Agilent 7250 Accurate-Mass Quadrupole Time-of-Flight GC/MS System

Troubleshooting and Maintenance Manual
Notices

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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.
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This chapter provides general information about the Agilent 7250 Accurate-Mass Quadrupole Time-of-Flight (Q-TOF) GC/MS System, including a hardware description and general safety warnings.
Abbreviations Used

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

Table 1 Abstractions

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Definition</th>
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<tbody>
<tr>
<td>AC</td>
<td>Alternating current</td>
</tr>
<tr>
<td>ALS</td>
<td>Automatic liquid sampler</td>
</tr>
<tr>
<td>CC</td>
<td>Collision cell</td>
</tr>
<tr>
<td>CI</td>
<td>Chemical ionization</td>
</tr>
<tr>
<td>DC</td>
<td>Direct current</td>
</tr>
<tr>
<td>EI</td>
<td>Electron impact</td>
</tr>
<tr>
<td>EPC</td>
<td>Electronic pneumatic control</td>
</tr>
<tr>
<td>eV</td>
<td>Electron volt</td>
</tr>
<tr>
<td>GC</td>
<td>Gas chromatograph</td>
</tr>
<tr>
<td>GC/MS</td>
<td>Gas chromatograph mass spectrometer</td>
</tr>
<tr>
<td>id</td>
<td>Inside diameter</td>
</tr>
<tr>
<td>IDP</td>
<td>Isolated dry pump</td>
</tr>
<tr>
<td>LAN</td>
<td>Local Area Network</td>
</tr>
<tr>
<td>LE-EI</td>
<td>Low energy EI</td>
</tr>
<tr>
<td>m/z</td>
<td>Mass-to-charge ratio</td>
</tr>
<tr>
<td>MFC</td>
<td>Mass flow controller</td>
</tr>
<tr>
<td>MS</td>
<td>Mass spectrometer</td>
</tr>
<tr>
<td>MS1</td>
<td>Quadrupole</td>
</tr>
<tr>
<td>OFN</td>
<td>Octafluoronaphthalene (sample)</td>
</tr>
<tr>
<td>PFTBA</td>
<td>Perfluorotributylamine (calibrant)</td>
</tr>
<tr>
<td>Q-TOF</td>
<td>Quadrupole time-of-flight</td>
</tr>
<tr>
<td>Quad</td>
<td>Quadrupole mass filter</td>
</tr>
<tr>
<td>RF</td>
<td>Radio frequency</td>
</tr>
<tr>
<td>RFPA</td>
<td>Radio frequency power amplifier</td>
</tr>
<tr>
<td>TOF</td>
<td>Time-of-flight</td>
</tr>
<tr>
<td>Torr</td>
<td>Unit of pressure, 1 mm Hg</td>
</tr>
<tr>
<td>Turbo</td>
<td>Turbomolecular vacuum pump</td>
</tr>
</tbody>
</table>
The 7250 Accurate-Mass Quadrupole Time-of-Flight GC/MS System

The 7250 Accurate-Mass Quadrupole Time-of-Flight (Q-TOF) GC/MS System is a standalone capillary GC detector for use with Agilent 8890 and 7890 Series gas chromatographs. The 7250 Q-TOF features:

- Three turbomolecular vacuum pumps
- Foreline pump
  - Rotary vane pump
  - Optional isolated dry pump (IDP)
- Independently MS-heated LE-EI ion source
- Independently MS-heated hyperbolic quadrupole mass filter, which can be heated to high temperatures, minimizing the contamination typical with low temperature analyses
- Single hexapole collision cell
- Ion-focusing slicer
- Vacuum-insulated flight tube with dual-stage ion mirror
- Fast electronics, allowing fast sampling rates
- Analog-to-digital detector
- Independently GC-heated GC/MS interface

Physical description

The 7250 Q-TOF GC/MS is approximately 53.5 cm high, 69 cm wide, and 92 cm deep. The flight tube extends 136 cm up over the top of the instrument.

The turbo pump mainframe weighs 159 kg. The weight of the attached foreline (rotary) pump is 25 kg for the DS202 rotary vane pump model, and 45 kg for the IDP model.

The basic components of the instrument are the:

- Frame/cover assemblies
- Vacuum system
- GC/MS interface
• Ion source
• Flight tube electronics
• Collision cell
• Detector
• Analyzer

Vacuum gauge

The 7250 Q-TOF GC/MS is equipped with three ion vacuum gauges:
• Vacuum manifold chamber
• TOF vacuum manifold chamber
• Turbomolecular vacuum pumps exhaust

The MassHunter Workstation can be used to read the pressure (high vacuum) in the vacuum manifold, at the turbomolecular vacuum pump discharge, and the flight tube.

Ionization modes

The 7250 Accurate-Mass Q-TOF GC/MS can operate in EI mode using the standard LE-EI ion source or in CI mode using the optional CI MS system. In electron impact mode, the Q-TOF can operate in standard or low-energy modes.
7250 Accurate-Mass Q-TOF GC/MS Description

Figure 1 is an overview of a typical 7250 Accurate-Mass Q-TOF GC/MS system.
Side Panel AC Power Connectors

Main power cord receptacle (top)
The AC power cord located on the left side of the MS brings in all electrical power for the MS. The power cord can be detached from the MS.

Foreline pump power receptacle (bottom)
The foreline pump power cord receptacle located on the left side of the MS provides AC power for the foreline pump. If the power switch is off, no power is supplied to the foreline pump.
Back Panel Connectors

Remote start connector

The remote start connector is the external connector for the remote start circuitry on the LAN/MS control card. It receives remote start signals from the GC.

LAN (I/O) connector

The LAN cable from the data system is a dedicated LAN line that is connected to the LAN communications connector. It carries all data communication between the PC and the MS.

Directly connect a single dedicated LAN cable between the PC and the 7250 Q-TOF. Do not use a LAN switch, router, or other device between the PC and the Q-TOF.
Interfacing Start Events to External Devices

Remote control processor

The remote control processor on the LAN/MS control card synchronizes start-run signals with GCs and other devices. The functions of the remote control processor are extended to the remote start (Remote) connector on the back panel of the MS. (See Figure 4.) The remote start cable connects the GC and the MS. An optional cable can extend these events to another instrument.

Remote start signals

It is often necessary to communicate with external devices (for example, a purge-and-trap) during a run. Typically, these communications are requests to send a system-ready signal. They also include:

- Receive a start run signal from an external device
- Program the timing of events during a run

System ready

When interfacing to an external device, it is often desirable to send a system-ready signal to the device. In the case of a multisample Tekmar purge-and-trap, each sample is purged onto a trap where it waits for a ready signal. On receipt of the ready signal, the desorption cycle begins. When a specific temperature is reached, the purge-and-trap closes a contact to indicate the run has started.

Figure 4. Remote start connector
The ready pin on the remote start connector on the GC is held low at all times except when the GC, MS, and data system are all ready. On system ready, a logic high of 5 VDC is present between that pin and any ground. This same high can be detected between the ready and ground pins on the remote start connector on the MS.

Start run input

The best way to generate a start run signal is to use the remote start connector on the GC. Since remote start cables are made for most common devices, this is often the simplest way. A general-purpose remote start cable that terminates in spade lugs (Y-Remote Start/Stop, APG p/n G1530-61200), is also available. Ensure that the system is actually ready before the start run signal is sent.

If necessary, the remote start connector on the back of the MS can be used to send the start run signal. A contact closure between the start and ground pins will start the run if the system is ready.
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. 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.
Precautions to take to prevent an explosion

**WARNING** The use of hydrogen gas is specifically prohibited with this product.

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

You MUST leave the collision cell 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.

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

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
- Column nuts attaching the column to an inlet, detector, or GC/MS interface
- Foreline pump
- GC/MS interface
- 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.
1 Introduction

**WARNING**

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

**WARNING**

The foreline pump can cause burns if touched when operating.

**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 constitutes a fire hazard. Keep the pan clean, but do not leave absorbent material such as paper towels in it.
Safety and Regulatory Certifications

The 7250 Q-TOF GC/MS conforms to the following safety standards:
• Canadian Standards Association (CSA): CAN/CSA-C22.2 No. 61010-1-04
• CSA/Nationally Recognized Test Laboratory (NRTL): UL 61010–1
• International Electrotechnical Commission (IEC): 61010–1
• EuroNorm (EN): 61010–1

The 7250 Q-TOF GC/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 61326-1
• AUS/NZ

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

The 7250 Q-TOF GC/MS is designed and manufactured under a quality system registered to ISO 9001.

The 7250 A-TOF GC/MS is RoHS compliant.

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 판매자 또는 사용자는 이 점을 주 의하시기 바라며, 가정외의 지역에서 사용하는 것을 목적으로 합니다.

Information

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.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, 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


Schalldruckpegel

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 Spillage

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

Moving or Storing the 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. For more information, see “To Move or Store the MS” on page 79.
2 General Troubleshooting

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This is a quick reference to symptoms and possible causes of the most common problems experienced by users. For each symptom, one or more possible causes are listed. In general, the causes listed first are the most likely causes or the easiest to check and correct.

Help with problems specific to operating in chemical ionization (CI) mode are covered in Chapter 3, "CI Troubleshooting," starting on page 49.

This chapter does not include corrective actions for the possible causes listed. Some of the corrective actions required may be dangerous if performed incorrectly. Do not attempt any corrective actions unless you are sure you know the correct procedure and the dangers involved. See the other chapters in this manual for more information.

If the material in this chapter and in the online help proves insufficient to help you diagnose a problem, contact your Agilent Technologies service representative.
Troubleshooting Tips and Tricks

Rule 1: “Look for what has been changed.”
Many problems are introduced accidentally by human actions. Every time any system is disturbed, there is a chance of introducing a new problem.

• If the MS was just pumped down after maintenance, suspect air leaks or incorrect assembly.
• If carrier gas or helium gas purifier was just changed, suspect leaks or contaminated or incorrect gas.
• If the GC column was just replaced, suspect air leaks or a contaminated or bleeding column.

Rule 2: “If complex isn’t working, go back to simple.”
A complex task is not only more difficult to perform, but also more difficult to troubleshoot. If you’re having trouble detecting your sample, verify that autotune is successful.

Rule 3: “Divide and conquer.”
This technique is known as “half-split” troubleshooting. If you can isolate the problem to only part of the system, it is much easier to locate.

To determine whether an air leak is in the GC or the MS, vent the MS, remove the column, and install the blank interface ferrule. If the leak goes away, it was in the GC.
General Symptoms

This section describes symptoms you might observe when first turning on the GC/MS system. All of these symptoms would prevent operation of the system.

**GC does not turn on**

Nothing happens when the GC is switched on. The GC fans do not turn on and the control display does not light.

- Disconnected GC power cord
- No voltage or incorrect voltage at the electrical outlet
- Failed fuse in the GC
- GC power supply is not working correctly

**MS does not turn on**

Nothing happens when the MS is switched on. The foreline pump does not start. The cooling fan for the high-vacuum pump does not turn on.

- Disconnected MS power cord
- No voltage or incorrect voltage at the electrical outlet
- Failed primary fuses - Not user replaceable
- MS electronics are not working correctly

**Foreline pump is not operating**

The MS is receiving power (the fan is operating) but the foreline pump is not operating.

- A large air leak (usually the analyzer door open) has caused pumpdown failure. You must power cycle the MS to recover from this state.
- Disconnected foreline pump power cord
- Malfunctioning foreline pump
- Check power switch on foreline pump
MS turns on but then the foreline pump shuts off

The MS will shut down both the foreline pump and the turbo pumps if the system fails to pump down correctly. This is usually because of a large air leak or the side plate has not sealed correctly. This feature helps prevent the foreline pump from sucking air through the system, which can damage the analyzer and the turbo pumps.

You must power cycle the MS to recover from this state.
Chromatographic Symptoms

These are symptoms you may observe in the chromatograms generated by data acquisition. In general, these symptoms do not prevent you from operating your GC/MS system. They indicate, however, that the data you are acquiring may not be the best data obtainable. These symptoms can be caused by instrument malfunctions, but are more likely caused by incorrect chromatographic technique.

Two of the symptoms also apply to mass spectral data. (See “Poor sensitivity” on page 32 and “Poor repeatability” on page 33.)

No peaks

If an analysis shows no chromatographic peaks, only a flat baseline or minor noise, run the automated tune program. If the MS passes tune, the problem is most likely related to the GC. If the MS does not pass tune, the problem is most likely in the MS.

Passes tune

• Incorrect sample concentration
• No analytes present
• Syringe missing from the ALS or not installed correctly
• Injection accidentally made in split mode instead of splitless mode
• Empty or almost empty sample vial
• Dirty GC inlet
• Leaking GC inlet*
• Loose column nut at the GC inlet*

* This could cause a fault condition in the GC that would prevent the GC from operating.

Does not pass tune

• Calibration vial is empty
• Excessive foreline or analyzer chamber pressure
• Very dirty ion source
• Calibration valve is not working correctly
2 General Troubleshooting

- Bad signal cable connection
- Filament has failed or is not connected correctly
- Bad ion source wiring connection
- Bad detector wiring connection
- Failed MS detector

Peaks are tailing
- Active sites in the sample path
- Injection is too large
- Incorrect GC inlet temperature
- Insufficient column flow
- GC/MS interface temperature is too low
- Ion source temperature is too low

Peaks are fronting
- Column film thickness mismatched with analyte concentration (column overload)
- Initial oven temperature is too low
- Active sites in the sample path
- Injection is too large
- GC inlet pressure too high
- Insufficient column flow

Peaks have flat tops
- Insufficient solvent delay
- Incorrect scale on the display
- Injection is too large
Peaks have split tops
- Bad injection technique
- Injection is too large

Baseline is rising
- Column bleed
- Other contamination

Baseline is high
- Column bleed
- Other contamination

Baseline is falling
A falling baseline indicates contamination is being swept away. Wait until the baseline reaches an acceptable level. Common causes include:
- Residual air and water from a recent venting
- Column bleed
- Septum bleed
- Splitless injection time too long (inlet is not properly swept, resulting in excess solvent on the column and slow solvent decay)
Baseline wanders

- Insufficient carrier gas supply pressure*
- Malfunctioning flow or pressure regulator*
- Intermittent leak in the GC inlet*

* This could cause a fault condition in the GC that would prevent the GC from operating.

Retention times for all peaks drift – shorter

- Column has been shortened
- Initial oven temperature was increased
- Column is getting old

Retention times for all peaks drift – longer

- Column flow has been reduced
- Initial oven temperature was decreased
- Active sites in the sample path
- Leaks in the GC inlet*

* This could cause a fault condition in the GC that would prevent the GC from operating.

Poor sensitivity

- Incorrect tuning, or tune file that does not match the type of analysis
- Repeller voltage is too low
- Incorrect temperatures (oven, GC/MS interface, ion source, or mass filter)
- Incorrect sample concentration
- Leaking GC inlet*
- Dirty GC inlet
- Incorrect split ratio
- Purge-off time in splitless mode is too short
2 General Troubleshooting

- Excessive pressure in the analyzer chamber
- Dirty ion source
- Air leaks between chambers
- Poor filament operation
- Detector is not working correctly
- Incorrect mass filter polarity
- Collision cell voltage

* This could cause a fault condition in the GC that would prevent the GC from operating.

Poor repeatability

- Dirty syringe needle
- Dirty GC inlet
- Leaking GC inlet*
- Injection is too large
- Loose column connections
- Variations in pressure, column flow, and temperature
- Dirty ion source
- Loose connections in the analyzer
- Ground loops

* This could cause a fault condition in the GC that would prevent the GC from operating.
Mass Spectra General Symptoms

This section describes symptoms you might observe in mass spectra. Some of these symptoms will appear in the mass spectra of samples. Others you will observe only in a tune report. Some of these symptoms have causes that can be corrected by the operator. Others, however, require service by an Agilent Technologies service representative.

Two of the chromatographic symptoms, also apply to mass spectral. (See “Poor sensitivity” on page 32 and “Poor repeatability” on page 33.)

No peaks

- Ion source cables not connected
- Bad connections to or from the detector
- Detector power supply output cable has failed
- Collision cell voltages
- Collision cell gas flow
- Other electronics failure
- Incorrect tune file (inappropriate parameters)

Isotopes are missing or isotope ratios are incorrect

- Wrong precursor or wrong product ion was selected
- MCP or PMT voltage is too low
- Repeller voltage is too high
- Wrong ions are chosen
- High background
- Dirty ion source
- Collision cell voltage
- Collision cell gas flow
High background

- TOF vacuum or Quad vacuum
- Air leak
- Contamination
Pressure Symptoms

This section describes unusual pressure readings and their possible causes. At typical column flow rates (0.5 to 2.0 mL/minute), the foreline pressure will be approximately 16 to 18 mTorr. The Quad pressure with collision cell gas on or off will be approximately $1 \times 10^{-4}$ to $2 \times 10^{-4}$ Torr. These pressures can vary widely from instrument to instrument so it is very important that you are familiar with the pressures that are typical for your instrument at given carrier and collision gas flows.

Table 2 Influence of carrier and collision cell gas flows on vacuum

<table>
<thead>
<tr>
<th>Column flow (mL/min)</th>
<th>Rough Vac (mTorr)</th>
<th>Quad Vac (Torr)</th>
<th>TOF Vac (Torr)</th>
<th>Rough Vac (mTorr)</th>
<th>Quad Vac (Torr)</th>
<th>TOF Vac (Torr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.7</td>
<td>1.25 E+02</td>
<td>3.50 E-05</td>
<td>2.61 E-07</td>
<td>2.70 E+01</td>
<td>5.78 E-07</td>
<td>1.58 E-07</td>
</tr>
<tr>
<td>1</td>
<td>1.30 E+02</td>
<td>3.49 E-05</td>
<td>2.61 E-07</td>
<td>3.61 E+01</td>
<td>6.21 E-07</td>
<td>1.58 E-07</td>
</tr>
<tr>
<td>1.2</td>
<td>1.34 E+02</td>
<td>3.49 E-05</td>
<td>2.61 E-07</td>
<td>4.13 E+01</td>
<td>6.55 E-07</td>
<td>1.58 E-07</td>
</tr>
<tr>
<td>2</td>
<td>1.48 E+02</td>
<td>3.51 E-05</td>
<td>2.61 E-07</td>
<td>6.18 E+01</td>
<td>8.09 E-07</td>
<td>1.59 E-07</td>
</tr>
<tr>
<td>3</td>
<td>1.63 E+02</td>
<td>3.52 E-05</td>
<td>2.61 E-07</td>
<td>8.45 E+01</td>
<td>9.99 E-07</td>
<td>1.60 E-07</td>
</tr>
</tbody>
</table>

Foreline pressure is too high

If the pressure you observe for a given column flow has increased over time, check the following:

- Column (carrier gas) flow is too high
- Collision cell gas flow is too high
- Air leak (usually the side plate is not pushed in or vent valve is open)
- Rotary foreline pump oil level is low or oil is contaminated
- IDP foreline pump tip seal is worn down and needs replacing
- Foreline hose is constricted
- Foreline pump is not working correctly
Foreline pressure is too low
If the foreline pressures you observe are below 20 mTorr, check for the following:
• Column (carrier gas) flow is too low
• Column plugged or crushed by an overtightened nut
• Collision gas flows are too low
• Empty or insufficient carrier gas supply*
• Bent or pinched carrier gas tubing*
• Foreline gauge is not working correctly
  * This could create a fault condition in the GC that would prevent the GC from operating.

Quad pressure is too low
If the quad pressure you observe is below $1 \times 10^{-6}$ Torr with the collision cell gas on or off, check for the following:
• Column (carrier gas) flow is too low
• Collision gas flows are too low
• Column plugged or crushed by overtightened nut
• Empty or insufficient carrier gas supply*
• Bent or pinched carrier gas tubing*
  * This could create a fault condition in the GC that would prevent the GC from operating.

High vacuum pressure is too high
If the high vacuum pressure you observe is above $2 \times 10^{-6}$ Torr, check for the following:
• Turbos are not up to speed
• Too much water is in the system
• Did not wait long enough for system to pump down
• Poor carrier gas quality
• System is not leak tight, check fittings
Temperature Symptoms

The MS has three heated zones:
- Ion source
- Mass filter
- GC/MS interface

Each heated zone has a heater and temperature sensor. The ion source and mass filter are powered and controlled by the MS. The GC/MS interface is powered and controlled by the GC.

Ion source will not heat up
- High-vacuum pump is off or has not reached normal operating conditions*
- Incorrect temperature setpoint
- Ion source has not had enough time to reach temperature setpoint
- Ion source heater cartridge is not connected*
- Ion source temperature sensor is not connected*
- Ion source heater failed (burned out or shorted to ground)*
- Ion source temperature sensor failed*
- Source power cable is not connected to the quadrupole board*
- MS electronics are not working correctly
  * This will cause an error message.

Mass filter (quad) heater will not heat up
- High-vacuum pump is off or has not reached normal operating conditions*
- Incorrect temperature setpoint
- Mass filter has not had enough time to reach temperature setpoint
- Mass filter heater cartridge is not connected*
- Mass filter temperature sensor is not connected*
- Mass filter heater failed (burned out or shorted to ground)*
- Mass filter temperature sensor failed*
2 General Troubleshooting

- Cable is not connected to the quadrupole board*
- MS electronics are not working correctly
  * This will cause an error message.

**GC/MS interface will not heat up**

- Incorrect setpoint(s)
- Setpoint entered in wrong heated zone
- GC/MS interface has not had enough time to reach temperature setpoint
- GC is off
- GC experienced a fault and needs to be reset*
- GC/MS interface heater/sensor cable is not connected*
- GC/MS interface heater failed (burned out)*
- GC/MS interface sensor failed*
- GC electronics are not working correctly*
  * This will cause a GC error message. GC error messages are described in the documentation supplied with your GC.
Error Messages

Sometimes a problem in your MS will cause an error message to appear in the MassHunter Workstation software. Some error messages appear only during tuning. Other messages may appear during tuning or data acquisition.

Some error messages are “latched.” These messages remain active in your data system even if the condition that caused the message has corrected itself. If the cause is removed, these messages can be removed by checking instrument status through the data system.

Difficulty in mass filter electronics

- Pressure in the analyzer chamber is too high
- RFPA is not adjusted correctly
- Mass filter (quad) contacts are shorted or otherwise not working correctly
- Mass filter is not working correctly
- MS electronics are not working correctly

Difficulty with the photo multiplier or microchannel device

- Broad peaks, such as the solvent peak, eluted while the analyzer was on
- MS electronics are not working correctly

Difficulty with the fan

If a cooling fan fault occurs, the vacuum control electronics automatically shut off the high-vacuum pump, the ion source, and mass filter heaters. Therefore, the message: “The system is in vent state” may also appear. It is important to note that even though the high-vacuum pump is off, the analyzer chamber may not actually be vented. See “The system is in vent state” on page 43 in this section for precautions to take.

- The fan is disconnected
- The fan has failed
- MS electronics are not working correctly
Difficulty with the high vacuum pump(s)

If the pump failed to reach 50% of full speed within 10 minutes, or experienced a fault.

You must switch the MS off and back on to remove this error message. Ensure the turbo pump has slowed down before switching off the MS. The message will reappear if the underlying problem has not been corrected.

- Large vacuum leak is preventing the turbo pump from reaching 50% of full speed
- Foreline pump is not working correctly
- Turbo pump(s) is not working correctly
- MS electronics are not working correctly

High foreline pressure

- Excessive carrier gas flow (typically > 5 mL/min)
- Excessive solvent volume injected
- Large vacuum leak
- Severely degraded foreline pump oil
- Collapsed or kinked foreline hose
- Foreline pump is not working correctly

Internal MS communication fault

- MS electronics are not working correctly

Lens supply fault

- Electrical short in the analyzer
- MS cannot maintain the voltage setpoint
- MS electronics are not working correctly
No peaks found

- Emission current was set to 0
- PMT or MCP voltage is too low
- Calibration vial(s) empty or almost empty
- Excessive pressure in the analyzer chamber
- Air leak
- Signal cable is not connected
- Electrical leads to the MCP are not connected correctly
- Electrical leads to the ion source are not connected correctly
- Filament to the source body is shorted

Temperature control disabled

- One of the heater fuses has failed
- MS electronics are not working correctly

Temperature control fault

This indicates that something has gone wrong with the temperature control of either the ion source or the mass filter (quad) heater:

- Source temperature sensor is open
- Source temperature sensor is shorted
- Mass filter (quad) temperature sensor is open
- Mass filter (quad) temperature sensor is shorted
- No heater voltage (heater fuse has probably failed)
- Heater voltage is too low
- Temperature zone has timed out (heater failed, bad heater wiring, or loose temperature sensor)
- Problem with the temperature control electronics
- Source heater is open
- Source heater is shorted
- Mass filter heater is open
- Mass filter heater is shorted
The high-vacuum pump is not ready

- One of the three Turbo pumps could have failed
- Turbo pump is on but has not had enough time (10 minutes) to reach 80% of its normal operating speed
- Turbo pump is not working correctly
- Foreline pump has not reached its target of 10 Torr after 10 minutes
- MS electronics are not working correctly

The system is in vent state

The message says the system is vented, but if the fault has just occurred it may still be under vacuum and the turbo pump may still be at high speed. Wait at least 30 minutes after seeing this message before you actually vent the MS.

**CAUTION**

Venting the MS too soon after this message appears can damage a turbo pump.

- System was vented purposely (no problem)
- Fan fault has turned off the high-vacuum pump (power cycle the MS to clear the fault)
- Fuse for the high-vacuum pump has failed
- MS electronics are not working correctly

There is no emission current

- Check tune file to be certain that emission current is not = 0
- Filament is not connected properly; try the other filament
- Filament has failed; try the other filament
- MS electronics are not working correctly

There is not enough signal to begin tune

- Corrupted tune file
- Poor mass axis calibration
- Width gain or offset is too high
2 General Troubleshooting

- Calibration vial empty or almost empty
- Excessive pressure in the analyzer chamber
- Air leak
- MCP or PMT voltage is too low
- Signal cable is not connected
- Electrical leads to the detector are not connected correctly
- Electrical leads to the ion source are not connected correctly
- Filament shorted to the source body
- Collision cell gas flow
- Collision cell voltages
Air Leaks

Air leaks are a problem for any instrument that requires a vacuum to operate. Leaks are generally caused by vacuum seals that are damaged or not fastened correctly. Symptoms of leaks include:

- Higher than normal analyzer chamber pressure or foreline pressure
- Higher than normal background
- Peaks characteristic of air ($m/z$ 18, 28, 32, and 44 or $m/z$ 14 and 16)
- Poor sensitivity
- Low relative abundance of $m/z$ 502 (this varies with the tune program used)

Leaks can occur in either the GC or the MS. The most likely point for an air leak is a seal you recently opened.

In the GC, most leaks occur in:

- GC inlet septum
- GC inlet column nut
- Broken or cracked capillary column

Leaks can occur in many more places in the MS:

- GC/MS interface column nut
- Side plate O-rings (all the way around)
- Calibration valve
- GC/MS interface O-ring (where the interface attaches to the analyzer chamber)
- End plate O-ring
- Turbo pump O-rings
- Collision cell cover O-ring
Contamination

Contamination is usually identified by excessive background in the mass spectra. It can come from the GC or from the MS. The source of the contamination can sometimes be determined by identifying the contaminants. Some contaminants are much more likely to originate in the GC. Others are more likely to originate in the MS.

Contamination originating in the GC typically comes from one of these sources:
- Column or septum bleed
- Dirty GC inlet
- GC inlet liner
- Contaminated syringe
- Poor quality carrier gas
- Dirty carrier gas tubing
- Fingerprints (improper handling of clean parts)

Contamination originating in the MS typically comes from one of the following sources:
- Air leak
- Cleaning solvents and materials
- Rotary foreline pump oil
- IDP foreline pump tip seal
- Fingerprints (improper handling of clean parts)

*Table 3, “Common contaminants,” on page 47 lists some of the more common contaminants, the ions characteristic of those contaminants, and the likely sources of those contaminants.*
### Table 3  Common contaminants

<table>
<thead>
<tr>
<th>Ions (m/z)</th>
<th>Compound</th>
<th>Possible source</th>
</tr>
</thead>
<tbody>
<tr>
<td>18, 28, 32, 44 or 14, 16</td>
<td>H₂O, N₂, O₂, CO₂ or N, O</td>
<td>Residual air and water, air leaks, outgassing from Vespel ferrules</td>
</tr>
<tr>
<td>31</td>
<td>Methanol</td>
<td>Cleaning solvent</td>
</tr>
<tr>
<td>43, 58</td>
<td>Acetone</td>
<td>Cleaning solvent</td>
</tr>
<tr>
<td>78</td>
<td>Benzene</td>
<td>Cleaning solvent</td>
</tr>
<tr>
<td>91, 92</td>
<td>Toluene or xylene</td>
<td>Cleaning solvent</td>
</tr>
<tr>
<td>105, 106</td>
<td>Xylene</td>
<td>Cleaning solvent</td>
</tr>
<tr>
<td>151, 153</td>
<td>Trichloroethane</td>
<td>Cleaning solvent</td>
</tr>
<tr>
<td>69</td>
<td>Foreline pump oil or PFTBA</td>
<td>Foreline pump oil vapor or calibration valve leak</td>
</tr>
<tr>
<td>73, 147, 207, 221, 281, 295, 355, 429</td>
<td>Dimethylpolysiloxane</td>
<td>Septum bleed or methyl silicone column bleed</td>
</tr>
<tr>
<td>149</td>
<td>Plasticizer (phthalates)</td>
<td>Vacuum seals (O-rings) damaged by high temperatures, vinyl gloves</td>
</tr>
<tr>
<td>Peaks spaced 14 m/z apart</td>
<td>Hydrocarbons</td>
<td>Fingerprints, foreline pump oil</td>
</tr>
</tbody>
</table>
2 General Troubleshooting
3 CI Troubleshooting

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This chapter outlines the troubleshooting of the Agilent 7250 Accurate-Mass Q-TOF GC/MS System equipped with the chemical ionization (CI) source. Most of the troubleshooting information in the previous chapter also applies to CI Q-TOFs.
Common CI-Specific Problems

Because of the added complexity of the parts required for CI, there are many potential problems added. By far the greatest number and most serious problems with CI are associated with leaks or contamination in the reagent gas introduction system. NCI is especially sensitive to the presence of air; leaks small enough to cause no problems in PCI can destroy NCI sensitivity.

As with EI, if the MS tunes well and no air leak is present, sample sensitivity problems should be addressed by GC inlet maintenance first.

• Wrong reagent gas
• Reagent gas not hooked up or hooked up to wrong reagent gas inlet port
• Wrong ions entered in tune file
• Wrong tune file selected
• Not enough bakeout time has elapsed since vent (background is too high)
• Wrong column positioning (extending > 4-5 mm past tip of interface)
• Interface tip seal not installed
• EI source installed in CI mode
• EI filament or other EI source parts in CI ion source
• Air leaks in reagent gas flow path
• CI filament has stretched and sagged:
  • High emission current
  • High temperature
  • Filament was defective
  • Linear (no inflection point) electron energy (EIEnrgy) ramp
Troubleshooting Tips and Tricks

Rule 1: “Look for what has been changed.”

Many problems are introduced accidentally by human actions. Every time any system is disturbed, there is a chance of introducing a new problem.

• If the MS was just pumped down after maintenance, suspect air leaks or incorrect assembly.
• If the reagent gas bottle or gas purifier were just changed, suspect leaks or contaminated or incorrect gas.
• If the GC column was just replaced, suspect air leaks or contaminated or bleeding column.
• If you have just switched ion polarity or reagent gas, suspect the tune file you have loaded in memory. Is it the appropriate file for your mode of operation?

Rule 2: “If complex isn't working, go back to simple.”

A complex task is not only more difficult to perform, but also more difficult to troubleshoot as well. For example, CI requires more parts to work correctly than EI does.

• If you are having trouble with NCI, verify that PCI still works.
• If you are having trouble with other reagent gases, verify that methane still works.
• If you are having trouble with CI, verify that EI still works.

Rule 3: “Divide and conquer.”

This technique is known as “half-split” troubleshooting. If you can isolate the problem to only part of the system, it is much easier to locate.

• To isolate an air leak, select Shutoff valve. If abundance of m/z 32 decreases, the problem is not in the flow module.
Air Leaks

How do I know if I have an air leak?

Run an air and water check. See the software online help for additional information.

**Large** air leaks can be detected by vacuum symptoms: loud gurgling noise from the foreline pump, inability of the turbo pumps to reach 95% speed, or, in the case of smaller leaks, high pressure readings on the high vacuum gauge controller.

The mass flow controller is calibrated for methane and the high vacuum gauge controller is calibrated for nitrogen, so measurements are not accurate in absolute terms:

Familiarize yourself with the measurements on your system under operating conditions. Watch for changes that may indicate a vacuum or gas flow problem.

There should not be any peak visible at \( m/z \) 32 (\( O_2 \)). This almost always indicates an air leak.

Figure 5. Looking for air leaks
Special NCI notes

Since NCI is so extremely sensitive, air leaks that are not detectable in EI or PCI can cause sensitivity problems in NCI. To check for this kind of air leak in NCI, inject OFN. The base peak should be at \( m/z \ 272 \). If the abundance of \( m/z \ 238 \) is much greater than that of \( m/z \ 272 \), you have an air leak.

How do I find the air leak?

1. See Figure 6, “Schematic of CI flow control,” on page 54 and Table 4, “Flow module valve state diagram,” on page 54.
2. Look for the last seal that was disturbed.
   - If you just pumped down the MS, press on the side plate to check for proper seal. Poor alignment between the front analyzer and the GC/MS interface seal can prevent the side plate from sealing.
   - If you just replaced the reagent gas bottle or gas purifier, check the fittings you just opened and refastened.
3. Check for tightness of seals at GC inlet and GC/MS interface column nuts. Ferrules for capillary columns often loosen after several heat cycles. Do not overtighten the interface nut.
4. If any of the fittings inside the flow module (VCR fittings) were loosened and then retightened, the gasket must be replaced. These gaskets are good for one use only.

**CAUTION**

Do not loosen the nuts on any VCR fittings unless you intend to replace the gaskets. Otherwise, you will create an air leak.

5. Remember that most small air leaks visible in CI mode are located in either the carrier gas or reagent gas flow paths. Leaks into the analyzer chamber are not likely to be seen in CI because of the higher pressure inside the ionization chamber.
6. Half-split the system.
   - Close valves starting at the gas select valves (Reagent gas and Carrier gas purge), then close the shutoff valve. See Figure 6, “Schematic of CI flow control,” on page 54 and Table 4, “Flow module valve state diagram,” on page 54.
   - Cool and vent the MS, remove the GC column, and cap off the interface.
If you use argon or other introduced gas to find air leaks, this does not work well for the reagent gas flow system. It takes as long as 15 minutes for the peak to reach the ion source if the leak is at the inlet to the flow module.

![Schematic of CI flow control](image)

**Figure 6. Schematic of CI flow control**

**Table 4 Flow module valve state diagram**

<table>
<thead>
<tr>
<th>Result</th>
<th>Gas A flow</th>
<th>Gas B flow</th>
<th>Purge with Gas A</th>
<th>Purge with Gas B</th>
<th>Pump out flow module</th>
<th>Standby, vented, or EI mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gas A</td>
<td>Open</td>
<td>Closed</td>
<td>Open</td>
<td>Closed</td>
<td>Closed</td>
<td>Closed</td>
</tr>
<tr>
<td>Gas B</td>
<td>Closed</td>
<td>Open</td>
<td>Open</td>
<td>Closed</td>
<td>Closed</td>
<td>Closed</td>
</tr>
<tr>
<td>MFCV</td>
<td>On (at setpoint)</td>
<td>On (at setpoint)</td>
<td>On (at 100%)</td>
<td>On (at 100%)</td>
<td>Off (at 0%)</td>
<td></td>
</tr>
<tr>
<td>Shutoff valve</td>
<td>Open</td>
<td>Open</td>
<td>Open</td>
<td>Open</td>
<td>Open</td>
<td>Closed</td>
</tr>
</tbody>
</table>
3 CI Troubleshooting

Pressure-Related Symptoms

The following symptoms are all related to high vacuum pressure. Each symptom is discussed in more detail in the following pages.

The mass flow controller is calibrated for methane and the high vacuum gauge controller is calibrated for nitrogen, so these measurements are not accurate in absolute terms (Table 5). They are intended as a guide to typical observed readings. They were taken with the following set of conditions:

- Source temperature: 300 °C
- Quad temperature: 150 °C
- Interface temperature: 280 °C to 320 °C
- Helium carrier gas flow: 1 mL/min

Table 5 Typical analyzer vacuum with reagent gas flow

<table>
<thead>
<tr>
<th>MFC (%)</th>
<th>Rough pump (Torr)</th>
<th>Quadrupole (Torr)</th>
<th>Flight tube (mTorr)</th>
<th>Rough pump (mTorr)</th>
<th>Quadrupole (Torr)</th>
<th>Flight tube (Torr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1.36e+02</td>
<td>3.62e-05</td>
<td>3.35e-07</td>
<td>9.13e+01</td>
<td>5.98e-07</td>
<td>1.64e-07</td>
</tr>
<tr>
<td>10</td>
<td>1.36e+02</td>
<td>3.62e-05</td>
<td>3.37e-07</td>
<td>1.14e+01</td>
<td>1.27e-06</td>
<td>1.65e-07</td>
</tr>
<tr>
<td>15</td>
<td>1.43e+02</td>
<td>3.66e-05</td>
<td>3.37e-07</td>
<td>1.23e+01</td>
<td>1.62e-06</td>
<td>1.67e-07</td>
</tr>
<tr>
<td>20</td>
<td>1.50e+02</td>
<td>3.71e-05</td>
<td>3.39e-07</td>
<td>1.31e+01</td>
<td>1.96e-06</td>
<td>1.67e-07</td>
</tr>
<tr>
<td>25</td>
<td>1.57e+02</td>
<td>3.73e-05</td>
<td>3.41e-07</td>
<td>1.39e+01</td>
<td>2.32e-06</td>
<td>1.70e-07</td>
</tr>
<tr>
<td>30</td>
<td>1.63e+02</td>
<td>3.77e-05</td>
<td>3.41e-07</td>
<td>1.46e+01</td>
<td>2.64e-06</td>
<td>1.71e-07</td>
</tr>
<tr>
<td>35</td>
<td>1.69e+02</td>
<td>3.81e-05</td>
<td>3.41e-07</td>
<td>1.52e+01</td>
<td>3.00e-06</td>
<td>1.71e-07</td>
</tr>
<tr>
<td>40</td>
<td>1.74e+02</td>
<td>3.83e-05</td>
<td>3.43e-07</td>
<td>1.58e+01</td>
<td>3.34e-06</td>
<td>1.72e-07</td>
</tr>
</tbody>
</table>
Poor vacuum without reagent gas flow

**Excess water**
Allow the instrument to bake out more and flow reagent gas through the lines to purge any accumulated water.

**Air leak**
Run an air and water check. See the software online help for additional information.

**The foreline pump is not working properly**
For the standard foreline pump, replace the pump oil. If that does not help, contact your local Agilent Technologies service representative.

**The turbo pumps are not working properly**
Check the pump speed. It should be at least 95%. Contact your local Agilent Technologies service representative.

**CAUTION**
Use of ammonia as reagent gas can shorten the life of the foreline pump oil (with standard pump) and possibly of the foreline pump itself. See “To Minimize Rotary Vane Foreline Pump Damage from Ammonia” on page 86.

High pressure with reagent gas flow

**The reagent gas flow rate is too high**
On the flow controller, turn down reagent gas flow as appropriate. Verify that reagent ion ratios are correct.

**Air leak**
Run an air and water check. See the software online help for additional information.

**Interface tip seal is not installed**
Check the source storage box. If the seal is not in the box, vent the MS and verify that the seal is correctly installed.
Pressure does not change when reagent flow is changed

**The reagent gas regulator is closed**
Check and, if necessary, open the reagent gas regulator.

**The reagent gas regulator is set to the wrong pressure**
Set the reagent gas regulator to 20 to 25 psi (138 to 172 kPa) for methane or to 3 to 10 psi (21 to 69 kPa) for isobutane or ammonia.

**The valve on the reagent gas bottle is closed**
Check and, if necessary, open the valve on the reagent gas bottle.

**The reagent gas supply is empty**
Check and, if necessary, replace the reagent gas supply.

**Reagent lines kinked, bent, pinched, or disconnected**
Inspect the reagent lines and repair any defects. Ensure the reagent line is connected to the rear of the flow module. Ensure the methane line is connected to the Gas A inlet.

**GC/MS interface clogged or damaged**
Check for flow and repair or replace components as indicated.
Signal-Related Symptoms

This section describes symptoms related to the signal. The symptom may be too much signal, too little signal, a noisy signal, or an incorrect signal.

Signal-related symptoms are generally observed during tuning but may also be observed during data acquisition.

Error messages in autotune due to insufficient signal may vary. The following symptoms are covered in more detail in this section:

- No peaks. See page 58.
- No or low reagent gas signal. See page 60.
- No or low PFDTD signal. See page 61.
- Excessive noise. See page 62.
- Low signal-to-noise ratio. See page 62.
- Peak at m/z 32. See page 63.

No peaks

When troubleshooting “no peaks”, it is important to specify what mode of operation is being used and what expected peaks are not being seen. Always start with methane PCI and verify presence of reagent ions.

No reagent gas peaks in PCI

If MS has been working well and nothing seems to have been changed

- Wrong tune file loaded, or tune file corrupted
- Wrong ion polarity (there are no reagent ions visible in NCI)
- No reagent gas flow; look for background ions and check pressure
- Wrong reagent gas selected for the tune file (looking for wrong ions)
- Large air leak
- Dirty ion source
- Poor vacuum (pump problem). See page 56.
If MS was recently switched from EI to CI

- No reagent gas flow
- Analyzer not sealed (big air leak)
- Wrong tune file loaded or tune file corrupted
- Ion source not assembled or connected correctly
- Wrong reagent gas selected for the tune file (looking for wrong ions)

No PFDTD peaks in PCI

- Incorrect reagent gas. There are no PCI PFDTD peaks created with isobutane or ammonia. Switch to methane.
- Analyzer not sealed (big air leak)
- No calibrant in vial
- Defective calibration valve(s)
- Air leak in carrier or reagent gas path

No reagent gas peaks in NCI

- Reagent gases do not ionize in NCI; look for background ions instead
- Verify tune parameters
- If no background ions are visible, go back to methane PCI

No PFDTD calibrant peaks in NCI

- Look for background ions: 35 (Cl⁻), and 235 (ReO₃⁻)
- Verify tune parameters
- Go back to methane PCI

No sample peaks in NCI

- Look for background ions: 35 (Cl⁻), and 235 (ReO₃⁻)
- Go back to methane PCI
- Poor quality reagent gas (purity less than 99.99%)
Large peak at \( m/z \ 238 \) in NCI OFN spectrum

- Look for background ions: 35 (Cl\(^-\)), and 235 (ReO\(_3\)^-)
- Find and fix your small air leak

No or low reagent gas signal

If you have just installed the CI ion source and have an air leak or large amounts of water in the system and have run one or more autotunes, the ion source is probably dirty now.

Fix the air leak. Clean the ion source. Then bake out for two hours before tuning. See the Agilent 7250 Accurate-Mass Quadrupole Time-of-Flight GC/MS System Operating Manual.

The wrong reagent gas is flowing.

Turn on the correct reagent gas for your tune file.

Ion polarity is set to Negative. No reagent gas ions are formed in NCI.

Switch to Positive ionization mode.

The reagent gas flow is set too low.

Increase the reagent gas flow.

Reagent gas supply tubing is blocked, kinked, pinched, or disconnected.

Inspect and, if necessary, repair or replace the reagent gas supply tubing.

Carbon has built up on the filament or filament has sagged out of alignment.

Inspect the filament. If necessary, replace the filament.

Too much air or water in the system.

Run an air and water check. See the software online help for additional information.

The signal cable is not connected.

Check and, if necessary, reconnect the signal cable.
The filament or filament support is shorted to the ion source body or repeller.
Inspect the filament. If necessary, realign the filament support arms.

The electron inlet hole is blocked.
Inspect the electron inlet hole. If necessary, clean the hole with a clean toothpick and a slurry of aluminum oxide powder and methanol. If the electron inlet hole is that dirty, the entire ion source probably needs to be cleaned.

Saturated methane/isobutane gas purifier
Replace the gas purifier.

Poor quality methane (purity below 99.99%)
Replace the methane with high-purity methane. If necessary, clean and purge the reagent gas lines and clean the ion source.

No or low PFDTD signal, but reagent ions are normal

You are using any reagent gas but methane in PCI.
Switch to methane.

Wrong or corrupted tune file loaded
Check your tune file.

No PFDTD in the calibrant vial
Inspect the calibration vial on the GC side of the MS. If necessary, fill the vial with PFDTD. Do not fill the vial completely; keep the level at least 0.5 cm from the top of the vial.

The pressure of the methane entering the flow controller is too high.
Make sure the regulator on the methane supply is set to 20 to 25 psi (138 to 172 kPa).
The Cl ion source is dirty.
Clean the ion source. See the Agilent 7250 Accurate-Mass Quadrupole Time-of-Flight GC/MS System Operating Manual.

The calibration valve was not purged after the vial was refilled.
Purge the calibration valve as described in “To Refill the CI Calibration Vial” on page 90. Then clean the ion source.

The calibrant vial was overfilled. Excess PFDTD can quench the chemical ionization reactions.
Check the level of the PFDTD in the calibration vial. It should be below the end of the inside tube in the vial.

Poor quality methane (purity below 99.99%)
Replace the methane with high-purity methane. If necessary, clean and purge the reagent gas lines and clean the ion source.

Excessive noise or low signal-to-noise ratio

The GC inlet needs maintenance.
Refer to the GC manual.

The Cl ion source is dirty.
Clean the ion source. See the Agilent 7250 Accurate-Mass Quadrupole Time-of-Flight GC/MS System Operating Manual for more information.

Poor vacuum
Check the pressure on the high vacuum gauge controller.

Air leak
Run an air and water check. See the software online help for additional information.

Saturated methane/isobutane gas purifier
Replace the gas purifier. See “To Replace the Chemical Ionization Gas Purifier” on page 88.
3 CI Troubleshooting

**Poor quality methane (purity below 99.99%)**
Replace the methane with high-purity methane. If necessary, clean and purge the reagent gas lines and clean the ion source.

**Reagent gas flows too high (in EI/PCI MSs)**
Verify that the reagent gas setup is correct.

**Peak at $m/z$ 32**
A visible peak at $m/z$ 32 in methane pretune often indicates air in the system.

**New or dirty reagent gas supply tubing**
Purge the reagent gas supply lines and flow module for at least 60 minutes. See the *Agilent 7250 Accurate-Mass Quadrupole Time-of-Flight GC/MS System Operating Manual* for more information.

**Air leak**
Check for leaks and correct any that you find. See “Air Leaks” on page 52. After all leaks have been corrected, clean the ion source.

**Contaminated reagent gas supply. Suspect this if you have recently replaced your gas tank, and you have ruled out air leaks.**
Replace the reagent gas supply.

**The capillary column is broken or disconnected.**
Inspect the capillary column. Make sure it is not broken and it is installed correctly.

**Saturated methane/isobutane gas purifier**
Replace the gas purifier.
Tuning-Related Symptoms

This section describes symptoms related to tuning. Most symptoms involve difficulties with tuning or with the results of tuning. The following symptoms are covered in this section:

- CI ion ratio is difficult to adjust or unstable
- Cannot complete autotune

Reagent gas ion ratio is difficult to adjust or unstable

The interface tip seal is incorrectly placed, damaged, or missing.
Inspect the interface tip seal. If necessary, remove and reinstall it to ensure a good seal with the CI ion source. Replace it if it is damaged. Install it if it is missing.

Residual air in the MS or in the reagent gas supply lines
Run an air and water check. See the software online help for additional information.

Air leak
Run an air and water check. See the software online help for additional information.

The reagent gas supply is at the wrong pressure.
Check the regulator on the reagent gas supply. It should be adjusted to 20 psi (138 kPa).

A leak in the reagent gas delivery path. This is especially likely if you have set the methane flow much higher than normal and the ratio is still too low.
Check the reagent gas path. Tighten fittings.

The CI ion source is dirty.
Clean the ion source. See the Agilent 7250 Accurate-Mass Quadrupole Time-of-Flight GC/MS System Operating Manual for more information.
Cannot complete Autotune

Wrong or corrupted tune file
Check the tune parameters.

The m/z 28/27 ion ratio (for methane) is incorrect. The correct ratio should be between 1.5 and 5.0.
If the ion ratio is incorrect, adjust it. See the Agilent 7250 Accurate-Mass Q-TOF GC/MS System Operating Manual for more information.

The CI ion source is dirty.
Clean the ion source. See the Agilent 7250 Accurate-Mass Q-TOF GC/MS System Operating Manual for more information.

Too much air or water in the system
See “Air Leaks” on page 52. After eliminating these problems, clean the ion source.

The CI ion source is dirty
Clean the ion source. See the Agilent 7250 Accurate-Mass Quadrupole Time-of-Flight GC/MS System Operating Manual for more information.

Air leak
Run an air and water check. See the software online help for additional information.
3 CI Troubleshooting
General Maintenance

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To Separate the GC from the MS  76
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This chapter describes maintenance procedures and requirements that are used with all Agilent 7250 Accurate Mass Q-TOF GC/MS Systems.
Before Starting

For your safety, read all of the information in this introduction before performing any maintenance tasks.

Scheduled maintenance

Common maintenance tasks are listed in Table 6. Performing these tasks when scheduled can reduce operating problems, prolong system life, and reduce overall operating costs.

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 6  Maintenance schedule

<table>
<thead>
<tr>
<th>Task</th>
<th>Every week</th>
<th>Every 6 months</th>
<th>Every year</th>
<th>As needed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check the foreline pump oil level</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check the calibration vial(s)</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Replace the foreline pump oil*</td>
<td></td>
<td></td>
<td></td>
<td>As needed</td>
</tr>
<tr>
<td>Replace the tip seals on the optional IDP</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Replace the filters on the optional IDP</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Clean the ion source</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Check the carrier gas trap(s) on the GC and MS</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Replace the worn out parts</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Replace GC gas supplies</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Replace CI reagent gas supplies</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Check the foreline pump</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Tune the MS</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Leak check the system</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Lubricate side plate or vent valve O-rings†</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

* Or as needed, every 3 months if ammonia is being used as CI reagent gas.
† Vacuum seals other than the side plate O-ring and vent valve O-ring do not need to be lubricated. Lubricating other seals can interfere with their correct function.
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 required materials list.

High voltage precautions

When the MS is plugged in, even if the power switch is off, dangerous voltage (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, dangerous voltages exist on:

- Electronic circuit boards
- Toroidal transformer
- Wires and cables between these boards
- Wires and cables between these boards and the connectors on the back panel of the 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

Do not perform 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
• Analyzer parts
• Vacuum pumps

**WARNING**  
The foreline pump can cause burns if touched when operating.

**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 heated 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.

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 rotary vane foreline pump also contains tiny droplets of foreline pump oil.

An oil mist filter is supplied with the rotary vane foreline pump. This filter stops only pump oil droplets. It does not trap any other chemicals. If you are using toxic solvents or analyzing toxic chemicals, install a hose from the mist filter outlet to the outdoors or into a fume hood vented to the outdoors. Comply with your local air quality regulations.

**WARNING**  
The oil mist filter supplied with the rotary vane 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, vent the exhaust to a safe location.

The oil in the rotary vane foreline pump also collects traces of the samples being analyzed. All used pump oil should be considered hazardous and handled accordingly. Dispose of used oil as specified by your local regulations.
Electrostatic discharge

All of the printed circuit boards in the MS contain components that can be damaged by electrostatic discharge (ESD). Do not handle or touch these boards unless absolutely necessary. In addition, wires, contacts, and cables can conduct ESD to the electronics boards to which they are connected. This is especially true of the mass filter (quadrupole) contact wires, which can carry ESD to sensitive components on the quadrupole 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 analyzer.
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.
To Refill the EI Calibration Vial

Materials needed

- Gloves, clean, lint-free
- Large (8650-0030)
- Small (8650-0029)
- PFTBA (05971-60571)

Procedure

1. Stop any tuning or data acquisition.
2. Turn off the MS electronics.
4. Turn the calibration vial collar counterclockwise to loosen it. (See Figure 7.) Do not remove the collar.
5. Pull the calibration vial out. You may feel some resistance due to the O-ring around the vial tube section.

![Calibration vial and collar](image.jpg)

Figure 7. Removing the EI calibration vial
6 Syringe or pipette PFTBA into the vial. With the vial vertical, the liquid should be just below the end of the internal tube, approximately 70-120 µL of sample.

7 Push the calibration vial into the valve as far as possible.

8 Withdraw the vial 1 mm. This prevents damage when you tighten the collar.

9 Turn the collar clockwise to tighten it. The collar should be snug but not overly tight. Do not use a tool to tighten the collar. It does not require that much force.

10 Reinstall the source window cover.

**CAUTION** After removing a calibrant vial, you must purge the calibration valve. Failure to do so will result in damage to the filament, microchannel plate, and the photomultiplier.

11 In the Instrument Control panel, select the MS Tune icon to display the GC-Q-TOF Tune dialog box. Select the Manual Tune tab then select the Ion Source tab to display the ion source parameters.

12 Turn off the Emission by selecting the check box.

13 Purge the calibration valve by selecting the El Cal Valve check box to open the calibration valve. Close the El Cal Valve after 30 seconds.
To Connect the GC Nitrogen Gas Source to the Collision Cell

Materials needed

- Wrench, open-end, 1/4-inch × 5/16-inch (8710-0510)
- Ferrule
- Swagelock nut

Procedure

1. With the MS vented, use a 5/16 in. wrench to remove the cap from the nitrogen connection located on the side of the instrument near the transfer line.

2. Place Swagelok nut and ferrule on the end of the nitrogen line tubing from the GC.

3. Connect the nitrogen line to the instrument.
To Separate the GC from the MS

This procedure is used for relocating or storing the instrument. This procedure applies to Agilent 8890 and 7890 GCs.

Materials needed

- Ferrule, blank (5181-3308)
- Self-tightening column nut (recommended, 5190-5233), or interface column nut (05988-20066)
- Wrench, open-end, 1/4-inch x 5/16-inch (8710-0510)

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
The use of hydrogen gas is specifically prohibited with this product.

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

WARNING
Ensure the GC/MS interface, GC inlet, and GC oven have cooled before you remove the column. These areas can be hot enough to burn skin.

Procedure

1. Cool down the GC/MS interface, GC inlet, and GC oven.

2. Before separating the GC from the MS, ensure that the capillary column in the GC oven is either disconnected from the transfer line, or has enough slack uncoiled from the column hanger. Transportation of either instrument requires a disconnection of the capillary column.

3. The foreline pump may be located on the floor, on the lab bench next to or behind the MS, or under the analyzer chamber at the back of the MS. Move it as needed to provide slack in the tubing and cables.

4. Carefully pull the GC away from the MS until you have access to the GC/MS interface cable. (See Figure 9, “Separating/connecting the MS and GC,” on
4 General Maintenance

The GC is guided as it slides by the spacer bracket underneath both instruments.

5 Disconnect the GC/MS interface cable. Disconnecting the cable with the GC on can cause a fault condition.

If you are moving or storing the MS, see “To Move or Store the MS” on page 79.

Figure 9. Separating/connecting the MS and GC
To Position the GC Next to the MS

This procedure is used to position the GC next to the MS after moving the GC away from the MS, or after relocating the instrument.

**WARNING**

Ensure the GC/MS interface, GC inlet, and GC oven have cooled. These areas can be hot enough to burn skin.

**Procedure**

1. Slide the units together and ensure you do not damage the capillary column.
2. Before closing the gap between the MS and the GC, connect the interface cable.
3. Push the GC towards the MS, and close the gap.
4. If needed, connect the column to the transfer line. See the *Agilent 7250 Accurate-Mass Q-TOF GC/MS System Operating Manual*.
5. Wind the excess column slack in the GC oven around the column basket.
6. Turn on the GC, and start carrier gas flow.
To Move or Store the MS

**Materials needed**
- Ferrule, blank (5181-3308)
- Self-tightening column nut (recommended, 5190-5233), or interface column nut (05988-20066)
- Wrench, open-end, 1/4-inch × 5/16-inch (8710-0510)

**Procedure**

**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**
The use of hydrogen gas is specifically prohibited with this product.

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

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

**CAUTION**
Never vent the MS by allowing air in through either end of the foreline hose. Always use the automated procedure in MassHunter Data Acquisition to vent the MS.

Do not exceed the maximum recommended total gas flow.

1. Cool down the GC and MS. See the *Agilent 7250 Accurate-Mass Q-TOF GC/MS System Operating Manual*.
2. Vent the MS. See the *Agilent 7250 Accurate-Mass Q-TOF GC/MS System Operating Manual*.
3. Shut off the carrier gas at the source.
4. Shut off the GC, and unplug the power cord.
4 General Maintenance

5 Disconnect the GC column from the GC/MS interface, and cap the end of the interface with a blank ferrule. See the Agilent 7250 Accurate-Mass Q-TOF GC/MS System Operating Manual.

6 Disconnect the MS power cords on the left side of the instrument.

7 Disconnect the LAN cable, control wires, and carrier gas located on the back of the instrument. See “Side Panel AC Power Connectors” on page 14.

8 Separate the GC from the MS. See “To Separate the GC from the MS” on page 76.

9 Disconnect the collision gas supply tubing, and install a plug.

10 Remove the source window cover (see Figure 12, “Remove covers to access the left side lifting handles,” on page 82), then remove the analyzer cover. (See Figure 10.)

11 Finger-tighten the side plate thumbscrews for the analyzer.

CAUTION

Do not overtighten the side plate thumbscrews. Overtightening will strip the threads in the analyzer chamber. It will also warp the side plate and cause leaks.
12. Reinstall the analyzer cover and source window cover.

13. Remove the front left grill and left side cover. See “To Access the Left Side Lifting Handle” on page 82. This uncovers the handles on the left side of the instrument.

The MS can now be stored or moved. The MS requires three people for lifting. One for the left side lifting handles, one for the right side lifting handles, and one for the back side lifting handles.

**CAUTION**
The MS must remain upright at all times. If you need to ship your MS to another location, contact your Agilent Technologies service representative for advice about packing and shipping.
To Access the Left Side Lifting Handle

![Image showing the left side lifting handles](image)

**Figure 12.** Remove covers to access the left side lifting handles

**Materials needed**

- Screwdriver, Torx T-10 (8710-1623) or T-20 (8710-1615)

**WARNING**
The GC/MS interface, the analyzer parts, and the vacuum system operate at temperatures high enough to cause serious burns. Give these parts enough time to cool before accessing them or handling them.

Before performing this procedure, move the GC away from the MS. (See “To Separate the GC from the MS” on page 76.) Both the GC and MS should be shut down and disconnected from the building power supply. All gas lines must be disconnected from the MS.
This procedure demonstrates how to remove the necessary covers to access the left side lifting handles. The handles on the right and rear sides of the instrument are not covered, and require no special procedures to access.

**Procedure**

1. To remove the front left grill, disengage the two captive screws on the left side edge of the grill. (See Figure 13.)

2. Swing the grill open, and remove it by disengaging the cover tabs on the right side.

3. To remove the left side cover, disengage the two captive screws at the front edge of the cover. (See Figure 14.)
4 Slide the left side cover towards the front of the instrument.

5 Remove this cover to access the handle. (See Figure 15.)

Figure 15. Left side lifting handles
5 CI Maintenance

To Minimize Rotary Vane Foreline Pump Damage from Ammonia  86
To Replace the Chemical Ionization Gas Purifier  88
To Clean the Reagent Gas Supply Lines  89
To Refill the CI Calibration Vial  90

This chapter describes maintenance procedures and requirements that are unique to an Agilent 7250 Accurate-Mass Q-TOF GC/MS System equipped with the chemical ionization hardware.
To Minimize Rotary Vane Foreline Pump Damage from Ammonia

Air ballasting for an hour every day removes most of the ammonia from the pump oil. This will greatly increase the life of the pump.

**CAUTION**
Only perform this procedure if the pump is at normal operating temperature. The water vapor in air can cause condensation of the ammonia at the ballast valve if the pump is cold.

**WARNING**
The pump may be dangerously hot. Wear insulating gloves before you touch it or the ballast valve.

**Procedure**
1. Turn the ballast valve on the foreline pump (Figure 16) until the 1s are aligned. The sound of the pump will get much louder.

2. Leave the ballast valve open for one hour. You can continue to run samples while the pump is ballasting.
3 Close the ballast valve by aligning the 0s. Leaving the ballast valve open all the time will result in loss of pump oil and damage to the pump.

**CAUTION**
Always purge the flow module with methane after flowing ammonia. The use of ammonia reagent gas also requires that the foreline pump oil be replaced every two to three months instead of the usual six months.
To Replace the Chemical Ionization Gas Purifier

**Materials needed**
- Chemical ionization gas purifier (5190-9071)
- Front ferrule for 1/8-inch tubing (5180-4110)
- Rear ferrule for 1/8-inch tubing (5180-4116)
- Tubing cutter (8710-1709)

The chemical ionization gas purifier needs to be replaced after four tanks of reagent gas. This frequency may vary depending on purity of the gas and care taken in uncapping and installing the gas purifier. A large leak upstream from the gas purifier can quickly exhaust the reduced metal of the oxygen and moisture traps.

**Procedure**
1. Turn off gas flow to the purifier.

**CAUTION**
Do not remove the caps until you are ready to install the gas purifier. Only remove the caps in the gas flow to prevent contamination by air.

**WARNING**
Methane is flammable. Extinguish all flames in the area before turning on gas flow.

2. Disconnect the fittings on the old purifier.
3. Remove the ferrules from the tubing at the outlet of the gas purifier. Using the tubing cutter, cut off the end of the tubing with the ferrules.
4. Install the new purifier.
5. Turn on the gas flow, and purge the new purifier.
6. Cap the old purifier, and prepare it to be sent for regeneration. See the instructions on the label.
To Clean the Reagent Gas Supply Lines

Materials needed

- Clean, dry nitrogen
- Heat gun
- Tubing cutter (8710-1709)

**WARNING**
Do not heat the gas tubing when reagent gas is flowing.

**CAUTION**
Do not put liquids into the tubing. Do not heat the tubing when it is connected to the MS.

Procedure

If the reagent gas lines become contaminated, they can be cleaned.

1. Turn off the reagent gas supply.
2. Disconnect the reagent gas tubing from the gas supply, the gas purifier, and the MS.
3. Cap the gas purifier following the instructions on the label.
4. Connect one end of the tubing to a supply of clean, dry nitrogen and turn on gas flow.
5. Use the heat gun to warm the tubing, starting at the supply end and working your way to the free end.
6. Repeat for any other pieces of tubing that need to be cleaned.
7. Reconnect the tubing to the gas supply, gas purifier, and MS. Follow the instructions on the gas purifier label.
8. Turn on the reagent gas supply.
To Refill the CI Calibration Vial

Materials needed
• PFDTD calibrant (8500-8510)
• Syringe or pipette, clean
• Gloves, clean, lint-free
  • Large (8610-0300)
  • Small (8610-0029)

Procedure
1. Stop any tuning or data acquisition.
2. Set the reagent gas flow to Gas Off.
3. Turn off the MS electronics.
4. Cool down the GC/MS transfer line, the GC oven, and the GC inlet to 30 °C.
5. Uncoil enough slack from the capillary column inside the GC oven to allow the GC to separate from the MS.
6. Move the GC away from the MS. See "To Separate the GC from the MS" on page 76.
7. The CI vial is located on the side of the instrument near the transfer line.
8. Turn the CI vial collar counterclockwise to loosen it (Figure 17 on page 91). Do not remove the collar.

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 while handling any parts that go inside the GC or analyzer chambers.
Pull the calibration vial out. You may feel some resistance due to the O-ring around the vial tube.

Syringe or pipette PFDTD into the vial. With the vial vertical, the liquid should be just below the end of the internal tube, approximately 70 µL of sample.

Push the calibration vial into the valve as far as possible.

Withdraw the vial 1 mm. This prevents damage when you tighten the collar.

Turn the collar clockwise to tighten it. The collar should be snug but not overly tight. Do not use a tool to tighten the collar. It does not require that much force.

Position the GC next to the MS. See “To Position the GC Next to the MS” on page 78.

---

**CAUTION**

Do not rinse the vial with any solvents. Never expose the inside of the vial to chlorinated solvents or isopropyl alcohol or water - this will result in severe loss of CI sensitivity.

---

**CAUTION**

After removing a calibrant vial, you must purge the calibration valve. Failure to do so will result in damage to the filaments and the electron multiplier.
5 CI Maintenance

15 In the Instrument Control panel, select the MS Tune icon to display the GC Q-TOF Tune dialog box. Select the Manual Tune tab then select the Ion Source tab to display the ion source parameters.

16 Turn off the Emission by selecting the check box.

17 Purge the calibration valve by selecting the CI Cal Valve check box to open the calibration valve. Close the CI Cal Valve after 30 seconds.
6 Vacuum System

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Common Vacuum System Problems 97
Foreline Pump 98
Side Plate 110
Vacuum Seals 110
EI Calibration Valve 111
CI Calibration Valve 112

This chapter describes maintenance requirements of the Agilent 7250 Accurate Mass Q-TOF GC/MS vacuum system.
Overview

The vacuum system creates the high vacuum (low pressure) required for the GC/MS to operate. Without the vacuum, the molecular mean free path would be very short and ions would collide with air molecules before they could reach the detector. Operation at high pressures also would damage analyzer components.

The Agilent 7250 Accurate-Mass GC/MS System uses four vacuum pumps to obtain the vacuum levels needed. Three turbomolecular (turbo) pumps create vacuum in the analyzer. These turbo pumps discharge into a manifold operating at foreline pump inlet pressure. The foreline pump discharges to near atmospheric pressure.

Most of the vacuum system operation is automated. Operator interaction and monitoring is accomplished through the data system.
Maintaining the Vacuum System

Periodic maintenance

As listed in Table 6, "Maintenance schedule," on page 68, some maintenance tasks for the vacuum system must be performed periodically. These include:

- Checking the rotary vane foreline pump oil (every week)
- Checking the calibration vial (every 6 months)
- Replacing the rotary vane foreline pump oil (every 6 months)
- Replacing IDP tip seal (yearly)
- Replacing IDP filters (yearly)

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

Other procedures

Problems with any of the vacuum system seals in the analyzer usually require the services of Agilent service personnel. See Chapter 2, “General Troubleshooting” on page 25, and see 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, see the Agilent 7250 Accurate-Mass Q-TOF GC/MS System Operating Manual.

Most of the procedures in this chapter are illustrated with video clips on the Agilent GC/MS Hardware User Information & Instrument Utilities and 7250 Q-TOF GC/MS User Information disks.
Vacuum System Components

The parts of the vacuum system are:

- Foreline (rough) pump
- 3 High-vacuum turbo pumps
- Analyzer chambers
- Collision cell connections
- Collision cell plate
- Nitrogen purge and vent system
- Side plate (analyzer door)
- Vacuum seals
- EI calibration valve
- Vacuum control electronics
- Vacuum gauges and gauge control electronics
Common Vacuum System Problems

Air leak symptoms

The most common problems associated with any vacuum system are air leaks. Symptoms of air leaks include:

• Loud gurgling noise from the foreline pump (very large leak)
• Inability of the turbo pumps to reach 95% speed
• Higher than normal high-vacuum gauge controller readings

The instrument will not pump down successfully unless you press on the side board (analyzer door) when you turn on the MS power. Continue to press until the sound from the foreline pump becomes quieter.

Pumpdown failure shutdown

The system will shut down both the high-vacuum and the foreline pump if the system fails to pump down correctly. It takes approximately 10 minutes for the foreline pump to achieve 10 Torr, which then allows the turbo pumps to start. If a turbo pump speed is below 80% after an additional 10 minutes, the system shuts down.

This is usually because of a large air leak: either the side plate has not sealed correctly or the electronic vent valve is still open.

To restart the MS, find and correct the air leak, then switch the power off and on. Press on the side plates when turning on the MS power to ensure good seals.
Foreline Pump

The 7250 can be used with either a standard oil-based rotary vane foreline pump (DS-202), or a dry scroll pump (IDP-15). Procedures for maintaining these pumps are provided on the following pages.

To connect the foreline hose to the foreline pump

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

Procedure
This procedure applies to the rotary vane and dry scroll pumps. The dry scroll pump is shown in the video.
1. Place the o-ring against the hepa filter inlet.
2. Place the foreline hose against the o-ring.
3. Place the clamp over the o-ring, hose flange, and filter flange.
4. Tighten the clamp using the long screw and wing nut.

To disconnect the foreline hose from the foreline pump

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

Procedure
This procedure applies to the rotary vane and dry scroll pumps. The dry scroll pump is shown in the video.

WARNING
The foreline pump can cause burns if touched when operating. Make sure it has had time to cool.

CAUTION
The MS must be vented and off before the hose is disconnected. Never vent the MS by allowing air in through either end of the foreline hose.

1. Unscrew the wing nut on the clamp.
2. While supporting the foreline hose, remove the clamp from the hepa filter inlet.
3. Remove the hose and o-ring from the filter inlet.

To check the rotary vane pump oil mist filter
Check the oil mist filter weekly for any damage and collected pump fluid.
- If the oil mist filter is damaged, replace it.
• If oil is found in the oil mist filter, open the gas ballast valve counterclockwise just enough to return the condensed oil back to the pump. Close the gas ballast valve clockwise.

**WARNING**  
Do not touch the fluid. The residue from some samples are toxic. Properly dispose of the fluid.

**NOTE**  
When you close the ballast valve, you increase the efficiency of the pump. However, you lose oil to the mist filter if you don’t recycle. Check the status of your oil mist filter at least once per week to ensure that it does not fill with oil. If you lose too much oil in the foreline pump, the vacuum will not be maintained, and the MS will vent.

To check the rotary vane foreline pump fluid level

Check the level and color of the pump fluid weekly.

• Check the fluid level in the window of the foreline pump. The fluid level should be between the marks for Max and Min.

• Check that the color of the pump fluid is clear or almost clear with few suspended particles. If the pump fluid is dark or full of suspended particles, replace it.

**WARNING**  
Never add or replace the foreline pump fluid while the pump is on.

**NOTE**  
Record this procedure in the Maintenance Logbook, which was supplied with your instrument.

To add oil to the rotary vane foreline pump

Add pump oil when the pump oil level is low.

**Materials needed**

• Funnel

• Gloves, clean, lint-free
• Large (8650-0030)
• Small (8650-0029)
• Foreline pump oil (Inland 45, 6040-0834)
• Safety glasses (goggles)

**WARNING** Never add pump oil while the pump is on.

**WARNING** The fill cap and pump may be dangerously hot. Check that the fill cup and pump are cool before you touch them.

**CAUTION** Use only foreline pump oil (Inland 45, 6040-0834). Any other fluids can substantially reduce pump life and invalidate the pump warranty.

**Procedure**

1. Vent and turn off the instrument. See the *Agilent 7250 Accurate-Mass Q-TOF GC/MS System Operating Manual*.
2. Unplug the instrument power cord from the electrical outlet.
3. Remove the fill cap on the foreline pump.
4. Add new pump fluid until the fluid level is near, but not over the maximum mark beside the fluid level window.
5. Reinstall the fill cap.
6. Wipe off all excess oil around and underneath of the pump.
7. Reconnect the power cord.
8. Start up the instrument. See the *Agilent 7250 Accurate-Mass Q-TOF GC/MS System Operating Manual*.

**To replace the oil in the rotary vane foreline pump**

Replace the pump oil every six months or sooner if the oil appears dark or cloudy.
Materials needed

- Container for catching old pump oil
- Funnel
- Gloves, clean, lint-free
  - Large (8650-0030)
  - Small (8650-0029)
- Foreline pump oil (Inland 45, 6040-0834)
- Screwdriver, flat-bladed, large (p/n 8710-1029)
- Safety glasses (goggles)

**WARNING**
Never add pump oil while the pump is on.

**WARNING**
The fill cap and pump may be dangerously hot. Check that the fill cap and pump are cool before you touch them.

**WARNING**
Do not touch the oil. The residue from some samples are toxic. Properly dispose of the oil.

**CAUTION**
Use only foreline pump oil (Inland 45, 6040-0834). Any other fluids can substantially reduce pump life and invalidate the pump warranty.

Procedure

1. Vent and turn off the instrument. See the *Agilent 7250 Accurate-Mass Q-TOF GC/MS System Operating Manual*.
2. Unplug the power cord from the instrument.
3. Place a container under the drain plug of the foreline pump.
4. Remove the fill cap, then open the drain plug. Drain the fluid completely by raising the motor end of the pump up.
5. Reinstall the drain plug.
6. Pour in new pump fluid until the fluid level is near, but not above the maximum mark beside the fluid level window.
7  Reinstall the fill cap.
8  Reconnect the power cord.
9  Start up the instrument. See the Agilent 7250 Accurate-Mass Q-TOF GC/MS System Operating Manual.
10 Pump down for 30 minutes, then inspect the pump for leaks.
11 Continue pumping down overnight and inspect the pump for leaks the next day.

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

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

**WARNING**

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

To remove the exhaust silencer filter

**Procedure**

This procedure applies to the rotary vane and dry scroll pumps. The dry scroll pump is shown in the video.

1  Unscrew the wing nut on the clamp. (See **Figure 19** on page 104.)
2  While supporting the silencer filter, remove the clamp.
3  Lift the filter and O-ring from the pump.
To install the exhaust silencer filter

Procedure

This procedure applies to the rotary vane and dry scroll pumps. The dry scroll pump is shown in the video.

1. Place the O-ring against the IDP-15 exhaust. (See Figure 19 on page 104.)
2. Place the exhaust silencer filter against the O-ring.
3. Place the clamp over the O-ring and KF flanges.
4. Tighten the clamp using the long screw and wing nut.
To replace the IDP-15 dry pump tip seal

Materials needed

- Gloves, clean, lint-free
  - Large (8650-0030)
  - Small (8650-0029)
- 4 mm hex wrench (8710-2720)
- 5 mm hex wrench (G4514-80524)
- 6 mm hex wrench (8710-1839)
- IDP-15 tip seal maintenance kit (5190-9613)

Procedure

1. Vent the mass spectrometer (see the Agilent 7250 Accurate-Mass Q-TOF GC/MS System Operating Manual).

2. Using a 4 mm hex wrench, unscrew the six screws securing the front cowl.

WARNING

The IDP pump operates at high temperatures. Do not touch any part until you are sure it is cool.
3 Rotate the cowl over the exhaust port.
4 Unplug the fan connector at the base of the cowl, and remove the cowl.
5 Set aside the L-bracket.

**WARNING**
Wear a face mask. The IDP pump may contain significant quantities of dust containing chemicals analyzed by the mass spectrometer. Do NOT use compressed air to blow out this dust. Using compressed air will contaminate your laboratory with potentially hazardous dust.

6 Using a 5 mm hex wrench, unscrew the six screws securing the outboard housing. It may be necessary to raise and support the top console to access the screws.
7 Remove the scroll housing by lifting it away from the rest of the pump.
8 Remove the O-ring.
9 Remove both tip seals from the orbiting plate and the outboard housing.
10 Use cotton swabs dampened with alcohol to clean all debris from the orbiting plate, outboard housing, and O-ring groove.
11 Install the new O-ring.
12 Install the new tip seals into the grooves in the orbiting scroll and outboard housing. The tip seal should be well seated in the grooves, protruding only slightly from the grooves.
13 Align the outboard housing with the orbiting plate, and reattach it using the six screws and a 5 mm hex wrench. When tightening the screws, do so in a crisscross pattern.
14 Reinstall the console.
15 Align the slots in the L-bracket with the holes in the electrical tray.
16 Reconnect the fan connector.
17 Rotate the front cowl over the exhaust port, and align it on the front of the pump.
18 Reattach the front cowl using the six screws and a 4 mm hex wrench.
To replace the IDP pump HEPA filter cartridge

This procedure applies only to the dry scroll foreline pump.

**Materials needed**

- Gloves, clean, lint-free
  - Large (8650-0030)
  - Small (8650-0029)
- HEPA filter with cartridge (SCRINTRPNW25)
- HEPA filter cartridge (REPLHEPAFILTER1)

**WARNING**

The IDP pump operates at high temperatures. Do not touch any part until you are sure it is cool.

**CAUTION**

The MS must be off and vented, and the foreline pump must be off, before performing this procedure.

**Procedure**

1. Undo the three latches securing the top of the HEPA filter.
2. Remove the lid, and the filter cartridge from the filter.
3. Insert the new filter cartridge, and replace the lid on top of the filter.
4. Secure the lid using the three latches.

To change the exhaust silencer filter cartridge

**Materials needed**

- Gloves, clean, lint-free
  - Large (8650-0030)
  - Small (8650-0029)
- Exhaust silencer filter cartridge
  - large (REPLSLRFILTER1)
Procedure
1. Unscrew the cap from the exhaust filter.
2. Pull the filter cartridge out of the filter cap.
3. Insert the new filter cartridge.
4. Align the cap onto the filter and twist the cap counter clockwise to lock it in place.

To install the IDP pump ballast

Materials needed
• 4 mm hex wrench (8710-2720)
• 6 mm hex wrench (8710-1839)
• 14 mm wrench
• Ballast (Contact Agilent for this part)

Procedure
1. Vent the mass spectrometer (see the Agilent 7250 Accurate-Mass Q-TOF GC/MS System Operating Manual).
2. Using a 4 mm hex wrench, unscrew the six screws securing the front cowl.
3. Rotate the cowl over the exhaust port.
4. Unplug the fan connector at the base of the cowl, and remove the cowl.
5. Using a 6 mm hex wrench, remove the ballast plug from the desired gas ballast port.

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

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

CAUTION
The MS must be off and vented, and the foreline pump must be off, before performing this procedure.
6 Screw the ballast into the empty port, and tighten it with a 14 mm wrench.

To remove the IDP pump ballast

Materials needed

- 4 mm hex wrench (8710-2720)
- 6 mm hex wrench (8710-1839)
- 14 mm wrench
- Ballast plug (Contact Agilent for this part)

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

CAUTION The MS must be off and vented, and the foreline pump must be off, before performing this procedure.

Procedure

1 Vent the mass spectrometer (see the Agilent 7250 Accurate-Mass Q-TOF GC/MS System Operating Manual).

2 Using a 4 mm hex wrench, unscrew the six screws securing the front cowl.

3 Rotate the cowl over the exhaust port.

4 Unplug the fan connector at the base of the cowl, and remove the cowl.

5 Using a 14 mm wrench, loosen the ballast until it can be removed by hand.

6 Unscrew and remove the ballast.

7 Using a 6 mm hex wrench, install the ballast plug.
Side Plate

The side plate covers the large opening in the side of the analyzer chamber. The analyzer assembly is attached to the side plate inside the analyzer chamber. Several electrical feedthroughs are built into the side plate. Wires connect the feedthroughs to analyzer components. Thumbscrews are located at each end of the side plate. We recommend that the thumbscrews be loosely tightened.

**CAUTION**

Fasten the side plate thumbscrews for shipping or storage only. For normal operation, both thumbscrews should be loose. Overtightening will warp the side plate and cause air leaks. Do not use a tool to tighten the side plate thumbscrews.

**CAUTION**

When you turn on the power to pump down the MS, press on the side plate to ensure good seals.

Vacuum Seals

Several types of Viton elastomer O-ring seals are used to prevent air leaks into the analyzer chamber. All these O-rings, and the surfaces to which they seal, must be kept clean and protected from nicks and scratches. A single hair, piece of lint, or scratch can produce a serious vacuum leak. Three of the O-rings are *lightly* lubricated with Apiezon-L vacuum grease: the side plate O-rings and the vent valve O-ring.

Contact Agilent to have these vacuum seals serviced.
EI Calibration Valve

The EI calibration valve is an electromechanical valve with a vial to hold the tuning compound. (See Figure 21.) When a calibration valve is opened, tuning compound in the vial diffuses into the ion source. The valve is controlled by the MassHunter Workstation software.

The EI calibration valve is held onto the top of the analyzer chamber by two screws. A small O-ring provides a face seal.

Perfluorotributylamine (PFTBA) is the most commonly used tuning compound for EI operation. PFTBA is required for automatic tuning of the MS.

Figure 21. EI calibration valve
CI Calibration Valve

The CI calibration valve is part of the reagent gas flow control module supplied with the optional chemical ionization ion source. The CI calibration valve is an electromechanical valve with a vial to hold the tuning compound. (See Figure 22.) It is controlled by the Agilent MassHunter Workstation software. It opens automatically during CI autotune or manual tuning, allowing the tuning compound, perfluoro-5,8-dimethyl-3,6,9-trioxidodecane (PFDTD), to diffuse through the GC/MS interface and into the ion source.

Figure 22. CI calibration valve
7 Replacement Parts

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Analyzer 121
GC/MS Interface 126
Consumables and Maintenance Supplies 128
Additional CI Parts 131

This chapter lists parts that can be ordered for use in maintaining your 7250 Accurate-Mass Q-TOF GC/MS System. It includes most of the parts or assemblies in the MS. Most of the parts listed are not user-replaceable. They are listed here for use by Agilent Technologies service representatives.
To Order Parts

To order parts for your MS, address the order or inquiry to your local Agilent Technologies office. Supply them with the following information:

- Model and serial number of your MS, located on a label near the power cord connections to the mainframe.
- Part number(s) of the part(s) needed
- Quantity of each part needed

Some parts are available as rebuilt assemblies

Rebuilt assemblies pass all the same tests and meet all the same specifications as new parts. Rebuilt assemblies can be identified by their part numbers. The first two digits of the second part of the part number are 69 or 89 (such as xxxx-69xxx or xxxx-89xxx). Rebuilt assemblies are available on an exchange-only basis. When you return the original part to Agilent Technologies (after you receive the rebuilt assembly) you will receive a credit.

If you cannot find a part you need

If you need a part that is not listed in this chapter, check the Agilent Technologies Analytical Supplies Catalog or the online catalog on the Worldwide Web at http://www.agilent.com/chem. If you still cannot find it, contact your Agilent Technologies service representative or your Agilent Technologies office.
Electronics

The printed circuit boards in the MS are available only as complete assemblies. Individual electronic components are not available. This section contains the following parts: Table 7, “External cables”, Table 8, “Internal cables,” on page 116; Table 9, “Printed circuit boards,” on page 116; and Table 10, “Fuses and power switches,” on page 117.

Cables

Table 7   External cables

<table>
<thead>
<tr>
<th>Description</th>
<th>Part number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remote Start-Stop cable</td>
<td>G1530-60930</td>
</tr>
<tr>
<td>Y Remote Start-Stop cable</td>
<td>G1530-61200</td>
</tr>
<tr>
<td>H Remote Start-Stop cable</td>
<td>35900-60800</td>
</tr>
<tr>
<td>MS LAN cable</td>
<td>8121-2846</td>
</tr>
<tr>
<td>LAN cable</td>
<td>8121-0940</td>
</tr>
<tr>
<td>C19 Q-TOF Mainframe</td>
<td></td>
</tr>
<tr>
<td>Power cord, Taiwan/S America, C19, 20 A</td>
<td>8120-6360</td>
</tr>
<tr>
<td>Power cord, Japan, C19, 20 amp</td>
<td>8120-6903</td>
</tr>
<tr>
<td>Power cord, Australia, C19, 16 amp</td>
<td>8120-8619</td>
</tr>
<tr>
<td>Power cord, GB/HK/SG/MY, C19, 13 amp</td>
<td>8120-8620</td>
</tr>
<tr>
<td>Power cord, Swiss/DK, C19, 16 amp</td>
<td>8120-8622</td>
</tr>
<tr>
<td>Power cord, China, C19, 15 amp, fast</td>
<td>8121-0070</td>
</tr>
<tr>
<td>Power cord, Israel, C19, 16 amp</td>
<td>8121-0161</td>
</tr>
<tr>
<td>Power cord, Argentina, C19, 16 amp</td>
<td>8121-0675</td>
</tr>
<tr>
<td>Power cord, India/S.Africa, C19, 15 amp</td>
<td>8121-0710</td>
</tr>
<tr>
<td>Power cord, Europe/S Korea, C19, 15 A, 250 V</td>
<td>8121-1222</td>
</tr>
<tr>
<td>Power cord, Thai 220 V, 15 A, 1.8 M, C19</td>
<td>8121-1301</td>
</tr>
<tr>
<td>Power cord, Brazil, C19, 250 V max</td>
<td>8121-1787</td>
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<tr>
<td>Power cord, US 240 V, C19, 15 amp</td>
<td>8121-0075</td>
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### Table 8  Internal cables

<table>
<thead>
<tr>
<th>Description</th>
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</tr>
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<tbody>
<tr>
<td>Cable, Switch board</td>
<td>G3850-60819</td>
</tr>
<tr>
<td>Cable, Quad driver-1 data</td>
<td>G3850-60802</td>
</tr>
<tr>
<td>Cable, Collision cell board data</td>
<td>G3850-60848</td>
</tr>
<tr>
<td>Cable, Filament drive board data</td>
<td>G3850-60847</td>
</tr>
<tr>
<td>Cable harness, main board 1</td>
<td>G3850-60826</td>
</tr>
<tr>
<td>Cable harness, main board 2</td>
<td>G3850-60855</td>
</tr>
<tr>
<td>Cable, Gauge 3 extension</td>
<td>G3850-60836</td>
</tr>
<tr>
<td>Cable, Turbo supply</td>
<td>G3850-60810</td>
</tr>
<tr>
<td>Cable, Turbo controller module data</td>
<td>G3850-60824</td>
</tr>
<tr>
<td>Cable, Turbo fan and turbo fan controller</td>
<td>G3850-60811</td>
</tr>
<tr>
<td>Cable, Turbo pump control module, AC</td>
<td>G3850-60825</td>
</tr>
<tr>
<td>Cable, Wire lens - 5</td>
<td>G3850-60833</td>
</tr>
<tr>
<td>Cable, Rough pump AC output</td>
<td>G3850-60837</td>
</tr>
</tbody>
</table>

### Printed circuit boards

### Table 9  Printed circuit boards

<table>
<thead>
<tr>
<th>Description</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Filament drive board</td>
<td>G7250-67018</td>
</tr>
<tr>
<td>Collision cell board</td>
<td>G7003-65914</td>
</tr>
</tbody>
</table>
Fuses and power switch

Table 10  Fuses and power switches

<table>
<thead>
<tr>
<th>Description</th>
<th>Part number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuse - AC Board</td>
<td>G1960-6117</td>
</tr>
<tr>
<td>Fuse (main frame) metric 8 A 250 V TD FE UL-REC CSA</td>
<td>2110-0969</td>
</tr>
<tr>
<td>Fuse (foreline pump) metric 12.5 A 250 V UL-LST CSA</td>
<td>2110-1398</td>
</tr>
<tr>
<td>Switch Bd PCA</td>
<td>G1960-61000</td>
</tr>
<tr>
<td>Power switch button</td>
<td>5041-8381</td>
</tr>
<tr>
<td>Switch board cable</td>
<td>G3850-60819</td>
</tr>
</tbody>
</table>

Figure 23.  Fuses and circuit breakers
Vacuum System

This section contains the following parts: Table 11, "O-rings and seals"; Table 12, "Rotary vane foreline pump and related parts," on page 119; Table 13, "IDP-15 Pump and related parts," on page 119; and Table 14, "Turbo pump MS vacuum system components," on page 120.

O-rings and seals

Table 11  O-rings and seals

<table>
<thead>
<tr>
<th>Description</th>
<th>Part number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calibration valve O-ring (1/4-inch)</td>
<td>5180-4182</td>
</tr>
<tr>
<td>End plate O-ring (for front and rear end plates)</td>
<td>0905-1441</td>
</tr>
<tr>
<td>GC/MS interface O-ring</td>
<td>0905-1405</td>
</tr>
<tr>
<td>KF10/16 seal (foreline pump inlet and turbo pump outlet)</td>
<td>0905-1463</td>
</tr>
<tr>
<td>KF25 O-ring assembly (turbo pump outlet)</td>
<td>0100-1551</td>
</tr>
<tr>
<td>Seal, turbo pump inlet</td>
<td>0100-1879</td>
</tr>
<tr>
<td>O-ring, forepump drain plug</td>
<td>0905-1619</td>
</tr>
<tr>
<td>Fill plug, forepump</td>
<td>0100-2451</td>
</tr>
<tr>
<td>Analyzer ion gauge</td>
<td>G1960-80303</td>
</tr>
<tr>
<td>Foreline ion gauge</td>
<td>G1960-80101</td>
</tr>
<tr>
<td>O-ring, standard forepump fill plug</td>
<td>0905-1630</td>
</tr>
<tr>
<td>O-ring, ion gauge</td>
<td>0905-1627</td>
</tr>
<tr>
<td>O-ring, collision cell feedthrough</td>
<td>0905-1405</td>
</tr>
<tr>
<td>O-ring, collision cell plate</td>
<td>0905-1689</td>
</tr>
<tr>
<td>Side plate O-ring</td>
<td>0905-1690</td>
</tr>
</tbody>
</table>
Rotary vane foreline pump (DS-202)

Table 12  Rotary vane foreline pump and related parts

<table>
<thead>
<tr>
<th>Description</th>
<th>Part number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foreline hose assembly (hose and internal spring)</td>
<td>05971-60119</td>
</tr>
<tr>
<td>Hose clamp used with 05971-60119</td>
<td>1400-3241</td>
</tr>
<tr>
<td>DS 202 foreline pump, 240V</td>
<td>G3850-80240</td>
</tr>
<tr>
<td>Oil return kit</td>
<td>9499376</td>
</tr>
<tr>
<td>Oil mist eliminator kit for KF25</td>
<td>9499392</td>
</tr>
<tr>
<td>Oil drain extension</td>
<td>9499375</td>
</tr>
<tr>
<td>Aluminum centering ring, with viton o-ring</td>
<td>KC25AV</td>
</tr>
<tr>
<td>Foreline pump inlet seal (KF10/16)</td>
<td>0905-1463</td>
</tr>
<tr>
<td>KF25 Clamp (tp end of hose – not shown)</td>
<td>0100-0549</td>
</tr>
<tr>
<td>KF25 Hose adapter (tp end of hose – not shown)</td>
<td>G1099-20532</td>
</tr>
<tr>
<td>O-ring for oil mist filter and hose barb adapter</td>
<td>0905-1193</td>
</tr>
</tbody>
</table>

IDP-15 dry scroll foreline pump

Table 13  IDP-15 Pump and related parts

<table>
<thead>
<tr>
<th>Description</th>
<th>Part number</th>
</tr>
</thead>
<tbody>
<tr>
<td>IDP-15 tip seal maintenance kit</td>
<td>5190-9613</td>
</tr>
<tr>
<td>IDP-15 tip seal replacement kit</td>
<td>X3815-67000</td>
</tr>
<tr>
<td>IDP-15 pump</td>
<td>X3815-64010</td>
</tr>
<tr>
<td>HEPA filter</td>
<td>SCRINTRPWN25</td>
</tr>
<tr>
<td>Exhaust silencer kit</td>
<td>EXSLRSH110</td>
</tr>
<tr>
<td>Ballast</td>
<td>Contact Agilent for this part</td>
</tr>
<tr>
<td>Ballast plug</td>
<td>Contact Agilent for this part</td>
</tr>
</tbody>
</table>
# Turbo pump and related parts

## Table 14  Turbo pump MS vacuum system components

<table>
<thead>
<tr>
<th>Description</th>
<th>Part number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fan (for high-vacuum pump)</td>
<td>G1099-60564</td>
</tr>
<tr>
<td>Pfeiffer HiPace300, rebuilt</td>
<td>G3170-89162</td>
</tr>
<tr>
<td>Pfeiffer HiPace300</td>
<td>G3170-80162</td>
</tr>
<tr>
<td>KF25 Clamp (for turbo pump outlet)</td>
<td>0100-0549</td>
</tr>
<tr>
<td>KF25 O-ring assembly (for turbo pump outlet)</td>
<td>0100-1551</td>
</tr>
<tr>
<td>Split flow turbo pump, nEXT200.200D</td>
<td>G3850-80010</td>
</tr>
<tr>
<td>Split flow turbo pump, nEXT200.200D, rebuilt</td>
<td>G3850-89010</td>
</tr>
<tr>
<td>ISO100 seals</td>
<td>3150-0962</td>
</tr>
<tr>
<td>Claw assembly</td>
<td>G3170-60580</td>
</tr>
<tr>
<td>* Flat washers</td>
<td>3050-0993</td>
</tr>
<tr>
<td>* Lock washers</td>
<td>2190-0669</td>
</tr>
<tr>
<td>* Hex nuts</td>
<td>0535-0048</td>
</tr>
<tr>
<td>* Half claw clamp</td>
<td>G3170-60580</td>
</tr>
<tr>
<td>Centering ring, NW25, with o-ring</td>
<td>0100-1551</td>
</tr>
<tr>
<td>O-ring, trapped</td>
<td>0905-1463</td>
</tr>
<tr>
<td>O-ring</td>
<td>0905-1574</td>
</tr>
<tr>
<td>O-ring</td>
<td>0905-1573</td>
</tr>
<tr>
<td>O-ring, backup</td>
<td>G1969-20082</td>
</tr>
<tr>
<td>Hinged clamp with wing nut, NW20/25</td>
<td>0100-1398</td>
</tr>
<tr>
<td>Cable, extension</td>
<td>G3850-60800</td>
</tr>
<tr>
<td>Flex hose, metal, NW 25</td>
<td>G3850-20156</td>
</tr>
<tr>
<td>Thermal barrier</td>
<td>G1969-20081</td>
</tr>
<tr>
<td>Power supply, TMH</td>
<td>G3850-60600</td>
</tr>
<tr>
<td>CC gas flow module, 3-channel</td>
<td>G7002-60044</td>
</tr>
<tr>
<td>* GC/MS QQQ flow weldment cap assembly</td>
<td>G7000-80500</td>
</tr>
<tr>
<td>* 3-Channel QQQ EPC</td>
<td>G7000-60506</td>
</tr>
</tbody>
</table>
### Analyzer

**Table 15** shows the analyzer chambers and associated parts.

#### Table 15  Analyzer chamber and related parts

<table>
<thead>
<tr>
<th>Description</th>
<th>Part number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Micro Ion Gauge</td>
<td>G1960-80303</td>
</tr>
<tr>
<td>Ion gauge baffle</td>
<td>G7000-20049</td>
</tr>
<tr>
<td>O-ring, ion gauge</td>
<td>0905-1627</td>
</tr>
<tr>
<td>M3x12L screws</td>
<td>0515-0664</td>
</tr>
<tr>
<td>El Calibration valve assembly</td>
<td>G3850-67204</td>
</tr>
<tr>
<td>Calibration vial</td>
<td>G3170-80002</td>
</tr>
<tr>
<td>Collision cell holder</td>
<td>G3850-20042</td>
</tr>
</tbody>
</table>

**Table 16** shows the replacement parts for the analyzers. Also included in this section are **Table 17**, "Analyzer screws," on page 122; and **Table 18**, "LE-EI ion source parts," on page 122.

#### Table 16  Analyzer parts

<table>
<thead>
<tr>
<th>Description</th>
<th>Part number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source PCA and cable assembly</td>
<td>G7002-60425</td>
</tr>
<tr>
<td>Mass filter cable kit</td>
<td>G3170-60130</td>
</tr>
<tr>
<td>Mass filter contacts (qty 1)</td>
<td>G1099-60142</td>
</tr>
<tr>
<td>Mass filter ceramic support, source end</td>
<td>G7002-20057</td>
</tr>
<tr>
<td>Mass filter heater assembly</td>
<td>G1099-60172</td>
</tr>
<tr>
<td>Pins for source and detector end mounting brackets</td>
<td>G1099-20137</td>
</tr>
<tr>
<td>p-filter bridge</td>
<td>G7000-60028</td>
</tr>
<tr>
<td>Side plate, weld assembly (support)</td>
<td>G7002-67021</td>
</tr>
</tbody>
</table>
Table 17  Analyzer screws

<table>
<thead>
<tr>
<th>Description</th>
<th>Part number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heater/Sensor (quad) assembly</td>
<td>G1099-60172</td>
</tr>
<tr>
<td>Ion source thumbscrew</td>
<td>G1099-20138</td>
</tr>
<tr>
<td>Magnet mounting screws</td>
<td>0515-1046</td>
</tr>
<tr>
<td>Screw – magnet bracket to source radiator</td>
<td>0515-1602</td>
</tr>
<tr>
<td>Screws – mass filter contact assembly/heater block</td>
<td>G3170-20122</td>
</tr>
<tr>
<td>Screws – radiator. Mounting brackets quadrupole board</td>
<td>0515-0430</td>
</tr>
<tr>
<td>Source radiator screws</td>
<td>0515-1052</td>
</tr>
<tr>
<td>Screws for Quad Stop</td>
<td>0515-0221</td>
</tr>
</tbody>
</table>

LE-EI ion source

A list of the replacement parts related to the LE-EI ion source may be found in Table 18 and an illustration of the parts is also provided in Figure 24, “LE-EI ion source,” on page 123.

Table 18  LE-EI ion source parts

<table>
<thead>
<tr>
<th>Part number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Source finger grip G7002-20008</td>
</tr>
<tr>
<td>2 Filament block G7002-20019</td>
</tr>
<tr>
<td>3 Extractor lens (5)*, with 3 mm opening G7004-20061</td>
</tr>
<tr>
<td>4 Ceramic insulator for extractor G7002-20064</td>
</tr>
<tr>
<td>5 Entrance lens (1)* G7250-20075</td>
</tr>
<tr>
<td>6 Ion focus lens (2)* G7004-20068</td>
</tr>
<tr>
<td>7 Lens insulator/holder G7002-20074</td>
</tr>
<tr>
<td>8 M2 x 0.4 screw x 12 mm long gold plated screw G7002-20083</td>
</tr>
<tr>
<td>9 Source body G7002-20084</td>
</tr>
<tr>
<td>10 Post extractor lens 2 (3)* G7004-20090</td>
</tr>
<tr>
<td>11 Post extractor lens 1 (4)* G7004-20004</td>
</tr>
</tbody>
</table>
Table 18  LE-EI ion source parts (continued)

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
<th>Part number</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>M2 x 6 mm gold plated screw</td>
<td>G7002-20109</td>
</tr>
<tr>
<td>13</td>
<td>Locking ring lens insulator</td>
<td>G7002-20126</td>
</tr>
<tr>
<td>14</td>
<td>Filament assembly, HE, single</td>
<td>G3850-60021</td>
</tr>
<tr>
<td>15</td>
<td>Ring heater/sensor assembly</td>
<td>G7002-60043</td>
</tr>
<tr>
<td>16</td>
<td>Source mount</td>
<td>G7002-60053</td>
</tr>
<tr>
<td>17</td>
<td>Repeller assembly</td>
<td>G7002-67057</td>
</tr>
<tr>
<td></td>
<td>Complete LE-EI Ion Source, Half Ramp</td>
<td>G7250-67170</td>
</tr>
</tbody>
</table>

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

![LE-EI ion source diagram](image)

Figure 24.  LE-EI ion source
Axial CI ion source

A list of the replacement parts related to the Axial CI ion source may be found in Table 19 and an illustration of the parts is also provided in Figure 25, “Axial CI ion source,” on page 125.

Table 19 Parts list for Axial CI ion source

<table>
<thead>
<tr>
<th>Item number</th>
<th>Item description</th>
<th>Part number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Source finger grip</td>
<td>G7002-20008</td>
</tr>
<tr>
<td>2</td>
<td>Filament block</td>
<td>G7002-20019</td>
</tr>
<tr>
<td>3</td>
<td>Filament, HES CI</td>
<td>G7250-60075</td>
</tr>
<tr>
<td>4</td>
<td>5973 Gold Fil Screw (M2 × 0.4 10MM-LG)</td>
<td>G1999-20021</td>
</tr>
<tr>
<td>5</td>
<td>in-WSHR-Shoulder 0.25 0.37 0.06 Alumina</td>
<td>3050-2670</td>
</tr>
<tr>
<td>6</td>
<td>HES CI source mount assembly</td>
<td>G7250-60009</td>
</tr>
<tr>
<td>7</td>
<td>HES CI repeller assy</td>
<td>G7250-60102</td>
</tr>
<tr>
<td>8</td>
<td>GCMS Ring heater/sensor assembly</td>
<td>G7002-60058</td>
</tr>
<tr>
<td>9</td>
<td>HES CI Body</td>
<td>G7250-20097</td>
</tr>
<tr>
<td>10</td>
<td>Drawout plate</td>
<td>G1999-20446</td>
</tr>
<tr>
<td>11</td>
<td>HES CI Drawout cylinder</td>
<td>G7250-20098</td>
</tr>
<tr>
<td>12</td>
<td>HES Ramp CI Ion focus</td>
<td>G7250-20096</td>
</tr>
<tr>
<td>13</td>
<td>Entrance lens assy, STD, Half-Ramped</td>
<td>G7250-20075</td>
</tr>
<tr>
<td>14</td>
<td>HES CI Lens insulator</td>
<td>G7250-20095</td>
</tr>
<tr>
<td>15</td>
<td>Locking ring for lens insulator</td>
<td>G7002-20126</td>
</tr>
<tr>
<td>16</td>
<td>Screw, M2 × 6 Pan Head Torx, gold plated</td>
<td>G7002-20109</td>
</tr>
<tr>
<td>Complete</td>
<td>Axial CI Ion Source Assy (Support)</td>
<td>G7250-67404</td>
</tr>
</tbody>
</table>
Figure 25. Axial CI ion source
A list of the replacement parts related to the GC/MS transferline interface for the 7890 GC and an illustration of the parts is also provided. (See Table 20 and Figure 26, “GC/MS interface for the 8890 and 7890 GCs,” on page 127.)

### Table 20  GC/MS interface for 8890 and 7890 GCs

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Part number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transferline assembly</td>
<td>Contact Agilent for this part</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Knurled tip seal retainer, threaded</td>
<td>G3870-20547</td>
</tr>
<tr>
<td>2</td>
<td>1/16 Ferrule no hole graphitized Vespel</td>
<td>0100-0691</td>
</tr>
<tr>
<td>2</td>
<td>1/16 Ferrule no hole (qty 10)</td>
<td>5181-3308</td>
</tr>
<tr>
<td>3</td>
<td>M3 x 3L Set screw, gold plated</td>
<td>G1999-20022</td>
</tr>
<tr>
<td>4</td>
<td>Transferline tip base, threaded</td>
<td>G3870-20548</td>
</tr>
<tr>
<td>5</td>
<td>Tip seal</td>
<td>G3870-20542</td>
</tr>
<tr>
<td>6</td>
<td>Self-tightening column nut</td>
<td>5190-5233</td>
</tr>
<tr>
<td>6</td>
<td>MS interface column nut</td>
<td>05988-20066</td>
</tr>
<tr>
<td>7</td>
<td>MS screw</td>
<td>G1999-20022</td>
</tr>
<tr>
<td>8</td>
<td>M4 X 0.7 16MM-LG</td>
<td>0515-0383</td>
</tr>
<tr>
<td>9</td>
<td>Heater clamp</td>
<td>G3850-20410</td>
</tr>
<tr>
<td>10</td>
<td>Tip seal spring</td>
<td>G7005-20024</td>
</tr>
<tr>
<td>11</td>
<td>Welded interface assembly</td>
<td>G3870-60301</td>
</tr>
<tr>
<td>12</td>
<td>Heater/sensor assembly</td>
<td>G1099-60107</td>
</tr>
<tr>
<td>13</td>
<td>M3 set screw</td>
<td>0515-0236</td>
</tr>
<tr>
<td>not shown</td>
<td>Fitting-face seal, 1/4 in cap sst 316</td>
<td>0100-2013</td>
</tr>
<tr>
<td>not shown</td>
<td>VCR gasket, size 4, AG on Ni retainer</td>
<td>0100-1436</td>
</tr>
</tbody>
</table>
Figure 26. GC/MS interface for the 8890 and 7890 GCs
Consumables and Maintenance Supplies

This section contains the following parts: Table 21, “EI maintenance supplies”; Table 22, “Tools”; Table 23, “Ferrules,” on page 129; and Table 24, “Miscellaneous parts and samples,” on page 130.

Table 21 EI maintenance supplies

<table>
<thead>
<tr>
<th>Description</th>
<th>Part number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abrasive paper, 30 µm</td>
<td>5061-5896</td>
</tr>
<tr>
<td>Aluminum oxide powder, 100 g</td>
<td>393706201</td>
</tr>
<tr>
<td>Cloths, clean (qty 300)</td>
<td>05980-60051</td>
</tr>
<tr>
<td>Cloths, cleaning (qty 300)</td>
<td>9310-4828</td>
</tr>
<tr>
<td>Cotton swabs (qty 100)</td>
<td>5080-5400</td>
</tr>
<tr>
<td>Foreline pump oil, Inland 45</td>
<td>6040-0834</td>
</tr>
<tr>
<td>Gloves, clean – Large</td>
<td>8650-0030</td>
</tr>
<tr>
<td>Gloves, clean – Small</td>
<td>8650-0029</td>
</tr>
<tr>
<td>Grease, Apiezon L, high vacuum</td>
<td>6040-0289</td>
</tr>
</tbody>
</table>

Table 22 Tools

<table>
<thead>
<tr>
<th>Description</th>
<th>Part number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Funnel</td>
<td>9301-6461</td>
</tr>
<tr>
<td>Hex key, 5 mm</td>
<td>8710-1838</td>
</tr>
<tr>
<td>Tool kit</td>
<td>G7077-60566</td>
</tr>
<tr>
<td>Ball drivers, 1.5-mm</td>
<td>8710-1570</td>
</tr>
<tr>
<td>Ball drivers, 2.0-mm</td>
<td>8710-1804</td>
</tr>
<tr>
<td>Ball drivers, 2.5-mm</td>
<td>8710-1681</td>
</tr>
<tr>
<td>Hex nut driver, 5.5-mm</td>
<td>8710-1220</td>
</tr>
<tr>
<td>Pliers, long-nose (1.5-inch nose)</td>
<td>8710-0004</td>
</tr>
<tr>
<td>Screwdrivers Flat-blade, large</td>
<td>8730-0002</td>
</tr>
<tr>
<td>Screwdrivers Torx, T-10</td>
<td>8710-1623</td>
</tr>
</tbody>
</table>
Table 22  Tools (continued)

<table>
<thead>
<tr>
<th>Description</th>
<th>Part number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screwdrivers Torx, T-15</td>
<td>8710-1622</td>
</tr>
<tr>
<td>Screwdrivers Torx, T-20</td>
<td>8710-1615</td>
</tr>
<tr>
<td>MS shipping kit</td>
<td>G7077-60502</td>
</tr>
<tr>
<td>Gas clean filter kit for carrier gas</td>
<td>CP17974</td>
</tr>
<tr>
<td>GC-Q-TOF MSD ship kit, EPC-BF</td>
<td>G7250-60180</td>
</tr>
<tr>
<td>Tweezers, non-magnetic</td>
<td>8710-2460</td>
</tr>
<tr>
<td>Wrenches, open-end 1/4-inch × 5/16-inch</td>
<td>8710-0510</td>
</tr>
<tr>
<td>Wrenches, open-end 10-mm</td>
<td>8710-2353</td>
</tr>
<tr>
<td>Wrist strap, antistatic, small</td>
<td>9300-0969</td>
</tr>
<tr>
<td>Wrist strap, antistatic, medium</td>
<td>9300-1257</td>
</tr>
<tr>
<td>Wrist strap, antistatic, large</td>
<td>9300-0970</td>
</tr>
</tbody>
</table>

Table 23  Ferrules

<table>
<thead>
<tr>
<th>Description</th>
<th>Part number</th>
</tr>
</thead>
<tbody>
<tr>
<td>For the GC/MS interface</td>
<td></td>
</tr>
<tr>
<td>• Blank, graphite-vespel</td>
<td>5181-3308</td>
</tr>
<tr>
<td>• 0.3-mm id, 85%/15% for 0.10-mm id columns</td>
<td>5062-3507</td>
</tr>
<tr>
<td>• 0.4-mm id, 85%/15%, for 0.20 and 0.25-mm id columns</td>
<td>5062-3508</td>
</tr>
<tr>
<td>• 0.5-mm id, 85%/15%, for 0.32-mm id columns</td>
<td>5062-3506</td>
</tr>
<tr>
<td>• 0.8-mm id, 85%/15%, for 0.53-mm id columns</td>
<td>5062-3538</td>
</tr>
<tr>
<td>For the GC inlet</td>
<td></td>
</tr>
<tr>
<td>• 0.27-mm id, 90%/10%, for 0.10-mm id columns</td>
<td>5062-3518</td>
</tr>
<tr>
<td>• 0.37-mm id, 90%/10%, for 0.20-mm id columns</td>
<td>5062-3516</td>
</tr>
<tr>
<td>• 0.40-mm id, 90%/10%, for 0.25-mm id columns</td>
<td>5181-3323</td>
</tr>
<tr>
<td>• 0.47-mm id, 90%/10%, for 0.32-mm id columns</td>
<td>5062-3514</td>
</tr>
<tr>
<td>• 0.74-mm id, 90%/10%, for 0.53-mm id columns</td>
<td>5062-3512</td>
</tr>
</tbody>
</table>
## Table 24 Miscellaneous parts and samples

<table>
<thead>
<tr>
<th>Description</th>
<th>Part number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collision cell gas flow module, 3-channel</td>
<td>G7002-60044</td>
</tr>
<tr>
<td>GC/MS quadrupole flow weldment cap assy</td>
<td>G7000-80500</td>
</tr>
<tr>
<td>Quadrupole EPC module, 3-channel</td>
<td>G7000-60506</td>
</tr>
<tr>
<td>Octafluoronaphthalene, OFN, 1 pg/µL</td>
<td>5188-5348</td>
</tr>
<tr>
<td>Octafluoronaphthalene, OFN, 100 fg/µL</td>
<td>5188-5348</td>
</tr>
<tr>
<td>Benzophenone, 100 pg/µL</td>
<td>8500-5440</td>
</tr>
<tr>
<td>PFTBA sample kit</td>
<td>05971-60571</td>
</tr>
<tr>
<td>Rough pump oil pan</td>
<td>G1946-00034</td>
</tr>
<tr>
<td>Eval A, hydrocarbons</td>
<td>05971-60045</td>
</tr>
<tr>
<td>Micro-Ion gauge electronics</td>
<td>G3170-89001</td>
</tr>
<tr>
<td>J20’ 1/8-inch id stainless steel</td>
<td>7157-0210</td>
</tr>
<tr>
<td>Wipes (qty 300)</td>
<td>9310-4828</td>
</tr>
<tr>
<td>Swagelok ferrule, front, 1/8-inch, 10/package</td>
<td>5180-4110</td>
</tr>
<tr>
<td>Swagelok ferrule, rear, 1/8-inch, 10/package</td>
<td>5180-4116</td>
</tr>
<tr>
<td>Swagelok nut, for 1/8-inch fitting, 10/package</td>
<td>5180-4104</td>
</tr>
<tr>
<td>Swagelok nut and ferrules, 10 set/package</td>
<td>5080-8751</td>
</tr>
<tr>
<td>Tubing cutter for SS tubing</td>
<td>8710-1709</td>
</tr>
<tr>
<td>Tubing cutter replacement blades</td>
<td>8710-1710</td>
</tr>
</tbody>
</table>
Additional CI Parts

This section shows parts that may be required to maintain the 7250 Q-TOF GC/MS System with CI. (See Table 25.) The parts in this section are related directly to the CI accessory and are in addition to the Axial CI ion source parts listed in Table 19, “Parts list for Axial CI ion source,” on page 124.

Table 25 CI flow control module

<table>
<thead>
<tr>
<th>Description</th>
<th>Part number</th>
</tr>
</thead>
<tbody>
<tr>
<td>CI calibration valve assembly</td>
<td>G1999-60452</td>
</tr>
<tr>
<td>PFDTD calibrant</td>
<td>8500-8510</td>
</tr>
<tr>
<td>Calibration sample vial</td>
<td>G3170-80002</td>
</tr>
<tr>
<td>Sample vial O-ring, 1/4-inch Viton</td>
<td>5180-4182</td>
</tr>
<tr>
<td>Solenoid valve and cable</td>
<td>G1999-60452</td>
</tr>
<tr>
<td>CI cable from SC to CI flow module</td>
<td>G3170-60808</td>
</tr>
<tr>
<td>Cable, CI to CI bulkhead</td>
<td>G7000-60825</td>
</tr>
<tr>
<td>CI Flow control PCA</td>
<td>G7000-61025</td>
</tr>
<tr>
<td>GF 100 Mass Flow Controller</td>
<td>G7000-80030</td>
</tr>
<tr>
<td>Shutoff valve</td>
<td>G1999-80402</td>
</tr>
<tr>
<td>MFC cable</td>
<td>G1999-60464</td>
</tr>
<tr>
<td>Reagent gas select valve (Gas A and Gas B)</td>
<td>G1999-80401</td>
</tr>
<tr>
<td>VCR cap, size 4 (1/4-inch)</td>
<td>0100-2013</td>
</tr>
<tr>
<td>Plug, size 4 316SS</td>
<td>0100-2014</td>
</tr>
<tr>
<td>VCR gasket, 1/4-inch, Ag on Ni retainer</td>
<td>0100-1436</td>
</tr>
<tr>
<td>VCR gasket, 1/8-inch</td>
<td>0100-0468</td>
</tr>
<tr>
<td>Chemical ionization gas purifier</td>
<td>5190-9071</td>
</tr>
<tr>
<td>Stainless steel tubing, 1/8-inch id, 20 feet</td>
<td>7157-0210</td>
</tr>
<tr>
<td>Swagelok ferrule, front, 1/8-inch, 20/package</td>
<td>5180-4110</td>
</tr>
<tr>
<td>Swagelok ferrule, rear, 1/8-inch, 20/package</td>
<td>5180-4116</td>
</tr>
<tr>
<td>Swagelok nut, for 1/8-inch fitting, 20/packs</td>
<td>5080-8751</td>
</tr>
</tbody>
</table>
7 Replacement Parts