Agilent 5977C MSD for OpenLab CDS

Operating Manual

Notices

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Agilent Technologies, Inc.
5301 Stevens Creek Boulevard
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Safety Notices

CAUTION

A CAUTION notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a CAUTION notice until the indicated conditions are fully understood and met.

WARNING

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

About This Manual

This manual contains information for operating and maintaining the Agilent 5975 through 5977 series of MSD with OpenLab CDS software. The Agilent 5977C Series Mass Selective Detector (MSD) is the base instrument described in this manual. Agilent instruments manufactured prior to the 5977C share many features and hardware with this new instrument. Please refer to the operating and maintenance documentation that was delivered with your instrument if other hardware differences are found.

1 "Introduction"

Chapter 1 describes general information about the 5977C Series MSDs, including a hardware description, general safety warnings, and hydrogen safety information.

2 "Installing 8890 GC Columns"

Chapter 2 shows you how to prepare a capillary column for use with the MSD, install it in the GC oven, and connect it to the MSD using the GC/MSD interface.

3 "Installing Intuvo 9000 GC Columns"

Chapter 3 shows you how to install an Agilent Intuvo column, connect the flow path from the inlet through the guard chip, bus components, and column to the MS Tail assembly, and maintain the column guard chip.

4 "Operating in EI Mode"

Chapter 5 describes basic tasks such as setting temperatures, monitoring pressures, tuning, venting, and pumpdown. Much of the information in this chapter also applies to CI operation.

5 "Operating in CI Mode"

Chapter 6 describes additional tasks necessary to operate in CI mode.

6 "General Maintenance"

Chapter 7 describes maintenance procedures common to both EI and CI instruments.

7 "CI Maintenance"

Chapter 8 describes maintenance procedures unique to CI MSDs.

Where to Find More Information

5977C

Accompanying your hardware and software is a comprehensive collection of manuals, videos, user applications, and method development tools.

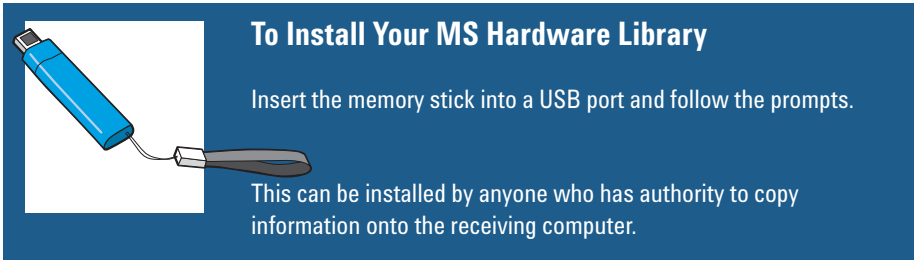
To access your GC Hardware Library,

1 Open a browser on a computer or other device that shares the same gateway as the GC.

2 Enter this URL `http://xxx.xxx.xxx.xxx/info`, where `xxx.xxx.xxx.xxx` is the IP address or host name of the GC. For example, Enter `http://10.1.1.101/info`.

3 When the **GC Help & Information Home** screen opens, select **Knowledgebase**, then scroll down and select **User Manual PDFs**.

4 Select a GC manual from the **PDF User Manuals** screen.



See the Agilent 5977C CG/MS with OpenLab CDS Quick Start document for information on finding and installing the documentation located on these USBs.

597x Series MSD prior to the 5977C MSD

Users of Agilent MSD instruments manufactured prior to the 5977C should refer to the documentation delivered to them when their MSD was purchased. The information in this manual is intended to supplement that documentation. Information included here will help you more effectively use the OpenLab CDS operating system with your instruments. Additionally, there is extensive online Help and Learning material provided with OpenLab.

Contents

1 Introduction

This chapter describes general information about the MSD, including a hardware description, general safety warnings, and hydrogen safety information.

If you are using the *Agilent Intuvo 9000 Gas Chromatograph* with your MSD, Chemical Ionization (CI) is not currently supported.

5977C Series MSD Version

The 5977C Series MSDs are equipped with a turbomolecular (turbo) pump and a choice of three foreline pumps (Pfeiffer Duo, Pfeiffer MVP-070-3x, Agilent IDP-3 24V) or a diffusion pump paired with a Pfeiffer Duo foreline pump. There are three types of electron ionization (EI) sources available on the 5977C Series MSD, a standard EI stainless steel (SS) source, an EI Extractor (XTR) source available on the Inert+ MSD model, and a high efficiency source (HES). The optional 5977C chemical ionization (CI) system includes a positive chemical ionization/negative chemical ionization (PCI/NCI) ion source, reagent gas flow control system, CI calibration system, and other required hardware features. The serial number label displays a product number that indicates what type of MSD you have. (See **Table 1**.)

Table 1 Available MSD models

Model name	Product number	Description	Ionization mode/Type
5977C MSD Diff Pump	G7080B	Diffusion pump	EI/SS
5977C MSD Turbo Pump	G7081B	Turbo pump	EI/SS
5977C Inert+ MSD EI Turbo	G7077B	Turbo pump	EI/XTR
5977C EI/CI MSD	G7078B	Turbo pump	EI/XTR CI (PCI/NCI)
5977C HES MSD	G7079B	Turbo pump	EI HES field upgradeable to CI

Abbreviations Used

The abbreviations in Table 2 are used in discussing this product. They are collected here for convenience.

Table 2 Abbreviations

Abbreviation	Definition
AC	Alternating current
ALS	Automatic liquid sampler
BFB	Bromofluorobenzene (calibrant)
CI	Chemical ionization
DA	Data analysis
DC	Direct current
DFTPP	Decafluorotriphenylphosphine (calibrant)
Diff	Diffusion
DIP	Direct insertion probe
DS	Data System
EI	Electron ionization
EM	Electron multiplier (detector)
EMV	Electron multiplier voltage
EPC	Electronic pneumatic control
eV	Electron volt
GC	Gas chromatograph
HED	High-energy dynode (refers to detector and its power supply)
HES	High Efficiency Source. New generation EI source constructed from inert material
Inert	Standard EI source constructed from inert materials
Inert+	MSD model designation equipped with an EI XTR source
id	Inside diameter
LAN	Local Area Network
LVDS	Low-voltage differential signaling

Table 2 Abbreviations (continued)

Abbreviation	Definition
m/z	Mass-to-charge ratio
MFC	Mass flow controller
MSD	Mass selective detector
NCI	Negative CI
OFN	Octafluoronaphthalene (calibrant)
PCI	Positive CI
PFDTD	Perfluoro-5,8-dimethyl-3,6,9-trioxydodecane (calibrant)
PFHT	2,4,6-tris(perfluoroheptyl)-1,3,5-triazine (calibrant)
PFTBA	Perfluorotributylamine (calibrant)
Quad	Quadrupole mass filter
RF	Radio frequency
RFPA	Radio frequency power amplifier
SS	Stainless steel
Torr	Unit of pressure, 1 mm Hg
Turbo	Turbomolecular (pump)
WUI	Web user interface
XTR	EI Extractor source

The 5977C Series MSD

The 5977C Series MSD is a single-quadrupole GC/MS system for use with Agilent 8890 and 9000 GCs. The MSD features (See **Table 3** on page 17):

- An optional JetClean system for cleaning the ion source in place under vacuum
- WEB User Interface (WUI) for locally monitoring and operating the MSD
- A turbo vacuum pump with one of three different foreline pumps (Pfeiffer Duo, Pfeiffer MVP-070-3x, Agilent IDP-3 24V) or a diffusion vacuum pump with a Pfeiffer Duo foreline pump
- Five different types of ion sources available:
  - Standard source in SS material
  - Standard source in Inert material
  - XTR source
  - HES
  - CI (PCI/NCI) source
- Turbo pump-equipped 5977C models, when used with an 8890 GC, are field upgradeable to CI (PCI/NCI) modes. The upgrade adds a CI source, CI source radiator for HES systems, CI flow module with an MFC, plumbing, and CI tuning calibration.
- Independently MSD-heated hyperbolic quadrupole mass filter
- Independently MSD-heated ion source
- HED EM
- Independently GC-heated GC/MSD interface

Physical description

The 5977C Series MSD housing is approximately 41 cm high, 30 cm wide, and 54 cm deep. The weight is 39 kg for the diffusion pump mainframe, 44 kg for the standard EI turbo pump mainframe, and 46 kg for the EI/CI turbo pump mainframe. The foreline (roughing) pump weighs an additional 11 kg (standard pump), and is usually located on the floor behind the MSD.

The basic components of the instrument are:

- Frame/cover assemblies
- Vacuum system

- GC/MSD interface
- Electronics
- Analyzer

Vacuum gauge

The MSD may be equipped (or ordered) with an ion vacuum gauge. The OpenLab CDS Acquisition software can be used to read the pressure (high vacuum) in the vacuum manifold. Operation of the gauge controller is described in this manual. The gauge is ***required*** for CI operation.

Table 3 5977C Series MSD features

Feature		
High vacuum pump	Diffusion	Turbo
Optimal He column flow mL/min	1	1 to 2
Maximum recommended gas flow mL/min*	1.5	4
Maximum gas flow, mL/min†	2	6.5
Max column id	0.25 mm (30 m)	0.53 mm (30 m)
CI capability‡	No	Yes
Inert ion sources available	Yes	Yes
GC compatibility	9000 and 8890	9000 and 8890
Foreline pumps available	Pfeiffer Duo	Pfeiffer Duo, Pfeiffer MVP-070-3x, Agilent IDP-3 24V
DIP** capability (3rd party)	Yes	Yes

* Total gas flow into the MSD: column flow plus reagent gas flow (if applicable). Based on helium gas use. For other gases the maximum flow will vary.

† Expect degradation of spectral performance and sensitivity.

‡ Turbo pump models are field upgradeable to CI.

** Direct insertion probe.

MSD Hardware Description

The Agilent 5977C MSD can be paired with one of several Agilent GCs (See Figure 1).

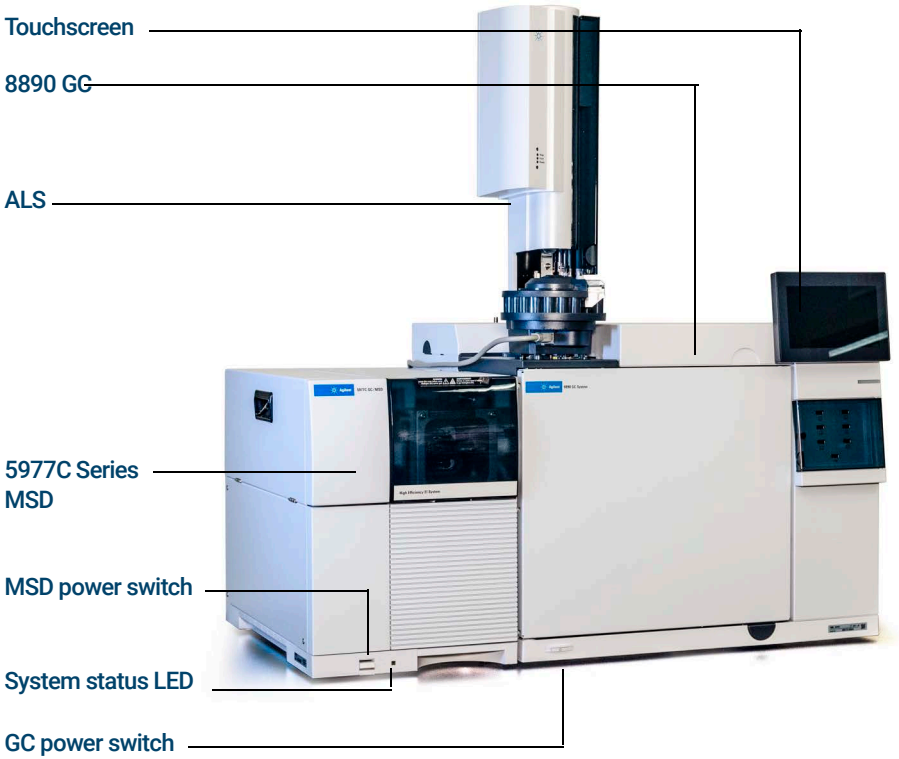


Figure 1. 5977C Series GC/MSD system, shown with an Agilent 8890 GC

In this manual, the term "CI MSD" refers to the G7078B MSD or to the G7077B, G7079B, and G7081B models that were field upgraded for CI operation. It also applies, unless otherwise specified, to the flow modules for these instruments.

The CI hardware upgrade allows the MSD to produce high-quality, classical CI spectra, which include molecular adduct ions. A variety of reagent gases can be used. (See Chapter 5, "Operating in CI Mode"" on page 119.)

The 5977C Series CI system field upgrade adds the following to the 5977C Series MSD:

- EI/CI GC/MSD interface
- JetClean option that shares the same MFC system EI/CI GC/MSD interface
- CI source with the new common interface tip seal that can also be used with an EI XTR source or HES
- Reagent gas MFC
- Bipolar HED power supply for PCI and NCI operation

A methane/isobutane gas purifier is provided and is ***required***. It removes oxygen, water, hydrocarbons, and sulfur compounds.

A high vacuum gauge controller (G3397B) is integrated in the system. Its use is ***required*** for CI, and it is recommended for EI also.

The CI system has been optimized to achieve the relatively high CI source pressure required for CI while still maintaining high vacuum in the quadrupole and detector. Special seals along the flow path of the reagent gas and very small openings in the ion source keep the source gases in the ionization volume long enough for the appropriate reactions to occur.

The CI interface has special plumbing for reagent gas. A spring-loaded tip seal fits onto the ion source end of the GC/MSD interface.

Switching back and forth between CI and EI sources takes less than an hour, however, a 1- to 2-hour wait is required to purge the reagent gas lines and bake out water and other contaminants.

Important Safety Warnings

There are several important safety notices to always keep in mind when using the MSD.

Many internal parts of the MSD carry dangerous voltages

If the MSD is connected to a power source, even if the power switch is off, potentially dangerous voltages exist on:

- The wiring between the MSD power cord and the AC power supply
- The AC power supply itself
- The wiring from the AC power supply to the power switch

With the power switch on, potentially dangerous voltages also exist on:

- All electronics boards in the instrument
- The internal wires and cables connected to these boards
- The wires for any heater (oven, detector, inlet, or valve box)

WARNING **All these parts are shielded by covers. With the covers in place, it should be difficult to accidentally make contact with dangerous voltages. Unless specifically instructed to, never remove a cover unless the detector, inlet, or oven are turned off.**

WARNING **If the power cord insulation is frayed or worn, the cord must be replaced. Contact your Agilent service representative.**

If one of the primary fuses has failed, the MSD will already be off, but for safety, switch off the MSD and unplug the power cord. It is not necessary to allow air into the analyzer chamber.

WARNING **Never replace the primary fuses while the MSD is connected to a power source.**

Electrostatic discharge is a threat to MSD electronics

The printed circuit boards in the MSD can be damaged by electrostatic discharge. Do not touch any of the boards unless it is absolutely necessary. If you must handle them, wear a grounded wrist strap, and take other antistatic precautions.

Many parts are dangerously hot

Many parts of the GC/MSD operate at temperatures high enough to cause serious burns. These parts include but are not limited to:

- GC inlets
- GC oven and its contents including the column nuts attaching the column to a GC inlet, GC/MSD interface, or GC detector
- GC detector
- GC valve box
- Foreline pump
- Diffusion pump
- Heated MSD ion source, GC/MSD interface, and quadrupole

Always cool these areas of the system to room temperature before working on them. They will cool faster if you first set the temperature of the heated zone to room temperature. Turn the zone off after it has reached the setpoint. If you must perform maintenance on hot parts, use a wrench and wear gloves. Whenever possible, cool the part of the instrument that you will be maintaining before you begin working on it.

WARNING **Be careful when working behind the instrument. During cool-down cycles, the GC emits hot exhaust which can cause burns.**

WARNING The insulation around the GC 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 the insulation in a sealed plastic bag
- Wash your hands with mild soap and cold water after handling the insulation

The oil pan under the foreline pump can be a fire hazard

Oily rags, paper towels, and similar absorbents in the oil pan could ignite and damage the pump and other parts of the MSD.

WARNING Combustible materials (or flammable/nonflammable wicking material) placed under, over, or around the foreline (roughing) pump constitutes a fire hazard. Keep the pan clean, and do not leave absorbent material such as paper towels in it.

Hydrogen Safety

WARNING **The use of hydrogen (H_2) as a GC carrier gas, detector fuel gas, or in the optional JetClean system, is potentially dangerous.**

WARNING **When using hydrogen (H_2) as the carrier gas or fuel gas, be aware that hydrogen can flow into the GC oven and create an explosion hazard. Therefore, ensure that the supply is turned off until all connections are made and that the inlet and detector column fittings are either connected to a column or capped when hydrogen is supplied to the instrument.**

Hydrogen is flammable. Leaks, when confined in an enclosed space, may create a fire or explosion hazard. In any application using hydrogen, leak test all connections, lines, and valves before operating the instrument. Always turn off the hydrogen supply at its source before working on the instrument.

Hydrogen is a commonly used GC carrier gas, detector fuel gas, and reactive cleaning gas for the optional JetClean system. Hydrogen is potentially explosive and has other dangerous characteristics:

- Hydrogen is combustible over a wide range of concentrations. At atmospheric pressure, hydrogen is combustible at concentrations from 4% to 74.2% by volume.
- Hydrogen has the highest burning velocity of any gas.
- Hydrogen has a very low ignition energy.
- Hydrogen that is allowed to expand rapidly from high pressure can self-ignite.
- Hydrogen burns with a nonluminous flame which can be invisible under bright light.

GC precautions

When using hydrogen as a carrier gas, remove the large round plastic cover for the GC/MSD interface located on the GC left side panel. In the unlikely event of an explosion, this cover may dislodge.

Dangers unique to GC/MSD operation

Hydrogen presents a number of dangers. Some are general, others are unique to GC or GC/MSD operation. Dangers include, but are not limited to:

- Combustion of leaking hydrogen
- Combustion due to rapid expansion of hydrogen from a high-pressure cylinder
- Accumulation of hydrogen in the GC oven and subsequent combustion (see your GC documentation and the label on the top edge of the GC oven door)
- Accumulation of hydrogen in the MSD and subsequent combustion

Hydrogen accumulation in an MSD

WARNING **The MSD cannot detect leaks in inlet or detector gas streams. For this reason, it is vital that column fittings should always be either connected to a column or have a cap or plug installed.**

WARNING **The MSD cannot detect leaks in the valves for the optional JetClean system. It is possible that hydrogen can leak into the MSD from this cleaning system. Always turn off the JetClean system, close the manual hydrogen shutoff valve to the JetClean MFC, and ensure good vacuum before venting the MSD.**

All users should be aware of the mechanisms by which hydrogen can accumulate and know what precautions to take if they know or suspect that hydrogen has accumulated. (See Table 4.) Note that these mechanisms apply to *all* mass spectrometers, including the MSD.

Table 4 Hydrogen accumulation mechanisms

Mechanism	Results
Mass spectrometer turned off	A mass spectrometer can be shut down deliberately. It can also be shut down accidentally by an internal or external failure. There is a safety feature that will shut down the flow of carrier gas in the event of a foreline pump shut down. However, if this feature fails, hydrogen may slowly accumulate in the mass spectrometer.
MS automated shutoff valves closed	The mass spectrometers are equipped with automated shutoff valves for the calibration vial, optional JetClean system, and the reagent gases. Deliberate operator action or various failures can cause the shutoff valves to close. Shutoff valve closure does not shut off the flow of carrier gas. As a result, hydrogen may slowly accumulate in the mass spectrometer.

Table 4 Hydrogen accumulation mechanisms (continued)

Mechanism	Results
Mass spectrometer automated shutoff valves closed	Some mass spectrometers are equipped with automated diffusion pump shutoff valves. In these instruments, deliberate operator action or various failures can cause the shutoff valves to close. Shutoff valve closure does not shut off the flow of carrier gas. As a result, hydrogen may slowly accumulate in the mass spectrometer. If the LVDS cable is properly connected between the MS and GC, the carrier gas should automatically shut off with an MS shutdown.
Mass spectrometer manual shutoff valves closed	Some mass spectrometers are equipped with manual diffusion pump shutoff valves. In these instruments, the operator can close the shutoff valves. Closing the shutoff valves does not shut off the flow of carrier gas. As a result, hydrogen may slowly accumulate in the mass spectrometer.
GC off	A GC can be shut down deliberately. It can also be shut down accidentally by an internal or external failure. Different GCs react in different ways. If an 8890 or 9000 Series GC equipped with Electronic Pressure Control (EPC) is shut off, the EPC stops the flow of carrier gas. If a GC's carrier flow is not under EPC control, the flow increases to its maximum. This flow may be more than some mass spectrometers can pump away, resulting in the accumulation of hydrogen in the mass spectrometer. If the mass spectrometer is shut off at the same time, the accumulation can be fairly rapid.
Power failure	If the power fails, both the GC and mass spectrometer shut down. The carrier gas, however, is not necessarily shut down. In some GCs, a power failure may cause the carrier gas flow to be set to maximum. As a result, hydrogen may accumulate in the mass spectrometer.

WARNING **Once hydrogen has accumulated in a mass spectrometer, extreme caution must be used when removing it. Incorrect startup of a mass spectrometer filled with hydrogen can cause an explosion.**

WARNING **After a power failure, the mass spectrometer may start up and begin the pumpdown process by itself. This does not guarantee that all hydrogen has been removed from the system, or that the explosion hazard has been removed.**

Precautions

Take the following precautions when operating a a GC/MSD system with hydrogen carrier gas or when operating the MSD with the JetClean option that supplies hydrogen from an MFC located on the MSD.

WARNING **You must remove the plastic cover over the glass window on the front of a 5977C Series MSD. In the unlikely event of an explosion, this cover may dislodge.**

WARNING You MUST make sure the top thumbscrew on the analyzer side plate is fastened finger-tight. Do not over tighten the thumbscrew; this can cause air leaks.

WARNING Failure to secure your MSD as described above greatly increases the chance of personal injury in the event of an explosion.

WARNING If hydrogen is plumbed to any connection on the GC or MS:

- The hydrogen supply to the system entry connection(s), such as from the hydrogen gas cylinder, hydrogen generator or other hydrogen supply, must be shut off when the system is powered off/vented.
- During the venting process it is important to open the manual vent valve.
- Before pumping the MS system down: Open the analyzer/sideplate door(s) 45 degrees or more for 10 minutes before powering the MS system on to begin the pump down process. This action is intended to prevent accumulation of hydrogen within the MS analyzer before MS power on in the event of a hydrogen leak.

WARNING MS Gas Flow:

Never exceed 50 mL/min of total H_2/methane flow to the MS, including column and/or reagent gas.

WARNING

Foreline Pumps:

Use only Agilent approved pumps.

- Agilent IDP pumps must be purchased through Agilent with GC/MS part numbers (i.e., part number begins with “G”) reflecting their compatible use with Agilent GC/MS systems. Pumps ordered directly through Agilent Vacuum division or another provider may not have the correct gas ballast installed.
- Agilent IDP pumps must be fitted with the supplied inlet valve that will close in a power outage.
- Pfeiffer Duo and MVP pumps should be operated with gas ballast closed with Agilent GC/MS systems.
- Edwards RV5 pumps should be operated with gas ballast closed with Agilent GC/MS systems.

WARNING

GC configuration:

- Ensure hydrogen is configured in the firmware for all gas channels using hydrogen. An EPC that is not configured for hydrogen when hydrogen is used could affect the hydrogen safety portion of the GC.
- Ensure all column connection(s) are configured correctly on the GC firmware, especially for any connection(s) to the MS system.
- When available, ensure LVDS cable is connected to GC. This tells the GC to shut off carrier gas if the MS has a pump failure or is powered off.

General laboratory precautions

- Avoid leaks in the carrier gas lines. Use leak-checking equipment to periodically check for hydrogen leaks.
- Eliminate as many ignition sources from your laboratory as possible (open flames, devices that can spark, sources of static electricity, etc.).
- Do not allow hydrogen from a high pressure cylinder to vent directly to atmosphere (danger of self-ignition).
- Use a hydrogen generator instead of bottled hydrogen.

Operating precautions

- Turn off the hydrogen as well as any other gas supply every time you shut down either the GC or the MSD. The supply should be turned off at the source of the gas supply.
- Turn off the hydrogen at its source every time you vent the MSD. (Do not heat the capillary column without carrier gas flow.)
- Turn off the hydrogen at its source every time shutoff valves in an MSD are closed. (Do not heat the capillary column without carrier gas flow.)
- Turn off the hydrogen at its source if a power failure occurs.
- If a power failure occurs while the GC/MSD system is unattended, even if the system has restarted by itself:

  1 Immediately turn off the hydrogen at its source.

  2 Turn off the GC.

  3 Turn off the MSD, and allow it to cool for 1 hour.

  4 Eliminate ***all*** potential sources of ignition in the room.

  5 Open the vacuum manifold of the MSD to atmosphere.

  6 Wait at least 10 minutes to allow any hydrogen to dissipate.

  7 Start up the GC and MSD as normal.

When using hydrogen, check the system for leaks to prevent possible fire and explosion hazards based on local Environmental Health and Safety (EHS) requirements. Always check for leaks after changing a tank or servicing the gas lines. Ensure the foreline pump exhaust and GC injection port vents are both vented into a fume hood.

Safety and Regulatory Certifications

The 5977C Series MSD conforms to the following safety standards:

- Canadian Standards Association (CSA): CAN/CSA-C222 No. 61010-1-04
- CSA/Nationally Recognized Test Laboratory (NRTL): UL 61010–1
- International Electrotechnical Commission (IEC): 61010–1
- EuroNorm (EN): 61010–1

The 5977C Series MSD conforms to the following regulations on Electromagnetic Compatibility (EMC) and Radio Frequency Interference (RFI):

- CISPR 11/EN 55011: Group 1, Class A
- IEC/EN 61326
- AUS/NZ 

This ISM device complies with Canadian ICES-001. Cet appareil ISM est conforme a la norme NMB—001 du Canada.

EMC declaration for South Korea

This equipment has been evaluated for its suitability for use in a commercial environment. When used in a domestic environment, there is a risk of radio interference.

사용자안내문
이 기기는 업무용 환경에서 사용할 목적으로 적합성평가를 받은 기기로서 가정용 환
경에서 사용하는 경우 전파간섭의 우려가 있습니다 .
※ 사용자 안내문은 " 업무용 방송통신기자재 " 에만 적용한다 .

The 5977C Series MSD is designed and manufactured under a quality system registered to ISO 9001.

The 5977C Series MSD is RoHS compliant.

Information

The Agilent Technologies 5977C Series MSD meets the following IEC classifications: Equipment Class I, Laboratory Equipment, Installation Category II, Pollution Degree 2.

This unit has been designed and tested in accordance with recognized safety standards. It is designed for use indoors. If the instrument is used in a manner not specified by the manufacturer, the protection provided by the instrument may be impaired. Whenever the safety protection of the MSD has been compromised, disconnect the unit from all power sources, and secure the unit against unintended operation.

Refer servicing to qualified service personnel. Substituting parts or performing any unauthorized modification to the instrument may result in a safety hazard.

Symbols

Warnings in the manual or on the instrument must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions violates safety standards of design and the intended use of the instrument. Agilent Technologies assumes no liability for the customer's failure to comply with these requirements.

See accompanying instructions for more information.

Indicates a hot surface.

Indicates hazardous voltages.

Indicates earth (ground) terminal.

Indicates potential explosion hazard.

or

Indicates radioactivity hazard.

Indicates electrostatic discharge hazard.

Indicates that you must not discard this electrical/electronic product in domestic household waste.

Electromagnetic compatibility

This device complies with the requirements of CISPR 11. Operation is subject to the following two conditions:

- This device may not cause harmful interference.
- This device must accept any interference received, including interference that may cause undesired operation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment on and off, the user is encouraged to try one or more of the following measures:

1 Relocate the radio or antenna.

2 Move the device away from the radio or television.

3 Plug the device into a different electrical outlet, so that the device and the radio or television are on separate electrical circuits.

4 Ensure that all peripheral devices are also certified.

5 Ensure that appropriate cables are used to connect the device to peripheral equipment.

6 Consult your equipment dealer, Agilent Technologies, or an experienced technician for assistance.

Changes or modifications not expressly approved by Agilent Technologies could void the user's authority to operate the equipment.

Sound emission declaration

Sound pressure

Sound pressure Lp <70 dB according to EN 27779:1991.

Sound pressure Lp <70 dB according to EN ISO 3744:1995

Intended Use

Agilent products must be used only in the manner described in the Agilent product user guides. Any other use may result in damage to the product or personal injury. Agilent is not responsible for any damages caused, in whole or in part, by improper use of the products, unauthorized alterations, adjustments, or modifications to the products, failure to comply with procedures in Agilent product user guides, or use of the products in violation of applicable laws, rules, or regulations.

Cleaning/Recycling the Product

To clean the unit, disconnect the power and wipe down with a damp, lint-free cloth. For recycling, contact your local Agilent sales office.

Agilent recommends you retain the original packaging that your product arrived in so it can be used to ensure the safe movement or transport of your product in the future. If you must discard any of the packaging, we recommend following local waste disposal regulations to ensure the largest amount of material is recycled and diverted from a landfill or incineration. For additional guidance, please refer to your local waste disposal authority.

Accidental Liquid Spillage

Do not spill liquids on the MSD. If liquid is accidentally spilled on the MSD, first, cut the power. Once the MSD is disconnected from all power sources, dry all affected parts. If the liquid spillage affects the electronics, wait at least 24 hours, depending upon the ambient humidity. While waiting for the parts to dry, please call your local Agilent service representative.

Moving or Storing the MSD

The best way to keep your MSD functioning properly is to keep it pumped down and hot, with carrier gas flow. If you plan to move or store your MSD, additional precautions are required:

- The MSD must remain upright at all times; this requires special caution when moving.
- The MSD should not be left vented to atmosphere for long periods.

Replacing the Primary Fuses

Materials needed

- Fuse, T12.5A, 250 V (2110-1398) – 2 required
- Screwdriver, flat-blade (8730-0002)

The most likely cause of primary fuse failure is a problem with the foreline pump. If the primary fuses in your MSD fail, check the foreline pump.

Procedure

1 Vent the MSD, and unplug the power cord from the electrical outlet.

If one of the primary fuses has failed, the MSD will already be off, but for safety, switch off the MSD and unplug the power cord. It is not necessary to allow air into the analyzer chamber.

WARNING **Never replace the primary fuses while the MSD is connected to a power source.**

WARNING **If you are using hydrogen as a carrier gas or for the JetClean system, the hydrogen gas flow must be off before turning off the MSD power. If the foreline pump is off, hydrogen will accumulate in the MSD and an explosion may occur. Read "Hydrogen Safety" on page 23 before operating the MSD with hydrogen gas.**

2 Turn one of the fuse holders counterclockwise until it pops out. The fuse holders are spring loaded. (See Figure 2 on page 34.)

3 Remove the old fuse from the fuse holder.

4 Install a new fuse in the fuse holder.

5 Reinstall the fuse holder.

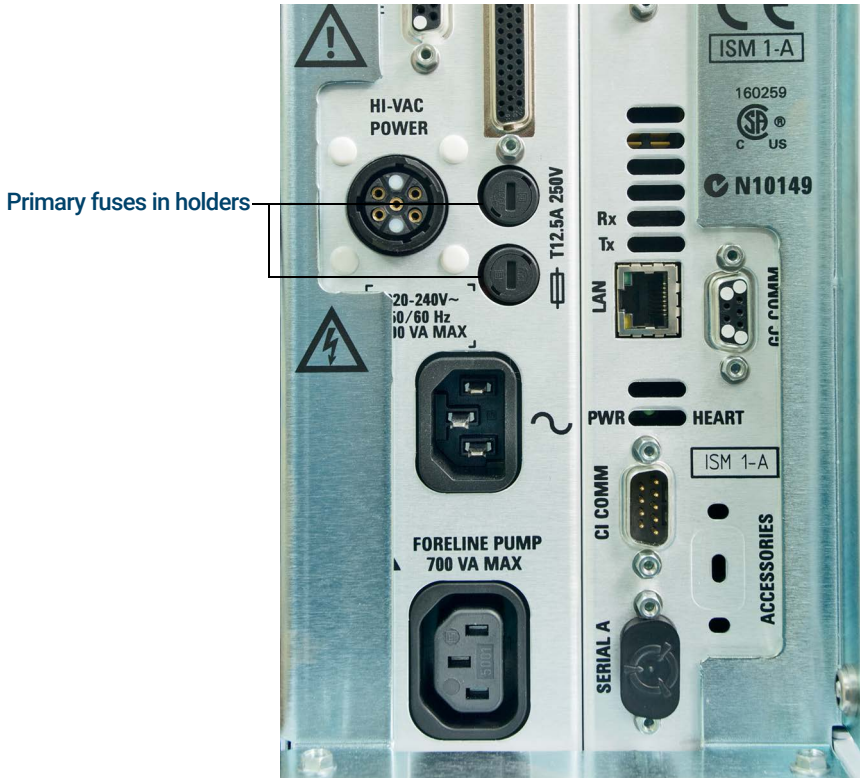


Figure 2. Primary fuses

6 Repeat steps 3 through 5 for the other fuse. Always replace both fuses.

7 Reconnect the MSD power cord to the electrical outlet.

8 Pumpdown the MSD.

2 Installing 8890 GC Columns

Before you can operate your GC/MSD system, you must select, install, and condition a GC column. This chapter shows you how to install and condition a column. For correct column and flow selection, you must know what type of vacuum system your MSD has.

Columns

This section applies to a 5977C MSD used with a 8890 GC. MSD models prior to the 5977C and Agilent GC models prior to the 8890 GC that were supplied with your MSD are generally compatible with the material covered in this chapter. Where differences occur, refer to the documentation supplied with your instrument.

Many types of GC columns can be used with the MSD, but there are some restrictions.

During tuning or data acquisition, the rate of column flow into the MSD should not exceed the maximum recommended flow. Therefore, there are limits to column length, diameter, and flow. Exceeding recommended flow results in degradation of mass spectral and sensitivity performance.

Remember that column flows vary greatly with oven temperature. Use the Flow Calculation software and Table 5 to determine whether a given column will give acceptable flow with realistic head pressure.

Table 5 Gas flows

Feature	Gas flows	
High vacuum pump	Diffusion	Turbo
Optimal He column flow mL/min	1	1 to 2
Maximum recommended gas flow mL/min*	1.5	4
Maximum gas flow, mL/min†	2	6.5
Max column id	0.53 mm (30 m)	0.53 mm (30 m)
CI capability	No	Yes
CI reagent flows, mL/min	NA	1 to 2
JetClean option H_2 flow	NA	0.4 mL/min

* Total gas flow into the MSD: column flow plus reagent gas flow (if applicable) plus JetClean H_2 flow (if applicable). Based on helium gas use. For other gases the maximum flow will vary.

† Expect degradation of spectral performance and sensitivity.

Conditioning columns

Conditioning a column before it is connected to the GC/MSD interface is essential. (See"Conditioning a Capillary Column" on page 41.)

A small portion of the capillary column stationary phase is often carried away by the carrier gas. This is called column bleed. Column bleed deposits traces of the stationary phase in the MSD ion source. This decreases MSD sensitivity, and makes cleaning the ion source necessary.

Column bleed is most common in new or poorly crosslinked columns. It is much worse if there are traces of oxygen in the carrier gas when the column is heated. To minimize column bleed, all capillary columns should be conditioned ***before*** they are installed in the GC/MSD interface.

Conditioning ferrules

Heating ferrules to their maximum expected operating temperature a few times before they are installed can reduce chemical bleed from the ferrules. Thermal cycling ferrules to their maximum operating temperatures, prior to running your application, will help reduce leaks from the assembly.

Tips and hints

- The column installation procedures for the 5977C Series MSDs may be different from that for previous MSDs. Using the procedure from another instrument may ***not*** work, and may damage the column or the MSD.
- Always use carrier gas that is at least 99.9995% pure.
- Because of thermal expansion, new ferrules may loosen after heating and cooling a few times. Check for tightness after two or three heating cycles or use the self tightening column nuts.
- Always wear clean gloves when handling columns, especially the end that will be inserted into the GC/MSD interface.

WARNING **If you are using hydrogen as a carrier gas or for the JetClean system, the hydrogen gas flow must be off before turning off the MSD power. If the foreline pump is off, hydrogen will accumulate in the MSD and an explosion may occur. Read "Hydrogen Safety" on page 23 before operating the MSD with hydrogen gas.**

WARNING **Always wear safety glasses when handling capillary columns. Avoid puncturing your skin with the end of the column.**

Installing a Capillary Column in a Split/Splitless Inlet

Materials needed

- Gloves, clean
  - Large (8650-0030)
  - Small (8650-0029)
- Metric ruler
- Wrench, open-end, 1/4-inch and 5/16-inch (8710-0510)
- Capillary column
- Column cutter, ceramic (5181-8836) or diamond (5183-4620)
- Ferrules
  - 0.27-mm id, for 0.10-mm id columns (5062-3518)
  - 0.37-mm id, for 0.20-mm id columns (5062-3516)
  - 0.40-mm id, for 0.25-mm id columns (5181-3323)
  - 0.5-mm id, for 0.32-mm id columns (5062-3514)
  - 0.8-mm id, for 0.53-mm id columns (5062-3512)
- Inlet column nut (5181-8830 for Agilent 9000 or 8890 GCs)
- Magnifying loupe
- Septum (may be old, used inlet septum)

To install columns in other types of inlets, refer to your GC User Information.

WARNING **The GC operates at high temperatures. Do not touch any parts of the GC until you are sure they are cool.**

WARNING **Always wear safety glasses when handling capillary columns. Avoid puncturing your skin with the end of the column.**

CAUTION **Always wear clean gloves while handling any parts that go inside the GC or analyzer chambers.**

Procedure

1 Cool the oven and inlet to room temperature.

2 Wearing clean gloves, press the column through the septum (this takes a bit of pressure). Then slide the column nut and conditioned ferrule onto the free end of the column. (See Figure 3.) The tapered end of the ferrule should point away from the column nut.

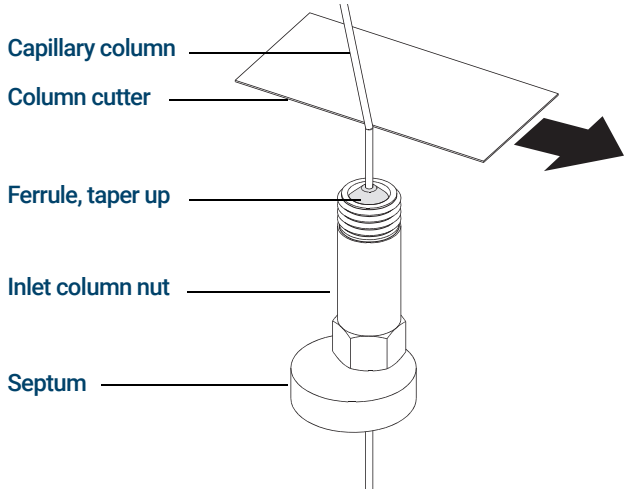


Figure 3. Preparing a capillary column for installation

3 Use the column cutter to score the column 2 cm or more from the end.

4 While holding the column, break the column end off at the score.

5 Inspect the end for jagged edges or burrs. If the break is not clean and even, repeat steps 3 and 4.

6 Wipe the outside of the free end of the column with a lint-free cloth moistened with methanol.

7 Position the column so it extends 4 to 6 mm past the end of the ferrule. (See Figure 4.)

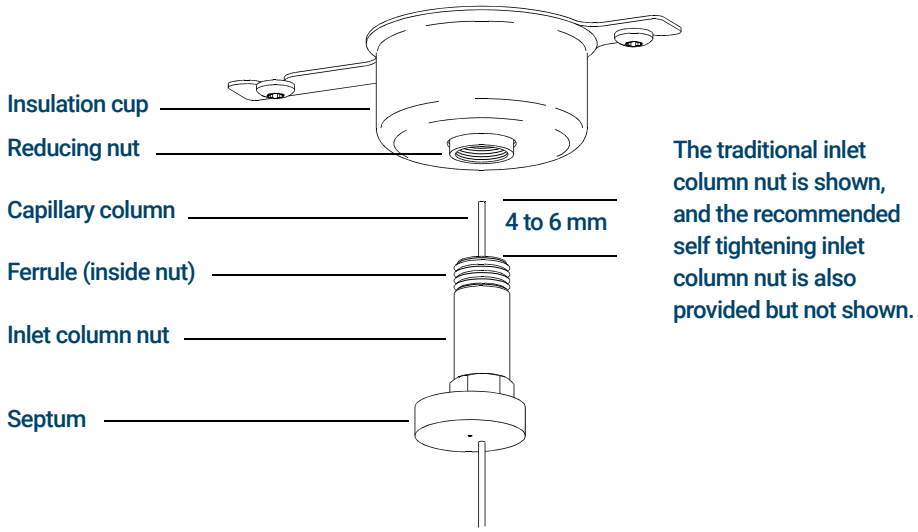


Figure 4. Installing a capillary column for a split/splitless inlet

8 Slide the septum up to the bottom of the nut to fix the correct column insertion length.

9 Insert the column in the inlet.

10 Slide the nut up the column to the inlet base, and finger-tighten the nut.

11 Adjust the column position so the septum is even with the bottom of the column nut.

12 Tighten the column nut an additional 1/4 to 1/2 turn. The column should not slide with a gentle tug.

13 Start carrier gas flow.

14 Verify flow by submerging the free end of the column in isopropanol. Look for bubbles.

See also

For more information about installing a capillary column, refer to *Optimizing Splitless Injections on Your GC for High Performance MS Analysis*, Agilent Technologies publication number 5988-9944EN.

Conditioning a Capillary Column

Materials needed

- Carrier gas, (99.9995% pure or better)
- Wrench, open-end, 1/4-inch and 5/16-inch (8710-0510)

WARNING **Do not condition your capillary column with hydrogen. Hydrogen accumulation in the GC oven can result in an explosion. If you plan to use hydrogen as your carrier gas, first condition the column with ultrapure (99.999% or better) inert gas such as helium, nitrogen, or argon.**

WARNING **The GC operates under high temperatures. Do not touch any GC parts unless you are certain they are cool.**

Procedure

1 Install the column in the GC inlet. (See"Installing a Capillary Column in a Split/Splitless Inlet" on page 38.)

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

3 Program the oven from room temperature to the maximum temperature limit for the column.

4 Increase the temperature at a rate of 10 to 15 °C/min.

5 Hold at the maximum temperature for 30 minutes.

CAUTION **Never exceed the maximum column temperature, either in the GC/MSD interface, the GC oven, or the inlet.**

6 Set the GC oven temperature to 30 °C, and wait for the GC to become ready.

7 Attach the column to the GC/MSD interface. (See"Installing a Capillary Column in the GC/MSD Interface Using the Self-Tightening Column Nut" on page 42.)

Installing a Capillary Column in the GC/MSD Interface Using the Self-Tightening Column Nut

This procedure is for the installation of a capillary column directly into the analyzer using the Agilent recommended self-tightening column nut.

Materials needed

- Interface tip seal (G3870-20542) (See **Figure 6** on page 44.) (Not used with EI SS or Inert source)
- Knurled tip seal retainer (G3870-20547) (Not used with EI SS or Inert source)
- Tip seal spring (G7005-20024) (Not used with EI SS or Inert source)
- Column cutter, ceramic (5181-8836) or diamond (5183-4620)
- Flashlight
- Magnifying loupe
- Gloves, clean
  - Large (8650-0030)
  - Small (8650-0029)
- Self Tightening column nut for GC\MSD interface (5190-5233)
- Ferrules, Vespel
  - 0.27 mm id, for 0.10 mm id columns (5062-3518)
  - 0.37 mm id, for 0.20 mm id columns (5062-3516)
  - 0.40 mm id, for 0.25 mm id columns (5181-3323)
  - 0.5 mm id, for 0.32 mm id columns (5062-3514)
  - 0.8 mm id, for 0.53 mm id columns (5062-3512)
- Septum (may be old, used inlet septum)
- Safety glasses

Procedure

CAUTION **Always wear clean gloves while handling any parts that go inside the GC or the analyzer chambers.**

WARNING **The analyzer, GC/MSD interface, and other components in the analyzer chamber operate at very high temperatures. Do not touch any part until you are sure it is cool.**

1 Condition the column. (See"Conditioning a Capillary Column" on page 41.)

WARNING **Dangerous voltages exist inside the analyzer chamber, which can result in fatal injury. Do not open the analyzer chamber door for any reason. If access is required, trained service personnel must first disconnect the instrument from the building power source.**

2 Vent the MSD and open the analyzer chamber. (See "Venting the MSD" on page 98 and"Opening the Analyzer Chamber" on page 146.) Be sure you can see the end of the GC/MSD interface.

WARNING **The GC operates under high temperatures. Do not touch any GC parts until you are certain they are cool.**

3 If installed, remove the interface tip seal, spring, and knurled tip seal retainer from the end of the GC/MSD interface.

4 Slide an interface nut and conditioned ferrule onto the free end of the GC column. The tapered end of the ferrule must point towards the nut.

5 Slide the column into the GC/MSD interface.

CAUTION **Do not break the column off inside the vacuum manifold. Pieces of column could fall or be pulled into the turbo pump and damage it.**

6 Use the column cutter to score the column 2 cm from its end.

7 While holding the column against the column cutter with your thumb, break the column against the edge of the column cutter.

8 Inspect the end for jagged edges or burrs. If the break is not clean and even, repeat steps 6 and 7.

9 Wipe the end with alcohol.

10 Adjust the column so it extends this specified distance from the end of the GC/MSD interface.

For an EI XTR, SS, Inert or CI Source Installation (See Figure 5.), **the column** extends about 1 mm from the column guide tube.

For an EI HES Installation (See Figure 6.), the column extends 4 to 5 mm from the column guide tube.

Use the flashlight and magnifying loupe, if necessary, to see the end of the column inside the analyzer chamber. Do not use your finger to feel for the column end.

Figure 5. Installing a capillary column in the GC/MSD interface for an EI EXT, SS, Inert, or CI source.

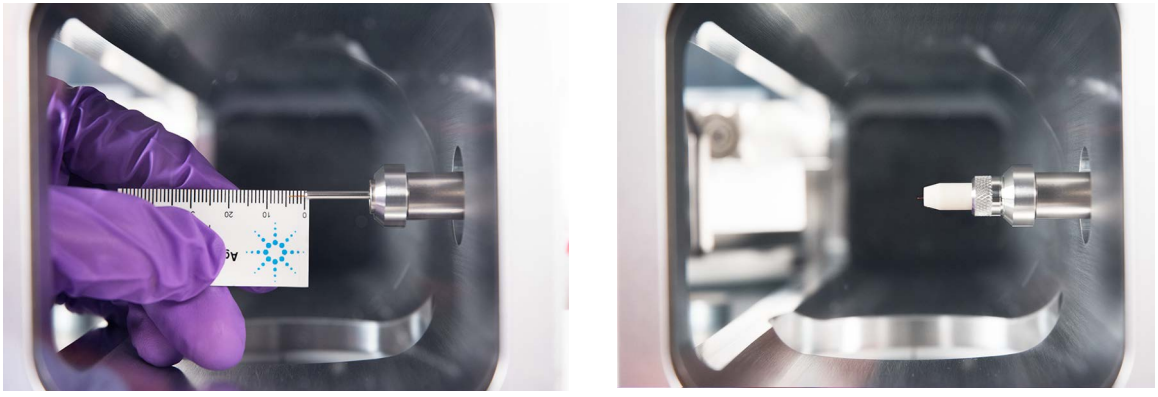


Figure 6. Installing a capillary column in the GC/MSD interface for an EI HES source.

11 Hand-tighten the nut. (See Figure 7.) Ensure the position of the column does not change as you tighten the nut. Do not over tighten the nut.

12 Tighten the nut in the clockwise direction. Continue to tighten until you feel the ferrule grip the column.

13 Check the GC oven to ensure that the column does not touch the oven walls.

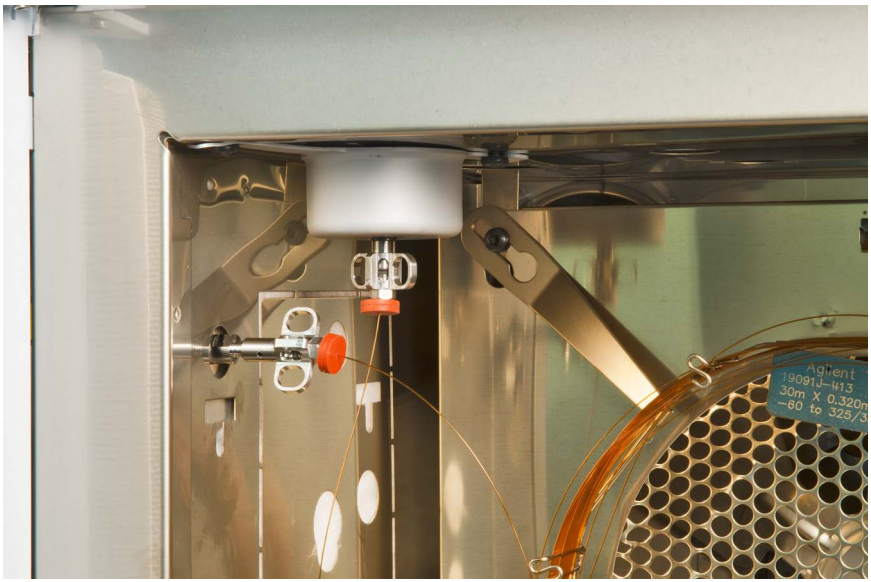


Figure 7. Installing a capillary column in the GC/MSD interface

CAUTION **Use care when placing the tip seal on the GC/MSD interface to avoid damaging the column.**

14 Install the spring, tip seal, and knurled tip seal retainer on the GC/MSD interface. (See"Installing the GC/MSD Interface Tip Seal" on page 50.) Do not use the tip seal, spring, and knurled tip seal retainer with an EI SS or Inert source. The interface socket on these sources does not allow the tip seal installation to fit. (See Figure 59 on page 170.)

CAUTION **Forcing the analyzer door closed if these parts are misaligned will damage the tip seal or the interface or the ion source, or will keep the sideplate from sealing.**

15 ***Gently*** check the alignment of the ion source and the interface tip seal.

When the ion source is aligned correctly, the analyzer chamber can be closed all the way with no resistance except the spring tension from the interface tip seal.

16 You can align the ion source and interface tip seal by wiggling the side plate on its hinge. If the door still will not close, contact your Agilent Technologies service representative.

17 Close the analyzer chamber door. (See **"Closing the Analyzer Chamber"** on page 199.)

Installing a Capillary Column in the GC/MSD Interface Using a Standard Column Nut

This procedure is for the installation of a capillary column directly into the analyzer. There are two types of column nuts that can be used in the GC/MSD interface: The standard column nut explained here, and the self tightening column nut explained in **"Installing a Capillary Column in the GC/MSD Interface Using the Self-Tightening Column Nut"** on page 42.

Materials needed

- Interface tip seal (G3870-20542) (See **Figure 5** on page 44 and **Figure 6** on page 44.) (Not used with EI SS or Inert source)
- Knurled tip seal retainer (G3870-20547) (Not used with EI SS or Inert source)
- Tip seal spring (G7005-20024) (Not used with SS or Inert EI source)
- Column cutter, ceramic (5181-8836) or diamond (5183-4620)
- Flashlight
- Magnifying loupe
- Gloves, clean
  - Large (8650-0030)
  - Small (8650-0029)
- Interface column nut (05988-20066)
- Ferrules
  - 0.3 mm id, for 0.10 mm id columns (5062-3507)
  - 0.4 mm id, for 0.20 and 0.25 mm id columns (5062-3508)
  - 0.5 mm id, for 0.32 mm id columns (5062-3506)
  - 0.8 mm id, for 0.53 mm id columns (5062-3512)
- Septum (may be old, used inlet septum)
- Safety glasses
- Wrench, open-end, 1/4-inch and 5/16-inch (8710-0510)

Procedure

CAUTION **Always wear clean gloves while handling any parts that go inside the GC or the analyzer chambers.**

WARNING **The analyzer, GC/MSD interface, and other components in the analyzer chamber operate at very high temperatures. Do not touch any part until you are sure it is cool.**

1 Condition the column. (See"Conditioning a Capillary Column" on page 41.)

WARNING **Dangerous voltages exist inside the analyzer chamber, which can result in fatal injury. Do not open the analyzer chamber door for any reason. If access is ever required, trained service personnel must first disconnect the instrument from the building power source.**

2 Vent the MSD and open the analyzer chamber. (See "Venting the MSD" on page 113 and"Opening the Analyzer Chamber" on page 146.) Be sure you can see the end of the GC/MSD interface.

WARNING **The GC operates under high temperatures. Do not touch any GC parts unless you are certain they are cool.**

3 If installed, remove the knurled tip seal retainer, interface tip seal, and spring from the end of the GC/MSD interface.

4 Slide an interface nut and conditioned ferrule onto the free end of the GC column. The tapered end of the ferrule must point towards the nut.

5 Slide the column into the GC/MSD interface.

CAUTION **Do not break the column off inside the vacuum manifold. Pieces of column could fall or be pulled into the turbo pump and damage it.**

6 Use the column cutter to score the column 2 cm from the end.

7 While holding the column against the column cutter with your thumb, break the column against the edge of the column cutter.

8 Inspect the end for jagged edges or burrs. If the break is not clean and even, repeat steps 6 and 7.

9 Wipe the end with alcohol.

10 Adjust the column so it extends this specified distance from the end of the transfer line.

- **For an XTR, SS, Inert, or CI Source Installation** (See Figure 5 on page 44.), the column extends about 1 mm.
- **For an EI HES Installation** (See Figure 6 on page 44.), the column extends 4 to 5 mm.

Use the flashlight and magnifying loupe if necessary to see the end of the column inside the analyzer chamber. Do not use your finger to feel for the column end.

11 Hand-tighten the nut. Ensure the position of the column does not change as you tighten the nut. Do not over tighten the nut.

12 Check the GC oven to be sure that the column does not touch the oven walls.

13 Tighten the nut 1/4 to 1/2 turn.

14 Check the nut's tightness after one or two heat cycles; tighten additionally as appropriate.

CAUTION **Use care when placing the tip seal on the end of the GC/MSD interface to avoid damaging the column.**

15 Install the spring, tip seal, and knurled tip seal retainer on the GC/MSD interface. (See"Installing the GC/MSD Interface Tip Seal" on page 50.) Do not use the tip seal, spring, and knurled tip seal retainer with an EI SS or Inert source. The interface socket on these sources does not allow the tip seal installation to fit. (See Figure 59 on page 170.)

CAUTION **Forcing the analyzer door closed if these parts are misaligned will damage the tip seal or the interface or the ion source, or will keep the sideplate from sealing.**

16 ***Gently*** check the alignment of the ion source and the interface tip seal.

When the ion source is aligned correctly, the analyzer chamber can be closed all the way with no resistance except the spring tension from the interface tip seal.

17 You can align the ion source and interface tip seal by wiggling the side plate on its hinge. If the door still will not close, contact your Agilent Technologies service representative.

18 Close the analyzer chamber door. (See "Closing the Analyzer Chamber" on page 199.)

Installing the GC/MSD Interface Tip Seal

Materials needed

- Interface tip seal (G3870-20542)
- Tip seal spring (G7005-20024)
- Knurled tip seal retainer (G3870-20547)

  The interface tip seal must be in place for the CI source, the EI XTR source, and HES. The interface tip seal, spring, and knurled seal retainer are not used with EI SS or Inert source.
- Gloves, clean, lint-free
  - Large 8650-0030
  - Small 8650-0029

CAUTION **Electrostatic discharges to analyzer components are conducted to the side board where they can damage sensitive components. Wear a grounded antistatic wrist strap and take other antistatic precautions *before* you open the analyzer chamber.**

CAUTION **Always wear clean gloves while handling any parts that go inside the GC or the analyzer chambers.**

Procedure

1 Verify that the CI source, EI XTR source, or HES is installed. This tip seal and its spring must not be installed when an EI SS or Inert source is installed (See Figure 8 on page 51).

2 Remove the interface tip seal, spring, and knurled nut retainer from the ion source storage box. In this order, slide the spring, tip seal, and knurled tip seal retainer over the column sleeve.

3 Thread the knurled tip seal retainer into the tip seal base finger tight.

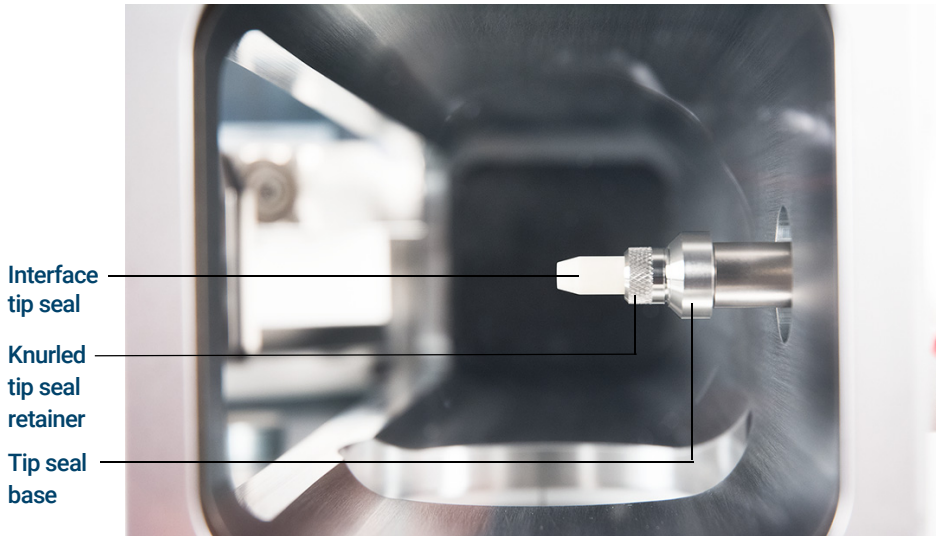


Figure 8. Interface tip seal

CAUTION **Forcing the analyzer closed if these parts are misaligned will damage the seal or the interface or the ion source, or keep the sideplate from sealing.**

4 ***Gently*** check the alignment of the analyzer and the interface.

When the analyzer is aligned correctly, the analyzer can be closed all the way with no resistance except the spring tension from the interface tip seal.

5 You can align the analyzer and interface by wiggling the side plate on its hinge. If the analyzer still will not close, contact your Agilent Technologies service representative.

The GC/MSD Interface for an 8890 Series GC

The GC/MSD interface is a heated conduit into the MSD for the capillary column. (See Figure 9.) It is bolted onto the right side of the analyzer chamber, with an O-ring seal. It has a protective cover which should be left in place.

One end of the interface passes through the side of the GC and extends into the oven. This end is threaded to allow connection of the column with a nut and ferrule. The other end of the interface fits into the ion source. The end of the capillary column extends slightly past the end of the column guide tube and into the ionization chamber.

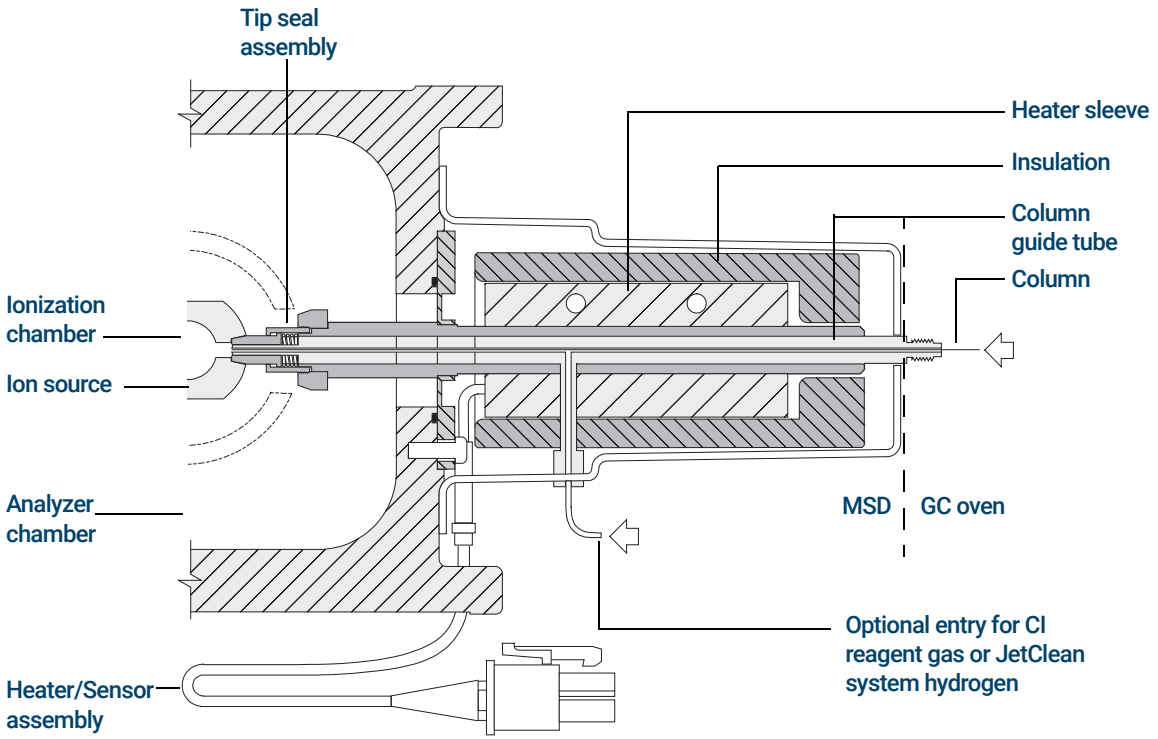


Figure 9. GC/MSD interface for an 8890 GC with EI XTR, HES, and CI sources

The GC/MSD interface is heated by an electric cartridge heater. Normally, the heater is powered and controlled by Thermal Aux #2 heated zone of the GC. The interface temperature can be set from Agilent OpenLab CDS Acquisition software or from the GC. A thermocouple sensor in the interface monitors the temperature.

The GC/MSD interface should be operated in the range of 250 ° to 350 °C. The interface temperature should be slightly higher than the maximum GC oven temperature, but ***never*** higher than the maximum column temperature.

The GC/MSD interface can be used with both EI and CI sources. The EI XTR, HES, and CI sources require a tip seal assembly. The tip seal, spring, and knurled tip seal retainer interfere with, and must be removed when using the EI SS and Inert sources.

(See "Installing a Capillary Column in the GC/MSD Interface Using the Self-Tightening Column Nut" on page 42, and "Installing a Capillary Column in the GC/MSD Interface Using a Standard Column Nut" on page 47.)

WARNING **The GC/MSD interface operates at high temperatures. If you touch it when it is hot, it will burn you.**

The 5975/5977A/5977B GC/MSD Interface

This interface is shown for MSDs prior to the 5977C.

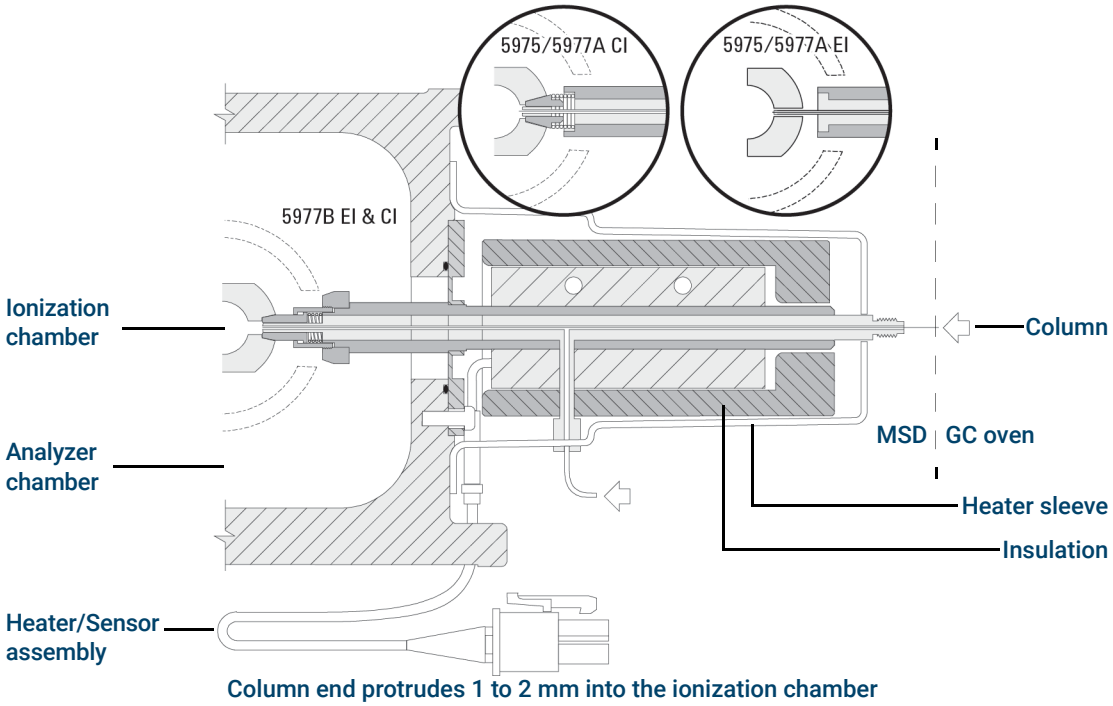


Figure 10. The GC/MSD interface

3 Installing Intuvo 9000 GC Columns

This chapter shows you how to install an Agilent Intuvo column, connect the flow path from the inlet through the guard chip, bus components, and column to the MS Tail assembly, and maintain the column guard chip.

If you are using the *Agilent Intuvo 9000 Gas Chromatograph* with your MSD, Chemical Ionization (CI) is not currently supported. The Agilent JetClean system is supported.

Columns

Many types of Intuvo 9000 GC columns can be used with the MSD, but there are some restrictions.

During tuning or data acquisition, the rate of column flow into the MSD should not exceed the maximum recommended flow. Therefore, there are limits to column length and flow. Exceeding recommended flow will result in degradation of mass spectral and sensitivity performance.

Remember that column flows vary greatly with temperature, requiring measurements of the actual flow to be taken. Use Table 6 to determine an acceptable column flow.

Table 6 Gas flows

Feature	Gas flows	
High vacuum pump	Diffusion	Turbo
Optimal He column flow mL/min	1	1 to 2
Maximum recommended gas flow mL/min*	1.5	4
Maximum gas flow, mL/min†	2	6.5
Max column id	0.53 mm (30 m)	0.53 mm (30 m)
JetClean option H_2 flow	NA	0.4 mL/min

* Total gas flow into the MSD: column flow plus reagent gas flow (if applicable) plus JetClean H_2 flow (if applicable). Based on helium gas use. For other gases the maximum flow will vary.

† Expect degradation of spectral performance and sensitivity.

Conditioning columns

Conditioning a column before it is connected to the GC/MSD interface is essential.

A small portion of the capillary column stationary phase is often carried away by the carrier gas. This is called column bleed. Column bleed deposits traces of the stationary phase in the MSD ion source. This decreases MSD sensitivity and makes cleaning the ion source necessary.

Column bleed is most common in new or poorly cross-linked columns. It is much worse if there are traces of oxygen in the carrier gas when the column is heated. To minimize column bleed, all capillary columns should be conditioned before they are installed in the GC/MSD interface. (See **"Conditioning an Intuvo Capillary Column"** on page 72.)

Tips and hints

- Always use carrier gas that is at least 99.9995% pure.
- Always wear clean gloves when handling a component's click and run connectors.
- Always wear clean gloves when handling a gasket.
- Always wear clean gloves when handling the 9000 GC/MS Tail.

WARNING **If you are using hydrogen as a carrier gas, the hydrogen gas flow must be off before turning off the MSD power. If the foreline pump is off, hydrogen will accumulate in the MSD and an explosion may occur. Read "Hydrogen Safety" on page 23 before operating the MSD with hydrogen gas.**

Handling the Intuvo 9000GC Column and Bus Components

The Agilent Intuvo 9000 Gas Chromatograph (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:

- Do not touch the click and run sealing surfaces with bare skin or dirty gloves. Skin oils and dirt can contaminate the flow path surfaces.
- Use only the provided Intuvo 9000 GC torque driver to tighten Intuvo compression bolts.
- Avoid scratching or deforming click and run sealing surfaces.
- If you need to clean a sealing surface, use clean, compressed air.
- Use a new gasket each time you install a column or Intuvo chip.

Replacing an Intuvo GC Column

This procedure applies to GCs with a single column. For a 2 column replacement see the *Agilent Intuvo 9000 Gas Chromatograph Maintaining Your GC* manual.

Materials needed

- Gloves, clean, lint-free
  - Large (8650-0030)
  - Small (8650-0029)
- Tweezers (8710-2460)
- Intuvo gasket, polyimide 5/pk, for temperatures < 350 °C (5190-9072)
- Intuvo gasket, nickel 5/pk, for temperatures 350 °C to 450 °C (5190-9073)
- Intuvo torque driver stored on oven door (5190-9571)

Procedure

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.**

CAUTION **Always wear clean gloves while handling any parts that are in the flow path going to the analyzer or parts that are located inside the analyzer.**

1 Prepare the GC for maintenance.
From the GC panel select **Maintenance > Column > Perform Maintenance > Install Column > Start Maintenance**. This procedure cools the inlet, detector, column, Guard Chip, and other components in the flow path heated zones to < 40 °C and configures the GC. Follow the on-screen GC prompts.

2 From OpenLab CDS Acquisition, vent the MSD (See **"Venting the MSD"** on page 113.)

3 If you are using hydrogen or other flammable gas as a carrier gas, close the manual gas supply valve to the instrument before turning off the MSD power.

4 Open the GC front door. (See Figure 11.)

5 Open the bus door and remove it by lifting the door vertically off its hinge pins.

6 Lower the oven door.

Figure 11. 9000 GC front door, bus door, oven door, and Intuvo torque driver

7 Using the Intuvo torque driver, rotate all four column clamps off the column's retainer ring. (See Figure 12.)

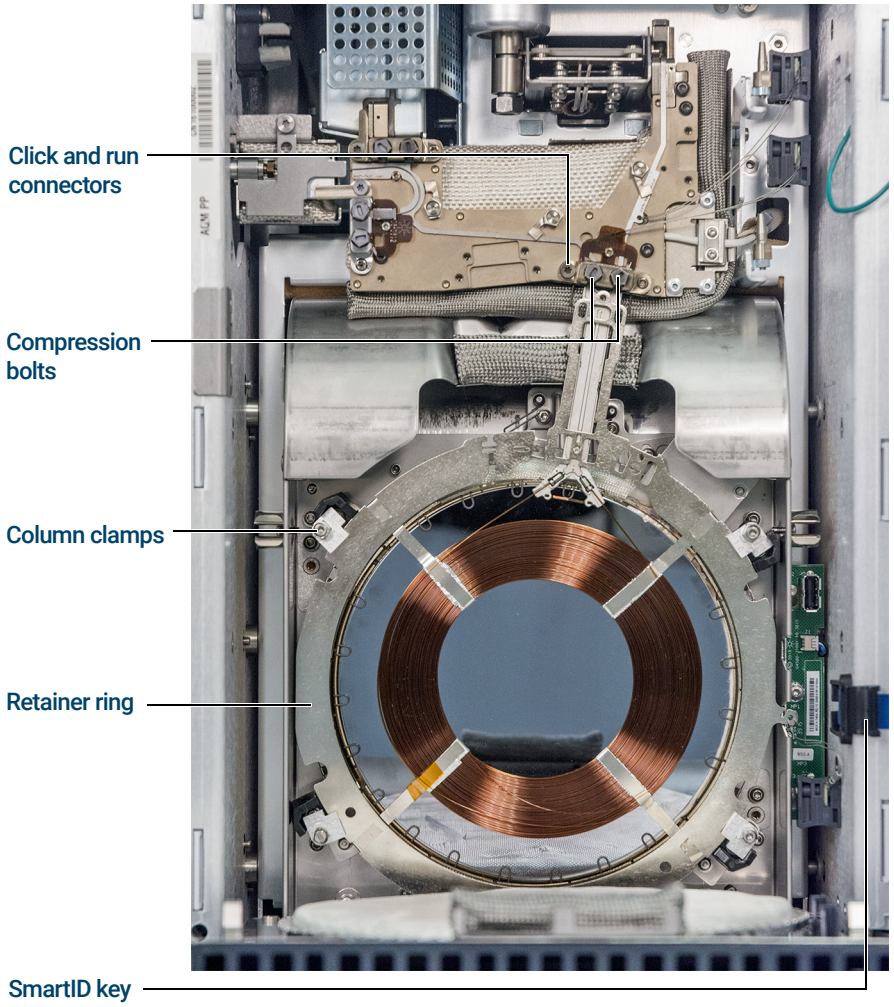


Figure 12. 9000 GC column and related parts

8 Unplug the column SmartID key from the lower USB port.

9 Using the Intuvo torque driver, remove the two compression bolts that seal the column's click and run connectors to the bus and store for later use.

10 Remove and store the column for later use in accordance with the column manufacturer's recommendations.

11 Replace the gasket with a new gasket rated for the maximum column temperature expected with your method. (See **"Replacing an Intuvo 9000 GC Gasket"** on page 63.)

12 Verify that all Intuvo gaskets in the flow path are rated for the maximum column temperature expected with your method. Replace any gaskets that have a lower temperature rating with one that has a temperature rating that is compatible with your method.

13 Place the column's click and run connectors into the single column (right) bus fitting. See the GC manual for installing 2 columns in the GC.

14 Insert the column's attached Intuvo SmartID Key into the lower USB connection shown.

15 Secure the new column by rotating the 1 c tab of the 4 column clamps over the column retaining ring using the Intuvo torque driver.

16 Verify that the column's click and run fittings sit flat against the gasket.

17 Loosely install the two compression bolts.

CAUTION **Use the Intuvo torque driver to tighten the compression bolt until you hear one click. Over-tightening can damage the flow path, strip the fittings, and cause leaks.**

18 Tighten the compression bolts until you hear a click from the Intuvo torque driver.

19 Close the column door.

20 Install the bus door.

21 Close the GC front door.

Replacing an Intuvo 9000 GC Gasket

This procedure assumes you have already removed the column, 9000 GC/MS Tail, or other part that sits on top of the gasket and that the instrument components are below 40 °C.

Materials needed

- Gloves, clean, lint-free
  - Large (8650-0030)
  - Small (8650-0029)
- Tweezers (8710-2460)
- Intuvo gasket, polyimide 5/pk, for temperatures < 350 °C (5190-9072)
- Intuvo gasket, nickel 5/pk, for temperatures 350 °C to 450 °C (5190-9073)

Procedure

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.**

CAUTION **Always wear clean gloves while handling any parts that are in the flow path going to the analyzer or parts that are located inside the analyzer.**

1. Remove the gasket tab from the alignment stud and discard the old gasket. Tweezers help when you are wearing the required gloved.
2. If needed, install any inlet or detector chips. All chips must be installed before installing the new gasket.
3. 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.
4. Carefully insert the round gasket lobes into the bus click and run fitting. Note that the gasket is double-sided.
5. Place the hole in the gasket over the alignment stud in the bus fitting, and press the gasket body flat against the bus.
6. Check that the gasket's round lobes fit flat against the bus click and run fitting.

The new gasket is ready for the chip or column attachment.

Installing a Column Guard or Jumper Chip

The column Guard Chip and the Jumper Chip are both single-use, consumable parts. Installation deforms part of the Chip to make a good seal, so that a misinstalled Chip cannot be reused. The Guard Chip cannot be cleaned or conditioned.

Materials needed

- Gloves, clean, lint-free
  - Large (8650-0030)
  - Small (8650-0029)
- Tweezers (8710-2460)
- Split/Splitless inlet Intuvo guard chip, 2/pk (G4587-60565)
- Multimode inlet Intuvo guard chip, 2/pk (G4587-60665)
- Split/Splitless inlet Intuvo jumper chip, 2/pk G4587-60575)
- Multimode Inlet Intuvo jumper chip, 2/pk (G4587-60675)
- Intuvo gasket, polyimide 5/pk, for temperatures < 350 °C (5190-9072)
- Intuvo gasket, nickel 5/pk, for temperatures 350 °C to 450 °C (5190-9073)
- Intuvo torque driver stored on oven door (5190-9571)
- 7/16-inch open-end wrench

Procedure

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.**

CAUTION **Always wear clean gloves while handling any parts that are in the flow path going to the analyzer or parts that are located inside the analyzer.**

1 Prepare the GC for maintenance. From the GC panel select **Maintenance > Inlets > Guard Chip > Prepare for Maintenance >Replace Liner and Guard Chip > Start Maintenance**. This procedure cools the inlet, detector, column, Guard Chip, and other components in the flow path heated zones to < 40 °C and configures the GC. Follow the on-screen GC prompts.

2 From OpenLab CDS Acquisition, Vent the MSD (See **"Venting the MSD"** on page 113.)

3 Wait until the GC reaches the ready state indicating the components are cooled below 40 °C and the instrument is vented before continuing the steps in this procedure.

4 If you are using hydrogen or other flammable gas as a carrier gas or for the JetClean system, close the manual gas supply valve to the instrument before turning off the MSD power.

5 If installed, remove the ALS injector from the inlet.

6 Remove the inlet cover. (See **Figure 13**.)

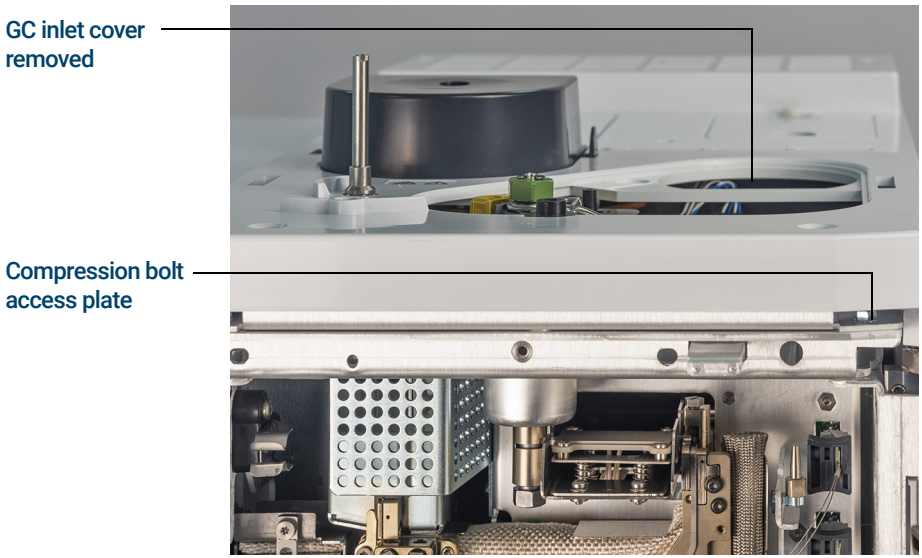


Figure 13. GC inlet cover and compression bolt access plate

7 Open the GC front door.

8 Open the bus door and remove it by lifting the door vertically off its hinge pins.

9 Pull the compression bolt access plate out to allow the torque driver to access the Guard chip compression bolt. (See Figure 14 on page 66.)

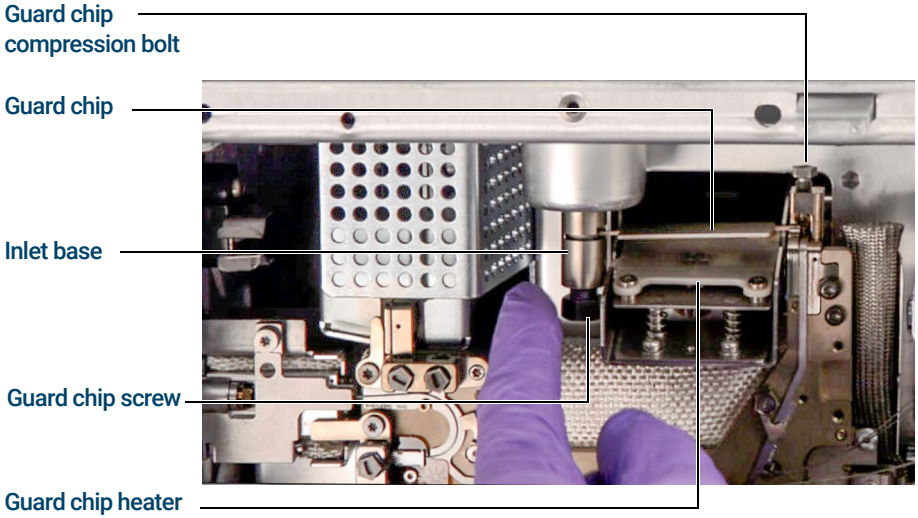


Figure 14. Guard chip and related parts

10 Use a 7/16-inch open-end wrench to loosen the Guard Chip screw at the base of the inlet.

11 Use your finger to gently rotate the front of the Guard Chip heater assembly down and expose the Guard Chip.

12 Loosen the Guard Chip compression bolt with the Intuvo torque driver.

13 Lift the right side of the Guard Chip tab over the boss then rotate it out of the bus connection.

14 Remove the left side of the Guard Chip from the inlet base.

15 Install a new Guard Chip. The larger end of the Guard Chip inserts into the inlet base first, then the smaller end is rotated into the bus connection, lifting its tab over the boss and into the bus mounting slot.

16 Finger tighten the compression bolt.

17 Raise the Guard Chip heater.

18 Finger tighten the Guard Chip screw in the inlet base.

19 Tighten the Guard Chip screw in the inlet base with a 7/16-inch open end wrench.

CAUTION **Use the Intuvo torque driver to tighten the compression bolt until you hear one click. Over-tightening can damage the flow path, strip the fittings, and cause leaks.**

20 Tighten the Guard Chip compression bolt using the provided torque driver until you hear one click.

21 Install the inlet cover.

22 Install the bus door on its hinges and close it.

23 Close the GC front door.

24 If removed, install the ALS injector.

Replacing the 9000 GC/MS Tail

This procedure is necessary if you are switching to a source that requires a different 9000 GC/MS Tail, replacing a leaking gasket or a contaminated 9000 GC/MS Tail, or separating the 9000 GC from the MSD.

Materials needed

- Gloves, clean, lint-free
  - Large (8650-0030)
  - Small (8650-0029)
- Tweezers (8710-2460)
- 9000 GC/MS Tail, used with a standard source (G4590-60009)
- 9000 GC/MS Tail, used with a HES (G4590-60109)
- Intuvo gasket, polyimide 5/pk, for temperatures < 350 °C (5190-9072)
- Intuvo gasket, nickel 5/pk, for temperatures 350 °C to 450 °C (5190-9073)
- Intuvo torque driver stored on oven door (5190-9571)
- 7/16-inch open-end wrench

Procedure

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.**

CAUTION **Always wear clean gloves while handling any parts that are in the flow path going to the analyzer or parts that are located inside the analyzer.**

1 Vent the MSD (See **"Venting the MSD"** on page 113.) When prompted, set the temperature for the ion source, quads, inlet, detector, column, Guard Chip, 9000 GC/MS Tail, and other components in the flow path heated zones to < 40 °C.

2 If you are using hydrogen or other flammable gas as a carrier gas, close the manual gas supply valve to the instrument before turning off the MSD power.

3 Wait until the GC reaches the ready state indicating the components are cooled below 40 °C before continuing the steps in this procedure.

4 Open the analyzer chamber. (See "Opening the Analyzer Chamber" on page 146.)

5 If present, unscrew the knurled tip seal retainer and remove it, the interface tip seal, and spring from the GC/MSD interface. (See "GC/MSD interface tip seal" on page 75.)

6 Ensure the MSD is properly aligned with the GC. If the GC and MSD are not properly aligned, the transfer line clamp screw will be difficult to tighten.

7 Open the GC front door.

8 Open the bus door and remove it by lifting the door vertically off its hinge pins.

9 Using the Intuvo torque driver, remove the compression bolt that secures the 9000 GC/MS Tail click and run bus connection. Also remove the bolt from the empty bus connection. (See Figure 15.)

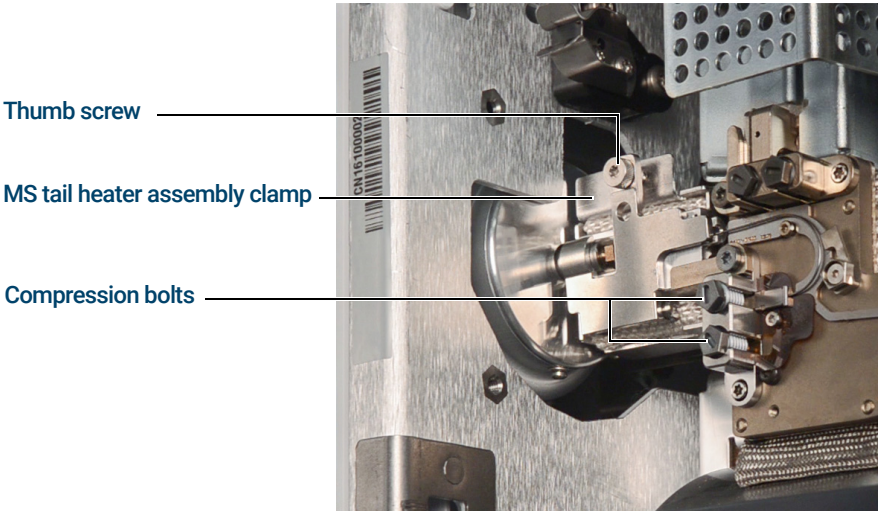


Figure 15. MS tail heater assembly clamp closed

10 Open the MS tail heater assembly by loosening the thumb screw at the top of the clamp and rotating the clamp down.

11 Push the MS tail heater assembly back a few millimeters. A magnet will hold the heater assembly away from the 9000 GC/MS Tail.

12 Remove the 9000 GC/MS Tail from the transfer line and bus. (See Figure 16 and Figure 17.)
If the ferrule becomes stuck, press a pointed object, like a paper clip, into the ferrule release hole at the end of the transfer line.

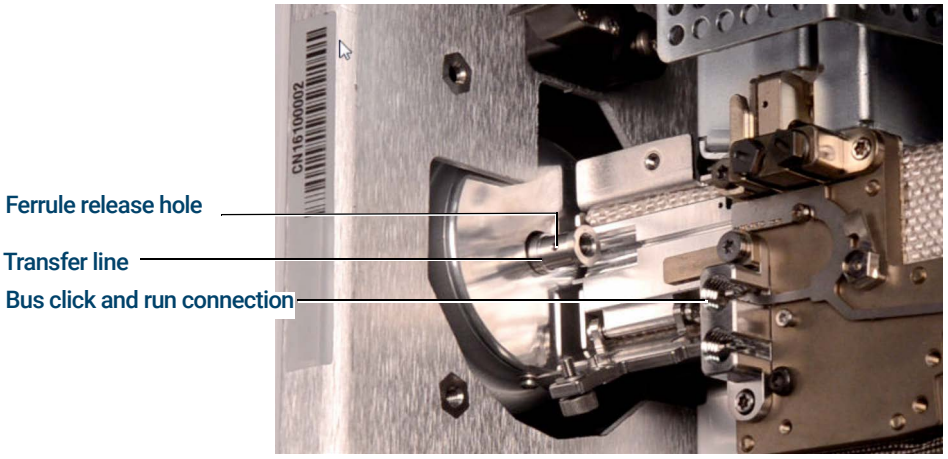


Figure 16. MS tail heater assembly clamp open with 9000 GC/MS Tail removed

Figure 17. 9000 GC/MS Tail removed from GC/MSD Interface

13 Replace the gasket. (See "Replacing an Intuvo 9000 GC Gasket" on page 63.)

14 Carefully slide the 9000 GC/MS Tail into the GC/MSD interface, and gently place the click and run connection into the bus connection.

15 Check that the 9000 GC/MS Tail click and run fitting sits flat against the gasket in the bus connection.

16 Screw the 9000 GC/MS Tail column nut to the transfer line threaded connector finger tight, then use a ¼-inch wrench to tighten the nut an additional 20 to 30 degrees.

17 Loosely install the two compression bolts.

CAUTION **Use the Intuvo torque driver to tighten the compression bolt until you hear one click. Over-tightening can damage the flow path, strip the fittings, and cause leaks.**

18 Tighten the single compression bolt until you hear a click from the Intuvo torque driver.

19 Loosely install the other compression bolt on the empty click and run bus connector.

20 Pull the MS tail heater assembly a few millimeters towards the 9000 GC/MS Tail until contact is made.

21 Close the MS tail heater assembly clamp, and hand tighten the thumb screw to secure it.

22 Install the bus door on its hinges and close it.

23 Close the GC front door.

24 Install the spring and tip seal on the GC/MSD interface. Align, gently slide, and screw the knurled tip seal retainer into the tip seal base. (See **"Installing the GC/MSD Interface Tip Seal"** on page 74.) The interface tip seal, spring, and knurled tip seal retainer are not used with EI SS or Inert source.

25 ***Gently*** check the alignment of the ion source and the interface tip seal.

When the ion source is aligned correctly, the front analyzer chamber can be closed all the way with no resistance except the spring tension from the interface tip seal.

CAUTION **Forcing the analyzer door closed if these parts are misaligned will damage the tip seal or the interface or the ion source, or will keep the sideplate from sealing.**

26 You can align the ion source and interface tip seal by wiggling the side plate on its hinge. If the door still will not close, contact your Agilent Technologies service representative.

27 Close the analyzer chamber. (See **"Closing the Analyzer Chamber"** on page 199.)

Conditioning an Intuvo Capillary Column

Materials needed

- Carrier gas, (99.9995% pure or better)
- Gloves, clean, lint-free
  - Large (8650-0030)
  - Small (8650-0029)
- Tweezers (8710-2460)
- Intuvo torque driver (5190-9571)
- Intuvo gasket, polyimide 5/pk, for temperatures < 350 °C (5190-9072)
- Intuvo gasket, nickel 5/pk, for temperatures 350 °C to 450 °C (5190-9073)
- Wrench, open-end, 1/4-inch and 5/16-inch (8710-0510)

Procedure

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.**

CAUTION **Always wear clean gloves while handling any parts that are in the flow path going to the analyzer or parts that are located inside the analyzer.**

1. Install the column that requires conditioning. (See "Replacing an Intuvo GC Column" on page 59.)
2. Set a minimum velocity of 30 cm/s, or as recommended by the column manufacturer. Allow gas to flow through the column at room temperature for 15 to 30 minutes to remove air.
3. Increase the column temperature to 120 °C.
4. Hold at the this temperature for 30 minutes.
5. Use OpenLab CDS to run an air and water check. Proceed to the next step if the air and water are within limits.

6 Program the column temperature to increase from 120 °C to the maximum temperature limit for the column at a rate of 10 to 15 °C/min.

CAUTION **Never exceed the maximum column temperature, in the GC/MSD interface, the GC oven, or the inlet.**

7 Hold at the maximum temperature for 30 minutes.

The column is conditioned and ready to be used with your method.

Installing the GC/MSD Interface Tip Seal

Materials needed

- Interface tip seal (G3870-20542)
- Tip seal spring (G7005-20024)
- Knurled tip seal retainer (G3870-20547)

  The interface tip seal must be in place for the CI source, the EI XTR source, and HES. The interface tip seal, spring, and knurled tip seal retainer are not used with EI SS or Inert source.
- Gloves, clean, lint-free
  - Large (8650-0030)
  - Small (8650-0029)

CAUTION **Electrostatic discharges to analyzer components are conducted to the side board where they can damage sensitive components. Wear a grounded antistatic wrist strap, and take other antistatic precautions *before* you open the analyzer chamber.**

CAUTION **Always wear clean gloves while handling any parts that go inside the GC or the analyzer chambers.**

Procedure

1 Verify that the CI source, EI XTR source, or HES is installed. The tip seal, spring, and knurled tip seal retainer must not be installed when an EI SS or Inert source is installed. (See Figure 18 on page 75.)

2 Remove the interface tip seal, spring, and knurled nut retainer from the ion source storage box. In this order, slide the spring, tip seal, and knurled tip seal retainer over the column sleeve.

3 Thread the knurled tip seal retainer into the tip seal base finger tight.

Figure 18. GC/MSD interface tip seal

CAUTION **Forcing the analyzer closed if these parts are misaligned will damage the seal or the interface or the ion source, or keep the sideplate from sealing.**

4 ***Gently*** check the alignment of the analyzer and the interface.

When the analyzer is aligned correctly, the analyzer can be closed all the way with no resistance except the spring tension from the interface tip seal.

5 You can align the analyzer and interface by wiggling the side plate on its hinge. If the analyzer still will not close, contact your Agilent Technologies service representative.

The GC/MSD Interface for a 9000 Series GC

The GC/MSD Interface is a heated conduit into the MSD for maintaining MSD vacuum and a suitable column effluent temperature. (See **Figure 19**.) The GC/MSD Interface is bolted onto the right side of the analyzer chamber, with an O-ring seal and has a protective cover which should be left in place.

One end of the interface passes through the side of the GC and is accessed from inside the GC front door. This allows connection of the 9000 GC/MS Tail column nut. The 9000 GC/MS Tail includes a swagged ferrule and column nut for attaching to the GC end of the GC/MSD Interface. The 9000 GC/MS Tail transports the column effluent from a heated column bus connector in the GC, through the heated GC/MSD Interface, and exits slightly past the end of the column guide tube and into the ionization chamber. The 9000 GC/MS Tail maintains temperature at several points along its length by a heated bus, an MS tail heater assembly, and the GC/MSD Interface.

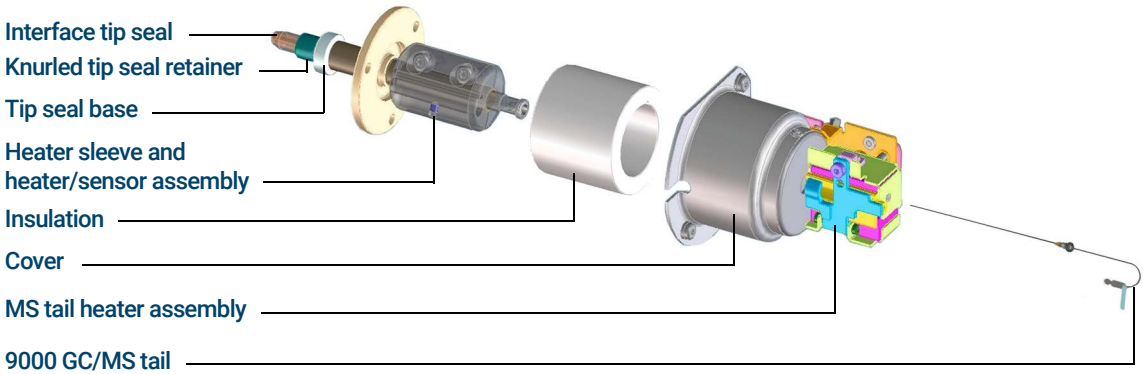


Figure 19. The GC/MSD Interface for a 9000 GC (not to scale)

The 9000 GC/MS Tail is heated by an electric cartridge heater. The heater is powered and controlled by a heated zone of the 9000 GC. The 9000 GC/MS Tail temperature can be set from the OpenLab CDS Acquisition software or from the GC. A sensor (thermocouple) in the interface monitors the temperature.

The interface tip seal assembly is required when using the EI XTR source or the HES.

The 9000 GC/MS Tail should be operated in the 250 ° to 350 °C range. Subject to that restriction, the GC/MSD interface temperature should be slightly higher than the column temperature, but ***never*** higher than the maximum column temperature.

4 Operating in EI Mode

This chapter describes how to perform some basic operating procedures for the Agilent 5977C Series GC/MSD using EI. If you are using the *Agilent Intuvo 9000 Gas Chromatograph* with your MSD, Chemical Ionization (CI) is not currently supported.

Operating the MSD from the DS

The OpenLab CDS software automates tasks such as pumping down, monitoring settings, setting temperatures, tuning, and venting the MSD. These tasks are described in this chapter. Additional information is described in the manuals and online help supplied with the OpenLab CDS software.

CAUTION **The software and firmware are revised periodically. If the steps in these procedures do not match your OpenLab CDS software, refer to the manuals and online help supplied with the software for more information.**

Operating the MSD from the GC Control Panel

This section only applies to the 5977B MSD. For earlier 5975/5977 MSD models, refer to **"Operating the 5975/5977 MSD From the Local Control Panel (LCP)"** on page 86.

The 7890B GC control panel can show the actual temperature and pressure of the MSD or initiate a task on the MSD without using the Agilent OpenLab CDS software. You can access functions, such as venting and setting temperatures, right from the GC control panel. Limited features are available from the GC control panel. The OpenLab CDS software is the full-featured controller for most instrument control operations.

MSD designated key on the GC control panel

The **MS/Aux Det** key on the 7890B GC control panel allows access to control and configuration parameters on the MSD. For older 7890 models with updated firmware, this key is labeled **Aux Det #**. which can be substituted for the **MS/Aux Det** key in the procedures that follow.

Figure 20. 7890 GC keypad

Changing MSD temperatures from the GC control panel

1 Press **MS/Aux Det** to display the 5977B MSD menu.

2 Press the down arrow to scroll to **Quad temp**, **Source temp** or **Transfer line.**

3 Use GC keypad to enter the desired temperature.

4 Press **Enter** to apply the changes.

Viewing MSD vacuum pressure and Turbo speed/Foreline Pressure from the GC control panel

1 Press **MS/Aux Det** to display the 5977B MSD menu.

2 Press the down arrow to scroll to **HiVac Pressure**, or **Turbo Speed % of full** / **Foreline Pressure**.

Venting the MSD from the GC control panel

1 With the MSD pumped down, press **MS/Aux Det** to bring up the 5977B MSD menu.

2 Press the down arrow to scroll to **Start MSD Vent?**. (Press **Off/No** to cancel the vent cycle and pump down the MS).

3 Press **ON/Yes** to start the venting cycle.

4 When prompted open the vent valve.

Pumping down the MSD from the GC control panel

1 With the MSD vented, press **MS/Aux Det** to bring up the 5977B MSD menu.

2 Press the down arrow to scroll to **Start MSD Vent?**.

3 Press **ON/Yes** to start the pump down cycle.

4 When prompted open the vent valve.

Viewing the firmware version of the MSD from the GC control panel

1 Press **MS/Aux Det** to bring up the 5977B MSD menu.

2 Press the down arrow to scroll to **Firmware**.

Viewing the serial number of the MSD from the GC control panel

1 Press **MS/Aux Det** to bring up the 5977B MSD menu.

2 Press the down arrow to scroll to **Serial#**.

Viewing the network settings for the MSD from the GC control panel

1 Press **Config,** and then press **MS/Aux Det** to bring up the CONFIGURE MS DETECTOR menu.

2 To configure the **IP:** parameter, use the GC keypad to enter the new IP address for the MSD, then press **Enter** to complete the entry.

3 Wait for the GC to display the new IP address. Reboot the MSD or proceed to the gateway address with the down arrow button

4 Press the down arrow to scroll to **GW:** and use the GC keypad to enter the new gateway address for the LAN and press **Enter** to complete the entry.

5 Press the down arrow to scroll to **SW:** and use the GC keypad to enter the new subnet mask for the LAN and press **Enter** to complete the entry.

6 Reboot the MSD. (See below)

Rebooting the MSD from the GC control panel

1 Press **Config,** and then press **MS/Aux Det** to bring up the CONFIGURE MS DETECTOR menu.

2 Press the down arrow to scroll to **Request MSD Reboot?**.

3 Press **On/Yes** to reboot the MSD and wait for the MSD to complete this cycle before trying to access it.

Enabling/disabling BOOTP on MSD

By default the BOOTP is disabled. If your LAN uses a BootP server, Enabling BOOTP causes the server to automatically assign an IP address to the MSD.

1 Press **Config,** and then press **MS/Aux Det** to bring up the CONFIGURE MS DETECTOR menu.

2 Press the down arrow to scroll to **MSD BOOTP**.

3 To enable BOOTP, press **On/Yes**.
To disable BOOTP, press **Off/No**.

4 Wait for the MSD to confirm the change on the GC control panel.

5 Reboot the MSD. See above.

Enabling/disabling LVDS on MSD

1 Press **Config,** and then press **MS/Aux Det** to bring up the CONFIGURE MS DETECTOR menu.

2 Press the down arrow to scroll to **Lvds communication**.
If you want to enable the LVDS, press **On/Yes**.
If you want to disable the LVDS, press **Off/No**.

3 Wait for the MSD to confirm the change on the GC control panel.

Configuring the MSD through the Web User Interface (WUI)

If your GC does not support LVDS communications with an Agilent GC, you can use the WUI to configure the MSD network settings. Reasons that a GC does not support configuring a 5977C MSD's network settings from the GC control panel include any of the following:

- LVDS communication does not exist between the GC and MSD.
- The GC is not an Agilent 8890 or 9000 model with the correct firmware.

Changing the network settings of the MSD

This procedure assumes that the operator has access to a PC located on the same LAN subnet as the MSD.

1 Open the top hinged cover on the MSD for accessing the analyzer to view the eModule mini display readout.

2 Press the **MSD On/Off** switch to start the instrument. When the instrument has completed its startup initialization it displays the current IP address information in the mini display readout and cycles through it for about **10 minutes**.

3 Copy the IP address, gateway, and subnet mask from the mini display readout. The defaults for each are 192.168.254.12, 0.0.0.0, and 255.255.255.0 respectively.

4 Enter the IP address into a PC web browser URL to display the WUI page. (See Figure 21.)

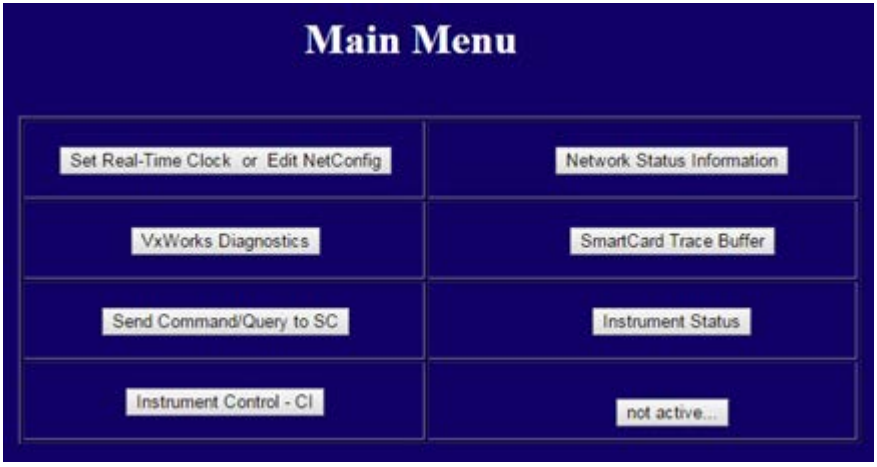


Figure 21. WUI main menu

5 Click **Set Real-Time Clock or Edit NetConfig**, and go to **Edit NetConfig (MSD network configuration).** (See Figure 22.)

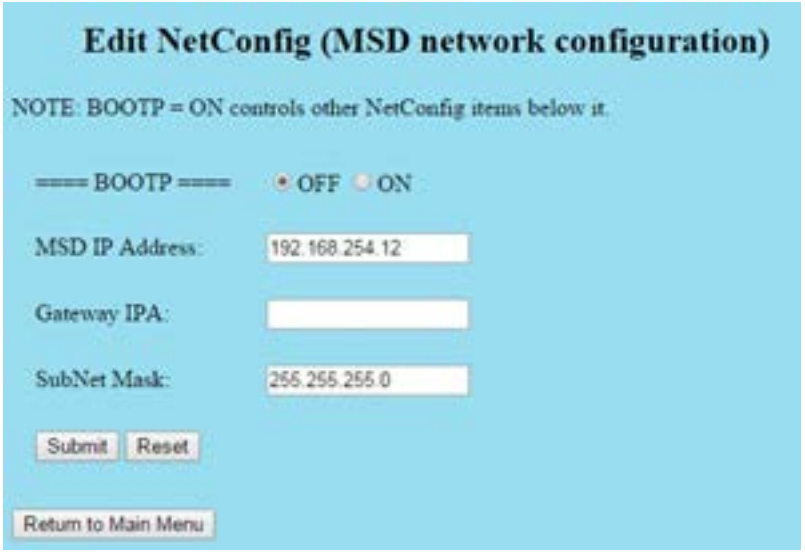


Figure 22. WUI Edit NetConfig

6 Confirm that **BootP** is set to **OFF**. If your LAN assigns IP addresses using a BootP server, click **ON** and skip the next step.

7 To update the **MSD IP address**, **Gateway IPA**, and **SubNet Mask** enter the new values. Before clicking submit, you can recover the previous settings by clicking **Return to Main Menu** and then returning here.

8 Click **Submit** to upload this net configuration to the MSD.

A dialog opens to confirm that the network configuration process has started. (See Figure 23.)

Figure 23 IP address configuration

9 Click **OK** to close the dialog and wait for the prompt requesting to **Manually reboot of the MSD/SmartCard to activate the new Settings.**

10 Use the **MSD on/off** switch to reboot the MSD SmartCard.

Operating the 5975/5977 MSD From the Local Control Panel (LCP)

Agilent 5975 and 5977 MSD models introduced before the 5977B MSD have a local control panel (LCP). The LCP shows the status of the MSD or initiates a task on the MSD without using the data acquisition software.

Only certain features are available from the LCP. The data acquisition software is the full-featured controller for most instrument control operations.

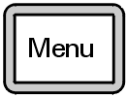
Modes of operation

The LCP has two modes of operation: Status and Menu.

Status mode requires no interaction and simply displays the current status of the MSD instrument or its various communication connections. If you select **[Menu]**, then **[No/Cancel]**, you will be returned to the Status mode.

Menu mode allows you to query various aspects of the GC/MSD and to initiate some actions like running a method or sequence or preparing to vent the system.

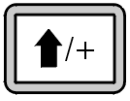
To access a particular menu option:



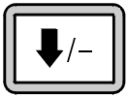
Press **[Menu]** until the desired menu appears.

Press **[Item]** until the desired menu item appears.

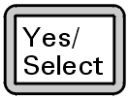
Use one or more of the following keys as appropriate to respond to prompts or select options:



Use **[Up]** to increase the displayed value or to scroll up (such as in a message list).



Use **[Down]** to decrease the displayed value or to scroll down (such as in a message list).



Use [**Yes/Select**] to accept the current value.

Use [**No/Cancel**] to return to the Status mode.

After you make your selection, or if you cycle through all available menus, the display automatically returns to Status mode.

Pressing [**Menu**], then [**No/Cancel**], will always display the Status mode.

Pressing [**No/Cancel**] twice will always return to the Status mode.

LCP Status Messages

The following messages may be displayed on the LCP to inform you of the status of the MSD system. If the LCP is currently in Menu mode, cycle through the menus to return to Status mode. No messages will be displayed if data acquisition software is not controlling the MSD.

ChemStation Loading <timestamp>

The Agilent OpenLab CDS software is starting up.

Executing <type>tune

A tuning procedure is in progress (type = QuickTune or Autotune).

Instrument Available <timestamp>

The Agilent OpenLab CDS software is not running.

Loading Method <method name>

Method parameters are being sent to the MSD.

Loading MSD Firmware

The MSD's firmware is being initialized.

The following messages alternately appear on the LCP if the MSD does *NOT* complete its bootup sequence properly:

Server not Found
Check LAN Connection

Seeking Server
Bootp Query xxx

These messages indicate that the MSD has not received its unique IP address from the Windows Service. If the messages persist after you have logged onto your account in the Agilent OpenLab CDS program, consult the Troubleshooting section of the Software Installation manual.

Loading OS

The operating system of the instrument controller is being initialized.

<method> Complete <timestamp>

The run and subsequent data processing are done. The same message appears even if the run was terminated prematurely.

Method Loaded <method name>

Method parameters were sent to the MSD.

MS locked by <computer name>

MS parameters can only be changed from the Agilent OpenLab CDS software.

Press Sideplate

A reminder during startup to press the MSD sideplate to ensure an adequate vacuum seal.

Run: <method> Acquiring <datafile>

A run is in progress; data is being acquired to the designated data file.

Viewing system status during startup

1 The following messages are displayed on the LCP display during startup:
   - **Press sideplate**
   - **Loading OS**
   - **Press sideplate**
   - **Loading MSD Firmware**

2 Continue to press the sideplate of the MSD until the **MSD Ready** message appears. This helps the instrument to pump down more quickly.

LCP Menus

To access a particular menu option, press [**Menu**] until the desired menu appears, then press [**Item**] until the desired menu item appears. Table 7 through Table 12 list the menus and selections.

NOTE **Many menu items, especially on the ChemStation, MS Parameters, and Maintenance menus, have no effect when the instrument is acquiring data.**

Table 7 ChemStation menu

Action	Description
Run Method	Displays the current method name and starts an analysis.
Run Sequence	Displays the current sequence and starts a sequence.
Run Current Tune	Displays the current tune file and starts an autotune
# of Messages	Displays the number of messages and the text of the most recent message. Use the arrow keys to scroll through previous messages (up to 20).
Release ChemStation	Disassociates OpenLab CDS from the MSD.
Connection Status	Displays the LAN connection status for the MSD. Remote = connected to an OpenLab CDS online session Local = not connected to an OpenLab CDS online session
Name of Instrument	Displays the name of the instrument if connected to an OpenLab CDS online session. The name of the instrument is the name assigned to the MSD by OpenLab CDS.

Table 8 Maintenance menu

Action	Description
Prepare to vent	Reminds you to shut down the GC then prepares the instrument for venting when **[Yes/Select]** is pressed.
Pumpdown	Initiates a pumpdown sequence.

Table 9 MS Parameters menu

Action	Description
High Vacuum Pressure	Only with Micro-Ion vacuum gauge installed.
Turbo Pump Speed	Displays the turbo pump speed.
Foreline Pressure	Displays the foreline pressure.
MSD Fault Status	Reports a summary fault status code (number) in 'dec' (decimal) and 'hex' (hexadecimal) format covering all possible fault combinations.
Ion Source Temp, °C	Displays and sets the ion source temperature.
Mass Filter Temp, °C	Displays and sets the mass filter temperature.
CI Reagent	Displays CI reagent gas and flow rate (if installed).

NOTE **MS parameters cannot be set from the LCP while an online OpenLab CDS session is connected to the MSD.**

Table 10 Network menu

Action	Description
MSD IP via BootP	Displays the IP address for the MSD.
Gateway IP Address	Displays the gateway IP address for the MSD.
Subnet Mask	Displays the subnet mask for the MSD.
ChemStation IP	Displays the IP address for the OpenLab CDS PC.
GC IP Address	Displays the IP address for the GC.
Ping gateway	Checks communication with the gateway.
Ping ChemStation	Displays the IP address for the OpenLab CDS PC.
Ping GC	Checks communication with the GC.
MS Controller MAC	Displays the MAC address of the SmartCard in the MSD.

Table 11 Version menu

Action	Description
Control firmware	Displays the MSD firmware version.
Operating system	Displays the OpenLab CDS operating system version.
Front panel	Displays the version of the LCP.
Log amplifier	Displays version information.
Sideboard	Displays the sideboard type.
Mainboard	Displays the mainboard type.
Serial number	Is assigned to the MSD by OpenLab CDS.

Table 12 Controller menu

Action	Description
Reboot controller	Starts the LAN/MS control card.
Test LCP?	Initiates a diagnostic test of the two-line display.
Test HTTP link to GC/MSD ChemStation?	Checks the status of the HTTP server.

eModule Mini Display Readout

The eModule mini display, accessible when the analyzer door cover is open, allows the operator to view the LAN configuration of the instrument including its IP address, subnet mask, default gateway, and MAC address. This LAN configuration can be changed using the GC control panel or the web user interface (WUI) from a web browser.

Figure 24. eModule mini display

Front Panel Instrument Status LED

Through the front panel instrument status LED, the operator can view the current status of the instrument using color codes and LED on/off timing. (See Table 13.)

Table 13 Front panel Instrument Status LED codes

Instrument status	LED code
Ready	Solid green
Acquiring data	Blinking green (<2 sec)
Not ready	Solid yellow
JetClean **Acquire & Clean** operation	Blinking magenta
JetClean **Clean Only** operation	Solid magenta
Ready and not connected to DS	Solid blue
Start up (prior to FW load)	Blinking red (<2 sec)
Fault	Solid red

Before You Turn On the MSD

Verify the following ***before*** you turn on or attempt to operate the MSD.

- The vent valve should be open slightly (knob turned 45 degrees counterclockwise from the fully closed position).
- All other vacuum seals and fittings must be in place and fastened correctly. The front side plate screw should not be tightened, unless hazardous carrier, JetClean system hydrogen, or reagent gases are being used.
- The MSD is connected to a grounded power source.
- The GC/MSD interface extends into the GC oven.
- A conditioned capillary column is installed in the GC inlet and in the GC/MSD interface.
- The GC is on, but the heated zones for the GC/MSD interface, the GC inlet, and the oven are off.
- Carrier gas of at least 99.9995% purity is plumbed to the GC with the recommended traps. The regulator, plumbing, traps, EPC module, inlet, and column have been purged of any gas to remove oxygen from the system.
- If hydrogen is used as carrier gas, or JetClean system supply, the carrier gas and JetClean system supply shutoff valves must be closed, and the analyzer top sideplate thumbscrew must be loosely fastened.
- The foreline pump exhaust is properly vented.

WARNING **The exhaust from the foreline pump contains solvents and the chemicals you are analyzing. If using the standard foreline pump, it also contains traces of pump oil. If you are using toxic solvents or analyzing toxic chemicals, remove the oil trap (standard pump) and install a hose to take the foreline pump exhaust outside or to a fume (exhaust) hood. Be sure to comply with local regulations. The oil trap supplied with the standard pump stops only pump oil. It does not trap or filter out toxic chemicals.**

WARNING **If hydrogen is used as a carrier gas or JetClean system supply, the carrier and JetClean system supply shutoff valves must be closed before turning off the MSD power. If the foreline pump is off, hydrogen will accumulate in the MSD and an explosion may occur. Read "Hydrogen Safety" on page 23 before operating the MSD with hydrogen gas.**

Pumping Down

The DS or 8890 or 9000 GC control panels help you pumpdown the MSD. The process is primarily automated. After you turn on the MSD by pressing the **On/Off** switch, close the analyzer door, and close the vent valve once you hear hissing (while pressing on the sideplate). The MSD pumps down by itself. The OpenLab CDS software monitors and displays system status during pumpdown. When the pressure is low enough, the program turns on the ion source and mass filter heaters and prompts you to turn on the GC/MSD interface heater. The MSD will shut down if it cannot pumpdown correctly.

Using the menus or MSD monitors, the DS can display:

- Motor speed for turbo pump MSDs (percent spin speed)
- Foreline pressure for diffusion pump MSDs
- Analyzer chamber pressure (vacuum) for MSDs with the optional G3397B Micro-Ion Gauge Controller

The 8890 and 9000 GC control panels also display this data.

Controlling Temperatures

MSD temperatures are controlled through the DS. The MSD has independent heaters and temperature sensors for the ion source and quadrupole mass filter. You can adjust the setpoints, and view these temperatures from the DS or from the GC control panel.

Normally, the GC/MSD interface heater is powered and controlled by the Thermal Aux #2 heated zone of the GC. The GC/MSD interface temperature can be set and monitored from the DS or from the 8890 or 9000 touchscreen.

Controlling Column Flow

Carrier gas flow is controlled by inlet pressure in the GC. Set the column mode to **Constant Pressure** to maintain a constant inlet pressure, and the column flow will decrease as the GC oven temperature increases. With EPC and the column mode set to **Constant Flow**, the same column flow is maintained regardless of temperature.

The MSD can be used to measure actual column flow. You inject a ***small*** amount of air or other unretained chemical, and time how long it takes to reach the MSD. With this time measurement, you can calculate the column flow. (For an 8890 GC, see the 8890 GC Operating Manual.)

Controlling JetClean Hydrogen Flow

The JetClean option uses hydrogen gas for cleaning the ion source. The JetClean system MFC sends hydrogen to the to the analyzer through the CI line in the GC/MSD interface. The flow rate is controlled by the OpenLab CDS software. The JetClean system is only supported on turbo based systems using an EI Inert source, or an EI HES. For a low cost JetClean flow control option, set the JetClean operation mode to **Clean Only**.

Venting the MSD

The DS guides you through the venting process. It turns off the GC and MSD heaters and diffusion pump heater or the turbo pump at the correct time. It also lets you monitor temperatures in the MSD and indicates when to vent the MSD.

The MSD *will* be damaged by incorrect venting. A diffusion pump will backstream vaporized pump fluid onto the analyzer if the MSD is vented before the diffusion pump has fully cooled. A turbo pump will be damaged if it is vented while spinning at more than 50% of its normal operating speed.

WARNING **Make sure the GC/MSD interface and the analyzer zones are cool (below 100 °C) before you vent the MSD. A temperature of 100 °C is hot enough to burn skin; always wear cloth gloves when handling analyzer parts.**

WARNING **If hydrogen is used as a carrier gas or JetClean system supply, the carrier and JetClean system supply shutoff valves must be closed before turning off the MSD power. If the foreline pump is off, hydrogen will accumulate in the MSD and an explosion may occur. Read "Hydrogen Safety" on page 23 before operating the MSD with hydrogen gas.**

WARNING **Never open the vent valve or shut down the vacuum pumps without first closing the shutoff valves for all hydrogen flows to the analyzer. This includes hydrogen carrier gas and hydrogen for the JetClean system.**

CAUTION **Never vent the MSD by allowing air in through either end of the foreline hose. Use the vent valve or remove the column nut and column.**

Do not vent while the turbo pump is still spinning at more than 50%.

Do not exceed the maximum recommended total gas flow. (See Table 3 on page 17.)

For complete venting instructions, see "Venting the MSD" on page 113.

Setting MS Analyzer Temperatures

Setpoints for the MSD ion source and mass filter (quad) temperatures are stored in the current tune (*.u) file. When a method is loaded, the setpoints in the tune file associated with that method are downloaded automatically.

1 Enable Tune Control and click **Manual Tune > Parameters**.

2 Enter the Source temp (°C) and Quad temp (°C) (mass filter).

The GC/MSD interface, ion source, and quadrupole heated zones interact. The analyzer heaters may not be able to accurately control temperatures if the setpoint for one zone is much different from that of an adjacent zone.

CAUTION **Do not exceed 200 °C for the quadrupole or 350 °C for the source.**

3 Click **Download tune file** to download these temperature setpoints to the MS and change the current control temperatures to these values.

4 Click **Save the tune parameters** to make these temperature settings part of this tune file or click **Save tune file as** to create a new tune file with these values.

5 Run an autotune if you want these new temperatures in an autotune file.

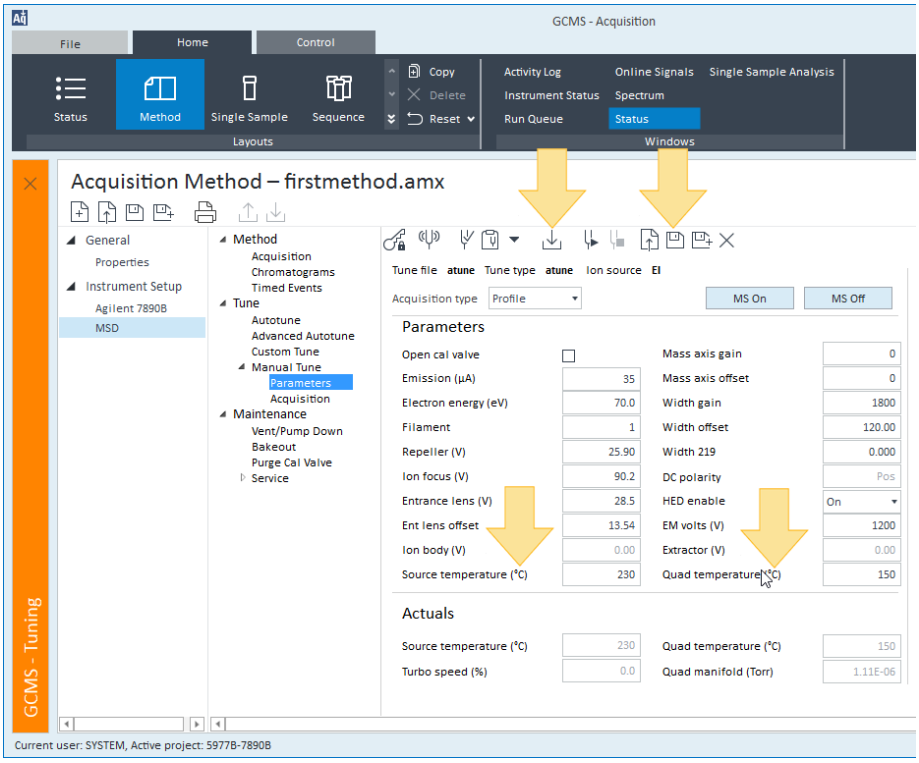


Figure 25. Set the Quad and Source temperatures

6 Release Tune Control.

Running an Autotune

A full autotune run takes about 15 to 20 minutes. When the **Quick Tune** option is not selected, the autotune requires less than five minutes. Alternatively, you can run an autotune from the dashboard.

Procedure

1 Click **Method > MSD > Tune > Autotune**.

2 Click **Request tune control**. The icon changes to **Release Tune Control** and the instrument status changes from green to orange to indicate that the instrument is in the Tuning state.

3 Select **Tune > Autotune**. The tune file used by the current method is loaded.

4 To use a different tune file, click the **Open a tune file** icon and select it.

5 Check **Quick Tune**, if relative abundances of the 3 masses are at acceptable values, unless a full autotune is needed.

6 Optionally, to send the Autotune report to the printer, in the **Reports** area, select the **Print Report** icon.

7 Click the **Start autotune** icon. The autotune procedure runs.

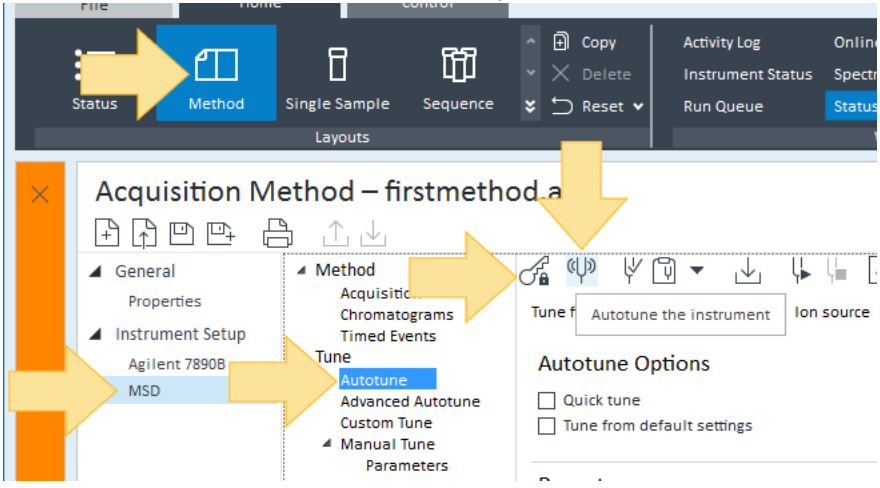


Figure 26. Run and autotune

8 Click the **Release Tune Control** icon.

9 As needed, click **Evaluate Tune Report** to generate the report.

Creating and Running a JetClean Clean Only Method

In order to create and run a JetClean method, your MSD must be equipped with, and configured for a JetClean or CI flow gas controller, and Hydrogen gas must be connected to port B.

1 Click **Method** 

then open  a method that you would use to do a normal chromatographic run.

2 Save the current Acquisition as a new file  .

3 Click **JetClean**, and from the **Operation** drop-down, select **Clean Only**. This option will not be available if your MSD is not configured for a JetClean gas controller.

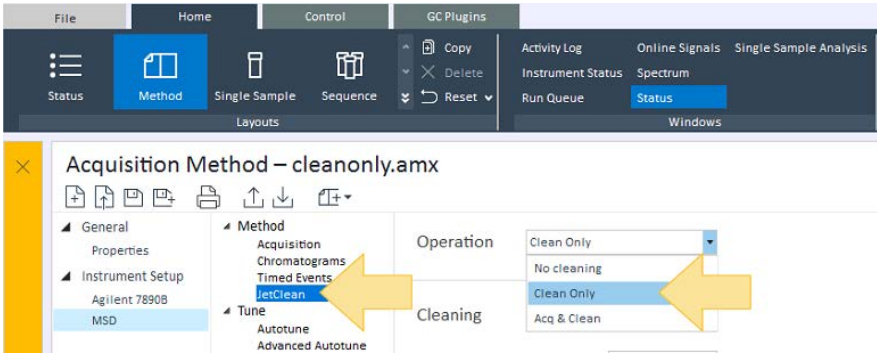


Figure 27. Clean Only JetClean method

4 When developing your **Clean Only** method, it is important to obtain the lowest possible hydrogen flow, while still observing good results.

- Too little hydrogen will fail to clean the source sufficiently.
- Too much hydrogen will "over condition" the source.

To begin, use these default parameters for your JetClean **Clean Only** method.

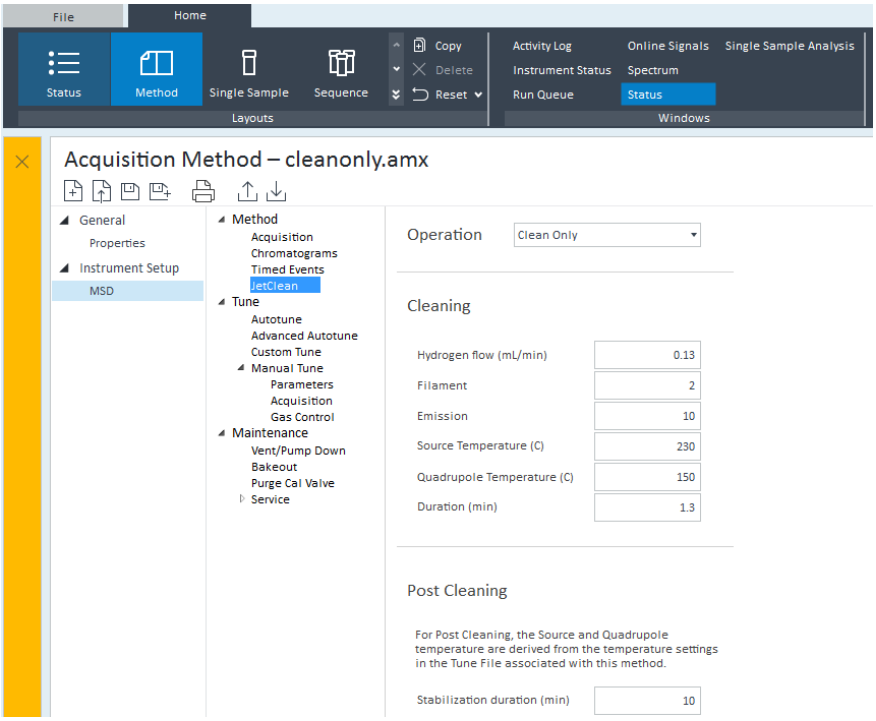


Figure 28. JetClean Clean Only default parameters

5 Select **Instrument Setup > GC > Oven** and modify the **Hold Time** and **Post Run Time** to correspond with those set in the MSD JetClean Cleaning window (1.3 minutes in the example shown below.).

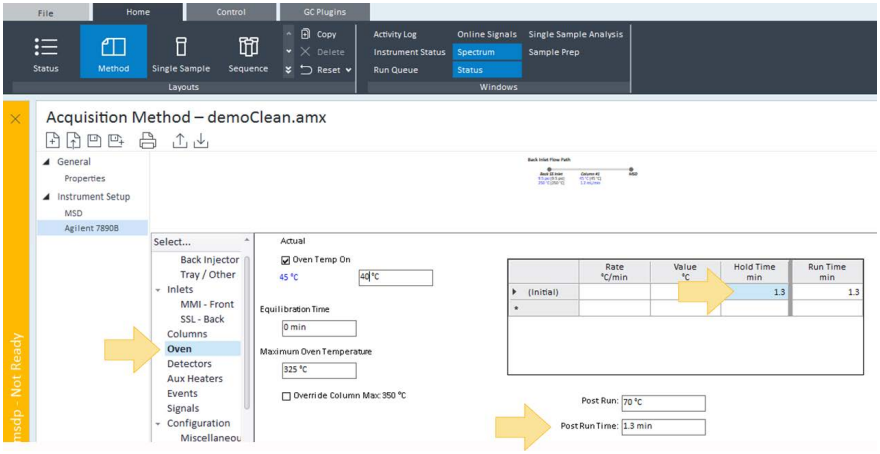


Figure 29. Holt Time and Post Run Time settings

6 Save the method. Both the GC and MS parameters, along with the method description, are saved with the method.

7 Access the **Single Sample** window.

8 For **Injection source**, select **No Injection/Instrument Blank**. This mode tells both the GC and the MS to run the specified method, even though no sample has been included. (See **Figure 30** on page 105.)

9 To begin the cleaning process, click **Run**.

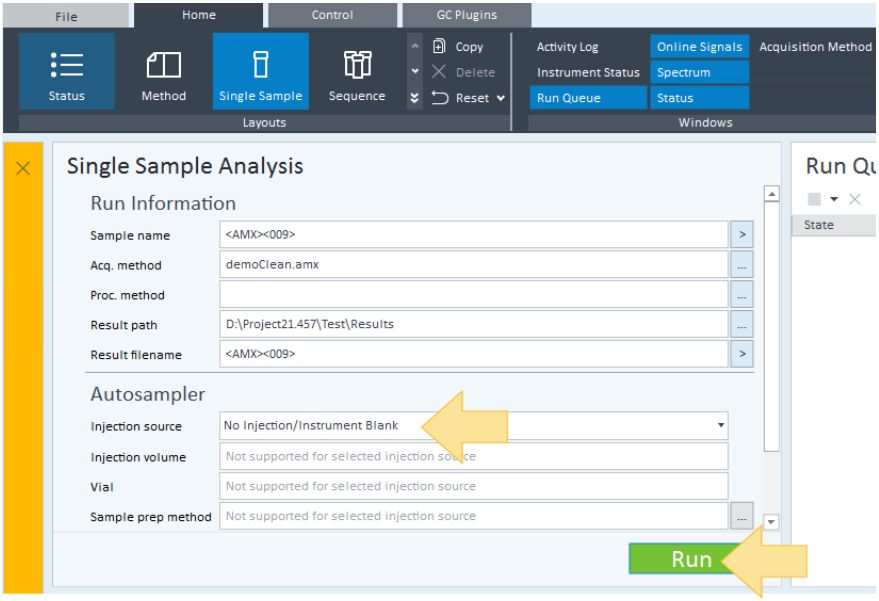


Figure 30. Single Sample window

10 From the Dashboard you can monitor the status of your instrument from the countdown timer, highlighted in Figure 31.

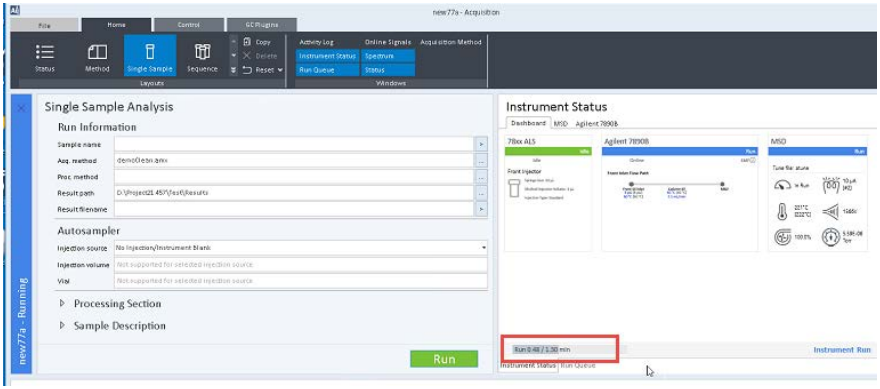


Figure 31. Countdown timer

Additionally, you can monitor the status of your instrument on the **MSD** details page.

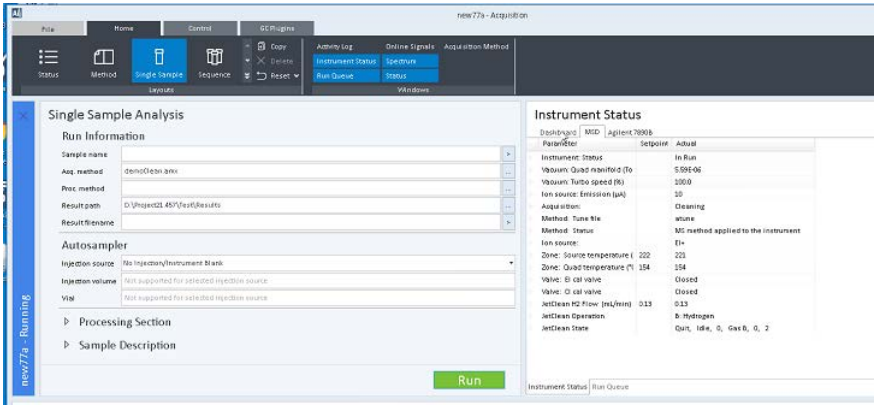


Figure 32. MSD details page

11 During the stabilization time, the instrument will return to the normal method setpoints. When the process completes, review your results.

If the **results have improved satisfactorily**, resume processing samples as usual.

If the **results have improved, but not sufficiently**, adjust the setpoints of the JetClean Clean Only method, very slightly, and re-run the JetClean method. (For example, increase the amount of hydrogen added or the exposure time.)

If the **results have gotten worse**, it may be time to perform a manual cleaning.

Creating and Running a JetClean Acquire & Clean Method

To create and run a GC/MS JetClean Acquire & Clean method, your MSD must be equipped with, and configured for a JetClean or CI flow gas controller, and Hydrogen gas must be connected to port B.

1 Set the MS Method Acquisition parameters.

a Click **Method** 

then open  , and navigate to the data acquisition method you will use.

b Save the acquisition method as a new file  (AcquireAndClean, for this example.)

c Click **JetClean**, then, from the **Operation** drop-down, select **Acq & Clean**. This option will not be available if your MSD is not configured with a gas flow controller. (See Figure 33.)

d Note the hydrogen flow that displays is the default flow of 0.13. The hydrogen flow shown here must match the hydrogen flow you enter in the tune parameters (described below in step 2).

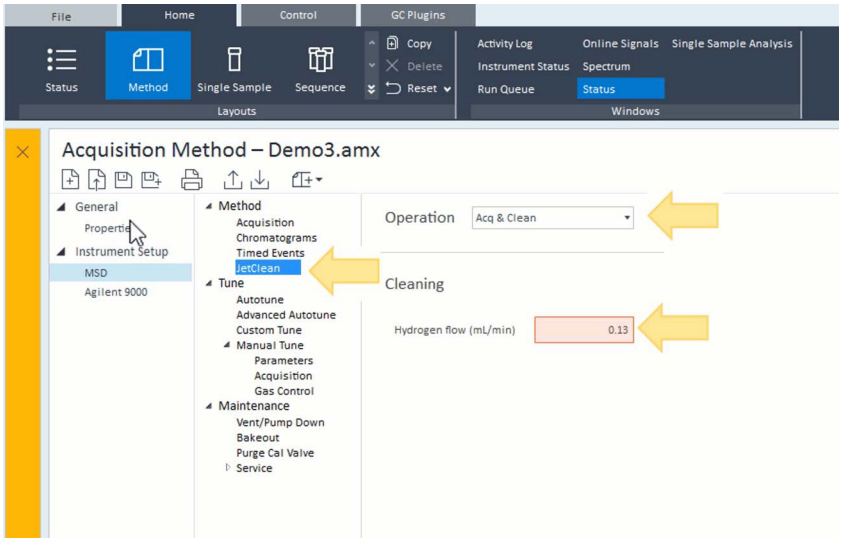


Figure 33. Method Acquisition parameters

e Save the acquisition method.

2 Set the tune parameters and tune the instrument.

a Select **Tune > Autotune**, then click **Request tune control** . The Tune File associated with the currently loaded Method is loaded and the name and type are displayed.

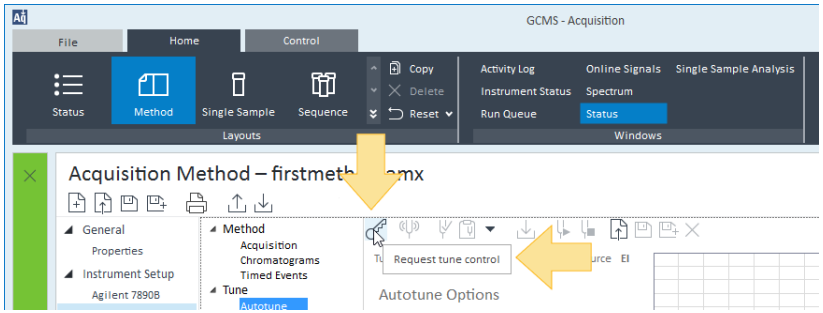


Figure 34. Autotune selection

b Select **Tune > Manual Tune > Parameters** and set the hydrogen **Gas flow** parameter to **0.13**. When developing your **Acquire and Clean** method, it is important to obtain the lowest possible hydrogen flow, while still observing good results. (See Figure 35 on page 109.)

- Too little hydrogen will fail to clean the source sufficiently.
- Too much hydrogen will "over condition" the source.

The default parameter is a hydrogen flow of 0.13. To begin, use this default parameter for your JetClean method. Remember, the hydrogen flow set here must match the flow in your MS method parameters, described above in step 1 on page 107 (0.13 is the default).

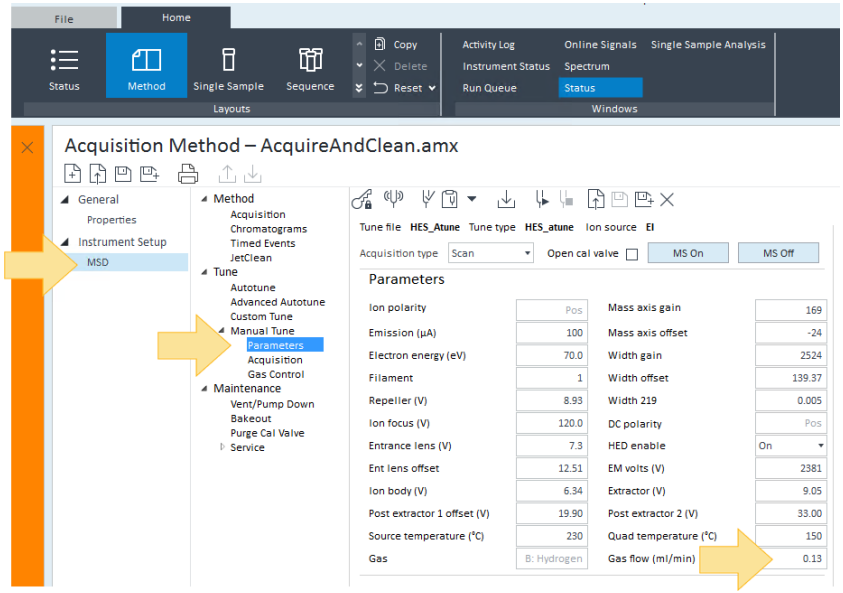


Figure 35. Manual Tune parameters

c Save the tune file with a name that is recognizable as your Acquire and Clean tune file (e.g., AcquireandCleanHES_Atune for this example).

d Click **Autotune the instrument** .

e After the autotune procedure runs, **release tune control** .

3 Load the newly created tune file into the MSD Acquisition parameters.

a Select **MSD > Method > Acquisition**, click **Load a Tune File** ... and select the tune file you created for this process. (**AcquireandCleanHES_Atune** for this example.) (See Figure 36 and Figure 37.)

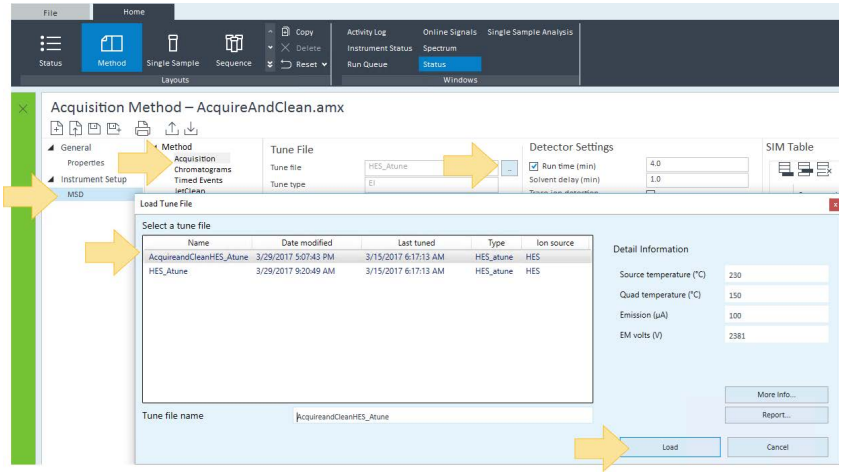


Figure 36. Select a Tune file to Load

b Save ... the method. Both the GC and MS parameters, along with the method description, are saved with the method.

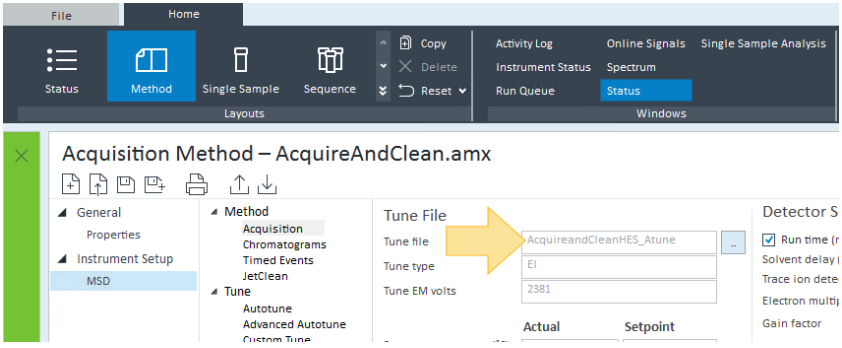


Figure 37. Loaded Tune file

Now that the new tune file is loaded and the method is saved, you may process your samples as usual using this **Acquire and Clean** method.

Enabling the GC/MS Interface and Oven

Procedure

1. Click **Method > Instrument Setup > GC > Aux Heaters**.
2. Select **On** for **Thermal Aux 2**.
3. Click **Oven** and select **On**.
4. Click **Download Method** to enable these temperature zones in the GC.
5. Save the method.

Opening the MSD Covers

If you need to open one of the MSD covers, follow these procedures.

To remove the analyzer window cover

Press down on the rounded area on the top of the window, tilt the window slightly forward and lift it off the MSD. (See Figure 38.)

CAUTION **Do not use excessive force or the plastic tabs that hold the cover to the mainframe will break off.**

Figure 38 5977C MSD covers

Pull the handle on the side of the MSD to the left and down to release the magnetic latch and open the cover. The cover is held in place by its hinges. (See Figure 38.)

WARNING **Do not remove any other covers. Dangerous voltages are present under other covers.**

Venting the MSD

Agilent OpenLab CDS software allows you to specify parameters in a GC method that will automate and speed up the vent process if direct communication (DCOMM) with the GC is established. You must predefine a Fast Vent method to use this option.

Procedure

1 Select **Method > MSD > Maintenance > Vent/Pump Down** and click **Vent** to begin the process. Follow the instructions presented.

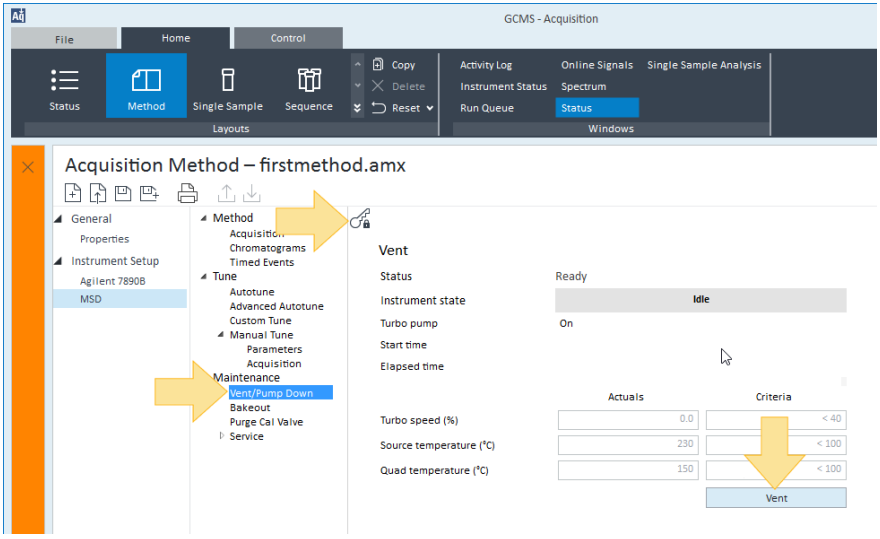


Figure 39. Vent the MSD

2 When prompted, turn the vent valve knob counterclockwise only 3/4 turns or until you hear the hissing sound of air flowing into the analyzer chamber. (See Figure 40.) Do *not* turn the knob too far, or the O-ring may fall out of its groove.

Figure 40. Vent valve knob

WARNING If hydrogen is used as a carrier gas or JetClean system supply, the carrier and JetClean system supply shutoff valves must be closed before turning off the MSD power. If the foreline pump is off, hydrogen will accumulate in the MSD and an explosion may occur. Read "Hydrogen Safety" on page 23 before operating the MSD with hydrogen carrier gas.

CAUTION Be sure the GC oven and the GC/MSD interface are cool before turning off carrier gas flow to prevent damage to the column.

Viewing MSD Temperatures and Vacuum

Select **Instrument Status** in the windows area, and click **MSD** to display the MSD's actuals values including the source and quad temperatures and quad manifold vacuum pressure.

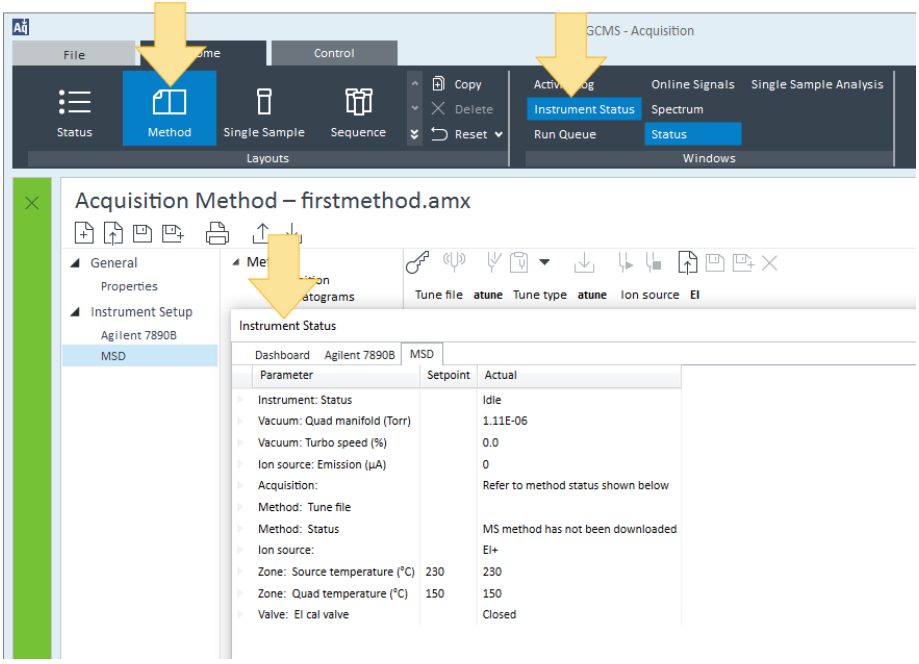


Figure 41. MSD tab Temperatures and Vacuum

Pumping down the MSD

You can also use the 8890 or 9000 GC touchscreen to perform this task.

WARNING **Make sure your MSD meets all the conditions listed in the introduction to this chapter before starting up and pumping down the MSD. (See "Before You Turn On the MSD" on page 95.) Failure to do so can result in personal injury.**

WARNING **Never open the vent valve without first closing the hydrogen supply line to all possible sources of hydrogen entry to the analyzer. This requires closing the hydrogen shutoff valve to the carrier gas flow module and the shutoff valve to the JetClean system supply if either of these hydrogen sources exist on the instrument. Read "Hydrogen Safety" on page 23 before operating the MSD with hydrogen gas.**

Procedure

1 Remove the analyzer window cover and open the analyzer cover. (See "Opening the MSD Covers" on page 112.)

2 Verify that the foreline pump inlet valve is open.

WARNING **Do not open the vent valve without verifying that the JetClean system hydrogen supply shutoff valve is closed if the optional JetClean system is installed. Refer to the JetClean system Operating manual for warnings regarding when the hydrogen shutoff valve is open.**

3 Verify that the vent valve is open by turning it clockwise until closed. (See Figure 42 on page 117.)

4 Open the vent valve by turning it counterclockwise 45 degrees. (See Figure 42.)

Figure 42 Vent valve knob

5 Verify that the MSD power cord is plugged into a grounded building's main receptacle.

6 Turn on the MSD by pressing the **On/Off** switch on the front of the MSD.

7 Press lightly on the side board to ensure a correct seal. Press on the metal box on the side board.

8 Close the vent valve when it makes a hissing sound. (See Figure 42.)

The foreline pump will make a gurgling noise. This noise should stop within a minute. If the noise continues, there is a ***large*** air leak in your system, probably at the side plate seal, the interface column nut, or the vent valve.

9 Start the OpenLab CDS Acquisition program. If the MS was configured for multiple ion source types, you are prompted for the ion source type that is currently installed. Click on the installed source type if prompted.

10 If the selected ion source in the previous step does not match the source used in the current method's tune file, you are prompted to enter a method with the correct ion source type. Load the correct method for your source type.

11 Enable Tune Control and click **Maintenance**.

12 Click **Pump Down** to start this procedure.

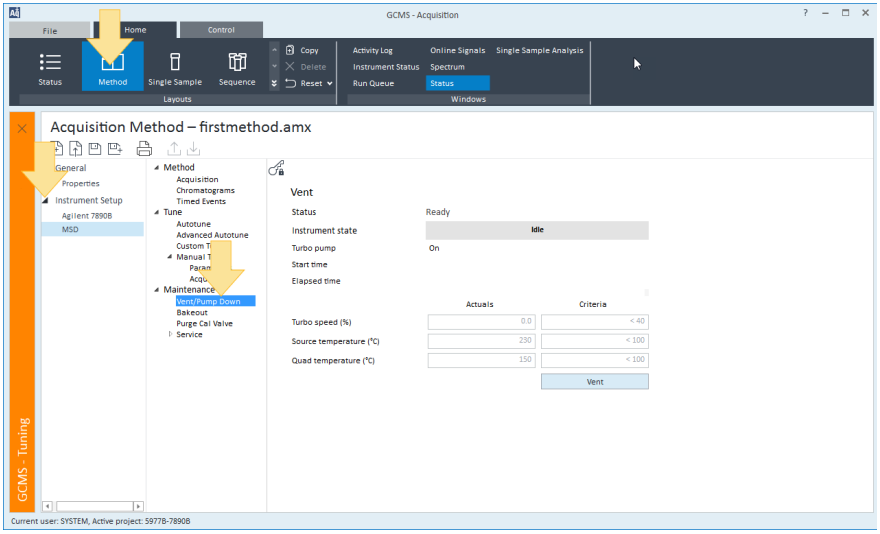


Figure 43. Pump down the MSD

CAUTION **Do not turn on any GC heated zones until carrier gas flow is on. Heating a column with no carrier gas flow will damage the column.**

13 You are prompted to turn on the transfer line heater and the GC oven. Click **OK** when you have done so.

14 The software will turn on the ion source and mass filter (quad) heaters. The temperature setpoints are stored in the current autotune file. The pump down status and "the MSD actual parameters" in comparison to "criteria required for pump down completion" is shown.

15 Wait for the MS to reach thermal equilibrium.

After the message **Okay to run** appears, wait 2 hours for the MS to reach thermal equilibrium. Data acquired before the MS has reached thermal equilibrium may not be reproducible.

16 When the pumpdown is finished, click **OK** to clear the pump down status window.

17 Tune the MS.

5 Operating in CI Mode

This chapter provides information and instructions for operating the 5977C Series CI MSDs in CI mode. Most of the information in the preceding chapter is also relevant.

Most of the material is related to methane CI but one section discusses the use of other reagent gases.

The software contains instructions for setting the reagent gas flow and for performing CI autotunes. Autotunes are provided for PCI with methane reagent gas and for NCI with any reagent gas.

If you are using the *Agilent Intuvo 9000 Gas Chromatograph* with your MSD, Chemical Ionization (CI) is not currently supported.

General Guidelines

- Always use the highest purity methane (and other reagent gases, if applicable). Methane must be at least 99.9995% pure.
- Always verify the MSD is performing well in EI mode before switching to CI.
- Ensure the CI source and GC/MSD interface tip seal are installed.
- Ensure the reagent gas plumbing has no air leaks. This is determined in PCI mode, checking for *m/z* 32 after the methane pretune.
- Ensure the reagent gas inlet line is equipped with gas purifiers (not applicable for ammonia).

CI Autotune

After the reagent gas flow is adjusted, the lenses and electronics of the MSD should be tuned. (See Table 14 on page 122.)
Perfluoro-5,8-dimethyl-3,6,9-trioxidodecane (PFDTD) is used as the calibrant. Instead of flooding the entire vacuum chamber, the PFDTD is introduced directly into the ionization chamber through the GC/MSD interface by means of the gas flow control module.

CAUTION **After the source is changed from EI to CI, or vented for any other reason, the MSD must be purged and baked out for at least 2 hours before tuning. Longer bakeout is recommended before running samples requiring optimal sensitivity.**

There is a PCI autotune for methane only, as there are no PFDTD ions produced by other gases in positive mode. PFDTD ions are visible in NCI for any reagent gas. Always tune for methane PCI first, regardless of which mode or reagent gas you wish to use for your analysis.

There are no tune performance criteria. If CI autotune completes, it passes.

EMV at or above 2600 V, however, indicates a problem. If your method requires EMV set at +400, you may not have adequate sensitivity in your data acquisition.

CAUTION **Always verify MSD performance in EI before switching to CI operation. Always set up the CI MSD in PCI first, even if you are going to run NCI.**

Table 14 Reagent gas settings

Reagent gas	Methane		Isobutane		Ammonia		EI
Ion polarity	Positive	Negative	Positive	Negative	Positive	Negative	N/A*
Emission	150 µA	50 µA	150 µA	50 µA	150 µA	50 µA	35 µA
Electron energy	150 eV	150 eV	150 eV	150 eV	150 eV	150 eV	70 eV
Filament	1	1	1	1	1	1	1 or 2
Repeller	3 V	3 V	3 V	3 V	3 V	3 V	30 V
Ion focus	130 V	130 V	130 V	130 V	130 V	130 V	90 V
Entrance lens offset	20 V	20 V	20 V	20 V	20 V	20 V	25 V
EM volts	1200	1400	1200	1400	1200	1400	1300
Shutoff valve	Open	Open	Open	Open	Open	Open	Closed
Gas select	A	A	B	B	B	B	None
Suggested flow	20%	40%	20%	40%	20%	40%	N/A
Source temp	250 °C	150 °C	250 °C	150 °C	250 °C	150 °C	230 °C
Quad temp	150 °C	150 °C	150 °C	150 °C	150 °C	150 °C	150 °C
Interface temp	280 °C	280 °C	280 °C	280 °C	280 °C	280 °C	280 °C
Autotune	Yes	Yes	No	Yes	No	Yes	Yes

* N/A Not Available

Operating the CI MSD

Operating your MSD in the CI mode is slightly more complicated than operating in the EI mode. After tuning, gas flow, source temperature, and electron energy may need to be optimized for your specific analyte. (See Table 15.)

Table 15 Temperatures for CI operation

	Ion source	Quadrupole	GC/MSD interface
PCI	250 °C	150 °C	280 °C
NCI	150 °C	150 °C	280 °C

Starting the system in PCI mode

By bringing the system up in PCI mode first, you will be able to do the following:

- Set up the MSD with methane first, even if you are going to use another reagent gas.
- Check the interface tip seal by looking at the *m/z* 28 to 27 ratio (in the methane flow adjust panel).
- Determine if a gross air leak is present by monitoring the ions at *m/z* 19 (protonated water) and 32.
- Confirm that the MSD is generating real ions and not just background noise.

It is nearly impossible to perform any diagnostics on the system in NCI. In NCI, there are no reagent gas ions to monitor. It is difficult to diagnose an air leak, and difficult to tell whether a good seal is being created between the interface and the ion volume.

Depending upon the application, use the following reagent gas flow rates during system startup:

- PCI mode set reagent gas flow to 20 (1 mL/min)
- NCI mode set reagent gas flow to 40 (2 mL/min)

Pumping Down the MSD in CI Mode

This procedure assumes that the instrument will eventually be PCI tuned using methane after the system is stable.

Procedure

1 Follow the instructions for the EI MSD. (See "Pumping down the MSD" on page 116.)

After the software prompts you to turn on the GC/MSD interface heater and GC oven, perform the following steps.

2 Select **Manual Tune > Parameters** to monitor that the pressure is decreasing (Hi-Vac gauge option installed). The Cal valve should be closed.

3 Verify that **PCICH4** is loaded and the source and Quad temperatures are correct.

Always start up and verify system performance in PCI mode before switching to NCI.

4 Set the GC/MSD interface to 280 °C. (See Table 15 on page 123.)

5 Set **Gas A (methane)** to 20%.

6 Let the system bake out and purge for at least 2 hours. If you will be running NCI, for best sensitivity, bake out the MSD overnight.

Setting Up the Software for CI Operation

CAUTION **Always verify GC/MSD performance in EI before switching to CI operation.**

Procedure

1 Click the **Request Tune Control** icon, and select the **Autotune the Instrument** icon. The tune file used by the current method is loaded.

If the tune file is not **PCICH4**, click the **Open a tune file** icon, and select the file.

2 If CI autotune has never been run for this tune file, the software will prompt you through a series of dialog boxes. *Accept the default values unless you have a very good reason for changing anything.*

The tune values have a dramatic effect on MSD performance. Always start with the default values when first setting up for CI, and then make adjustments for your specific application. (See Table 16 for default values for the Tune Control Limits box.) These limits are used by Autotune only. They should *not* be confused with the parameters set in MS Parameters or with those appearing on the tune report.

Table 16 Default Tune Control Limits, used by CI autotune only

Reagent gas	Methane		Isobutane		Ammonia	
Ion polarity	Positive	Negative	Positive	Negative	Positive	Negative
Abundance target	$1x10^6$	$1x10^6$	N/A	$1x10^6$	N/A	$1x10^6$
Peakwidth target	0.6	0.6	N/A	0.6	N/A	0.6
Maximum repeller	4	4	N/A	4	N/A	4
Maximum emission current, µA	240	50	N/A	50	N/A	50
Max electron energy, eV	240	240	N/A	240	N/A	240

Notes for Table 16:

- **N/A**: Not available. There are no PFDTD ions formed in PCI with any reagent gas but methane, hence, CI autotune is not available with these configurations.
- **Ion polarity**: Always set up in PCI with methane first, then switch to your desired ion polarity and reagent gas.
- **Abundance target**: Adjust higher or lower to get the desired signal abundance. Higher signal abundance also gives higher noise abundance. This is adjusted for data acquisition by setting the EMV in the method.
- **Peakwidth target**: Higher peakwidth values give better sensitivity, lower values give better resolution.
- **Maximum emission**: **current** Optimum emission current maximum for NCI is very compound-specific and must be selected empirically. Optimum emission current for pesticides, for example, may be about 200 µA. Maximum current limit is 200 µA for EI and 250 µA for CI.

Operating the Reagent Gas Flow Control Module

CAUTION **After the system has been switched from EI to CI mode, or vented for any other reason, the MSD must be baked out for at least 2 hours before tuning.**

CAUTION **Continuing with CI autotune if the MSD has an air leak or large amounts of water will result in *severe* ion source contamination. If this happens, you need to *vent the MSD* and *clean the ion source*.**

Procedure

1 To monitor and control the gas flow, with your tune file loaded, click **Method > Instrument Setup > MSD > Manual Tune > Gas Control**. The Gas control window opens. From here you may: admit gas, purge gas, pump out gas, or close all valves to your instrument.

2 Click the **Request tune control** icon, and select **Manual Tune > Gas Control**.

The system evacuates the gas lines for 6 minutes, then turns on the selected gas (A or B). This is to reduce cross-mixing of the gases in the lines.

3 Enter the reagent gas flow setpoint in the **Flow** field. This value is entered as a percentage of maximum flow rate. The recommended flow is 20% for a PCI source and 40% for an NCI source.

The flow control hardware remembers the flow setting for each gas. When either gas is selected, the control board automatically sets the same flow that was used for that gas the last time.

4 Select an item below to control the gas valves.

- To admit gas, click **Admit gas** (A: or B:), then click **Apply**. You can watch the status in either the Gas Control window or the MSD detail window.
- To purge gas, click **Purge gas** (A or B), then click **Apply**.
- To turn off the flow, click **Pump out**, then click **Apply**. When this is completed, the flow controller is closed, but the shut off valve is normally left open and continues pumping.
- To close all valves, click **No flow, All valves closed**, then click **Apply**.

When completed, click the **Release tune control** icon.

The CI flow control module

The CI reagent gas flow control module regulates the flow of reagent gas into the CI GC/MSD interface. The flow module consists of a MFC, gas select valves, CI calibration valve, shutoff valve, control electronics, and plumbing. (See Figure 44 and Table 17 on page 129.)

The back panel provides Swagelok inlet fittings for methane (**CH4**) and one **OTHER** reagent gas. The software refers to them as **Gas A** and **Gas B**, respectively. If you are not using a second reagent gas, cap the **OTHER** fitting to prevent accidental admission of air to the analyzer. Supply reagent gases at 25 to 30 psi (170 to 205 kPa).

The shutoff valve prevents contamination of the flow control module by atmosphere while the MSD is vented or by PFTBA during EI operation.

When a CI system is installed along with a JetClean system, the MFC is shared by both systems. By design, its use is restricted to one of these systems at a time. In this case, the Gas B supply is dedicated to hydrogen used for source cleaning. For detailed information on the JetClean system refer to the JetClean Operating manual installed on your PC along with this manual.

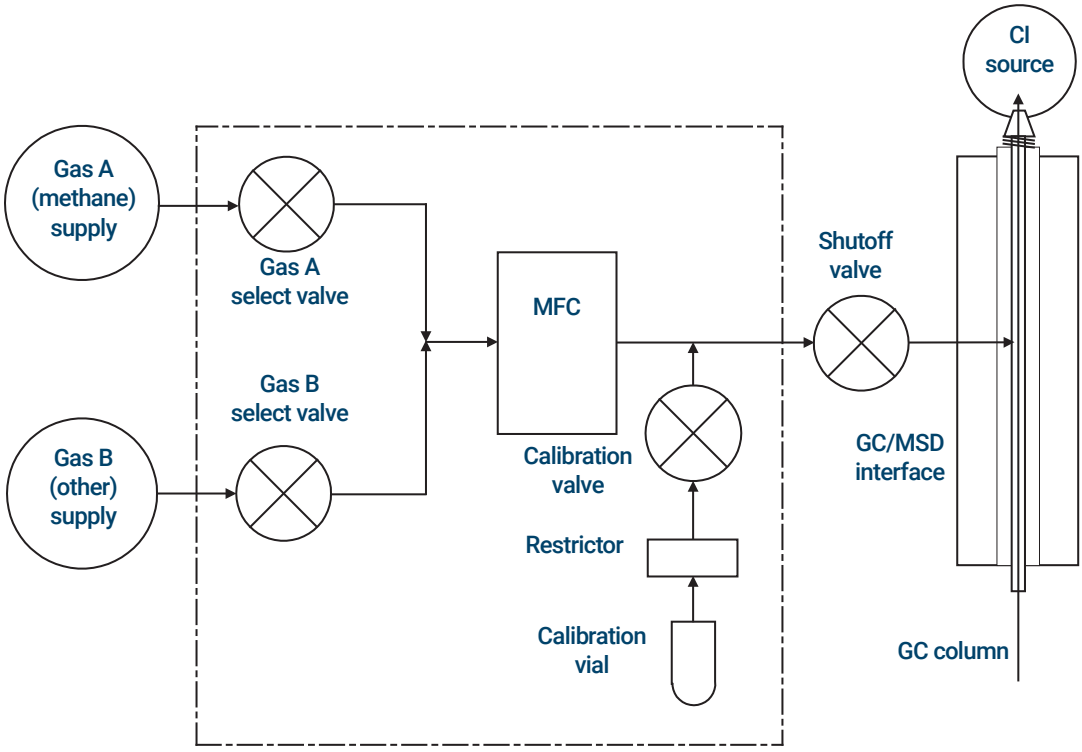


Figure 44. Reagent gas flow control module schematic

Table 17 Flow control module state diagram

Result	Gas A flow	Gas B flow	Purge with Gas A	Purge with Gas B	Pump out flow module	Standby, vented, or EI mode
Gas A	Open	Closed	Open	Closed	Closed	Closed
Gas B	Closed	Open	Closed	Open	Closed	Closed
MFC	On → setpoint	On → setpoint	On → 100%	On → 100%	On → 100%	Off →0%
Shutoff valve	Open	Open	Open	Open	Open	Closed

The **Open** and **Closed** states are shown in the monitors as **Open** and **Closed** respectively.

Setting Up Methane Reagent Gas Flow

The reagent gas flow must be adjusted for maximum stability before tuning the CI system. Do the ***initial*** setup with methane in PCI mode. No flow adjustment procedure is available for NCI, as no negative reagent ions are formed.

Adjusting the methane reagent gas flow is a three-step process: setting the flow control, pretuning on the reagent gas ions, and adjusting the flow for stable reagent ion ratios, for methane, *m/z* 28/27.

Your data system will prompt you through the flow adjustment procedure.

Procedure

1 Using an EI source, perform the standard autotune, save the report, and note the reported pressure.

2 Vent the system. (See **"Venting the MSD"** on page 113.)

3 Install the CI source. (See **"Installing the CI Source"** on page 230.)

4 Pump out the system. (See **"Pumping Down the MSD in CI Mode"** on page 124.)

5 Wait until the pressure is near the previously recorded pressure for the EI autotune.

6 Select **MSD > Maintenance > Bakeout** to access the Bakeout parameters. Set a minimum time of 2 hours, adjust the other parameters, and click **OK** to begin the bake out.

CAUTION

After the system has been switched from EI to CI mode, or vented for any other reason, the MSD must be baked out for at least 2 hours before tuning.

Continuing with CI autotune if the MSD has an air leak or large amounts of water will result in *severe* ion source contamination. If this happens, you need to *vent the MSD* and *clean the ion source*.

7 Select **Methane Pretune** from the **Setup** menu and follow the system prompts. See the OpenLab CDS software online help for additional information.

The methane pretune tunes the instrument for optimum monitoring of the ratio of methane reagent ions *m/z* 28/27.

8 Examine the displayed profile scan of the reagent ions. (See Figure 45.)
   - There should be no visible peak at *m/z* 32. A peak there indicates an air leak. Repair the leak before proceeding. Operating in the CI mode with an air leak will rapidly contaminate the ion source.
   - The peak at *m/z* 19 (protonated water) is less than 50% of the peak at *m/z* 17.

9 When prompted, click **OK** to perform the methane Flow Adjust.

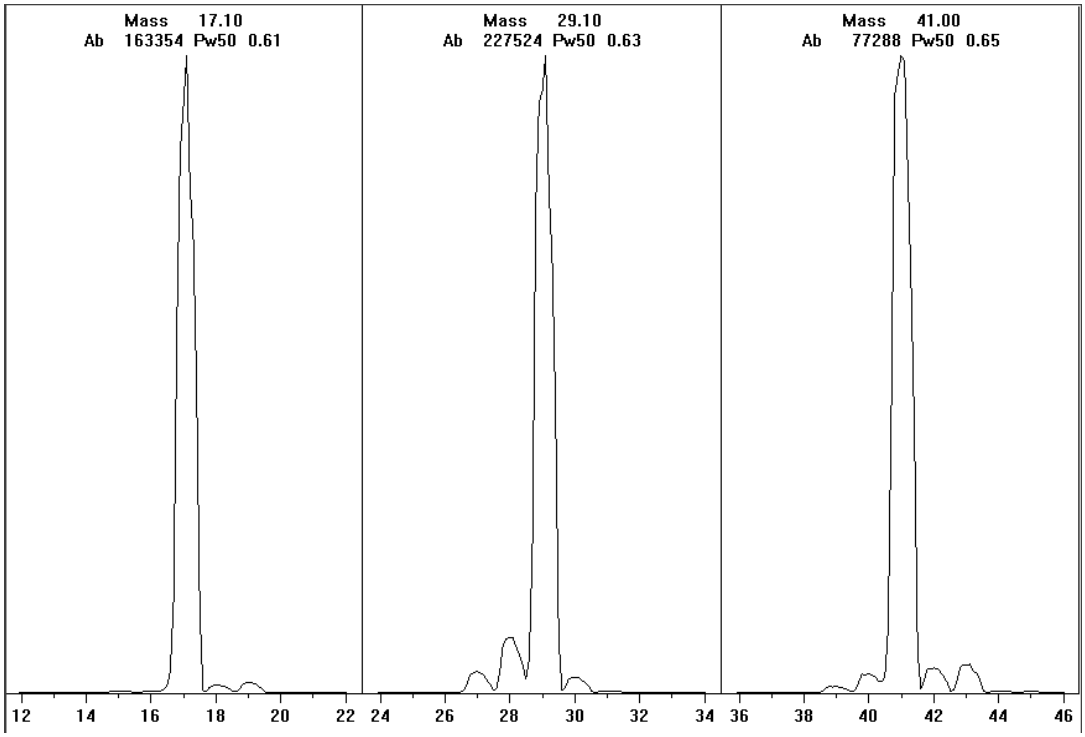


Figure 45. Reagent ion scans after a very long bake out

Methane pretune after more than a day of baking out

Note the low abundance of *m/z* 19 and absence of any visible peak at *m/z* 32. Your MSD will probably show more water at first, but the abundance of *m/z* 19 should still be less than 50% of *m/z* 17.

Performing a PCI Autotune (Methane Only)

CAUTION

Always verify MSD performance in EI before switching to CI operation. Always set up the CI MSD in PCI first, even if you are going to run NCI.

Avoid tuning more often than is absolutely necessary; this will minimize PFDTD background noise and help prevent ion source contamination.

Procedure

1 Verify that the MSD performs correctly in EI mode first.

2 Select **Tune > Autotune**. The tune file used by the current method is loaded.

If the tune file is not **PCICH4**, click the **Open a tune file** icon and select the file. If you use an existing tune file, be sure to save it with a new name if you do not want to overwrite the existing values.

3 Accept the default settings.

4 Perform methane setup. (See "Setting Up Methane Reagent Gas Flow" on page 130.)

5 Click **Method > MSD > Tune > Autotune**.

6 Click **Request tune control**. The icon changes to **Release Tune Control** and the instrument status changes from green to orange to indicate that the instrument is in the Tuning state. The tune file associated with the currently loaded method is displayed.

7 Click the **Start autotune** icon. The autotune procedure runs.

There are no tune performance criteria. If autotune completes, it passes. (See Figure 46 on page 133.) If the tune sets the EMV at or above 2,600 V, however, you may not be able to acquire data successfully if your method sets EMV to "+400" or higher.

The autotune report contains information about air and water in the system. (See "PCI autotune report" on page 133.)

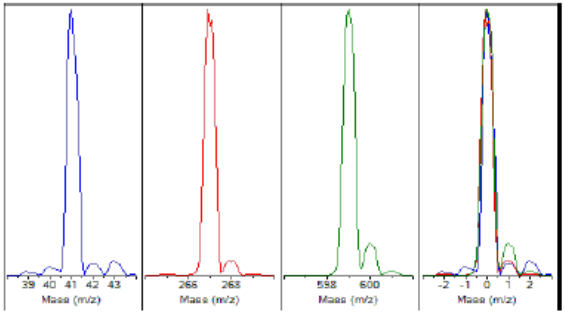
The 19/29 ratio shows the abundance of water.

The 32/29 ratio shows the abundance of oxygen.

Methane@17 CI Autotune - 5977

8/5/2015 7:41:30 PM (UTC-4:00) CT12

D:\MASSHUNTER\GCMS\1\5977\PCICH4.U US1531Nxxx



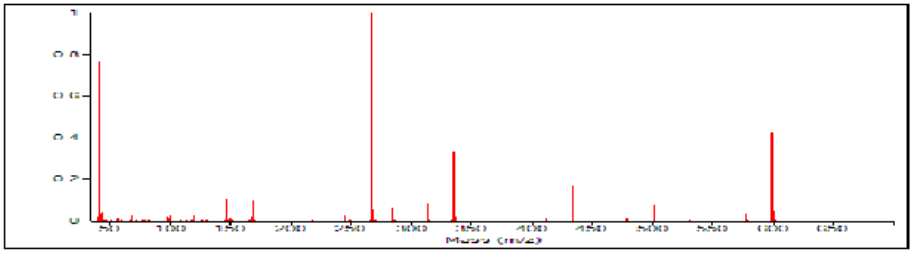
Ion Polarity	Pos	Mass Gain	-384
Emission	240.1	Mass Offset	-35
Electron Energy	65.0	Amu Gain	1511
Filament	1	Amu Offset	118.38
Repeller	2.89	Width219	-0.021
Ion Focus	129.9	DC Polarity	Pos
Entrance Lens	13.1	HED Enable	On
Ent Lens Offset	16.46	EM Volts	858.8
Ion Body	0.00	Extractor Lens	0.00
		Scan Speed	3
		Averages	3
PFDTD	Open	Step Size	0.10

Actual m/z	Abund	Rel Abund	Pw50
41.00	410,787	100.0%	0.61
266.90	529,995	129.0%	0.62
599.00	221,740	54.0%	0.62

Temperatures and Pressures

MS Source	300	Turbo Speed	100.0
MS Quad	150	Hi Vac	7.51e-05

Low	High	Step	Speed	Threshold	Peaks	Base	Abundance	Total Ion
35.00	700.00	0.10	3	1	680	267.00	508,096	1,956,041



Target m/z	Actual m/z	Abund	Rel Abund	Iso m/z	Iso Abund	Iso Ratio
41.00	41.00	388,096	76.4%	42.00	16,696	4.3%
267.00	267.00	508,096	100.0%	268.00	27,480	5.4%
599.00	599.00	217,920	42.9%	600.00	25,448	11.7%

Air/Water Check: H20 ~N/A% N2 ~N/A% O2 ~N/A% CO2 ~N/A% N2/H20 ~N/A%
Column(1) Flow: 1.19 Column(2): 0.00 ml/min Interface Temp: 280

Ramp Criteria:

Ion Focus maximum N/A volts using ion N/A; Electron Multiplier Gain 6470.073
Repeller maximum N/A volts using ion N/A; Gain Factor 0.0647

Mass Gain Values(Scan Speed): -384(3) -384(2) -384(1) -384(0) -281(FS1) -280(FS2)

TARGET MASS:	50	69	131	219	414	502	1050
Amu Offset	118.4	118.4	118.4	118.4	118.4	118.4	118.4
Entrance Lens Offset	16.5	16.5	16.5	16.5	16.5	16.5	16.5

Figure 46. PCI autotune report

Performing an NCI Autotune (Methane Reagent Gas)

CAUTION **Always verify MSD performance in EI before switching to CI operation. Always set up the CI MSD in PCI with methane as the reagent gas first, even if you are going to be using a different reagent gas or going to run NCI.**

Procedure

1 Select **Tune > Autotune**. The tune file used by the current method is loaded.If the tune file is not **PCICH4**, click the **Open a tune file** icon and select the file.

2 Click **Method > MSD > Tune > Autotune**.

Accept the default temperature and other settings.

If you use an existing tune file, be sure to save it with a new name if you don't want to overwrite the existing values.

3 Click **Request tune control**. The icon changes to **Release Tune Control** and the instrument status changes from green to orange to indicate that the instrument is in the Tuning state. The tune file associated with the currently loaded method is displayed.

4 Click the **Start autotune** icon. The autotune procedure runs.

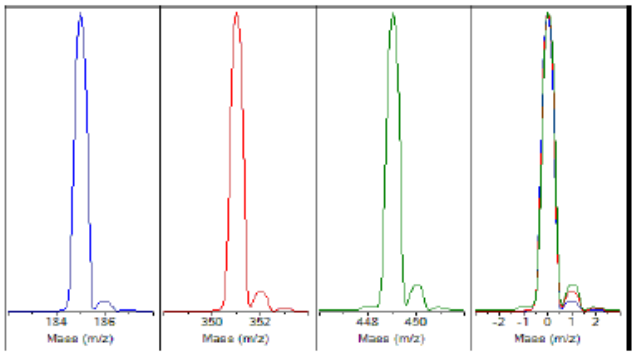
CAUTION **Avoid tuning unless absolutely necessary; this will minimize PFDTD background noise and help prevent ion source contamination.**

There are no tune performance criteria. If autotune completes, it passes. (See Figure 47 on page 135.) If the tune sets the EMV at or above 2,600 V, however, you may not be able to acquire data successfully if your method sets EMV to "+400" or higher.

Methane@40 CI Autotune - 5977

8/5/2015 8:47:11 PM (UTC-4:00) CT12

D:\MASSHUNTER\GCMS\1\5977\NCICH4.U US1531Nxxx



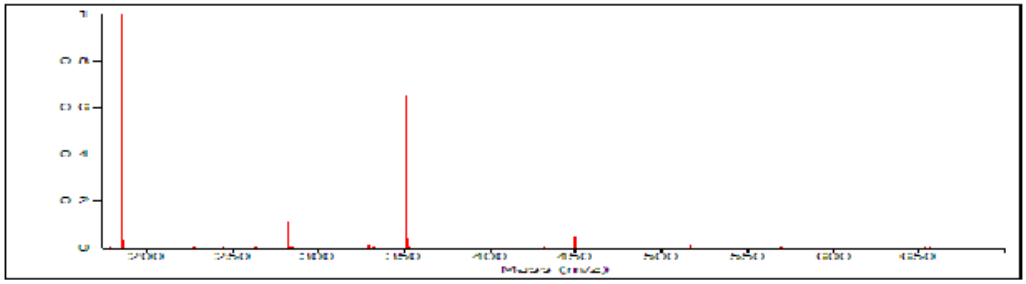
Ion Polarity	Neg	Mass Gain	-376
Emission	50.0	Mass Offset	-34
Electron Energy	139.9	Amu Gain	1499
Filament	1	Amu Offset	122.13
Repeller	2.79	Width219	0.000
Ion Focus	144.9	DC Polarity	Neg
Entrance Lens	15.9	HED Enable	On
Ent Lens Offset	14.18	EM Volts	1047.1
Ion Body	0.00	Extractor Lens	0.00
		Scan Speed	3
		Averages	3
PFDTD	Open	Step Size	0.10

Actual m/z	Abund	Rel Abund	Pw50
185.00	542,810	100.0%	0.61
351.00	349,809	64.4%	0.61
449.00	25,371	4.7%	0.61

Temperatures and Pressures

MS Source	150	Turbo Speed	100.0
MS Quad	150	Hi Vac	1.49e-04

Low	High	Step	Speed	Threshold	Peaks	Base	Abundance	Total Ion
175.00	700.00	0.10	3	100	77	185.00	520,128	1,040,425



Target m/z	Actual m/z	Abund	Rel Abund	Iso m/z	Iso Abund	Iso Ratio
185.00	185.00	520,128	100.0%	186.00	17,184	3.3%
351.00	351.00	340,416	65.4%	352.00	22,112	6.5%
449.00	449.00	25,088	4.8%	450.00	2,179	8.7%

Air/Water Check: H20 ~N/A% N2 ~N/A% O2 ~N/A% CO2 ~N/A% N2/H20 ~N/A%

Column(1) Flow: 1.20 Column(2): 0.00 ml/min Interface Temp: 250

Ramp Criteria:

Ion Focus maximum N/A volts using ion N/A; Electron Multiplier Gain 30460.038

Repeller maximum N/A volts using ion N/A; Gain Factor 0.3046

Mass Gain Values(Scan Speed): -377(3) -377(2) -377(1) -377(0) -273(FS1) -273(FS2)

Figure 47. NCI autotune

6 General Maintenance

If you are using the *Agilent Intuvo 9000 Gas Chromatograph* with your MSD, Chemical Ionization (CI) and the JetClean system are not currently supported.

Before Starting

You can perform much of the maintenance required by your MSD. For your safety, read all of the information in this introduction before performing any maintenance tasks.

Scheduled maintenance

Performing the common maintenance tasks when scheduled can reduce operating problems, prolong system life, and reduce overall operating costs. (See Table 18.)

Table 18 Maintenance schedule

Task	Frequency
Check the foreline pump oil level	Every week
Check the calibration vial(s)	Every 6 months
Replace the foreline pump oil*	Every 6 months
Replace the diffusion pump fluid	Every year
Change the dry foreline pump tip seal	Every year
Check the dry foreline pump	As needed
Tune the MSD	As needed
Change the foreline pump exhaust filter	As needed
Clean the ion source	As needed
Check the carrier gas trap(s) on the GC and MSD	As needed
Replace the worn out parts	As needed
Lubricate sideplate or vent valve O-rings†	As needed
Replace CI Reagent gas supply	As needed
Replace GC gas supplies	As needed
Leak check system	As needed

* Every 3 months for CI MSDs using ammonia reagent gas.

† Vacuum seals other than the side plate O-ring and vent valve O-ring do not need to be lubricated. Lubricating other seals can interfere with their correct function.

Keep a record of system performance (tune reports) and maintenance operations performed. This makes it easier to identify variations from normal operation and to take corrective action.

Tools, spare parts, and supplies

Some of the required tools, spare parts, and supplies are included in the GC shipping kit, MSD shipping kit, or MSD tool kit. You must supply others yourself. Each maintenance procedure includes a list of the materials required for that procedure.

High voltage precautions

Whenever the MSD is plugged in, even if the power switch is off, potentially dangerous voltage (120 VAC or 200/240 VAC) exists on:

- The wiring and fuses between where the power cord enters the instrument and the power switch

When the power switch is on, potentially dangerous voltages exist on:

- Electronic circuit boards
- Toroidal transformer
- Wires and cables between these boards
- Wires and cables between these boards and the connectors on the back panel of the MSD
- Some connectors on the back panel (for example, the foreline power receptacle)

Normally, all of these parts are shielded by safety covers. As long as the safety covers are in place, it should be difficult to accidentally make contact with dangerous voltages.

WARNING **Perform no maintenance with the MSD turned on or plugged into its power source unless you are instructed to by one of the procedures in this chapter.**

Some procedures in this chapter require access to the inside of the MSD while the power switch is on. Do not remove any of the electronics safety covers in any of these procedures. To reduce the risk of electric shock, follow the procedures carefully.

Dangerous temperatures

Many parts in the MSD operate at, or reach, temperatures high enough to cause serious burns. These parts include, but are not limited to:

- GC inlet
- GC oven and its contents
- GC detector
- GC valve box
- Foreline pump
- Heated MSD ion source, GC/MSD interface, and quadrupole

WARNING **Never touch these parts while your MSD is on. After the MSD is turned off, give these parts enough time to cool before handling them.**

WARNING **The GC/MSD interface heater is powered by a thermal zone on the GC. The interface heater can be on, and at a dangerously high temperature, even though the MSD is off. The GC/MSD interface is well insulated. Even after it is turned off, it cools very slowly.**

WARNING **The foreline pump can cause burns if touched when operating. It has a safety shield to prevent the user from touching it.**

The GC inlets and GC oven also operate at very high temperatures. Use the same caution around these parts. See the documentation supplied with your GC for more information.

Chemical residue

Only a small portion of your sample is ionized by the ion source. The majority of any sample passes through the ion source without being ionized. It is pumped away by the vacuum system. As a result, the exhaust from the foreline pump will contain traces of the carrier gas and your samples. Exhaust from the standard foreline pump also contains tiny droplets of foreline pump oil.

An oil trap is supplied with the standard foreline pump. This trap stops ***only*** pump oil droplets. It ***does not*** trap any other chemicals. If you are using toxic solvents or analyzing toxic chemicals, do not use this oil trap. For all foreline pumps,

install a hose to take the exhaust from the foreline pump outdoors or into a fume hood vented to the outdoors. For the standard foreline pump, this requires removing the oil trap. Be sure to comply with your local air quality regulations.

WARNING **The oil trap supplied with the standard foreline pump stops only foreline pump oil. It does not trap or filter out toxic chemicals. If you are using toxic solvents or analyzing toxic chemicals, remove the oil trap. Do not use the trap if you have a CI MSD. Install a hose to take the foreline pump exhaust outside or to a fume hood.**

The fluids in the diffusion pump and standard foreline pump also collect traces of the samples being analyzed. All used pump fluid should be considered hazardous and handled accordingly. Dispose of used fluid correctly, as specified by your local regulations.

WARNING **When replacing pump fluid, use appropriate chemical-resistant gloves and safety glasses. Avoid all contact with the fluid.**

Ion source cleaning

The main effect of operating the MSD in CI mode is the need for more frequent ion source cleaning. In CI operation, the ion source chamber is subject to more rapid contamination than in EI operation because of the higher source pressures required for CI.

WARNING **Always perform any maintenance procedures using hazardous solvents under a fume hood. Be sure to operate the MSD in a well-ventilated room.**

Electrostatic discharge

All of the printed circuit boards in the MSD contain components that can be damaged by electrostatic discharge (ESD). Do not handle or touch these boards unless absolutely necessary. In addition, wires, contacts, and cables can conduct ESD to the electronics boards to which they are connected. This is especially true of the mass filter (quadrupole) contact wires which can carry ESD to sensitive components on the side board. ESD damage may not cause immediate failure, but it will gradually degrade the performance and stability of your MSD.

When you work on or near printed circuit boards or when you work on components with wires, contacts, or cables connected to printed circuit boards, always use a grounded antistatic wrist strap and take other antistatic precautions. The wrist strap should be connected to a known good earth ground. If that is not possible, it should be connected to a conductive (metal) part of the assembly being worked on, but *not* to electronic components, exposed wires or traces, or pins on connectors.

Take extra precautions, such as a grounded antistatic mat, if you must work on components or assemblies that have been removed from the MSD. This includes the analyzer.

CAUTION

To be effective, an antistatic wrist strap must fit snugly (not tight). A loose strap provides little or no protection.

Antistatic precautions are not 100% effective. Handle electronic circuit boards as little as possible and then only by the edges. Never touch components, exposed traces, or pins on connectors and cables.

Maintaining the Vacuum System

Periodic maintenance

Some maintenance tasks for the vacuum system must be performed periodically. (See **Table 18** on page 138.) These include:

- Checking the foreline pump fluid (every week)
- Replacing the tip seal on the optional IDP-3 dry scroll pump (annually)
- Checking for leaks (every month)
- Checking the calibration vial(s) (every 6 months)
- Replacing the foreline pump oil (every 6 months; every 3 months for CI MSDs using ammonia reagent gas)
- Tightening the foreline pump oil box screws (first oil change after installation)
- Replacing the diffusion pump fluid (once a year)
- Replacing the dry foreline pump seals (once a year)

Failure to perform these tasks as scheduled can result in decreased instrument performance. It can also result in damage to your instrument.

Other procedures

Tasks such as replacing a foreline vacuum gauge or Micro-Ion vacuum gauge should be performed only when needed. Refer to the *Agilent 5977C Series MSD Troubleshooting and Maintenance* manual and the online help in OpenLab CDS software for symptoms that indicate this type of maintenance is required.

More information is available

If you need more information about the locations or functions of vacuum system components, refer to the *Agilent 5977C Series MSD Troubleshooting and Maintenance* manual.

Most of the procedures in this chapter are illustrated with video clips. See **"Where to Find More Information"** on page 4 for details.

Maintaining the Analyzer

Scheduling

None of the analyzer components require periodic maintenance. Some tasks, however, must be performed when MSD behavior indicates they are necessary. These tasks include:

- Cleaning the ion source
- Replacing filaments
- Replacing the electron multiplier horn

The *Agilent 5977C Series MSD Troubleshooting and Maintenance Manual* provides information about symptoms that indicate the need for analyzer maintenance. The troubleshooting material in the online help in the OpenLab CDS software provides more extensive information.

Precautions

Cleanliness

Keep components clean during analyzer maintenance. Analyzer maintenance involves opening the analyzer chamber and removing parts from the analyzer. During analyzer maintenance procedures, take care to avoid contaminating the analyzer or the interior of the analyzer chamber. Wear clean gloves during all analyzer maintenance procedures. After cleaning, parts must be thoroughly baked out before they are reinstalled. During and after cleaning, analyzer parts should be placed only on clean, lint-free cloths.

CAUTION **If not done correctly, analyzer maintenance can introduce contaminants into the MSD.**

WARNING **The analyzer operates at high temperatures. Do not touch any part until you are sure it is cool.**

Some parts can be damaged by electrostatic discharge

The wires, contacts, and cables connected to the analyzer components can carry electrostatic discharges (ESD) to the electronics boards to which they are connected. This is especially true of the mass filter (quadrupole) contact wires which can conduct ESD to sensitive components on the side board. ESD damage may not cause immediate failure but will gradually degrade performance and stability. (See "Electrostatic discharge" on page 141 for more information.)

CAUTION **Electrostatic discharges to analyzer components are conducted to the side board where they can damage sensitive components. Wear a grounded antistatic wrist strap (see "Electrostatic discharge" on page 141) and take other antistatic precautions *before* you open the analyzer chamber.**

Some analyzer parts should not be disturbed

The mass filter (quadrupole) requires no periodic maintenance. In general, the mass filter should never be disturbed. In the event of extreme contamination, it can be cleaned, but such cleaning should only be done by a trained Agilent Technologies service representative. The HED ceramic insulator must never be touched.

CAUTION **Incorrect handling or cleaning of the mass filter can damage it and have a serious, negative effect on instrument performance. Do not touch the HED ceramic insulator.**

More information is available

If you need more information about the locations or functions of analyzer components, refer to the *Agilent 5977C Series MSD Troubleshooting and Maintenance Manual*.

Many procedures in this chapter are illustrated with video clips.

Opening the Analyzer Chamber

The analyzer chamber should only be opened to clean or replace the ion source, change the detector's EM, or to change a filament.

Materials needed

- Gloves, clean, lint-free
  - Large (8650-0030)
  - Small (8650-0029)
- Wrist strap, antistatic
  - Small (9300-0969)
  - Medium (9300-1257)
  - Large (9300-0970)

CAUTION **Electrostatic discharges to analyzer components are conducted to the quad driver board, where they can damage sensitive components. Wear a grounded antistatic wrist strap and take other antistatic precautions (See "Electrostatic discharge" on page 141.) before you open the analyzer chamber.**

Procedure

1 Vent the MSD. (See "Venting the MSD" on page 113.)

2 Open the left side panel. (See "Opening the MSD Covers" on page 112.)

WARNING **The analyzer, GC/MSD interface, and other components in the analyzer chamber operate at very high temperatures. Do not touch any part until you are sure it is cool.**

CAUTION **Always wear clean gloves to prevent contamination when working in the analyzer chamber.**

3 Loosen the analyzer side plate thumbscrews if they are fastened. (See Figure 48 on page 147.)

The bottom thumbscrew on the analyzer side plate should be unfastened during normal use. It is only fastened during shipping. The top thumbscrew on the front side plate should only be fastened if hydrogen or other flammable or toxic substances are used for carrier gas, or during CI operation.

CAUTION **In the next step, if you feel resistance, *stop*. Do not try to force the side plate open. Verify that the MSD is vented. Verify that both the front and rear side plate screws are completely loose.**

4 *Gently* swing the side plate out.

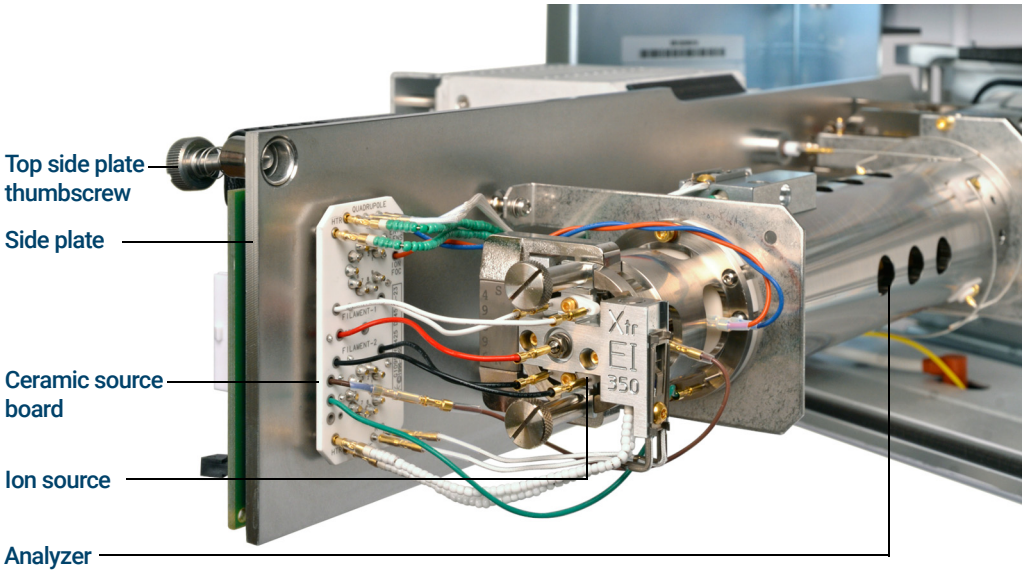


Figure 48. The analyzer chamber for an Inert+ model MSD

Removing the EI HES

Materials needed

- Gloves, clean, lint-free
  - Large (8650-0030)
  - Small (8650-0029)
- Tweezers (8710-2460)

Procedure

1 Vent the MSD. (See "Venting the MSD" on page 113.)

WARNING **The analyzers, GC/MSD interface, and other components in the analyzer chamber operate at very high temperatures. Do not touch any part until you are sure it is cool.**

CAUTION **Always wear clean gloves to prevent contamination when working in the analyzer chamber.**

2 Open the analyzer chamber. (See "Opening the Analyzer Chamber" on page 146.)

CAUTION **Make sure you use an antistatic wrist strap and take other antistatic precautions before touching analyzer components.**

CAUTION **When disconnecting leads, pull on the connectors, not on the wires.**

3 Remove the two large thumbscrews that hold the ion source in place. (See Figure 49 on page 149.)

4 Disconnect the wires from the EI HES. (See Figure 49 on page 149.) Do not bend the wires any more than necessary. (See "Connecting/Disconnecting Wiring to the EI HES" on page 150.)

5 Using the source finger grip, pull the ion source out of the source radiator.

The source contacts have spring loaded pins so some force must be applied to pull the source out.

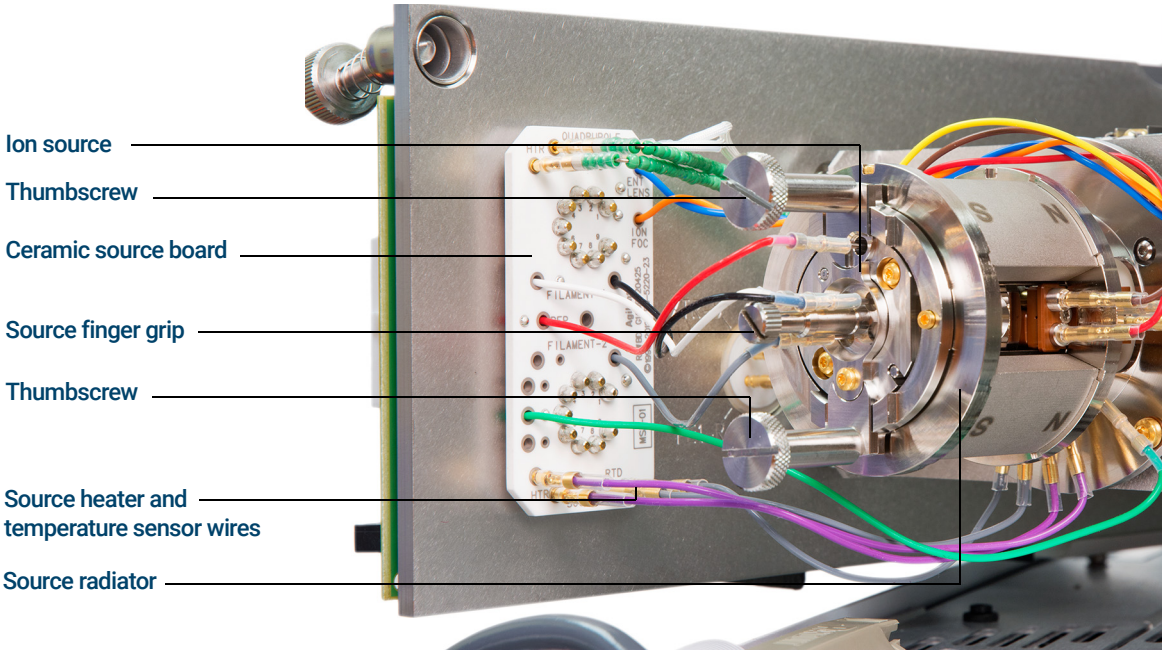


Figure 49 The analyzer chamber for the HES MSD

Connecting/Disconnecting Wiring to the EI HES

Materials needed

- Gloves, clean, lint-free
  - Large (8650-0030)
  - Small (8650-0029)
- Pliers, long-nose (8710-1094)
- Tweezers (8710-2460)

Procedure

1 Use tweezers or needle nose pliers to connect/disconnect the ceramic board wire leads (red, white, black, and gray) at the source connectors. (See Figure 50.)

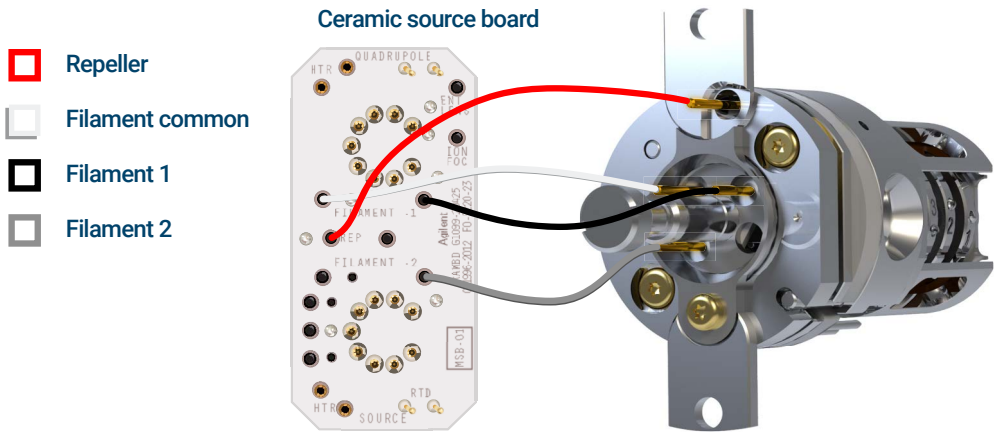


Figure 50 Wiring to be connected/disconnected during source installation or removal.

Disassembling the EI HES

Materials needed

- Gloves, clean, lint-free
  - Large (8650-0030)
  - Small (8650-0029)
- Cloths, clean (05980-60051)
- T6 Torx driver, (8710-2548)
- Tweezers (8710-2460)

Procedure

Refer to the exploded parts view **Figure 51** and the EI HES parts list **Table 19** on page 152 while using this procedure.

1 Place a clean cloth on your work surface to hold the ion source parts.

2 Use a T6 Torx screwdriver to remove the screw securing the filament block to the source mount. Use the finger grip to remove the filament block.

CAUTION **Use care when removing the filament from the filament block. Excessive stress can crack the filament ceramic. If this happens, do not attempt to operate with a defective filament, it must be replaced.**

3 Remove the dual filament from the filament block by lifting the source body up off of the filament block, while holding the filament block so that the dual filament will not fall and become damaged.

CAUTION **Never remove the finger grip from the filament block.**

4 Use a T6 Torx screwdriver to remove the two screws securing the source mount to the source body.

5 Remove the source mount from the lens body.

6 Remove the repeller and ring heater sensor assembly from the source body.

7 Separate the repeller from the ring heater assembly.

8 Use a T6 Torx screwdriver to remove the screw and locking ring for the lens insulator that secures the lens stack in the source body, then remove the lens stack.

9 If necessary, use gravity to remove the lens stack ceramic insulator from the source body.

CAUTION **Use care when removing the lenses from the lens insulator casing. Putting excessive stress on this casing can break or crack it. If this happens, do not attempt to operate with a defective lens insulator, it must be replaced.**

10 Remove the five lenses from the lens insulator/holder.

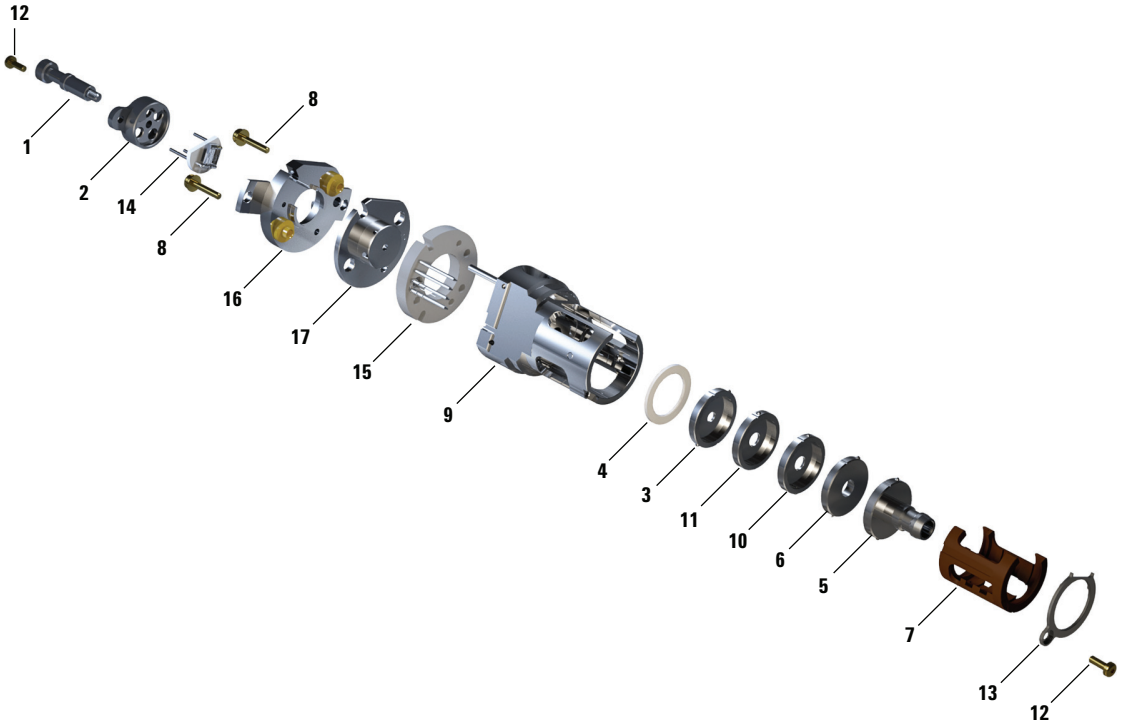


Figure 51 Exploded parts view of the EI HES

Table 19 Parts list for EI HES (Figure 51)

Item number	Item description	Part number (XTR)
1	Source finger grip	G7002-20008
2	Filament block	G7002-20019
3	Extractor lens (5)*, with 3 mm opening	G7004-20061

Table 19 Parts list for EI HES (Figure 51) (continued)

Item number	Item description	Part number (XTR)
4	Ceramic insulator for extractor	G7002-20064
5	Entrance lens assembly, Extended, HES (1)*	G7004-20065
6	Ion focus lens (2)*	G7004-20068
7	Lens insulator/holder	G7002-20074
8	M2 x 0.4 screw x 12 mm long gold plated screw	G7002-20083
9	Source body	G7002-20084
10	Post extractor lens 2 (3)*	G7004-20090
11	Post extractor lens 1 (4)*	G7004-20004
12	M2 x 6 mm gold plated screw	G7002-20109
13	Locking ring lens insulator	G7002-20126
14	High efficiency dual filament	G7002-60001
15	Ring heater/sensor assembly	G7002-60043
16	Source mount 1.5 mm	G7002-60053
17	Repeller assembly	G7002-67057
Not shown	HES assembly	G7004-67056

* The number in parenthesis is the number engraved on the lens

Cleaning the EI HES

Materials needed

- Abrasive paper (5061-5896)
- Alumina abrasive powder (393706201)
- Aluminum foil, clean
- Cloths, clean (05980-60051)
- Cotton swabs (5080-5400)
- Glass beakers, 500 mL
- Gloves, clean, lint-free
  - Large (8650-0030)
  - Small (8650-0029)
- Solvents
  - Methanol (reagent-grade)
  - Methylene chloride (reagent-grade)
  - Acetone (reagent-grade)
- Ultrasonic bath

Procedure

1 Disassemble the EI HES. (See "Disassembling the EI HES" on page 151.)

2 Collect the following parts to be cleaned: (See Figure 52 on page 155.)
   - Filament mount
   - Source mount (does not get abrasively or ultrasonically cleaned)
   - Repeller
   - Source body
   - Extractor lens (5)
   - Post extractor lens 1 (4)
   - Post extractor lens 2 (3)
   - Ion focus lens (2)
   - Entrance lens (1)

These are the parts that contact the sample or ion beam. The other parts normally should not require cleaning.

CAUTION **If insulators are dirty, clean them with a cotton swab dampened with reagent-grade methanol. If that does not clean the insulators, replace them. Do not abrasively or ultrasonically clean the insulators.**

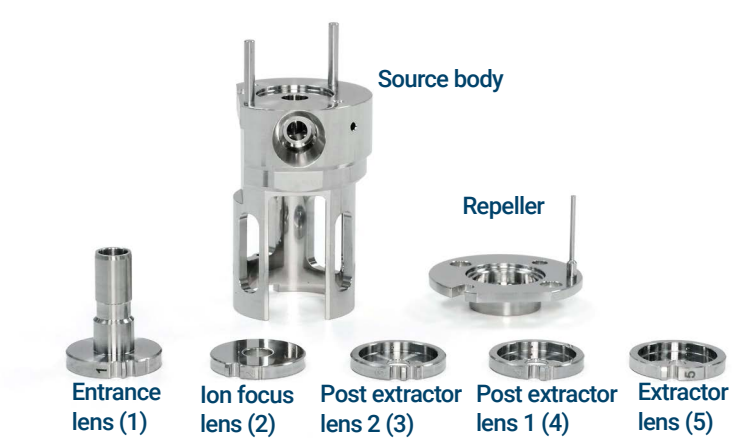


Figure 52 EI HES parts to be cleaned

CAUTION **The filaments, source heater assembly, insulators, source mounting plate, and filament block cannot be cleaned ultrasonically. Replace these components if major contamination occurs.**

3 If the contamination is serious, such as an oil backflow into the analyzer, seriously consider replacing the contaminated parts

CAUTION **Do not use the abrasive slurry on the source mount bushings.**

4 Abrasively clean the surfaces that contact the sample or ion beam.

   Use an abrasive slurry of alumina powder and reagent-grade methanol on a cotton swab. Use enough force to remove all discolorations. Polishing the parts is not necessary; small scratches will not harm performance. Also, abrasively clean the discolorations where electrons from the filaments enter the source body.

5 Rinse away all abrasive residue with reagent-grade methanol.

   Ensure ***all*** abrasive residue is rinsed away *before* ultrasonic cleaning. If the methanol becomes cloudy or contains visible particles, rinse again.

6 Separate the parts that were abrasively cleaned from the parts that were not abrasively cleaned.

CAUTION **Always wear clean gloves to prevent contamination when working in the analyzer chamber.**

WARNING **All of these solvents are hazardous. Work in a fume hood, and take all appropriate precautions.**

7 Ultrasonically clean the parts (each group separately) for 15 minutes in each of the following solvents:

- Methylene chloride (reagent-grade)
- Acetone (reagent-grade)
- Methanol (reagent-grade)

8 Place the parts in a clean beaker. *Loosely* cover the beaker with clean aluminum foil (dull side down).

9 Dry the cleaned parts in an oven at 100 °C for 5–6 minutes.

Assembling the EI HES

Materials needed

- Gloves, clean, lint-free
  - Large (8650-0030)
  - Small (8650-0029)
- T6 Torx driver, (8710-2548)
- Tweezers (8710-2460)

Procedure

CAUTION **Always wear clean gloves when working in the analyzer chamber to avoid contamination.**

Refer to the exploded parts view Figure 55 and the EI HES parts list Table 20 on page 160 while using this procedure.

CAUTION **Use care when inserting the lenses into the lens insulator casing. Putting excessive stress on this casing can break or crack it. If this happens, do not attempt to operate with a defective lens insulator, it must be replaced.**

1 Assemble the five lenses inside the lens insulator. (See Figure 53 on page 158.) The lens number is engraved into the outer circumference of each lens.

   a Starting with the entrance lens 1, set the lens into the end groove in the lens insulator, and rotate the lens until you feel the ball seat into the circular recess.

   b Insert the next 4 lenses, in numerical order, into the lens insulator. The lens chamber open end always faces the entrance lens 1. Rotate each lens until you feel the ball seat into the circular recess.

It is easier to insert lens 5 on an angle because the lens stack at this point makes the lens insulator less flexible.

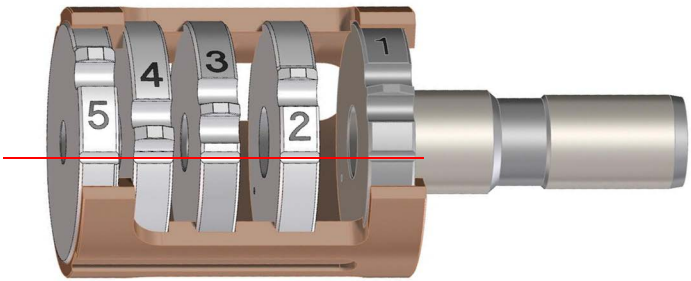


Figure 53 Assembled EI HES lens stack

2 Insert the extractor ceramic insulator into the source body.

CAUTION **The ceramic insulator must be positioned flat against the source body when inserting the lens stack in the next step.**

3 Insert the lens stack encased in the insulator into the source body. (See Figure 55 on page 160.) The engraved numbers face the full opening extending to the end of the source body. Verify that the ceramic is sitting flush at the end of the source body.

4 Using the T6 Torx driver, install and secure the gold plated setscrew and lock ring lens insulator that holds the lens assembly in place. (See Figure 54 on page 159.)

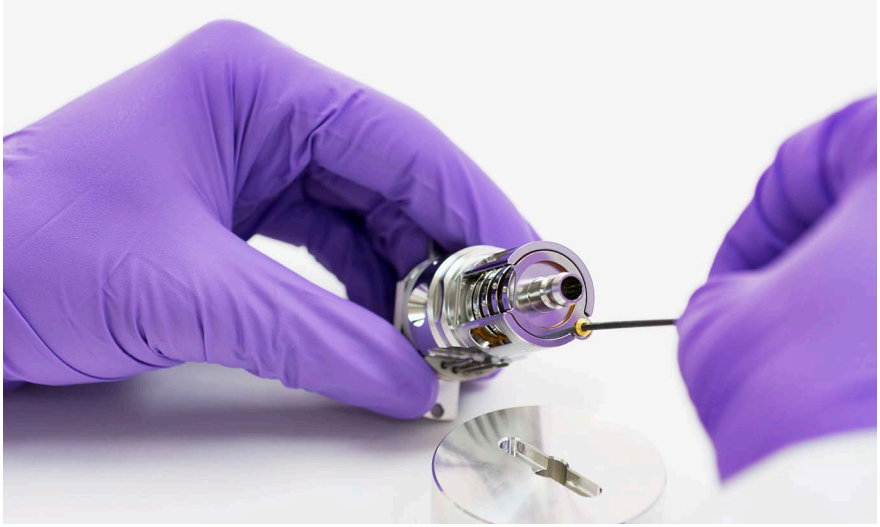


Figure 54 Secure the lens screw and lock ring insulator

5 Place the heater/sensor assembly over the guide pins on the source body with the four electrical pins oriented down the flat side of the source body.

6 Place the repeller onto the heater/sensor assembly with the flat side of the repeller circumference aligned with the interface socket in the source body.

7 Place the source mount over the repeller.

8 Finger tighten the two gold plated screws using a T6 Torx screwdriver to secure the source mount to the source body.

CAUTION **Do not overtighten the screws in the source body. Damage may occur to the repeller.**

9 On the side of the filament block opposite the finger grip, orient the dual filament ceramic holder so that it lines up with the flat of the filament block. Fully insert the three filament leads into the filament block.

10 Inset the filament block into the source holder, and use a T6 Torx screwdriver to secure it to the holder with the gold plated screw. The filament block should lay flat on the source holder. If it does not, remove the filament block and make sure the filament is properly installed before reinserting the filament block.

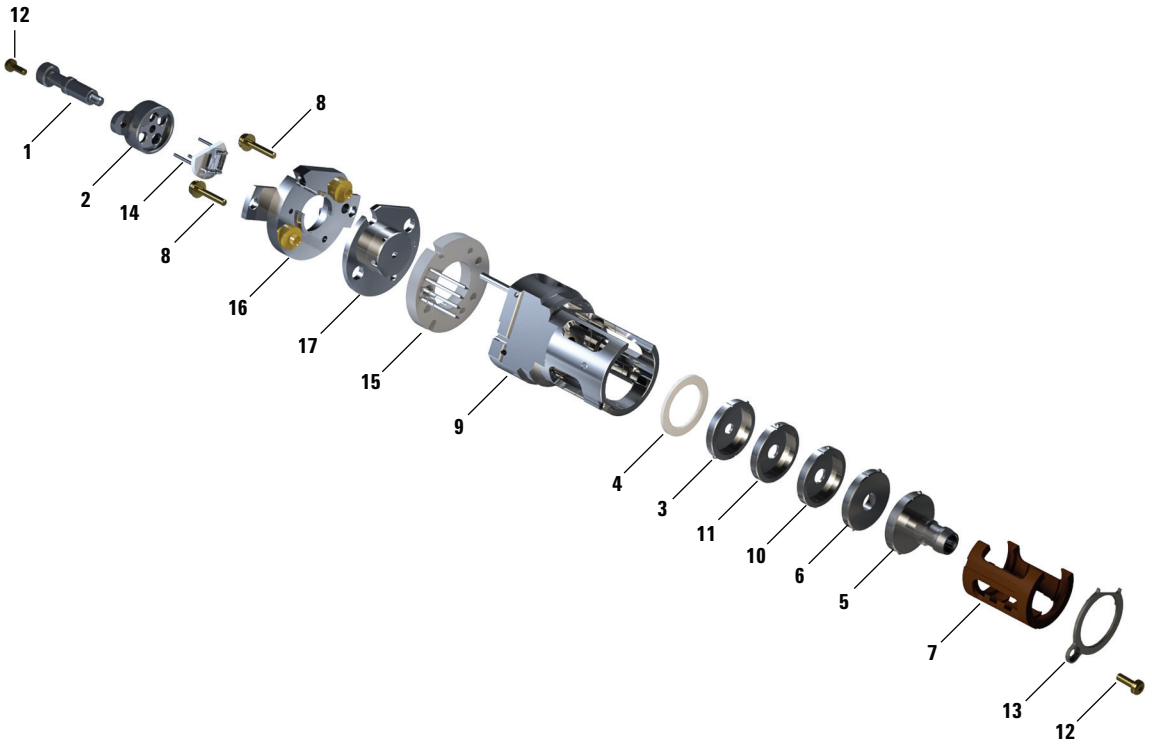


Figure 55 Assembling the EI HES

Table 20 Parts list for EI HES (Figure 55)

Item number	Item description	Part number (XTR)
1	Source finger grip	G7002-20008
2	Filament block	G7002-20019
3	Extractor lens (5)*, with 3 mm opening	G7004-20061
4	Ceramic insulator for extractor	G7002-20064
5	Entrance lens assembly, Extended, HES (1)*	G7004-20065
6	Ion focus lens (2)*	G7004-20068
7	Lens insulator/holder	G7002-20074
8	M2 x 0.4 screw x 12 mm long gold plated screw	G7002-20083
9	Source body	G7002-20084

Table 20 Parts list for EI HES (Figure 55) (continued)

Item number	Item description	Part number (XTR)
10	Post extractor lens 2 (3)*	G7004-20090
11	Post extractor lens 1 (4)*	G7004-20004
12	M2 x 6 mm gold plated screw	G7002-20109
13	Locking ring lens insulator	G7002-20126
14	High efficiency dual filament	G7002-60001
15	Ring heater/sensor assembly	G7002-60043
16	Source mount 1.5 mm	G7002-60053
17	Repeller assembly	G7002-67057
Not shown	HES assembly	G7004-67056

* The number in parenthesis is the number engraved on the lens

Removing the EI HES Filaments

Materials needed

- Gloves, clean, lint-free
  - Large (8650-0030)
  - Small (8650-0029)
- Cloths, clean (05980-60051)
- T6 Torx driver, (8710-2548)

Procedure

1 Vent the MSD. (See "Venting the MSD" on page 113.)

CAUTION **Always wear clean gloves to prevent contamination when working in the analyzer chamber.**

WARNING **The analyzer, GC/MSD interface, and other components in the analyzer chamber operate at very high temperatures. Do not touch any part until you are sure it is cool.**

2 Open the analyzer chamber. (See "Opening the Analyzer Chamber" on page 146.)

3 Remove the ion source and place it on a clean cloth on your work surface. (See "Removing the EI HES" on page 148.)

4 Remove the screw securing the filament block to the source mount. (See Figure 56.)

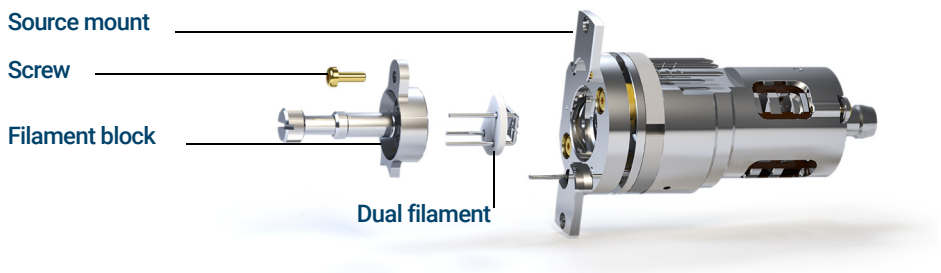


Figure 56 Replacing the dual filament

5 Use the hand grip on the filament block to remove the filament block from the source.

CAUTION **Use extra caution when removing the dual filament, as it is extremely brittle.**

6 Remove the dual filament from the filament block by lifting the source body up off of the filament block, while holding the filament block so that the dual filament will not fall and become damaged.

Installing the EI HES Filament

Materials needed

- Filament assembly, high efficiency dual filament (G7001-60001)
- Hex ball driver, 1.5 mm (8710-1570)
- Gloves, clean, lint-free
  - Large (8650-0030)
  - Small (8650-0029)
- T6 Torx driver, (8710-2548)

Procedure

1 Remove the old filament. (See **"Removing the EI HES Filaments"** on page 162.)

2 Insert the 3 pins on the dual filament through the rear of the filament block. (See **Figure 56** on page 162.)

3 Place the filament block in the source mount.

4 Use a T6 Torx screwdriver to tighten the screw securing the filament block to the source mount.

5 Reinstall the ion source. (See **"Installing the EI HES"** on page 165.)

6 Close the analyzer chamber. (See **"Closing the Analyzer Chamber"** on page 199.)

7 Pumpdown the MSD. (See **"Pumping down the MSD"** on page 116.)

8 Autotune the MSD.

Installing the EI HES

Materials needed

- Gloves, clean, lint-free
  - Large (8650-0030)
  - Small (8650-0029)
- Tweezers (8710-2460)

Procedure

CAUTION **Always wear clean gloves when working in the analyzer chamber to avoid contamination.**

1 Align the EI HES so that the slotted opening for the lens stack, where the lens numbers are visible, is on the right side. Also, position it so the two attachment tabs of the source mount align with the corresponding slots in the source radiator. Slide the ion source into the source radiator until resistance is felt.

2 Snap the source into place so that the source mount tabs are flush against the source mount attachment surface of radiator. Some force is required to overcome the resistance of the spring-loaded pins for the electrical contacts..

3 Connect the EI HES wires. (See "Connecting/Disconnecting Wiring to the EI HES" on page 150.)

4 Install and hand-tighten the source thumbscrews. Do not overtighten the thumbscrews.

5 Close the analyzer chamber. (See "Closing the Analyzer Chamber" on page 199.)

6 Pumpdown the MSD. (See "Pumping down the MSD" on page 116.)

7 Tune the MSD.

Removing the EI XTR, SS, Inert, or HydroInert Source

Materials needed

- Gloves, clean, lint-free
  - Large (8650-0030)
  - Small (8650-0029)
- Pliers, long-nose (8710-1094)

Procedure

1 Vent the MSD. (See "Venting the MSD" on page 113.)

WARNING **The analyzers, GC/MSD interface, and other components in the analyzer chamber operate at very high temperatures. Do not touch any part until you are sure it is cool.**

CAUTION **Always wear clean gloves to prevent contamination when working in the analyzer chamber**

2 Open the analyzer chamber. (See "Opening the Analyzer Chamber" on page 146.)

CAUTION **Make sure you use an antistatic wrist strap and take other antistatic precautions before touching analyzer components.**

CAUTION **When disconnecting leads, pull on the connectors, not the wires.**

3 Disconnect the wires from the EI source. Do not bend the wires any more than necessary. (See "Connecting/Disconnecting Wiring from the EI XTR, SS, and Inert Sources" on page 167 or "Connecting/Disconnecting Wiring from the EI HydroInert Source" on page 168.)

4 Remove the thumbscrews that hold the ion source in place. (See Figure 68 on page 196.)

5 Pull the ion source out of the source radiator.

Connecting/Disconnecting Wiring from the EI XTR, SS, and Inert Sources

Materials needed

- Gloves, clean, lint-free
  - Large (8650-0030)
  - Small (8650-0029)
- Pliers, long-nose (8710-1094)
- Tweezers (8710-2460)

Procedure

1 Use tweezers or needle nose pliers to connect/disconnect the ceramic source board wire leads at the source connectors. (See Figure 57.)

2 Use tweezers or needle nose pliers to connect/disconnect the source heater wire leads at the ceramic source board.

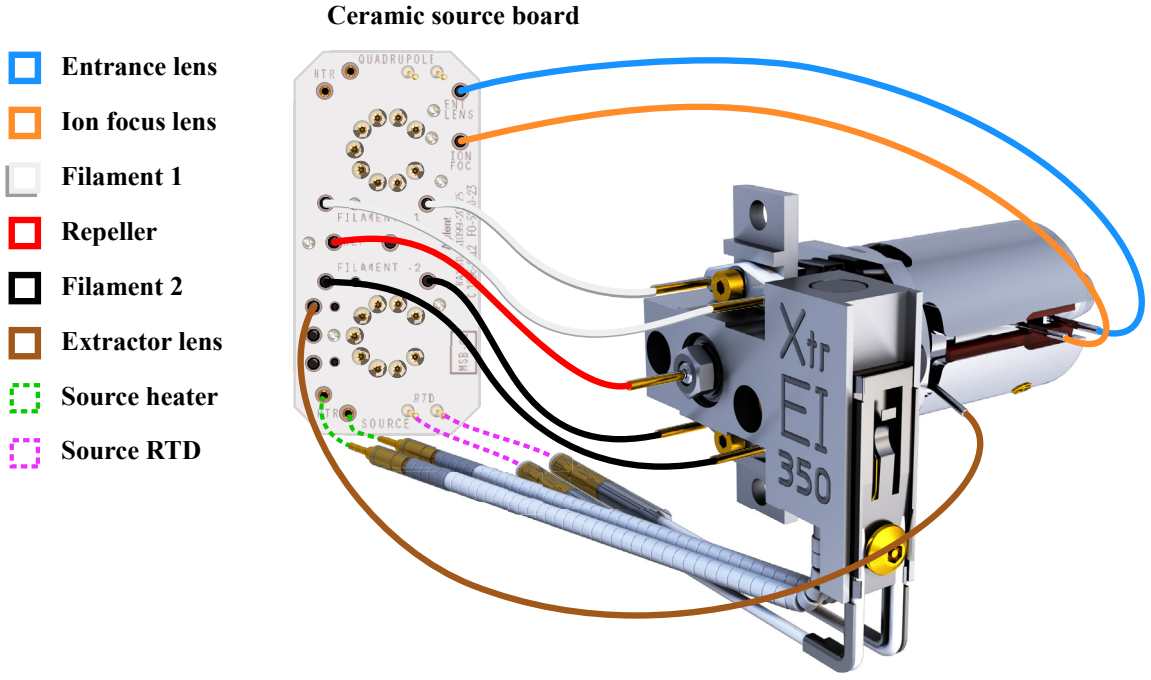


Figure 57 Wiring for the EI XTR Source

Connecting/Disconnecting Wiring from the EI HydroInert Source

Materials needed

- Gloves, clean, lint-free
  - Large (8650-0030)
  - Small (8650-0029)
- Pliers, long-nose (8710-1094)
- Tweezers (8710-2460)

Procedure

1 Use tweezers or needle nose pliers to connect/disconnect the ceramic source board wire leads at the source connectors. (See Figure 58.)

2 Use tweezers or needle nose pliers to connect/disconnect the source heater wire leads at the ceramic source board.

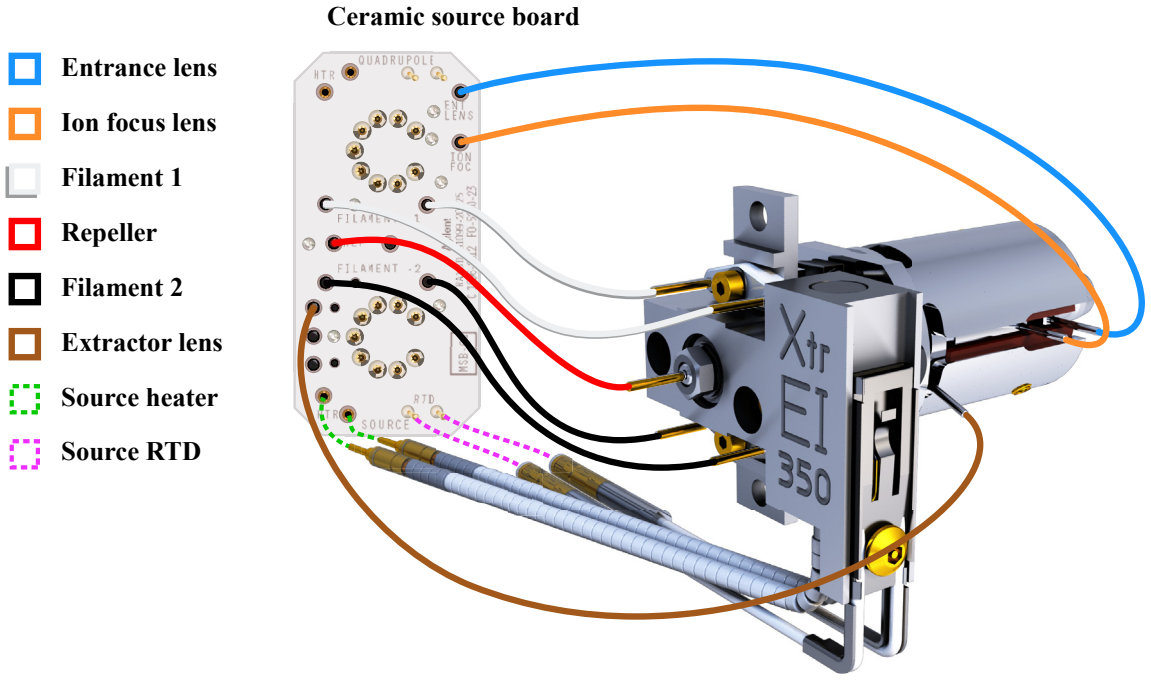


Figure 58 Wiring for the EI HydroInert Source

Disassembling the EI SS or EI Inert Source

Materials needed

- Gloves, clean, lint-free
  - Large (8650-0030)
  - Small (8650-0029)
- Hex ball driver, 1.5 mm (8710-1570)
- Hex ball driver, 2.0 mm (8710-1804)
- Wrench, open-end, 10 mm (8710-2353)

Procedure

Refer to the exploded parts view Figure 59 and the EI SS and EI Inert parts list Table 21 on page 170 while using this procedure.

1 Remove the EI source. (See "Removing the EI HES" on page 148 or "Removing the EI XTR, SS, Inert, or HydroInert Source" on page 166.)

2 Remove the two gold plated screws from the filaments and remove the filaments from the source.

3 Loosen the two gold plated screws from the source heater block assembly, and separate the repeller assembly from the source body. The repeller assembly includes the source heater block assembly, repeller, and related parts.

4 Remove the repeller nut and washers then remove the repeller from the source heater block assembly.

5 Remove the repeller insulators and the repeller block insert from the source heater block assembly.

6 Remove the gold plated setscrew from the side of the source body.

7 Push on the drawout plate to remove the entrance lens, ion focus lens, drawout cylinder, and drawout plate from the other end of the source body.

8 Unscrew the interface socket. A 10-mm open-end wrench fits the flats on the interface socket.

9 Remove the entrance lens and ion focus lens from the lens insulator.

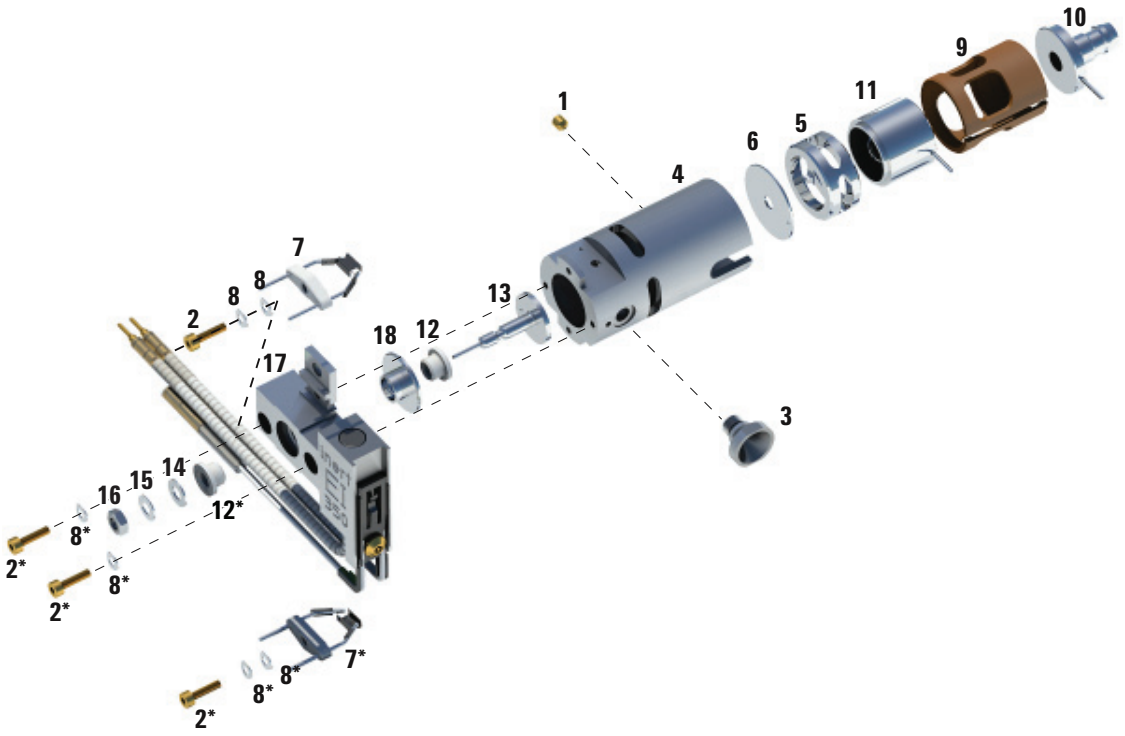


Figure 59. Disassembling the EI SS or Inert source

Table 21 Parts list for the EI SS or Inert source (Figure 59)

Item number	Item description	Part number (SS)	Part number (Inert)
1	Gold plated set screw	G1999-20022	G1999-20022
2	Gold plated screw	G3870-20021	G3870-20021
3	Interface socket	G1099-20136	G1099-20136
4	Source body	G1099-20130	G2589-20043
5	Drawout cylinder	G1072-20008	G1072-20008
6	Drawout plate	05971-20134	G2589-20100
7	4-turn filament	G7005-60061	G7005-60061
8	Spring washer	3050-1374	3050-1374

Table 21 Parts list for the EI SS or Inert source (Figure 59) (continued)

Item number	Item description	Part number (SS)	Part number (Inert)
8	Flat washer	3050-0982	3050-0982
9	Lens insulator	G3170-20530	G3170-20530
10	Entrance lens	G3170-20126	G3170-20126
11	Ion focus lens	05971-20143	05971-20143
12	Repeller insulator	G1099-20133	G1099-20133
13	Repeller	G3870-60172	G3870-60173
14	Flat washer	3050-0627	3050-0627
15	Belleville spring washer	3050-1301	3050-1301
16	Repeller nut	0535-0071	0535-0071
17	Source heater block assembly	G3870-60180	G3870-60179
18	Repeller block insert	G3870-20135	G3870-20135

Disassembling the EI XTR Source

Materials needed

- Gloves, clean, lint-free
  - Large (8650-0030)
  - Small (8650-0029)
- Hex ball driver, 1.5 mm (8710-1570)
- Hex ball driver, 2.0 mm (8710-1804)
- Wrench, open-end, 10 mm (8710-2353)

Procedure

Refer to the exploded parts view **Figure 60** and the EI EXT parts list **Table 22** on page 173 while using this procedure.

1 Remove the EI XTR source. (See **"Removing the EI XTR, SS, Inert, or HydroInert Source"** on page 166.)

2 Remove the filaments by removing the two gold plated screws and separating the filaments from the source.

3 Loosen the two gold plated screws on the source heater block assembly, and separate the repeller assembly from the source body. The repeller assembly includes the source heater block assembly, repeller, and related parts.

4 Remove the gold plated setscrews from the side of the source body.

5 Pull the entrance lens and ion focus lens to remove them from the source body.

6 Remove the extractor lens and insulator.

7 Separate the entrance lens and ion focus lens from the lens insulator.

8 Remove the repeller nut, washers, and insulator from the front side of the source heater block assembly, then remove the repeller, insulator, and repeller block insert from the opposite side.

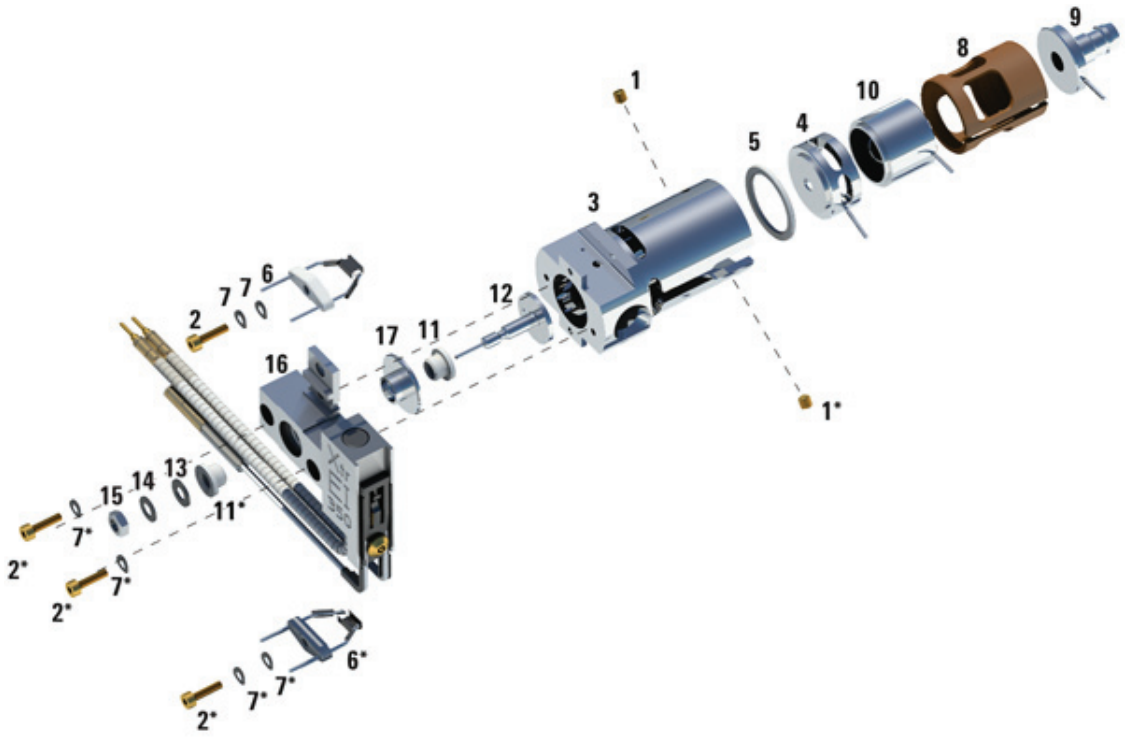


Figure 60. Disassembling the EI XTR source

Table 22 Parts list for EI XTR source (Figure 60)

Item	Description	Part number
1	Setscrews	G3870-20446
2	Screws	G3870-20021
3	Source body	G3870-20440
4	Extractor lens	G3870-20444
5	Extractor lens insulator	G3870-20445
6	Filaments	G7005-60061
7	Spring washer	3050-1301
7	Flat washer	3050-0982

Table 22 Parts list for EI XTR source (Figure 60) (continued)

Item	Description	Part number
8	Lens insulator	G3870-20530
9	Entrance lens assembly, Extended	G7000-20026
10	Ion focus lens	05971-20143
11	Repeller insulator	G1099-20113
12	Repeller	G3870-60171
13	Flat washer	3050-0891
14	Belleville spring washer	3050-1301
15	Repeller nut	0535-0071
16	Source heater block assembly	G3870-60177
17	Repeller block insert	G3870-20135
Not shown	EI XTR source assembly	G7003-67720

Disassembling the EI HydroInert Source

Materials needed

- Gloves, clean, lint-free
  - Large (8650-0030)
  - Small (8650-0029)
- Hex ball driver, 1.5 mm (8710-1570)
- Hex ball driver, 2.0 mm (8710-1804)
- Wrench, open-end, 10 mm (8710-2353)

Procedure

Refer to the exploded parts view **Figure 61** and the EI HyrdoInert parts list **Table 23** on page 176 while using this procedure.

1 Remove the EI HyrdoInert source. (See **"Removing the EI XTR, SS, Inert, or HydroInert Source"** on page 166.)

2 Remove the filaments by removing the two gold plated screws and separating the filaments from the source.

3 Loosen the two gold plated screws on the source heater block assembly, and separate the repeller assembly from the source body. The repeller assembly includes the source heater block assembly, repeller, and related parts.

4 Remove the gold plated setscrews from the side of the source body.

5 Pull the entrance lens and ion focus lens to remove them from the source body.

6 Remove the extractor lens and insulator.

7 Separate the entrance lens and ion focus lens from the lens insulator.

8 Remove the repeller nut, washers, and insulator from the front side of the source heater block assembly, then remove the repeller, insulator, and repeller block insert from the opposite side.

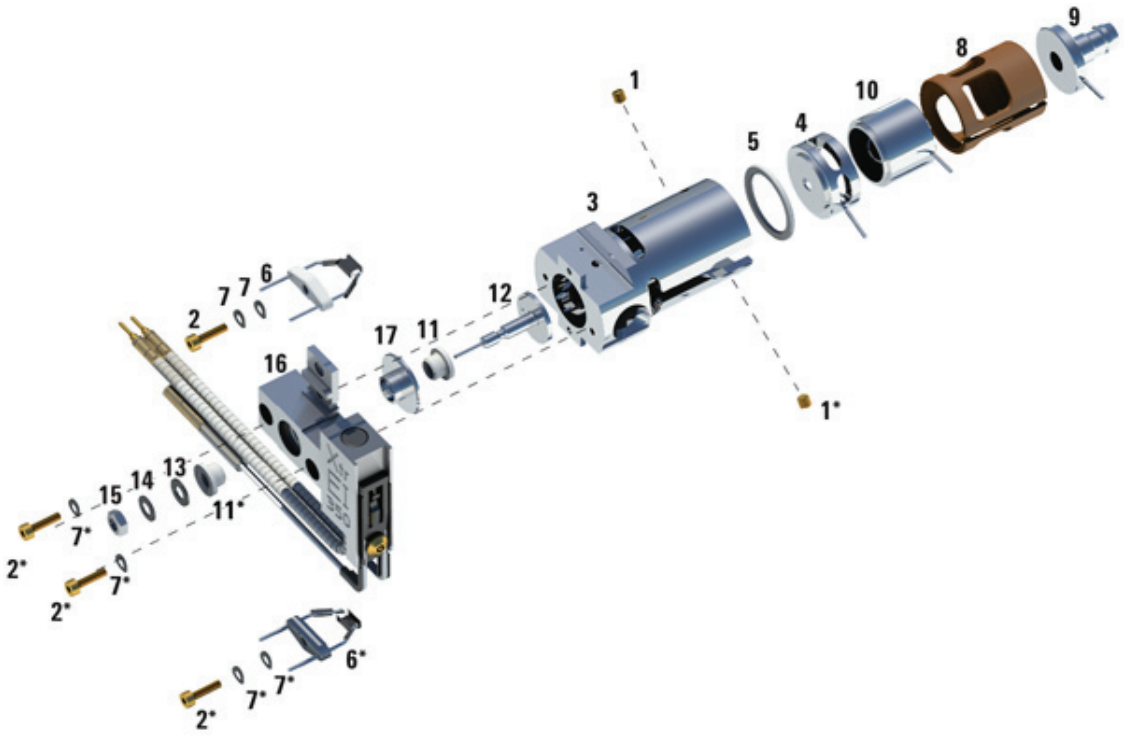


Figure 61. Disassembling the EI HydroInert source

Table 23 Parts list for EI HydroInert source (Figure 61)

Item	Description	Part number
1	Setscrews	G3870-20446
2	Screws	G3870-20021
3	Source body	G7078-20903
4	Extractor lens, 9 mm	G7078-20909
5	Extractor lens insulator	G3870-20445
6	Filaments	G7005-60061
7	Spring washer	3050-1301
7	Flat washer	3050-0982

Table 23 Parts list for EI HydroInert source (Figure 61) (continued)

Item	Description	Part number
8	Lens insulator	G3870-20530
9	Entrance lens assembly,	G7078-20904
10	Ion focus lens	G7078-20905
11	Repeller insulator	G1099-20133
12	Repeller	G7078-20902
13	Flat washer	3050-0891
14	Belleville spring washer	3050-1301
15	Repeller nut	0535-0071
16	Source heater block assembly	G7078-20910
17	Repeller block insert	G7078-20901
Not shown	EI HydroInert source assembly	G7078-67930
Not shown	Wire, Extractor Lens	G7000-60827

Cleaning an EI XTR, SS, or Inert Source

Materials needed

- Abrasive paper (5061-5896)
- Alumina abrasive powder (8660-0791)
- Aluminum foil, clean
- Cloths, clean (05980-60051)
- Cotton swabs (5080-5400)
- Glass beakers, 500 mL
- Gloves, clean, lint-free
  - Large (8650-0030)
  - Small (8650-0029)
- Solvents
  - Acetone, reagent grade
  - Methanol, reagent grade
  - Methylene chloride, reagent grade
- Ultrasonic bath

Preparation

1 Disassemble the ion source. (See "Disassembling the EI SS or EI Inert Source" on page 169 or "Disassembling the EI XTR Source" on page 172.)

2 Collect the following parts to be cleaned for an EI SS or Inert source: (See Figure 62 on page 180.)
  - Repeller
  - Interface socket
  - Source body
  - Repeller block insert
  - Drawout plate
  - Drawout cylinder
  - Ion focus lens
  - Entrance lens

3 Collect the following parts to be cleaned for an EI XTR source: (See Figure 62 on page 180.)

- Repeller
- Repeller block insert
- Source body
- Extractor lens
- Ion focus lens
- Entrance lens

These are the parts that contact the sample or ion beam. The other parts normally should not require cleaning.

CAUTION **If insulators are dirty, clean them with a cotton swab dampened with reagent-grade methanol. If that does not clean the insulators, replace them. Do not abrasively or ultrasonically clean the insulators.**

Figure 62. Source parts to be cleaned

Procedure

CAUTION **The filaments, source heater assembly, and insulators cannot be cleaned ultrasonically. Replace these components if major contamination occurs.**

1 If the contamination is serious, such as an oil backflow into the analyzer, seriously consider replacing the contaminated parts.

2 Abrasively clean the surfaces that contact the sample or ion beam.

Use an abrasive slurry of alumina powder and reagent-grade methanol on a cotton swab. Use enough force to remove all discolorations. Polishing the parts is not necessary; small scratches will not harm performance. Also abrasively clean the discolorations where electrons from the filaments enter the source body.

3 Rinse away all abrasive residue with reagent-grade methanol.

Make sure *all* abrasive residue is rinsed *before* ultrasonic cleaning. If the methanol becomes cloudy or contains visible particles, rinse again three times.

4 Separate the parts that were abrasively cleaned from the parts that were not abrasively cleaned.

WARNING **All of these solvents are hazardous. Work in a fume hood and take all appropriate precautions.**

5 Ultrasonically clean the parts (each group separately) for 15 minutes. For dirty parts, use all three solvents in the order shown, cleaning 15 minutes with each of the following solvents:

- Methylene chloride (reagent-grade)
- Acetone (reagent-grade)
- Methanol (reagent-grade)

For routine cleaning, cleaning with methanol is sufficient.

6 Place the parts in a clean beaker. *Loosely* cover the beaker with clean aluminum foil (dull side down).

7 Dry the cleaned parts in an oven at 100 °C for 5–6 minutes.

WARNING **Let the parts cool before you handle them.**

NOTE **Take care to avoid recontaminating cleaned and dried parts. Put on new, clean gloves before handling the parts. Do not set the cleaned parts on a dirty surface. Set them only on clean, lint-free cloths.**

Cleaning the EI HydroInert Source

CAUTION **Do not abrasively clean the coated parts of the source. Abrasives will destroy the coating and require a new part to be purchased.**

Replacement of HydroInert source parts is recommended if a reduction in sensitivity is observed that cannot be recovered by performing maintenance on the GCMS system. This maintenance should include items know to cause sensitivity problems such as syringe replacement, syringe wash replacement, inlet cleaning, inlet consumables replacement, column replacement, and rough pump maintenance.

The coated parts of the HydroInert source shown in the figure below are the parts labeled 17, 12, 3, 4, 10 and 9. After disassembly, if an examination of the 12-Repeller and 4-extractor lens shows a buildup of residue, replace these parts. Additionally, replacement of the insulators, 5-Extractor Lens insulator and 11-Repeller Insulator, is recommended. See Table 18 on page 177 for a list of part numbers.

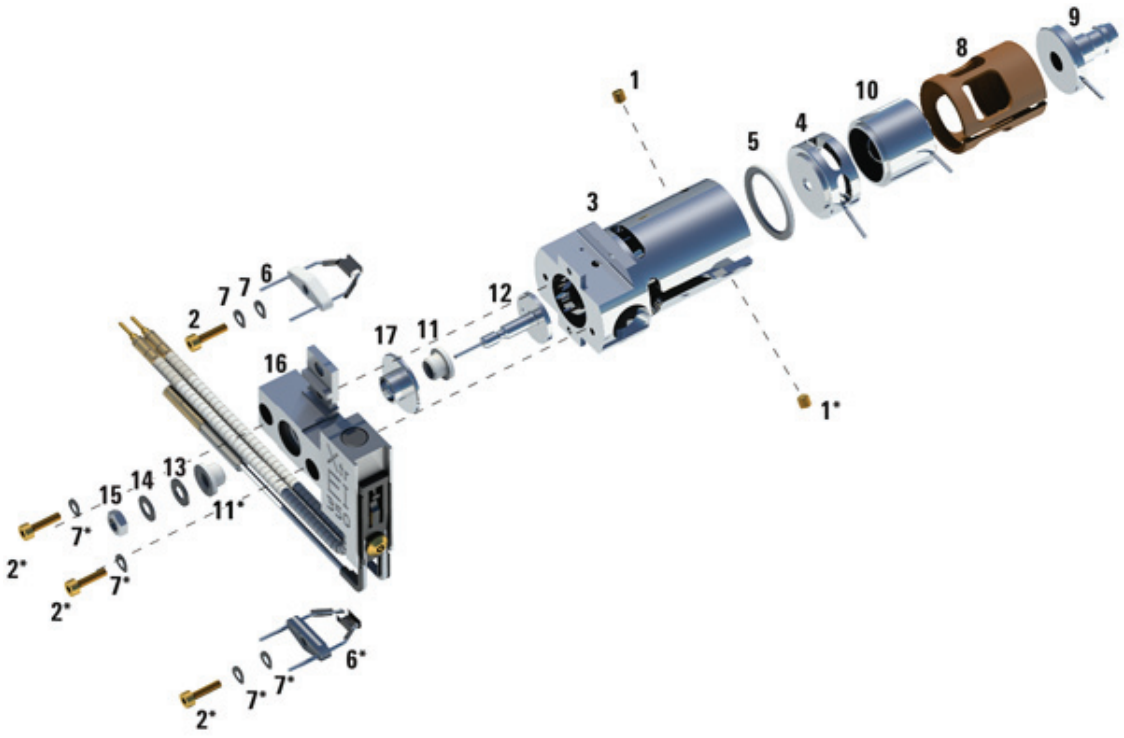


Figure 63. Cleaning the EI HydroInert source

Table 24 Parts list for EI HydroInert source (Figure 61)

Item	Description	Part number
1	Setscrews	G3870-20446
2	Screws	G3870-20021
3	Source body	G7078-20903
4	Extractor lens, 9 mm	G7078-20909
5	Extractor lens insulator	G3870-20445
6	Filaments	G7005-60061
7	Spring washer	3050-1301

Table 24 Parts list for EI HydroInert source (Figure 61) (continued)

Item	Description	Part number
7	Flat washer	3050-0982
8	Lens insulator	G3870-20530
9	Entrance lens assembly,	G7078-20904
10	Ion focus lens	G7078-20905
11	Repeller insulator	G1099-20133
12	Repeller	G7078-20902
13	Flat washer	3050-0891
14	Belleville spring washer	3050-1301
15	Repeller nut	0535-0071
16	Source heater block assembly	G7078-20910
17	Repeller block insert	G7078-20901
Not shown	EI HydroInert source assembly	G7078-67930
Not shown	Wire, Extractor Lens	G7000-60827

Assembling an EI SS or Inert Source

Materials needed

- Gloves, clean, lint-free
  - Large (8650-0030)
  - Small (8650-0029)
- Hex ball driver, 1.5 mm (8710-1570)
- Hex ball driver, 2.0 mm (8710-1804)
- Wrench, open-end, 10 mm (8710-2353)

Procedure

Refer to the exploded parts view Figure 64 and EI SS and EI Inert parts list Table 25 on page 186 while using this procedure.

CAUTION **Do not overtighten the repeller nut or the ceramic repeller insulators will break when the source heats up. The nut should only be finger-tight.**

1 Assemble the repeller assembly.
   a Install the repeller block insert into the source heater block assembly.
   b Install the repeller insulators into the source heater block assembly and repeller block insert.
   c Install the repeller through the repeller insulators, then put the flat washer followed by the belleville spring washer onto the end of the repeller shaft, and secure finger tight with the repeller nut.
2 Insert the drawout plate and the drawout cylinder into the source body.
3 Assemble the ion focus lens, entrance lens, and lens insulators.
4 Slide these assembled parts into the source body.
5 Install the setscrew that holds the lenses in place.
6 Install the interface socket.
7 Attach the repeller assembly to the source body using the two gold plated screws and spring washers.
8 Install the filaments using the two gold plated screws and spring washers.

CAUTION Do not overtighten the interface socket. Overtightening could strip the threads.

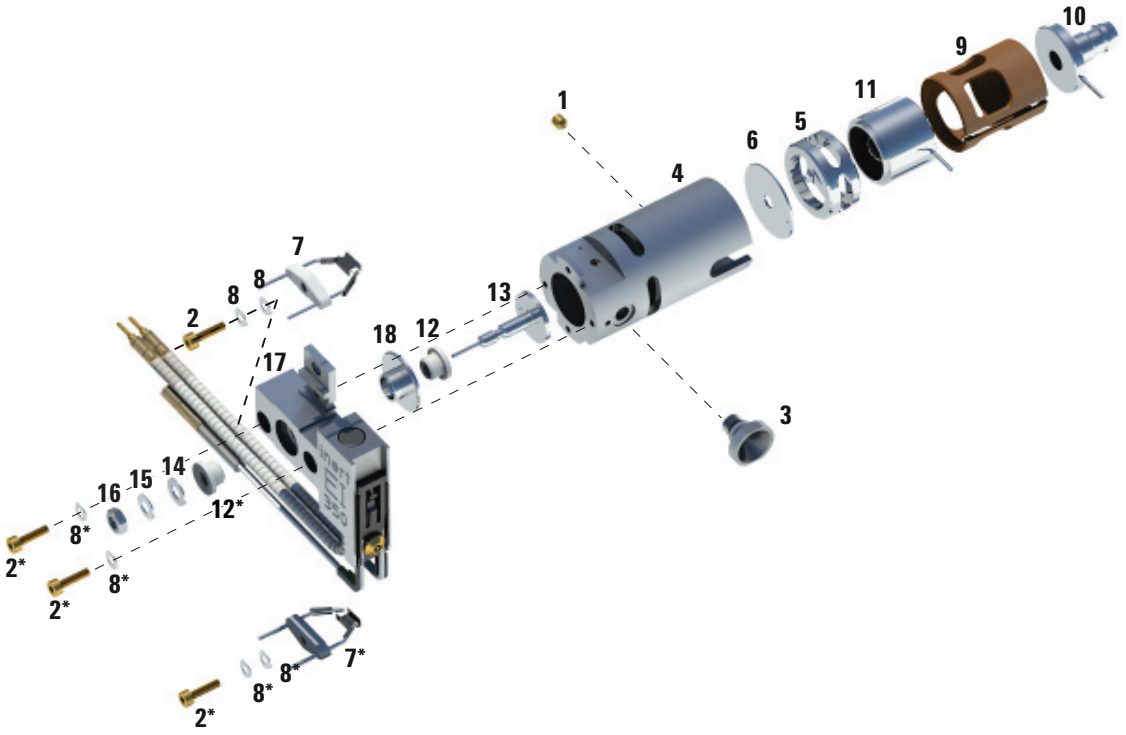


Figure 64. Assembling the EI standard or EI Inert source

Table 25 Parts list for the EI standard or EI Inert source (Figure 64)

Item number	Item description	Part number (SSL)	Part number (Inert)
1	Gold plated set screw	G1999-20022	G1999-20022
2	Gold plated screw	G3870-20021	G3870-20021
3	Interface socket	G1099-20136	G1099-20136
4	Source body	G1099-20130	G2589-20043
5	Drawout cylinder	G1072-20008	G1072-20008

Table 25 Parts list for the EI standard or EI Inert source (Figure 64) (continued)

Item number	Item description	Part number (SSL)	Part number (Inert)
6	Drawout plate	05971-20134	G2589-20100
7	4-turn filament	G7005-60061	G7005-60061
8	Spring washer	3050-1374	3050-1374
8	Flat washer	3050-0982	3050-0982
9	Lens insulator	G3170-20530	G3170-20530
10	Entrance lens	G3170-20126	G3170-20126
11	Ion focus lens	05971-20143	05971-20143
12	Repeller insulator	G1099-20133	G1099-20133
13	Repeller	G3870-60172	G3870-60173
14	Flat washer	3050-0627	3050-0627
15	Belleville spring washer	3050-1301	3050-1301
16	Repeller nut	0535-0071	0535-0071
17	Source heater block assembly	G3870-60180	G3870-60179
18	Repeller block insert	G3870-20135	G3870-20135

Assembling the EI XTR Source

Materials needed

- Gloves, clean, lint-free
  - Large (8650-0030)
  - Small (8650-0029)
- Hex ball driver, 1.5 mm (8710-1570)
- Hex ball driver, 2.0 mm (8710-1804)
- Wrench, open-end, 10 mm (8710-2353)

Procedure

Refer to the exploded parts view Figure 65 and EI XTR parts list Table 26 on page 189 while using this procedure.

1 Slide the ceramic washer into the source body.

2 Insert the extractor lens into the source body, flat side first.

3 Insert the entrance lens and ion focus lens into the insulator in the order shown in Figure 65 on page 189.

4 Slide the insulator containing the ion focus and entrance lens into the source body, with the ion focus lens against the extractor lens.

5 Install the two gold plated setscrews that holds the lenses in place.

CAUTION **Do not overtighten the repeller nut or the ceramic repeller insulators will break when the source heats up. The nut should only be finger tight.**

6 Assemble the repeller assembly.

   a Install the repeller block insert into the source heater block assembly.

   b Install the repeller insulators into the source heater block assembly and repeller block insert.

   c Install the repeller through the repeller insulators, then put the flat washer followed by the belleville spring washer onto the end of the repeller shaft and secure finger tight with the repeller nut.

7 Attach the repeller assembly to the source body using the two gold plated screws and spring washers.

8 Install the filaments using the two gold plated screws and spring washers.

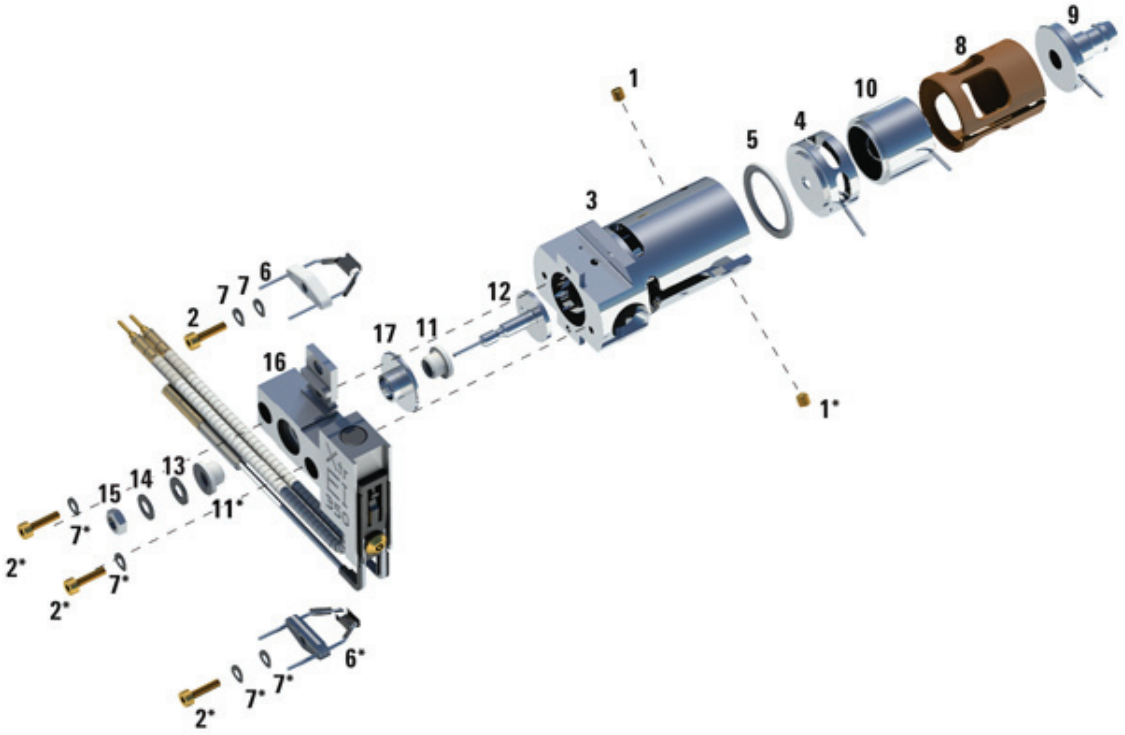


Figure 65. Assembling the EI XTR source

Table 26 Parts list for EI XTR source (Figure 65)

Item	Description	Part number
1	Setscrews	G3870-20446
2	Screws	G3870-20021
3	Source body	G3870-20440
4	Extractor lens	G3870-20444
5	Extractor lens insulator	G3870-20445
6	Filaments	G7005-60061
7	Spring washer	3050-1301
7	Flat washer	3050-0982

Table 26 Parts list for EI XTR source (Figure 65) (continued)

Item	Description	Part number
8	Lens insulator	G3870-20530
9	Entrance lens assembly, Extended	G7000-20026
10	Ion focus lens	05971-20143
11	Repeller insulator	G1099-20113
12	Repeller	G3870-60171
13	Flat washer	3050-0891
14	Belleville spring washer	3050-1301
15	Repeller nut	0535-0071
16	Source heater block assembly	G3870-60177
17	Repeller block insert	G3870-20135
Not shown	EI XTR source assembly	G7003-67720

Assembling the EI HydroInert Source

Materials needed

- Gloves, clean, lint-free
  - Large (8650-0030)
  - Small (8650-0029)
- Hex ball driver, 1.5 mm (8710-1570)
- Hex ball driver, 2.0 mm (8710-1804)
- Wrench, open-end, 10 mm (8710-2353)

Procedure

Refer to the exploded parts view **Figure 66** and EI HyrdoInert parts list **Table 27** on page 192 while using this procedure.

1 Slide the ceramic washer into the source body.

2 Insert the extractor lens into the source body, flat side first.

3 Insert the entrance lens and ion focus lens into the insulator in the order shown in **Figure 66** on page 192.

4 Slide the insulator containing the ion focus and entrance lens into the source body, with the ion focus lens against the extractor lens.

5 Install the two gold plated setscrews that holds the lenses in place.

CAUTION **Do not overtighten the repeller nut or the ceramic repeller insulators will break when the source heats up. The nut should only be finger tight.**

6 Assemble the repeller assembly.

   a Install the repeller block insert into the source heater block assembly.

   b Install the repeller insulators into the source heater block assembly and repeller block insert.

   c Install the repeller through the repeller insulators, then put the flat washer followed by the belleville spring washer onto the end of the repeller shaft and secure finger tight with the repeller nut.

7 Attach the repeller assembly to the source body using the two gold plated screws and spring washers.

8 Install the filaments using the two gold plated screws and spring washers.

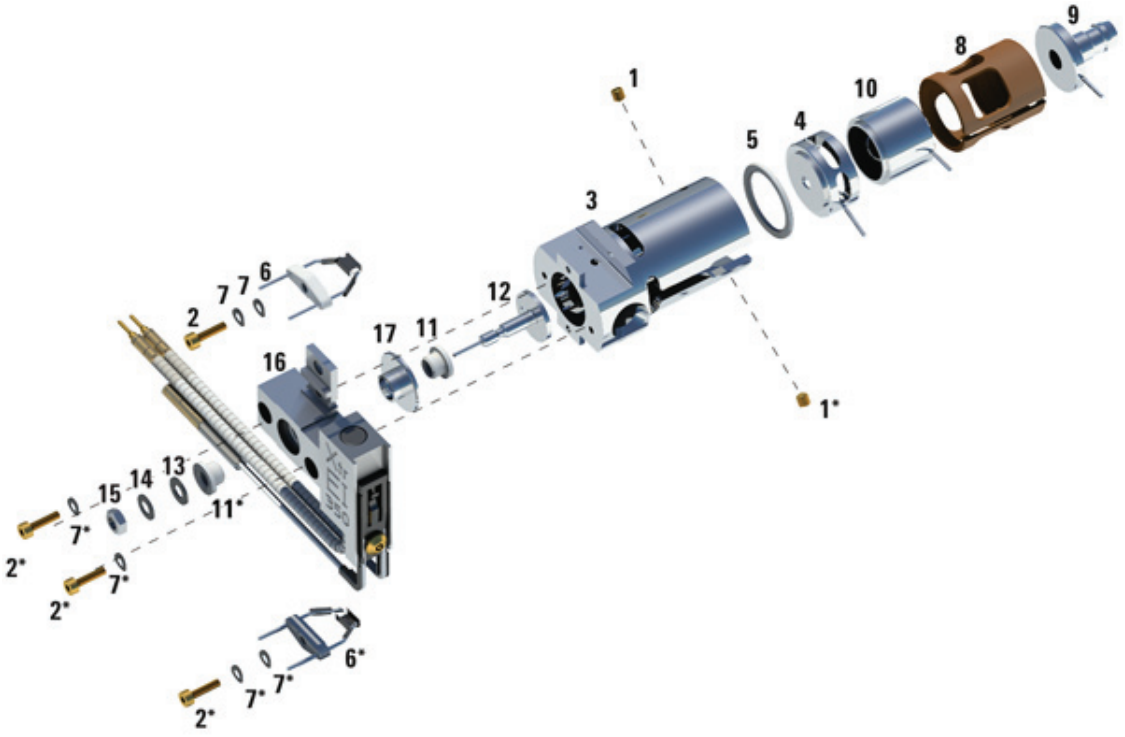


Figure 66. Assembling the EI HydroInert source

Table 27 Parts list for EI HyrdroInert source (Figure 66)

Item	Description	Part number
1	Setscrews	G3870-20446
2	Screws	G3870-20021
3	Source body	G7078-20903
4	Extractor lens, 9 mm	G7078-20909
5	Extractor lens insulator	G3870-20445
6	Filaments	G7005-60061
7	Spring washer	3050-1301
7	Flat washer	3050-0982

Table 27 Parts list for EI HyrdroInert source (Figure 66) (continued)

Item	Description	Part number
8	Lens insulator	G3870-20530
9	Entrance lens assembly	G7078-20904
10	Ion focus lens	G7078-20905
11	Repeller insulator	G1099-20133
12	Repeller	G7078-20902
13	Flat washer	3050-0891
14	Belleville spring washer	3050-1301
15	Repeller nut	0535-0071
16	Source heater block assembly	G7078-20910
17	Repeller block insert	G7078-20901
Not shown	EI HydroInert source assembly	G7078-67930

Replacing a Filament in an EI XTR, SS, Inert, or HydroInert Source

Materials needed

- Filament assembly (G7005-60061)
- Gloves, clean, lint-free
  - Large (8650-0030)
  - Small (8650-0029)
- Hex ball driver, 1.5-mm (8710-1570)

Procedure

1 Vent the MSD. (See "Venting the MSD" on page 98.)

WARNING **The analyzer operates at high temperatures. Do not touch any part until you are sure it is cool.**

2 Open the analyzer chamber. (See "Opening the Analyzer Chamber" on page 146.)

3 Remove the ion source. (See "Removing the EI XTR, SS, Inert, or HydroInert Source" on page 166.)

4 Remove the gold plated screw and washer from the filament. (See Figure 67 on page 195.)

5 Slide the filament assembly off the ion source assembly.

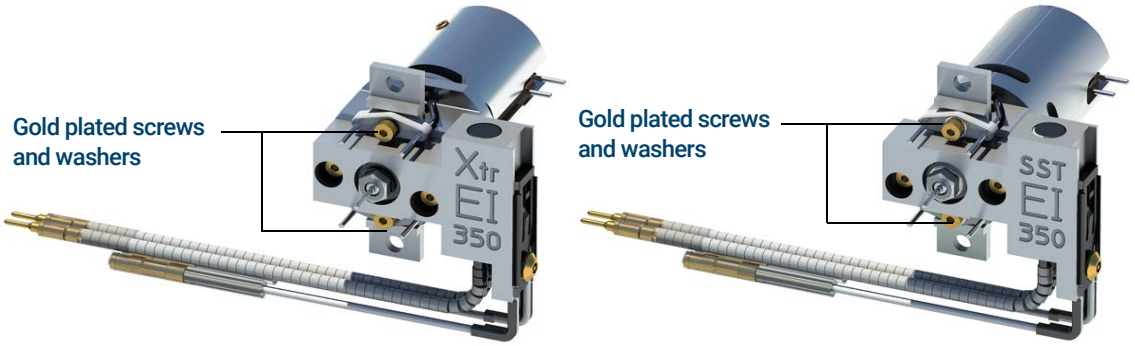


Figure 67. Changing the filament

6 Secure the new filament with the gold plated screw and washer. (See Figure 67.)

7 After installing the filament, verify that it is not grounded to the source body.

8 Install the EI source. (See "Installing the EI XTR, SS, Inert, or HydroInert Source" on page 196.)

9 Close the analyzer chamber. (See "Closing the Analyzer Chamber" on page 199.)

10 Pumpdown the MSD. (See "Pumping down the MSD" on page 116.)

11 Autotune the MSD.

12 In the Manual Tune dialog, the **Filament** parameter allows you to enter **1** or **2** for the filament number. Whichever number was present during the previous autotune enter the other filament number.

13 Autotune the MSD again.

14 Enter the filament number that gave the best results.

If you decide to use the first filament number, run Autotune again to make sure the tune parameters are compatible with the filament.

15 Select **Save Tune Parameters** from the **File** menu.

Installing the EI XTR, SS, Inert, or HydroInert Source

Materials needed

- Gloves, clean, lint-free
  - Large (8650-0030)
  - Small (8650-0029)
- Pliers, long-nose (8710-1094)

Procedure

1 Slide the ion source into the source radiator. (See Figure 68.)

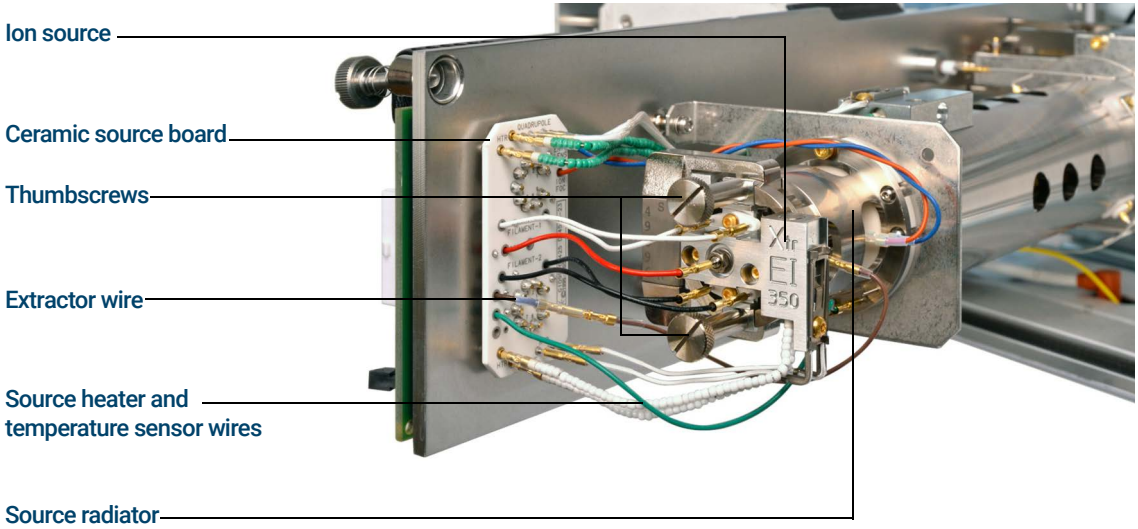


Figure 68. Installing the EI source

2 Insert and hand tighten the source thumbscrews. Do not overtighten the thumbscrews. (See Figure 68.)

3 Connect the ion source wires. (See "Connecting/Disconnecting Wiring from the EI XTR, SS, and Inert Sources" on page 167 or "Connecting/Disconnecting Wiring from the EI HydroInert Source" on page 168.)

4 Close the analyzer chamber. (See "Closing the Analyzer Chamber" on page 199.)

Replacing the Electron Multiplier Horn

The replacement EM horn part number for this Series 2 detector is stamped on the front face of the detector. You can determine which series detector you have without having to directly check the detector. The detector series is displayed as "Triple Axis Series 2" in the detector tab of manual tune, in the detector section on the second page of the tune report and in the pumpdown window.

Materials needed

- Electron multiplier horn (Series 2 Detector G7002-80103)
- Gloves, clean, lint-free
  - Large (8650-0030)
  - Small (8650-0029)
- Pliers, long-nose (8710-1094)

Procedure

1 Vent the MSD. (See"Venting the MSD" on page 113.)

WARNING **The analyzer, GC/MSD interface, and other components in the analyzer chamber operate at very high temperatures. Do not touch any part until you are sure it is cool.**

CAUTION **Always wear clean gloves to prevent contamination when working in the analyzer chamber.**

2 Open the analyzer chamber. (See "Opening the Analyzer Chamber" on page 146.)

3 Open the retaining clip. (See Figure 69 on page 198.) Lift the arm of the clip up and swing the clip away from the electron multiplier horn.

4 Slide the blue signal wire from the connector in the sideplate.

5 Remove the electron multiplier horn. (See Figure 70 on page 198.)

6 Hold the new horn with blue signal wire end down, and attach the signal wire to the connector in the sideplate.

7 Slide the electron multiplier horn into position.

8 Close the retaining clip.

9 Close the analyzer chamber. (See "Closing the Analyzer Chamber" on page 199.)

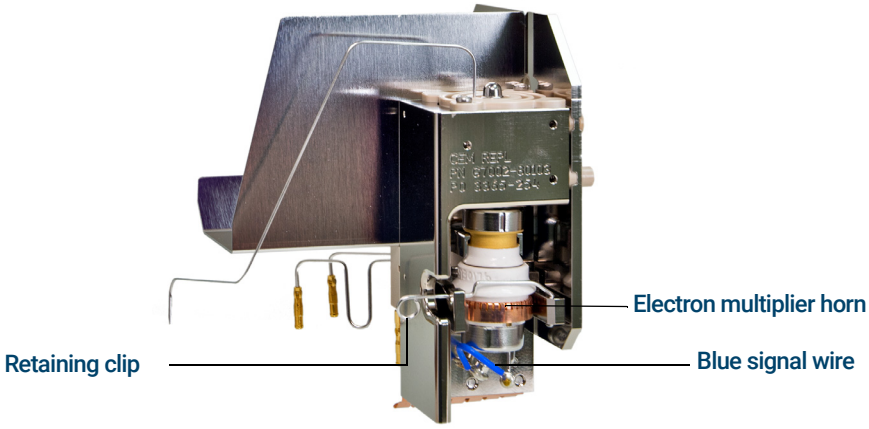


Figure 69. Replacing the EM horn on a Series 2 Detector

Figure 70. Electron multiplier horn

Closing the Analyzer Chamber

Procedure

1 Ensure all the internal analyzer electrical leads are correctly attached. Wiring is not the same for both the EI and CI sources. (See "Connecting/Disconnecting Wiring from the EI XTR, SS, and Inert Sources" on page 167.)

Check the side plate O-ring.

Make sure the O-ring has a *very* light coat of Apiezon L high vacuum grease. If the O-ring is very dry, it may not seal well. If the O-ring looks shiny, it has too much grease on it. Refer to the *5977 Series MSD Troubleshooting and Maintenance Manual* for lubricating instructions.

CAUTION **Do not force the analyzer door when closing, or you may damage the quadrupole.**

2 Swing the analyzer side plate closed.

3 Ensure the vent valve is closed.

4 If hydrogen or other flammable or toxic substance is used for carrier gas, *gently* hand-tighten the top thumbscrew on the analyzer side plate.

5 Pumpdown the MSD. (See "Pumping down the MSD" on page 116.)

WARNING **The top thumbscrew must be fastened if hydrogen (or other hazardous gas) is being used as the GC carrier gas or if hydrogen is used for the JetClean system. In the unlikely event of an explosion, it may prevent the side plate from opening.**

CAUTION **Do not overtighten the thumbscrew; it can cause air leaks or prevent successful pumpdown. Do not use a screwdriver to tighten the thumbscrew.**

6 Once the MSD has pumped down, close the left analyzer cover and replace the window cover.

7 Tune the MSD.

7 CI Maintenance

This chapter describes maintenance procedures and requirements that are unique to 5977C Series MSDs equipped with the CI hardware.

If you are using the *Agilent Intuvo 9000 Gas Chromatograph* with your MSD, Chemical Ionization (CI) is not currently supported.

General Information

Ion source cleaning

The main effect of operating the MSD in CI mode is the need for more frequent ion source cleaning. In CI operation, the ion source chamber is subject to more rapid contamination than in EI operation because of the higher source pressures required for CI.

WARNING **Always perform any maintenance procedures using hazardous solvents under a fume hood. Be sure to operate the MSD in a well-ventilated room.**

Ammonia

Ammonia, used as a reagent gas, increases the need for foreline pump maintenance. Ammonia causes foreline pump oil to break down more quickly. Therefore, the oil in the standard foreline vacuum pump must be checked and replaced more frequently.

Always purge the MSD with methane after using ammonia.

Be sure to install the ammonia with the tank in an upright position. This will help prevent liquid ammonia from getting into the flow module.

Setting up your MSD for CI operation

Setting up your MSD for operation in CI mode requires special care to avoid contamination and air leaks.

Guidelines

- Before venting in EI mode for the installation of the CI source, verify that the GC/MSD system is performing correctly.
- Make sure the reagent gas inlet line(s) are equipped with gas purifiers (not applicable for ammonia).
- Use extra-high purity reagent gases; 99.99% or better for methane and as pure as is available for other reagent gases.

Switching from the EI HES to the CI Source

Procedure

CAUTION **Always verify GC/MSD performance in EI before switching to CI operation.**

1 Vent the MSD. (See"Venting the MSD" on page 113.) The software will prompt you for the appropriate actions.

2 Open the left side access panel. (See"Opening the MSD Covers" on page 112.)

CAUTION **Electrostatic discharges to analyzer components are conducted to the side board where they can damage sensitive components. Wear a grounded antistatic wrist strap. (See"Electrostatic discharge is a threat to MSD electronics" on page 21.) Take antistatic precautions *before* you open the analyzer chamber.**

3 Open the analyzer chamber. (See"Opening the Analyzer Chamber" on page 146.)

4 Remove the EI HES. (See"Removing the EI HES" on page 148.)

5 Make sure the EI HES source has cooled and then place it in its storage container.

6 Remove the EI HES radiator. (See"Removing the EI HES Radiator" on page 203.)

7 Place the EI HES radiator in the storage container.

8 Remove the CI source radiator from the storage container.

9 Install the CI source radiator. (See"Removing the CI Source Radiator" on page 209.)

10 Remove the CI source from the storage container.

11 Install the CI source. This requires shortening the column so that it protrudes from the transfer line by 1 to 2 mm. (See"Installing the CI Source" on page 230.)

12 Pumpdown the MSD. (See"Pumping Down the MSD in CI Mode" on page 124.)

Removing the EI HES Radiator

Materials needed

- Gloves, clean, lint-free
  - Large (8650-0030)
  - Small (8650-0029)
- Tweezers (8710-2460)
- T10 Torx screwdriver (5182-3466)

Procedure

WARNING **The analyzers, GC/MSD interface, and other components in the analyzer chamber operate at very high temperatures. Do not touch any part until you are sure it is cool.**

CAUTION

- **Always wear clean gloves to prevent contamination when working in the analyzer chamber.**
- **Make sure you use an antistatic wrist strap and take other antistatic precautions before touching analyzer components.**
- **When disconnecting leads, pull on the connectors, not on the wires**

1 Remove the EI HES. (See"Removing the EI HES" on page 148.)

2 Disconnect the wires from the EI HES radiator. (See"Connecting/Disconnecting Wiring to the EI HES Radiator" on page 204.)

3 Use a T10 Torx screwdriver to loosen the 2 screws that secure the radiator to the analyzer, and place the radiator in its storage container.

Connecting/Disconnecting Wiring to the EI HES Radiator

Materials needed

- Gloves, clean, lint-free
  - Large (8650-0030)
  - Small (8650-0029)
- Pliers, long-nose (8710-1094)
- Tweezers (8710-2460)

Procedure

1 Use tweezers or needle nose pliers to connect/disconnect the green ground wire and the 5 lens wires from the radiator. Do not bend the wires any more than necessary. (See Figure 71.)

2 Use tweezers or needle nose pliers to connect/disconnect the 2 purple source heater wires and the 2 gray RTD wires from the ceramic source board.

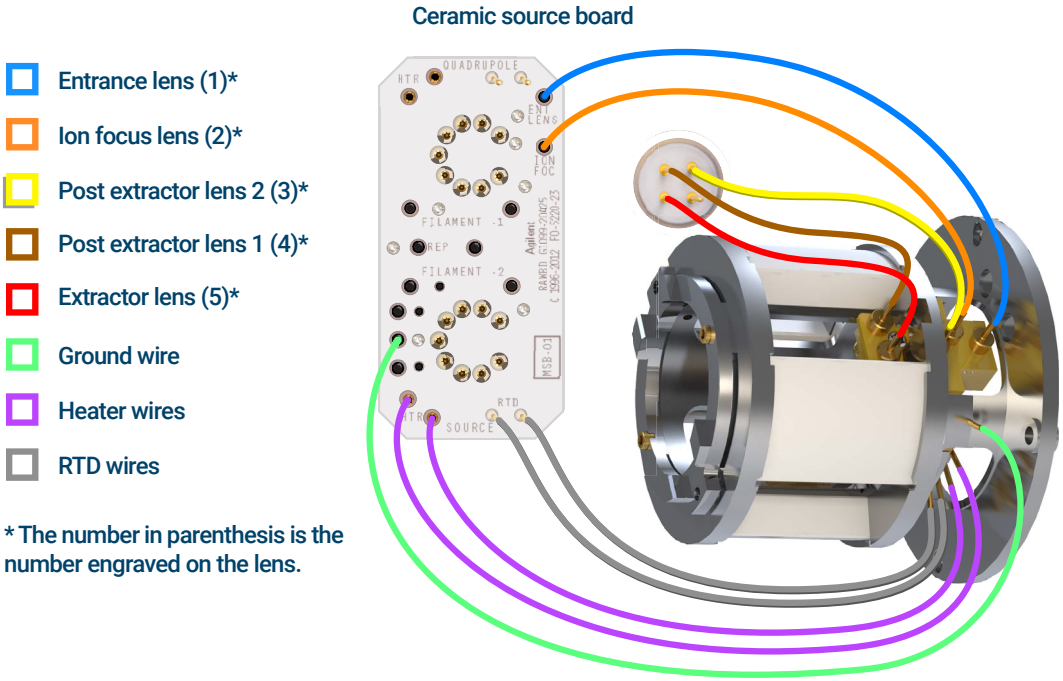


Figure 71 Wiring between the ceramic source board/feedthrough connector and the EI HES radiator

Installing the CI Source Radiator

Materials needed

- Gloves, clean, lint-free
  - Large (8650-0030)
  - Small (8650-0029)
- Tweezers (8710-2460)
- T10 Torx screwdriver (5182-3466)

Procedure

WARNING **The analyzers, GC/MSD interface, and other components in the analyzer chamber operate at very high temperatures. Do not touch any part until you are sure it is cool.**

CAUTION **Always wear clean gloves to prevent contamination when working in the analyzer chamber.**

CAUTION **Make sure you use an antistatic wrist strap and take other antistatic precautions before touching analyzer components.**

CAUTION **When disconnecting leads, pull on the connectors, not on the wires.**

1 Align the radiator over the two guide pins on the analyzer support, and secure it using the two retained screws with a number T10 Torx screwdriver.

2 Connect the green ground wire to the radiator. (See Figure 72.)

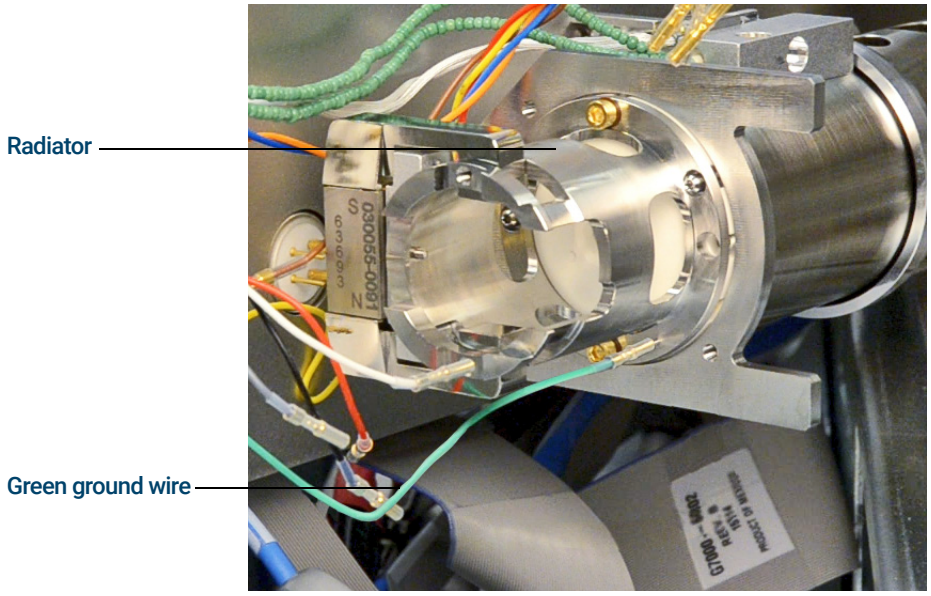


Figure 72 CI Source radiator

Switching from the CI Source to the EI HES

Procedure

1 Vent the MSD. (See"Venting the MSD" on page 98.) The software will prompt you for the appropriate actions.

CAUTION **Always wear clean gloves while touching the analyzer or any other parts that go inside the analyzer chamber.**

CAUTION **Electrostatic discharges to analyzer components are conducted to the side board where they can damage sensitive components. Wear a grounded antistatic wrist strap and take other antistatic precautions *before* you open the analyzer chamber. (See"Electrostatic discharge is a threat to MSD electronics" on page 21.)**

2 Open the left side access panel. (See"Opening the MSD Covers" on page 112.)

3 Open the analyzer chamber door. (See"Opening the Analyzer Chamber" on page 146.)

4 Remove the CI source. (See"Removing the CI Source" on page 214.)

5 Place the CI source in the storage container.

6 Remove the CI source radiator. The Radiator should not be removed or installed with the CI source in place. (See"Removing the CI Source Radiator" on page 209.)

7 Place the CI source radiator in the storage container.

8 Loosen the column nut and remove the column from the GC/MSD Interface.

9 Cut the column on the tapered side of the ferrule to remove the ferrule.

10 Install the column into the GC/MSD interface extending 4 to 5 mm past the analyzer end of the transfer line. (See"Installing a Capillary Column in the GC/MSD Interface Using the Self-Tightening Column Nut" on page 42 or "Installing a Capillary Column in the GC/MSD Interface Using a Standard Column Nut" on page 47.)

11 Remove the EI HES radiator from the storage container.

12 Install the EI HES radiator. (See"Installing the EI HES Radiator" on page 211.)

13 Remove the EI HES from the storage container.

14 Install the EI HES. (See"Installing the EI HES" on page 165.)

15 Pumpdown the MSD. (See"Pumping down the MSD" on page 116.)

Removing the CI Source Radiator

Materials needed

- Gloves, clean, lint-free
  - Large (8650-0030)
  - Small (8650-0029)
- Tweezers (8710-2460)
- T10 Torx screwdriver (5182-3466)

Procedure

WARNING The analyzers, GC/MSD interface, and other components in the analyzer chamber operate at very high temperatures. Do not touch any part until you are sure it is cool.

CAUTION Always wear clean gloves to prevent contamination when working in the analyzer chamber.

CAUTION Make sure you use an antistatic wrist strap and take other antistatic precautions before touching analyzer components.

CAUTION When disconnecting leads, pull on the connectors, not on the wires.

1 Remove the CI source. (See"Removing the CI Source" on page 214.)

2 Disconnect the green ground wire from the radiator. (See Figure 73.)

3 Use a T-10 Torx screwdriver to loosen the two retained screws that secure the radiator to the analyzer and place the radiator in its storage container.

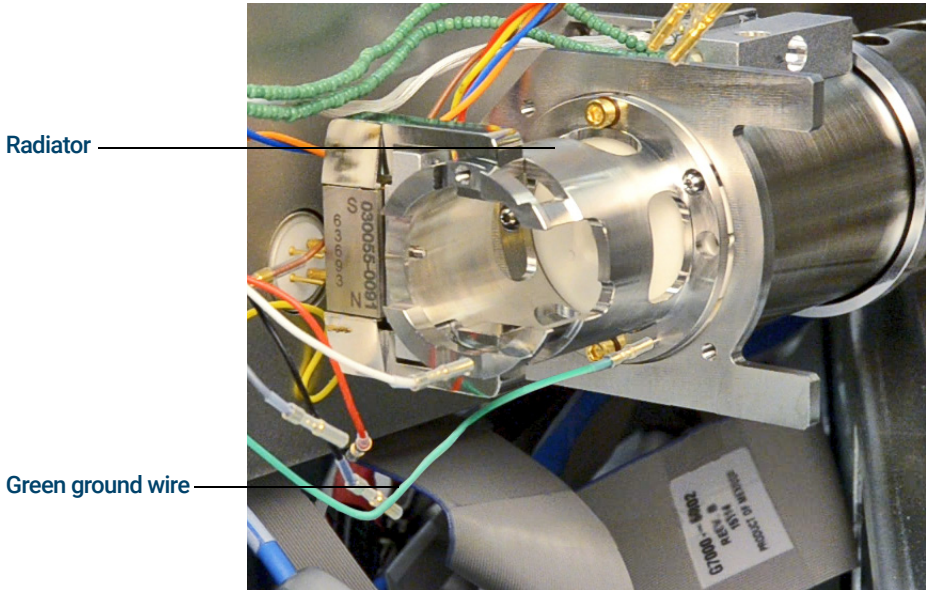


Figure 73 CI Source radiator

Installing the EI HES Radiator

Materials needed

- Gloves, clean, lint-free
  - Large (8650-0030)
  - Small (8650-0029)
- T10 Torx screwdriver (5182-3466)
- Tweezers (8710-2460)

Procedure

WARNING **The analyzers, GC/MSD interface, and other components in the analyzer chamber operate at very high temperatures. Do not touch any part until you are sure it is cool.**

CAUTION **Always wear clean gloves to prevent contamination when working in the analyzer chamber.**

CAUTION **Make sure you use an antistatic wrist strap and take other antistatic precautions before touching analyzer components.**

1 Place the radiator over the guide pins on the analyzer support and use a T10 Torx screwdriver to secure it using the (2) M3 x 12 gold plated screws (part number G7002-20110).

2 Use tweezers to connect the wires from the EI HES radiator. (See"Connecting/Disconnecting Wiring to the EI HES Radiator" on page 204.)

Switching from an EI XTR, SS, or Inert Source to the CI Source

CAUTION

Always verify MSD performance in EI before switching to CI operation.

Always set up the CI MSD in PCI first, even if you are going to run NCI.

Procedure

1 Vent the MSD. (See"Venting the MSD" on page 113.)

CAUTION

Electrostatic discharges to analyzer components are conducted to the side board where they can damage sensitive components. Wear a grounded antistatic wrist strap. (See"Electrostatic discharge" on page 141.) Take antistatic precautions *before* you open the analyzer chamber.

2 Open the analyzer. (See"Opening the Analyzer Chamber" on page 146.)

3 Remove the EI source. (See"Removing the EI XTR, SS, Inert, or HydroInert Source" on page 166.)

4 If removing an XTR source, remove the brown extractor wire from the ceramic source board and store it with the EI XTR source. (SeeFigure 49 on page 149.)

5 Install the CI source. (See"Installing the CI Source" on page 230.)

6 Install the CI/Extractor interface tip seal if it is not already installed (p/n G3870-20542). (See"Installing the GC/MSD Interface Tip Seal" on page 50.)

7 Close the analyzer. (See"Closing the Analyzer Chamber" on page 199.)

8 Pumpdown the MSD. (See"Pumping Down the MSD in CI Mode" on page 124.)

Switching from the CI Source to an EI XTR, SS, or Inert Source

Procedure

CAUTION **Always wear clean gloves while touching the analyzer or any other parts that go inside the analyzer chamber.**

CAUTION **Electrostatic discharges to analyzer components are conducted to the side board where they can damage sensitive components. Wear a grounded antistatic wrist strap, and take other antistatic precautions *before* you open the analyzer chamber. (See "Electrostatic discharge" on page 141.)**

1. Vent the MSD. (See "Venting the MSD" on page 113.) The software will prompt you for the appropriate actions.
2. Open the analyzer. (See "Opening the Analyzer Chamber" on page 146.)
3. Remove interface tip seal, spring, and knurled tip seal retainer if switching to an EI SS or EI Inert source.
4. Install the EI source. (See "Removing the EI XTR, SS, Inert, or HydroInert Source" on page 166.)
5. If installing an EI XTR source, locate the brown extractor wire from storage and connect it to the extractor lens and the source board.
6. Place the CI source in the ion source storage box.
7. If installing an EI SS or Inert source, remove the interface tip seal, spring, and knurled tip seal retainer, and put them in the CI storage container.
8. Pumpdown the MSD. (See "Pumping down the MSD" on page 116.)

Removing the CI Source

Materials needed

- Gloves, clean, lint-free
  - Large (8650-0030)
  - Small (8650-0029)
- Tweezers (8710-2460)

Procedure

The video shows wiring connections for the non-HES model MSD.

1 Vent the MSD. (See"Venting the MSD" on page 113.)

WARNING **The analyzers, GC/MSD interface, and other components in the analyzer chamber operate at very high temperatures. Do not touch any part until you are sure it is cool.**

CAUTION **Always wear clean gloves to prevent contamination when working in the analyzer chamber.**

2 Open the analyzer chamber. (See"Opening the Analyzer Chamber" on page 146.)

CAUTION **Make sure you use an antistatic wrist strap, and take other antistatic precautions before touching analyzer components.**

CAUTION **When disconnecting leads, pull on the connectors, not on the wires.**

3 Use tweezers to disconnect the wires from the CI source. Do not bend the wires any more than necessary. (See"Connecting/Disconnecting non-HES Model Wiring from the CI Source" on page 216 or "Connecting/Disconnecting EI HES Model Wiring to the CI Source" on page 217.)

   Trace the wires for the ion source heater and temperature sensor to the ceramic source board, and disconnect them there. (See"Connecting/Disconnecting EI HES Model Wiring to the CI Source" on page 217.)

4 Remove the two large thumbscrews that hold the ion source in place.

5 Pull the ion source out of the source radiator, and place it in its storage container.

Connecting/Disconnecting non-HES Model Wiring from the CI Source

Materials needed

- Gloves, clean, lint-free
  - Large (8650-0030)
  - Small (8650-0029)
- Pliers, long-nose (8710-1094)
- Tweezers (8710-2460)

Procedure

1 Use pliers to connect/disconnect the ceramic board wire leads at the source connectors. (See Figure 74.)

2 Use pliers to connect/disconnect the source heater wire leads at the ceramic source board. (See Figure 74.)

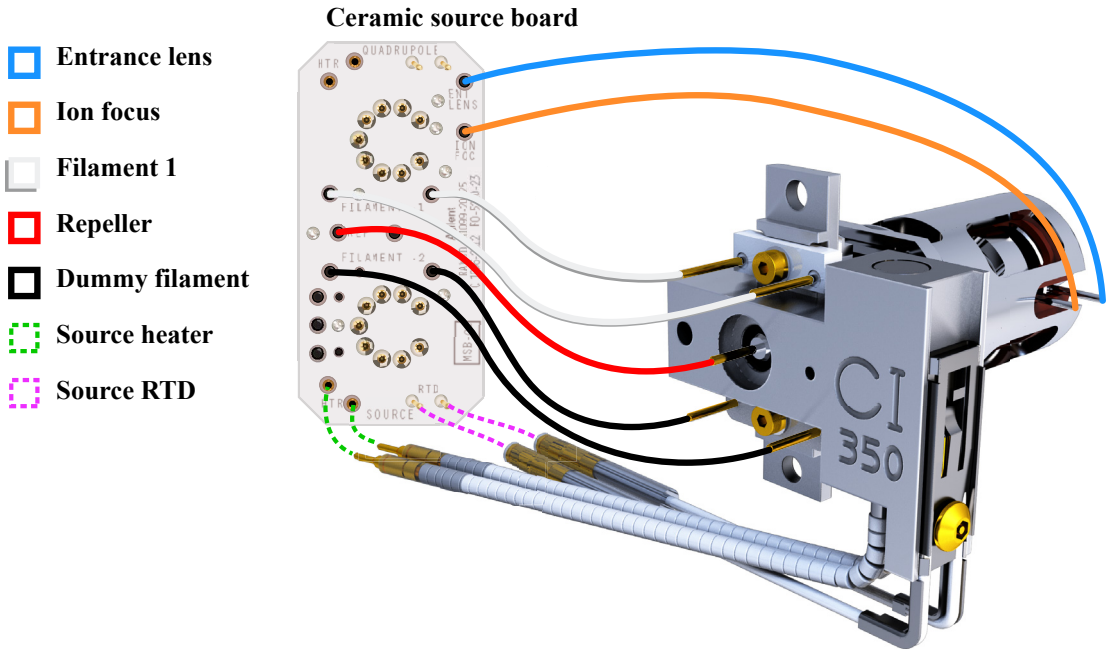


Figure 74 Wiring between the ceramic source board and the source

Connecting/Disconnecting EI HES Model Wiring to the CI Source

Materials needed

- Gloves, clean, lint-free
  - Large (8650-0030)
  - Small (8650-0029)
- Pliers, long-nose (8710-1094)
- Tweezers (8710-2460)

Procedure

1 Use pliers to connect/disconnect the ceramic board wire leads (red, white, black, and gray) at the source connectors. (See Figure 75.)

2 Use pliers to connect/disconnect the source heater wire leads at the ceramic source board. (See Figure 75.)

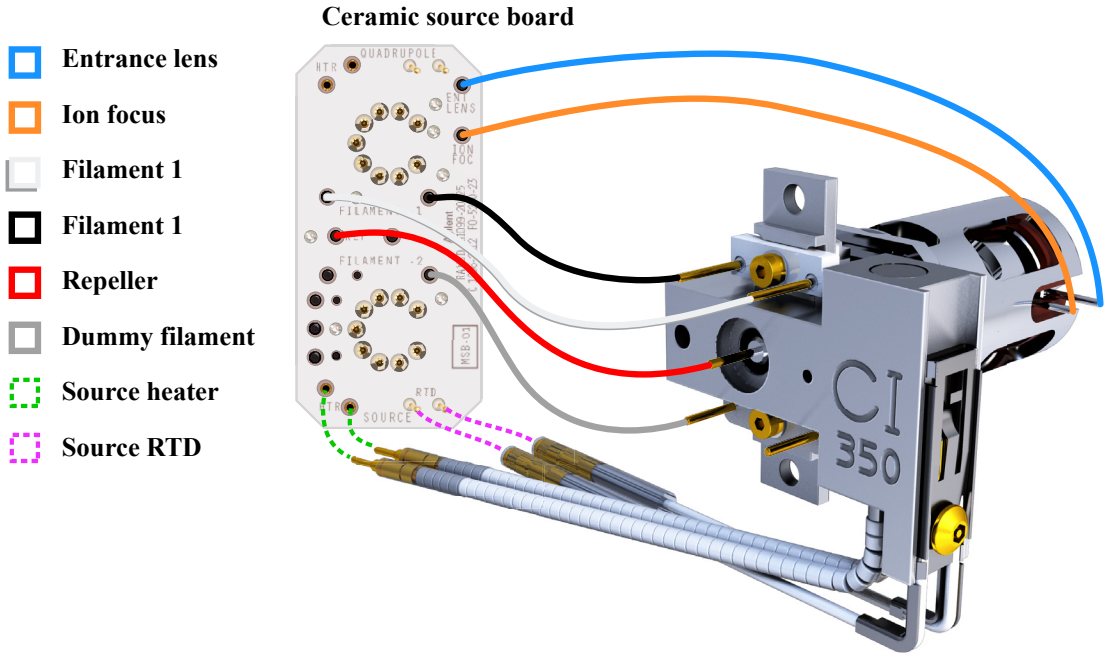


Figure 75 Wiring between the ceramic source board and the source

Disassembling the CI Source

Materials needed

- Gloves, clean, lint-free
  - Large (8650-0030)
  - Small (8650-0029)
- Hex ball driver, 1.5 mm (8710-1570)
- Hex ball driver, 2.0 mm (8710-1804)
- Wrench, open-end, 10 mm (8710-2353)
- Nut driver, 5.5 mm (8710-1220)
- Tweezers (8710-2460)

Procedure

Refer to the exploded parts view **Figure 76** and CI source parts list **Table 28** on page 219 while using this procedure.

1 Remove the CI source. (See**"Removing the CI Source"** on page 214.)

2 Remove the filaments. (See**"Removing the CI Source Filament"** on page 227.)

3 Separate the source heater assembly from the source body. The source heater assembly includes the source heater, repeller, and related parts.

4 Disassemble the repeller assembly by removing the ceramic insulator from the repeller.

5 Remove the setscrew securing the lenses to the source body.

6 Pull the lenses out of the source body and separate the lens insulator, ion focus lens, drawout cylinder, drawout lens, and entrance lens.

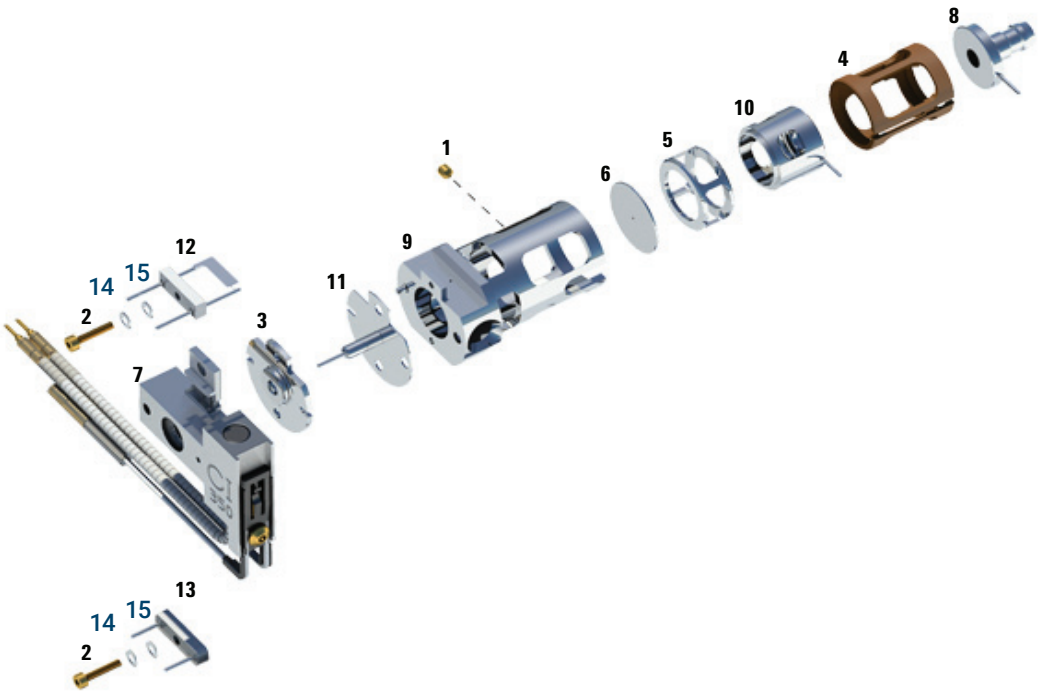


Figure 76. Disassembling the CI source

Table 28 Parts list for CI source (Figure 76)

Item	Description	Part number
1	Set screw	G1999-20022
2	Filament screw	G1999-20021
3	CI repeller insulator	G1999-20433
4	CI lens insulator	G3170-20540
5	CI drawout cylinder	G1999-20444
6	CI drawout plate	G1999-20446
7	CI source heater block assembly	G3870-60415
8	Entrance lens	G3170-20126
9	CI source body	G3170-20430

Table 28 Parts list for CI source (Figure 76) (continued)

Item	Description	Part number
10	Ion focus lens	G1999-20443
11	CI repeller	G7077-20432
12	CI filament- 2PK	G7005-60072
13	Dummy filament	G1999-60454
14	Washer spring curved 2.2 mm-ID 4.5 mm-OD, Qty. 2	3050-1374
15	Flat washer	3050-9082
Not shown	Package, GC/MS source Clamshell	G7002-80008
Not shown	Bracket, GC/MS source, Clamshell	G7002-00008
Not shown	CI source assembly	G7002-67404
Not shown	CI source assembly (without tip seal)	G7077-67404

Cleaning the CI Source

Materials needed

- Abrasive paper (5061-5896)
- Alumina abrasive powder (8660-0791)
- Aluminum foil, clean
- Cloths, clean (05980-60051)
- Cotton swabs (5080-5400)
- Glass beakers, 500 mL
- Gloves, clean, lint-free
  - Large (8650-0030)
  - Small (8650-0029)
- Solvents
  - Acetone, reagent grade
  - Methanol, reagent grade
  - Methylene chloride, reagent grade
- Ultrasonic bath

Preparation

1 Disassemble the CI source. (See"Disassembling the CI Source" on page 218.)

2 Collect the following parts to be cleaned for a CI source: (See Figure 77 on page 222.)
  - Repeller
  - Source body
  - Drawout plate
  - Drawout cylinder
  - Ion focus lens
  - Entrance lens

These are the parts that contact the sample or ion beam. The other parts normally should not require cleaning.

CAUTION **If the CI repeller insulator is dirty, clean it with a cotton swab dampened with reagent-grade methanol. If that does not clean the insulator, replace it. Do not abrasively or ultrasonically clean the insulator.**

Figure 77. CI source parts to be cleaned

Procedure

1 If the contamination is serious, such as an oil backflow into the analyzer, seriously consider replacing the contaminated parts.

2 Abrasively clean the surfaces that contact the sample or ion beam.

Use an abrasive slurry of alumina powder and reagent-grade methanol on a cotton swab. Use enough force to remove all discolorations. Polishing the parts is not necessary; small scratches will not harm performance. Also abrasively clean the discolorations where electrons from the filaments enter the source body.

3 Rinse away all abrasive residue with reagent-grade methanol.

Ensure ***all*** abrasive residue is rinsed ***before*** ultrasonic cleaning. If the methanol becomes cloudy or contains visible particles, rinse again three times.

4 Separate the parts that were abrasively cleaned from the parts that were not abrasively cleaned.

WARNING **All of these solvents are hazardous. Work in a fume hood and take all appropriate precautions.**

5 Ultrasonically clean the parts (each group separately) for 15 minutes. For dirty parts, use all three solvents in the order shown, cleaning 15 minutes with each of the following solvents:

- Methylene chloride (reagent-grade)
- Acetone (reagent-grade)
- Methanol (reagent-grade)

For routine cleaning, cleaning with methanol is sufficient.

6 Place the parts in a clean beaker. *Loosely* cover the beaker with clean aluminum foil (dull side down).

7 Dry the cleaned parts in an oven at 100 °C for five to six minutes.

WARNING **Let the parts cool before you handle them.**

NOTE **Take care to avoid contaminating cleaned and dried parts. Put on new, clean gloves before handling the parts. Do not set the cleaned parts on a dirty surface. Set them only on clean, lint-free cloths.**

Assembling the CI Source

Materials needed

- Gloves, clean, lint-free
  - Large (8650-0030)
  - Small (8650-0029)
- Hex ball driver, 1.5 mm (8710-1570)
- Hex ball driver, 2.0 mm (8710-1804)
- Wrench, open-end, 10 mm (8710-2353)

Procedure

Refer to the exploded parts view Figure 78 and the CI source parts list Table 29 on page 225 while using this procedure.

CAUTION **Always wear clean gloves when working in the analyzer chamber to avoid contamination.**

1 Assemble the ion focus lens, entrance lens, and lens insulator.

2 Slide the drawout plate and the drawout cylinder into the source body.

3 Slide the parts assembled in step 1 into the source body.

4 Install the setscrew that holds the lenses in place.

5 Attach the ceramic disk to the repeller and place on top of the source body.

6 Place the heater block assembly on top of the source body.

7 Reinstall the dummy filament, and the filament and attach with the setscrews.

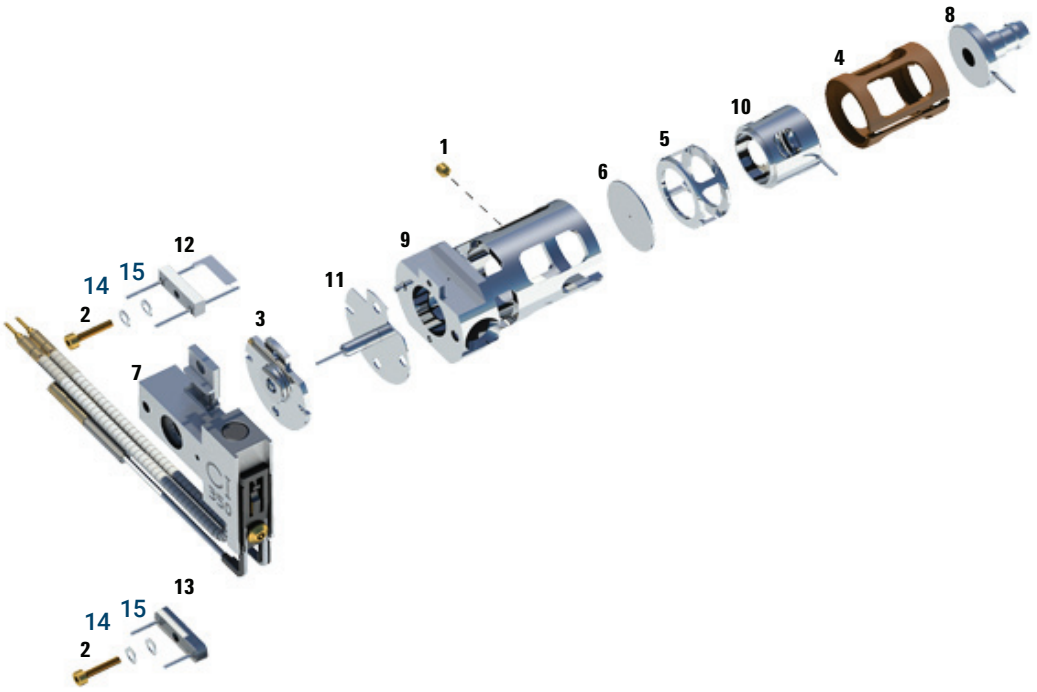


Figure 78. Assembling the CI source

Table 29 Parts list for CI source (Figure 78)

Item	Description	Part number
1	Set screw	G1999-20022
2	Filament screw	G1999-20021
3	CI repeller insulator	G1999-20433
4	CI lens insulator	G3170-20540
5	CI drawout cylinder	G1999-20444
6	CI drawout plate	G1999-20446
7	CI source heater block assembly	G3870-60415
8	Entrance lens	G3170-20126
9	CI source body	G3170-20430
10	Ion focus lens	G1999-20443

Table 29 Parts list for CI source (Figure 78) (continued)

Item	Description	Part number
11	CI repeller	G7077-20432
12	CI filament- 2PK	G7005-60072
13	Dummy filament	G1999-60454
14	Washer spring curved 2.2 mm-ID 4.5 mm-OD, Qty. 2	3050-1374
15	Flat washer	3050-9082
Not shown	Package, GC/MS source Clamshell	G7002-80008
Not shown	Bracket, GC/MS source, Clamshell	G7002-00008
Not shown	CI source assembly	G7002-67404
Not shown	CI source assembly (without tip seal)	G7077-67404

Removing the CI Source Filament

Materials needed

- Gloves, clean, lint-free
  - Large (8650-0030)
  - Small (8650-0029)
- Hex ball driver, 1.5 mm (8710-1570)
- Tweezers (8710-2460)

Procedure

1 Vent the MSD. (See "Venting the MSD" on page 113.)

CAUTION **Always wear clean gloves to prevent contamination when working in the analyzer chamber.**

WARNING **The analyzer, GC/MSD interface, and other components in the analyzer chamber operate at very high temperatures. Do not touch any part until you are sure it is cool.**

2 Open the analyzer chamber. (See "Opening the Analyzer Chamber" on page 146.)

3 Remove the CI source. (See "Removing the CI Source" on page 214.)

4 Remove the screw holding the filament to the CI source body. (See Figure 79.)

5 Slide the filament off the CI source assembly. (See Figure 79.)

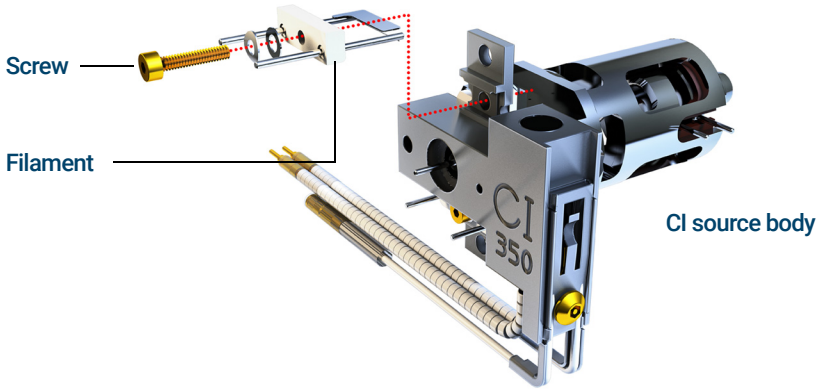


Figure 79. Changing the CI source filament

Installing a CI Source Filament

Materials needed

- Filament assembly, 2-pk, CI (G7005-60072)
- Gloves, clean, lint-free
  - Large (8650-0030)
- Small (8650-0029)Tweezers (8710-2460)

Procedure

1 Remove the old filament. (See"Removing the CI Source Filament" on page 227.)

2 Place the new filament into its position on the ion source body. (See Figure 79 on page 228.)

3 Secure the filament to the ion source body with the screw. (See Figure 79 on page 228.)

4 After installing the filament, verify that it is not grounded to source body.

5 Reinstall the CI source. (See"Installing the CI Source" on page 230 or "General Information" on page 201.)

6 Pumpdown the MSD. (See"Pumping Down the MSD in CI Mode" on page 124.)

7 Autotune the MSD.

Installing the CI Source

CAUTION **Electrostatic discharges to analyzer components are conducted to the side board where they can damage sensitive components. Wear a grounded antistatic wrist strap and take other antistatic precautions *before* you open the analyzer chamber.**

Procedure

The video shows wiring connections for the non-HES model MSD.

1 Vent the MSD. (See"Venting the MSD" on page 113.)

2 Open the analyzer chamber. (See"Opening the Analyzer Chamber" on page 146.)

3 Slide the CI source into the radiator. (See Figure 80.)

4 Install the thumbscrews. (See Figure 80.)

5 Connect the wiring to the CI source. (See"Connecting/Disconnecting non-HES Model Wiring from the CI Source" on page 216 or "Connecting/Disconnecting EI HES Model Wiring to the CI Source" on page 217.)

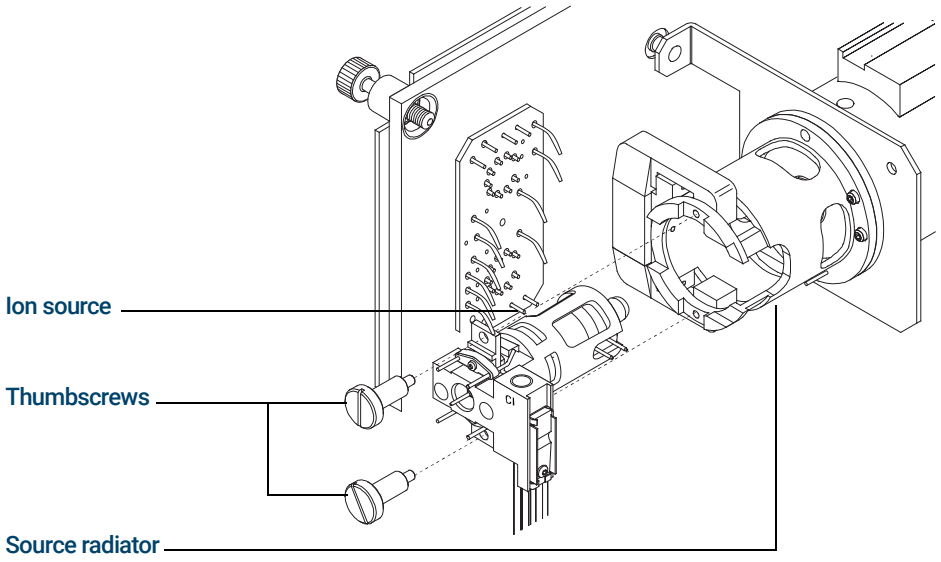


Figure 80. Installing the CI source

6 Close the analyzer door. (See"Closing the Analyzer Chamber" on page 199.)

7 Pumpdown the MSD. (See"Pumping Down the MSD in CI Mode" on page 124.)

8 Tune the MSD. (See"CI Autotune" on page 121.)

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