



Agilent 7000/7010 Series Triple Quadrupole Operating Manual



Notices

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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 7000/7010 Series Triple Quad (TQ) Mass Spectrometer (MS) system.

1 “Introduction”

Chapter 1 describes general information about the 7000/7010 Series TQ GC/MS, including a hardware description, general safety warnings, and hydrogen safety information.

2 “Installing 8890 GC Columns”

Chapter 2 shows you how to prepare Agilent 8890 GC capillary columns for use with the MS, install it in the GC oven, and connect it to the MS using the GC/MS interface.

3 “Installing Intuvo 9000 GC Column”

Chapter 3 shows you how to install an Agilent Intuvo column, connect a flow path from the column through the MS transfer line and into the ion source, and maintain the column guard chip.

4 “Installing 7890 GC Columns”

Chapter 4 shows you how to prepare Agilent 7890 GC capillary columns for use with the MS, install it in the GC oven, and connect it to the MS using the GC/MS interface.

5 “Operating in EI Mode”

Chapter 5 describes routine operations in EI mode such as setting temperatures, monitoring pressures, tuning, venting, and pumpdown.

6 “Operating in CI Mode”

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

7 “General Maintenance”

Chapter 7 describes general maintenance procedures for the 7000/7010 Series TQ GC/MS.

8 “CI Maintenance”

Chapter 8 describes maintenance procedures unique to CI MS.

Hardware User Information

Accompanying your hardware and software is a comprehensive collection of manuals, videos, user applications, and method development tools. These are located on the:

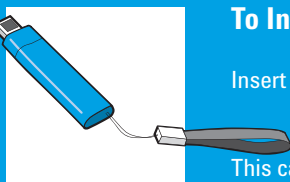
- Agilent GC and GC/MS User Manuals and Tools DVD set
- Agilent GC/MS Software Information and Manuals memory stick



To Install Your Hardware Library

Insert the disk into your DVD drive and follow the prompts.

This can be installed by anyone who has authority to copy information onto the receiving computer.



To Install Your Software Library

Insert the memory stick into a USB port and follow the prompts.

This can be installed by anyone who has authority to copy information onto the receiving computer.

See the Agilent 7000/7010 Series TQ GC/MS System Quick Start document for information on finding and installing the documentation located on this USB and DVDs.

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This section provides general information about the 7000/7010 Series Triple Quad (TQ) Gas Chromatograph (GC) / Mass Spectrometer (MS), including a hardware description, general safety warnings, and hydrogen safety information.

Abbreviations Used

The abbreviations in **Table 1** are used in discussing this product. They are collected here for convenience.

Table 1 **Abbreviations**

Abbreviation	Definition
AC	Alternating current
ALS	Automatic liquid sampler
CC	Collision cell
CI	Chemical ionization
CID	Collision induced dissociation
CSB	Ceramic source board
DC	Direct current
EI	Electron impact
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
id	Inside diameter
Inert	Standard EI source constructed of inert materials
LAN	Local Area Network
LCP	Local control panel
m/z	Mass-to-charge ratio
MFC	Mass flow controller
MRM	Multiple reaction monitoring
MS	Mass spectrometer

Table 1 **Abbreviations (continued)**

Abbreviation	Definition
MS1	Front quadrupole
MS2	Rear quadrupole
NCI	Negative chemical ionization
OFN	Octafluoronaphthalene (sample)
PCI	Positive chemical ionization
PFDTD	Perfluoro-5,8-dimethyl-3,6,9-trioxydodecane (calibrant)
PFTBA	Perfluorotributylamine (calibrant)
Quad	Quadrupole mass filter
RF	Radio frequency
RFPA	Radio frequency power amplifier
Torr	Unit of pressure, 1 mm Hg
TQ	Triple Quad (quadrupole)
Turbo	Split flow turbomolecular vacuum pump
XTR	EI Extractor source

The 7000/7010 Series TQ GC/MS

The 7000/7010 Series TQ GC/MS is a standalone capillary GC detector for use with the Agilent 8890, 9000, or 7890 GCs. (See **Figure 1** on page 18.) The TQ GC/MS features:

- One split flow turbomolecular vacuum pump
- Rotary vane or optional dry scroll foreline pump
- A choice of two independently MS-heated high sensitivity EI sources
- An optional JetClean system for cleaning the ion source in place under vacuum
- CI and EI modes available (PCI/NCI/EI)
- Two independently MS-heated hyperbolic Quads
- Single hexapole CC
- HED EM
- Independently GC-heated GC/MS interface with interface tip seal
- Independently GC-controlled CC gas flows

Physical description

The 7000/7010 Series TQ GC/MS is a rectangular box, approximately 47 cm high, 35 cm wide, and 86 cm deep. The weight is 59 kg for the turbo pump mainframe and 64 kg for the mainframe with CI. The attached foreline (roughing) pump weighs an additional 22.2 kg.

The basic components of the instrument are:

- Frame/cover assemblies
- Vacuum system
- GC/MS interface
- Ion source
- Electronics
- CC
- Detector
- Front and rear analyzers

Vacuum gauge

The 7000/7010 Series TQ GC/MS is equipped with two ion vacuum gauges. The Agilent MassHunter GC/MS Acquisition software can be used to read the pressure (high vacuum) in the vacuum manifold and at the turbomolecular vacuum pump discharge.

7000/7010 CI MS System

In this manual, the term “CI MS” refers to the 7000/7010 Series TQ GC/MS CI source system. It also applies, unless otherwise specified, to the mass flow controller (MFC) for these instruments.

The 7000/7010 Series TQ GC/MS CI source system (preconfigured or upgrade kit) adds to the 7000/7010 TQ MS:

- EI/CI GC/MS interface
- CI source
- Reagent gas MFC system
- JetClean option available that shares the same MFC system
- HED with high sensitivity electronics
- Bipolar HED power supply for PCI and NCI operation

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

The CI MS system has been optimized to achieve the relatively high source pressure required for CI while still maintaining high vacuum in the CC, quadrupoles, 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 insulating seal fits onto the tip of the interface.

Switching back and forth between CI and EI sources takes about 1 hour, however, a 1- to 2-hour wait is required to purge the reagent gas lines and bake out water and other contaminants. Switching from PCI to NCI requires about 2 hours for the ion source to cool.

7000/7010 Series Triple Quadrupole Hardware Description

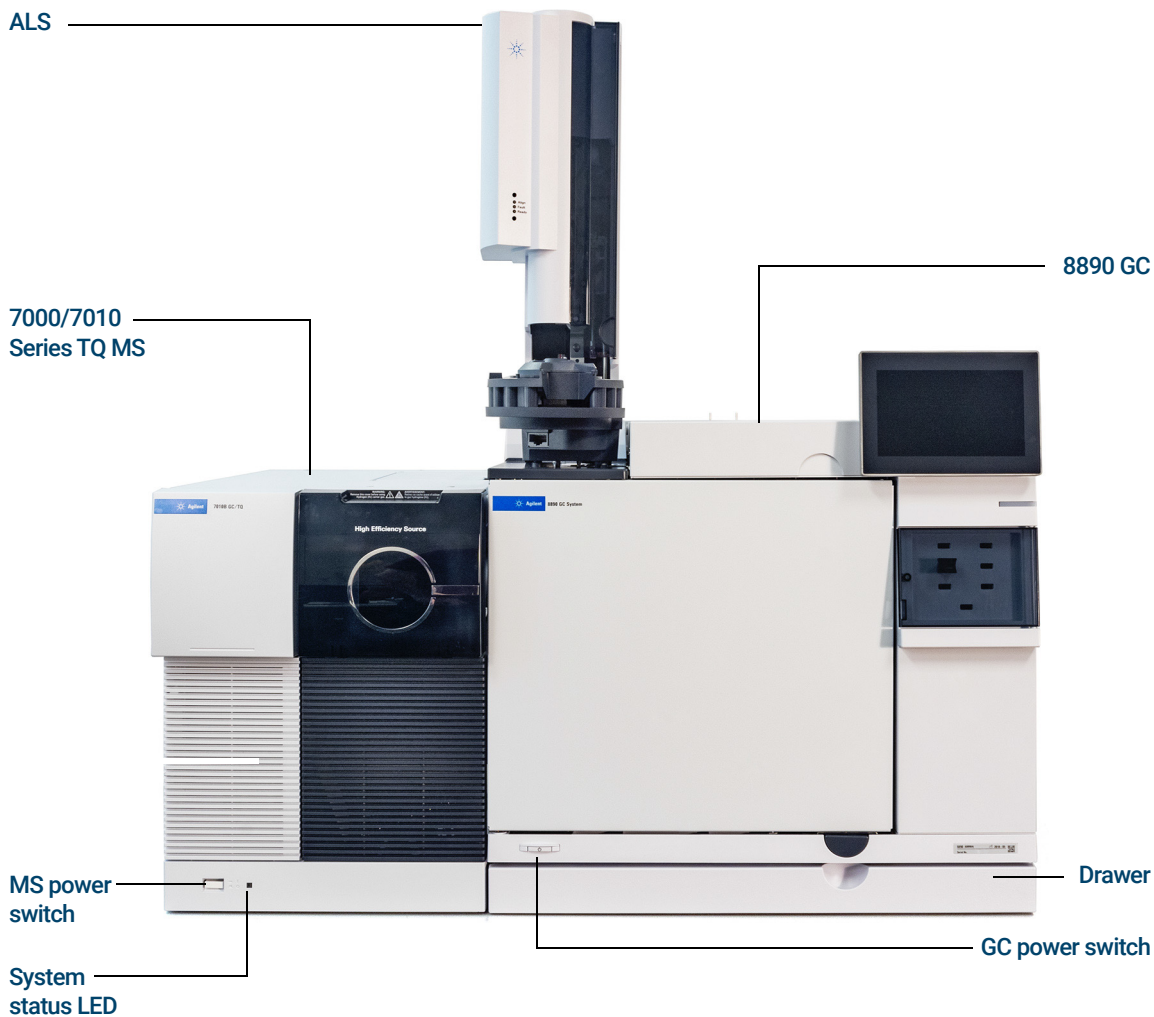


Figure 1. 7000/7010 Series TQ GC/MS system with 8890 GC

Important Safety Warnings

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

Many internal parts of the MS carry dangerous voltages

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

- The wiring between the MS 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, and oven are turned off.

WARNING

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

Electrostatic discharge is a threat to MS electronics

The printed circuit boards in the MS can be damaged by electrostatic discharge (ESD). 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.

1 Introduction

Many parts are dangerously hot

Many parts are dangerously hot

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

- Inlet
- Oven and its contents
- Valve box
- Detectors
- Column nuts attaching the column to an inlet or detector
- Foreline pump
- GC/MS transfer line
- Quadrupole
- Ion source

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 that can cause burns.

WARNING

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

The oil pan under the rotary vane 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 MS.

WARNING

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

Hydrogen Safety

WARNING

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

WARNING

When using hydrogen (H₂) as the carrier gas or fuel gas, be aware that hydrogen gas can flow into the GC oven and create an explosion hazard. Therefore, ensure that the hydrogen supply is turned off until all connections are made, and ensure that the inlet and detector column fittings are either connected to a column or capped at all times when hydrogen gas 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.

Dangers unique to GC/MS operation

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

- Combustion of leaking hydrogen
- Combustion due to rapid expansion of hydrogen from a high-pressure cylinder

1 Introduction

Hydrogen accumulation in an MS

- 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 MS and subsequent combustion

Hydrogen accumulation in an MS

WARNING

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

All users should be aware of the mechanisms by which hydrogen can accumulate, and know what precautions to take if they are certain or suspect that hydrogen has accumulated. (See [Table 2](#).) Note that these mechanisms apply to *all* MSs.

Table 2 Hydrogen accumulation mechanisms

Mechanism	Results
MS turned off	A MS can be shut down deliberately. It can also be shut down accidentally by an internal or external failure. A MS shutdown does not shut off the flow of carrier gas. As a result, hydrogen may slowly accumulate in the MS.
MS automated shutoff valves closed	The MSs 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 MS.
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 8890/9000/7890 Series GC equipped with Electronic Pressure Control (EPC) is shut off, the EPC stops the flow of carrier gas. If the carrier flow is <i>not</i> under EPC control, the flow increases to its maximum. This flow may be more than some MSs can pump away, resulting in the accumulation of hydrogen in the MS. If the MS is shut off at the same time, the accumulation can be fairly rapid.
Power failure	If the power fails, both the GC and MS shut down. The flow of carrier gas, however, is not necessarily shut down. As described previously, 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 MS.

WARNING

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

WARNING

After a power failure, the MS 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 GC/MS system with hydrogen carrier gas, or when operating the MS with the JetClean option that supplies hydrogen to the MS from a MFC located on the analyzer.

Equipment precautions

WARNING

You **MUST** ensure the top thumbscrew on the front analyzer side plate and the top thumbscrew on the rear analyzer side plate are both fastened finger-tight. Do not over tighten the thumbscrews; this can cause air leaks.

You **MUST** leave the CC chamber top plate shipping brackets fastened. Do not remove the shipping brackets from the top plate for normal operation; they secure the top plate in the event of an explosion.

You **MUST** remove the plastic cover over the glass window on the front of the analyzer. In the unlikely event of an explosion, this cover may dislodge.

WARNING

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

General laboratory precautions

- Avoid leaks in the carrier gas, fuel gas, and in the optional JetClean system lines. Use leak-checking equipment to periodically check for hydrogen leaks.
- Eliminate from your laboratory as many ignition sources as possible (for example, open flames, devices that can spark and sources of static electricity).
- 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 at its source every time you shut down the GC or MS.
- Do not use hydrogen as a CC gas.
- Turn off the hydrogen at its source every time you vent the MS. (Do not heat the capillary column without carrier gas flow.)
- Turn off the hydrogen at its source every time shutoff valves in the MS 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/MS 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 MS 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 MS to atmosphere.
 - 6 Wait at least 10 minutes to allow any hydrogen to dissipate.
 - 7 Start up the GC and MS as normal.

When using hydrogen gas, 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. Always ensure the vent line is vented into a fume hood.

Safety and Regulatory Certifications


The 7000/7010 Series TQ GC/MS 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 7000/7010 Series TQ GC/MS is designed and manufactured under a quality system registered to ISO 9001.

EMC

The 7000/7010 TQ MS 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.



South Korean Class A EMC Declaration

A 급 기기 (업무용 방송통신기자재)

This equipment is Class A suitable for professional use and is for use in electromagnetic environments outside of the home.

이 기기는 업무용 (A 급) 전자파적합기기로서 판 매자 또는 사용자는 이 점을 주의하시기 바라 며 , 가정외의 지역에서 사용하는 것을 목적으 로 합니다 .

Information

The Agilent Technologies 7000/7010 Series TQ GC/MS meets the following IEC classifications: Equipment Class I, Laboratory Equipment, Installation Category II, and Pollution Degree 2.

This unit has been designed and tested in accordance with recognized safety standards and 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 MS 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.



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.

1 Introduction

Sound emission declaration

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:

- Relocate the radio or antenna.
- Move the device away from the radio or television.
- Plug the device into a different electrical outlet, so that the device and the radio or television are on separate electrical circuits.
- Ensure that all peripheral devices are also certified.
- Ensure that appropriate cables are used to connect the device to peripheral equipment.
- 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 $L_p < 70$ dB according to EN 27779:1991 and EN ISO 3744:1995.

Schalldruckpegel

Schalldruckpegel $L_P < 70$ dB nach EN 27779:1991 und EN ISO 3744:1995.

Intended Use

Agilent products must only be used 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.

Accidental Liquid Spill

In case of an accidental liquid spill, first turn off the MS and remove the power cord from the buildings electrical power supply. Then call your local Agilent service representative for assistance.

Only Agilent trained technicians should service the electrical components inside an MS.

Moving or Storing the MS

The best way to keep your MS functioning properly is to keep it pumped down and hot, with carrier gas flow. If you plan to move or store your MS, a few additional precautions are required. The MS must remain upright at all times; this requires special caution when moving. The MS should not be left vented to atmosphere for long periods. (See "**Moving or Storing the MS**" in the *7000/7010 Series TQ GC/MS Troubleshooting and Maintenance Manual*.)

2

Installing 8890 GC Columns

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This chapter shows you how to select, install, and condition a GC column, which must be performed before you operate your MS.

Columns

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

During tuning or data acquisition, the rate of column flow into the MS 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 oven temperature, requiring measurements of the actual flow to be taken. Use the flow calculator in the Agilent Instrument Utilities software, and **Table 3** to determine an acceptable column flow. EI and CI systems also have different column outlet flow pressures. (See **Table 7** on page 106 for EI mode and **Table 10** on page 132 for CI mode.)

Table 3 Gas flows

Feature	Gas flows
High-vacuum pump	Split flow turbo
Optimal He column gas flow, mL/min (carrier gas)	1 to 2
Reagent gas flow, mL/min	1 to 2
CC gas flow	3 to 4
Maximum recommended gas flow, mL/min*	4 to 6
Maximum gas flow, mL/min†	6.5
Maximum column id	0.53 mm (30 m length)
JetClean option H ₂ flow,	0.4 mL/min

* Total gas flow into the MS = column flow + CC gas flow + reagent gas flow (if applicable) + JetClean H₂ flow (if applicable)

† Expect degradation of spectral performance and sensitivity.

Conditioning columns

Conditioning a column before it is connected to the GC/MS 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 MS ion source. This decreases MS 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/MS 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 procedure for the 7000/7010 Series TQ GC/MS is different from that for previous MSs. Using the procedure from another instrument may *not* work and may damage the column or the MS.
- You can remove old ferrules from column nuts with an ordinary pushpin.
- 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. Agilent recommends use of their new self-tightening nuts on the MS transfer line, inlet, and GC detector.
- Always wear clean gloves when handling columns, especially the end that will be inserted into the GC/MS 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 MS power. If the foreline pump is off, hydrogen will accumulate in the MS and an explosion may occur. Read "[Hydrogen Safety](#)" on page 21 before operating the MS with hydrogen gas.

WARNING

Always wear safety glasses when handling capillary columns. Use care to avoid puncturing your skin with the end of the column.

2 Installing 8890 GC Columns

To Install a Capillary Column in a Split/Splitless Inlet

To Install a Capillary Column in a Split/Splitless Inlet

Materials needed

- Gloves, clean, lint-free (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)
- Self-tightening column nut (5190-6194)
- Alternate: Standard Inlet column nut (5181-8830, for use with Vespel ferrules)
- 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)
- Magnifying loupe
- Septum (may be old, used inlet septum)

To install columns in other types of inlets, refer to your GC user information.



Procedure

WARNING

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

- 1 Cool the oven to room temperature.

WARNING

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

2 Installing 8890 GC Columns

To Install a Capillary Column in a Split/Splitless Inlet

CAUTION

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

- 2 Wearing clean gloves, slide a septum, column nut, and conditioned ferrule onto the free end of the column. **Figure 2** shows a standard inlet column nut, but the nut is similarly positioned for a self-tightening column nut. The tapered end of the ferrule should point away from the column nut for a column attachment to an inlet.

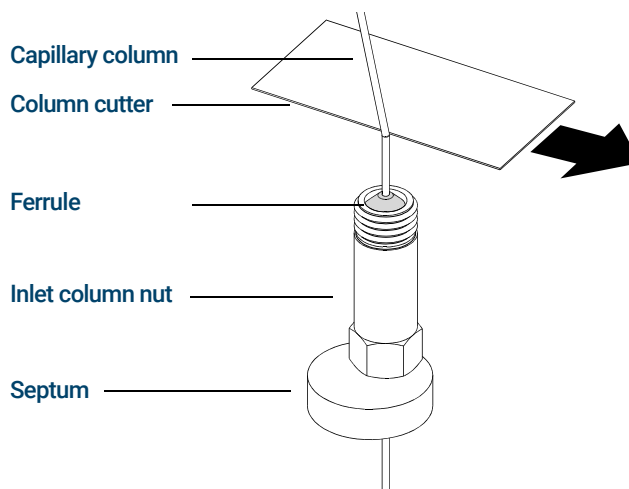


Figure 2. Preparing a capillary column for installation (standard inlet column nut shown)

- 3 Use the column cutter to score the column 2 cm from the end.
- 4 While holding the column against the column cutter with your thumb, break the column against the edge of the column cutter.
- 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 septum under the column nut so that the column extends 4 to 6 mm past the end of the ferrule. (See **Figure 3** on page 34.)
- 8 Insert the column in the inlet.
- 9 Slide the nut up the column to the inlet base and finger-tighten the nut.

2 Installing 8890 GC Columns

To Install a Capillary Column in a Split/Splitless Inlet

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

CAUTION

Never use a wrench to tighten a self-tightening nut. This may result in damage to the nut or instrument.

- 11 For the self-tightening column nut, finger-tighten until it begins to grip the column, then turn an additional 30 to 60 degrees until tight.

For the standard column nut, (shown in [Figure 3](#)) tighten the nut an additional 1/4 to 1/2 turn. The column should not slide with a gentle tug.

- 12 Start the carrier gas flow.
- 13 Verify flow by submerging the free end of the column in isopropanol. Look for bubbles.

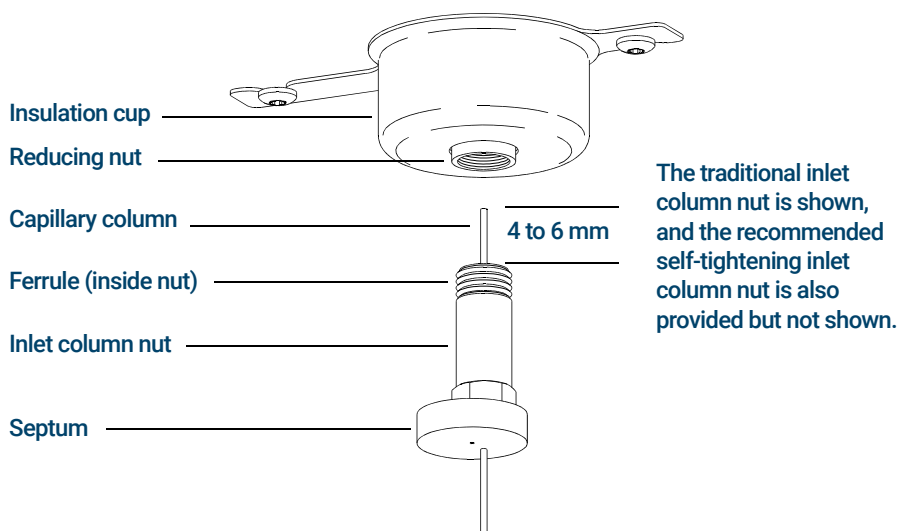


Figure 3. Installing a capillary column for a split/splitless inlet

To Condition 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 (99.9995% 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 [“To Install a Capillary Column in a Split/Splitless Inlet”](#) on page 32.)
- 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 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, in the GC/MS 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 Install the column in the GC/MS interface.

2 Installing 8890 GC Columns

To Condition a Capillary Column

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.

2 Installing 8890 GC Columns

To Install a Capillary Column in the GC/MS Interface Using the Self-Tightening Column Nut

To Install a Capillary Column in the GC/MS 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 4** and **Figure 5** on page 39.)
- Knurled tip seal retainer (G3870-20547)
- Tip seal spring (G7005-20024)
- Column cutter, ceramic (5181-8836) or diamond (5183-4620)
- Flashlight
- Magnifying loupe
- Gloves, clean, lint-free (Large 8650-0030) (Small 8650-0029)
- Self-tightening column nut for GC\MS 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

2 Installing 8890 GC Columns

To Install a Capillary Column in the GC/MS Interface Using the Self-Tightening Column Nut



Procedure

CAUTION

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

WARNING

The analyzer, GC/MS 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 [“To Condition a Capillary Column”](#) on page 35.)

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.

- 2 Vent the MS (See [“To Vent the MS”](#) on page 124.) and open the front analyzer chamber. (See [“To Open the Front Analyzer Chamber”](#) on page 156.) Ensure you can see the end of the GC/MS interface.

WARNING

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

- 3 Remove the interface tip seal, spring, and knurled tip seal retainer from the GC/MS interface. (See [Figure 4](#) and [Figure 5](#) on page 39.)
- 4 Slide the self-tightening column 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/MS interface.
- 6 Lightly thread the self-tightening column nut onto the GC/MS interface.
- 7 Use the column cutter to score the column 2 cm from the end.

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.

- 8 While holding the column against the column cutter with your thumb, break the column against the edge of the column cutter.
- 9 Inspect the end for jagged edges or burrs. If the break is not clean and even, repeat steps 6 and 7.

2 Installing 8890 GC Columns

To Install a Capillary Column in the GC/MS Interface Using the Self-Tightening Column Nut

- 10** Adjust the column so it extends this specified distance from the end of the transfer line. (See [Figure 4](#) and [Figure 5](#) on page 39.)

For an EI XTR or CI Source Installation, the column extends about 1 to 2 mm. (See [Figure 4](#).)

For an EI HES Installation, the column extends about 4 to 5 mm. (See [Figure 5](#).)

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 4. Installing a capillary column in the GC/MS interface for an EI XTR or a CI source

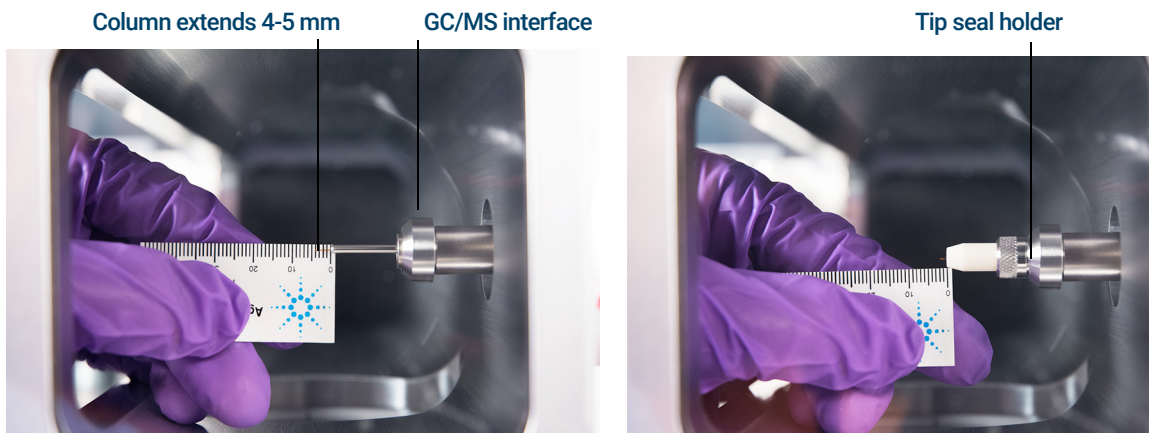


Figure 5. Installing a capillary column in the GC/MS interface for an EI HES

2 Installing 8890 GC Columns

To Install a Capillary Column in the GC/MS Interface Using the Self-Tightening Column Nut

- 11 Hand-tighten the nut. (See **Figure 6**.) Ensure the position of the column does not change as you 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.

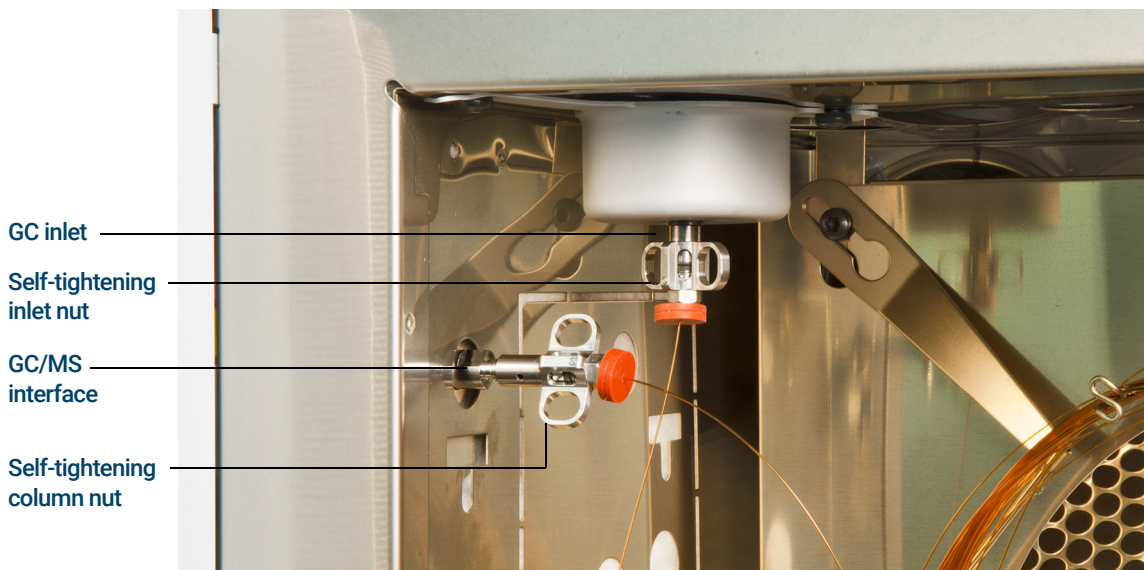


Figure 6. Installing a capillary column in the GC/MS interface

CAUTION

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

- 14 Install the tip seal, spring, and knurled tip seal retainer on the GC/MS interface. Align, gently slide, and screw the knurled tip seal retainer into the tip seal holder. (See **Figure 4** and **Figure 5** on page 39.)

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 side plate from sealing.

2 Installing 8890 GC Columns

To Install a Capillary Column in the GC/MS Interface Using the Self-Tightening Column Nut

- 15 **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.
- 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 front analyzer chamber. (See **"To Close the Front Analyzer Chamber"** on page 195.)

2 Installing 8890 GC Columns

To Install a Capillary Column in the GC/MS Interface Using a Standard Column Nut

To Install a Capillary Column in the GC/MS 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/MS interface: The standard column nut explained here, and the self-tightening column nut explained in the previous section.

Materials needed

- Interface tip seal (G3870-20542) (See **Figure 4** and **Figure 5** on page 39.)
- Tip seal spring (G7005-20024)
- Knurled tip seal retainer (G3870-20547)
- Column cutter, ceramic (5181-8836) or diamond (5183-4620)
- Flashlight
- Magnifying loupe
- Gloves, clean, lint-free (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)

2 Installing 8890 GC Columns

To Install a Capillary Column in the GC/MS Interface Using a Standard Column Nut



Procedure

CAUTION

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

WARNING

The analyzer, GC/MS 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 [“To Condition a Capillary Column”](#) on page 35.)

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.

- 2 Vent the MS and open the front analyzer chamber. (See [“To Vent the MS”](#) on page 124 and [“To Open the Front Analyzer Chamber”](#) on page 156.) Ensure you can see the end of the GC/MS interface.

WARNING

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

- 3 Remove the interface tip seal, spring, and knurled tip seal retainer from the GC/MS interface. (See [Figure 4](#) and [Figure 5](#) on page 39.)
- 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/MS interface.
- 6 Hand-tighten the nut.
- 7 Use the column cutter to score the column 2 cm from the end.

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.

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

2 Installing 8890 GC Columns

To Install a Capillary Column in the GC/MS Interface Using a Standard Column Nut

- 9 Inspect the end for jagged edges or burrs. If the break is not clean and even, repeat steps 6 and 7.
- 10 Adjust the column so it extends this specified distance from the end of the transfer line. (See **Figure 4** and **Figure 5** on page 39.)

For an EI XTR or CI Source Installation (See **Figure 4** on page 39.), the column extends about 1 to 2 mm.

For an EI HES Installation (See **Figure 5** on page 39.), the column extends about 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 Tighten the nut 1/4 to 1/2 turn. 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 Check the nut's tightness after one or two heat cycles; retighten as appropriate.

CAUTION

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

- 14 Install the tip seal, spring, and knurled tip seal retainer on the GC/MS interface. Align, gently slide, and screw the knurled tip seal retainer into the tip seal holder. (See **Figure 4** and **Figure 5** on page 39.)

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 side plate from sealing.

- 15 **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.
- 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 front analyzer chamber. (See **"To Close the Front Analyzer Chamber"** on page 195.)

To Install the GC/MS Interface Tip Seal

Materials needed

- Interface tip seal (G3870-20542)
- Tip seal spring (G7005-20024)
- Knurled tip seal retainer (G3870-20547)
- Gloves, clean, lint-free (Large 8650-0030) (Small 8650-0029)

The interface tip seal must be in place for the CI source, the EI XTR source, and HES.

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. (See **Figure 7** on page 46.)
- 2 Remove the interface tip seal, spring, and knurled tip seal 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 holder finger tight.

2 Installing 8890 GC Columns

To Install the GC/MS Interface Tip Seal



Figure 7. GC/MS 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 side plate 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.

2 Installing 8890 GC Columns

The GC/MS Interface for an 8890 Series GC

The GC/MS Interface for an 8890 Series GC

The GC/MS interface is a heated conduit into the MS for the capillary column. (See **Figure 8**.) It 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 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.

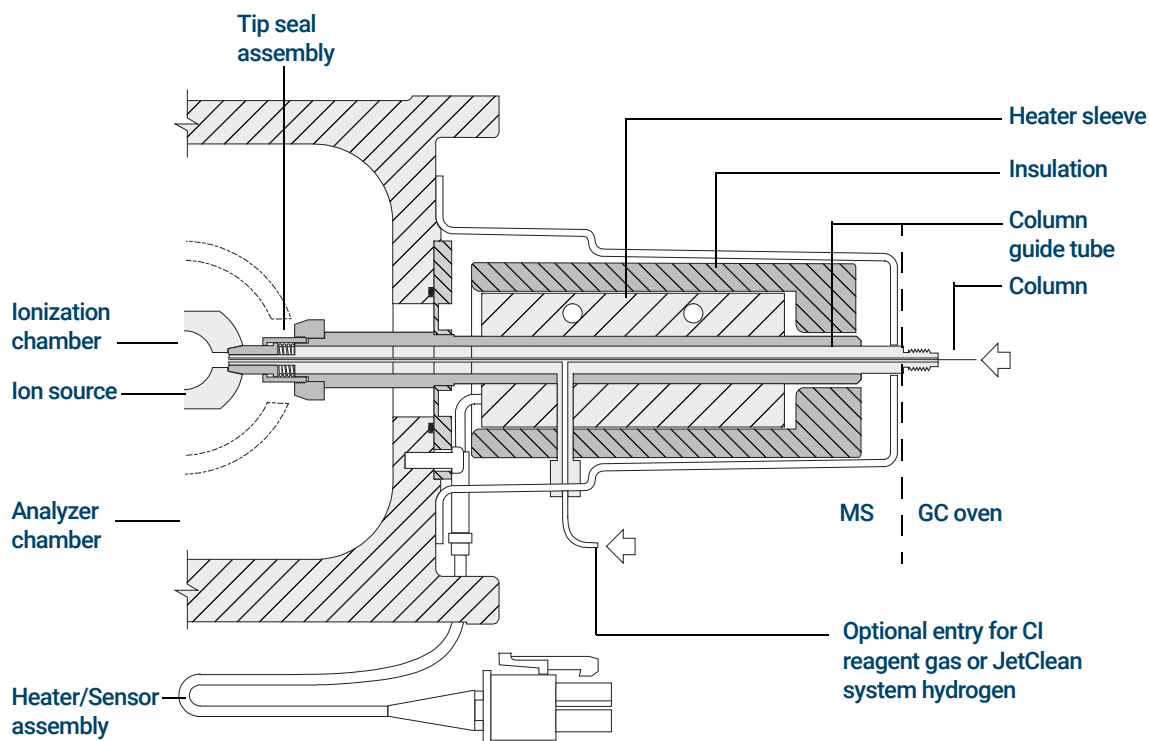


Figure 8. The GC/MS interface for an 8890 Series GC

2 Installing 8890 GC Columns

The GC/MS Interface for an 8890 Series GC

When operating in CI mode, reagent gas is plumbed into the interface. The interface assembly extends into the ionization chamber. A spring-loaded seal helps to keep reagent gases inside the source. The reagent gas enters the interface body and mixes with carrier gas and sample in the ion source.

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

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

The interface should be operated in the 250 ° to 350 °C range. Subject to that restriction, the interface temperature should be slightly higher than the maximum GC oven temperature, but **never** higher than the maximum column temperature. When operating in CI mode, 280 °C is the recommended temperature for the GC/MS interface.

(See **“To Install a Capillary Column in the GC/MS Interface Using the Self-Tightening Column Nut”** on page 37 and **“To Install a Capillary Column in the GC/MS Interface Using a Standard Column Nut”** on page 42.)

CAUTION

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

WARNING

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

3

Installing Intuvo 9000 GC Column

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To Install a Column Guard or Jumper Chip 58

To Replace the 9000 GC/MS Tail 62

To Condition an Intuvo Capillary Column 66

To Install the GC/MS Interface Tip Seal 68

The GC/MS Interface for a 9000 GC 70

This chapter shows you how to install an Agilent Intuvo column, connect a flow path through the GC/MS Interface into the ion source, and maintain the column guard chip.

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

Columns

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

During tuning or data acquisition, the rate of column flow into the MS 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 4** to determine an acceptable column flow and also refer to **Table 7**, "Influence of carrier and CC gas flows on ion vacuum gauge readings," on page 106.

Table 4 Gas flows

Feature	Gas flows
High-vacuum pump	Split flow turbo
Optimal He column gas flow, mL/min (carrier gas)	1 to 2
CC gas flow	3 to 4
Maximum recommended gas flow, mL/min*	4 to 6
Maximum gas flow, mL/min†	6.5
Maximum column id	0.53 mm (30 m length)
JetClean option H ₂ flow	0.4 mL/min

* Total gas flow into the MS = column flow + CC gas flow + JetClean H₂ flow (if applicable)

† Expect degradation of spectral performance and sensitivity

Conditioning Intuvo columns

An Intuvo column is checked for column bleed as part of the manufacturing process. This eliminates the need for conditioning of an Intuvo column before it is connected to the GC/MS interface. When first connected to the GC/MS interface, Agilent recommends running a short column conditioning procedure. This procedure reduces initial column bleed to an insignificant amount that won't adversely contaminate the ion source. (See **"To Condition an Intuvo Capillary Column"** on page 66.)

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 MS power. If the foreline pump is off, hydrogen will accumulate in the MS and an explosion may occur. Read **"Hydrogen Safety"** on page 21 before operating the MS with hydrogen gas.

Handling the Intuvo 9000 GC 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.

To Replace 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 MassHunter Data Acquisition, Vent the MS (See **"To Vent the MS"** on page 124.)
- 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 MS power.
- 4 Open the GC front door. (See **Figure 9** on page 54.)

3 Installing Intuvo 9000 GC Column

To Replace an Intuvo GC Column



Figure 9. 9000 GC front door, bus door, oven door, and Intuvo torque driver

- 5 Open the bus door and remove it by lifting the door vertically off its hinge pins.
- 6 Lower the oven door.
- 7 Using the Intuvo torque driver, rotate all four column clamps off the column's retainer ring. (See **Figure 10**.)

3 Installing Intuvo 9000 GC Column To Replace an Intuvo GC Column

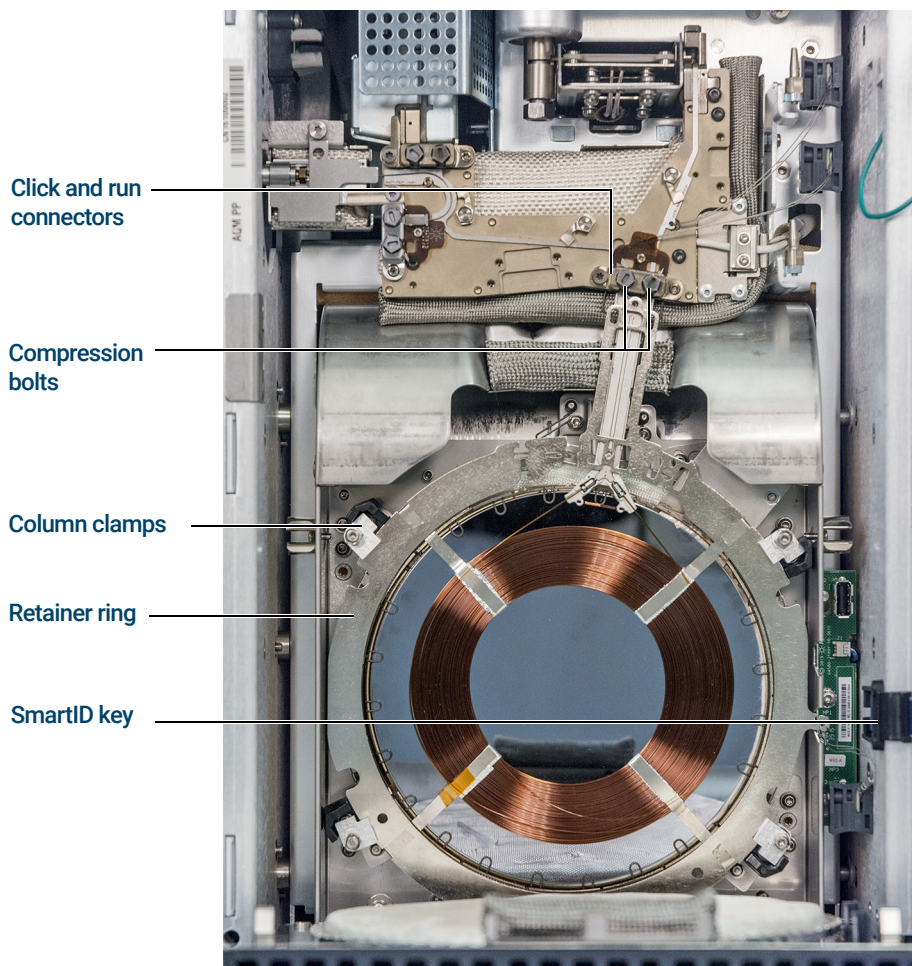


Figure 10. 9000 GC column and related parts

- 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 **"To Replace an Intuvo 9000 GC Gasket"** on page 57.)

3 Installing Intuvo 9000 GC Column

To Replace an Intuvo GC Column

- 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.

To Replace 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.

3 Installing Intuvo 9000 GC Column

To Install a Column Guard or Jumper Chip

To Install 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 mis-installed Chip cannot be re-used. 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 MassHunter Data Acquisition, Vent the MS (See **"To Vent the MS"** on page 124.)

3 Installing Intuvo 9000 GC Column

To Install a Column Guard or Jumper Chip

- 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 MS power.
- 5 If installed, remove the ALS injector from the inlet.
- 6 Remove the inlet cover. (See **Figure 11.**)

GC inlet cover
removed

Compression bolt
access plate

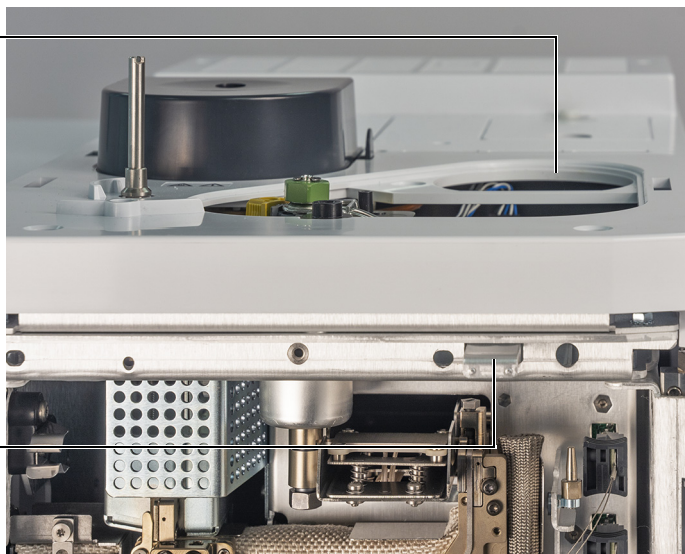


Figure 11. GC inlet cover and compression bolt access plate

- 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 12** on page 60.)

3 Installing Intuvo 9000 GC Column

To Install a Column Guard or Jumper Chip

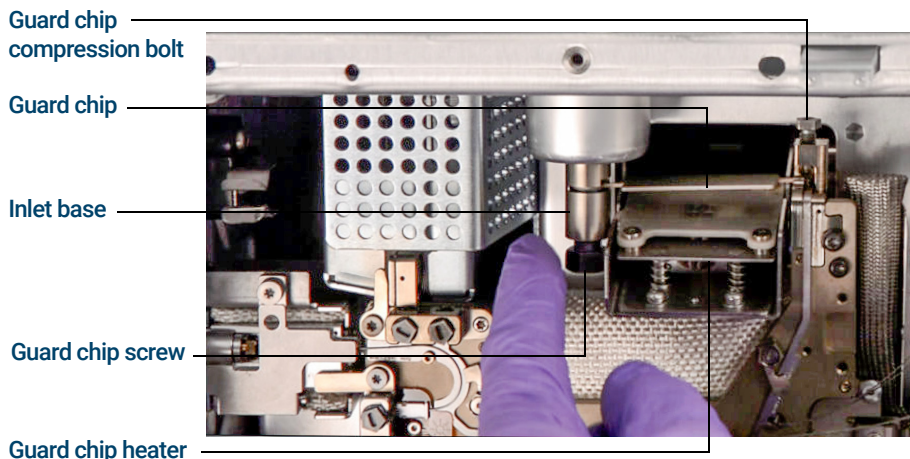


Figure 12. Guard chip and related parts

- 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.

3 **Installing Intuvo 9000 GC Column**

To Install a Column Guard or Jumper Chip

- 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.

3 Installing Intuvo 9000 GC Column To Replace the 9000 GC/MS Tail

To Replace 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 MS.

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 MS (See **"To Vent the MS"** on page 124.) 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 MS 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 front analyzer chamber. (See **"To Open the Front Analyzer Chamber"** on page 156.)

3 Installing Intuvo 9000 GC Column

To Replace the 9000 GC/MS Tail

- 5 Unscrew the knurled tip seal retainer from the tip seal holder and remove the tip seal, spring, and knurled tip seal retainer from the GC/MS interface. (See **"GC/MS interface tip seal"** on page 69.)
- 6 Ensure the MS is properly aligned with the GC. If the GC/MS is 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 13.**)

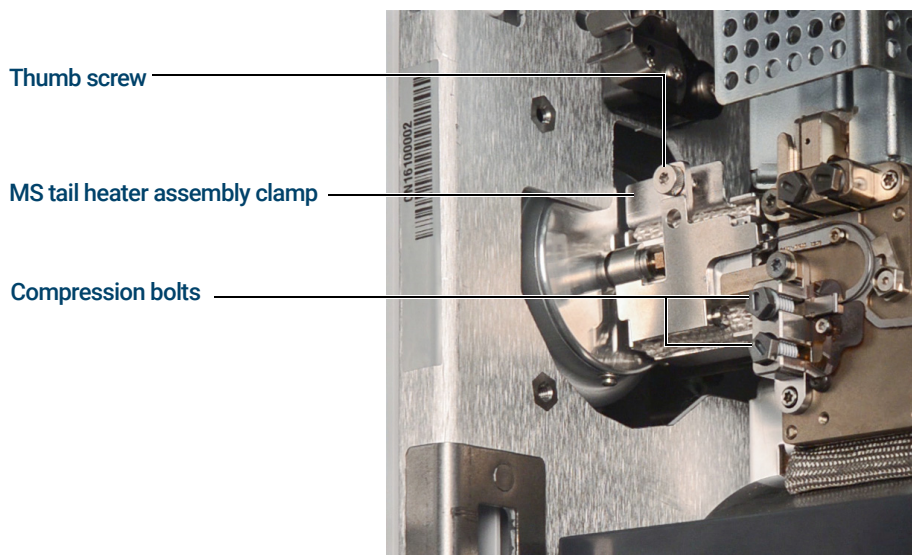


Figure 13. MS tail heater assembly clamp closed

- 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 14** on page 64 and **Figure 15** on page 64.) 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.

3 Installing Intuvo 9000 GC Column

To Replace the 9000 GC/MS Tail

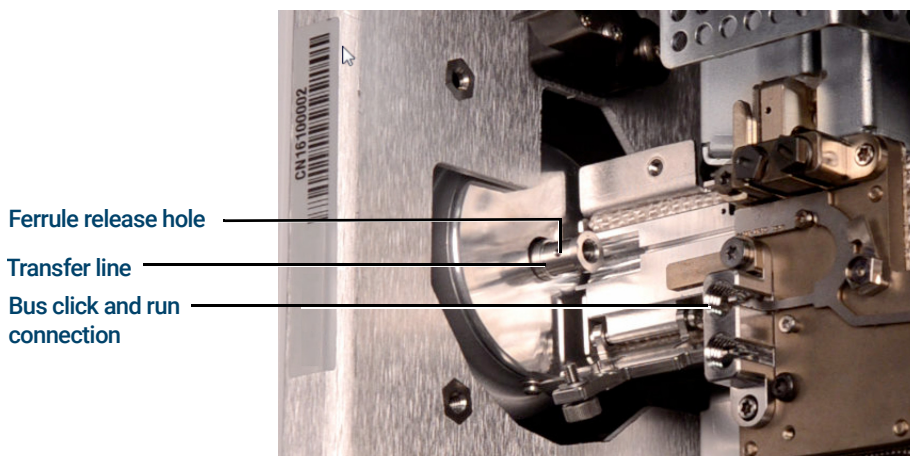


Figure 14. MS tail heater assembly clamp open with 9000 GC/MS Tail removed



Figure 15. 9000 GC/MS Tail removed from GC/MS Interface

- 13 Replace the gasket. (See **“To Replace an Intuvo 9000 GC Gasket”** on page 57.)
- 14 Carefully slide the 9000 GC/MS Tail into the GC/MS 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.

3 Installing Intuvo 9000 GC Column

To Replace the 9000 GC/MS Tail

- 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 tip seal and spring on the GC/MS interface. Align, gently slide, and screw the tip seal into the tip seal holder. (See **“To Install the GC/MS Interface Tip Seal”** on page 68.)
- 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 side plate 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 front analyzer chamber. (See **“To Close the Front Analyzer Chamber”** on page 195.)

To Condition 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 stored on oven door (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 [“To Replace an Intuvo GC Column”](#) on page 53.)
- 2 Set a minimum velocity of 30 cm/s, or as recommended by the column manufacturer. Allow carrier gas to flow through the column at room temperature for 5 minutes.
- 3 Increase the column temperature to 120 °C.
- 4 Hold at the this temperature for 30 minutes.
- 5 Use MassHunter 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/MS interface, the GC oven, or the inlet.

3 Installing Intuvo 9000 GC Column

To Condition an Intuvo Capillary Column

7 Hold at the maximum temperature for 30 minutes.

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

To Install the GC/MS Interface Tip Seal

Materials needed

- Interface tip seal (G3870-20542)
- Tip seal spring (G7005-20024)
- Knurled tip seal retainer (G3870-20547)
- Gloves, clean, lint-free (Large 8650-0030) (Small 8650-0029)

The interface tip seal must be in place for the CI source, the EI XTR source, and HES.

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. (See **Figure 16** on page 69.)
- 2 Remove the interface tip seal, spring, and knurled tip seal 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 holder finger tight.

3 Installing Intuvo 9000 GC Column

To Install the GC/MS Interface Tip Seal



Figure 16. GC/MS 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 side plate 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.

3 Installing Intuvo 9000 GC Column

The GC/MS Interface for a 9000 GC

The GC/MS Interface for a 9000 GC

The GC/MS Interface is a heated conduit into the MS for maintaining MS vacuum and a suitable column effluent temperature. (See **Figure 17**.) The GC/MS 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/MS Interface. The 9000 GC/MS Tail transports the column effluent from a heated column bus connector in the GC, through the heated GC/MS 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/MS Interface.

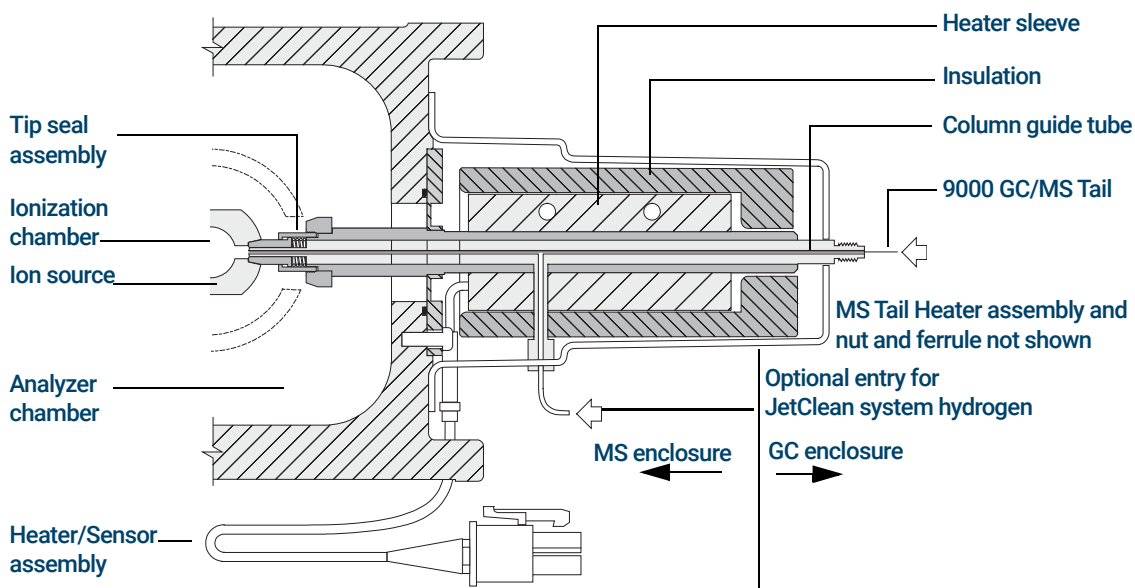


Figure 17. The GC/MS Interface for a 9000 GC (not to scale)

3 Installing Intuvo 9000 GC Column

The GC/MS Interface for a 9000 GC

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 Agilent MassHunter GC/MS Acquisition software or from the GC. A sensor (thermocouple) in the interface monitors the temperature.

The GC/MS 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/MS interface temperature should be slightly higher than the column temperature.

3 Installing Intuvo 9000 GC Column

The GC/MS Interface for a 9000 GC

4

Installing 7890 GC Columns

Columns 74

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The GC/MS Interface for an 7890 Series GC 91

To Calibrate the Column 93

This chapter shows you how to select, install, and condition a GC column, which must be performed before you operate your MS.

Columns

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

During tuning or data acquisition, the rate of column flow into the MS 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 oven temperature, requiring measurements of the actual flow to be taken. Use the flow calculator in the Agilent Instrument Utilities software, and **Table 5** to determine an acceptable column flow. EI and CI systems also have different column outlet flow pressures. (See **Table 7** on page 106 for EI mode and **Table 10** on page 132 for CI mode.)

Table 5 Gas flows

Feature	Gas flows
High-vacuum pump	Split flow turbo
Optimal He column gas flow, mL/min (carrier gas)	1 to 2
Reagent gas flow, mL/min	1 to 2
CC gas flow	3 to 4
Maximum recommended gas flow, mL/min*	4 to 6
Maximum gas flow, mL/min†	6.5
Maximum column id	0.53 mm (30 m length)
JetClean option H ₂ flow,	0.4 mL/min

* Total gas flow into the MS = column flow + CC gas flow + reagent gas flow (if applicable) + JetClean H₂ flow (if applicable)

† Expect degradation of spectral performance and sensitivity.

Conditioning columns

Conditioning a column before it is connected to the GC/MS 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 MS ion source. This decreases MS 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/MS 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 procedure for the 7000/7010 Series TQ GC/MS is different from that for previous MSs. Using the procedure from another instrument may *not* work and may damage the column or the MS.
- You can remove old ferrules from column nuts with an ordinary pushpin.
- 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. Agilent recommends use of their new self-tightening nuts on the MS transfer line, inlet, and GC detector.
- Always wear clean gloves when handling columns, especially the end that will be inserted into the GC/MS 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 MS power. If the foreline pump is off, hydrogen will accumulate in the MS and an explosion may occur. Read “[Hydrogen Safety](#)” on page 21 before operating the MS with hydrogen gas.

WARNING

Always wear safety glasses when handling capillary columns. Use care to avoid puncturing your skin with the end of the column.

4 Installing 7890 GC Columns

To Install a Capillary Column in a Split/Splitless Inlet

To Install a Capillary Column in a Split/Splitless Inlet

Materials needed

- Gloves, clean, lint-free (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)
- Self-tightening column nut (5190-6194)
- Alternate: Standard Inlet column nut (5181-8830, for use with Vespel ferrules)
- 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)
- Magnifying loupe
- Septum (may be old, used inlet septum)

To install columns in other types of inlets, refer to your GC user information.



Procedure

WARNING

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

- 1 Cool the oven to room temperature.

WARNING

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

4 Installing 7890 GC Columns

To Install a Capillary Column in a Split/Splitless Inlet

CAUTION

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

- 2 Wearing clean gloves, slide a septum, column nut, and conditioned ferrule onto the free end of the column. **Figure 18** shows a standard inlet column nut, but the nut is similarly positioned for a self-tightening column nut. The tapered end of the ferrule should point away from the column nut for a column attachment to an inlet.

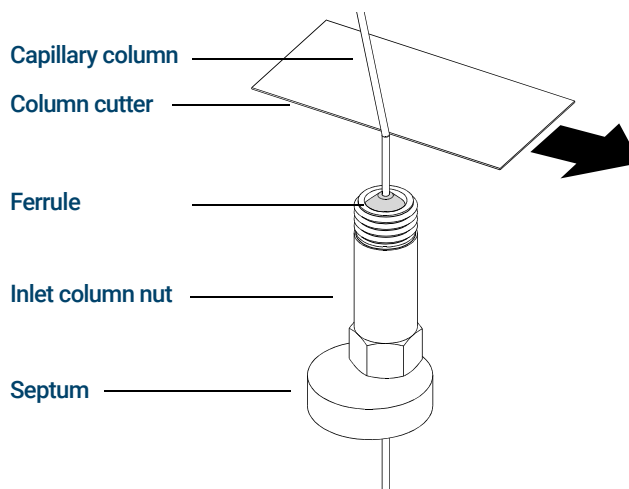


Figure 18. Preparing a capillary column for installation (standard inlet column nut shown)

- 3 Use the column cutter to score the column 2 cm from the end.
- 4 While holding the column against the column cutter with your thumb, break the column against the edge of the column cutter.
- 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 septum under the column nut so that the column extends 4 to 6 mm past the end of the ferrule. (See **Figure 19** on page 78.)
- 8 Insert the column in the inlet.
- 9 Slide the nut up the column to the inlet base and finger-tighten the nut.

4 Installing 7890 GC Columns

To Install a Capillary Column in a Split/Splitless Inlet

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

CAUTION

Never use a wrench to tighten a self-tightening nut. This may result in damage to the nut or instrument.

- For the self-tightening column nut, finger-tighten until it begins to grip the column, then turn an additional 30 to 60 degrees until tight.

For the standard column nut, (shown in [Figure 19](#)) tighten the nut an additional 1/4 to 1/2 turn. The column should not slide with a gentle tug.

- Start the carrier gas flow.
- Verify flow by submerging the free end of the column in isopropanol. Look for bubbles.

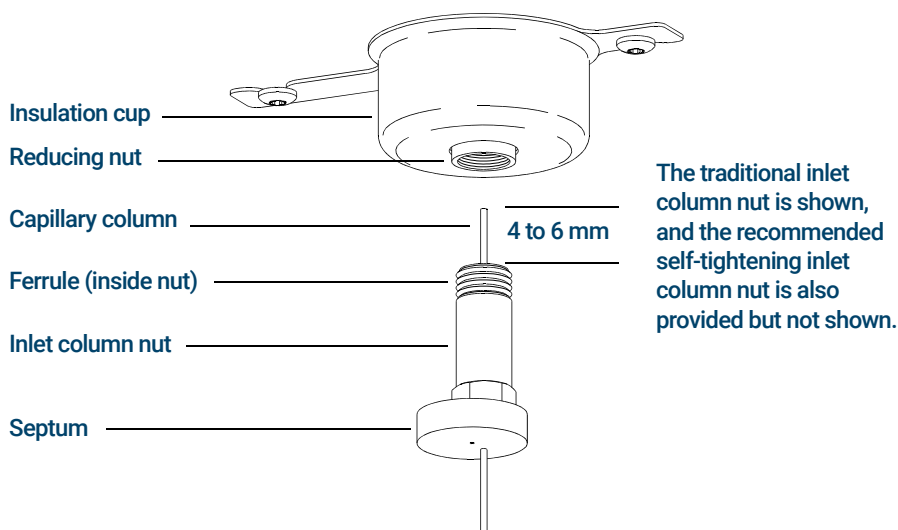


Figure 19. Installing a capillary column for a split/splitless inlet

To Condition 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 (99.9995% 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 **[“To Install a Capillary Column in a Split/Splitless Inlet”](#)** on page 76.)
- 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 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, in the GC/MS 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 Install the column in the GC/MS interface.

4 Installing 7890 GC Columns

To Condition a Capillary Column

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.

4 Installing 7890 GC Columns

To Install a Capillary Column in the GC/MS Interface Using the Self-Tightening Column Nut

To Install a Capillary Column in the GC/MS 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 20** and **Figure 21** on page 83.)
- Knurled tip seal retainer (G3870-20547)
- Tip seal spring (G7005-20024)
- Column cutter, ceramic (5181-8836) or diamond (5183-4620)
- Flashlight
- Magnifying loupe
- Gloves, clean, lint-free (Large 8650-0030) (Small 8650-0029)
- Self-tightening column nut for GC\MS 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

4 Installing 7890 GC Columns

To Install a Capillary Column in the GC/MS Interface Using the Self-Tightening Column Nut



Procedure

CAUTION

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

WARNING

The analyzer, GC/MS 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 [“To Condition a Capillary Column”](#) on page 79.)

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.

- 2 Vent the MS (See [“To Vent the MS”](#) on page 124.) and open the front analyzer chamber. (See [“To Open the Front Analyzer Chamber”](#) on page 156.) Ensure you can see the end of the GC/MS interface.

WARNING

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

- 3 Remove the interface tip seal, spring, and knurled tip seal retainer from the GC/MS interface. (See [Figure 20](#) and [Figure 21](#) on page 83.)
- 4 Slide the self-tightening column 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/MS interface.
- 6 Lightly thread the self-tightening column nut onto the GC/MS interface.
- 7 Use the column cutter to score the column 2 cm from the end.

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.

- 8 While holding the column against the column cutter with your thumb, break the column against the edge of the column cutter.
- 9 Inspect the end for jagged edges or burrs. If the break is not clean and even, repeat steps 6 and 7.

4 Installing 7890 GC Columns

To Install a Capillary Column in the GC/MS Interface Using the Self-Tightening Column Nut

- 10** Adjust the column so it extends this specified distance from the end of the transfer line. (See [Figure 20](#) and [Figure 21](#) on page 83.)

For an EI XTR or CI Source Installation, the column extends about 1 to 2 mm. (See [Figure 20](#).)

For an EI HES Installation, the column extends about 4 to 5 mm. (See [Figure 21](#).)

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 20. Installing a capillary column in the GC/MS interface for an EI XTR or a CI source

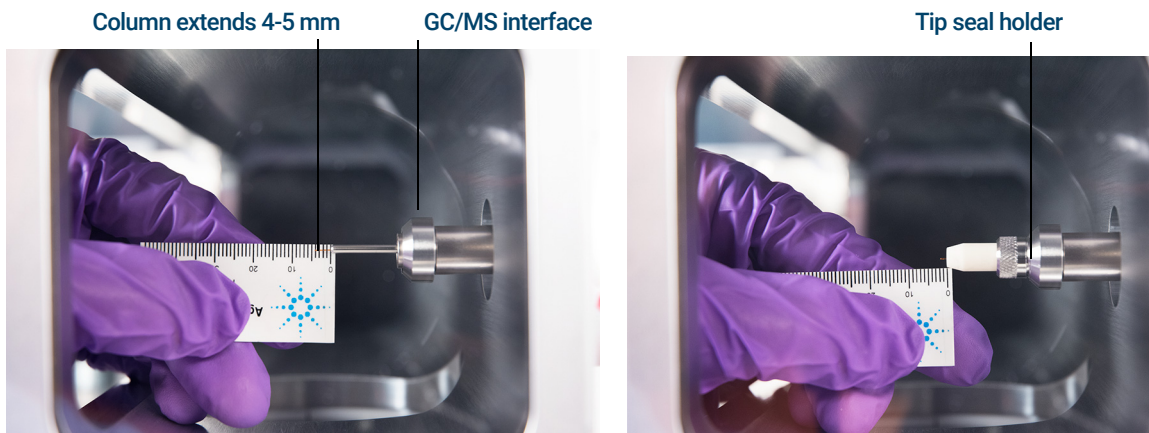


Figure 21. Installing a capillary column in the GC/MS interface for an EI HES

4 Installing 7890 GC Columns

To Install a Capillary Column in the GC/MS Interface Using the Self-Tightening Column Nut

- 11 Hand-tighten the nut. (See **Figure 22**.) Ensure the position of the column does not change as you 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.

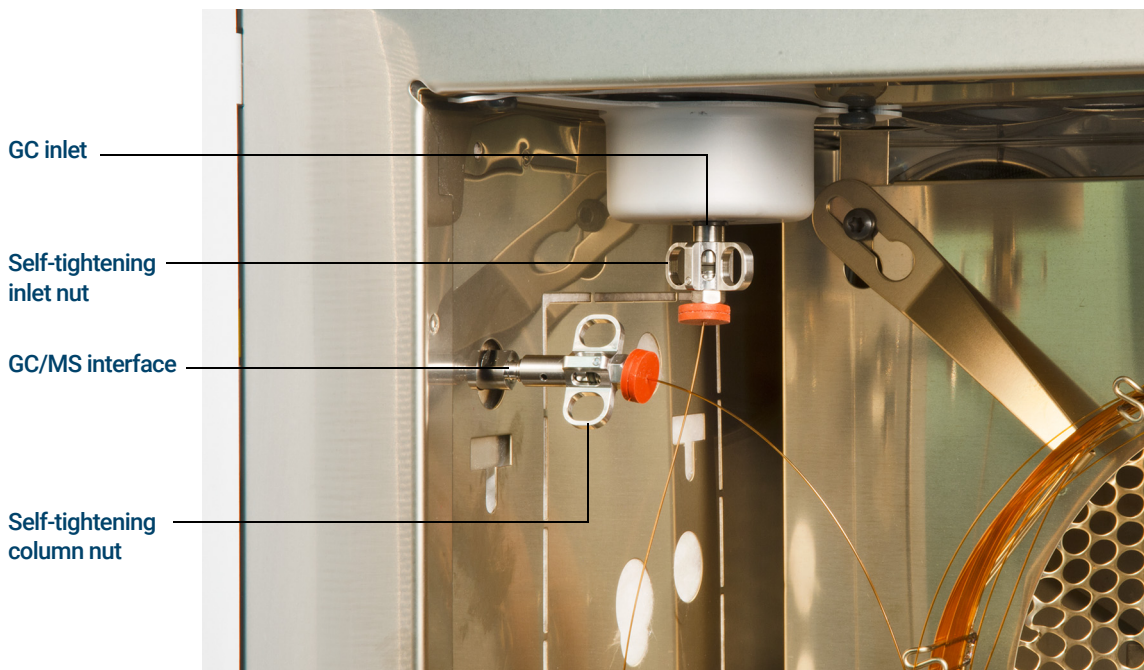


Figure 22. Installing a capillary column in the GC/MS interface

CAUTION

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

- 14 Install the tip seal, spring, and knurled tip seal retainer on the GC/MS interface. Align, gently slide, and screw the knurled tip seal retainer into the tip seal holder. (See **Figure 20** and **Figure 21** on page 83.)

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 side plate from sealing.

4 Installing 7890 GC Columns

To Install a Capillary Column in the GC/MS Interface Using the Self-Tightening Column Nut

- 15 **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.
- 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 front analyzer chamber. (See **"To Close the Front Analyzer Chamber"** on page 195.)

4 Installing 7890 GC Columns

To Install a Capillary Column in the GC/MS Interface Using a Standard Column Nut

To Install a Capillary Column in the GC/MS 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/MS interface: The standard column nut explained here, and the self-tightening column nut explained in the previous section.

Materials needed

- Interface tip seal (G3870-20542) (See **Figure 20** and **Figure 21** on page 83.)
- Tip seal spring (G7005-20024)
- Knurled tip seal retainer (G3870-20547)
- Column cutter, ceramic (5181-8836) or diamond (5183-4620)
- Flashlight
- Magnifying loupe
- Gloves, clean, lint-free (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)

4 Installing 7890 GC Columns

To Install a Capillary Column in the GC/MS Interface Using a Standard Column Nut



Procedure

CAUTION

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

WARNING

The analyzer, GC/MS 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 [“To Condition a Capillary Column”](#) on page 79.)

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.

- 2 Vent the MS and open the front analyzer chamber. (See [“To Vent the MS”](#) on page 124 and [“To Open the Front Analyzer Chamber”](#) on page 156.) Ensure you can see the end of the GC/MS interface.

WARNING

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

- 3 Remove the interface tip seal, spring, and knurled tip seal retainer from the GC/MS interface. (See [Figure 20](#) and [Figure 21](#) on page 83.)
- 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/MS interface.
- 6 Hand-tighten the nut.
- 7 Use the column cutter to score the column 2 cm from the end.

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.

- 8 While holding the column against the column cutter with your thumb, break the column against the edge of the column cutter.
- 9 Inspect the end for jagged edges or burrs. If the break is not clean and even, repeat steps 6 and 7.

4 Installing 7890 GC Columns

To Install a Capillary Column in the GC/MS Interface Using a Standard Column Nut

- 10 Adjust the column so it extends this specified distance from the end of the transfer line. (See **Figure 20** and **Figure 21** on page 83.)

For an EI XTR or CI Source Installation (See **Figure 20** on page 83.), the column extends about 1 to 2 mm.

For an EI HES Installation (See **Figure 21** on page 83.), the column extends about 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 Tighten the nut 1/4 to 1/2 turn. 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 Check the nut's tightness after one or two heat cycles; retighten as appropriate.

CAUTION

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

- 14 Install the tip seal, spring, and knurled tip seal retainer on the GC/MS interface. Align, gently slide, and screw the knurled tip seal retainer into the tip seal holder. (See **Figure 20** and **Figure 21** on page 83.)

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 side plate from sealing.

- 15 **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.
- 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 front analyzer chamber. (See **"To Close the Front Analyzer Chamber"** on page 195.)

To Install the GC/MS Interface Tip Seal

Materials needed

- Interface tip seal (G3870-20542)
- Tip seal spring (G7005-20024)
- Knurled tip seal retainer (G3870-20547)
- Gloves, clean, lint-free (Large 8650-0030) (Small 8650-0029)

The interface tip seal must be in place for the CI source, the EI XTR source, and HES.

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. (See [Figure 23](#) on page 90.)
- 2 Remove the interface tip seal, spring, and knurled tip seal 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 holder finger tight.

4 Installing 7890 GC Columns

To Install the GC/MS Interface Tip Seal



Figure 23. GC/MS 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 side plate 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.

4 Installing 7890 GC Columns

The GC/MS Interface for an 7890 Series GC

The GC/MS Interface for an 7890 Series GC

The GC/MS interface is a heated conduit into the MS for the capillary column. (See **Figure 24.**) It 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 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.

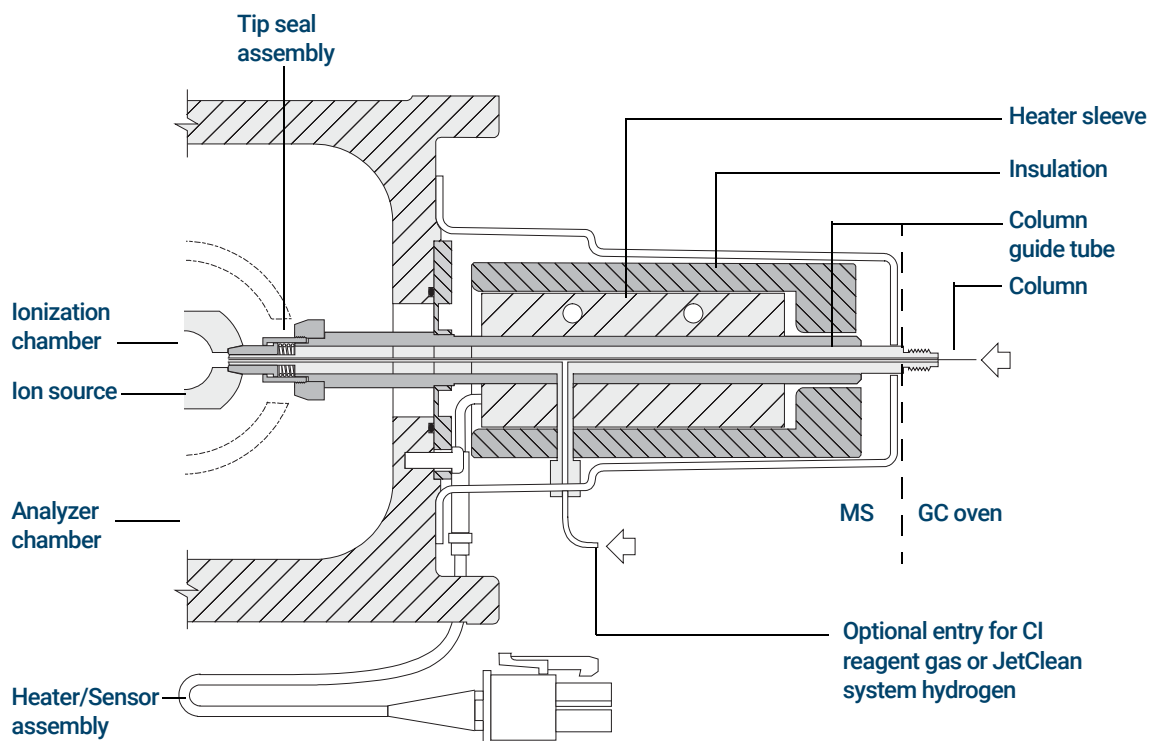


Figure 24. The GC/MS interface for an 8890 Series GC

4 Installing 7890 GC Columns

The GC/MS Interface for an 7890 Series GC

When operating in CI mode, reagent gas is plumbed into the interface. The interface assembly extends into the ionization chamber. A spring-loaded seal helps to keep reagent gases inside the source. The reagent gas enters the interface body and mixes with carrier gas and sample in the ion source.

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

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

The interface should be operated in the 250 ° to 350 °C range. Subject to that restriction, the interface temperature should be slightly higher than the maximum GC oven temperature, but **never** higher than the maximum column temperature. When operating in CI mode, 280 °C is the recommended temperature for the GC/MS interface.

(See **“To Install a Capillary Column in the GC/MS Interface Using the Self-Tightening Column Nut”** on page 81 and **“To Install a Capillary Column in the GC/MS Interface Using a Standard Column Nut”** on page 86.)

CAUTION

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

WARNING

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

To Calibrate the Column

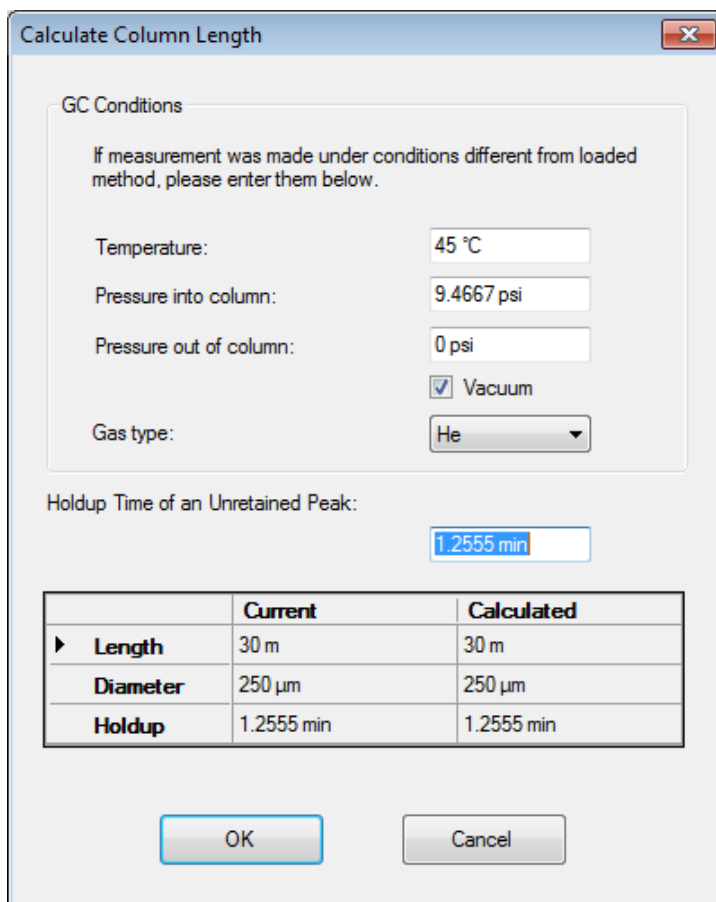
Capillary columns must be calibrated prior to use with the MS. This procedure applies only to the 7890 GC.

Procedure

- 1 Set Data Acquisition for splitless manual injection and selected ion monitoring (SIM) of m/z 28.
- 2 Press **[Prep Run]** on the GC keypad.
- 3 Inject 1 μ L of air into the GC inlet and press **[Start Run]**.
- 4 Wait until a peak elutes at m/z 28. Note the retention time.
- 5 In the **Instrument Control** panel, select **Instrument > GC Configuration**.
- 6 Select the **Configuration** tab.
- 7 Select the **Column** tab, click **Inventory**, and verify that the column you are using is in inventory. Select the column to be calibrated and click **Install Selected Column**.
- 8 Highlight the column in the inventory list and select **Calibrate**.
- 9 Select **Calc Length**.
- 10 In the **Calculate Column Length** dialog, enter the recorded retention time in the **Holdup Time** field. Verify that the other parameters listed (temperature, inlet and outlet pressures, and gas type) are those used in the method to determine the holdup time. Change any parameters that are different than those used in your method. (See **Figure 25** on page 94.)

4 Installing 7890 GC Columns

To Calibrate the Column



The dialog box is titled "Calculate Column Length" and contains a section for "GC Conditions". It includes input fields for Temperature (45 °C), Pressure into column (9.4667 psi), Pressure out of column (0 psi), a checked "Vacuum" checkbox, and a "Gas type" dropdown menu set to "He". Below this is a field for "Holdup Time of an Unretained Peak" set to 1.2555 min. At the bottom is a table with three columns: "Length", "Diameter", and "Holdup", each with "Current" and "Calculated" values. The "Current" values are 30 m, 250 µm, and 1.2555 min, while the "Calculated" values are identical. "OK" and "Cancel" buttons are at the bottom.

Calculate Column Length

GC Conditions

If measurement was made under conditions different from loaded method, please enter them below.

Temperature: 45 °C

Pressure into column: 9.4667 psi

Pressure out of column: 0 psi

☒ Vacuum

Gas type: He

Holdup Time of an Unretained Peak: 1.2555 min

	Current	Calculated
► Length	30 m	30 m
Diameter	250 µm	250 µm
Holdup	1.2555 min	1.2555 min

OK Cancel

Figure 25. Calculate Column Length dialog

11 When the new column length appears, click **OK** to save the changes.

12 Click **OK** on the **Calibrate Columns** dialog to save the calibration.

5

Operating in EI Mode

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This chapter explains how to perform some routine operating procedures for the 7000/7010 Series TQ GC/MS in EI mode.

Operating the MS from the Data System

The Agilent MassHunter GC/MS Acquisition software performs tasks such as pumping down, monitoring pressures, setting temperatures, tuning, and preparing to vent. These tasks are described in this chapter. Additional information is described in the manuals and online help supplied with the MassHunter GC/MS Acquisition software.

Your 7000 TQ operates in EI mode using the EI XTR Ion Source Assembly, and your 7010 TQ operates in EI mode using the EI HES Source Assembly, which provides higher sensitivity when ionizing the sample.

CAUTION

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

5 Operating in EI Mode

Set the IP Address and View TQ Parameters with the WUI

Set the IP Address and View TQ Parameters with the WUI

The Web User Interface (WUI) is used by Agilent field support for setup and monitoring of the instrument. There are a couple of things available in this WUI that are useful and sometimes essential for operation. These include setting the TQ IP address and monitoring instrument parameters during pumpdown without the Agilent MassHunter GC/MS Acquisition software use. These procedures assume that the operator has access to a PC located on the same LAN subnet as the TQ.

To change the network settings of the TQ

The GC firmware does not support LVDS communications with the 7000/7010 series TQ MS at this time so you must use the Web User Interface (WUI) to configure the TQ network settings.

- 1 Press the **MS On/Off** switch to start the instrument.
- 2 Enter the instrument IP address into a PC web browser URL to display the WUI Main Menu page. (See [Figure 26](#).)

If the IP address was never configured, the factory defaults for the IP address, gateway, and subnet are 192.168.254.12, 0.0.0.0, and 255.255.255.0 respectively.

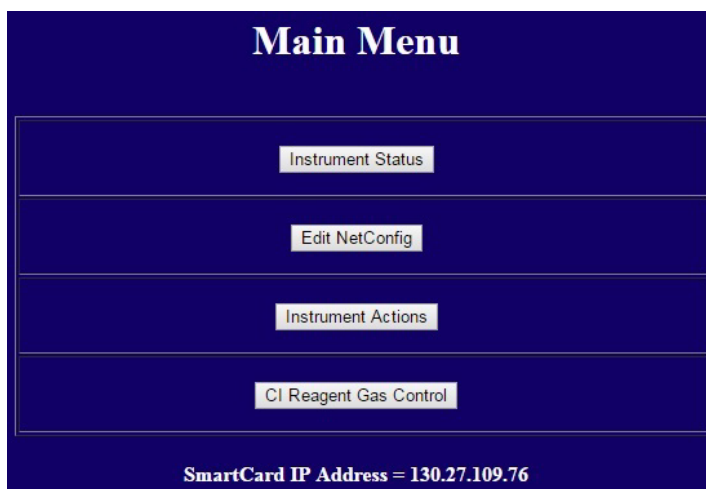


Figure 26. WUI main menu

5 Operating in EI Mode

To change the network settings of the TQ

- 3 Click **Edit NetConfig**, and go to Edit NetConfig (QQQ network configuration). (See [Figure 27.](#))

Set Real-Time Clock (RTC)

Time (HH:MM:SS)	11 : 54 : 32	Date (MM/DD/YYYY)	6 / 21 / 2016
Day:	Tuesday ▼		

Note: The time above is the time of your Web-Client (your PC) and not the time of your embedded controller
The current time of your QQQ Controller (SmartCard) is: Tue Jun 21 11:59:07 2016

Edit NetConfig (QQQ network configuration)

Dcomm Partner (GC) IP Address:

QQQ IP Address:

Gateway IPA:

SubNet Mask:

Figure 27. WUI Edit NetConfig

- 4 Enter the GC IP Address in the DCOMM Partner IP Address if your GC supports DCOMM. Your GC must be an Agilent 7890B or 7890A+ with the latest firmware for DCOMM support.
- 5 Enter the IP Address, Gateway IPA, and Subnet Mask for the TQ.
- 6 Click **Submit** to assign this IP address to the TQ.

Agilent recommends attaching a label to the TQ recording these NetConfig parameters.

- 7 Close the browser page when you are done.
- 8 Run the Agilent GC/MS Instrument Configuration program. To configure the TQ for DCOMM you must first configure the GC before configuring the TQ in

5 Operating in EI Mode

View the TQ parameters

GC/MS Instrument Configuration program. See Configure the system in the 7890A+ or 7890B GC in the GC/MS Instrument Configuration program help.

- 9 In the GC/MS Instrument Configuration program, edit the TQ IP address using these new parameters.

View the TQ parameters

This procedure allows you to monitor TQ parameters without running the MassHunter GC/MS Acquisition software. It is useful when manually pumping down the TQ and monitoring the instrument's status.

- 1 Press the **MS On/Off** switch to start the instrument.
- 2 Enter the instrument IP address into a PC web browser URL to display the WUI Main Menu page. (See [Figure 28](#).)

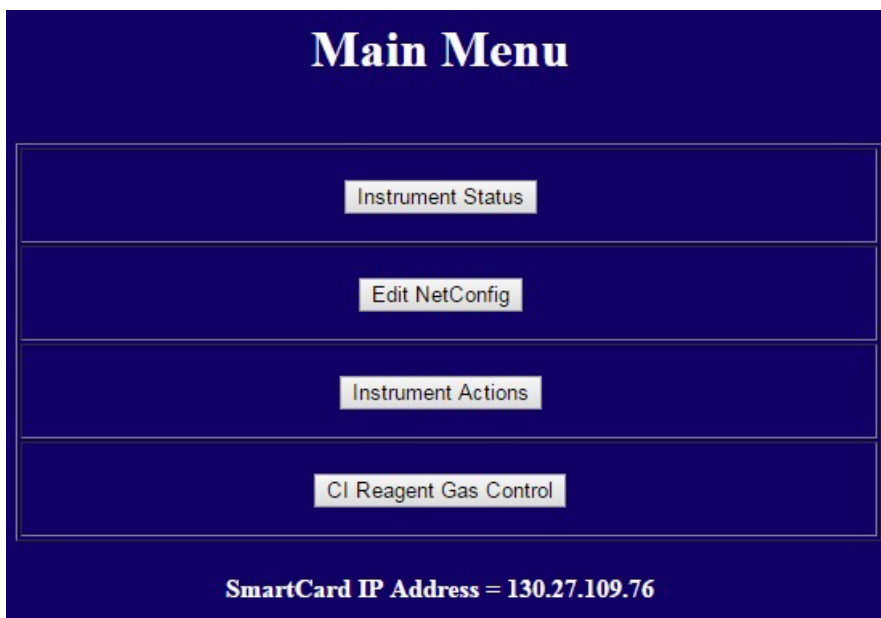


Figure 28. WUI main menu

5 Operating in EI Mode

View the TQ parameters

- Click **Instrument Status** to display the TQ turbo pump speed, zone temperatures, high vacuum pressure, TQ faults, net configuration parameters, and smart card firmware version. (See [Figure 29](#).)

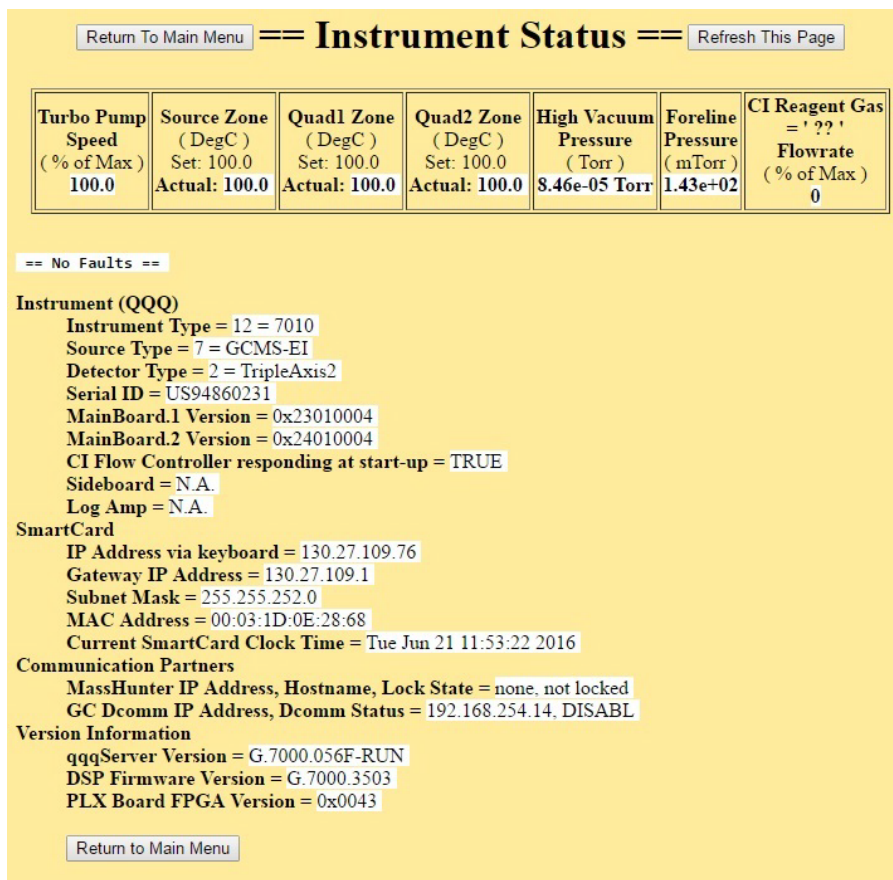


Figure 29. WUI instrument status

- When done, close the browser.

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 6.**)

Table 6 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 MS

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

- The vent valve must be closed (the knob turned all the way clockwise). (See **"To Pumpdown the MS"** on page 120.)
- All other vacuum seals and fittings must be in place and fastened correctly. All analyzer plate thumbscrews should be open, unless hazardous carrier, JetClean system hydrogen, or reagent gases are being used.
- The MS is connected to a grounded power source.
- The GC/MS interface extends into the GC oven.
- A conditioned capillary column is installed in the GC inlet and in the GC/MS interface.
- The GC is on, but the heated zones for the GC/MS 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.
- If hydrogen is used as carrier gas or JetClean system supply, the carrier gas and JetClean system supply shutoff valves must be closed. The top thumbscrew on the front analyzer side plate and the top thumbscrew on the rear analyzer side plate must both 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. 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 MS power. If the foreline pump is off, hydrogen will accumulate in the MS and an explosion may occur. Read **"Hydrogen Safety"** on page 21 before operating the MS with hydrogen gas.

CAUTION

When hydrogen is used as a carrier gas or during the JetClean system acquire and clean mode, do not use helium in the collision cell.

Pumping Down

The data system helps you pumpdown the MS. The process is primarily automated. After you turn on the MS by pushing the **On/Off** switch, close the analyzer door, and close the vent valve once you hear hissing (while pressing on both analyzer side plates), the MS pumps down by itself. The Agilent MassHunter GC/MS Acquisition 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/MS interface heater. The MS will shut down if it cannot pumpdown correctly.

Using the MS monitors, the data system can display:

- Motor speed for turbo pump MS
- Analyzer chamber pressure (vacuum)
- Foreline pump pressure

Controlling Temperatures

MS temperatures are controlled through the data system. The MS has independent heaters and temperature sensors for the ion source, the MS1 mass filter, and the MS2 mass filter. You can adjust the setpoints and view these temperatures from the data system.

Normally, the GC/MS interface heater is powered and controlled by the Thermal Aux #2 heated zone of the GC. The GC/MS interface temperature can be set and monitored from the data system or from the GC.

Controlling Column Flow

Carrier gas flow is controlled by column 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 MS can be used to measure actual column flow. Inject a **small** amount of air or other unretained chemical, and time how long it takes to reach the MS. With this time measurement, you can calculate the column flow. (See **“To Calibrate the Column”** on page 93.)

Controlling CC Flow

The CC gas flow rate is controlled by an EPC module located in the GC. The CC gas flow is a combination of two gases mixed at the EPC outlet and sent in a single tubing line to the MS. Typically, these two gases are nitrogen and helium, though only nitrogen is used when hydrogen is the carrier gas. The gas flow rates to the GC CC EPC are controlled by the Agilent MassHunter GC/MS Acquisition software or directly at the GC panel. (See **“To Set the CC Gas Flow Rates”** on page 115.)

Controlling JetClean Hydrogen Flow

The JetClean option uses hydrogen gas for cleaning the ion source. The JetClean system MFC sends hydrogen to the annular space surrounding the column in the GC/MS interface where it then enters the ion source body. The flow rate is controlled by the MassHunter GC/MS Acquisition software. (See **“To Set the Mode for the Optional JetClean System”** on page 113.)

Venting the MS

A program in the data system guides you through the venting process. It turns off the GC and MS heaters and the turbo pump at the correct time. It also lets you monitor temperatures in the MS, and indicates when to vent the MS.

The Fast Vent feature loads a user-defined GC method that sets an oven temperature, turns off the transfer line heater, and sets the column flow to a user predefined level.

The MS **will** be damaged by incorrect venting. A turbo pump will be damaged if it is vented while spinning at more than 50% of its normal operating speed.

WARNING

Ensure the GC/MS interface and the analyzer zones are cool (below 100 °C) before you vent the MS. 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 MS power. If the foreline pump is off, hydrogen will accumulate in the MS and an explosion may occur. Read "[Hydrogen Safety](#)" on page 21 before operating the MS with hydrogen gas.

WARNING

Never open the vent valve or shutdown 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 MS 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 30.)

For complete venting instructions, see "[To Vent the MS](#)" on page 124.

High Vacuum Pressure in EI Mode

The largest influences on operating pressure in EI mode are the carrier gas (column) and CC gas flows. **Table 7** lists typical pressures for various helium and nitrogen CC gas flows. These pressures are approximate and will vary from instrument to instrument by as much as 30%.

Table 7 Influence of carrier and CC gas flows on ion vacuum gauge readings

Column Flow (mL/min)	CC Gas On N ₂ = 1.5, He = 2.25		CC Gas Off		CC Gas On N ₂ = 1.5, He off	
	Rough Vac	High Vac	Rough Vac	High Vac	Rough Vac	High Vac
0.5	1.58×10^{-1}	1.11×10^{-4}	8.82×10^{-2}	6.05×10^{-7}	1.36×10^{-1}	1.31×10^{-4}
0.7	1.61×10^{-1}	1.10×10^{-4}	9.92×10^{-2}	7.75×10^{-7}	1.39×10^{-1}	1.31×10^{-4}
1	1.66×10^{-1}	1.10×10^{-4}	1.00×10^{-1}	8.38×10^{-7}	1.44×10^{-1}	1.31×10^{-4}
1.2	1.69×10^{-1}	1.10×10^{-4}	1.05×10^{-1}	9.38×10^{-7}	1.47×10^{-1}	1.31×10^{-4}
2	1.80×10^{-1}	1.11×10^{-4}	1.22×10^{-1}	1.36×10^{-6}	1.60×10^{-1}	1.32×10^{-4}
3	1.95×10^{-1}	1.12×10^{-4}	1.41×10^{-1}	1.82×10^{-6}	1.75×10^{-1}	1.32×10^{-4}
4	2.10×10^{-1}	1.12×10^{-4}	1.57×10^{-1}	2.33×10^{-6}	1.90×10^{-1}	1.31×10^{-4}
6	2.37×10^{-1}	1.13×10^{-4}	1.89×10^{-1}	3.29×10^{-6}	2.18×10^{-1}	1.34×10^{-4}

If the pressure is consistently higher than those listed, refer to the online help in the Agilent MassHunter GC/MS Acquisition software for information on troubleshooting air leaks and other vacuum problems.

5 Operating in EI Mode

To Set Monitors for MS Temperature and Vacuum Status

To Set Monitors for MS Temperature and Vacuum Status

A monitor displays the current value of a single instrument parameter. They can be added to the standard instrument control window. Monitors can be set to change color if the actual parameter varies beyond a user-determined limit from its setpoint.

Procedure

- 1 Select **Method > Edit Monitors** to display the **Select Monitors** dialog. (See [Figure 30](#).)

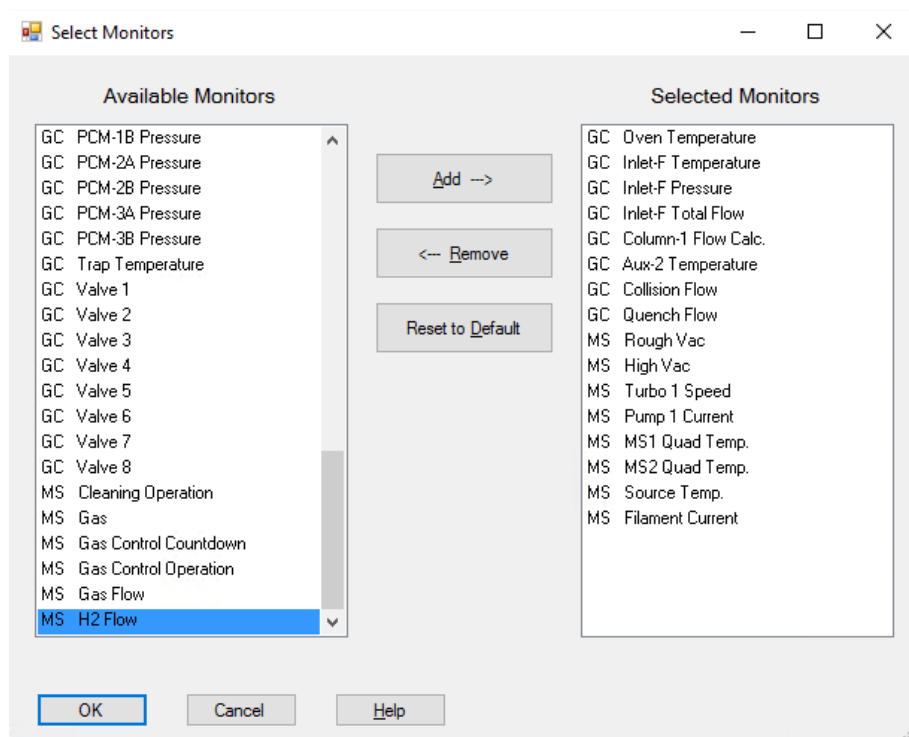


Figure 30. Select Monitors dialog box

The available monitors may change due to the configuration of the GC and MS.

5 Operating in EI Mode

To Set Monitors for MS Temperature and Vacuum Status

- 2 In the **Available Monitors** column, select **MS High Vac** and click **Add** to move the selection to the **Selected Monitors** column.
- 3 In the **Available Monitors** column, select **MS 1 Heater**, and click **Add** to move the selection to the **Selected Monitors** column.
- 4 In the **Available Monitors** column, select **MS 2 Heater**, and click **Add** to move the selection to the **Selected Monitors** column.
- 5 In the **Available Monitors** column, select **MS Turbo Speed**, and click **Add** to move the selection to the **Selected Monitors** column.
- 6 In the **Available Monitors** column, select **MS Source Temp**, and click **Add** to move the selection to the **Selected Monitors** column.
- 7 In the **Available Monitors** column, select **Foreline Pressure**, and click **Add** to move the selection to the **Selected Monitors** column.
- 8 Select any other monitors you want, and **add them** to the **Selected Monitors** column.
- 9 Click **OK**. The new monitors will be stacked on top of each other in the lower right corner of the **Instrument Control** window.
- 10 Select **Window > Arrange Plots and Monitors**, or click and drag each monitor to the desired position. See [Figure 31](#) for one way of arranging the monitors.

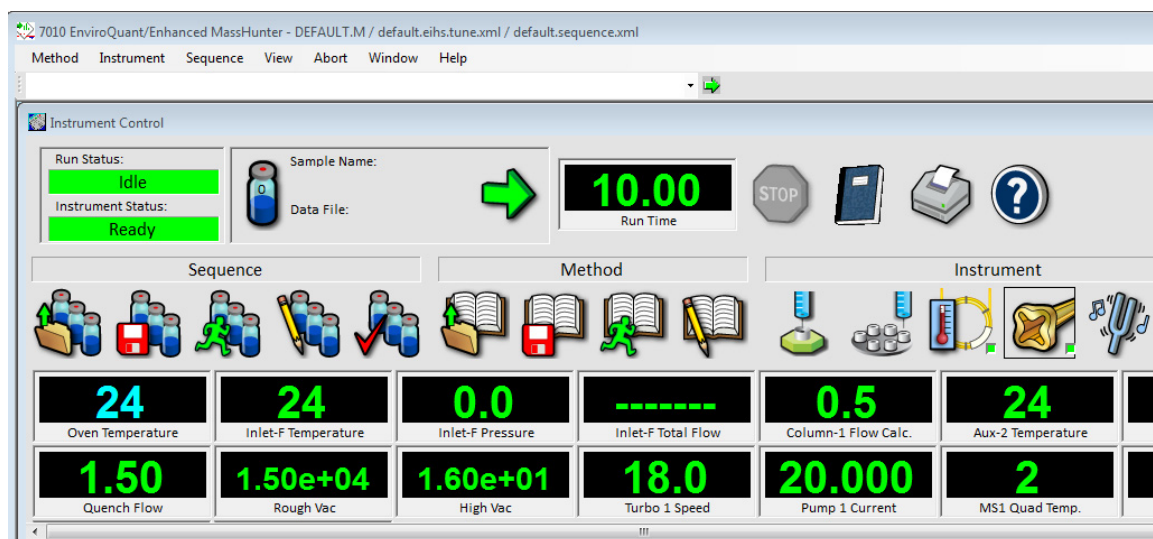


Figure 31. Arranging monitors

- 11 To make the new settings part of the method, select **Save** from the **Method** menu.

To Set the MS Analyzer's Temperatures

Setpoints for the MS ion source, front quad (MS1), rear quad (MS2), and temperatures are stored in the current tune file. When a method is loaded, the setpoints in the tune file associated with that method are downloaded automatically.

Procedure

- 1 In **Instrument Control** view, select the **MS Tune** icon to display the **Tune** dialog box. Select the **Manual Tune** tab, then select the **Ion Source** tab to display the ion source parameters.
- 2 Enter the temperature setpoint in the **Source Temp** field. See **Table 8** for recommended setpoints.
- 3 Select the **MS1** tab to display the MS1 parameters. (See **Figure 32** on page 110.)
- 4 Enter the temperature setpoint in the **MS1 Quad Temp** field. See **Table 8** for the recommended setpoint.
- 5 Select the **MS2** tab to display the MS2 parameters.
- 6 Enter the temperature setpoint in the **MS2 Quad Temp** field. See **Table 8** for recommended setpoint.
- 7 Select the **Files and Reports** tab, then click **Save** to save the tune file with these changes.

Table 8 Recommended temperature settings

Zone	EI operation
MS Source	230 °C default. High limit 350 °C. Application dependent.
MS Quad 1	150 °C
MS Quad 2	150 °C

5 Operating in EI Mode

To Set the MS Analyzer's Temperatures

Files and Reports | Autotune | Advanced Autotune | Manual Tune | Vacuum Control

Ion Source : EI+ | MS1 | Collision Cell | MS2 | Lag Factors | Detector | Acquisition

☐ TTI
☐ SIM
☐ Scan
☒ Profile

Cutoff amu
 Mass amu
 From To

	Mass (m/z)	Window
▶	69	10
	264	10
	502	10
*		

Peak Width
 MS1 Mass Axis Gain
 MS1 Mass Axis Offset amu
 MS1 Width Gain amu
 MS1 Width Offset amu
 MS1 Quad DC V
 Post Filter DC V
☐ Link ion energy parameters
 MS1 Quad Temp. °C

Ramp: From To Step Dwell Time

Off Default CheckTune limits have been restored at 4/19/2016 10:05:32 AM.

Figure 32. MS1 parameters

The GC/MS interface, ion source, and the MS1 quadrupole heated zones interact. The analyzer heater may not be able to accurately control temperature if the setpoint for one zone is much different from that of an adjacent zone.

The software will not allow you to exceed 200 °C for the quadrupole or 350 °C for the source.

5 Operating in EI Mode

To Set the GC/MS Interface Temperature from MassHunter

To Set the GC/MS Interface Temperature from MassHunter

You can also use the **GC Control** panel to perform this task.

Procedure

- 1 Select **Instrument > GC Parameters** from the **Instrument Control** panel.
- 2 Click the **Aux Heaters** icon to edit the interface temperature. (See [Figure 33](#).) This example has the GC/MS interface temperature configured as Thermal Aux 2.

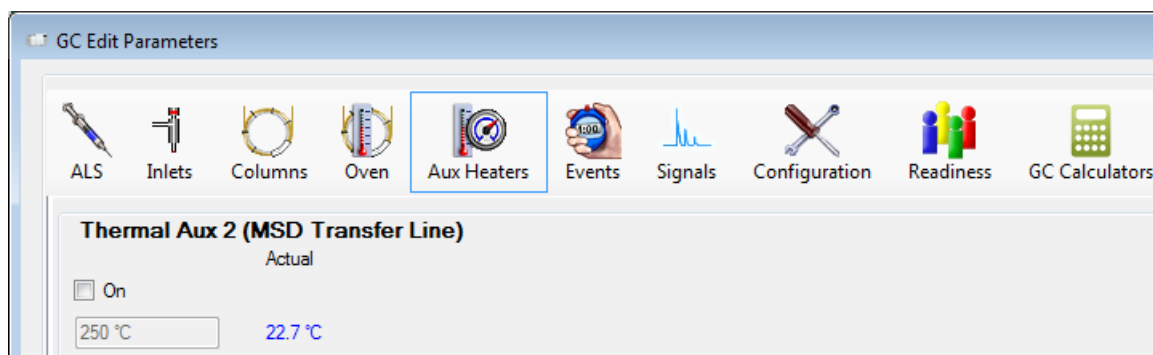


Figure 33. Setting the interface temperature

CAUTION

Ensure that the carrier gas is turned on and the column has been purged of air before heating the GC/MS interface or the GC oven.

CAUTION

When setting the GC/MS interface temperature, never exceed the maximum for your column.

- 3 Click the heater **On** check box, and type the setpoint in the **Value °C** column. The typical setpoint is 280 °C. The limits are 0 °C to 400 °C. A setpoint below ambient temperature turns off the interface heater.
- 4 Click **Apply** to download setpoints or click **OK** to download setpoints, and close the window.
- 5 To make the new settings part of the method, select **Save** from the **Method** menu.

To Configure CC Gas

- 1 Configure the use of **Quench Gas** and **Collision Gas**. (See **"To Set the CC Gas Flow Rates"** on page 115.)
- 2 Select **Instrument > GC Parameters** from the **Instrument Control** panel.
- 3 Click the **Configuration** icon, then select the **Modules** tab to display the screen. (See **Figure 34.**)

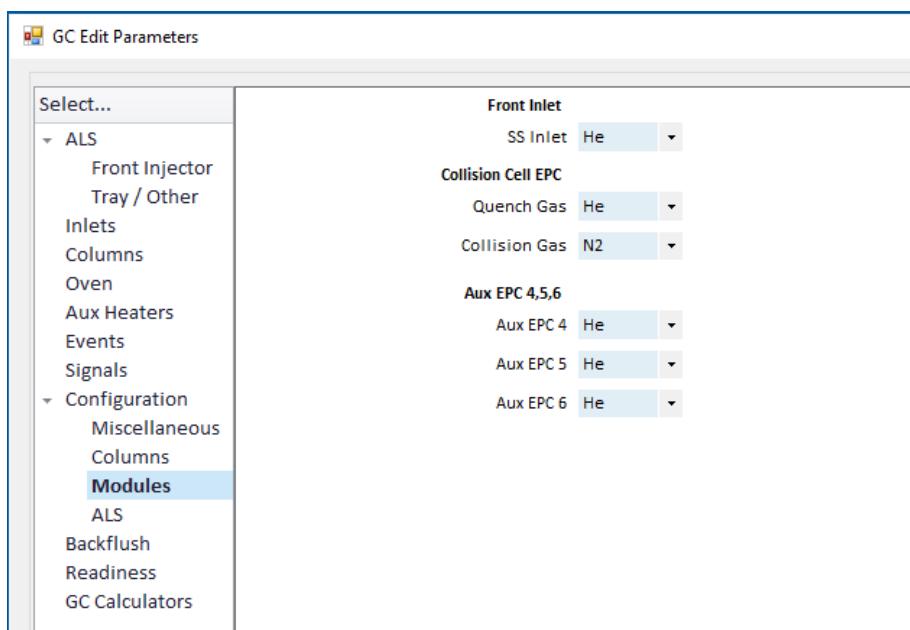


Figure 34. Configure CC gas

- 4 From the **Collision Cell EPC > Quench Gas** drop-down menu, select the quench gas.
- 5 From the **Collision Cell EPC > Collision Gas** drop-down menu, select the collision gas.
- 6 Click **OK** to save the configuration.

5 Operating in EI Mode

To Set the Mode for the Optional JetClean System

To Set the Mode for the Optional JetClean System

- 1 Click the **MS Parameters** icon in the **Instrument Control** view.
- 2 Click **Source Cleaning** from the **Triple Quadrupole MS Method Editor** navigation panel.
- 3 Select a mode from the **Operation** dropdown menu. (See [Figure 35.](#))

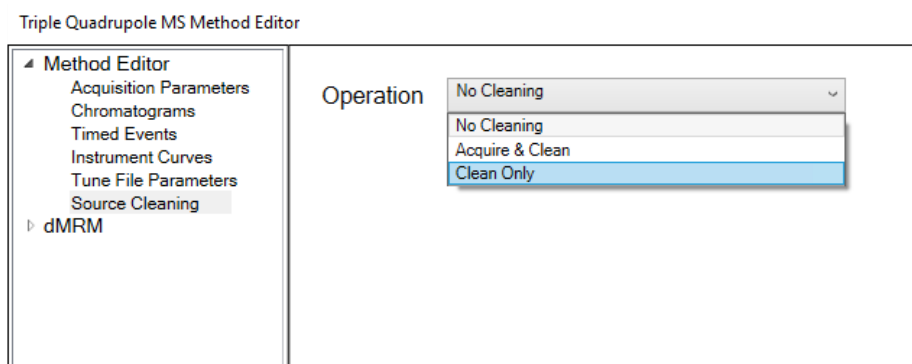


Figure 35. TQ MS Method Editor Source Cleaning panel

For detailed information on the JetClean system see the *JetClean Operating manual*.

5 Operating in EI Mode

To Set the JetClean Parameters for the Clean Only Mode

To Set the JetClean Parameters for the Clean Only Mode

- 1 Click the **MS Parameters** icon in the **Instrument Control** view.
- 2 Select **Source Cleaning** from the **Triple Quadrupole MS Method Editor** navigation panel.
- 3 Select **Clean Only** from the **Operation** dropdown menu. (See [Figure 36](#).)

The screenshot displays the 'Triple Quadrupole MS Method Editor' window. On the left is a navigation panel with a tree structure. Under 'Method Editor', the following items are listed: Acquisition Parameters, Chromatograms, Timed Events, Instrument Curves, Tune File Parameters, and Source Cleaning (which is highlighted). Below this is a sub-item 'dMRM'. The main area of the window is divided into two sections. The top section, titled 'Operation', contains a dropdown menu currently set to 'Clean Only'. The bottom section, titled 'Cleaning', contains a table of parameters with their respective values:

Parameter	Value
HydrogenFlow (mL/min)	2.00
Filament	2
Emission (μA)	50.0
Source Temperature (°C)	300.0
Quadrupole Temperature (°C)	200.0
Duration (min)	15.0

Below the 'Cleaning' section is a 'Post Cleaning' section. It contains a text block stating: 'For Post Cleaning, the Source and Quadrupole temperatures are derived from the temperature settings in the Tune File associated with this method.' Below this text is a single parameter: 'Stabilization Duration (min)' with a value of '60.0'.

Figure 36. JetClean set to Clean Only mode

- 4 Enter the parameters supplied by your method developer.
- 5 Save the method.

To Set the CC Gas Flow Rates

- 1 From the Agilent **MassHunter GC/MS Acquisition software Instrument Control** panel, select **Instrument > GC Parameters**.
- 2 Click the **Columns** icon to display the control parameter entry screen for column and Aux flow modules. (See **Figure 37** on page 116.)
- 3 Select **Collision Cell EPC** in the description list.
- 4 Enter the required gas flow rates in the appropriate field.

NOTE

Helium should only be used as a quench gas in the CC when it is also used as the carrier gas. When hydrogen is being used as the carrier gas, turn off the helium flow to the CC, and cap off the helium input line with a leak-tight fitting.

NOTE

You must manually set the collision gas flow to on when in manual tune. Set the system to the same conditions [Column flow(s), Collision Cell flows, and MS analyzer temperatures] that will be used for data acquisition. Wait sufficient time for system thermal equilibrium.

- 5 Click the **He Quench Gas On** check box to allow the He quench gas flow. Click the **N2 Collision Gas On** check box to allow the N2 collision gas flow.
- 6 Click **Apply** to download the setpoints or **OK** to download the setpoints and close the window.
- 7 To make the new settings part of the method, select **Save** from the **Method** menu.

5 Operating in EI Mode

To Set the CC Gas Flow Rates

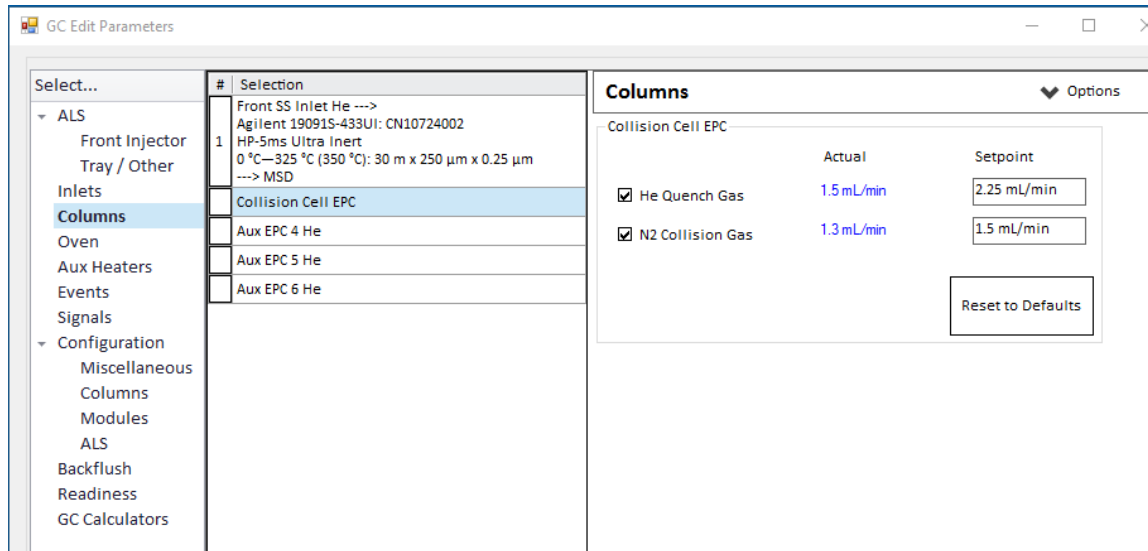


Figure 37. Setting CC gas flow rate

To Autotune the MS for EI Mode

The MS can be tuned using the Agilent MassHunter GC/MS Acquisition software.

Procedure

- 1 Set the system to the same conditions (column flow and MS analyzer temperatures) that will be used for data acquisition. Since the GC temperature varies throughout the run, select a temperature in the mid range.
- 2 In the **Instrument Control** panel, click the **MS Tune** icon to display the **Triple Quadrupole MS Tune** window.
- 3 The current tune file is displayed in the upper left corner of the **Triple Quadrupole MS Tune** window. Verify that the correct tune file is loaded.
- 4 If necessary, load a new tune file by clicking on the **Files and Report** tab, then click **Load** in the **Tune File** area. Select an etune.u based tune file for an EI XTR source or an HES_atune.U based tune file for a HES, and click **OK**.
- 5 Click the **Autotune** tab, and select **EI high sensitivity autotune** for an EI HES or XTR source. (See **Figure 38** on page 118.)
- 6 Select the **Tune from default settings** check box if you are restarting the system after a system vent, major servicing, or a power outage. If you clear the **Tune from default settings** box, the autotune process starts using the previous tune values.
- 7 Select **Save tune file when done** check box to save the new tune parameters generated by the autotune. Do not select this item if you want to review the autotune report before saving the newly generated tune parameters.
- 8 Select the **Print autotune report** check box to automatically print a tune report.

5 Operating in EI Mode

To Autotune the MS for EI Mode

The screenshot shows the 'Autotune' software interface. At the top, there are tabs: 'Files and Reports', 'Autotune', 'Advanced Autotune', 'Manual Tune', and 'Vacuum Control'. The 'Autotune' tab is active, showing sub-tabs 'Autotune' and 'Check Tune'. The 'Autotune' sub-tab is selected.

Autotune Type

- ☐ EI autotune
- ☒ EI high sensitivity autotune
- ☐ PCI autotune
- ☐ NCI autotune

CI Reagent Gas

- ☐ Methane
- ☒ Hydrogen

Autotune Options

- ☐ Tune from default settings
- ☐ Use custom autotune parameters
- ☐ Print autotune report
- ☒ Save tune file when done

File Selection

- ☒ Default filename
- ☐ Current filename
- ☐ Save as

Buttons: Autotune, Quick Tune, Abort Tune, Browse...

Status Bar

Off Default CheckTune limits have been restored at 4/19/2016 10:24:44 AM. Close Help

Figure 38. Setting up for autotune on a system configured with CI

- 9 Click **Autotune** to start the autotune. The **Status** line displays the current step in the autotune process, and the plot of the tuned parameter for that step is shown in the top graph. If specified above, at the completion of the autotune, a Tune Report is printed.

To stop the autotune before it completes the automatic parameter selection, click **Abort Autotune**. The parameters from the last successful autotune are used.

- 10 Review the Tune Report. If the results are acceptable and you did not select the **Save tune file when done** check box, save the autotune by clicking the **Files and Report** tab, then click **Save**.

Refer to the manuals or online help provided with your Agilent MassHunter GC/MS Acquisition software for additional information about tuning.

5 Operating in EI Mode

To Open Left Side Panel for Access to the Analyzer Chambers

To Open Left Side Panel for Access to the Analyzer Chambers

The left side panel should only be opened to access the front and rear analyzer chambers or the analyzer side plates. This is necessary to pumpdown, clean or change the ion source, replace a filament, or replace the EM horn. If you need to open the left side panel follow this procedure. (See [Figure 39](#).)



Procedure

Pull gently on the front left window, and allow the left side panel to slide forward and down.

Left side panel



Figure 39. The left side panel

To Pumpdown the MS

WARNING

Ensure your MS meets all the conditions listed in the introduction to this chapter before starting up and pumping down the MS. Failure to do so can result in personal injury.

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 MS power. If the foreline pump is off, hydrogen will accumulate in the MS and an explosion may occur. Read [“Hydrogen Safety”](#) on page 21 before operating the MS with hydrogen gas.



Procedure

- 1 Remove the analyzer window cover, and open the left analyzer panel to access the vent valve and the analyzer quad driver boards. (See [“To Open Left Side Panel for Access to the Analyzer Chambers”](#) on page 119.)
- 2 Verify that the foreline pump inlet valve is open.

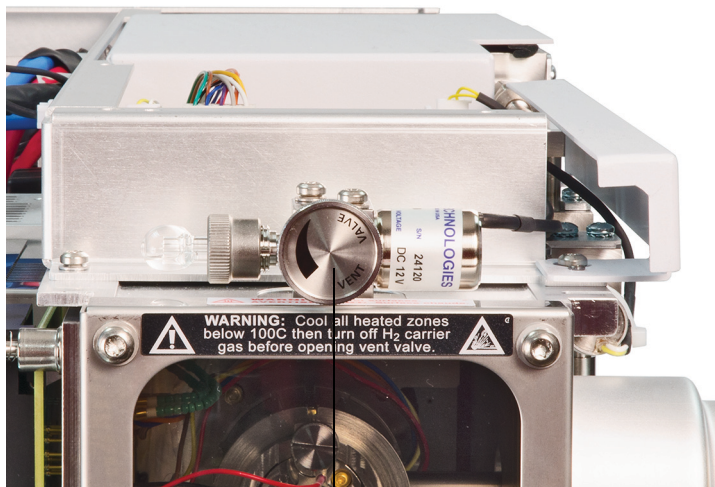
WARNING

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

- 3 Verify that the vent valve is open by turning it clockwise until closed. (See [Figure 40](#) on page 121.)

5 Operating in EI Mode

To Pumpdown the MS



Vent valve knob

Figure 40. Vent valve knob

- 4 Open the vent valve by turning it counterclockwise 45 degrees.
- 5 Verify that the MS power cord is plugged into a grounded building's mains receptacle.
- 6 Turn on the MS by pressing the On/Off switch on the front of the MS.
- 7 Press lightly on the front and rear analyzer quad driver boards to ensure a correct seal. Press on the metal box on the quad driver board.

CAUTION

Do not push on the filament board safety cover while pressing on the analyzer boards. This cover was not designed to withstand this type of pressure.

- 8 Close the vent valve when it makes a hissing sound. (See [Figure 40](#).)
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 Agilent MassHunter GC/MS Acquisition software. If the TQ was configured for both an EI and a CI source, you are prompted for the ion source type that is currently installed. Click on an EI or CI source type if prompted.
- 10 Select the **MS Tune** icon from the **Instrument Control** panel.

5 Operating in EI Mode

To Pumpdown the MS

- 11 Select the **Manual Tune** tab.
- 12 Click **Pumpdown**. You are prompted if you want to load high temperature settings for the ion source and MS1 and MS2 quads.
- 13 Click **Yes** to set the source/MS1/MS2 at 230/150/150 or click **No** to set them at 100/100/100.
- 14 The **Pumpdown** dialog displays. (See [Figure 41](#).) You are prompted to make sure the vent valve is closed.
- 15 Click **OK** to close the Pumpdown manual step dialog and start the Pumpdown.

Pumpdown

Status **Pumping down**

Pumpdown Cycle Started: 4/19/2016 10:27:16 AM

Elapsed Time: 5 mins 31 secs

	Actuals	Criteria	
Turbo 1 Speed	23.0	> 90	%
Turbo 1 Power	600.0	---	W
Rough Vac	2.00E+4	---	mTorr
High Vac	2.10E+1	---	Torr
Source Temp.	6	---	°C
MS1 Quad Temp.	7	---	°C
MS2 Quad Temp.	39	---	°C

TQ1
7010 None
Triple Axis Series 2 detector

Close

Figure 41. Pumpdown status

5 Operating in EI Mode

To Pumpdown the MS

CAUTION

Within 10 to 15 minutes, the turbo pump speed should be up to 80% . The pump speed should eventually reach 95%. If these conditions are not met, the MS electronics will shut off the foreline pump. To recover from this condition, you must power cycle the MS. If the MS does not pumpdown correctly, refer to the manual or online help for information on troubleshooting air leaks and other vacuum problems.

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.

- 16 When prompted, turn on the GC/MS interface heater and GC oven. Click **OK** when you have done so. The software will turn on the ion source and mass filter (quad) heaters. The temperature setpoints are stored in the current tune file.
- 17 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.
- 18 Tune the MS. (See **[“To Autotune the MS for EI Mode”](#)** on page 117 or **[“To Perform a CI Autotune”](#)** on page 142.)
- 19 If using the JetClean system, prepare the hydrogen system for use. Refer to the *JetClean Operating manual* for warnings regarding hydrogen safety.

To Vent the MS

Agilent MassHunter GC/MS Acquisition 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. Refer to the MassHunter GC/MS Acquisition software Online Help for information on how to configure a Fast Vent method.



Procedure

- 1 Click the **MS Tune** icon from the **Instrument Control** panel.
- 2 Select the **Manual Tune** tab.
- 3 Select the **Vacuum Control** tab.

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 MS power. If the foreline pump is off, hydrogen will accumulate in the MS and an explosion may occur. Read **"Hydrogen Safety"** on page 21 before operating the MS with hydrogen gas.

CAUTION

Ensure the GC oven and the GC/MS interface are cool before turning off carrier gas flow.

- 4 Click **Fast Vent** if your system supports DCOMM communication between the GC and MS, or click **Vent** if it does not. If your system supports DCOMM, MassHunter will load the Fast Vent method to turn off the GC oven and interface heaters, the source and quad heaters, and the turbo pump.

If your system does not support DCOMM or if DCOMM has been disabled, when prompted you must set the GC/MS interface heater and the GC oven temperatures to ambient (room temperature).
- 5 Turn off the MS by pressing the power switch. (See **Figure 1** on page 18.)
- 6 Unplug the MS power cord.

WARNING

When the MS is vented, do not put the MassHunter software into Instrument Control view. Doing so will turn on the interface heater.

5 Operating in EI Mode

To Vent the MS

- 7 Remove the analyzer window cover. (See [“To Open Left Side Panel for Access to the Analyzer Chambers”](#) on page 119.)
 - 8 Turn the vent valve knob counterclockwise **only** 3/4 turn or until you hear the hissing sound of air flowing into the analyzer chamber. (See [Figure 42](#).)
- Do **not** turn the knob too far or the O-ring may fall out of its groove.

WARNING

Allow the analyzers to cool to near room temperature before touching them.

CAUTION

Always wear clean gloves while handling any parts that go inside the analyzer chambers.

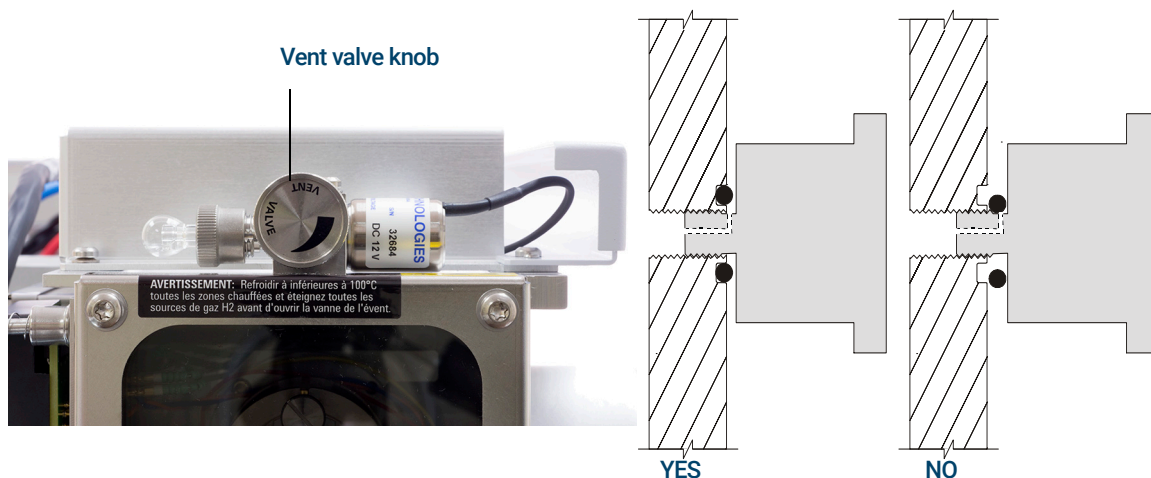


Figure 42. The MS vent valve knob

5 Operating in EI Mode

To Set the GC/MS Interface Temperature from the 7890 GC

To Set the GC/MS Interface Temperature from the 7890 GC

The interface temperature can be set directly at the GC. For the Agilent 7890 Series GC, this is usually the Aux #2 temperature. See the *7890 Series GC Advanced User Guide* for details.

CAUTION

Never exceed the maximum temperature of your column.

CAUTION

Ensure that the carrier gas is turned on, and the column has been purged of air before heating the GC/MS interface or the GC oven to avoid damaging the column.

Procedure

- 1 Press **[Aux Temp #2]**, and scroll to the interface temperature. Press **[Enter]**.
- 2 Scroll to **Temperature**. Enter a value, and press **[Enter]**.
- 3 Scroll to **Initial time**. Enter a value, and press **[Enter]**.
- 4 Scroll to **Rate 1**. Enter **0** to end the program here or enter a positive value to create a temperature program.

If you want the new setpoint saved with a method stored on the GC, press **OK** to save the method. You can also upload the GC method to the MassHunter Workstation to save the new setpoints made at the GC keypad. When a new method is loaded, all the setpoints in the new method will overwrite those currently in the GC.

To Save a Method on the 7890 GC

Procedure

- 1 Press **[Method]**, and scroll to the specific method number.
- 2 Press **[Store]** and **[On/Yes]** to store the new method using the chosen number. Alternatively, press **[Off/No]** to return to the stored methods list without saving the method.

A message is displayed if a method with the number you selected already exists.

- 3 Press **[On/Yes]** to *replace* the existing method or **[Off/No]** to return to the stored methods list without saving the method.

5 Operating in EI Mode

To Save a Method on the 7890 GC

6

Operating in CI Mode

Setting Up Your MS to Operate in CI Mode 130

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To Pumpdown and Switch from EI to CI Mode 144

This chapter provides information and instructions for operating the 7000/7010 Series TQ GC/MS system 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 positive CI (PCI) with methane reagent gas and for negative CI (NCI) with any reagent gas.

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

Setting Up Your MS to Operate in CI Mode

Setting up your MS for operation in CI mode requires special care to avoid contamination and air leaks.

- Always use the highest purity methane (and other reagent gases, if applicable). Methane must be at least 99.9995% pure.
- Always verify the MS is performing well in EI mode before switching to CI.
- Ensure the CI source and GC/MS 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(s) are equipped with gas purifiers (not applicable for ammonia).

Operating the CI MS

Operating your GC/MS 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 9](#).)

Table 9 Temperatures for CI operation

	Ion source	Front analyzer	Rear analyzer	GC/MS interface
PCI	300 °C	150 °C	150 °C	280 °C
NCI	150 °C	150 °C	150 °C	280 °C

Start the system in CI mode

When starting up the system, you may begin in either PCI or NCI mode. Depending upon the application, use the following reagent gas flowrates 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)

High Vacuum Pressure in CI Mode

The largest influences on operating pressure in CI mode are the reagent and CC gas flows. **Table 10** lists typical pressures for various reagent gas flows, depending upon the CC gas flowrate. Familiarize yourself with the measurements on **your** system under operating conditions, and watch for **changes** that may indicate a vacuum or gas flow problem. Measurements will vary by as much as 30% from one MS to the next.

Analyzer vacuum with reagent gas flowing

Note that the MFC is calibrated for methane and the vacuum gauge is calibrated for nitrogen, so these measurements are not accurate, but are intended as a guide to typical observed readings. (See **Table 10**.) They were taken with the following set of conditions. Note that these are typical PCI temperatures:

Source temperature	300 °C
Front quad temperature	150 °C
Rear quad temperature	150 °C
Interface temperature	280 °C to 320 °C
Helium carrier gas flow	1 mL/min

Table 10 Typical analyzer vacuum with reagent gas flow

MFC (%)	CC gas flow on N ₂ = 1.5, He = 2.25		CC gas flow off	
	Rough vac	High vac	Rough vac	High vac
10	1.77×10^{-1}	7.15×10^{-5}	1.33×10^{-1}	2.56×10^{-6}
15	1.86×10^{-1}	7.19×10^{-5}	1.43×10^{-1}	3.00×10^{-6}
20	1.94×10^{-1}	7.23×10^{-5}	1.53×10^{-1}	3.45×10^{-6}
25	2.02×10^{-1}	7.27×10^{-5}	1.63×10^{-1}	3.86×10^{-6}
30	2.10×10^{-1}	7.31×10^{-5}	1.71×10^{-1}	4.30×10^{-6}
35	2.18×10^{-1}	7.39×10^{-5}	1.80×10^{-1}	4.76×10^{-6}
40	2.25×10^{-1}	7.43×10^{-5}	1.88×10^{-1}	5.18×10^{-6}

Other Reagent Gases

This section describes the use of isobutane or ammonia as the reagent gas. You should be familiar with operating the CI-equipped 7000/7010 Series TQ GC/MS with methane reagent gas before attempting to use other reagent gases.

CAUTION

Do not use nitrous oxide as a reagent gas. It radically shortens the life span of the filament.

Changing the reagent gas from methane to either isobutane or ammonia changes the chemistry of the ionization process and yields different ions. The principal CI reactions encountered are described in general in the [Agilent 7000/7010 Triple Quadrupole GC/MS Concepts Guide](#). If you are not experienced with CI, we suggest reviewing that material before you proceed.

Isobutane CI

Isobutane (C_4H_{10}) is commonly used for CI when less fragmentation is desired in the CI spectrum. This is because the proton affinity of isobutane is higher than that of methane; hence less energy is transferred in the ionization reaction.

Addition and proton transfer are the ionization mechanisms most often associated with isobutane. The sample itself influences which mechanism dominates.

Ammonia CI

Ammonia (NH_3) is commonly used for CI when less fragmentation is desired in the CI spectrum. This is because the proton affinity of ammonia is higher than that of methane; hence less energy is transferred in the ionization reaction.

Because many compounds of interest have insufficient proton affinities, ammonia CI spectra often result from the addition of NH_4^+ and then, in some cases, from the subsequent loss of water. Ammonia reagent ion spectra have principal ions at m/z 18, 35, and 52, corresponding to NH_4^+ , $\text{NH}_4(\text{NH}_3)^+$, and $\text{NH}_4(\text{NH}_3)_2^+$.

CAUTION

Use of ammonia affects the maintenance requirements of the MS. (See [Chapter 7, "General Maintenance,"](#) starting on page 147 for more information.)

CAUTION

The pressure of the ammonia supply must be less than 5 psig. Higher pressures can result in ammonia condensing from a gas to a liquid.

Always keep the ammonia tank in an upright position, below the level of the flow module. Coil the ammonia supply tubing into several vertical loops by wrapping the tubing around a can or bottle. This will help keep any liquid ammonia out of the flow module.

Ammonia tends to break down vacuum pump fluids and seals. Ammonia CI makes more frequent vacuum system maintenance necessary. Refer to the *7000/7010 Series Triple Quad GC/MS Troubleshooting and Maintenance Manual*.

CAUTION

When running ammonia for 5 or more hours a day, the foreline pump must be ballasted (flushed with air) for at least 1 hour a day to minimize damage to pump seals. Always purge the MS with methane after flowing ammonia.

Frequently, a mixture of 5% ammonia and 95% helium or 5% ammonia and 95% methane is used as a CI reagent gas. This is enough ammonia to achieve good CI while minimizing its negative effects.

Carbon Dioxide CI

Carbon dioxide is often used as a reagent gas for CI. It has obvious advantages of availability and safety.

CI Autotune

After the reagent gas flow is set, the lenses and electronics of the MS should be tuned. (See [Table 11](#).) 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/MS 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 MS must be purged and baked out for at least 2 hours before tuning. Longer bakeout is recommended before running samples requiring optimal sensitivity.

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 MS performance in EI before switching to CI operation.

Table 11 CI tune default settings

Parameter	Methane		Isobutane		Ammonia	
Ion polarity	Positive	Negative	Positive	Negative	Positive	Negative
Emission	150 μ A	50 μ A	150 μ A	50 μ A	150 μ A	50 μ A
Electron energy	150 eV	150 eV	150 eV	150 eV	150 eV	150 eV
Filament	1	1	1	1	1	1
Repeller	3 V	3 V	3 V	3 V	3 V	3 V
Ion focus	130 V	130 V	130 V	130 V	130 V	130 V
Entrance lens offset	20 V	20 V	20 V	20 V	20 V	20 V
EM volts	1200	1400	1200	1400	1200	1400
Shutoff valve	Open	Open	Open	Open	Open	Open
Gas select	A	A	B	B	B	B
Suggested flow	20%	40%	20%	40%	20%	40%
Source temp	250 °C	150 °C	250 °C	150 °C	250 °C	150 °C

6 Operating in CI Mode

CI Autotune

Table 11 CI tune default settings (continued)

Parameter	Methane		Isobutane		Ammonia	
Front quad temp	150 °C	150 °C	150 °C	150 °C	150 °C	150 °C
Rear quad temp	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
Autotune	Yes	Yes	No	Yes	No	Yes

The CI Flow Control Module

The CI reagent gas flow control module regulates the flow of reagent gas through the GC/MS interface and into the CI source. (See **Figure 43** and **Table 12** on page 138.) The CI option consists of the MFC, gas select valves, CI calibration valve, shutoff valve, control electronics, plumbing, tip seal assembly, and CI source.

The back panel provides Swagelok inlet fittings for methane (**CH₄**) and one **other** gas. The software refers to them as **Gas A** and **Gas B**, respectively. If you are not using a second 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 MS is vented or by PFTBA during EI operation. The MS monitors will reflect **On** as **1** and **Off** as **0**. (See **Table 12** on page 138.)

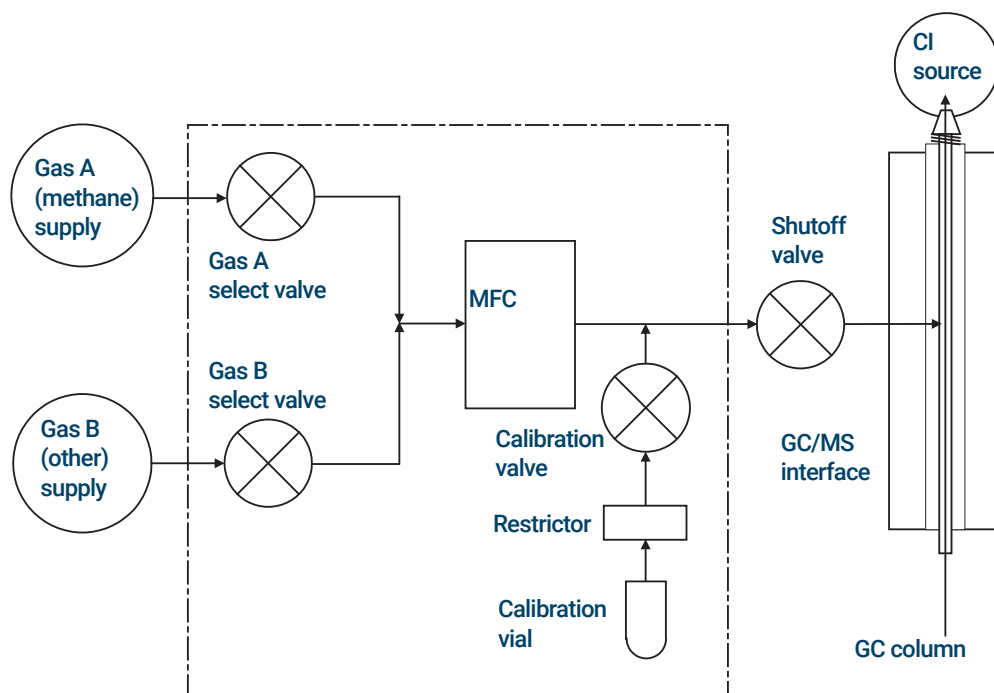


Figure 43. Reagent gas flow control module schematic

6 Operating in CI Mode

The CI Flow Control Module

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.

Table 12 CI system MFC state

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 **Opened** and **Closed**.

To Operate the Reagent Gas Flow Control Module

Procedure

- 1 In **Instrument Control** panel, select the **MS Tune** icon to display the **Triple Quadrupole MS Tune** window. Select the **Manual Tune** tab, then select the **Ion Source** tab to display the ion source parameters. (See [Figure 44.](#))

The screenshot displays the 'Manual Tune' window with the 'Ion Source' tab selected. The 'Ion Source : CI+' label is at the top left. Below it, there are several parameter groups:

- Source Temp.**: 300 °C, 6
- Emission**: ☐ 150 µA, 9
- Filament**: ☒ 1, ☐ 2
- EI Cal Valve**: ☐
- CI Cal Valve**: ☐

On the right side, there are more parameters:

- Energy**: 150 eV
- Repeller**: 8.0 V
- Ion Body**: (empty field)
- Ion Focus**: -90.0 V
- Entrance Lens**: -12.0 V
- ☐ EI high sensitivity mode

In the center-left, the **CI Reagent Gas Control** section is visible:

- ☒ Methane, ☐ Hydrogen
- CI Gas Flow**: 20 %, 20
- Methane: Flow Set** buttons: Set, Off, Purge, Pumpout

At the bottom, there is a **Ramp** section with fields for From, To, Step, and Dwell Time, and buttons for Start Ramp and Get Ramp Defaults. Below that are buttons for Acquire, Start, Stop, and Capture.

The status bar at the very bottom shows a red **Off** button and a message: **Default CheckTune limits have been restored at 4/19/2016 11:32:42 AM.**

Figure 44. CI flow control

6 Operating in CI Mode

To Operate the Reagent Gas Flow Control Module

- 2 Use the parameters in the **CI Reagent Gas Control** area to control reagent gas flow.

CI Gas A - Selects Methane as the reagent gas.

CI Gas B - Selects the gas connected to the B inlet on the gas flow controller as the reagent gas.

CI Gas Flow - Enter percent of maximum volumetric flow for the selected reagent gas. The actual % transmitted by the flow controller is shown next to this entry. A good value for PCI is 20%, and 40% is a good value for NCI.

Set - Opens the selected reagent gas supply valve and controls the reagent gas flow to the entered setpoint.

Off - Turns off the reagent gas flow.

Purge - Opens the selected reagent gas valve for 6 minutes to clear the system of unwanted compounds.

Pumpout - Closes both reagent gas valves for 4 minutes, and evacuates the system of reagent gases. At the end of the pumpout time, the selected reagent gas valve opens.

To Set a Reagent Gas Flow

CAUTION

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

CAUTION

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

Procedure

- 1 In **Instrument Control** panel, select the **MS Tune** icon to display the **Triple Quadrupole MS Tune** window. Select the **Manual Tune** tab, then select the **Ion Source** tab to display the ion source parameters.
- 2 In the **CI Reagent Gas Control** area, select **CI Gas A** if you are using methane for the reagent gas or select **CI Gas B** to use the reagent gas attached to the CI reagent gas controller's B gas inlet for the reagent gas.
- 3 Enter the reagent gas flow setpoint in the **CI Gas 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.
- 4 Click **Set**. The **Flow Set** indication is displayed.
The reagent gas is flowing into the ion source at the rate displayed next to the setpoint.
- 5 Click the **Files and Reports** tab, then click **Save** to save your changes to the currently loaded tune file.

To Perform a CI Autotune

If you are switching from an EI to a CI source, do not use this procedure. See **“To Pumpdown and Switch from EI to CI Mode”** on page 144.

Procedure

CAUTION

Always verify MS performance in EI before switching to CI operation.

CAUTION

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

- 1 Verify that the MS performs correctly in EI mode first.
- 2 Click the **MS Tune** icon in the **Instrument Control** panel to display the **Triple Quadrupole MS Tune** window.
- 3 If necessary, load a new tune file by clicking on the **Files and Report** tab, then click **Load** in the **Tune File** area. Select a tune file and click **OK**.

The tune file must match the type of ion source in the analyzer. For a CI source, select a tune file created for a positive or negative CI source.

- 4 Click the **Autotune** tab, and select **PCI source** for a positive CI source or **NCI source** for a negative CI source.
- 5 Click on **Methane** if you are using methane as the reagent gas, or click on **Ammonia** if using the gas attached to the reagent gas controllers B port as the reagent gas.
- 6 If a log file and associated data files of the tune are required, click the **Files and Reports** tab, and in the **Log Files** section, click **Browse** to create a directory and files for the logs. Click on the required log and data files check boxes.
- 7 Click on the **Manual Tune** tab, and select the **Ion source** tab. In the **CI Reagent Gas** section, select **CI Gas A** or **CI Gas B** as the reagent gas, and then enter a **CI Gas Flow** rate of 20% for a PCI source or 40% for an NCI source. Click on the **Autotune** tab to return to Autotune.

6 Operating in CI Mode

To Perform a CI Autotune

- 8 Select the **Tune from default settings** check box if you are restarting the system after a system vent, major servicing, or a power outage. If you clear the **Tune from default settings** box, the Autotune process starts using previous tune values.
- 9 Select the **Save tune file when done** check box to save the new tune parameters generated by the autotune. Do not select this item if you want to review the autotune report before saving the newly generated tune parameters.
- 10 Select the **Print autotune report** check box to automatically print a tune report.
- 11 Click **Autotune** to start the autotune. The Status line displays the current step in the autotune process, and the plot of the tuned parameter for that step is shown in the top graph. If specified, at the completion of the autotune a Tune Report is printed.

To stop the autotune before it completes the autotune parameter selection, click **Abort Autotune**. The parameters from the last successful autotune are used.

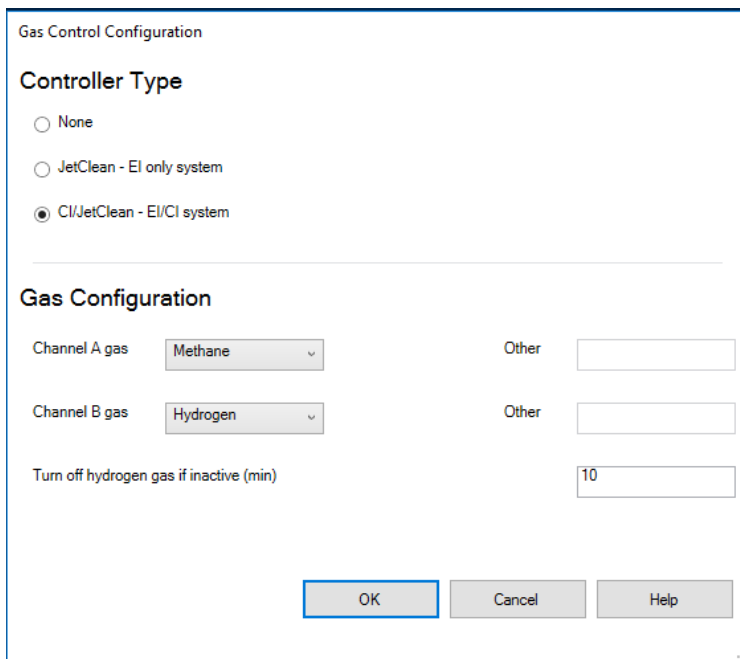
- 12 Review the Tune Report. If the results are acceptable and you did not select the **Save tune file when done** check box, save the autotune by clicking the **Files and Report tab**, then click **Save**.

To Pumpdown and Switch from EI to CI Mode

This procedure assumes that the instrument is switching from EI to CI mode, and will be PCI tuned using methane after the system is stable.

Procedure

- 1 Follow the instructions for the EI MS pumpdown. (See **"To Pumpdown the MS"** on page 120.)
After the software prompts you to turn on the GC/MS interface heater and GC oven, perform the following steps.
- 2 Load a PCI tune file by clicking on the **Files and Report** tab, then click **Load** in the **Tune File** area. Select a PCI tune file, and click **OK**. Always start up and verify system performance in PCI mode before switching to NCI.
- 3 In **Instrument Control** view, select **Instrument > Gas Controller Configuration** to display the Gas Controller Configuration dialog. (See **Figure 45**.)



The image shows a 'Gas Control Configuration' dialog box. It has two main sections: 'Controller Type' and 'Gas Configuration'. In the 'Controller Type' section, there are three radio buttons: 'None', 'JetClean - EI only system', and 'CI/JetClean - EI/CI system', with the third one selected. The 'Gas Configuration' section contains three rows of settings. The first row is for 'Channel A gas' with a dropdown menu set to 'Methane' and an 'Other' text box. The second row is for 'Channel B gas' with a dropdown menu set to 'Hydrogen' and an 'Other' text box. The third row is for 'Turn off hydrogen gas if inactive (min)' with a text box set to '10'. At the bottom right, there are three buttons: 'OK', 'Cancel', and 'Help'.

Controller Type	
<input type="radio"/> None	
<input type="radio"/> JetClean - EI only system	
<input checked="" type="radio"/> CI/JetClean - EI/CI system	

Gas Configuration			
Channel A gas	Methane	Other	
Channel B gas	Hydrogen	Other	
Turn off hydrogen gas if inactive (min)	10		

OK Cancel Help

Figure 45. Gas controller configuration for CI

6 Operating in CI Mode

To Pumpdown and Switch from EI to CI Mode

- 4 Select **CI/JetClean - EI/CI system** since this controller is installed for the CI control option.
- 5 For **Channel A gas**, select **Methane**. Click **OK**.
- 6 Click the MS Tune icon in the **Instrument Control** panel to display the **Triple Quadrupole MS Tune** window, and select the **Vacuum Control** tab to monitor that the pressure is decreasing.
- 7 In the **Triple Quadrupole MS Tune** window, select the **Manual Tune** tab; then select the **Ion Source: CI+** tab, and then in the **CI Reagent Gas Control** area select **Gas Valve A** for **Methane** gas. (See [Figure 46](#).)

The screenshot shows the 'Manual Tune' tab of the 'Triple Quadrupole MS Tune' window. The 'Ion Source: CI+' sub-tab is selected. In the 'CI Reagent Gas Control' section, 'Methane' is selected with a flow rate of 20%. Other parameters include Source Temp (300 °C), Energy (150 eV), Repeller (8.0 V), and Ion Focus (-90.0 V). The 'Methane: Flow Set' section has buttons for 'Set', 'Off', 'Purge', and 'Pumpout'.

Figure 46. Setting reagent gas flow

- 8 Set **Gas A (methane)** to 20%.
- 9 Set the GC/MS interface to 280 °C.
- 10 Let the system bake out and purge for at least 2 hours. If you will be running NCI, for best sensitivity, bake out the MS overnight.
- 11 Click the **MS Tune** icon in the **Instrument Control** panel to display the **Triple Quadrupole MS Tune** window and select the **Autotune** tab. The method selects the correct PCI or NCI source and reagent gas setting.
- 12 Select the **Tune from default settings** check box because you have changed the ion source.
- 13 Select the **Print autotune report** check box to automatically print a tune report.

6 Operating in CI Mode

To Pumpdown and Switch from EI to CI Mode

- 14 Click **Autotune** to start the autotune. At the completion of the autotune a Tune Report is printed.
- 15 Review the Tune Report. If the results are acceptable, save the autotune by clicking the **Files and Report** tab, then click **Save**. Default tune control limits are shown in **Table 13**.

Table 13 Default Tune Control Limits, used by CI autotune only

Reagent gas	Methane		Ammonia	
Ion polarity	Positive	Negative	Positive	Negative
Abundance target	1×10^6	1×10^6	N/A	1×10^6
Peak width target	0.7	0.7	N/A	0.7
Maximum repeller	4	4	N/A	4
Maximum emission current, μA	240	50	N/A	50
Max electron energy, eV	240	240	N/A	240

Notes for Table 13:

- N/A: Not available.
- Abundance target: Adjust higher or lower to get 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 .

7

General Maintenance

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Before Starting

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

Scheduled maintenance

Performing common maintenance tasks when scheduled can reduce operating problems, prolong system life, and reduce overall operating costs. (See **Table 14.**)

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.

Table 14 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 dry scroll pump tip seals	Every year
Tune the MS	As needed
Check the foreline pump	As needed
Clean the ion source	As needed
Check the carrier gas trap(s) on the GC and MS	As needed
Replace the worn out parts	As needed
Lubricate side plate or vent valve O-rings [†]	As needed
Replace GC gas supplies	As needed
Leak check the system	As needed

* Or as needed.

[†] 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.

Tools, spare parts, and supplies

Some of the required tools, spare parts, and supplies are included in the GC shipping kit, MS shipping kit, or MS 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 MS 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 the boards
- Wires and cables between the boards and the connectors on the back panel of the MS
- 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 MS turned on or plugged into its power source unless you are instructed to do so by one of the procedures in this chapter.

Some procedures in this chapter require access to the inside of the MS 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 MS operate at, or reach, temperatures high enough to cause serious burns. These parts include, but are not limited to:

- GC/MS interface

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Dangerous temperatures

- Analyzer parts
- Vacuum pumps

WARNING

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

WARNING

The GC/MS 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 MS is off. The GC/MS 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 could have an optional 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. Install a hose to take the exhaust from the foreline pump outdoors or into a fume hood vented to the outdoors. This requires removing the oil trap. 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.

The fluids in the 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 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.

WARNING

The optional dry scroll foreline pump may contain significant quantities of dust. This dust can contain traces of the chemicals analyzed by the mass spectrometer. When replacing the pump's tip seal, do NOT use compressed air to blow out this dust. Using compressed air will contaminate your laboratory with potentially hazardous dust.

Ion source cleaning

The main effect of operating the MS 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. Operate the MS 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 MS with methane after using ammonia.

Install the ammonia so the tank is in an upright position. This will help prevent liquid ammonia from getting into the flow module.

Electrostatic discharge

All of the printed circuit boards in the MS contain components that can be damaged by 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

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Electrostatic discharge

mass filter (quadrupole) and CC contact wires which can carry ESD to sensitive components on the quad driver board. ESD damage may not cause immediate failure, but it will gradually degrade the performance and stability of your MS.

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 MS. This includes the analyzers.

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 14** on page 148.) These include:

- Checking the foreline pump fluid (every week)
- Checking the calibration vial(s) (every 6 months)
- Replacing the foreline pump oil (every 6 months or as needed)
- Tightening the foreline pump oil box screws (first oil change after installation)
- Replacing the foreline pump (typically, every 3 years)
- Replacing the tip seals in the optional dry scroll pump (every year)
- Checking the system for leaks (On a monthly basis for safety, or as needed depending upon the type of gases being used in the lab.)

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 an ion vacuum gauge should be performed only when needed. Refer the *Agilent 7000/7010 Series Triple Quad GC/MS Troubleshooting and Maintenance Manual* and the online help in the MassHunter WorkStation 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 the *Agilent 7000/7010 Series Triple Quad GC/MS Troubleshooting and Maintenance Manual*.

Most of the procedures in this chapter are illustrated with video clips on the Agilent GC/MS Hardware User Information & Instrument Utilities DVD.

Maintaining the Analyzer

Scheduling

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

- Cleaning the ion sources
- Replacing filaments
- Replacing the EM horn

The *Agilent 7000/7010 Series Triple Quad GC/MS Troubleshooting and Maintenance Manual* provides information about symptoms that indicate the need for analyzer maintenance. The troubleshooting material in the online help in the MassHunter Workstation software provides more extensive information.

Precautions

Cleanliness

Keep components clean during analyzer maintenance. Analyzer maintenance involves opening either analyzer chamber, and removing parts from the analyzers. During analyzer maintenance procedures, avoid contaminating the analyzers or interior of the analyzer chambers. Wear clean gloves during all analyzer maintenance procedures. After cleaning, parts must be thoroughly baked out before they are reinstalled. 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 MS.

WARNING

The analyzers operate at high temperatures. Do not touch any part until you are sure it is cool.

Electrostatic discharge

The wires, contacts, and cables connected to the analyzer components can carry ESDs to the electronics boards to which they are connected. This is especially true of the mass filter (quadrupole) and CC contact wires which can conduct ESD to sensitive components on the quad driver board. ESD damage may not cause immediate failure but will gradually degrade performance and stability. (See **“Electrostatic discharge”** on page 151 for more information.)

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. (See **“Electrostatic discharge” on page 151.) Take other antistatic precautions *before* you open the analyzer chambers.**

Analyzer parts that should not be disturbed

The mass filters (quadrupoles) and the CC require no periodic maintenance. In general, the mass filters should never be disturbed. In the event of extreme contamination, they can be cleaned, but such cleaning should only be done by a trained Agilent Technologies service representative.

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 7000/7010 Series Triple Quad GC/MS Troubleshooting and Maintenance Manual*.

To Open the Front Analyzer Chamber

The front analyzer chamber should only be opened to clean or replace the ion source, 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 before you open the analyzer chamber. (See [“Electrostatic discharge”](#) on page 151.)



Procedure

- 1 Vent the MS. (See [“Venting the MS”](#) on page 105.)
- 2 Open the left side panel. (See [“To Open Left Side Panel for Access to the Analyzer Chambers”](#) on page 119.)

WARNING

The analyzer, GC/MS 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 front analyzer side plate thumbscrews if they are fastened. (See [Figure 47](#) on page 158.)

7 General Maintenance

To Open the Front Analyzer Chamber

The bottom thumbscrew on the front 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 MS is vented. Verify that both the front and rear side plate screws are completely loose.

4 Gently swing the side plate out. (See [Figure 47](#) on page 158.)

7 General Maintenance

To Open the Front Analyzer Chamber

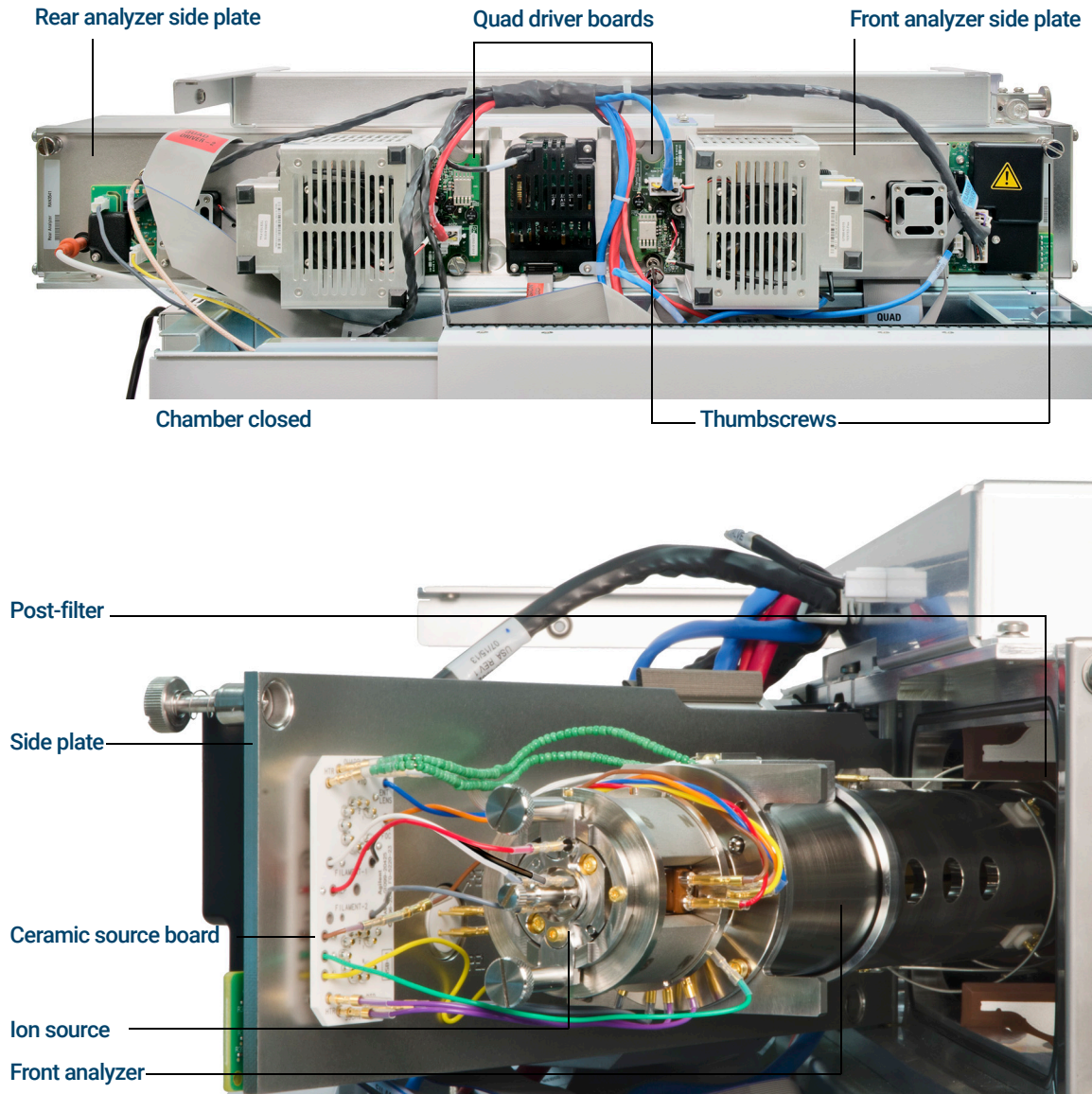


Figure 47. The front analyzer chamber on a 7010 MS

To Remove the EI HES

Materials needed

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



Procedure

- 1 Vent the MS. (See **"To Vent the MS"** on page 124.)

WARNING

The analyzers, GC/MS 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

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.

- 2 Open the front analyzer chamber. (See **"To Open the Front Analyzer Chamber"** on page 156.)
- 3 Remove the two large thumbscrews that hold the ion source in place. (See **Figure 48** on page 160.)
- 4 Disconnect wiring from the EI HES. Do not bend the wires any more than necessary. (See **"To Connect or Disconnect Wiring to the EI HES"** on page 161.)

7 General Maintenance

To Remove the EI HES

- 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. (See [Figure 48.](#))

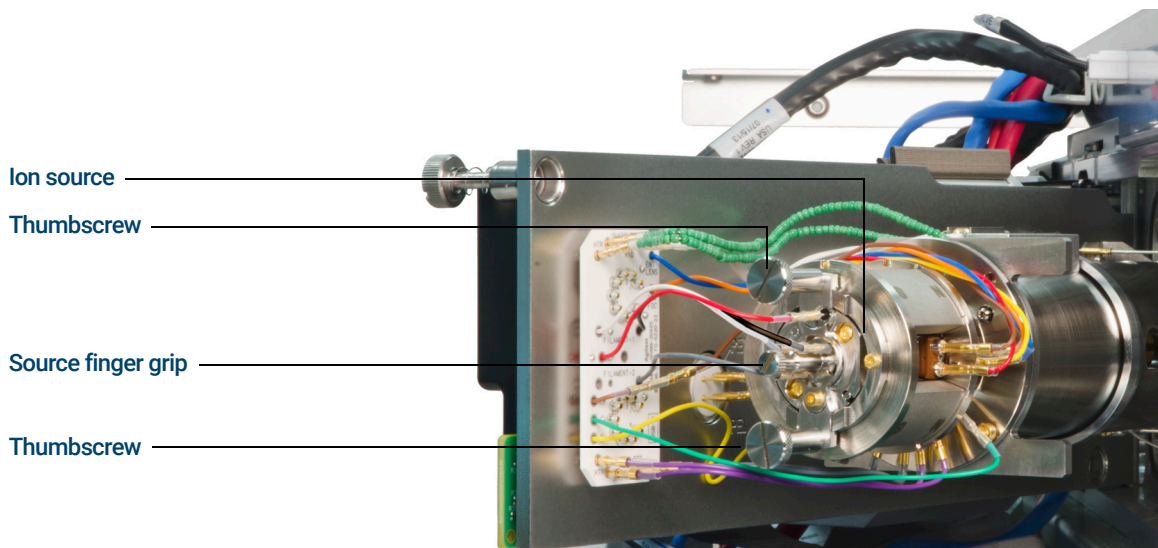


Figure 48. The EI HES before removal

7 General Maintenance

To Connect or Disconnect Wiring to the EI HES

To Connect or Disconnect Wiring to the EI HES

This topic is used to identify the wiring connections to the ion source. (For detailed procedures and videos, see **“To Remove the EI HES”** on page 159 or **“To Install the EI HES”** on page 185.)

Materials needed

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

Procedure

Use tweezers or pliers to connect or disconnect the ceramic board wire leads (red, white, black, and gray) at the source connectors. (See **Figure 49**.)

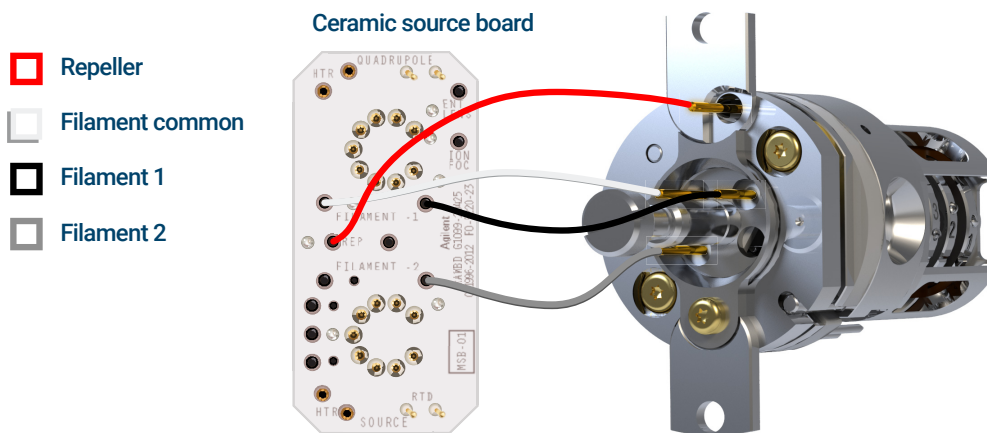


Figure 49. Wiring for the EI HES

To Remove the EI XTR Source

Materials needed

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



Procedure

- 1 Vent the MS. (See **“To Vent the MS”** on page 124.)

WARNING

The analyzers, GC/MS 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

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.

- 2 Open the front analyzer chamber. (See **“To Open the Front Analyzer Chamber”** on page 156.)

7 General Maintenance

To Remove the EI XTR Source

- 3 Disconnect wiring from the EI XTR. Do not bend the wires any more than necessary. (See **"To Connect or Disconnect Wiring to the EI XTR Source"** on page 164.)
- 4 Remove the thumbscrews that hold the ion source in place. (See **Figure 50.**)
- 5 Pull the ion source out of the source radiator.

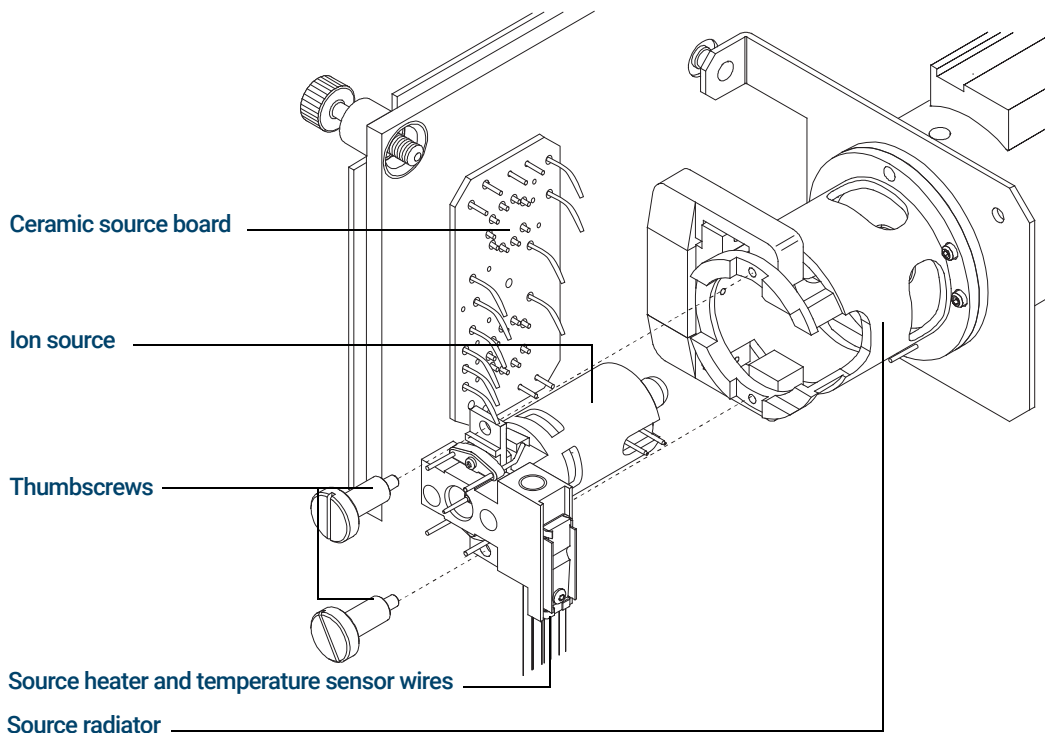


Figure 50. Removing the EI XTR source

To Connect or Disconnect Wiring to the EI XTR Source

This topic is used to identify the wiring connections to the ion source. (For detailed procedures and videos, see **“To Remove the EI XTR Source”** on page 162 or **“To Install the EI XTR Source”** on page 187.)

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 pliers to connect or disconnect the ceramic board wire leads at the source connectors.
- 2 Use tweezers or pliers to connect or disconnect the source heater wire leads at the ceramic source board (CSB). (See **Figure 51**.)

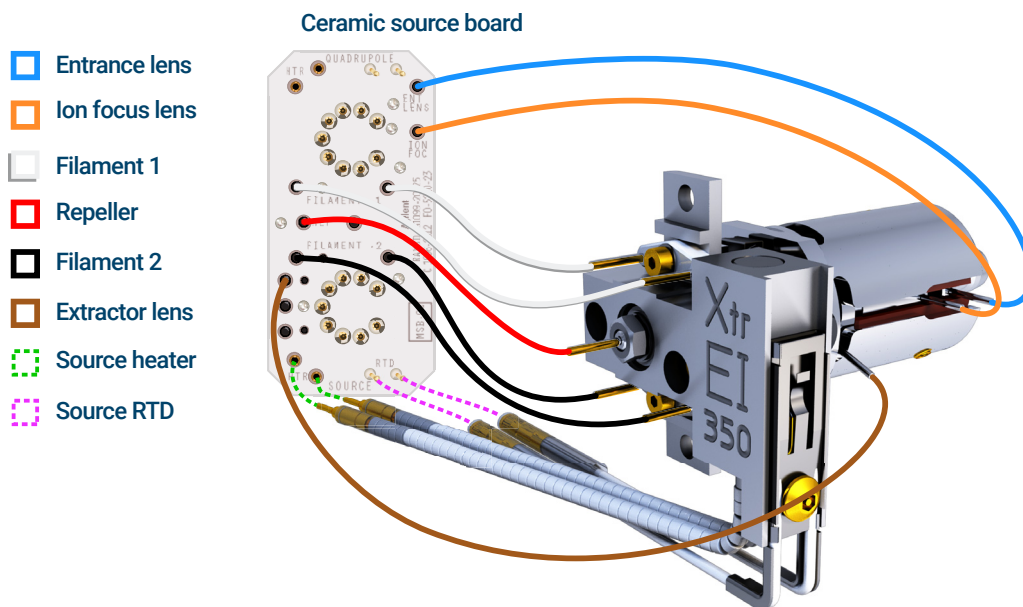


Figure 51. Wiring for the EI XTR

To Disassemble 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 and the EI HES parts list while using this procedure. (See **Figure 52** on page 166 and **Table 15** on page 166.)

- 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 and using the finger grip, remove the filament block.

CAUTION

Use care when removing the filament from the filament block. Putting excessive stress on this can break or crack it. 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.
- 4 Remove the finger grip from the filament block.
- 5 Use a T6 Torx screwdriver to remove the two screws securing the source mount to the source body.
- 6 Use the finger grip to remove the source mount from the lens body.
- 7 Remove the repeller and ring heater sensor assembly from the source body.
- 8 Separate the repeller from the ring heater assembly.
- 9 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.
- 10 If necessary, use gravity to remove the lens stack ceramic insulator from the source body.

7 General Maintenance

To Disassemble the EI HES

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.

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

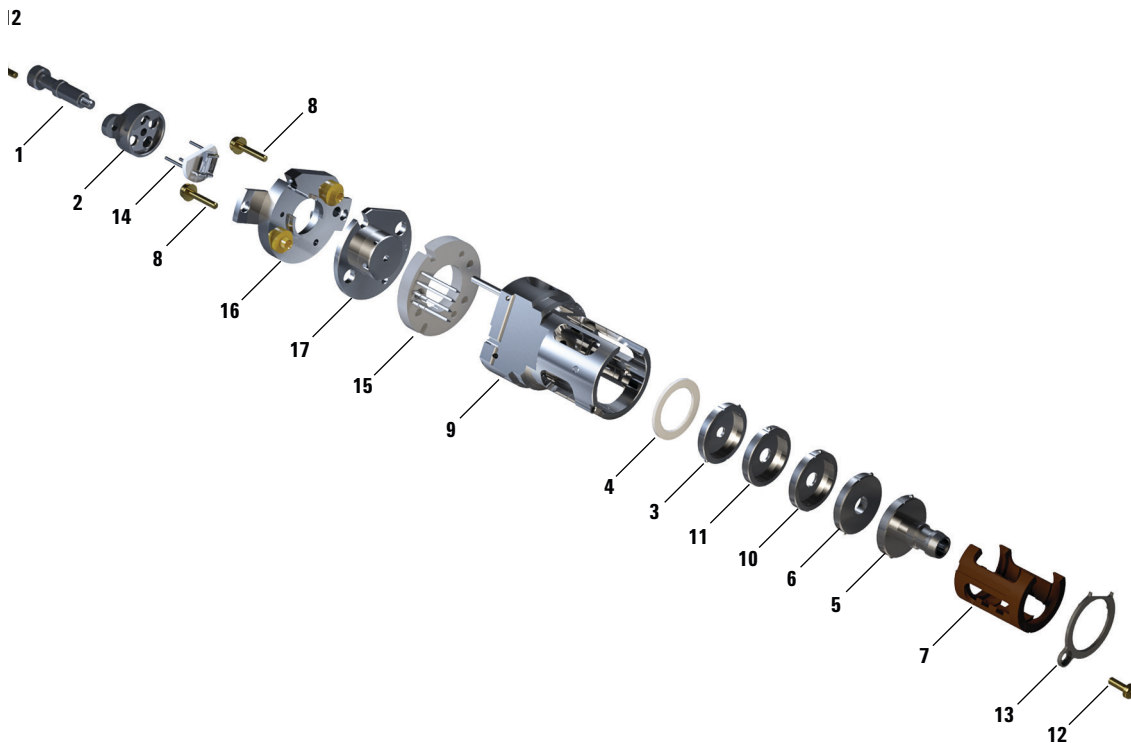


Figure 52. Exploded parts view of the EI HES

Table 15 Parts list for EI HES (Figure 52)

Item number	Item description	Part number
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

7 General Maintenance

To Disassemble the EI HES

Table 15 Parts list for EI HES (Figure 52) (continued)

Item number	Item description	Part number
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	G7002-60057
Not shown	HES assembly	G7004-67056

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

To Disassemble 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)
- Nut driver, 5.5 mm (8710-1220)
- Tweezers (8710-2460)



Procedure

Refer to the exploded parts view and the EI XTR parts list while using this procedure. (See **Figure 53** and **Table 16** on page 169.)

- 1 Remove the ion source. (See **“To Remove the EI XTR Source”** on page 162.)
- 2 Remove the filaments. (See **“To Remove a Filament from the EI XTR Source”** on page 189.)
- 3 Separate the source heater assembly from the source body by removing the two screws. The source heater assembly includes the source heater, repeller, and related parts. (See **Figure 53** and **Table 16** on page 169.)
- 4 Disassemble the repeller assembly by removing the repeller nut, washers, ceramic insulators and repeller. (See **Figure 53** on page 169.)
- 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, extractor lens, extractor lens insulator, and extended entrance lens. (See **Figure 53** on page 169.)

7 General Maintenance

To Disassemble the EI XTR Source

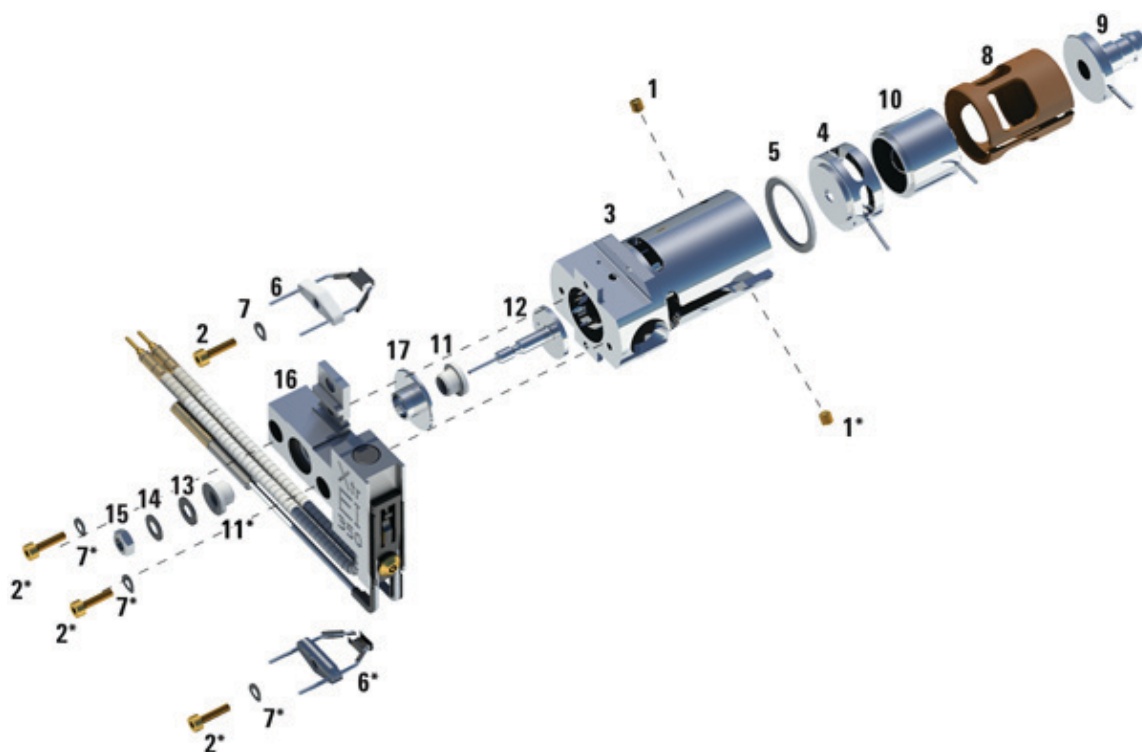


Figure 53. Disassembling the EI XTR source

Table 16 Parts list for EI XTR source (Figure 53)

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

7 General Maintenance

To Disassemble the EI XTR Source

Table 16 Parts list for EI XTR source (Figure 53) (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

To Clean the EI HES

Materials needed

- Abrasive paper (5061-5896)
- Alumina abrasive powder, 100 g (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 ion source. (See **"To Disassemble the EI HES"** on page 165 or **"To Disassemble the EI XTR Source"** on page 168.)
- 2 Collect the following parts to be cleaned if you are cleaning an EI HES: (See **Figure 54** on page 172.)
 - Repeller
 - Source body
 - Extractor lens (5)
 - Post extractor lens 1 (4)
 - Post extractor lens 2 (3)
 - Ion focus lens (2)
 - Extended entrance lens (1)

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

7 General Maintenance

To Clean the EI HES

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.

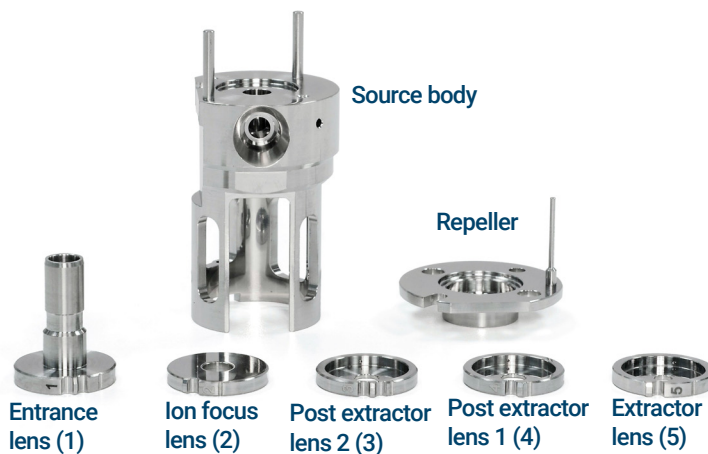


Figure 54. EI HES parts to be cleaned

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.

7 General Maintenance

To Clean the EI HES

- 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.

To Clean the EI XTR Source

Materials needed

- Abrasive paper (5061-5896)
- Alumina abrasive powder, 100 g (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
 - Acetone, reagent grade
 - Methanol, reagent grade
 - Methylene chloride, reagent grade
- Ultrasonic bath

Preparation

- 1 Disassemble the EI XTR source. (See **"To Disassemble the EI XTR Source"** on page 168.)
- 2 Collect the following parts to be cleaned for an EI XTR source: (See **Figure 55** on page 175.)
 - Repeller
 - Repeller block insert
 - Entrance lens
 - Ion focus lens
 - Extractor lens
 - Source body

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

7 General Maintenance

To Clean the EI XTR Source

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.

CAUTION

The filaments, source heater assembly, and insulators cannot be cleaned ultrasonically. Replace these components if major contamination occurs.



Figure 55. EI XTR 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.

7 General Maintenance

To Clean the EI XTR Source

- 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.

To Assemble 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 and the EI HES parts list while using this procedure. (See [Figure 58](#) and [Table 17](#) on page 180.)

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 56](#).) The lens number is engraved into the outer circumference of each lens.
 - a Starting with the extended 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 on the back of the lens insulator.
 - b Insert the next 4 lenses, in numerical order, into the lens insulator. The lens chamber open end always faces the extended 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.

7 General Maintenance

To Assemble the EI HES

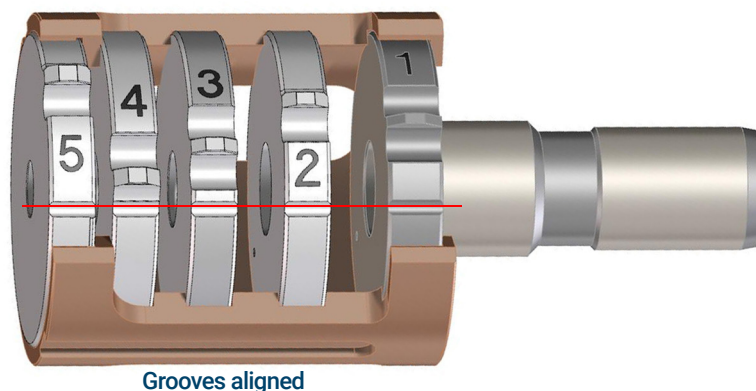


Figure 56. Assembled EI HES lens stack

- 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 58](#) on page 180.) 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 57](#).)

7 General Maintenance

To Assemble the EI HES



Figure 57. Secure the lens screw and locking 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 Thread the finger grip into the filament block. (See [Figure 58](#) and [Table 17](#) on page 180.)
- 10 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.
- 11 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.

7 General Maintenance

To Assemble the EI HES

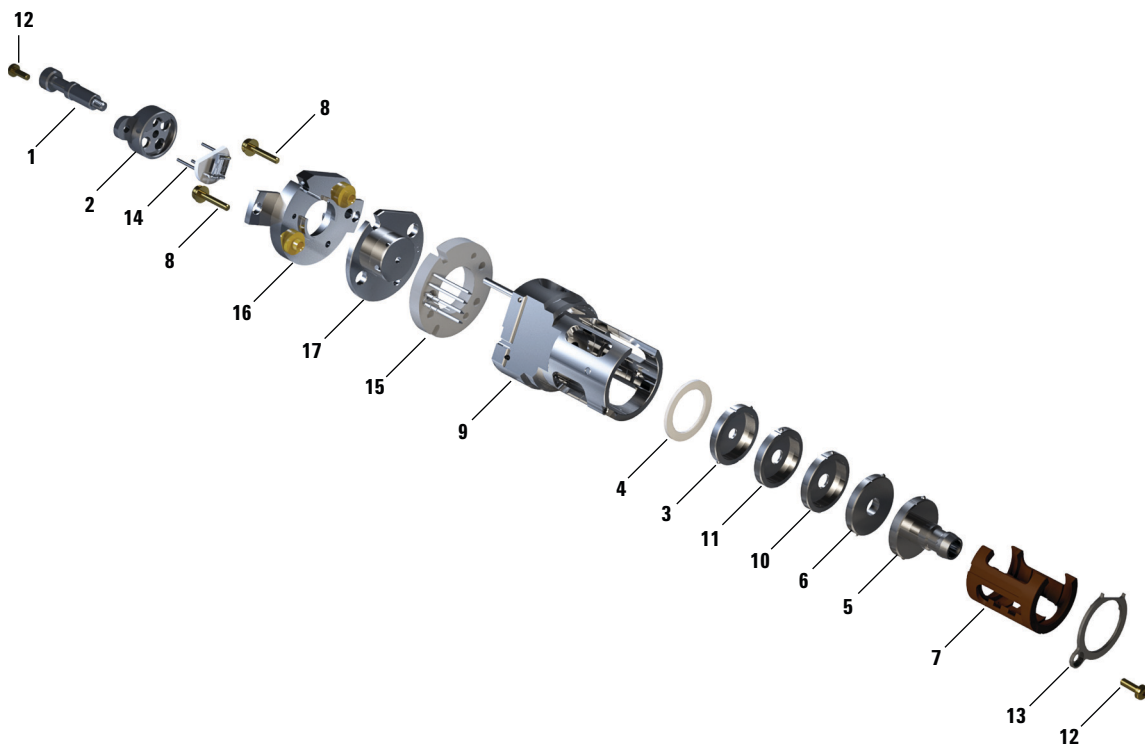


Figure 58. Assembling the EI HES

Table 17 Parts list for EI HES (Figure 58)

Item number	Item description	Part number
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 × 0.4 screw × 12 mm long gold plated screw	G7002-20083
9	Source body	G7002-20084

7 General Maintenance

To Assemble the EI HES

Table 17 Parts list for EI HES (Figure 58) (continued)

Item number	Item description	Part number
10	Post extractor lens 2 (3)*	G7004-20090
11	Post extractor lens 1 (4)*	G7004-20004
12	M2 × 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	G7002-60057
Not shown	HES assembly	G7004-67056

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

To Assemble 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

CAUTION

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

Refer to the exploded parts view and the EI XTR parts list while using this procedure. (See [Figure 59](#) and [Table 18](#) on page 183.)

- 1 Assemble the ion focus lens, extended entrance lens, and lens insulator. (See [Figure 59](#) and [Table 18](#) on page 183.)
- 2 Attach the extractor lens insulator to the extractor lens, and slide them into the source body. (See [Figure 59](#) on page 183.)
- 3 Slide the parts assembled in step 1 into the source body.
- 4 Install the setscrew that holds the lenses in place.

CAUTION

While installing, 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.

- 5 Assemble the repeller assembly by attaching the repeller, repeller insulators, washers, and repeller nut onto the source heater assembly.
- 6 Attach the repeller assembly to the source body with two screws and washers.
- 7 Install the filaments. (See [“To Install a Filament on the EI XTR Source”](#) on page 191.)

7 General Maintenance

To Assemble the EI XTR Source

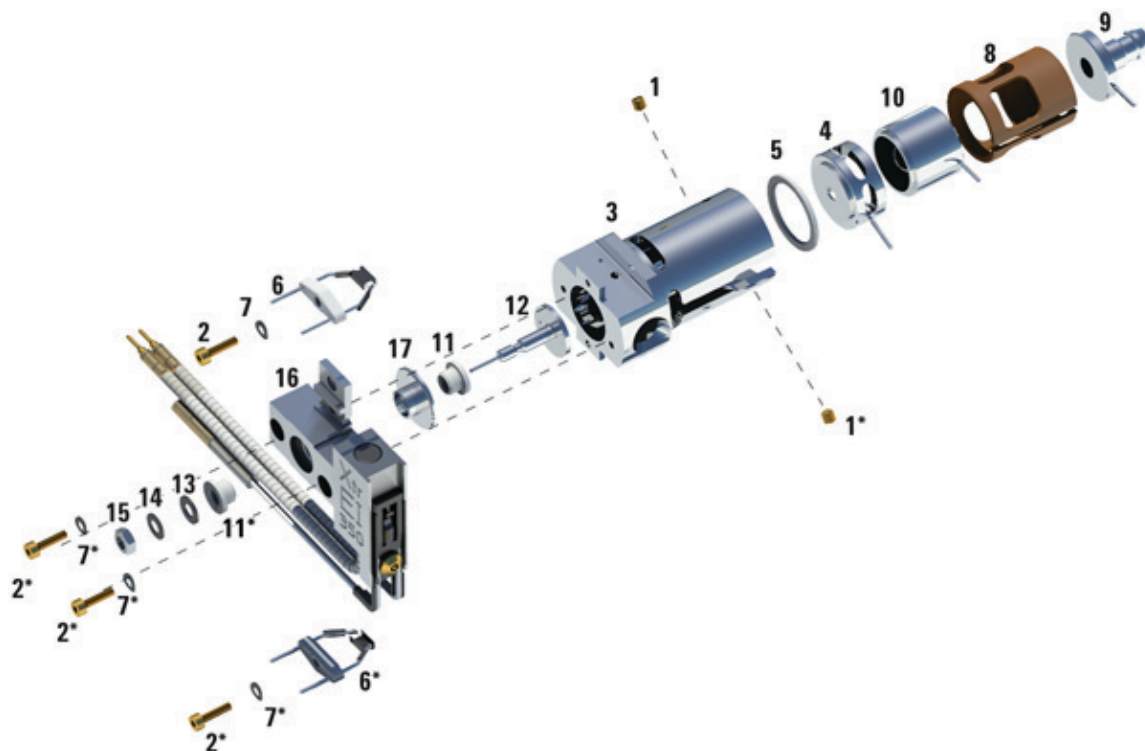


Figure 59. Assembling the EI XTR source

Table 18 Parts list for EI XTR source (Figure 59)

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

7 General Maintenance

To Assemble the EI XTR Source

Table 18 Parts list for EI XTR source (Figure 59) (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

To Install the EI HES

Materials needed

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



Procedure

CAUTION

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

- 1 Vent the MS. (See **"To Vent the MS"** on page 124.)
- 2 Open the front analyzer chamber. (See **"To Open the Front Analyzer Chamber"** on page 156.)
- 3 Align the ion source 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. (See **Figure 60**). Slide the ion source into the source radiator until resistance is felt.

EI HES
thumbscrew
attachment

Slots for source
mount alignment

EI HES thumbscrew
attachment

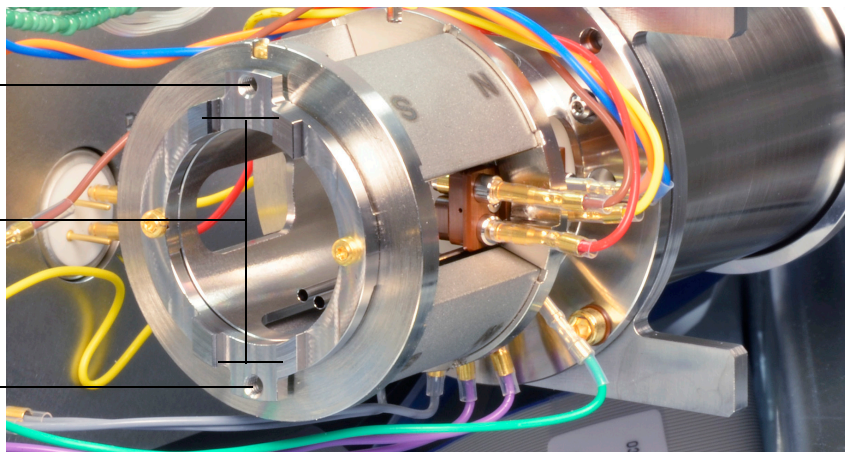


Figure 60. The EI HES radiator

7 General Maintenance

To Install the EI HES

- 4 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 electrical contacts, spring loaded surfaces.
- 5 Connect the ion source wires. (See **"To Connect or Disconnect Wiring to the EI HES"** on page 161.)
- 6 Install and hand-tighten the source thumbscrews. Do not overtighten the thumbscrews. (See **Figure 60** on page 185.)
- 7 Close the front analyzer chamber. (See **"To Close the Front Analyzer Chamber"** on page 195.)
- 8 Pumpdown the MS. (See **"To Pumpdown the MS"** on page 120.)
- 9 Tune the MS. (See **"To Autotune the MS for EI Mode"** on page 117.)

To Install the EI XTR Source

Materials needed

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



Procedure

CAUTION

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

- 1 Vent the MS. (See **"To Vent the MS"** on page 124.)
- 2 Open the front analyzer chamber. (See **"To Open the Front Analyzer Chamber"** on page 156.)
- 3 Slide the ion source into the source radiator. (See **Figure 61** on page 188.)
- 4 Install and hand-tighten the source thumbscrews. Do not overtighten the thumbscrews. (See **Figure 61** on page 188.)
- 5 Connect the ion source wires. (See **"To Connect or Disconnect Wiring to the EI XTR Source"** on page 164.)

7 General Maintenance

To Install the EI XTR Source

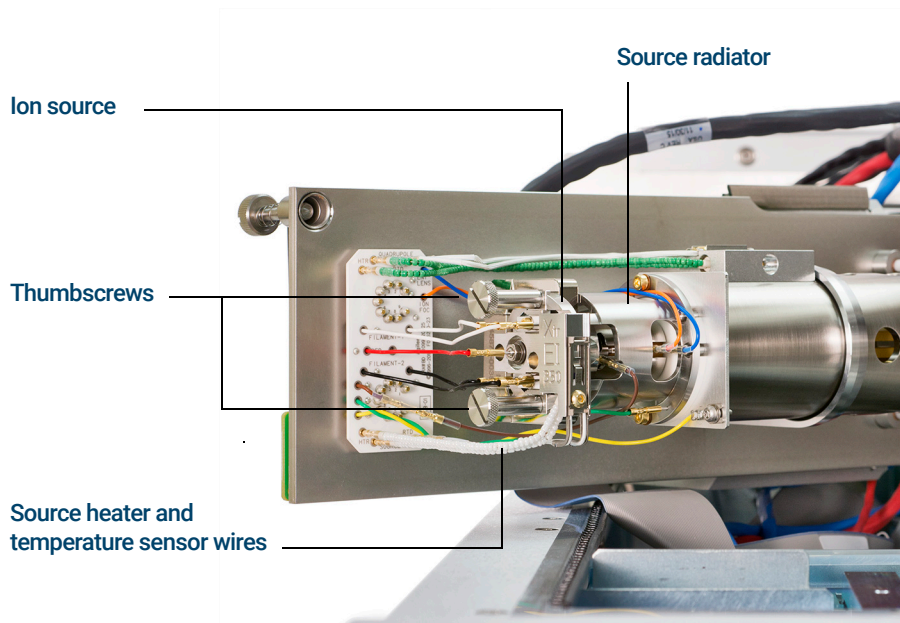


Figure 61. Installing the EI XTR source on a 7000 Series MS

- 6 Close the front analyzer chamber. (See **"To Close the Front Analyzer Chamber"** on page 195.)
- 7 Pumpdown the MS. (See **"To Pumpdown the MS"** on page 120.)
- 8 Tune the MS. (See **"To Autotune the MS for EI Mode"** on page 117.)

To Remove a Filament from the EI XTR Source

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 MS. (See **"To Vent the MS"** on page 124.)

CAUTION

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

WARNING

The analyzer, GC/MS 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 front analyzer chamber. (See **"To Open the Front Analyzer Chamber"** on page 156.)
- 3 Remove the ion source. (See **"To Remove the EI XTR Source"** on page 162.)
- 4 Remove the screws holding the filaments to the ion source body. (See **Figure 62** on page 190.)
- 5 Slide the filaments off the ion source assembly. (See **Figure 62** on page 190.)

7 General Maintenance

To Remove a Filament from the EI XTR Source

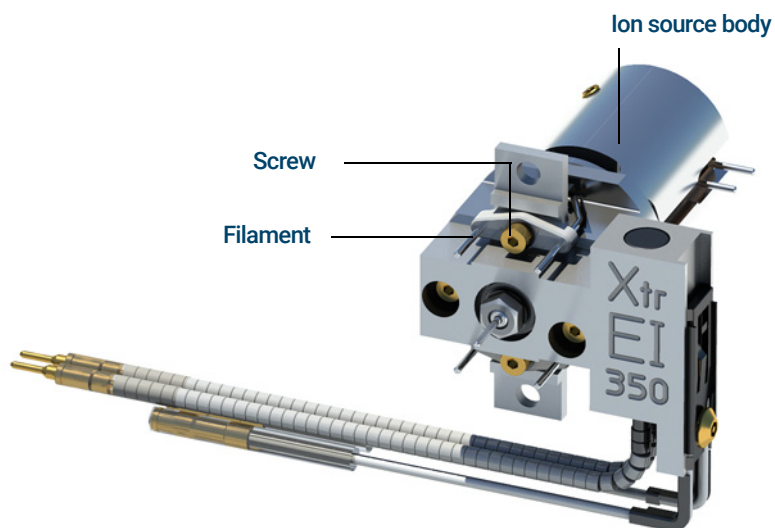


Figure 62. Changing the EI XTR filament

To Install a Filament on the EI XTR Source

Materials needed

- Filament assembly, EI (G7005-60061)
- Gloves, clean, lint-free (Large 8650-0030) (Small 8650-0029)
- Tweezers (8710-2460)



Procedure

- 1 Remove the old filament. (See **"To Remove a Filament from the EI XTR Source"** on page 189.)
- 2 Place the new filament into its position on the ion source body. (See **Figure 62** on page 190.)
- 3 Secure the filament to the ion source body with the screw.
- 4 After installing the filament, verify that it is not grounded to source body.
- 5 Reinstall the ion source. (See **"To Install the EI XTR Source"** on page 187.)
- 6 Close the front analyzer chamber. (See **"To Close the Front Analyzer Chamber"** on page 195.)
- 7 Pumpdown the MS. (See **"To Pumpdown the MS"** on page 120.)
- 8 Autotune the MS. (See **"To Autotune the MS for EI Mode"** on page 117.)

To Remove 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 MS. (See **"To Vent the MS"** on page 124.)

CAUTION

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

WARNING

The analyzer, GC/MS 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 front analyzer chamber. (See **"To Open the Front Analyzer Chamber"** on page 156.)
- 3 Remove the ion source, and place it on a clean cloth on your work surface. (See **"To Remove the EI HES"** on page 159.)
- 4 Remove the screw securing the filament block to the source mount. (See **Figure 63.**)

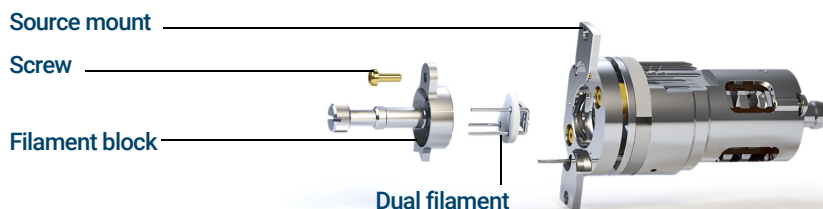


Figure 63. Replacing the dual filament

- 5 Use the hand grip on the filament block to remove the filament block from the source.

7 General Maintenance

To Remove the EI HES Filaments

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.

To Install the EI HES Filaments

Materials needed

- Filament assembly, high efficiency dual filament (G7002-60001)
- 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 **"To Remove the EI HES Filaments"** on page 192.)
- 2 Insert the three pins on the dual filament through the rear of the filament block. (See **Figure 63** on page 192.)
- 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 **"To Install the EI HES"** on page 185.)
- 6 Close the front analyzer chamber. (See **"To Close the Front Analyzer Chamber"** on page 195.)
- 7 Pumpdown the MS. (See **"To Pumpdown the MS"** on page 120.)
- 8 Autotune the MS. (**"To Autotune the MS for EI Mode"** on page 117.)

To Close the Front Analyzer Chamber



Procedure

- 1 Check the side plate O-ring.

Ensure 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 *7000/7010 Series MS Troubleshooting and Maintenance Manual* for lubricating instructions.

CAUTION

Do not force the analyzer door when closing, or you may damage the CC or quadrupole.

- 2 Swing the front analyzer side plate closed.

The post-filter on the exit side of the quad helps to position the CC when the analyzer door is closed. When closing, the door should give minimal resistance while the quad is reseating the CC. The analyzer should slide into place with minimal pressure.

- 3 Ensure the rear analyzer door is closed.
- 4 Ensure the vent valve is closed.

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.

- 5 If hydrogen or an other flammable or toxic substance is used for carrier gas, *gently* hand-tighten the top thumbscrew on the front analyzer side plate.
- 6 Pumpdown the MS. (See **"To Pumpdown the MS"** on page 120.)
- 7 Once the MS has pumped down, close the left analyzer cover and replace the window cover.
- 8 Tune the MS.

To Remove Left Rear Cover

The rear cover should be removed to open the rear analyzer side plate. This is necessary when replacing the electron multiplier horn. If you need to access the rear analyzer chamber, follow these procedures to remove the rear cover. (See **Figure 64** on page 197.)

Materials needed

- Screwdriver, Torx T-10 and T-20



Procedure

- 1 Loosen the top screw of the rear cover. It is captive so you will not be able to remove it entirely. (See **Figure 64** on page 197.)
- 2 Lift the bottom flap of the cover out of the groove in the back of the MS to free the cover.

WARNING

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

7 General Maintenance

To Remove Left Rear Cover

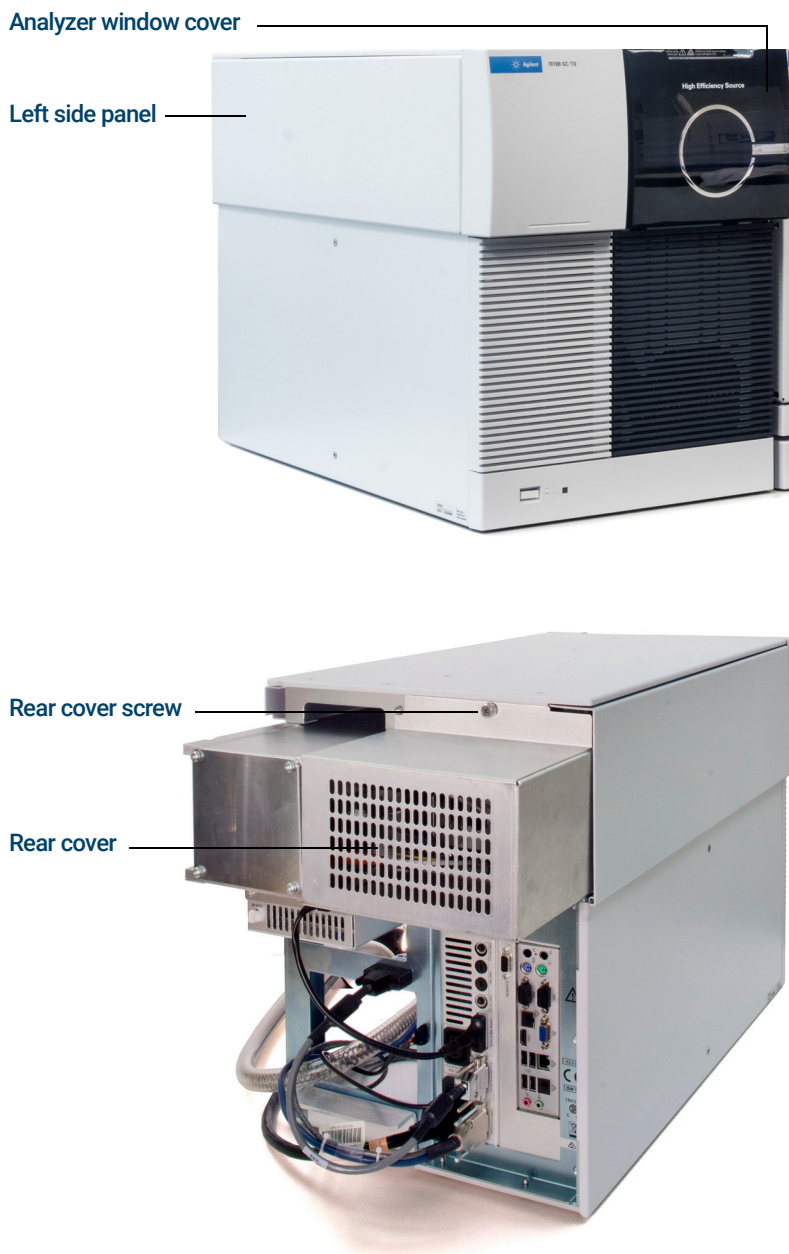


Figure 64. Removing covers

To Open the Rear Analyzer Chamber

The rear analyzer chamber should only be opened to change the EM horn.

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 before you open the analyzer chamber. (See [“Electrostatic discharge”](#) on page 151.)

Procedure

- 1 Vent the MS. (See [“To Vent the MS”](#) on page 124.)
- 2 Remove the analyzer window cover. (See [“To Remove Left Rear Cover”](#) on page 196.)
- 3 Open the left side panel. (See [“To Open Left Side Panel for Access to the Analyzer Chambers”](#) on page 119.)

WARNING

The analyzer, GC/MS 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.

- 4 Loosen the rear analyzer side plate thumbscrews, if they are fastened. (See [Figure 65](#) on page 200.)

7 General Maintenance

To Open the Rear Analyzer Chamber

Both thumbscrews for the rear analyzer side plate should have their threads engaged during normal operation.

CAUTION

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

5 ***Gently*** swing the side plate out.

7 General Maintenance

To Open the Rear Analyzer Chamber

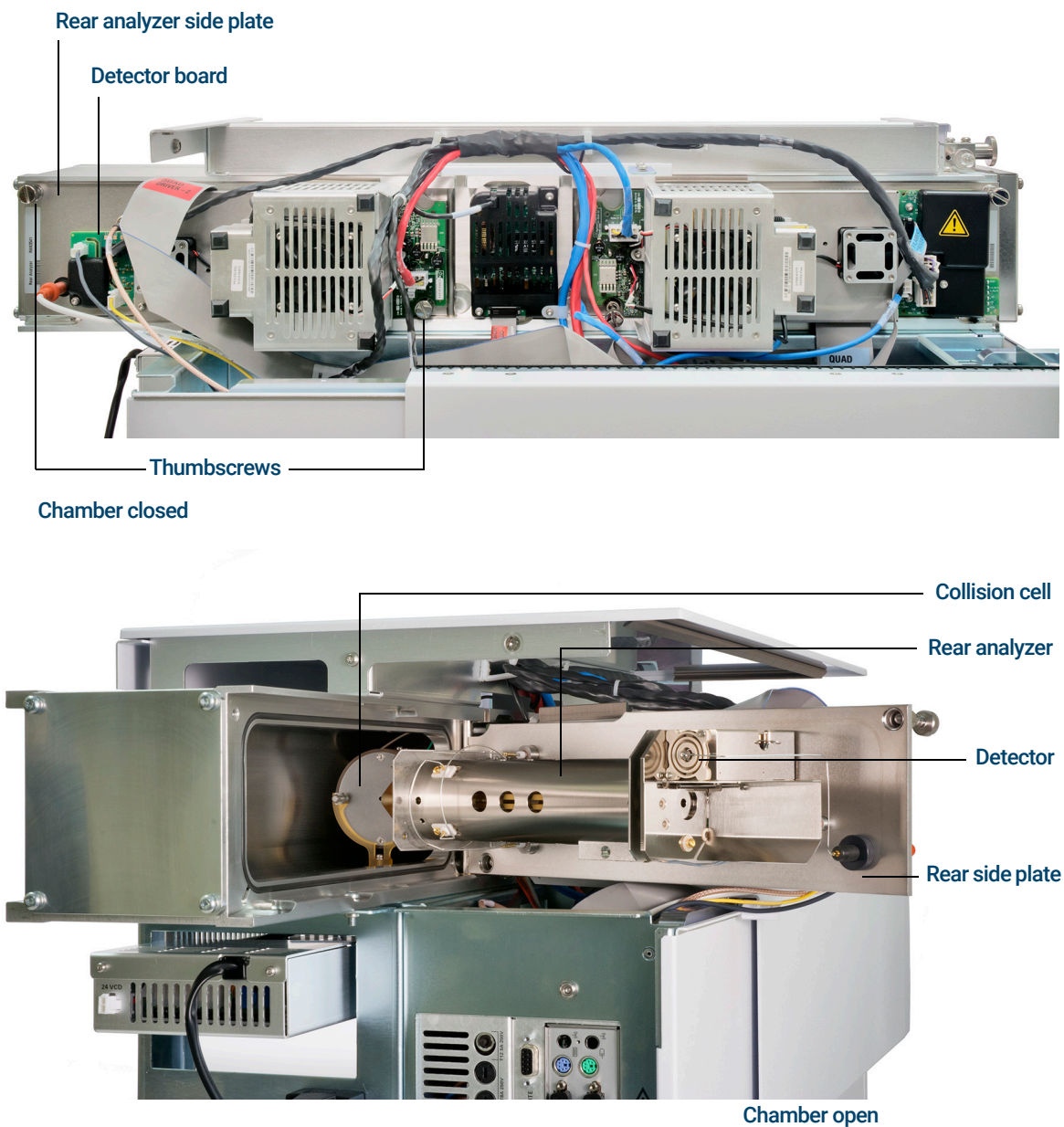


Figure 65. The rear analyzer chamber

To Replace the EM Horn

The replacement EM horn part number for this Series 2 detector is stamped on the front face of the detector. Through MassHunter, 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 dialog.

Materials needed

- EM 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 MS. (See **"To Vent the MS"** on page 124.)

WARNING

The analyzer, GC/MS 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 rear analyzer chamber. (See **"To Open the Rear Analyzer Chamber"** on page 198.)
- 3 Slide the blue signal wire from the connector in the side plate. (See **Figure 66** on page 202.)
- 4 Open the retaining clip. (See **Figure 66** on page 202.) Lift the arm of the clip up, and swing the clip away from the EM horn.
- 5 Remove the EM horn.
- 6 Hold the new horn with blue signal wire end down, and attach the signal wire to the connector in the side plate. (See **Figure 67** on page 202.)
- 7 Slide the EM horn into position.
- 8 Close the retaining clip.

7 General Maintenance

To Replace the EM Horn

- 9 Close the rear analyzer chamber. (See **"To Close the Rear Analyzer Chamber"** on page 203.)

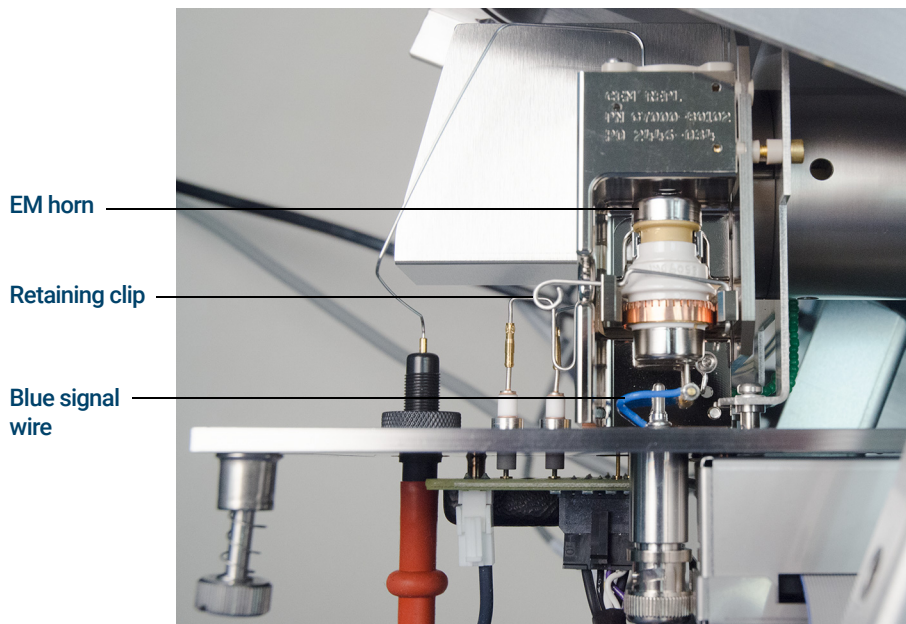


Figure 66. Replacing the EM horn (on a Series 2 detector)



Figure 67. EM horn for a Series 2 detector

To Close the Rear Analyzer Chamber

Materials needed

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

Procedure

- 1 Check the side plate O-ring.

Ensure 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 *7000/7010 Series MS Troubleshooting and Maintenance Manual* for lubrication instructions.

CAUTION

Do not force the analyzer side plate when closing, or you may damage the CC or quadrupole.

- 2 Close the rear analyzer side plate. The prefilter on the entrance side of the quad helps to position the CC when the analyzer door is closed. When closing, the door should give minimal resistance while the quad is reseating the CC. The analyzer should slide into place with minimal pressure.
- 3 Engage both rear analyzer side panel thumbscrews and gently hand tighten them. Do not over tighten the thumbscrews; this can cause air leaks.
- 4 Ensure the front analyzer side plate is closed.
- 5 Ensure the vent valve is closed.
- 6 Pumpdown the MS. (See **"To Pumpdown the MS"** on page 120.)

WARNING

The top thumbscrews on both analyzer side plates must be loosely fastened if hydrogen (or other hazardous gas) is being used as the GC carrier gas. In the unlikely event of an explosion, they may prevent the side plates from opening.

CAUTION

Do not overtighten the thumbscrews; it can cause air leaks or prevent successful pumpdown. Do not use a screwdriver to tighten the thumbscrew.

- 7 If hydrogen or any other flammable material is used for the carrier gas, gently hand-tighten the top thumbscrew on the front analyzer side plate.
- 8 Once the MS has pumped down, close the left side panel, replace the rear cover, and replace the analyzer window cover.
- 9 Tune the MS.

7 General Maintenance

To Close the Rear Analyzer Chamber

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This chapter describes maintenance procedures and requirements that are unique to 7000/7010 Series MS equipped with the CI hardware.

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

General Information

Ion source cleaning

The main effect of operating the MS 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. Operate the MS 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 MS with methane after using ammonia.

Install the ammonia with the tank in an upright position. This will help prevent liquid ammonia from getting into the flow module.

To set up your MS for CI operation

Setting up your MS 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/MS system is performing correctly.
- Ensure 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.

To Switch from an EI XTR Source to the CI Source

CAUTION

Always verify MS performance in EI before switching to CI operation.

Always set up the CI MS in PCI first, even if you are going to run NCI.

Procedure

- 1 Vent the MS. (See **"To Vent the MS"** on page 124.)

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 151.) Take antistatic precautions *before* you open the analyzer chamber.

- 2 Open the analyzer. (See **"To Open the Front Analyzer Chamber"** on page 156.)
- 3 Remove the EI XTR source. (See **"To Remove the EI XTR Source"** on page 162.)
- 4 Remove the brown extractor wire from the CSB and store it with the EI extractor storage box. (See **"To Connect or Disconnect Wiring to the EI XTR Source"** on page 164.)
- 5 Install the CI source. (See **"To Install the 7010 Series CI Source"** on page 211.)
- 6 Close the analyzer. (See **"To Close the Front Analyzer Chamber"** on page 195.)
- 7 Pumpdown and switch from EI to CI mode. (See **"To Pumpdown and Switch from EI to CI Mode"** on page 144.)

To Remove 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

- 1 Vent the MS. (See **"To Vent the MS"** on page 124.)

WARNING

The analyzers, GC/MS 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

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.

- 2 Open the front analyzer chamber. (See **"To Open the Front Analyzer Chamber"** on page 156.)
- 3 Remove the EI HES source. (See **"To Remove the EI HES"** on page 159.)
- 4 Disconnect the wires from the radiator or CSB. Do not bend the wires any more than necessary. (See **"To Connect or Disconnect EI HES Radiator Wiring"** on page 210.)
- 5 Use a T10 Torx screwdriver to loosen the two screws that secure the radiator to the analyzer and place the radiator in its storage container. (See **Figure 68** on page 209.)

8 CI Maintenance

To Remove the EI HES Radiator

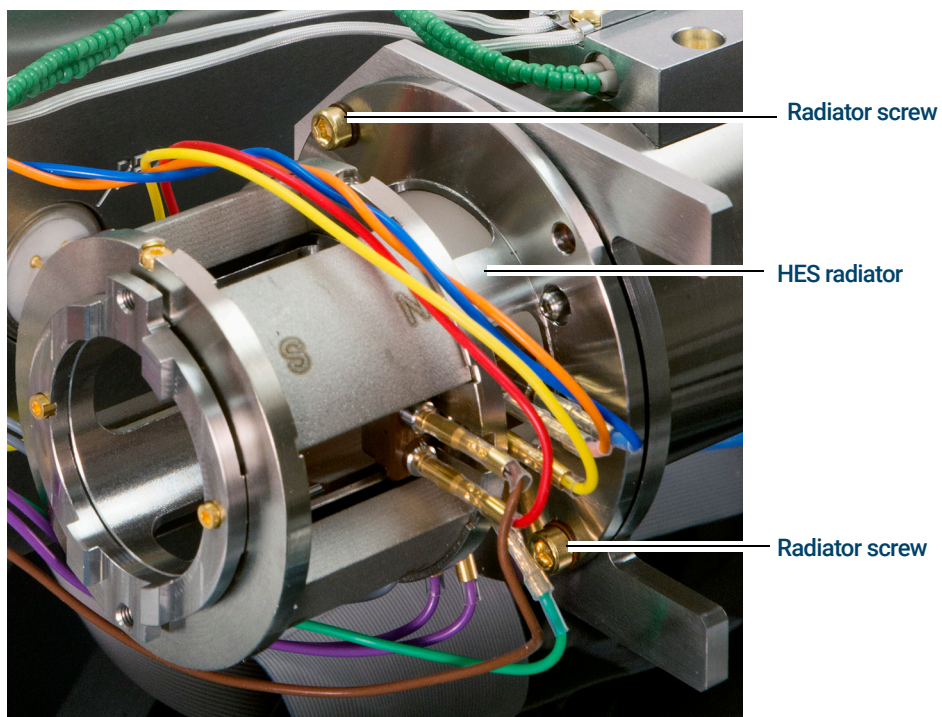


Figure 68. Removing the EI HES radiator

8 CI Maintenance

To Connect or Disconnect EI HES Radiator Wiring

To Connect or Disconnect EI HES Radiator Wiring

This topic is used to identify the wiring connections to the ion source. (For detailed procedures and videos, see **"To Remove the EI HES Radiator"** on page 208 or **"To Install the EI HES Radiator"** on page 214.)

Materials needed

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

Procedure

- 1 Use tweezers or needle nose pliers to connect or disconnect the green ground wire and the five lens wires from the radiator. Do not bend the wires any more than necessary. (See **Figure 69**.)
- 2 Use tweezers or needle nose pliers to connect or disconnect the two purple source heater wires and the two gray RTD wires from the CSB.

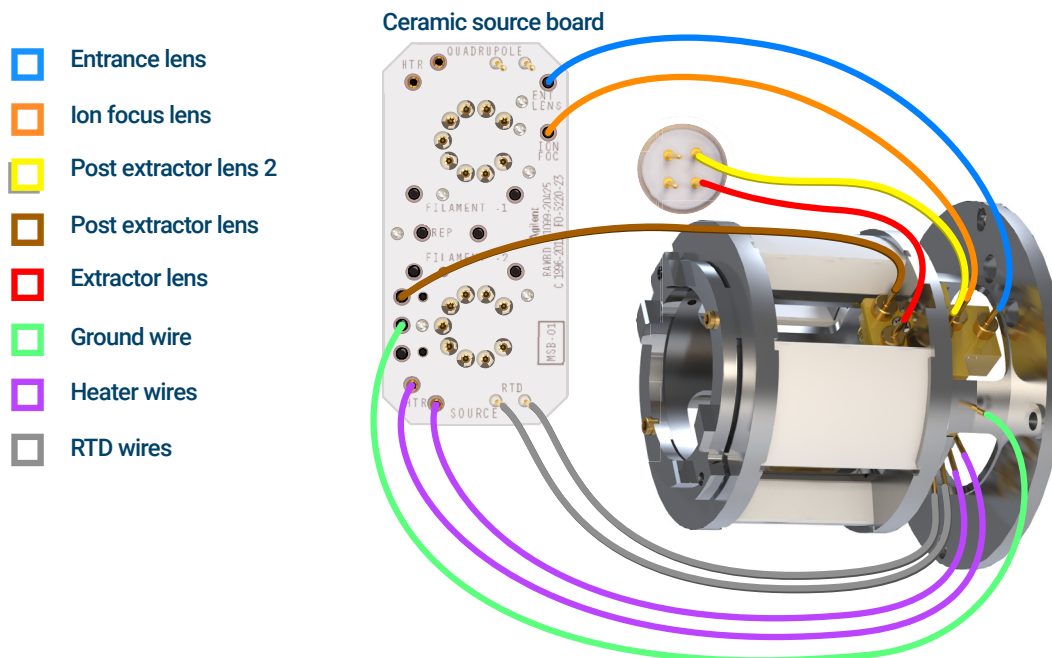


Figure 69. HES radiator wiring

To Install the 7010 Series 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

- 1 Vent the MS. (See **"To Vent the MS"** on page 124.)
- 2 Open the front analyzer chamber. (See **"To Open the Front Analyzer Chamber"** on page 156.)
- 3 Slide the CI source into the radiator.
- 4 Install the thumbscrews. (See **Figure 70.**)
- 5 Connect the wiring to the CI source. (See **"To Connect or Disconnect 7010 Series CI Source Wiring"** on page 217.)

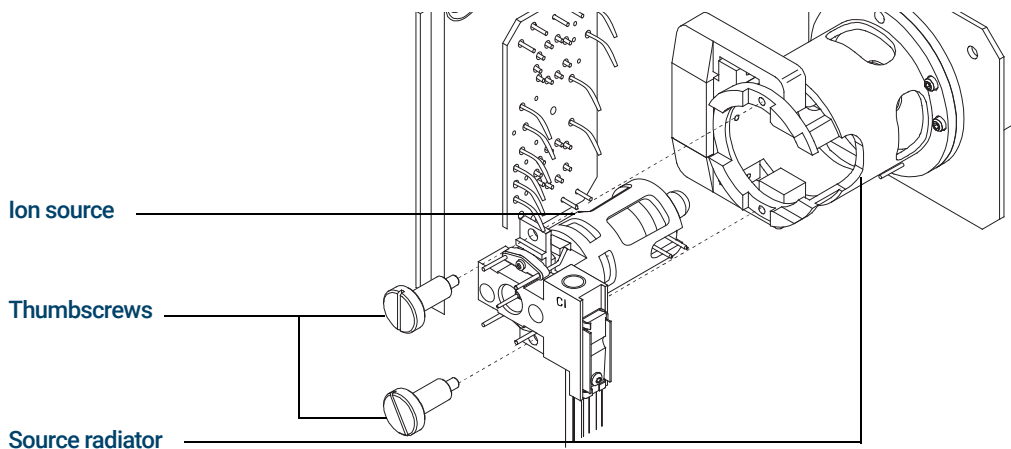


Figure 70. Installing the CI source

- 6 Close the analyzer door. (See **"To Close the Front Analyzer Chamber"** on page 195.)
- 7 Pumpdown the MS. (See **"To Pumpdown the MS"** on page 120.)
- 8 Tune the MS. (See **"CI Autotune"** on page 135.)

To Install the 7000 Series 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

- 1 Vent the MS. (See **"To Vent the MS"** on page 124.)
- 2 Open the front analyzer chamber. (See **"To Open the Front Analyzer Chamber"** on page 156.)
- 3 Slide the CI source into the radiator.
- 4 Install the thumbscrews. (See **Figure 71.**)
- 5 Connect the wiring to the CI source. (See **"To Connect or Disconnect 7000 Series CI Source Wiring"** on page 218.)

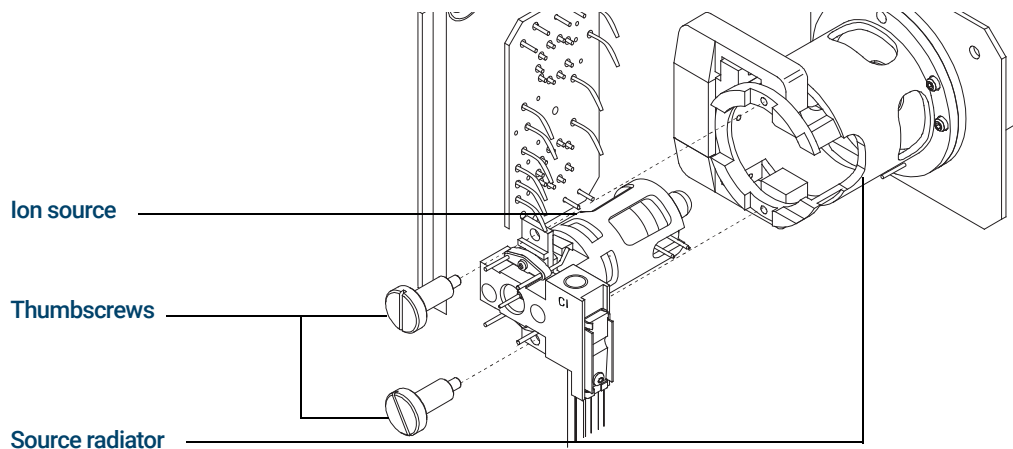


Figure 71. Installing the CI source

- 6 Close the analyzer door. (See **"To Close the Front Analyzer Chamber"** on page 195.)
- 7 Pumpdown the MS. (See **"To Pumpdown the MS"** on page 120.)
- 8 Tune the MS. (See **"CI Autotune"** on page 135.)

To Switch from the CI Source to the EI HES

Procedure

- 1 Vent the MS. (See **"To Vent the MS"** on page 124.) 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"** on page 151.)

- 2 Open the left side access panel. (See **"To Open Left Side Panel for Access to the Analyzer Chambers"** on page 119).
- 3 Open the front analyzer chamber. (See **"To Open the Front Analyzer Chamber"** on page 156.)
- 4 Remove the CI source. (See **"To Remove the 7000 Series CI Source"** on page 220.)
- 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 **"To Remove the CI Source Radiator from the 7010 Series TQ"** on page 227.)
- 7 Place the CI source radiator in the storage container.
- 8 Loosen the column nut and remove the column from the GC/MS Interface.
- 9 Cut the column on the tapered side of the ferrule to remove the ferrule.
- 10 Install the column into the GC/MS interface. (See **"To Install a Capillary Column in the GC/MS Interface Using the Self-Tightening Column Nut"** on page 37 or **"To Install a Capillary Column in the GC/MS Interface Using a Standard Column Nut"** on page 42.)
- 11 Remove the EI HES radiator from the storage container.
- 12 Install the EI HES radiator. (See **"To Install the EI HES Radiator"** on page 214.)
- 13 Remove the EI HES from the storage container.
- 14 Install the EI HES. (See **"To Install the EI HES"** on page 185.)
- 15 Pumpdown the MS. (See **"To Pumpdown the MS"** on page 120.)

To Install 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/MS 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

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 × 12 gold plated screws (G7002-20110). (See **Figure 72** on page 215.)
- 2 Attach the wires to the radiator or CSB. Do not bend the wires any more than necessary. (See **“To Connect or Disconnect EI HES Radiator Wiring”** on page 210.)

8 CI Maintenance

To Install the EI HES Radiator

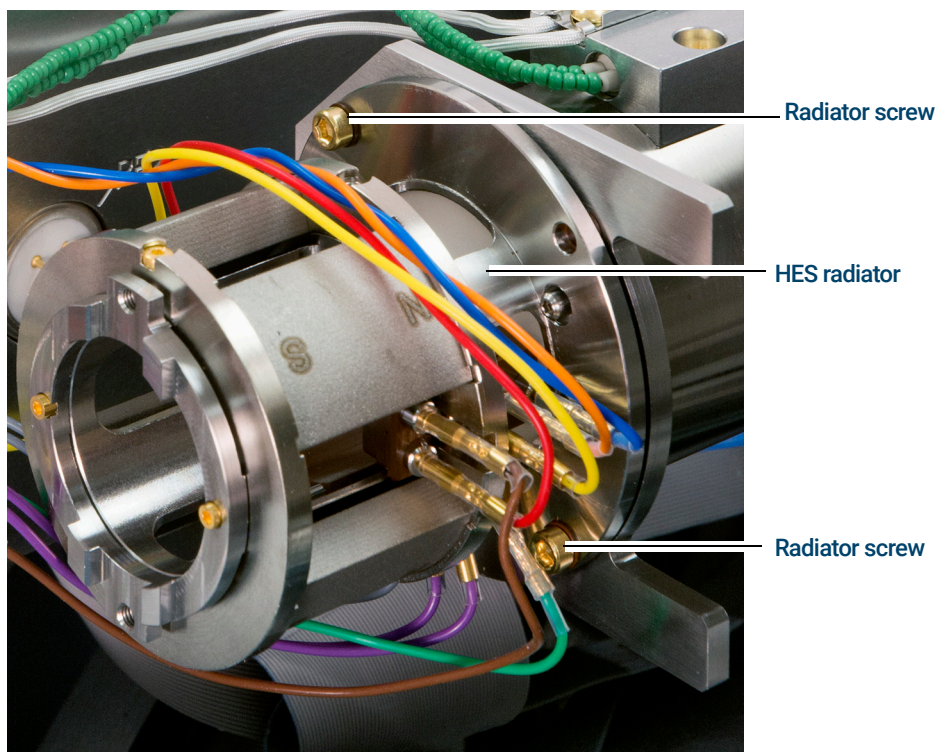


Figure 72. Securing the EI HES radiator

To Switch from the CI Source to the EI XTR Source

Procedure

- 1 Vent the MS. (See **"To Vent the MS"** on page 124.) 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"** on page 151.)

- 2 Open the left side access panel. (See **"To Open Left Side Panel for Access to the Analyzer Chambers"** on page 119).
- 3 Open the front analyzer chamber. (See **"To Open the Front Analyzer Chamber"** on page 156.)
- 4 Remove the CI source. (See **"To Remove the 7000 Series CI Source"** on page 220.)
- 5 Install the EI XTR source. (See **"To Install the EI XTR Source"** on page 187.)
- 6 Place the CI source in the storage container.
- 7 Pumpdown the MS. (See **"To Pumpdown the MS"** on page 120.)

To Connect or Disconnect 7010 Series CI Source Wiring

This topic is used to identify the wiring connections to the ion source. (For detailed procedures and videos, see [“To Remove the 7000 Series CI Source”](#) on page 220 or [“To Install the 7010 Series CI Source”](#) on page 211.)

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 pliers to connect or disconnect the ceramic board wire leads (red, white, black, and gray) at the source connectors. (See [Figure 73](#).)
- 2 Use tweezers or pliers to connect or disconnect the source heater wire leads at the CSB.

Ceramic source board

- Entrance lens
- Ion focus
- Filament 1
- Filament 1
- Repeller
- Dummy filament
- Source heater
- Source RTD

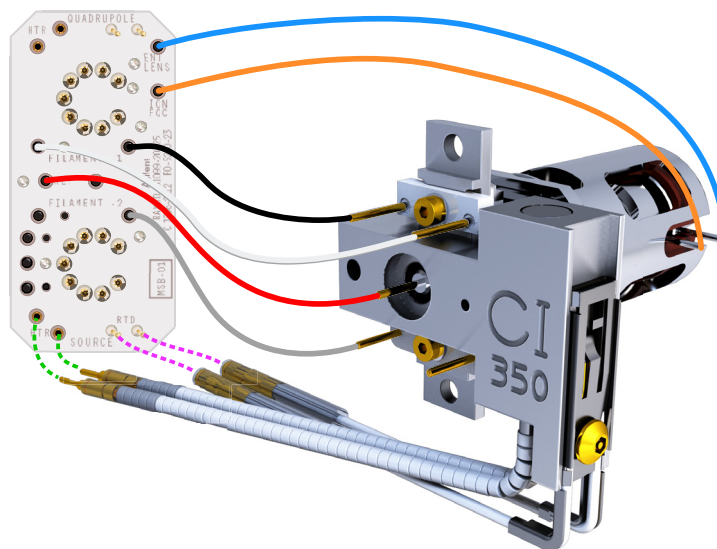


Figure 73. Wiring between the CSB and the source

To Connect or Disconnect 7000 Series CI Source Wiring

This topic is used to identify the wiring connections to the ion source. (For detailed procedures and videos, see [“To Remove the 7000 Series CI Source”](#) on page 220 or [“To Install the 7000 Series CI Source”](#) on page 212.)

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 pliers to connect or disconnect the ceramic board wire leads at the source connectors. (See [Figure 74.](#))
- 2 Use tweezers or pliers to connect or disconnect the source heater wire leads at the CSB.

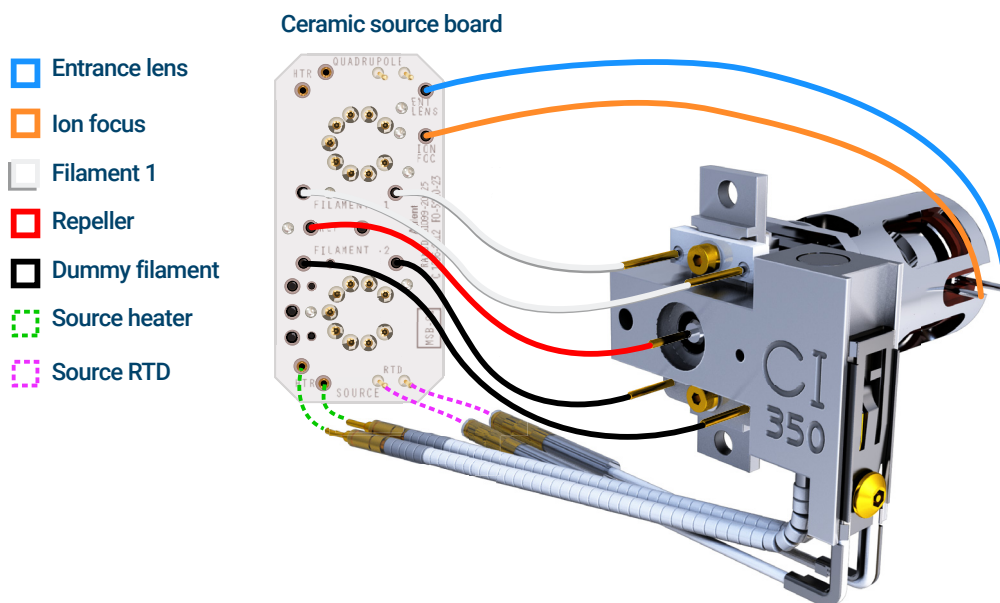


Figure 74. Wiring between the CSB and the CI source

To Switch from the CI Source to an EI XTR 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 151.)

- 1 From the Tune and Vacuum Control view, vent the MS. (See **“To Vent the MS”** on page 124.) The software will prompt you for the appropriate actions.
- 2 Open the analyzer. (See **“To Open the Front Analyzer Chamber”** on page 156.)
- 3 Remove the CI source. (See to **“To Remove the 7000 Series CI Source”** on page 220.)
- 4 Install the EI XTR source. (See **“To Install the EI XTR Source”** on page 187.)
- 5 Place the CI source in the ion source storage box.
- 6 If installing an EI SS or Inert source, remove the interface tip seal and put it in the CI storage container.
- 7 Pumpdown the MS. (See **“To Pumpdown the MS”** on page 120.)
- 8 Load your EI tune file and Tune the MS.

To Remove the 7000 Series CI Source

Materials needed

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



Procedure

- 1 Vent the MS. (See **"To Vent the MS"** on page 124.)

WARNING

The analyzers, GC/MS 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 **"To Open the Front Analyzer Chamber"** on page 156.)

CAUTION

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 Disconnect the wires from the ion source. (See **"To Connect or Disconnect 7000 Series CI Source Wiring"** on page 218.)
- 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.

To Remove the 7010 Series CI Source

Materials needed

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



Procedure

- 1 Vent the MS. (See **"To Vent the MS"** on page 124.)

WARNING

The analyzers, GC/MS 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 **"To Open the Front Analyzer Chamber"** on page 156.)

CAUTION

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 Disconnect the wires from the ion source. (See **"To Connect or Disconnect 7010 Series CI Source Wiring"** 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.

To Switch from the EI HES to the CI Source

Procedure

CAUTION

Always verify GC/MS performance in EI before switching to CI operation.

- 1 Vent the MS. (See **"To Vent the MS"** on page 124.) The software will prompt you for the appropriate actions.
- 2 Open the left side access panel. (See **"To Open Left Side Panel for Access to the Analyzer Chambers"** on page 119.)

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 151.) Take antistatic precautions *before* you open the analyzer chamber.

- 3 Open the analyzer chamber. (See **"To Open the Front Analyzer Chamber"** on page 156.)
- 4 Remove the EI HES. (See **"To Remove the EI HES"** on page 159.)
- 5 Place the EI HES in the storage container.
- 6 Remove the EI HES radiator. (See **"To Remove the EI HES Radiator"** on page 208.)
- 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 **"To Install the CI/EI XTR Source Radiator"** on page 223.)
- 10 Remove 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 **"To Install the 7010 Series CI Source"** on page 211.)
- 12 Pumpdown and switch from EI to CI mode. (See **"To Pumpdown and Switch from EI to CI Mode"** on page 144.)

To Install the CI/EI XTR 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/MS 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

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. Make sure the insulators are in place under the screws.

8 CI Maintenance

To Install the CI/EI XTR Source Radiator

- 2 Connect the green ground wire to the radiator. (See **Figure 75.**)

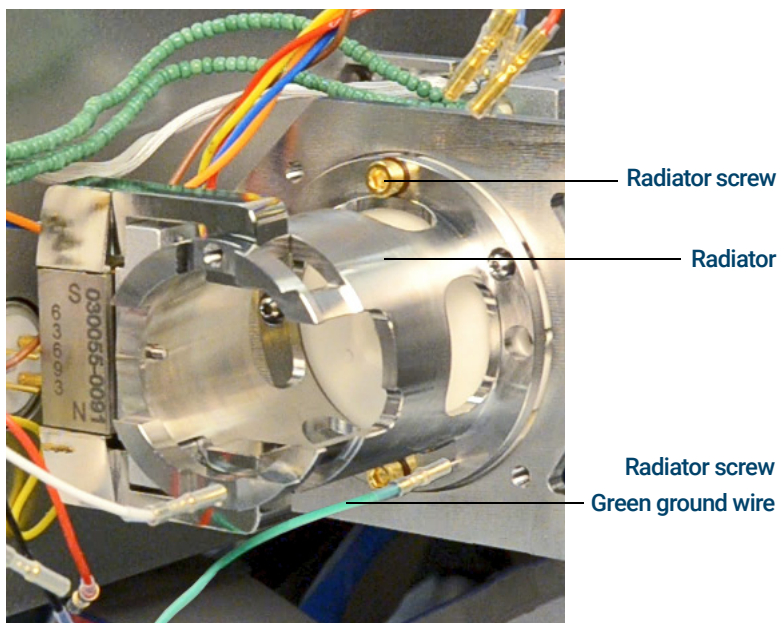


Figure 75. CI Source radiator

To Switch from the CI Source to the EI HES

Procedure

- 1 Vent the MS. (See **"To Vent the MS"** on page 124.) 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"** on page 151.)

- 2 Open the left side access panel. (See **"To Open Left Side Panel for Access to the Analyzer Chambers"** on page 119).
- 3 Open the analyzer chamber door. (See **"To Open the Front Analyzer Chamber"** on page 156.)
- 4 Remove the CI source. (See **"To Remove the 7010 Series CI Source"** on page 221.)
- 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 **"To Remove the CI Source Radiator from the 7010 Series TQ"** on page 227.)
- 7 Place the CI source radiator in the storage container.
- 8 Loosen the column nut and remove the column from the GC/MS Interface.
- 9 Cut the column on the tapered side of the ferrule to remove the ferrule.
- 10 Install the column into the GC/MS interface extending 4 to 5 mm past the analyzer end of the transfer line. (See **"To Install a Capillary Column in the GC/MS Interface Using the Self-Tightening Column Nut"** on page 37 or **"To Install a Capillary Column in the GC/MS Interface Using a Standard Column Nut"** on page 42.)
- 11 Remove the EI HES radiator from the storage container.
- 12 Install the EI HES radiator. (See **"To Install the EI HES Radiator"** on page 214.)
- 13 Remove the EI HES from the storage container.
- 14 Install the EI HES. (See **"To Install the EI HES"** on page 185.)
- 15 Pumpdown the MS. (See **"To Pumpdown the MS"** on page 120.)

To Install 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)
- Hex ball driver, 1.5 mm (8710-1570)



Procedure

- 1 Remove the old filament. (See **[“To Remove the CI Source Filament”](#)** on page 238.)
- 2 Place the new filament into its position on the ion source body. (See **[Figure 80](#)** on page 239.)
- 3 Secure the filament to the ion source body with the screw.
- 4 After installing the filament, verify that it is not grounded to source body.
- 5 Reinstall the CI source. (See **[“To Install the 7010 Series CI Source”](#)** on page 211 or see **[“To Remove the CI Source Filament”](#)** on page 238.)
- 6 Pumpdown the MS. (See **[“To Pumpdown the MS”](#)** on page 120.)
- 7 Autotune the MS.

To Remove the CI Source Radiator from the 7010 Series TQ

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/MS 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.

This procedure is only applicable if you are using the 7010 side plate.

- 1 Remove the CI source. (See **[“To Remove the 7010 Series CI Source”](#)** on page 221.)

8 CI Maintenance

To Remove the CI Source Radiator from the 7010 Series TQ

- 2 Disconnect the green ground wire from the radiator. (See **Figure 76**.)
- 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.

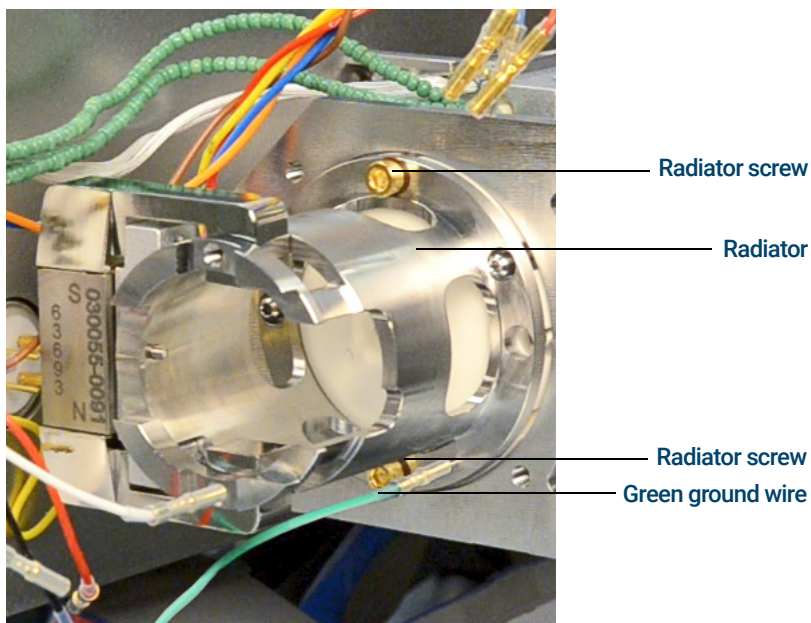


Figure 76. CI/EI XTR Source radiator

To Disassemble 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 and the CI source parts list while using this procedure. (See **Figure 77** and **Table 19** on page 230.)

- 1 Remove the CI source. (See **“To Remove the 7000 Series CI Source”** on page 220.)
- 2 Remove the filaments. (See **“To Remove the CI Source Filament”** on page 238.)
- 3 Separate the source heater assembly from the source body. The source heater assembly includes the source heater, repeller, and related parts. (See **Figure 77** and **Table 19** on page 230.)
- 4 Disassemble the repeller assembly by removing the ceramic insulator from the repeller. (See **Figure 77** on page 230.)
- 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. (See **Figure 77** on page 230.)

8 CI Maintenance

To Disassemble the CI Source

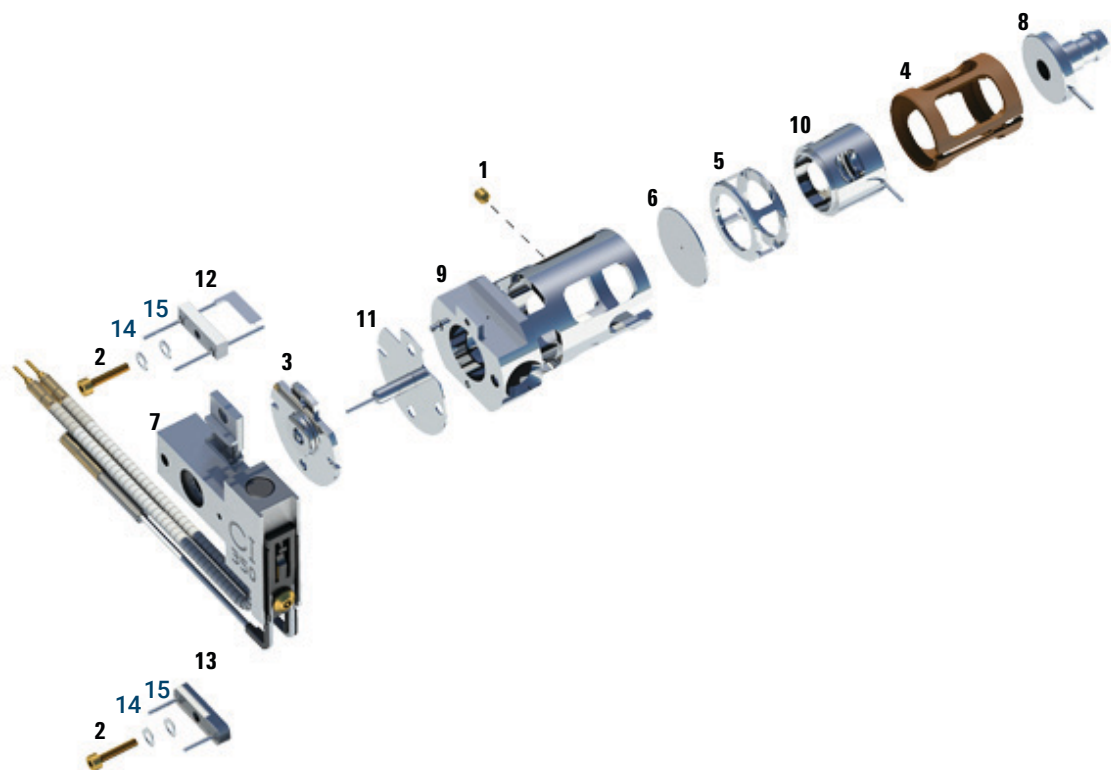


Figure 77. Disassembling the CI source

Table 19 Parts list for CI source (Figure 77)

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	G7000-20026

8 CI Maintenance

To Disassemble the CI Source

Table 19 Parts list for CI source (Figure 77) (continued)

Item	Description	Part number
9	CI source body	G3170-20430
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

To Clean the CI Source

Materials needed

- Abrasive paper (5061-5896)
- Alumina abrasive powder, 100 g (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
 - Acetone, reagent grade
 - Methanol, reagent grade
 - Methylene chloride, reagent grade
- Ultrasonic bath

Preparation

- 1 Disassemble the CI source. (See **"To Disassemble the CI Source"** on page 229.)
- 2 Collect the following parts to be cleaned for a CI source: (See **Figure 78** on page 233.)
 - 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.

8 CI Maintenance

To Clean the CI Source

CAUTION

If the CI lens insulator is dirty, clean it with a cotton swab dampened with reagent-grade methanol. If that does not clean it, replace it. Do not abrasively or ultrasonically clean this insulator. Do not attempt to clean other ceramic insulators in the source.



Figure 78. 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.
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.

8 CI Maintenance

To Clean the CI Source

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.

To Assemble 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

CAUTION

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

Refer to the exploded parts view and the CI source parts list while using this procedure. (See **Figure 79** and **Table 20** on page 236.)

- 1 Assemble the ion focus lens, entrance lens, and lens insulator. (See **Figure 79** and **Table 20** on page 236.)
- 2 Slide the drawout plate and the drawout cylinder into the source body. (See **Figure 79** on page 236.)
- 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.

8 CI Maintenance

To Assemble the CI Source

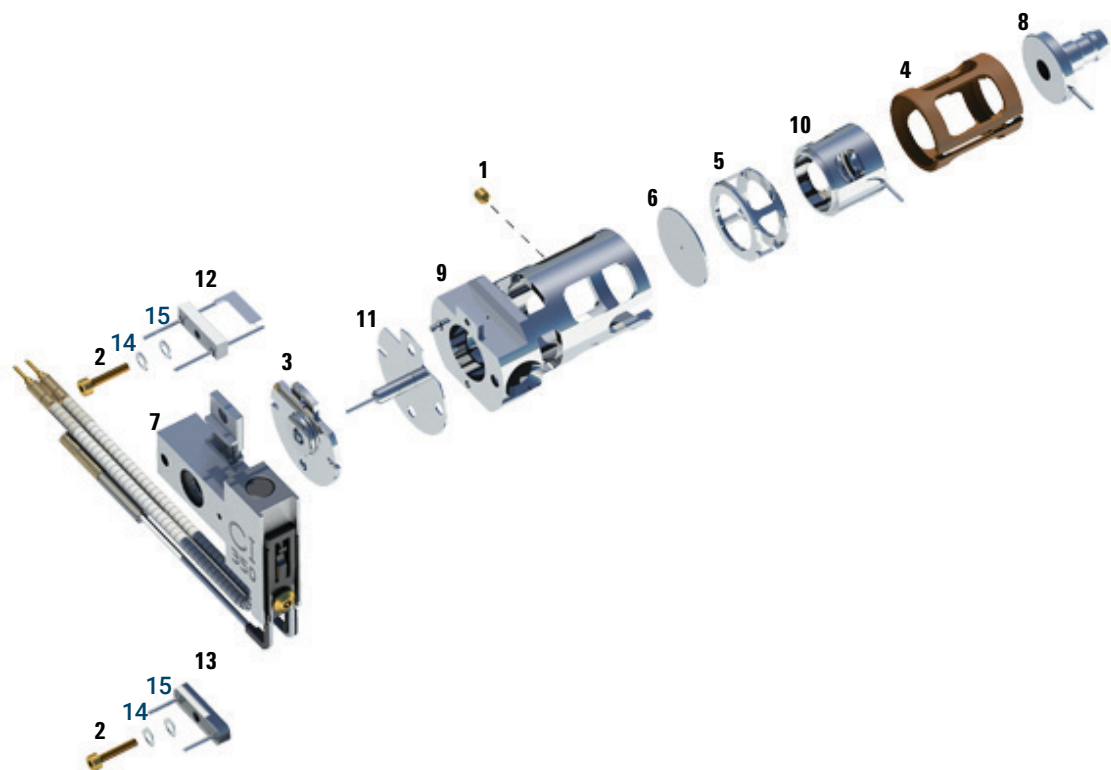


Figure 79. CI source exploded view

Table 20 Parts list for CI source (Figure 79)

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	G7000-20026

8 CI Maintenance

To Assemble the CI Source

Table 20 Parts list for CI source (Figure 79) (continued)

Item	Description	Part number
9	CI source body	G3170-20430
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

To Remove 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 MS. (See **"To Vent the MS"** on page 124.)

CAUTION

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

WARNING

The analyzer, GC/MS 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 front analyzer chamber. (See **"To Open the Front Analyzer Chamber"** on page 156.)
- 3 Remove the CI source. (See **"To Remove the 7000 Series CI Source"** on page 220.)
- 4 Remove the screw holding the filament to the CI source body. (See **Figure 80** on page 239.)
- 5 Slide the filament off the CI source assembly. (See **Figure 80** on page 239.)

8 CI Maintenance

To Remove the CI Source Filament

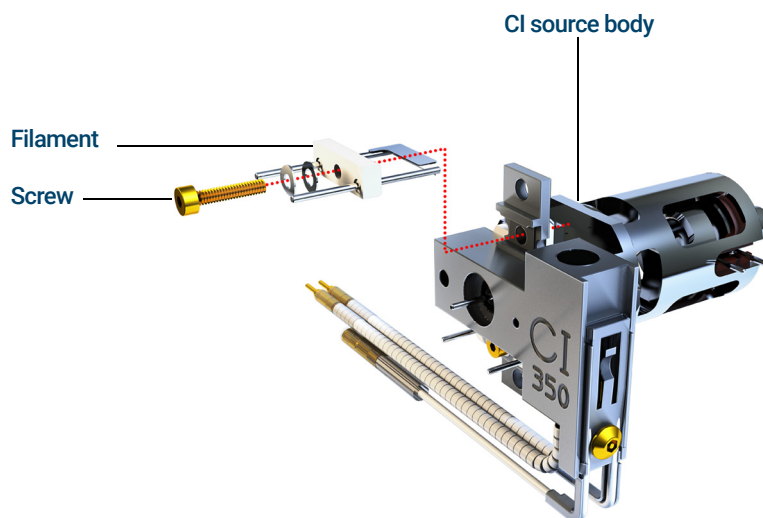


Figure 80. Changing the CI source filament

To Install 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 **"To Remove the CI Source Filament"** on page 238.)
- 2 Place the new filament into its position on the ion source body. (See **Figure 80** on page 239.)
- 3 Secure the filament to the ion source body with the screw.
- 4 After installing the filament, verify that it is not grounded to source body.
- 5 Reinstall the CI source. (See **"To Install the 7010 Series CI Source"** on page 211.)
- 6 Pumpdown the MS. (See **"To Pumpdown the MS"** on page 120.)
- 7 Autotune the MS.

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