

Agilent 7890A Gas Chromatograph

Safety Manual



Agilent Technologies

Notices

© Agilent Technologies, Inc. 2009

No part of this manual may be reproduced in any form or by any means (including electronic storage and retrieval or translation into a foreign language) without prior agreement and written consent from Agilent Technologies, Inc. as governed by United States and international copyright laws.

Manual Part Number

G3430-90013

Edition

Third edition, May 2009

Second edition, December 2007

First edition, February 2007

Printed in USA and China

Agilent Technologies, Inc.
2850 Centerville Road
Wilmington, DE 19808-1610 USA

安捷伦科技（上海）有限公司
上海市浦东新区外高桥保税区
英伦路 412 号
联系电话：（800）820 3278

Warranty

The material contained in this document is provided “as is,” and is subject to being changed, without notice, in future editions. Further, to the maximum extent permitted by applicable law, Agilent disclaims all warranties, either express or implied, with regard to this manual and any information contained herein, including but not limited to the implied warranties of merchantability and fitness for a particular purpose. Agilent shall not be liable for errors or for incidental or consequential damages in connection with the furnishing, use, or performance of this document or of any information contained herein. Should Agilent and the user have a separate written agreement with warranty terms covering the material in this document that conflict with these terms, the warranty terms in the separate agreement shall control.

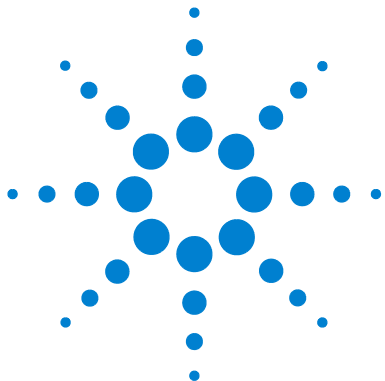
Safety Notices

CAUTION

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

WARNING

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



1 Introduction

Important Safety Warnings	4
Hydrogen Safety	7
Micro-Electron Capture Detector (μ ECD)	14
Fuses and Batteries	16
Safety and Regulatory Certifications	17
Intended Use	20
Cleaning	20
Recycling the Product	20



Important Safety Warnings

Before moving on, there are several important safety notices that you should always keep in mind when using the Agilent 7890A GC.

WARNING

When handling/using chemicals for preparation or use within the GC, all applicable local and national laboratory safety practices must be followed. This would include, but is not limited to, correct use of Personal Protective Equipment (PPE), correct use of storage vials, and correct handling of chemicals, as defined in the laboratory's internal safety analysis and standard operating procedures. Failure to adhere to laboratory safety practices could lead to injury or death.

Many internal parts of the GC carry dangerous voltages

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

- The wiring between the GC power cord and the AC power supply, the AC power supply itself, and the wiring from the AC power supply to the power switch.

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

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

WARNING

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

WARNING

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

Do not use an Uninterruptable Power Supply (UPS) with a GC

If the area where the GC is located suddenly loses power, an unsafe condition can result if the GC remains powered on. Do not use the GC with a UPS.

Electrostatic discharge is a threat to GC electronics

The printed circuit (PC) boards in the GC 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. Wear a grounded wrist strap any time you must remove the GC right side cover.

Many parts are dangerously hot

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

- The inlets
- The oven and its contents
- The detectors
- The column nuts attaching the column to an inlet or detector
- The valve box

You should always cool these areas of the GC 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 thermally protective gloves. Whenever possible, cool the part of the instrument that you will be maintaining before you begin working on it.

WARNING

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

WARNING

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

Oven thermal leaks

WARNING

Objects passing through the oven door seal can cause thermal leaks which create hazardous hot spots which cause burns and melt equipment.

Do not allow wiring or temperature probes to pass through the oven door jam. Agilent recommends using one of the access holes.

Hydrogen Safety

Hydrogen gas may be used as carrier gas, and/or as fuel for the FID, FPD, and NPD. When mixed with air, hydrogen can form explosive mixtures.

WARNING

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

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

Hydrogen is a commonly used GC carrier gas. Hydrogen is potentially explosive and has other dangerous characteristics.

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

GC precautions

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

Hydrogen shutdown

Hydrogen gas may be used as a carrier or as fuel for some detectors. When mixed with air, hydrogen can form explosive mixtures.

The GC monitors inlet and auxiliary gas streams. If a stream shuts down because it is unable to reach its flow or pressure setpoint *and* if that stream is configured to use hydrogen, the GC assumes that a leak has occurred and declares a *hydrogen safety shutdown*. The effects are:

- The offending channel and any associated channels (such as septum purge) are set off.
- The split valves in the split/splitless and PTV inlets open.
- The oven (heater and fan) turns off.
- The small heated zones are turned off.
- An alarm tone sounds.

To recover from this state, fix the cause of the shutdown (tank valve closed, serious leak, others). Turn the instrument off, then back on.

WARNING

The GC cannot always detect leaks in inlet and/or detector gas streams. For this reason, it is vital that column fittings should always be either connected to a column, or have a cap or plug installed. The H₂ streams must be configured for hydrogen so that the GC is aware of hydrogen use.

Dangers unique to GC/MSD operation

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

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

Hydrogen accumulation in a GC/MSD

WARNING

The GC/MSD cannot always detect leaks in inlet and/or detector gas streams. For this reason, it is vital that column fittings should always be either connected to a column, or have a cap or plug installed. The H₂ streams must be configured for hydrogen so that the GC is aware of hydrogen use.

All users should be aware of the mechanisms by which hydrogen can accumulate ([Table 1](#)) and know what precautions to take if they know or suspect that hydrogen has accumulated. Note that these mechanisms apply to *all* mass spectrometers, including the GC/MSD.

Table 1 Potential hydrogen accumulation mechanisms in GC/MSD

Mechanism	Results
Mass spectrometer turned off	A mass spectrometer can be shut down deliberately. It can also be shut down accidentally by an internal or external failure. A mass spectrometer shutdown does not shut off the flow of carrier gas. As a result, hydrogen may slowly accumulate in the mass spectrometer.

Table 1 Potential hydrogen accumulation mechanisms in GC/MSD (continued)

Mechanism	Results
Mass spectrometer automated isolation valves closed	Some mass spectrometers are equipped with automated diffusion pump isolation valves. In these instruments, deliberate operator action or various failures can cause the isolation valves to close. Isolation valve closure does not shut off the flow of carrier gas. As a result, hydrogen may slowly accumulate in the mass spectrometer.
Mass spectrometer manual isolation valves closed	Some mass spectrometers are equipped with manual diffusion pump isolation valves. In these instruments, the operator can close the isolation valves. Closing the isolation valves does not shut off the flow of carrier gas. As a result, hydrogen may slowly accumulate in the mass spectrometer.
GC off	A GC can be shut down deliberately. It can also be shut down accidentally by an internal or external failure. Different GCs react in different ways. If a 7890A GC equipped with Electronic Pressure Control (EPC) is shut off, the EPC stops the flow of carrier gas. If the carrier flow is not under EPC control, the flow increases to its maximum. This flow may be more than some mass spectrometers can pump away, resulting in the accumulation of hydrogen in the mass spectrometer. If the mass spectrometer is shut off at the same time, the accumulation can be fairly rapid.
Power failure	If the power fails, both the GC and mass spectrometer shut down. The carrier gas, however, is not necessarily shut down. As described previously, in some GCs a power failure may cause the carrier gas flow to be set to maximum. As a result, hydrogen may accumulate in the mass spectrometer.

Table 1 Potential hydrogen accumulation mechanisms in GC/MSD (continued)

Mechanism	Results
Major GC leaks or a column is missing or broken	If the GC is off and configured for hydrogen, the rear oven flap is open to vent out the hydrogen. Proper lab venting, as described in the Site Prep manual, is recommended. If there is a significant leak, such as a missing column, the GC inlet, PCM, and Aux are provided with flow limiting frits to minimize any hydrogen accumulation within the oven. When the GC is on, major leaks are detected automatically.

WARNING

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

WARNING

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

Precautions

Take the following precautions when operating a GC/MSD system with hydrogen carrier gas.

Equipment precaution

You **MUST** make sure the front side-plate thumbscrew is fastened finger-tight. Do not overtighten the thumbscrew; it can cause air leaks.

WARNING

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

You must remove the plastic cover over the glass window on the front of a 5975 MSD. In the unlikely event of an explosion, this cover may dislodge.

General laboratory precautions

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

Operating precautions

- Turn off the hydrogen at its source every time you shut down the GC or MSD.
- Turn off the hydrogen at its source every time you vent the MSD (do not heat the capillary column without carrier gas flow).
- Turn off the hydrogen at its source every time isolation valves in an MSD are closed (do not heat the capillary column without carrier gas flow).
- Turn off the hydrogen at its source if a power failure occurs.
- If a power failure occurs while the GC/MSD system is unattended, even if the system has restarted by itself:
 - 1 Immediately turn off the hydrogen at its source.
 - 2 Turn off the GC.
 - 3 Turn off the MSD and allow it to cool for 1 hour.
 - 4 Eliminate **all** potential sources of ignition in the room.
 - 5 Open the vacuum manifold of the MSD to atmosphere.
 - 6 Wait at least 10 minutes to allow any hydrogen to dissipate.
 - 7 Start up the GC and MSD as normal.

When using hydrogen gas, check the system for leaks to prevent possible fire and explosion hazards based on local Environmental Health and Safety (EHS) requirements. Always check for leaks after changing a tank or servicing the gas lines. Always make sure the vent line is vented into a fume hood.

Measuring hydrogen gas flows

WARNING

Do not measure hydrogen together with air or oxygen. This can create explosive mixtures that may be ignited by the automatic ignitor.

To avoid this hazard:

Turn the automatic ignitor off before you begin.

Always measure gases separately.

When measuring gas flows on a detector using hydrogen for the detector flame or carrier gas, measure the hydrogen flow separately. Never allow an air stream to enter when hydrogen is present in the flow meter.

Micro-Electron Capture Detector (μ ECD)

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

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

WARNING

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

WARNING

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

- 1 After turning off the main power and allowing the instrument to cool to room temperature, cap the detector inlet and exhaust vent openings. Wear disposable plastic gloves and observe normal laboratory safety precautions.
- 2 Contact your local Agilent Technologies sales office or distributor for ECD disposal instructions
- 3 Include a letter stating the condition of abuse.

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

WARNING

Do not use solvents to clean the μ ECD.

WARNING

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

When handling μ ECDs:

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

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

Fuses and Batteries

The GC requires fuses and batteries for proper operation. These must only be accessed by Agilent trained service personnel.

Table 2 AC board fuses

Fuse designation	Line voltage	Fuse rating and type
F1, F2	All	20 A, 250 Vac, IEC 127 type f (non-time delay), ceramic body
F3, F4	All	8 A, 250 Vac, IEC type f (non-time delay), glass body

Table 3 Logic board battery


Battery designation	Battery rating and type
BT1	3-volt lithium-poly carbon battery, .048A-HR, Panasonic model BR 1225

Safety and Regulatory Certifications

The Agilent 7890A GC conforms to the following safety standards:

- Canadian Standards Association (CSA): C22.2 No. 1010.1
- CSA/Nationally Recognized Test Laboratory (NRTL): UL 61010
- International Electrotechnical Commission (IEC): 61010-1
- EuroNorm (EN): 61010-1

The Agilent 7890A GC conforms to the following regulations on Electromagnetic Compatibility (EMC) and Radio Frequency Interference (RFI):

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

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



The Agilent 7890A GC is designed and manufactured under a quality system registered to ISO 9001.



Instructions for Disposal of Waste Equipment by Users in the European Union. This symbol on the product or its packaging indicates that this product must not be disposed of with other waste. Instead, it is your responsibility to dispose of your waste equipment by handing it over to a designated collection point for the recycling of waste electrical and electronic equipment. The separate collection and recycling of your waste equipment at the time of disposal will help conserve natural resources and ensure that it is recycled in a manner that protects human health and the environment. For more information about where you can drop off your waste equipment for recycling, please contact your local city recycling office or the dealer from whom you originally purchased the product.

Information

The Agilent Technologies 7890A Gas Chromatograph meets the following IEC (International Electro-technical Commission) classifications: Safety Class I, Transient Overvoltage Category II, Pollution Degree 2.

This unit has been designed and tested in accordance with recognized safety standards and is designed for use indoors in non-classified locations. 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 Agilent 7890A Gas Chromatograph has been compromised, disconnect the unit from all power sources and secure the unit against unintended operation.

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

Symbols

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

See accompanying instructions for more information.



Indicates a hot surface.



Indicates hazardous voltages.



Indicates earth (ground) terminal.



Indicates potential explosion hazard.



or



Indicates radioactivity hazard.



Indicates electrostatic discharge hazard.



Indicates a hazard. See the Agilent 7890A GC user documentation for the item labeled.



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:

- 1** Relocate the radio or antenna.
- 2** Move the device away from the radio or television.
- 3** Plug the device into a different electrical outlet, so that the device and the radio or television are on separate electrical circuits.
- 4** Make sure that all peripheral devices are also certified.
- 5** Make sure that appropriate cables are used to connect the device to peripheral equipment.
- 6** Consult your equipment dealer, Agilent Technologies, or an experienced technician for assistance.
- 7** Changes or modifications not expressly approved by Agilent Technologies could void the user's authority to operate the equipment.

Sound Emission Certification for Federal Republic of Germany

Sound pressure

Sound pressure $L_p < 70$ dB(A) according to DIN- EN 27779.

Schalldruckpegel

Schalldruckpegel $LP < 70$ dB(A) nach DIN- EN 27779.

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

To clean the unit, disconnect the power and wipe down with a damp, lint-free cloth.

Recycling the Product



For recycling, contact your local Agilent sales office.