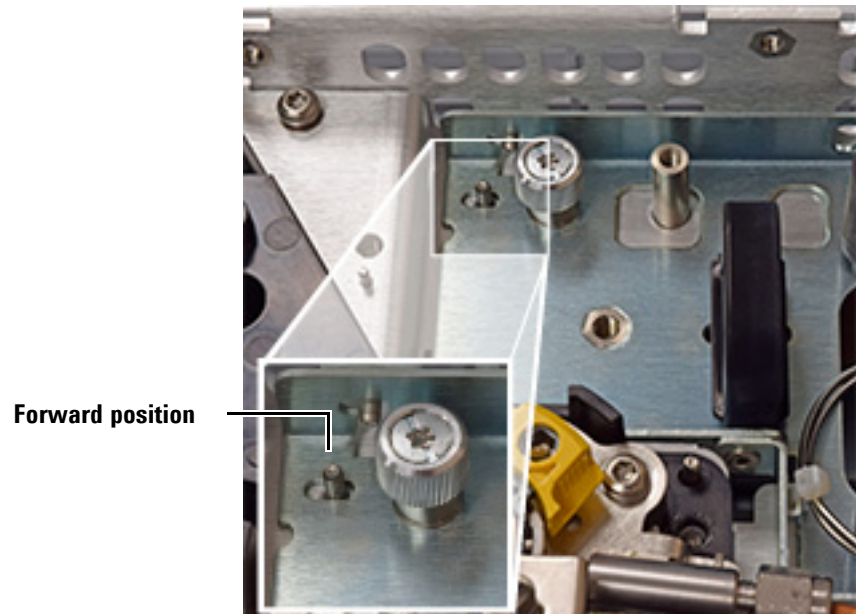


- 8 Replace the gasket.
 - a Remove the old gasket using tweezers.
 - b Press the new gasket flat against the bus so the round sealing surfaces rest flat on the detector bus click and run connectors.

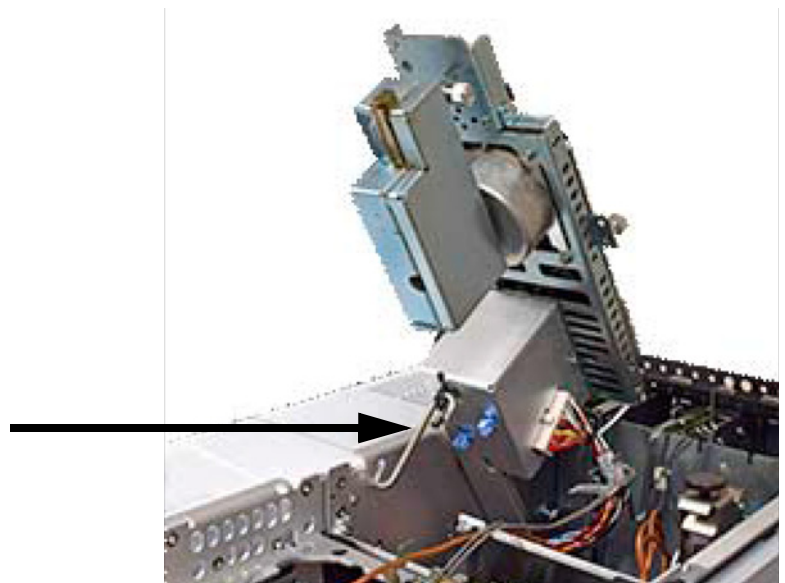


2 Maintaining Columns and Bus Components

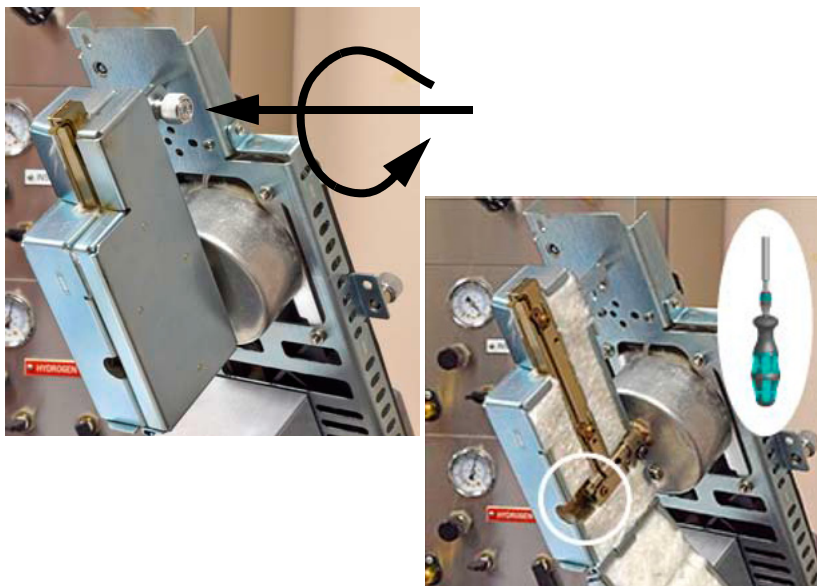
- 9 Using the black handle, slide the detector module forward until it stops (about 3 mm).



- 10 Raise the detector module and secure in place using the S-hook.



- 11 Open the detector tail housing and remove the compression bolt.

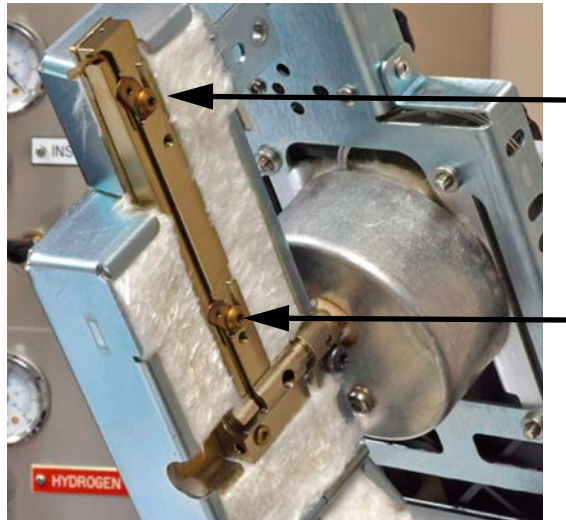


- 12 Free the ferrule from the fitting. Use a T20 Torx driver to press against the ferrule through the open hole shown. This may require some force.

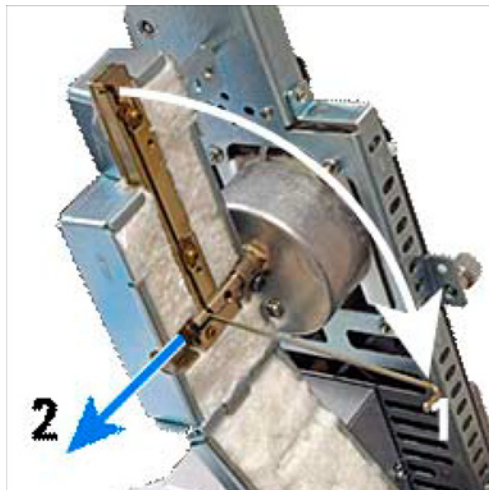


2 Maintaining Columns and Bus Components

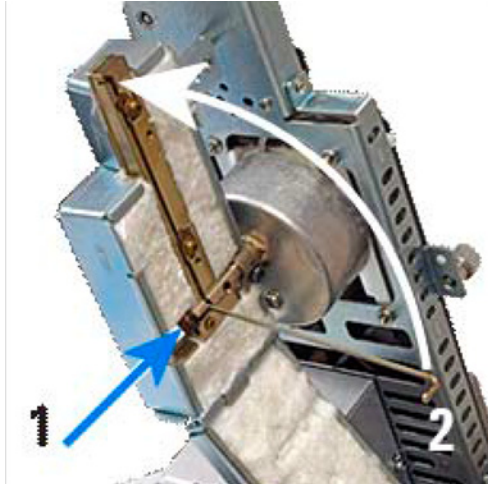
13 Open the clips that hold the tail in the housing.



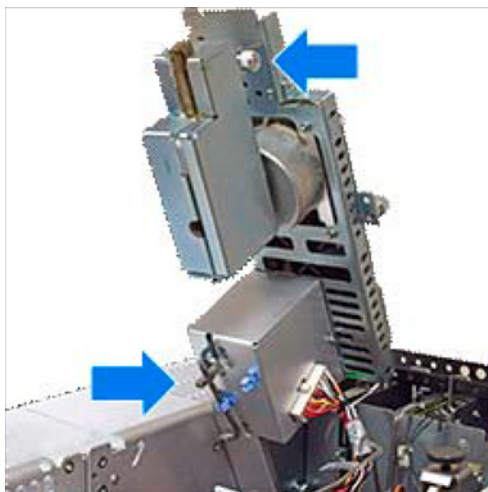
14 Remove the detector tail. Rotate the tail 90 degrees out of the housing. The tail should move freely. If you feel resistance, again use a T20 driver to side-load the ferrule. Rotating the detector tail if the ferrule sticks can damage the tail. When the tail is fully rotated, slide it out from the detector tail housing.



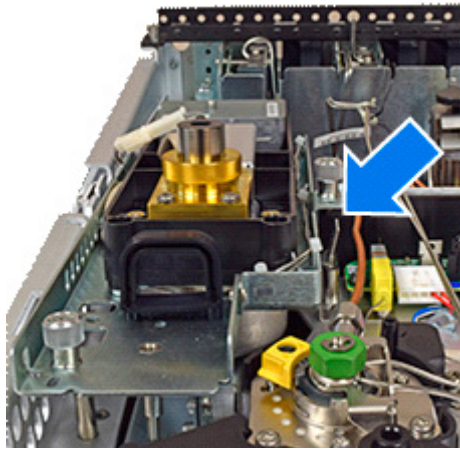
- 15** Install the new detector tail.
- a** Slide the detector tail into the detector tail housing, then rotate it up and into place.
 - b** Close the clips to hold it in place.
 - c** Install and tighten the compression bolt until you hear one click.



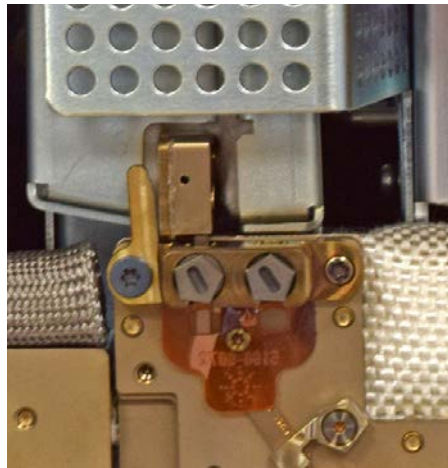
- 16** Reassemble the detector.
- a** Close and secure the tail housing.
 - b** While holding the detector by its handle, unclip the S hook.
 - c** Store the S hook in its clips.
 - d** Gently lower the detector until it rests on the safety catch



- 17 Release the safety catch and set the detector fully down.
 - a While holding the handle, press the clip and lower the detector. As you lower the detector, check that the detector tail click and run connection fits into the detector bus fitting. If misaligned, lift the detector and retry.
 - b Once the detector tail is correctly seated, slide the detector back until it stops (about 3 mm).



- 18 Install the compression bolts. Tighten until you hear one click.



- 19 Reinstall the bus door.
- 20 Close the GC front door.
- 21 Reinstall the ALS support bracket.
- 22 Reinstall the GC covers. When installing the GC top cover, start with the front two screws.
- 23 If you performed this procedure using the GC's maintenance feature, then the GC will perform checks at the appropriate

times, and will automatically reset the maintenance counters.

If you did not use the GC maintenance wizard, use the GC touch screen to perform any necessary checks and to reset the maintenance counters.

Replace an MS Transfer Line

When connected to a mass selective detector, the Intuvo GC uses a short transfer line to transfer the sample from the GC detector chip to the MS. Replace this transfer line as follows.

Removal:

- 1 Gather the following:
 - New MS transfer line
 - 1/4-inch open-end wrench
 - Intuvo torque driver
- 2 Prepare for maintenance. **Maintenance > Instrument > Perform Maintenance > Maintenance Standby Mode > Start Maintenance.** The GC will cool, and the MS will vent. Continue when the GC reports that it is ready.
- 3 Open the GC front door.
- 4 Remove the bus door.
- 5 Loosen the thumbscrew on the Intuvo D2/MS Chip tail clip.
- 6 Rotate the Intuvo D2/MS Chip tail clip out of the way.
- 7 Gently press the Intuvo D2/MS Chip tail heater block back into the GC until it clicks in place. A magnet will hold the heater block in position.
- 8 Use a 1/4-inch wrench to loosen the nut on the transfer line fitting.
- 9 Use the torque driver to remove the compression bolt that secures the transfer line in the click and run fitting.
- 10 Gently pull the MS transfer line click and run connector from the fitting.
- 11 Withdraw the transfer line from the Intuvo D2/MS Chip tail and MS.

Installation:

- 1 Install a new gasket onto the bus MS fitting.
- 2 The new transfer line ships with an UltiMetal ferrule and nut pre-swaged in place. Slide the new transfer line into the Intuvo D2/MS Chip tail and into the MS.
- 3 Insert the transfer line click and run connector into the bus fitting.
- 4 Tighten the transfer line nut finger-tight.

- 5 Check that the transfer line connector is flat against the gasket and fully seated in the fitting, then install the compression bolt finger-tight.
- 6 Use the Intuvo torque driver to tighten the compression bolt.
- 7 Use a 1/4-inch wrench to tighten the transfer line nut 20–30 degrees past finger-tight. **Do not overtighten.**
- 8 Slide the Intuvo D2/MS Chip tail heater block forward.
- 9 Rotate the Intuvo D2/MS Chip tail clip around the transfer line fitting. The transfer should now be secured by the clip. The transfer line should be seated in the matching groove in the heater block.
- 10 Tighten the thumbscrew on the MS tail finger-tight. (It only needs to be secure.)

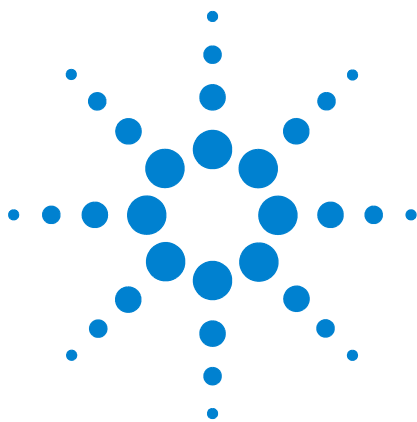
Replace the Filter in the Split Vent Line

- 1 Gather the following:
 - New filter cartridge.
- 2 Prepare for maintenance. **Maintenance > Instrument > Perform Maintenance > Maintenance Standby Mode > Start Maintenance.** Wait for the GC to become ready.
- 3 Remove the split vent trap cover (top, back of GC).

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.

- 4 Remove the split vent trap cover (top, back of GC).
- 5 Loosen the large knurled nut that secures the filter cartridge in place.
- 6 Remove the old filter cartridge and insert a new one. The flared (wider) end of the filter faces forward; the narrower end faces towards the threaded exhaust fitting.
- 7 Tighten the knurled nut finger tight.
- 8 Check for leaks.
- 9 Install the split vent trap cover.
- 10 Reset the filter EMF counter.



3 Maintaining the Split/Splitless Inlet

- Consumables and Parts for the Split/Splitless Inlet 56
- Exploded Parts View of the Split/Splitless Inlet 58
- To Change the Septum on the Split/Splitless Inlet 59
- To Clean the Septum Seat in the Insert Assembly of the Split/Splitless Inlet 61
- To Change the Liner and O-Ring on the Split/Splitless Inlet 63
- To Bakeout Contaminants from the Split/Splitless Inlet 66



Consumables and Parts for the Split/ Splitless Inlet

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

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

Mode	Description	Deactivated	Part number
Split	Low-pressure drop, glass wool, single taper, 870 μ L	Yes	5183-4647
Split	Glass wool, 990 μ L	No	19251-60540
Split	MS Certified, single taper, glass wool	Yes	5188-6576
Split—Manual only	Empty pin and cup, 800 μ L	No	18740-80190
Split—Manual only	Packed pin and cup, 800 μ L	No	18740-60840
Split or splitless	Ultra Inert, low pressure drop, glass wool	Yes	5190-2295
Splitless	Single taper, glass wool, 900 μ L	Yes	5062-3587
Splitless	Single taper, no glass wool, 900 μ L	Yes	5181-3316
Splitless	Dual taper, no glass wool, 800 μ L	Yes	5181-3315
Splitless	MS Certified, single taper, glass wool	Yes	5188-6568
Splitless—Direct inject	2-mm id, quartz, 250 μ L	No	18740-80220
Splitless—Direct inject	2-mm id, 250 μ L	Yes	5181-8818
Direct inject —Headspace or purge and trap	1.5-mm id, 140 μ 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

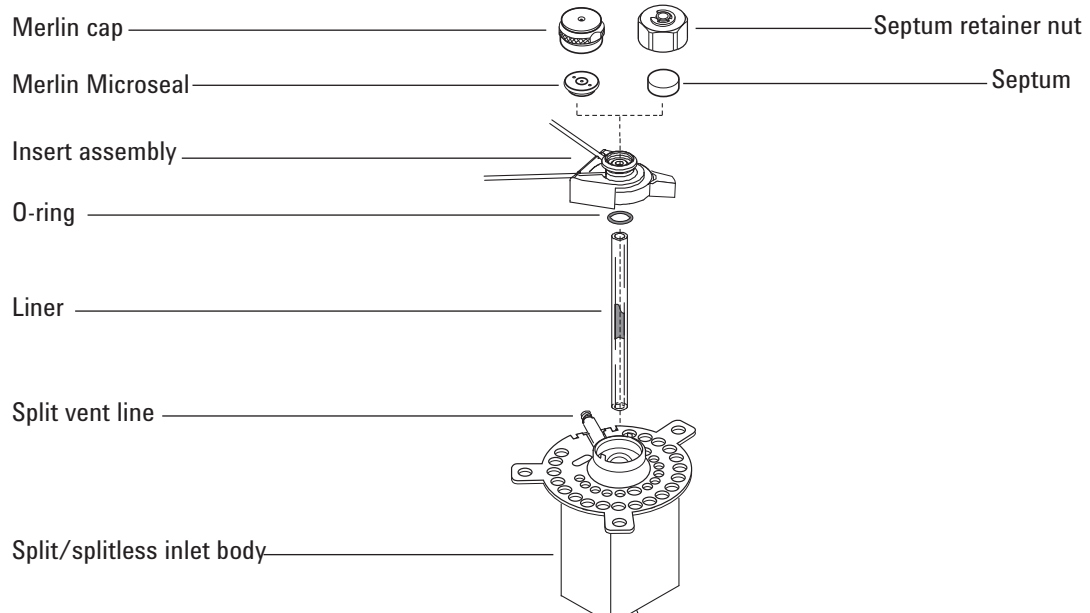
Table 6 Other consumables and parts for the split/splitless inlet

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
Merlin Microseal septum (high-pressure)	5182-3444
Merlin Microseal septum (30 psi)	5181-8815

Table 6 Other consumables and parts for the split/splitless inlet

Description/quantity	Part number
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
Split vent trap PM kit, single cartridge	5188-6495
Capillary inlet preventative maintenance kit, split	5188-6496
Capillary inlet preventative maintenance kit, splitless	5188-6497
Intuvo 9000 Split/Splitless Inlet Guard Chips (2-pack)	G4587-60565
Intuvo 9000 Split/Splitless Inlet Jumper Chips (2-pack)	G4587-60575

Exploded Parts View of the Split/Splitless Inlet



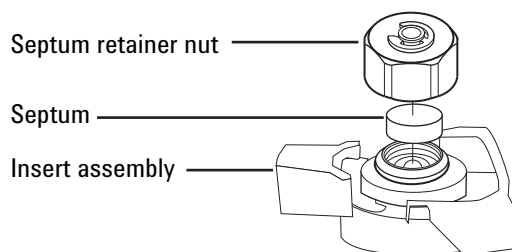
To Change the Septum on the Split/Splitless Inlet

- Gather the following:
 - Replacement septum. (See “Consumables and Parts for the Split/Splitless Inlet” on page 56.)
 - Wrench, hex for changing septum
 - 0- or 00-grade steel wool (optional)
 - Tweezers
 - Wrench, capillary inlet (optional)
- Launch the GC maintenance wizard: **Maintenance > Inlet > Perform Maintenance > Replace Septum > Start Maintenance**. The wizard will walk through the steps needed to replace the inlet. These 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.

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



- 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).

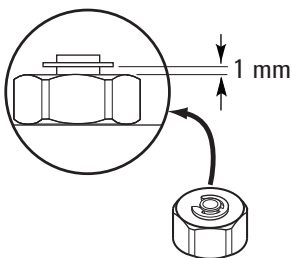


3 Maintaining the Split/Splitless Inlet

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

CAUTION

Overtightening the septum nut can cause contamination.



- 7 Restore the analytical method.
- 8 If you performed this procedure using the GC's maintenance feature, then the GC will perform checks at the appropriate times, and will automatically reset the maintenance counters.

If you did not use the GC maintenance wizard, use the GC touch screen to perform any necessary checks and to reset the maintenance counters.

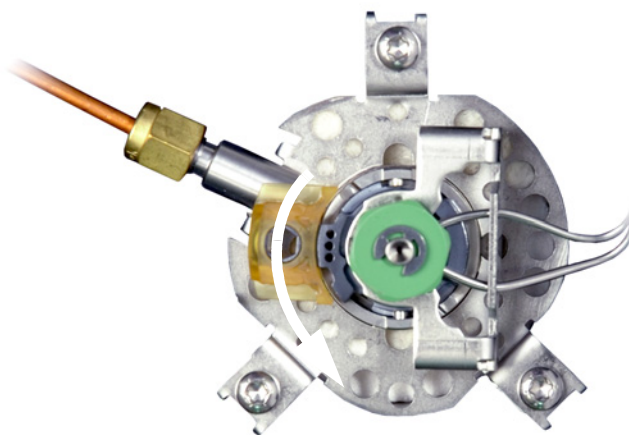
To Clean the Septum Seat in the Insert Assembly of the Split/Splitless Inlet

- 1 Gather the following:
 - Replacement septum (See “Consumables and Parts for the Split/Splitless Inlet” on page 56.)
 - 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 temperature to $< 40\text{ }^{\circ}\text{C}$, and wait for the inlet to cool before continuing.

WARNING

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

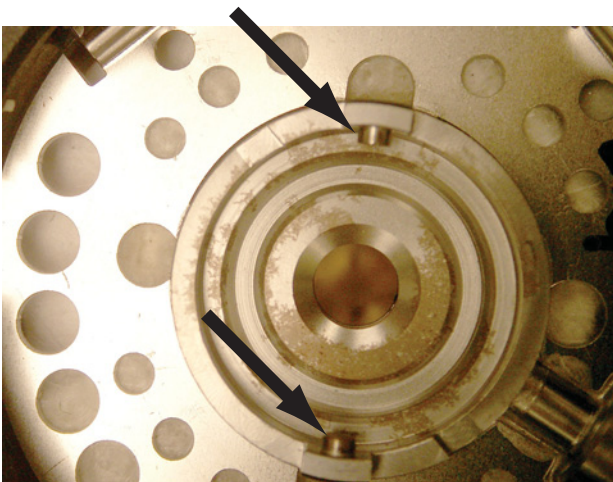
- 3 Slide the locking tab forward (counterclockwise). Lift the septum assembly straight up and away from the inlet to avoid chipping or breaking the liner.



- 4 Remove the septum retainer nut or Merlin cap.
- 5 Use tweezers to remove the septum or Merlin Microseal from the retainer nut. (See “To Change the Septum on the Split/Splitless Inlet” on page 59.)
- 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.

3 Maintaining the Split/Splitless Inlet

- 7 Use compressed air or nitrogen to blow away the pieces of steel wool and septum.
- 8 Line up the tab on the bottom of the septum assembly with the slot on the insert assembly and push down to connect. Slide the locking tab to the left.



- 9 Firmly press the new septum or Merlin Microseal into the fitting. (See “[To Change the Septum on the Split/Splitless Inlet](#)” on page 59.)
- 10 Replace the septum retainer nut or Merlin cap and finger-tighten. (See “[To Change the Septum on the Split/Splitless Inlet](#)” on page 59.)
- 11 Restore the analytical method.
- 12 On the GC touch screen select **Maintenance > Inlet > Septum**, and touch **Reset Counter**.

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

NOTE

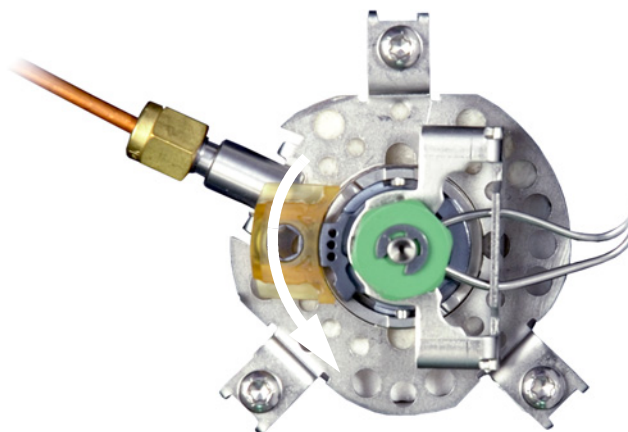
Verify that a guard chip or jumper chip is installed. If not install it before installing the liner.

- 1 Gather the following:
 - Replacement O-ring (See “Consumables and Parts for the Split/Splitless Inlet” on page 56.)
 - Replacement liner
 - Tweezers
 - Wrench, hex for changing septum
 - Wrench, capillary inlet (optional)
 - Lint-free gloves
- 2 Launch the GC maintenance wizard: **Maintenance > Inlet > Perform Maintenance > Replace Liner and O-Ring > Start Maintenance**. The wizard will walk through the replacement procedure. These 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 septum assembly straight up and away from the inlet to avoid chipping or breaking the liner.



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

3 Maintaining the Split/Splitless Inlet



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



- 6 Clean the inlet if there is visible or suspected contamination.
Clean O-ring residue from sealing surface.

CAUTION

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

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



- 9 Line up the tab on the bottom of the septum assembly with the slot on the insert assembly and push down to connect. Slide the locking tab to the back.
- 10 Turn on the inlet. Allow the inlet and column to purge with carrier gas for 15 minutes before heating the inlet or the column oven.
- 11 Bakeout contaminants. (See [“To Bakeout Contaminants from the Split/Splitless Inlet”](#) on page 66.)
- 12 Restore the analytical method.
- 13 If you performed this procedure using the GC’s maintenance feature, then the GC will perform checks at the appropriate times, and will automatically reset the maintenance counters.

If you did not use the GC maintenance wizard, use the GC touch screen to perform any necessary checks and to reset the maintenance counters.

To Bakeout Contaminants from the Split/Splitless Inlet

It is recommended to perform an inlet bakeout with the column installed.

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



4 Maintaining the MMI

- Consumables and Parts for the MMI 68
- Exploded Parts View of the MMI 70
- To Change the Septum on the MMI 71
- To Clean the Septum Seat in the Insert Assembly of the MMI 73
- To Change the Liner and O-Ring on the MMI 75
- To Bakeout Contaminants from the MMI 78



Consumables and Parts for the MMI

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

Table 7 Split, splitless, direct, and direct connect inlet liners

Mode	Description	Deactivated	Part number
Split	Low-pressure drop, glass wool, single taper, 870 μ L	Yes	5183-4647
Split	Glass wool, 990 μ L	No	19251-60540
Split—Manual only	Empty pin and cup, 800 μ L	No	18740-80190
Split—Manual only	Packed pin and cup, 800 μ L	No	18740-60840
Splitless	Single taper, glass wool, 900 μ L	Yes	5062-3587
Splitless	Single taper, no glass wool, 900 μ L	Yes	5181-3316
Splitless	Dual taper, no glass wool, 800 μ L	Yes	5181-3315
Splitless—Direct inject	2-mm id, quartz, 250 μ L	No	18740-80220
Splitless—Direct inject	2-mm id, 250 μ L	Yes	5181-8818
Direct inject —Headspace or purge and trap	1.5-mm id, 140 μ 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

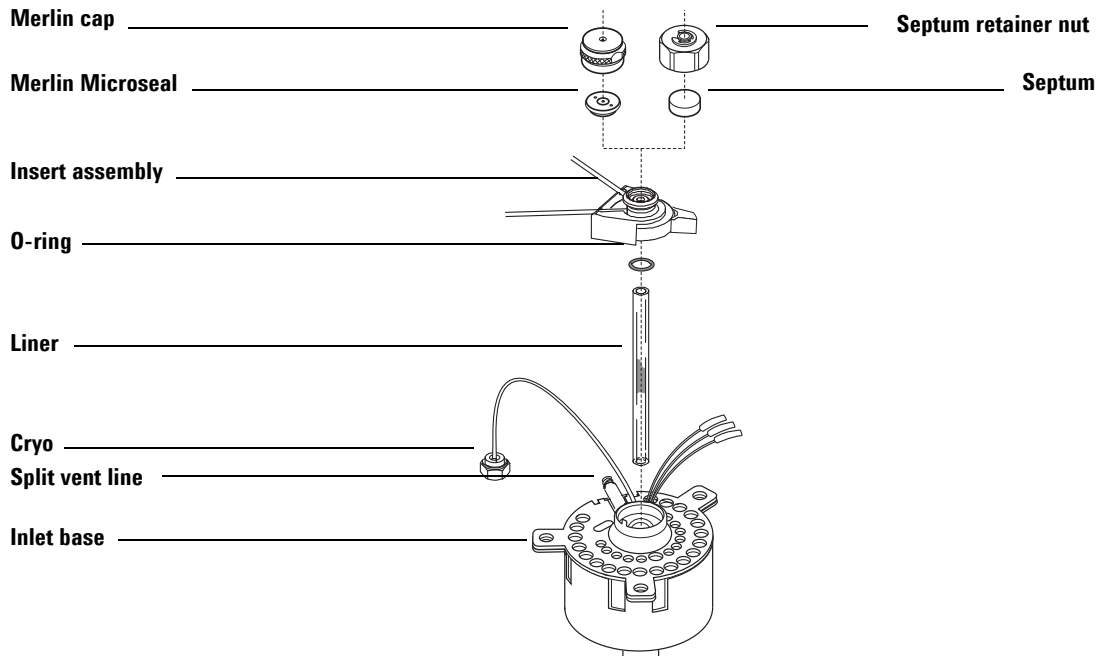
Table 8 Other consumables and parts for the multimode inlet (MMI)

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 $^{\circ}$ C), 10/pk	5188-5365

Table 8 Other consumables and parts for the multimode inlet (MMI)

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
Cleaning kit, multimode inlet. (Contains 5 each abrasive swabs and 5 each cotton swabs.)	G3510-60820
Intuvo 9000 Multimode Inlet Guard Chips (2-pack)	G4587-60665
Intuvo 9000 Multimode Inlet Jumper Chips (2-pack)	G4587-60675

Exploded Parts View of the MMI



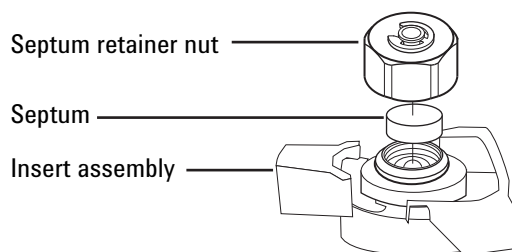
To Change the Septum on the MMI

- 1 Gather the following:
 - Replacement septum. (See “Consumables and Parts for the MMI” on page 68.)
 - Wrench, hex for changing septum
 - 0- or 00-grade steel wool (optional)
 - Tweezers
 - Wrench, capillary inlet (optional)
- 2 Launch the GC maintenance wizard: **Maintenance > Inlet > Perform Maintenance > Replace Septum > Start Maintenance**. The wizard will walk through the replacement procedure. These steps are repeated below.

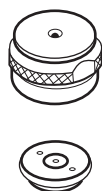
WARNING

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.



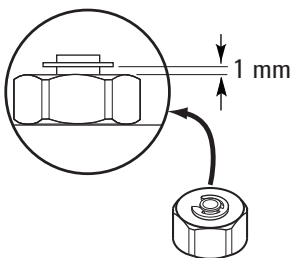
- 5 Firmly press the new septum or Merlin Microseal into the fitting. The metal parts side of the Merlin Microseal should face down (toward the oven).



- 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.



- 7 Restore the analytical method.
- 8 If you performed this procedure using the GC's maintenance feature, then the GC will perform checks at the appropriate times, and will automatically reset the maintenance counters.

If you did not use the GC maintenance wizard, use the GC touch screen to perform any necessary checks and to reset the maintenance counters.

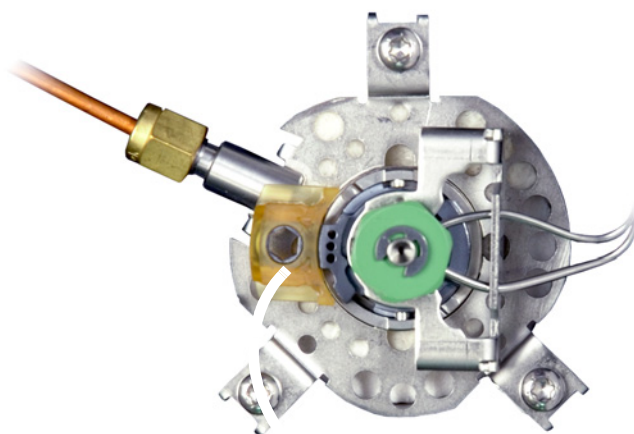
To Clean the Septum Seat in the Insert Assembly of the MMI

- 1 Gather the following:
 - Replacement septum (See “Consumables and Parts for the MMI” on page 68.)
 - Wrench, hex for changing septum
 - 0- or 00-grade steel wool (optional)
 - Tweezers
 - Compressed, filtered, dry air or nitrogen
- 2 Manually set the inlet temperature to $< 40\text{ }^{\circ}\text{C}$, and wait for the inlet to cool before continuing.

WARNING

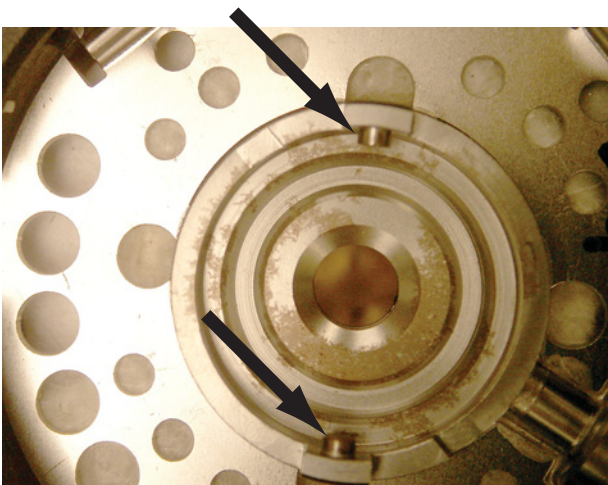
Be careful! The oven and/or inlet may be hot enough to cause burns. If either is hot, wear heat-resistant gloves to protect your hands.

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



- 4 Remove the septum retainer nut or Merlin cap.

- 5 Use tweezers to remove the septum or Merlin Microseal from the retainer nut. (See [“To Change the Septum on the MMI”](#) on page 71.)
- 6 Scrub the residue from the retainer nut and septum holder with a small piece of rolled-up steel wool and tweezers. Do not do this over the inlet.
- 7 Use compressed air or nitrogen to blow away the pieces of steel wool and septum.
- 8 Line up the tab on the bottom of the septum assembly with the slot on the insert assembly and push down to connect. Slide the locking tab to the left.



- 9 Firmly press the new septum or Merlin Microseal into the fitting. (See [“To Change the Septum on the MMI”](#) on page 71.)
- 10 Replace the septum retainer nut or Merlin cap and finger-tighten. (See [“To Change the Septum on the MMI”](#) on page 71.)
- 11 Restore the analytical method.
- 12 If you performed this procedure using the GC’s maintenance feature, then the GC will perform checks at the appropriate times, and will automatically reset the maintenance counters.

If you did not use the GC maintenance wizard, use the GC touch screen to perform any necessary checks and to reset the maintenance counters.

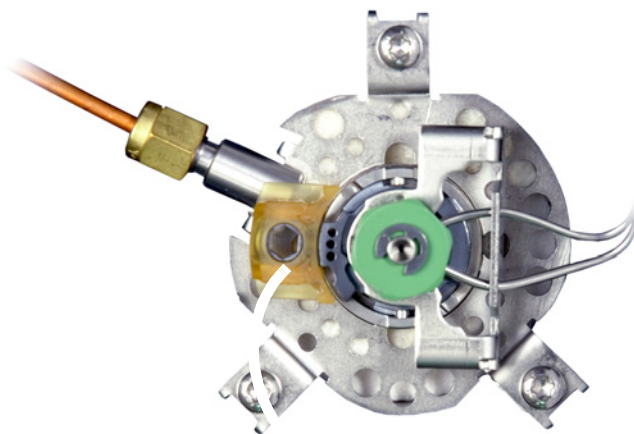
To Change the Liner and O-Ring on the MMI

- 1 Gather the following:
 - Replacement O-ring (See “Consumables and Parts for the MMI” on page 68.)
 - Replacement liner
 - Tweezers
 - Wrench, hex for changing septum
 - Lint-free gloves
- 2 Launch the GC maintenance wizard: **Maintenance > Inlet > Perform Maintenance > Replace Liner and O-Ring > Start Maintenance**. The wizard will walk through the replacement procedure. These 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 septum assembly straight up and away from the inlet to avoid chipping or breaking the liner.



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

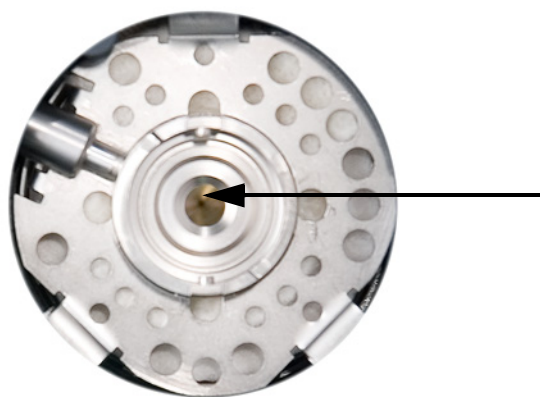
4 Maintaining the MMI



- 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.



Clean the inlet if there is visible or suspected contamination.

Clean O-ring residue from sealing surfaces.

CAUTION

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

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



- 9 Line up the tab on the bottom of the septum assembly with the slot on the insert assembly and push down to connect. Slide the locking tab to the back.
- 10 Turn on the inlet. Allow the inlet and column to purge with carrier gas for 15 minutes before heating the inlet or the column oven.
- 11 Bakeout contaminants. (See [“To Bakeout Contaminants from the MMI”](#) on page 78.)
- 12 Restore the analytical method.
- 13 If you performed this procedure using the GC’s maintenance feature, then the GC will perform checks at the appropriate times, and will automatically reset the maintenance counters.

If you did not use the GC maintenance wizard, use the GC touch screen to perform any necessary checks and to reset the maintenance counters.

To Bakeout Contaminants from the MMI

It is recommended to perform an inlet bakeout with the column installed.

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



5 Maintaining the FID

Consumables and Parts for the FID	80
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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).

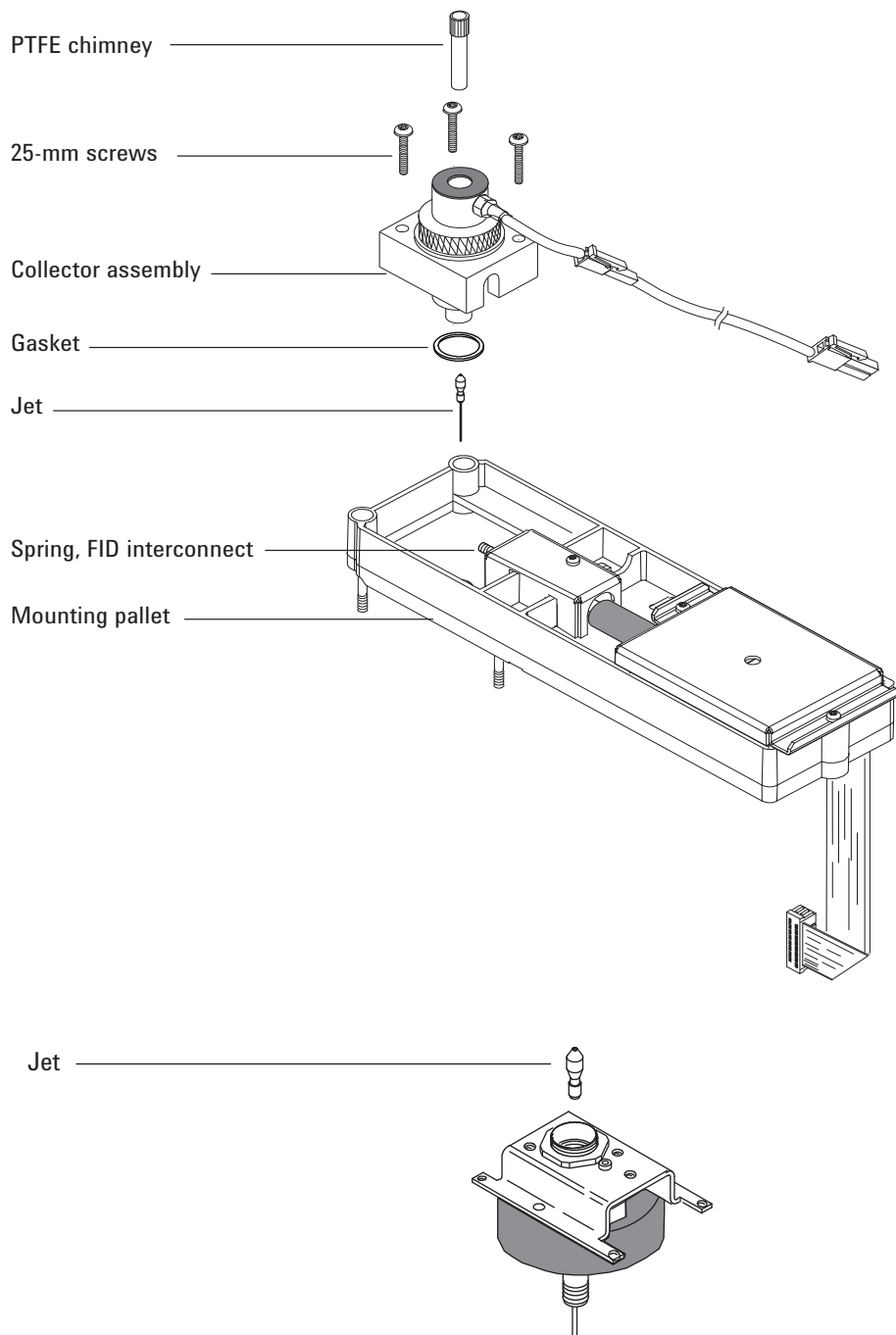
Table 9 FID parts and subassemblies

Description	Part number/quantity
Screw, M4 × 25 mm, Torx, T20	0515-2712 (3/pk)
FID vent chimney (includes chimney and self-tapping screws)	G4580-60404
Collector assembly	G1531-60690
Jet, FID, 0.11-inch id	G4591-20320

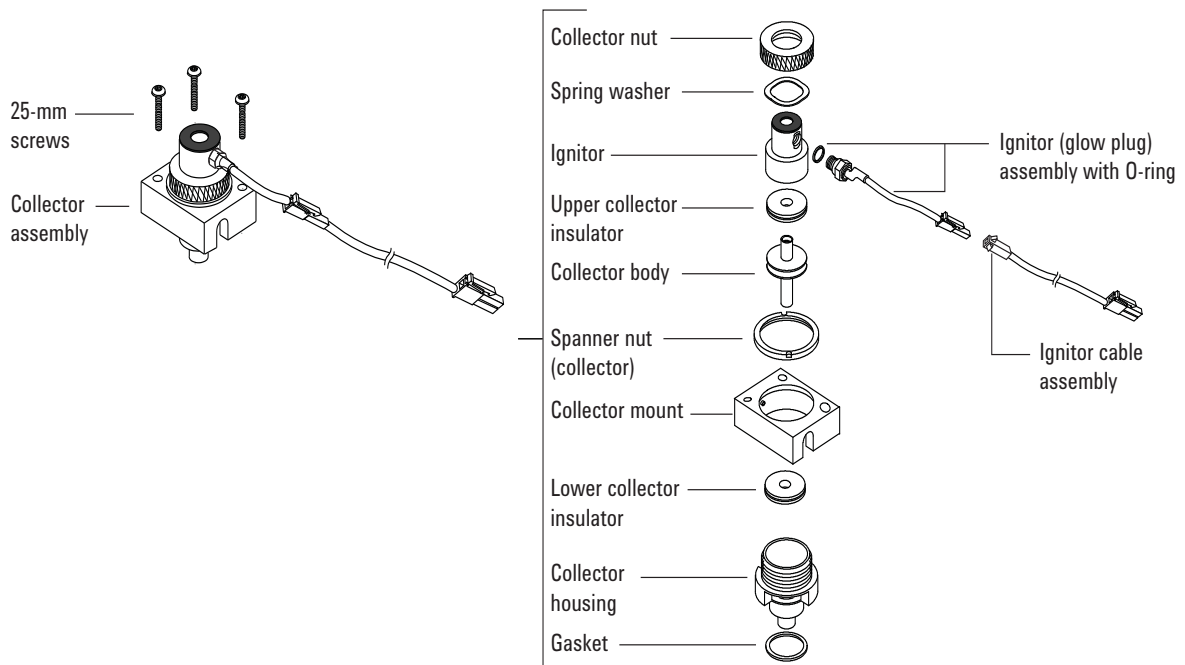
Table 10 FID collector assembly parts

Description	Part number/quantity
Screw, M4 × 25 mm, Torx, T20	0515-2712 (3/pk)
Collector assembly	G1531-60690
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 (collector)	19231-20980
Collector mount	G1531-20550
Collector housing	G1531-20740
Gasket	5180-4165 (12/pk)
Ignitor (glow plug) assembly with O-ring	19231-60680

Exploded Parts Views of the FID



5 Maintaining the FID



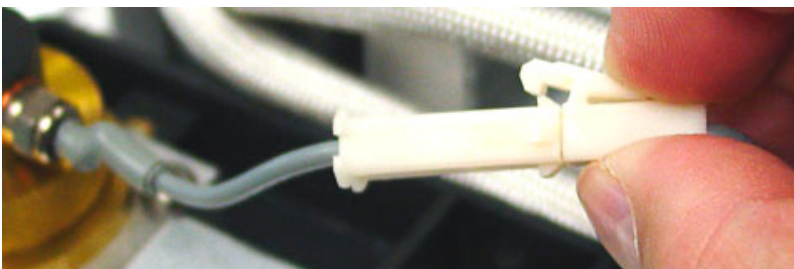
To Replace the FID Collector Assembly

- 1 Gather the following:
 - New FID collector assembly. (See “Consumables and Parts for the FID” on page 80.)
 - Intuvo torque driver
 - T-20 Torx screwdriver
 - T-10 Torx screwdriver
 - 1/4-inch nut driver
 - Tweezers
 - Lint-free gloves

CAUTION

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

- 2 Prepare for maintenance. **Maintenance > Instrument > Perform Maintenance > Maintenance Standby Mode > Start Maintenance.** Wait for the GC to become ready.
- 3 Disconnect the ignitor cable assembly.



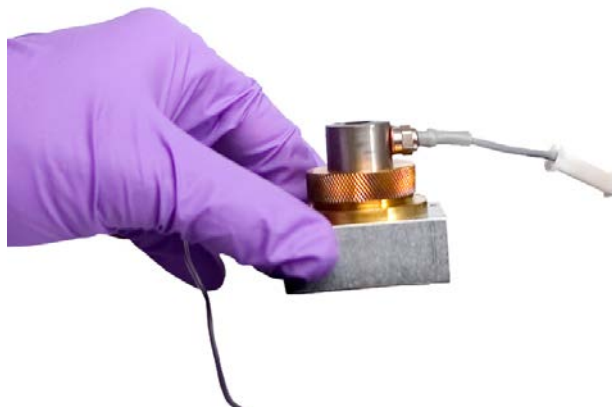
- 4 Remove the three screws holding the collector assembly to the mounting pallet.



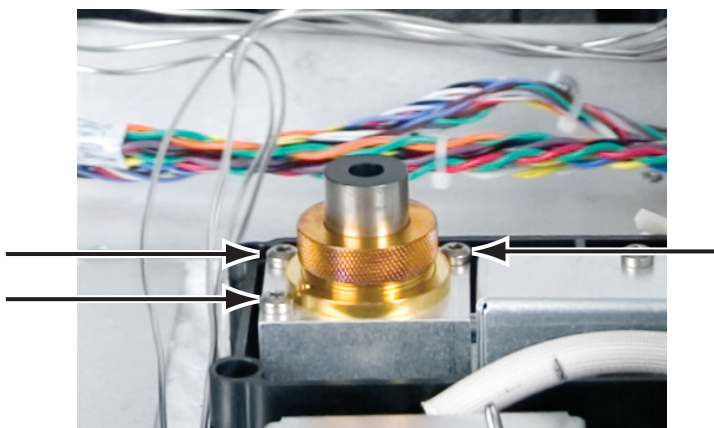
CAUTION

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.

- 5 Lift and remove the assembly from the pallet.



- 6 Remove the ignitor cable assembly from the new collector assembly, if present.
- 7 Remove any protective caps from the new collector assembly, if present.
- 8 Lower the new collector assembly into the housing.
- 9 Insert the three screws and tighten (to 18 inch-pounds).



- 10** Connect the ignitor extension cable.
- 11** Verify assembly:
 - a** Check the FID leakage current. (See [“To Check the FID Leakage Current”](#) on page 97.)
 - b** Check the FID baseline. (See [“To Check the FID Baseline”](#) on page 98.)
- 12** Reset the EMF counter. See [To Reset an EMF Counter](#) in the *Operation Manual*.

To Replace an FID Jet

- 1 Gather the following:
 - Replacement jet
 - 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 > Detector > Perform Maintenance > Replace FID Jet > Start Maintenance**. The wizard will walk through the replacement procedure. These steps are repeated 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.

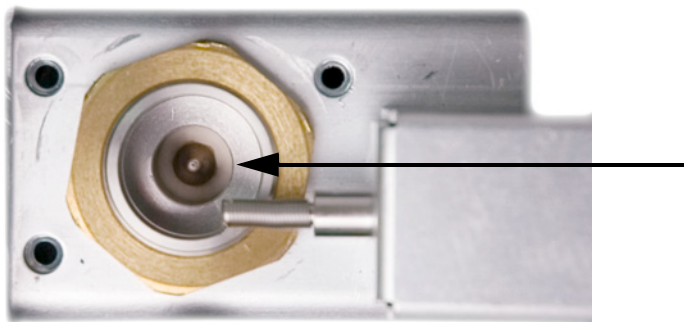
- 3 If installed, remove the capillary column from the detector.

CAUTION

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

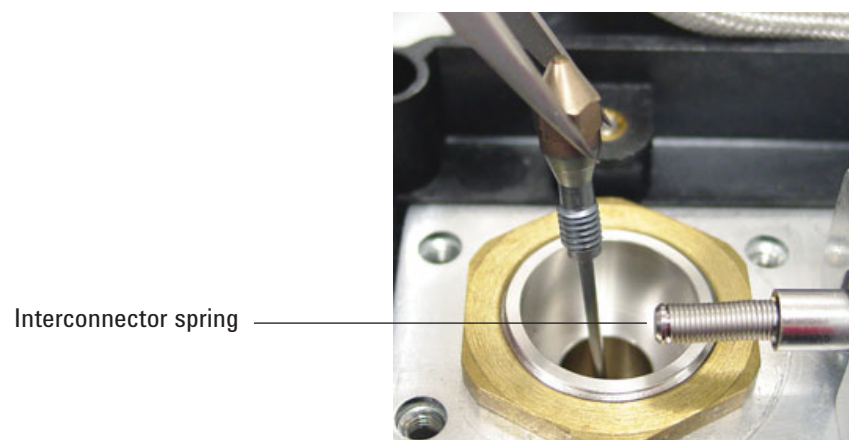
- 4 Remove the FID collector assembly and place it on a clean cloth. (See [“To Replace the FID Collector Assembly”](#) on page 83.)

- 5 Locate the jet inside the housing.

**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.

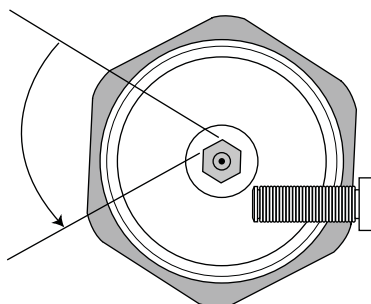


- 7 Clean the detector base cavity using solvent, a swab, and compressed air or nitrogen.
- 8 Use tweezers to lower the new jet into the housing.

CAUTION

Do not overtighten the jet! Overtightening may permanently deform and damage the jet, the detector base, or both. The torque specification is 10 inch-pounds.

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



- 10 Install the collector assembly. (See [“To Replace the FID Collector Assembly”](#) on page 83.)
- 11 Reset the jet counter. See [To Reset an EMF Counter](#) in the *Operation Manual*.
- 12 Establish a flow of carrier gas and purge as recommended by the column manufacturer.
- 13 Check the FID leakage current. (See [“To Check the FID Leakage Current”](#) on page 97.)
- 14 Bakeout the detector. (See [“To Bakeout the FID”](#) on page 100.)
- 15 Restore the analytical method.
- 16 Check the FID baseline. (See [“To Check the FID Baseline”](#) on page 98.)

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 80.)
- 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.

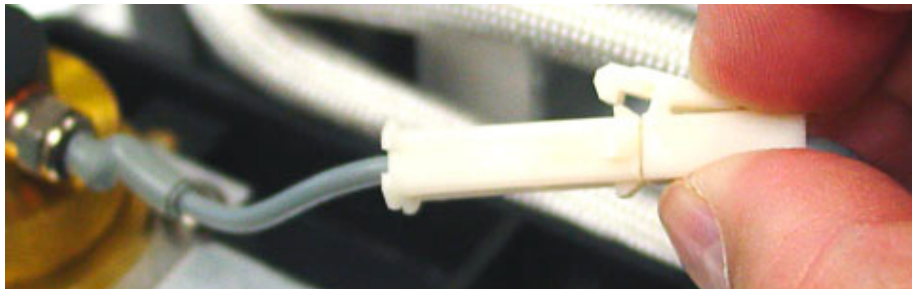
- 2**
- Prepare for maintenance.
- Maintenance > Instrument > Perform Maintenance > Maintenance Standby Mode > Start Maintenance.**
-
- Wait for the GC to become ready.

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.

5 Maintaining the FID

- 3 Remove the FID ignitor.
 - a Disconnect the ignitor cable assembly.



- b Loosen the ignitor with a wrench.



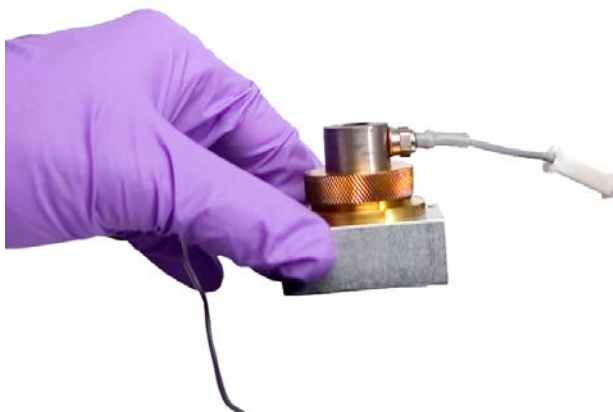
- c Turn the nut counterclockwise by hand. Remove the ignitor and copper washer.
- 4 If replacing only the FID ignitor assembly with copper washer, skip to [step 16](#) for assembly.
- 5 Remove the three screws that hold the collector mount to the FID thermal strap.



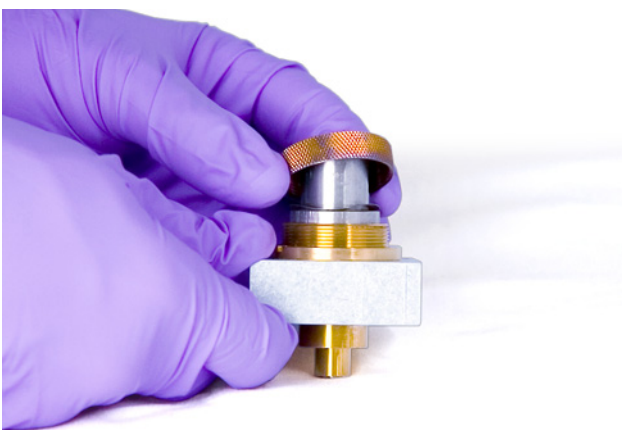
CAUTION

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

- 6 Remove the collector assembly. Place it on a clean cloth for additional disassembly.



- 7 Remove the gasket from the bottom of the assembly, if necessary.
- 8 Remove the FID ignitor castle.
 - a Loosen the collector nut.
 - b Remove the collector nut and the spring washer.



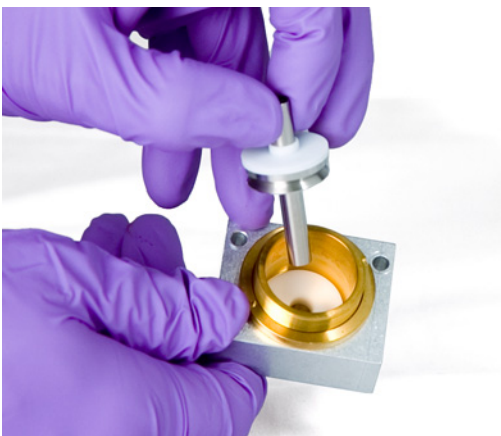
- c Lift the castle out of the collector housing. When removing the castle, some of the collector parts may be attached. Set these on a clean cloth to protect from scratches or dirt.



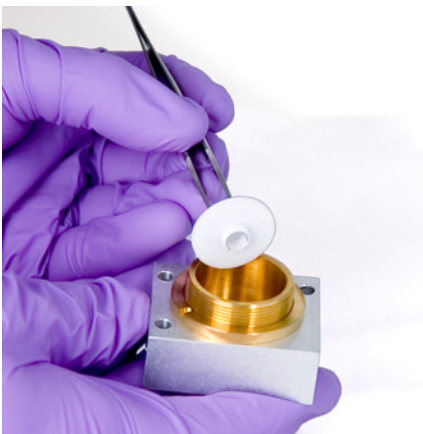
9 If only replacing the FID castle, skip to [step 15](#) for reassembly.

10 Remove the collector and insulators.

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



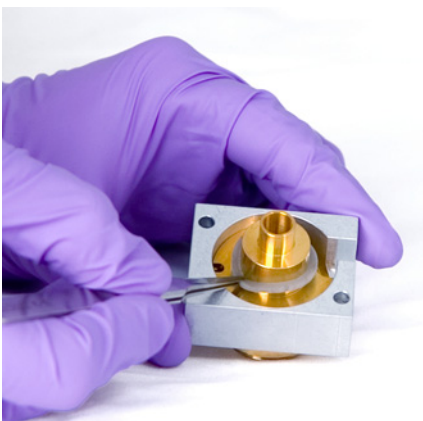
- b** Remove the lower insulator with tweezers and place the parts on a clean cloth.



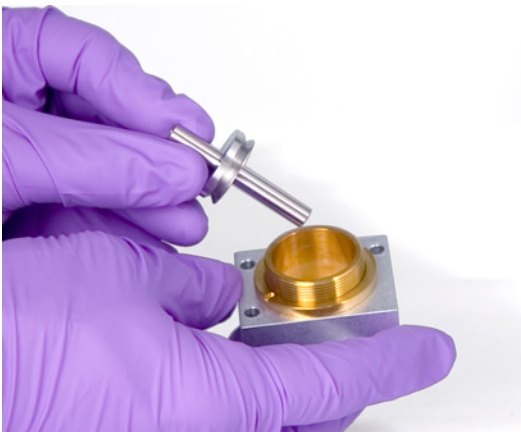
- 11 Remove the collector housing from the mount, if necessary.
- 12 Use tweezers to remove the gasket from the bottom of the housing.

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

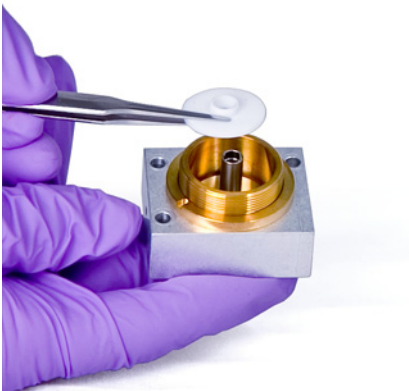
- 13 Use tweezers to install a new gasket onto the housing, being sure that it lays flat on the brass surface.



- 14 Install the collector insulators.
 - a Insert one of the insulators into the base of the housing. Seat the insulator with the flat surface facing out of the housing.
 - b Insert the long end of collector into the housing and lower insulator.



- c Insert the other insulator onto the top of the collector, with the flat surface facing towards the housing.



15 Install the FID ignitor castle.

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



- b Insert the FID castle into the collector housing.
- c Install the spring washer over the castle.



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

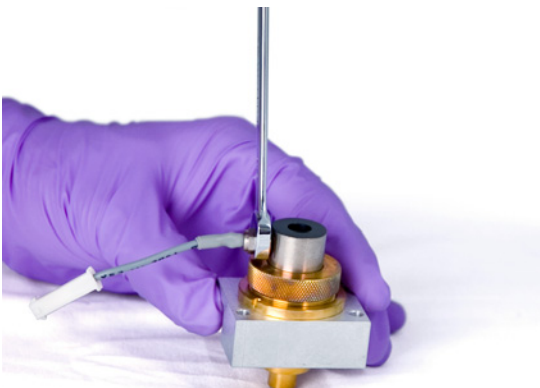


16 Install the FID ignitor.

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



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



17 Lower the collector assembly into the housing.

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



19 Connect the ignitor extension cable.

20 Verify assembly:

- a** Check the FID leakage current. (See [“To Check the FID Leakage Current”](#) on page 97.)
- b** Bakeout the detector. (See [“To Bakeout the FID”](#) on page 100.)
- c** Check the FID baseline. (See [“To Check the FID Baseline”](#) on page 98.)

21 Reset the EMF counters. See [To Reset an EMF Counter](#) in the *Operation Manual*.

To Check the FID Leakage Current

- 1 Load the analytical method.
 - Make sure flows are acceptable for ignition.
 - Heat the detector to operating temperature or 300 °C.
- 2 Turn off the FID flame.
- 3 Show the detector output signal in **Status**.
- 4 Verify that the output is stable and < 1.0 pA.

If the output is unstable or > 1.0 pA, turn off the GC and check for proper assembly of the upper FID parts and contamination. If this contamination is confined to the detector, bakeout the FID. (See [“To Bakeout the FID”](#) on page 100.)

- 5 Turn on the flame.

To Check the FID Baseline

- 1 Load the checkout method.
- 2 Set the oven temperature to 35 °C.
- 3 Show the detector output signal in **Status**.
- 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 100.)

To Install the Optional FID Vent Chimney

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.

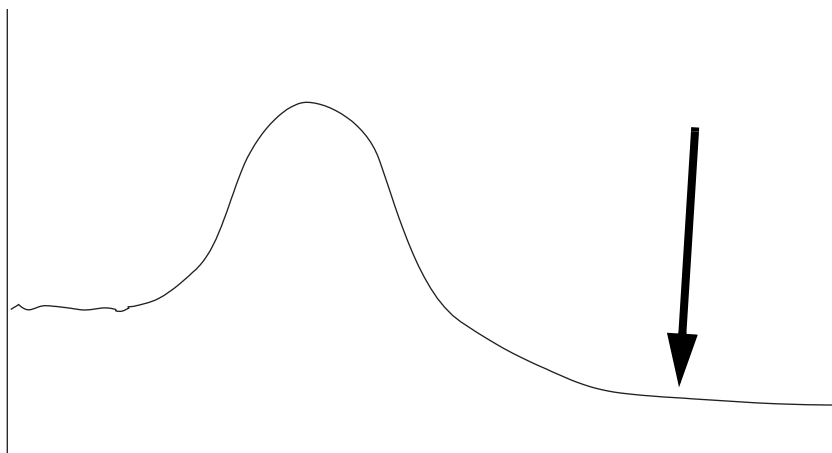
CAUTION

Use if methylene chloride solvent or other sample produces corrosive byproducts.

- 1 Remove the detector cover.
- 2 Insert the O-ring into bottom of FID vent chimney.
- 3 Insert the long end of the FID vent chimney up through the bottom of the detector cover so that the holes in the vent chimney align with the holes in the cover.
- 4 Secure the vent chimney to the cover using the two self-tapping screws.

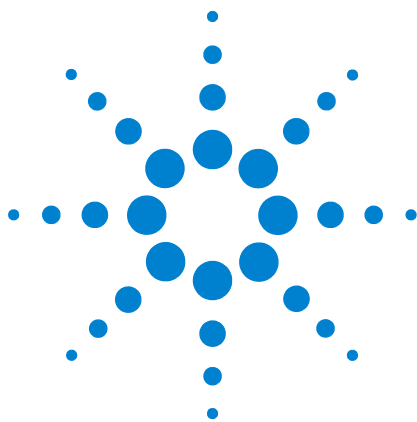
To Bakeout the FID

- 1 Set the detector temperature at 350 to 375 °C.
- 2 Set normal operating flows.
- 3 Light the FID flame.
- 4 Set the oven temperature to 250 °C or 25 °C above the normal maximum operating temperature. Do not exceed the column's temperature limit.
- 5 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.



- 6 Restore the analytical method and allow the FID to equilibrate.
- 7 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.



6 Maintaining the TCD

Consumables and Parts for the TCD [102](#)

To Bakeout Contaminants from the TCD [103](#)



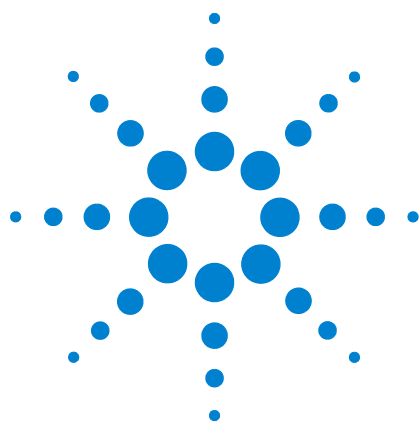
Consumables and Parts for the TCD

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

To Bakeout Contaminants from the TCD

- 1 Turn off the TCD filament.
- 2 Set the reference gas flow rate between 20 and 30 mL/min.
- 3 Set the detector temperature to 375 °C.
- 4 Hold at 375 °C for several hours.
- 5 Load the analytical method.
- 6 Allow the oven, inlet, and detector to equilibrate at operating temperature, then re-tighten the fittings.

6 Maintaining the TCD



7

Maintaining the FPD⁺

Consumables and Parts for the FPD ⁺	106
Exploded Parts View of the FPD ⁺	107
To Change the FPD ⁺ Wavelength Filter	108
To Remove the FPD ⁺ Cover	111
To Replace the FPD ⁺ Ignitor	113
To Install the FPD ⁺ Cover	115
Cleaning the FPD ⁺ Brazement	116



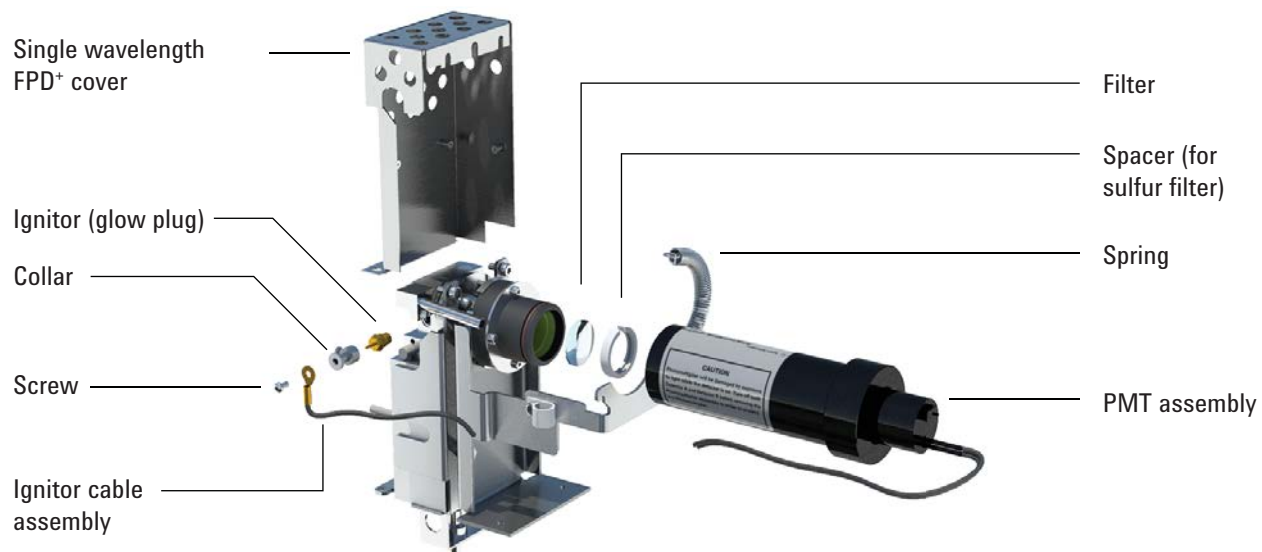
Consumables and Parts for the FPD⁺

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

Table 11 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
Spring to secure photomultiplier tube	1460-1160
Preventive maintenance kit, single FPD ⁺	G3435-67000

Exploded Parts View of the FPD⁺



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 106.)
 - Phosphorus filter
 - Cotton swab
 - Lens tissue
 - Lint-free gloves
- 2 Prepare for maintenance. **Maintenance > Instrument > Perform Maintenance > Maintenance Standby Mode > Start Maintenance.** Wait for the GC to become ready.
- 3 Turn off the photomultiplier tube (PMT).
 - a Navigate to **Settings > Configuration**, then select the detector.
 - b Locate the PMT voltage setting and turn it off.

WARNING

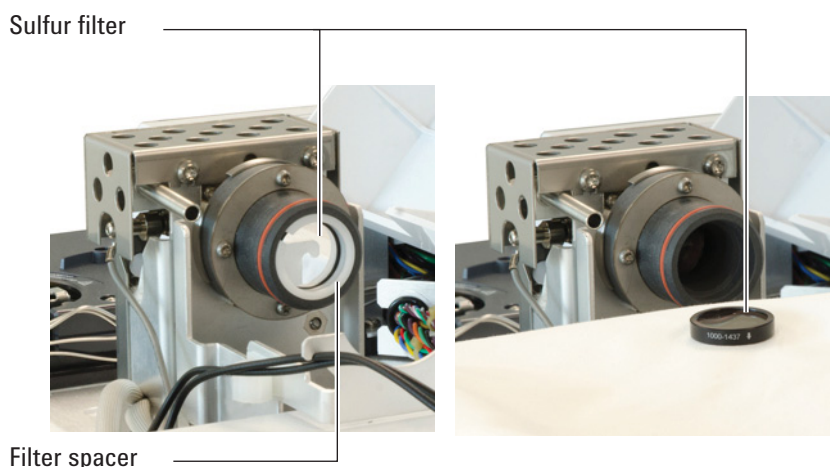
Be careful! The detector may be hot enough to cause burns. If the detector is hot, wear heat-resistant gloves to protect your hands.

CAUTION

The photomultiplier tube (PMT) is extremely sensitive to light. Always turn off the electrometer (which turns off the high voltage to the PMT) before removing the PMT housing or opening the emissions chamber. Failing to do this can destroy the PMT.

Even with the electrometer off, protect the PMT from room light. Cap the housing after it is removed, place it end down to exclude light, or reduce the room light level before exposing the PMT. A brief exposure (always with the electrometer turned off) will not damage it, but prolonged exposure will cause a gradual loss of sensitivity.

- 4 Disconnect the retaining spring that holds the PMT assembly to the bracket. With a rotating motion, pull the assembly away from the filter housing.
- 5 To prevent light from damaging the PMT, cap the end or place it face down.
- 6 Place a clean cloth under the filter housing to catch the filter.
 - For phosphorus filter, use the sharpened wooden tip of a toothpick or cotton swab to dislodge the filter from the housing.
 - For sulfur filter (shown below), use the wooden tip of the cotton swab to remove the filter spacer. Then dislodge the filter from the housing.

**CAUTION**

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

- 7 Clean the new filter with lens tissue.

CAUTION

Filters are designed for the light of the flame to pass through in a specific direction. The triangle (on the edge of the phosphorus filter) and the arrow (on the edge of the sulfur filter) should face away from the flame and *toward* the PMT.

- 8 Install the filter in the filter housing. Install the sulfur filter spacer, if necessary.
- 9 Replace the PMT assembly and secure with the spring.

7 Maintaining the FPD⁺

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

- 11** Restore the analytical method.

To Remove the FPD⁺ Cover

- 1 Gather the following:
 - T-20 Torx screwdriver
- 2 Prepare for maintenance. **Maintenance > Instrument > Perform Maintenance > Maintenance Standby Mode > Start Maintenance.** Wait for the GC to become ready.

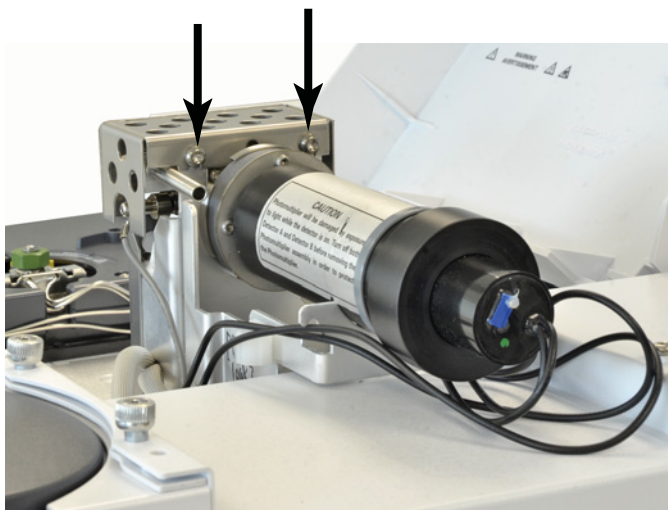
CAUTION

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

WARNING

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

- 3 Open the FPD detector top cover.
- 4 Loosen the screws securing the FPD cover to the top of the detector.



7 Maintaining the FPD⁺

- 5 For a single wavelength FPD, remove the two screws at the bottom left of the cover.



- 6 Lift the cover off the detector.

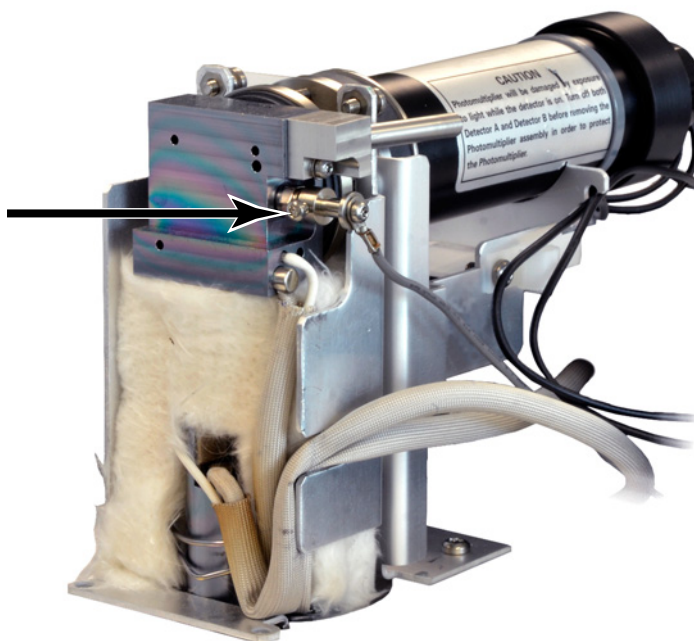
To Replace the FPD⁺ Ignitor

- 1 Gather the following:
 - Ignitor replacement kit. (See “Consumables and Parts for the FPD⁺” on page 106.)
 - Torx screwdrivers, T-20 and T-10
 - 5/16-inch nut driver (or wrench)
- 2 Prepare for maintenance. **Maintenance > Instrument > Perform Maintenance > Maintenance Standby Mode > Start Maintenance.** Wait for the GC to become ready.

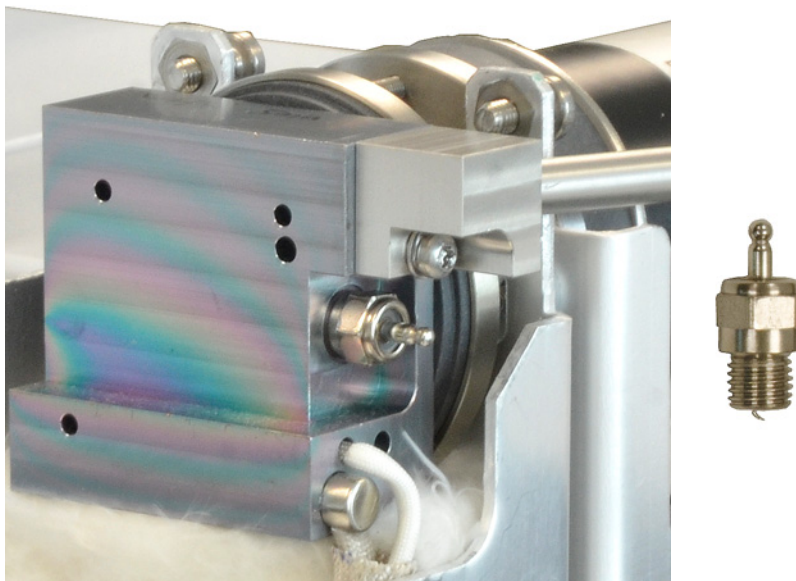
WARNING

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

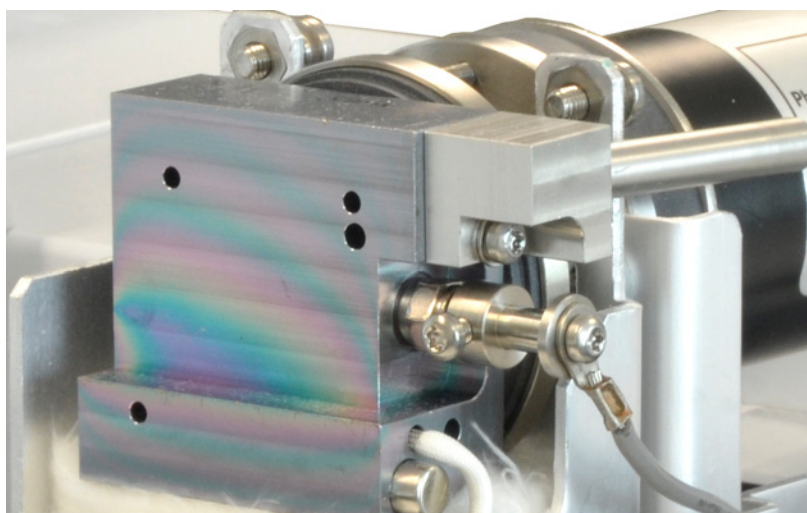
- 3 Remove the FPD cover. (See “To Remove the FPD⁺ Cover” on page 111.)
- 4 Loosen the collet screw holding the cable assembly to the ignitor. Remove the collet and cable assembly.



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



- 6 Install the new ignitor assembly and tighten with the nut driver. Do not overtighten. (If the ignitor comes with a copper washer, discard the copper washer.)
- 7 Replace the ignitor collet and cable assembly and tighten the screw. Align the collet set screw as shown. Do not let the collet screw touch metal parts, such as the emission block or PMT bracket (dual wavelength detector).



- 8 Replace the FPD cover. (See [“To Install the FPD⁺ Cover”](#) on page 115.)
- 9 Restore the analytical method.
- 10 Wait 20 min. for the detector to heat up, then ignite the flame.
- 11 Reset the EMF counter. See [To Reset an EMF Counter](#) in the *Operation Manual*.

To Install the FPD⁺ Cover

- 1 Gather the following:
 - T-20 Torx screwdriver
- 2 Install the cover.

Single-wavelength detector:

 - a Start the two screws on the right side of the cover.
 - b Start and tighten the screws at the base on the left side.
 - c Tighten the screws on the right side.
- 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.)



8 Maintaining the ECD

Important Safety Information About the ECD	118
Consumables and Parts for the ECD	121
Exploded Parts View of the ECD	122
To Bakeout the ECD	123

This section describes the routine maintenance tasks for the Electron Capture Detector (ECD). For important regulatory and safety information for this detector, refer to the general information booklet and CD provided with the detector.



Important Safety Information About the ECD

The ECD contains a cell plated with ^{63}Ni , a radioactive isotope. The beta particles released at the energy level in the detector have little penetrating power—the surface layer of the skin or a few sheets of paper will stop most of them—but they may be hazardous if the isotope is ingested or inhaled. For this reason, handle the cell with care. Cap the detector inlet and outlet fittings when the detector is not in use. Never introduce corrosive chemicals into the detector. Vent detector exhaust outside the laboratory environment.

Refer to the safety documentation provided with the detector for important details about safety, maintenance, and compliance with local government regulation.

WARNING

Materials that may react with the ^{63}Ni source, either to form volatile products or to cause physical degradation of the plated film, must be avoided. These materials include oxidizing compounds, acids, wet halogens, wet nitric acid, ammonium hydroxide, hydrogen sulfide, PCBs, and carbon monoxide. This list is not exhaustive but indicates the kinds of compounds that may cause damage to ^{63}Ni detectors.

WARNING

In the extremely unlikely event that both the oven and the detector-heated zone should go into thermal runaway (maximum, uncontrolled heating in excess of 400 °C) at the same time and the detector remains exposed to this condition for more than 12 hours, take the following steps:

- 1 After turning off the main power and allowing the instrument to cool, cap the detector inlet and exhaust vent openings. Wear disposable plastic gloves and observe normal laboratory safety precautions.**
- 2 Return the cell for disposal, following directions included with the License Verification Form (part number 19233-90750).**
- 3 Include a letter stating the condition of abuse.**

It is unlikely, even in this very unusual situation, that radioactive material will escape the cell. However, permanent damage to the ^{63}Ni plating within the cell is possible; therefore, the cell must be returned for exchange.

WARNING

Do not use solvents to clean the ECD.

WARNING

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

When handling ECDs:

- Never eat, drink, or smoke.
- Always wear safety glasses when working with or near open ECDs.
- Wear protective clothing such as laboratory jackets, safety glasses, and gloves, and follow good laboratory practices. Wash hands thoroughly with a mild nonabrasive cleaner after handling ECDs.
- Cap the inlet and outlet fittings when the ECD is not in use.
- Connect the ECD exhaust vent to a fume hood or vent it to the outside. See the latest revision of 10 CFR Part 20 (including Appendix B), or the applicable state regulation. For other countries, consult with the appropriate agency for equivalent requirements.

Agilent Technologies recommends a vent line internal diameter of 6 mm (1/4-inch) or greater. With a line of this diameter, the length is not critical.

WARNING

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

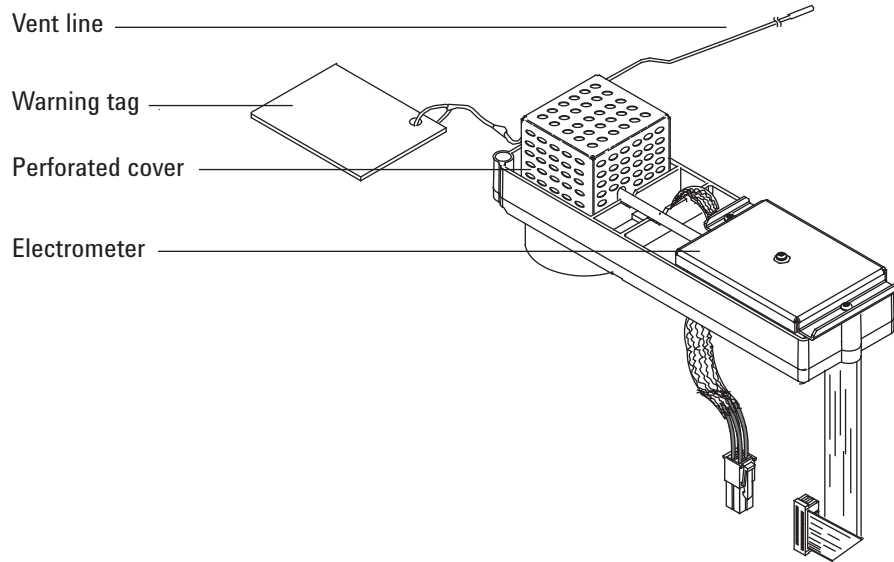
Consumables and Parts for the ECD

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

Table 12 ECD consumables and parts

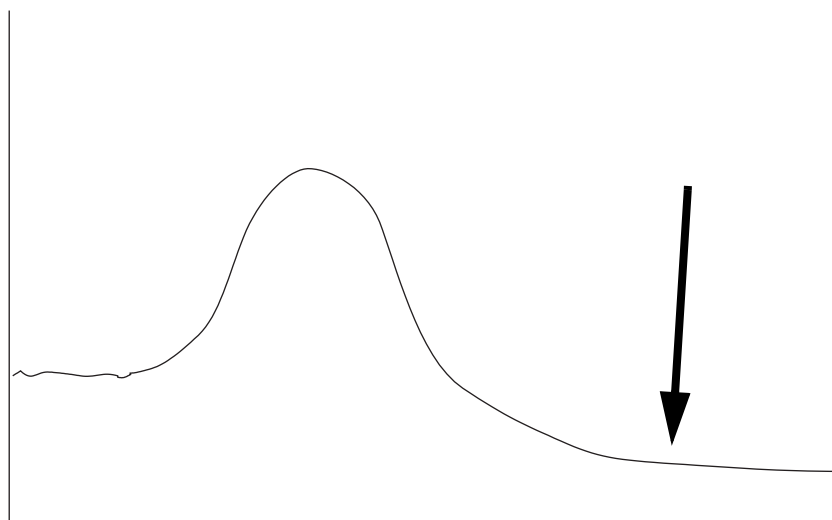
Description	Part number/quantity
ECD wipe test kit	18713-60050

Exploded Parts View of the ECD



To Bakeout the ECD

- 1 With the detector oven at normal operating temperatures, show the detector output. Note the value of the **Output** for later comparison.
- 2 Set the ECD temperature to 350 to 375 °C, the makeup gas flow to 60 mL/min, and the oven temperature to 250 °C. If the column is uninstalled, leave the oven off to protect the column.
- 3 Set the oven temperature to 250 °C or 25 °C above the normal maximum operating temperature. Do not exceed the column's temperature limit.
- 4 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.



- 5 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.
- 6 Restore the analytical method.



9 Maintaining the NPD

- Consumables and Parts for the NPD 126
- Exploded Parts View of the NPD 127
- To Replace the NPD Bead Assembly 128
- To Maintain the NPD Collector, Ceramic Insulators, and Jet 134
- To Check the NPD Leakage Current 140
- To Bakeout the NPD 141



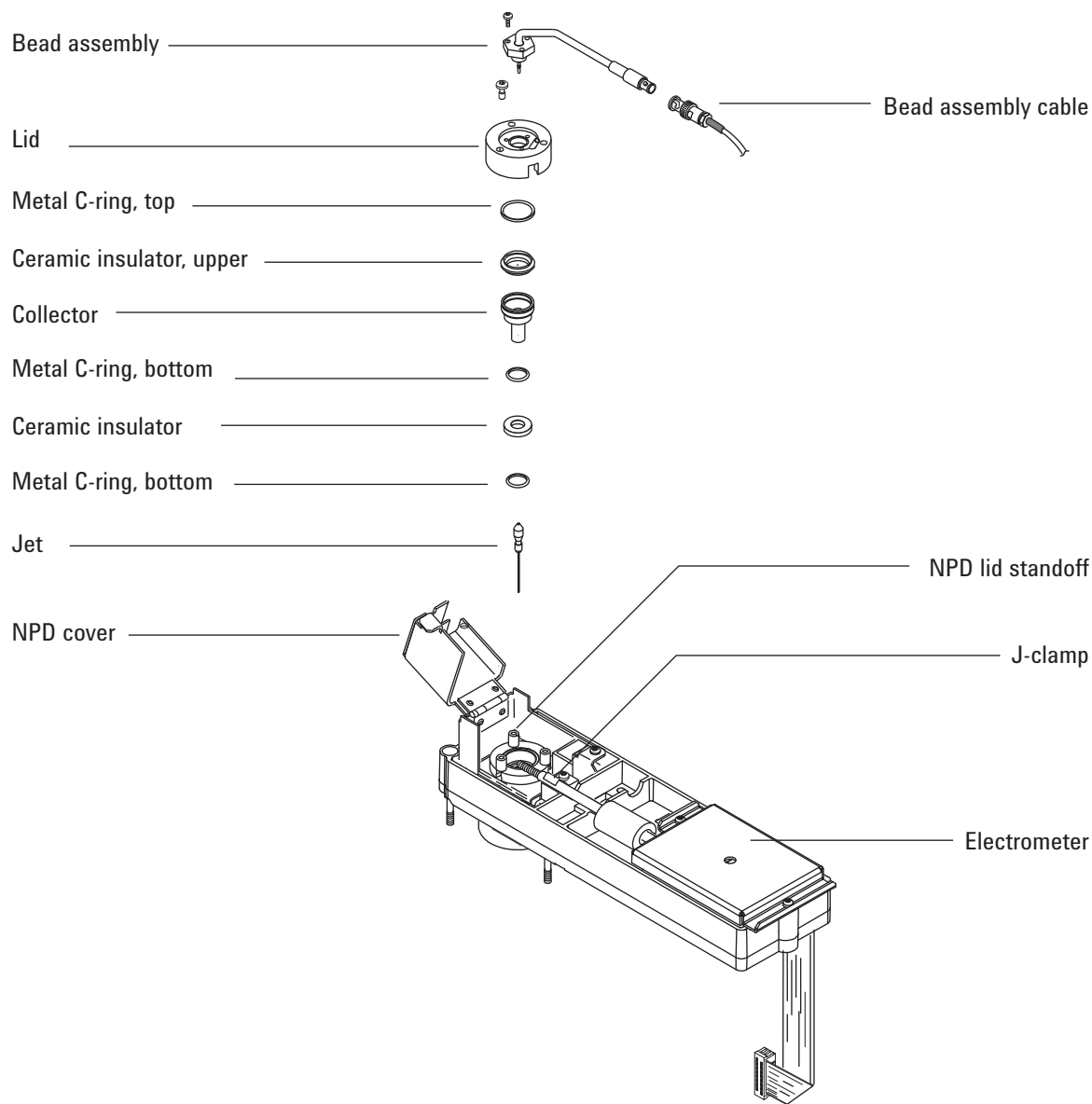
Consumables and Parts for the NPD

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

Table 13 NPD parts

Description	Part number/quantity
Collector	G1534-20530
Screw, M3 × 0.5 × 8 mm	0515-0655
NPD white ceramic bead assembly	G1534-60570
NPD black ceramic bead assembly	5183-2007
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"> • Metal C-rings, top and bottom • Ceramic insulators, upper and lower 	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

Exploded Parts View of the NPD



To Replace the NPD Bead Assembly

- 1 Gather the following:
 - Replacement NPD bead assembly. (See “[Consumables and Parts for the NPD](#)” on page 126.)
 - Lint-free gloves
 - T-10 Torx screwdriver
- 2 Prepare for maintenance. **Maintenance > Instrument > Perform Maintenance > Maintenance Standby Mode > Start Maintenance.** Wait for the GC to become ready.

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 Set the NPD bead voltage to **0.0**, then turn it off. (Setting the bead voltage to zero first makes sure that when you turn the bead back on, the voltage is safe. Otherwise, turning off the bead voltage will save a high setpoint that can damage a new bead.)

Agilent data system users: After setting the bead voltage to 0.0, save the data system method and shut down the instrument session. (Note that in some data system versions, you may need to use the touch screen to set the voltage. To do this, the keypad must be unlocked and you must close the GC parameters screen of the data system. Upload the revised setting, then save the method and shut down the instrument session.)

- 4 Set **Adjust Offset** to **Off**.
- 5 Cool the detector to 60 °C or lower. Leave all gas flows on. To cool the detector faster, raise the GC detector cover and open the hinged NPD cover.
- 6 Remove the GC detector top cover.

WARNING

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

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

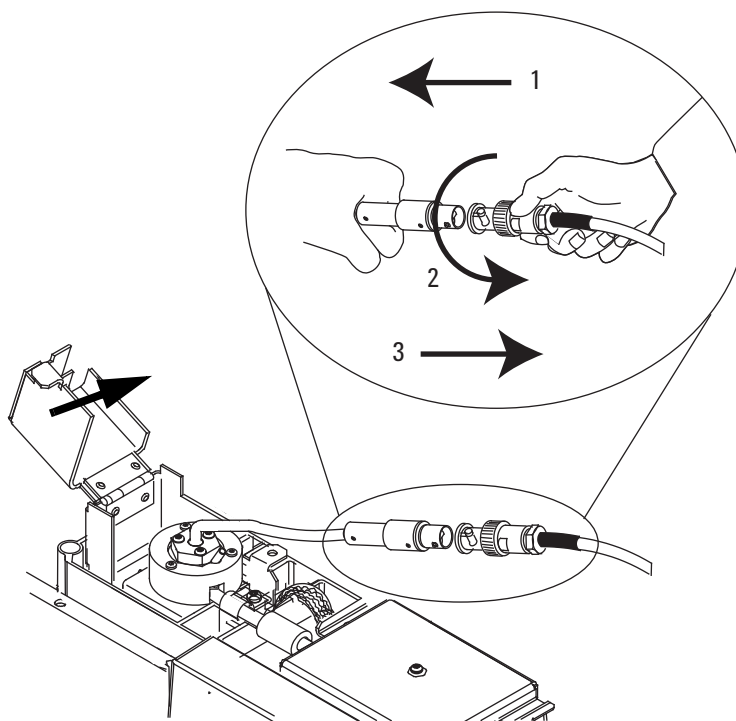
WARNING

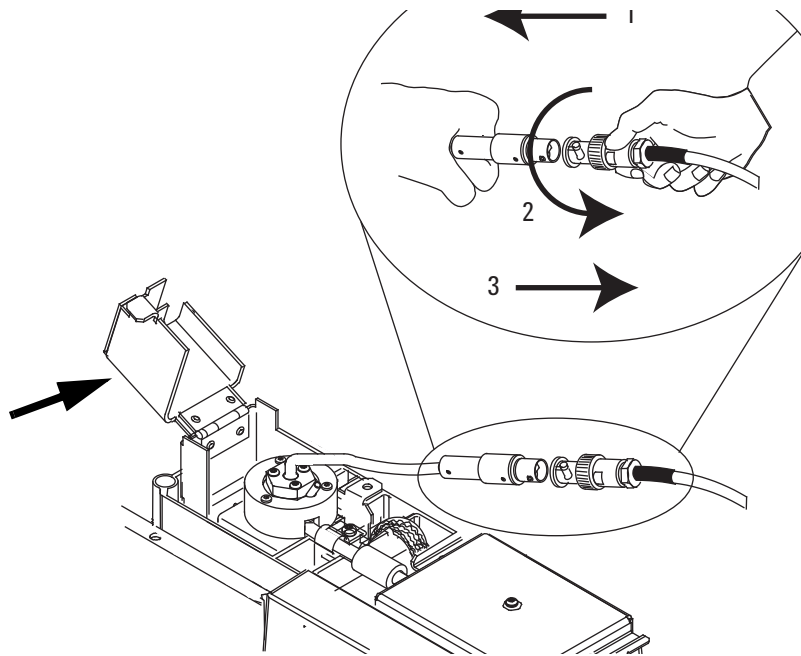
Be careful! The detector fittings may be hot enough to cause burns.

CAUTION

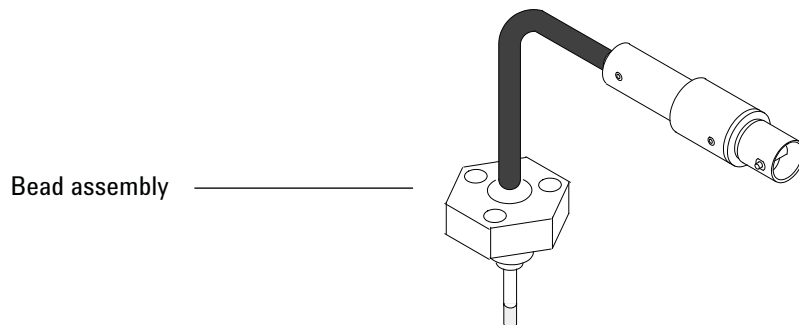
Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.

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

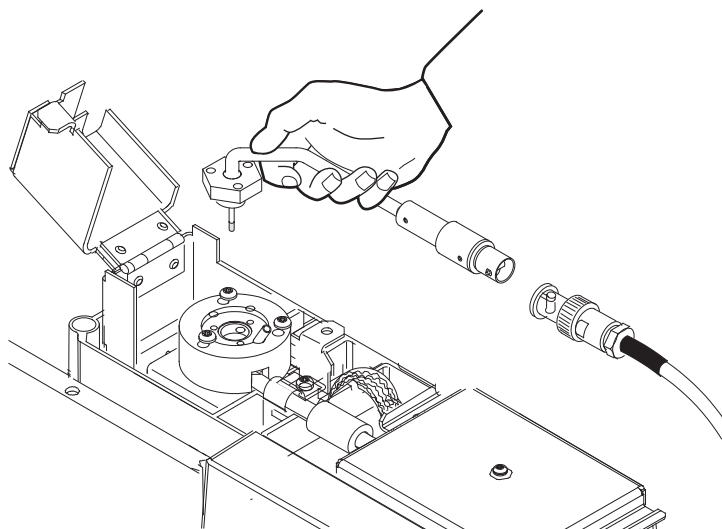




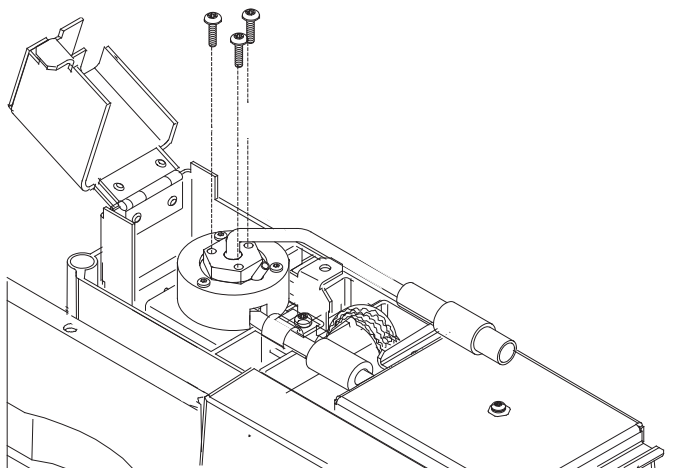
9 Remove the 3 T-10 Torx screws from the bead assembly.



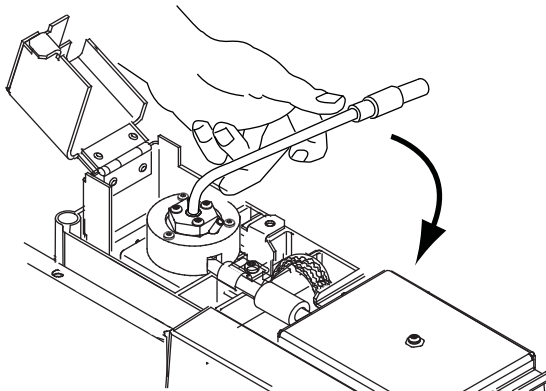
10 Gently lift up and remove the old bead assembly. Avoid bumping the bead on the sides of the collector.



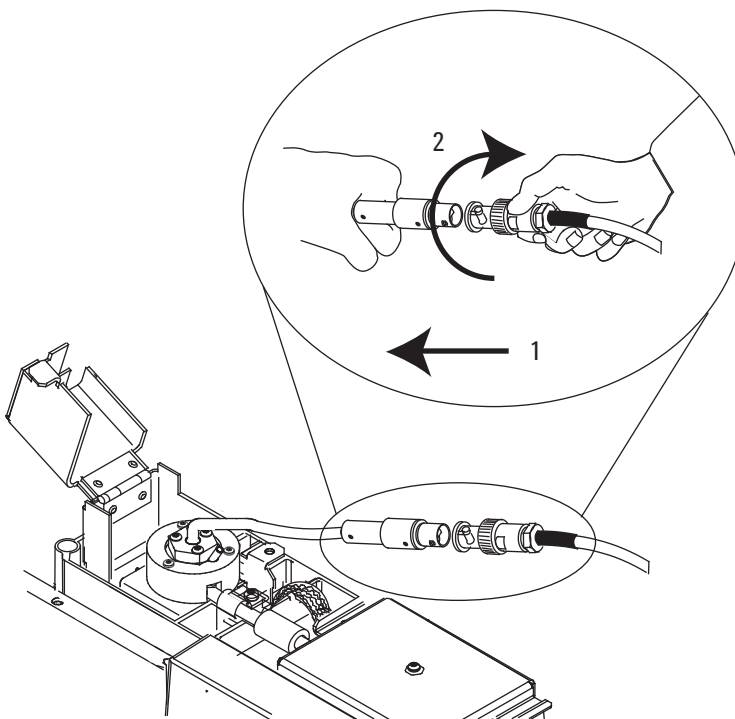
- 11** Remove the protective cap covering the new bead.
- 12** Mount the new bead assembly on the NPD lid. Be careful not to bump the bead on the sides of the lid or collector.
- 13** Replace the screws. Finger-tighten the first screw; tighten the remaining screws normally and then completely tighten the first screw. Do not overtighten the screws.



- 14** Carefully bend the bead assembly cable 90 °.



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



16 Close the NPD cover, install the GC detector top cover, and install the electronics top cover. All covers must be closed to get a stable NPD baseline.

17 Configure the new bead.

- Set the bead type.
- Review the **Maximum Bead Voltage** setting and adjust, if necessary.

- Review the **Dry Bead** and **Auto Adjust Bead** settings.
- 18 Restore normal NPD operating gas flows.
 - 19 With all gases on, heat the detector to 150 °C and hold for about 15 minutes, then increase the temperature to 250 °C and hold for 15 minutes.
 - 20 Increase the temperature to operating value (310 to 320 °C recommended). Allow 15 minutes for equilibration.
 - 21 Check the NPD leakage current. (See [“To Check the NPD Leakage Current”](#) on page 140.) 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 Bloss beads, and 30 pA for white or black beads. For white and black beads, an offset of 25 to 30 pA is sufficient for most applications. The bead life may be shortened at a higher offset.
 - 25 Reset the bead counter. See [To Reset an EMF Counter](#) in the *Operation Manual*.

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 126.)
 - 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 Set the bead voltage to **0.0** and **Adjust Offset** to **Off**.
- 3 Check and note the NPD leakage current for reference. (See [“To Check the NPD Leakage Current”](#) on page 140.)

- 4 Prepare for maintenance. **Maintenance > Instrument > Perform Maintenance > Maintenance Standby Mode > Start Maintenance.** Wait for the GC to become ready.

WARNING

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

- 5 Remove the bead. (See [“To Replace the NPD Bead Assembly”](#) on page 128.)

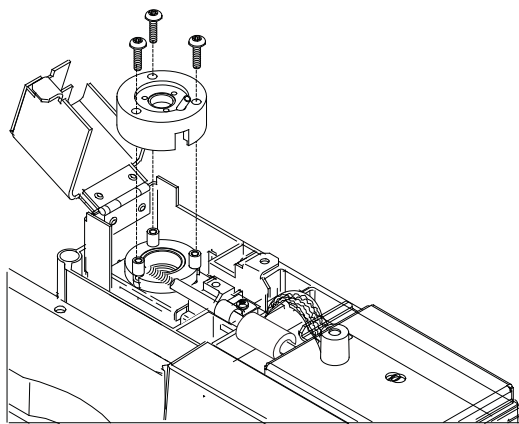
CAUTION

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

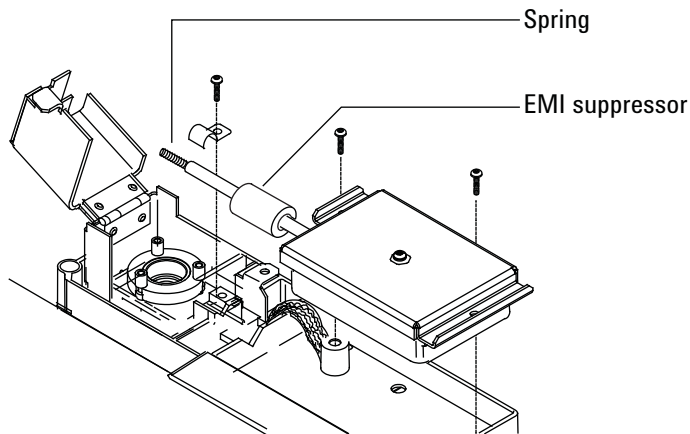
CAUTION

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

- 6 Remove the screws that secure the lid, and remove it. The top metal C-ring and upper ceramic insulator may be attached to the lid.



- 7 Remove the screws that secure the electrometer and the interconnect.



- 8 Pull the electrometer away from the detector to free the interconnect. Turn the electrometer to the right to obtain working space. Be careful not to touch or bend the spring. Be careful not to lose the EMI suppressor.
- 9 Remove the large metal C-ring and the upper ceramic insulator if they were not attached to the lid.
- 10 Remove the collector. If the detector is operated at high temperatures, the collector parts may stick inside the detector. Gently push and wiggle them to break the seal.

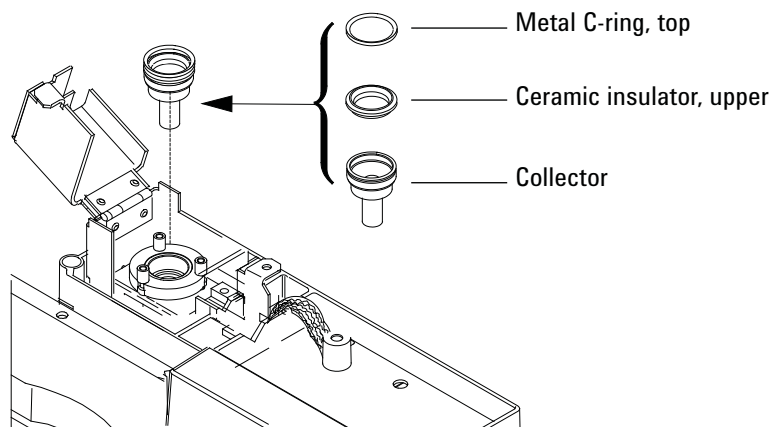


Figure 7 NPD collector, upper insulator, and metal C-ring

- 11 Use tweezers to remove the lower ceramic insulator and the two small metal C-rings located above and below the collector. If these parts are stuck together, do not separate them. If they are not stuck, remember which metal ring was on top of the insulator and which was below it. The pieces must be reassembled in the same orientation.

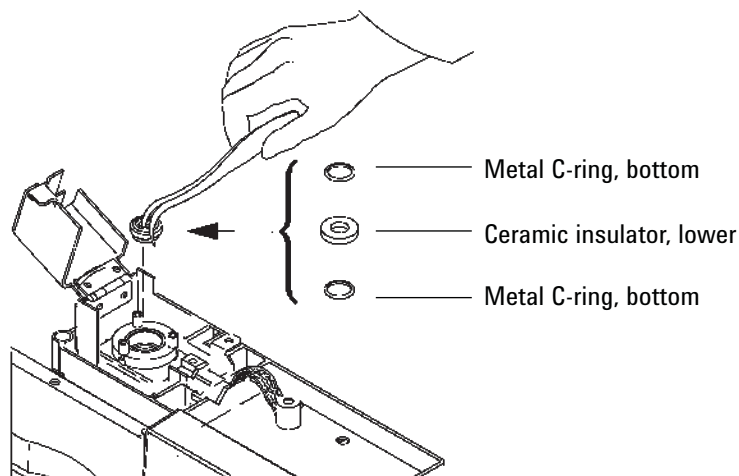
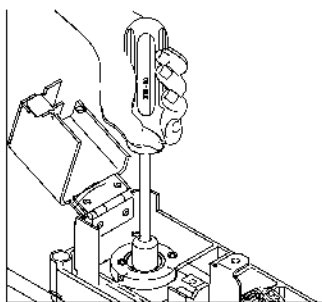


Figure 8 NPD lower ceramic insulator and metal C-rings

12 If not replacing the jet, skip to [step 17](#).

13 Loosen the jet with a nut driver.



14 Pull the jet straight out of the detector. Use tweezers, if necessary.

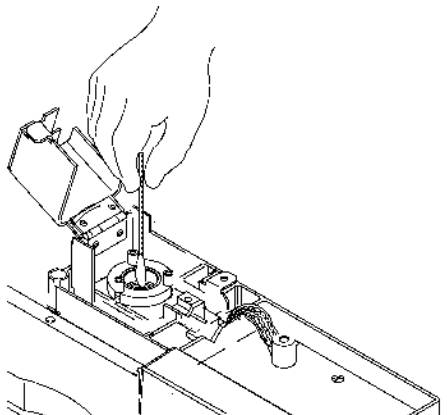
CAUTION

The adaptable NPD jet is longer than the capillary optimized NPD extended jet and should never be installed in a capillary optimized detector.

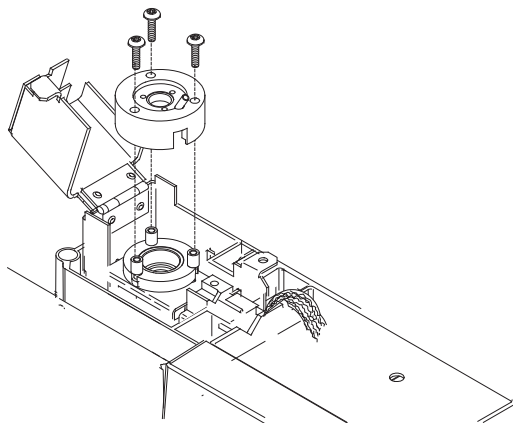
15 Place the new jet in the detector body.

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

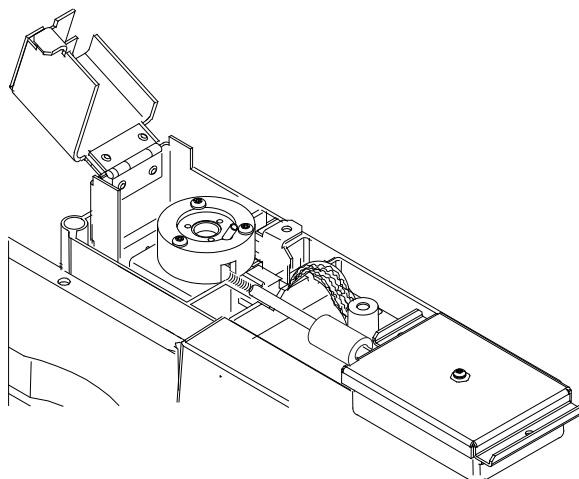
17 Use a cotton swab wetted with solvent to clean the residue from the inside of the collector and around the jet. If the collector appears very dirty, replace it with a new one.



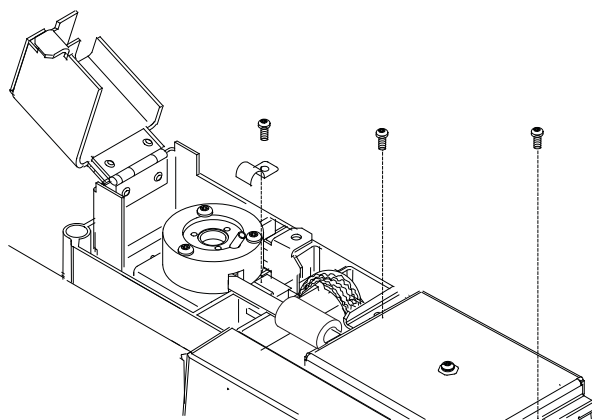
- 18 Install the bottom metal C-ring, the lower ceramic insulator, and the top metal C-ring. See [Figure 7](#).
- 19 Install the collector.
- 20 Install the upper ceramic insulator and top metal C-ring above the collector. See [Figure 8](#).
- 21 Install the lid, making sure that the NPD lid standoffs 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.



- 22 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.



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



- 24** Install the bead assembly and restore normal operating conditions. (See [“To Replace the NPD Bead Assembly”](#) on page 128.) (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 140.) 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.

- 25** Reset the EMF counters. See [To Reset an EMF Counter](#) in the *Operation Manual*.

To Check the NPD Leakage Current

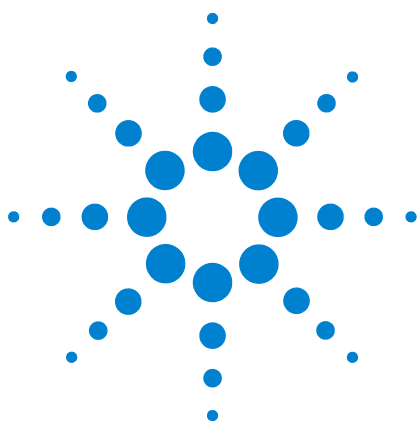
- 1 Load the analytical method.
- 2 Set the **NPD Adjust Offset** to **Off** and the **Bead Voltage** to **0.00 V**.
 - Leave the NPD at operating temperature
 - Leave flows on or off
- 3 Show the detector output signal in **Status**.
- 4 Verify that the output (leakage current) is stable and < 2.0 pA.

The output should slowly drop towards 0.0 pA, and should stabilize in the *tenths* of a picoamp. Current > 2.0pA indicates a problem.

To Bakeout the NPD

- 1 Set the bead voltage to 0, then turn it Off.
- 2 Set normal operating flows.
- 3 Set the detector temperature at 25 °C above the typical method setpoint temperature.
- 4 Set the oven temperature to 250 °C or 25 °C above the normal maximum operating temperature. Do not exceed the column's temperature limit.
- 5 Hold at temperature for 15 to 30 minutes.
- 6 Restore the analytical method and allow the NPD to equilibrate at operating temperatures and flows for 10 to 30 minutes.
- 7 Check the NPD leakage current. See [“To Check the NPD Leakage Current”](#) on page 140.
- 8 Start the NPD bead Auto Adjust process.

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



A Swagelok Connections

Making Swagelok Connections 144

Using a Swagelok Tee 148

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



Making Swagelok Connections

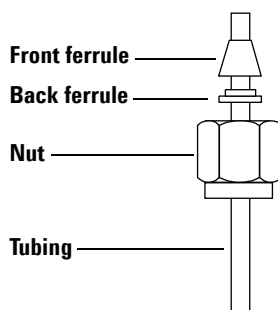
Objective

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 9](#).



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

Figure 9 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 ([Figure 10](#)).
- 4 Make sure that the front ferrule is touching the plug. Slide the Swagelok nut over the ferrule and thread it onto the plug.

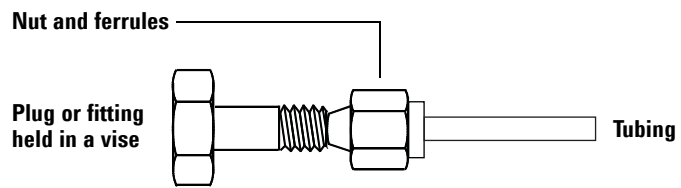


Figure 10 Assembling the fitting

- 5 Push the tube fully into the plug, then withdraw it approximately 1 to 2 mm ([Figure 11](#)).

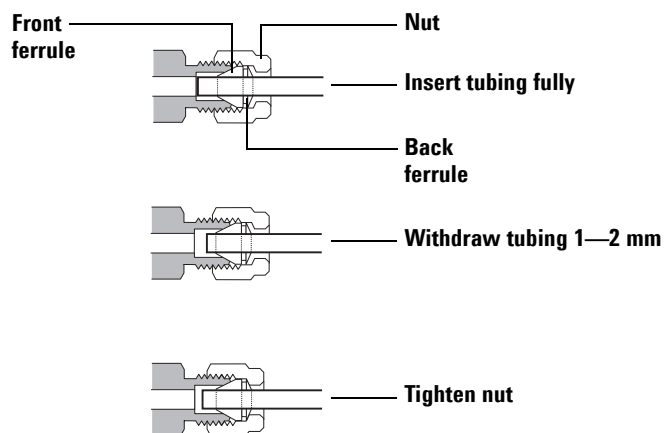


Figure 11 Insert the tubing

- 6 Finger-tighten the nut.
- 7 Mark the nut with a pencil line ([Figure 12](#)).

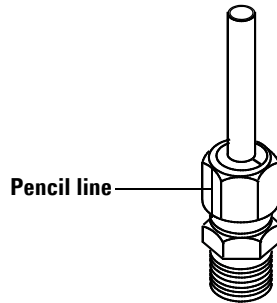


Figure 12 Marking the fitting

- 8** For 1/8-inch Swagelok fittings, use a pair of 7/16-inch wrenches to tighten the fitting 3/4 of a turn (Figure 13). For 1/4-inch fittings, use a pair of 9/16-inch wrenches to tighten them 1-1/4 turn (Figure 13).

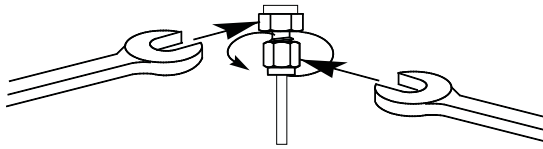


Figure 13 Final tightening

- 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 14. 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.

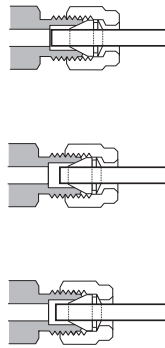


Figure 14 Completed fitting

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 15](#).

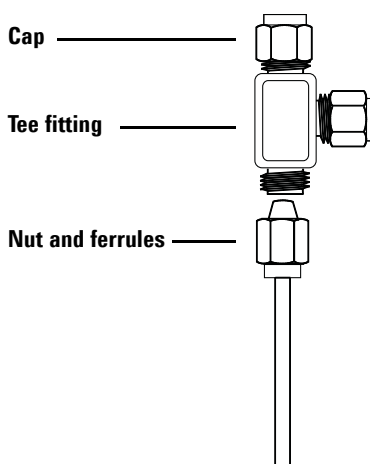


Figure 15 Swagelok tee

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

