Agilent

Agilent 8890 Gas Chromatograph

Site Preparation Guide

Notices

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WARNING

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

Contents

1 Agilent 8890 GC Site Preparation

This guide outlines the site requirements for GC, GC/MS, and automatic liquid sampler (ALS) installation. Site requirements include the necessary space, electrical supplies, gas supplies, operating supplies and consumables required to successfully install the GC and related instruments and systems.

The site must meet the requirements specified in this guide before beginning installation.

Refer to the Agilent Web site at **www.agilent.com** for the most up-to-date listing of GC, GC/MS, and ALS supplies and consumables.

Site Preparation Checklist

For typical system requirements for system installation, see the diagrams on **page 8** through **page 11**.

Use the following checklist to ensure that the site is properly prepared for GC system installation.

- ☐ **1** Ensure that the appropriate installation hardware has been acquired. See **"Installation Kits"** on page 14.
- ☐ **2** Ensure that the location in which the GC system is being installed meets the requirements for environmental conditions. See **"Environmental Conditions"** on page 24. Also see **"Heat Dissipation"** on page 25.
- ☐ **3** Prepare bench space for the GC system. Ensure that the bench has the size and weight capacity to accommodate the GC and associated components. See **"Bench Preparation"** on page 7. Also see **"Dimensions and Weight"** on page 18.
- ☐ **4** Ensure that system components are oriented so that they can be connected properly. See **"Maximum Length of Cables and Hoses"** on page 12.
- ☐ **5** If the system being installed includes an MSD, ensure that the bench allows for proper installation and connection of the foreline pump. See **"Foreline Pump Requirements for Systems Including an MSD"** on page 21.
- ☐ **6** Ensure that appropriate venting is provided for the GC system. See **"Exhaust Venting"** on page 28.
- ☐ **7** Ensure that a dedicated power circuit is available for each device in the system. See **"Power Requirements"** on page 32.
- ☐ **8** Ensure that appropriate gas and reagent supplies are provided for the GC system. See **"Gas and Reagent Selection"** on page 40.
- ☐ **9** Ensure that appropriate gas plumbing is provided for the GC system. See **"Gas Plumbing"** on page 49.
- ☐ **10** If the GC uses cryogenic cooling, ensure that appropriate cryogenic cooling supplies are provided for the GC. See **"Cryogenic Cooling Requirements"** on page 56.
- ☐ **11** If the GC system being installed includes a data system, ensure that the PC meets the requirements necessary to properly support the GC system. For more information, see the site prep guide for your data system.
- ☐ **12** If the GC being installed is to be connected to a site LAN, ensure that the appropriate cabling is available. See **"Site LAN Network"** on page 60.

Bench Preparation

When planning a bench layout:

- Consider component dimensions, weights, and space requirements. See **"Dimensions and Weight"** on page 18.
- Consider the lengths of cables and hoses for connection of components. See **"Maximum Length of Cables and Hoses"** on page 12.
- For systems that include an MS, consider foreline pump requirements. See **"Foreline Pump Requirements for Systems Including an MSD"** on page 21.
- Allow space for operational access.
- Note that the 7200 Q-TOF requires 48 cm (1.6 ft) of space in front to allow for the RIS probe extraction tool handle when installed.
- Note that some repairs to the GC/MS, or to the GC itself, will require access to the back of the instrument(s).

Examples are provided here for systems including a GC with an ALS, computer and printer. Most examples also include an MS.

See several example layouts below.

Application	Gas*	Purity	Supply Pressure (psi)†
Carrier	Helium Hydrogen Nitrogen	99.9995 99.9995 99.9995	50 - 80 50 - 80 50 - 80
Detectors			
TCD	Helium	99.9995	50 - 80
FID, NPD, FPD, TCD	Hydrogen	99.9995	50 - 80
ECD, FID, FPD, NPD, TCD	Nitrogen	99.9995	50 - 80
FID, NPD, FPD	Air	Zero grade	50 - 80

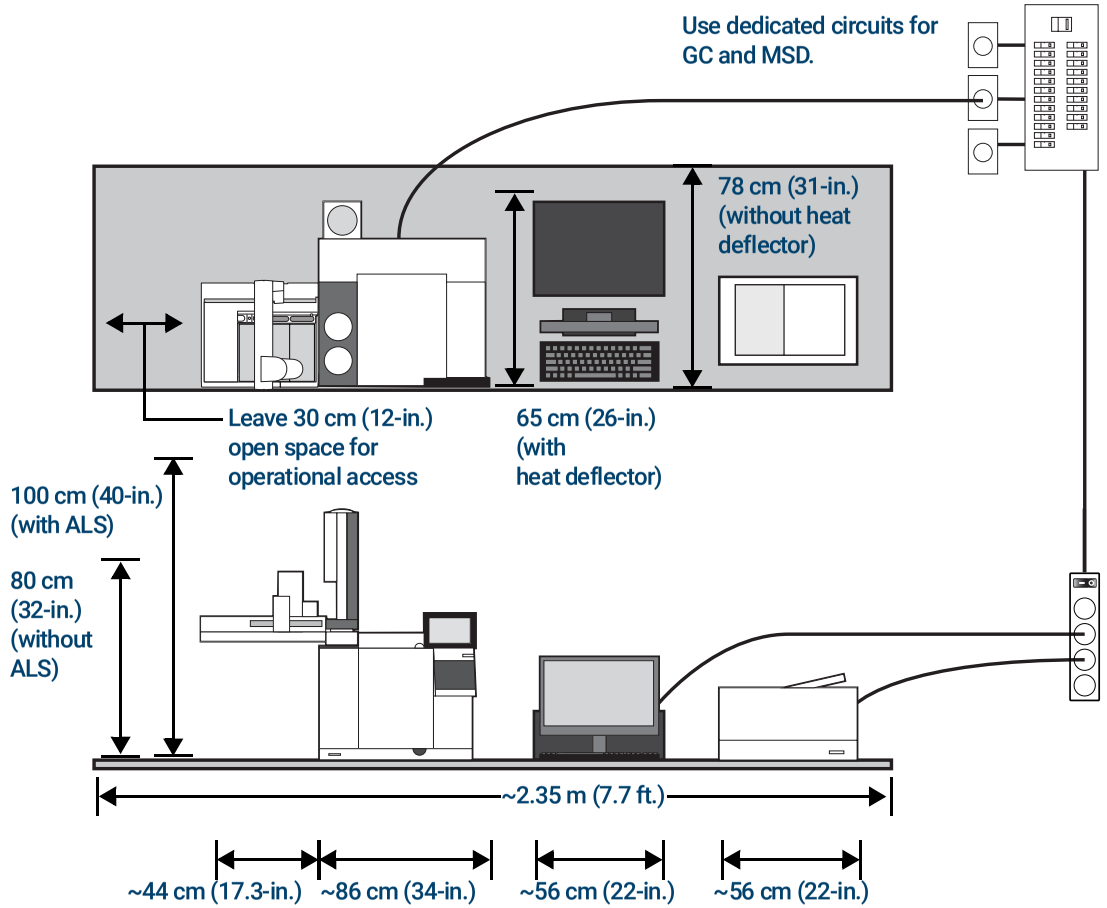
* Use 1/8-in Swagelok gas connections

† 1 psi = 6.89 kPa

Cryo Cooling (Liquid)	Tubing	Supply Pressure (psi)*
CO_2	1/8-inch stainless tubing	700-900
N_2	1/4-inch insulated tubing	20-25

* 1 psi = 6.89 kPa

Typical GC System - 8890 GC with computer and printer.



Total weight: ~84 kg (186 lb)
Maximum power consumption: ~3,950 VA (13,478 btu/hr)

Application	Gas*	Purity	Supply Pressure (psi)†
Carrier	Helium Hydrogen Nitrogen	99.9995 99.9995 99.9995	50 - 80 50 - 80 50 - 80
Detectors			
TCD	Helium	99.9995	50 - 80
FID, NPD, FPD, TCD	Hydrogen	99.9995	50 - 80
ECD, FID, FPD, NPD, TCD	Nitrogen	99.9995	50 - 80
FID, NPD, FPD	Air	Zero grade	50 - 80

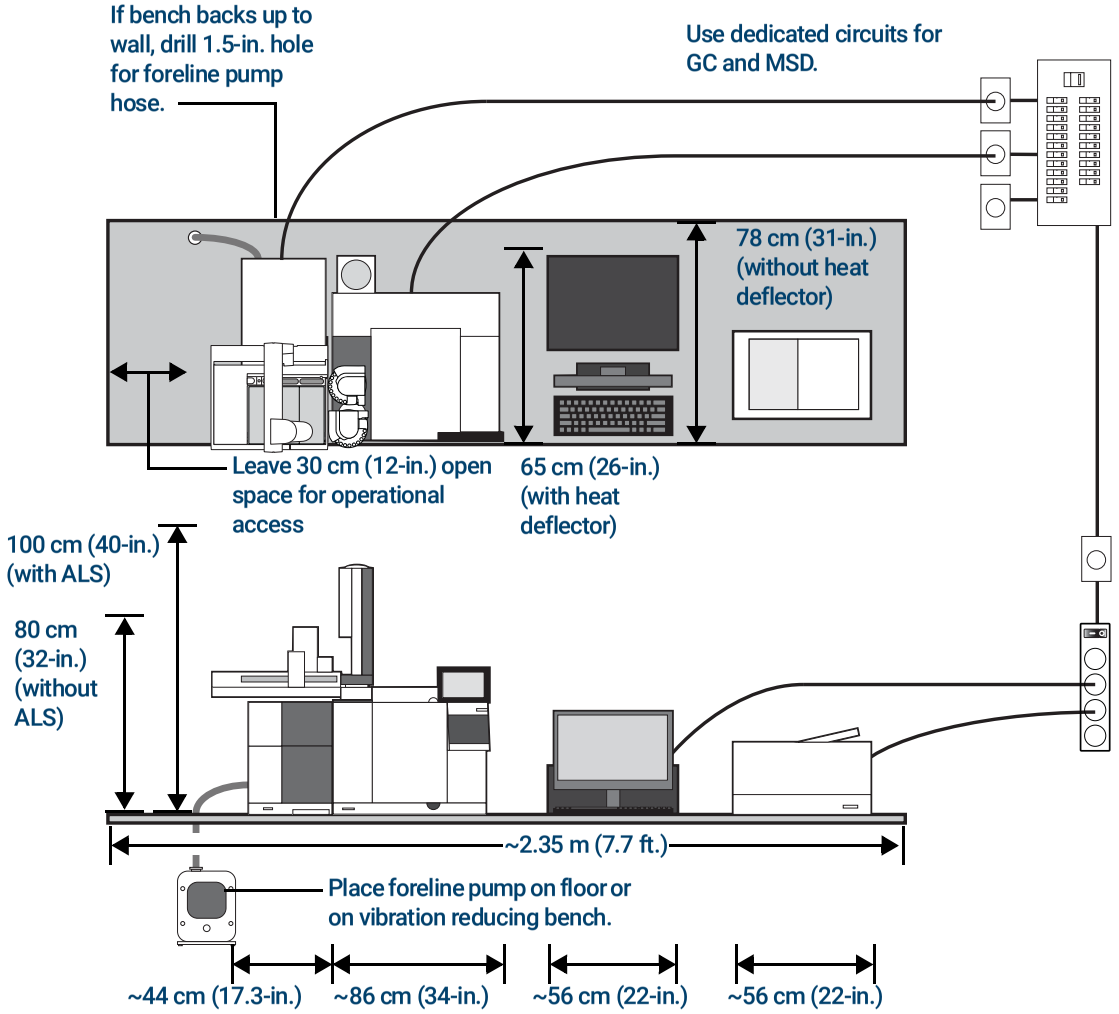
* Use 1/8-in Swagelok gas connections

† 1 psi = 6.89 kPa

Cryo Cooling (Liquid)	Tubing	Supply Pressure (psi)*
CO_2	1/8-inch stainless tubing	700-900
N_2	1/4-inch insulated tubing	20-25

* 1 psi = 6.89 kPa

Typical GC/MS System - 8890 GC, 5977 MSD, with computer and printer.



Total weight: ~123 kg (271 lb)
Maximum power consumption: ~5,050 VA (17,232 btu/hr)

Application	Gas*	Purity	Supply Pressure (psi)†
Carrier	Helium Hydrogen Nitrogen	99.9995 99.9995 99.9995	50 - 80 50 - 80 50 - 80
Detectors			
TCD	Helium	99.9995	50 - 80
FID, NPD, FPD, TCD	Hydrogen	99.9995	50 - 80
ECD, FID, FPD, NPD, TCD	Nitrogen	99.9995	50 - 80
FID, NPD, FPD	Air	Zero grade	50 - 80

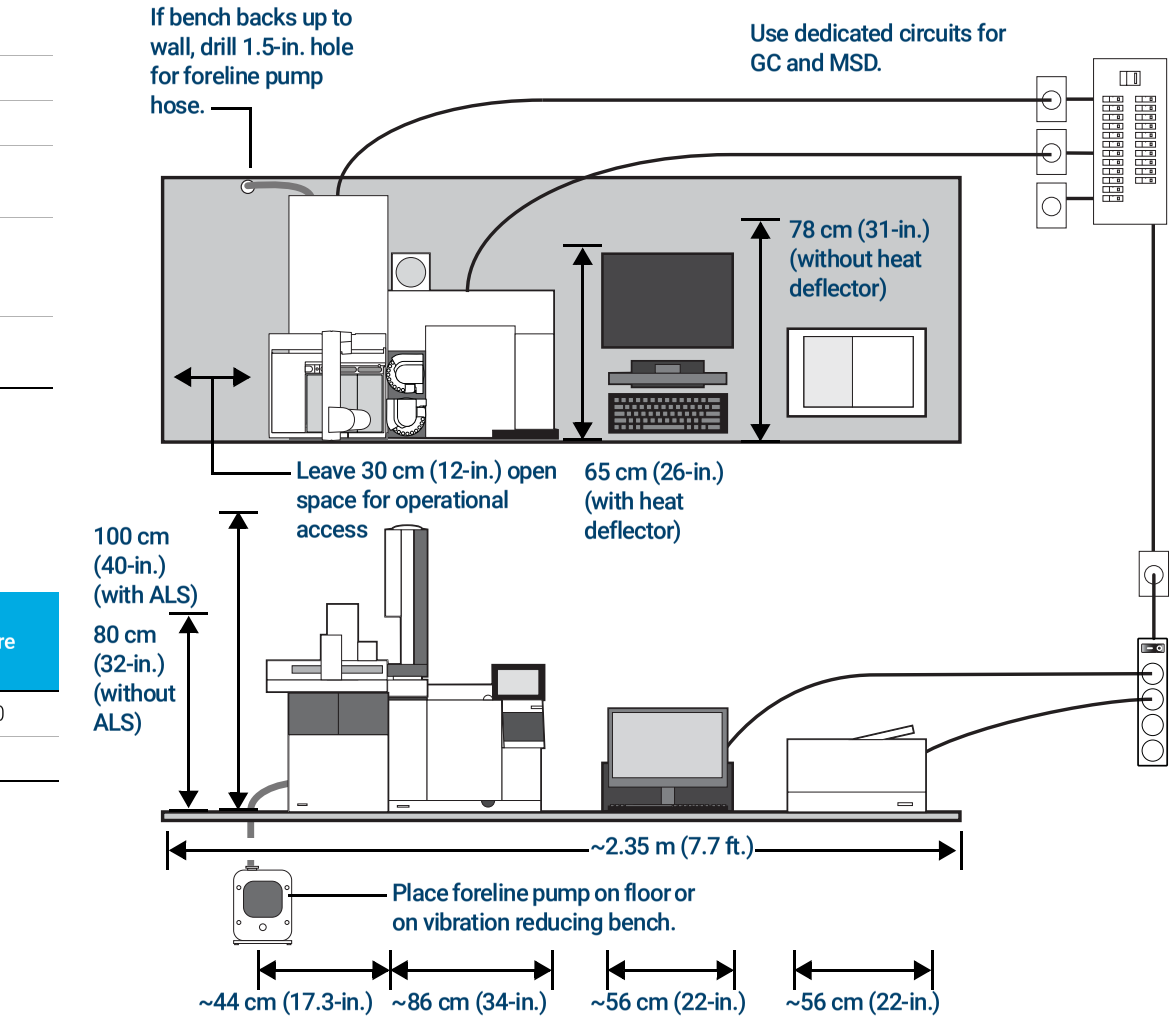
* Use 1/8-in Swagelok gas connections

† 1 psi = 6.89 kPa

Cryo Cooling (Liquid)	Tubing	Supply Pressure (psi)*
CO_2	1/8-inch stainless tubing	700-900
N_2	1/4-inch insulated tubing	20-25

* 1 psi = 6.89 kPa

Typical GC/MS System - 8890 GC, 7000 or 7010 MSD, with computer and printer.



Total weight: ~142 kg (311 lb)
Maximum power consumption: ~5,550 VA (18,938 btu/hr)

Application	Gas*	Purity	Supply Pressure (psi)†
Carrier	Helium Hydrogen Nitrogen	99.9995 99.9995 99.9995	50 - 80 50 - 80 50 - 80
Detectors			
TCD	Helium	99.9995	50 - 80
FID, NPD, FPD, TCD	Hydrogen	99.9995	50 - 80
ECD, FID, FPD, NPD, TCD	Nitrogen	99.9995	50 - 80
FID, NPD, FPD	Air	Zero grade	50 - 80

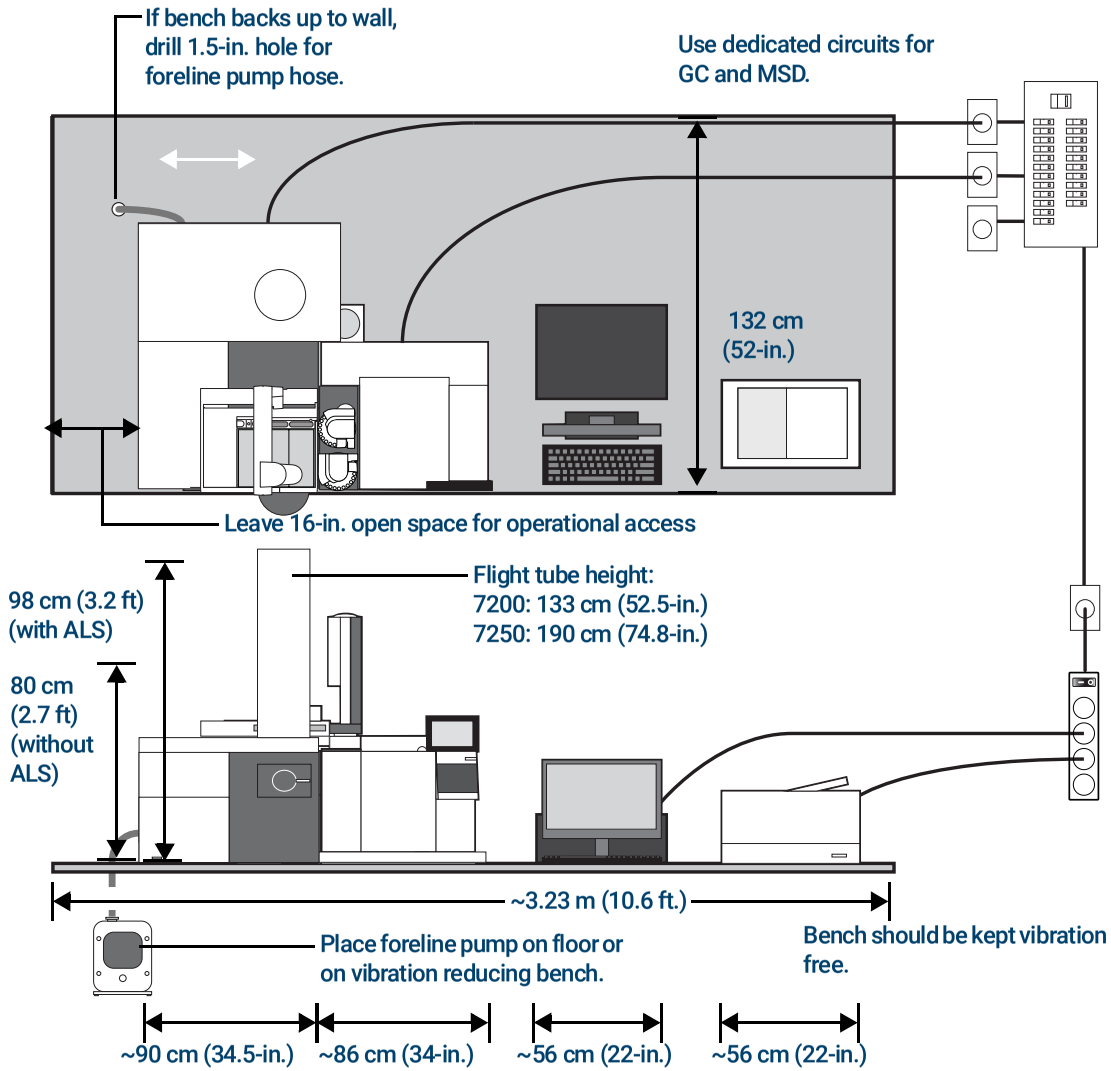
* Use 1/8-in Swagelok gas connections

† 1 psi = 6.89 kPa

Cryo Cooling (Liquid)	Tubing	Supply Pressure (psi)*
CO_2	1/8-inch stainless tubing	700-900
N_2	1/4-inch insulated tubing	20-25

* 1 psi = 6.89 kPa

Typical GC/MS System - 8890 GC, 7200 or 7250 Q-TOF MS, with computer and printer.



Total weight: ~244 kg (536 lb)
Maximum power consumption: ~5,750 VA (19,620 btu/hr)

Maximum Length of Cables and Hoses

The distance between system modules may be limited by some of the cabling and the vent or vacuum hoses.

Table 1 Cable and hose lengths

Item	Length
Remote cable	2 m (6.6 ft)
LAN cable	10 m (32.8 ft)
Power cords	2 m (6.6 ft)
Vacuum hose	1.3 m (4.24 ft)
Foreline pump power cord	2 m (6.6 ft)
7697A Headspace Sampler transfer line	99 cm (39-in.)
G1888 Headspace Sampler transfer line	80 cm (31.5-in.)

CAUTION

The supporting surface for the 7200/7250 Q-TOF GC/MS system should be kept relatively vibration free. Do not put the rough pump on your laboratory bench with the 7200/7250 Q-TOF GC/MS due to the vibration that the pump creates. Vibration can lead to a loss of mass accuracy and resolution.

2 GC Installation Kits

This section provides details for available installation hardware.

Refer to the Agilent Web site at **www.agilent.com** for the most up-to-date listing of GC, GC/MS, and ALS supplies and consumables.

Installation Kits

NOTE

Installation kits are not supplied with the GC. If you did not order the GC with the factory plumbing option (305), Agilent highly recommends the following kits in Table 2.

- Agilent recommends purchasing the installation kit(s) that provides parts useful for GC installation. (**Table 2** lists the appropriate installation kits.)

In addition to these installation kits, fittings and reducers are required to convert gas cylinder regulator fittings (for example, 1/4-inch male NPT) to the 1/8-inch female Swagelok fittings needed to connect gases to the instrument. These fittings are not included with the GC or with the installation kits. See **"Gas Plumbing"** on page 49 for details.

Table 2 Installation kits

Kit	Part number	Contents
Recommended for GCs with FID, NPD, FPD:		
GC Supply Gas Installation Kit with Gas Purifiers See **Figure 1**.	19199N	Includes Gas Clean Filter system kit CP736530 (with 1 oxygen, 1 moisture, and 2 charcoal filters), 1/8-inch brass nuts and ferrules, copper tubing, 1/8-inch brass tees, tubing cutter, 1/8-inch brass caps, universal external split vent trap with replacement cartridges, and 1/8-inch ball valve.
Recommended for GCs with TCD/ECD, MS, and MSD:		
GC Supply Gas Installation Kit See **Figure 2**.	19199M	Includes 1/8-inch brass nuts and ferrules (20), copper tubing, 1/8-inch brass tees, tubing cutter, 1/8-inch brass caps, 7-mm nut driver, T-10 Torx driver, T-20 Torx driver, 4 open-end wrenches, and 1/8-inch ball valve
Gas Clean carrier gas filter kit, 1/8-inch See **Figure 3**.	CP17974	

Figure 1. GC Supply Gas Installation Kit with Gas Purifiers 19199N

Figure 2. GC Supply Gas Installation Kit 19199M

Figure 3. Gas Clean carrier gas filter kit, 1/8-inch CP17974

3 Dimensions and Weights

This section lists the dimensions of the GC, GC/MS, and automatic liquid samplers (ALS).

Dimensions and Weight

1 Ensure that you can accommodate the shipping pallets when you take delivery. See **Table 3**.

2 Prepare laboratory bench space before the system arrives. Make sure the prepared area is clean, clear, and level. Pay special attention to the total height requirements. Avoid bench space with overhanging shelves. See **Table 4**.

Table 3 Pallet dimensions and weights

Product	Height	Width	Depth	Weight
GC				
8890 Series GC shipping pallet With fourth detector (side mount)	76 cm (30-inch) 76 cm (30-inch)	86 cm (34-inch) 87 cm (34-inch)	103 cm (40.5-inch) 108 cm (42.5-inch)	N/A
MS				
7200/7250 Q-TOF MS	96 cm (38-inch)	130 cm (51-inch)	91 cm (36-inch)	175 kg (385 lb)
7200 Flight Tube	66 cm (26-inch)	66 cm (26-inch)	147 cm (58-inch)	36.4 kg (80 lb)
7250 Flight Tube	66 cm (26-inch)	206 cm (81-inch)	81 cm (32-inch)	87 kg (191 lb)

Table 4 Instrument dimensions, weights, and required clearances

Product	Height	Width	Depth	Weight
GC				
8890 Series GC With fourth detector (side mount)	50 cm (19.2-inch) 50 cm (19.2-inch)	59 cm (23-inch) 68 cm (27-inch)	54 cm (21-inch) 54 cm (21-inch)	50 kg (112 lb) 57 kg (125.4 lb)
• GC operational /oven access		Requires ≥ 30 cm (12-inch) open space above GC. Requires ≥ 27 cm (10.7-inch) open space in front of GC.		
• GC rear ventilation / maintenance clearance		Requires ≥ 25 cm (10-inch) clearance between back of instrument and wall to dissipate hot air and allow for routine maintenance.		
MSD				
5975 Series MSD				
• Diffusion pump	41 cm (16-inch)	30 cm (12-inch)	54 cm (22-inch)	39 kg (85 lb)
• Standard turbo pump	41 cm (16-inch)	30 cm (12-inch)	54 cm (22-inch)	39 kg (85 lb)
• Performance turbo pump	41 cm (16 in)	30 cm (12 in)	54 cm (22 in)	41 kg (90 lb)
• Performance CI/EI turbo pump	41 cm (16 in)	30 cm (12 in)	54 cm (22 in)	46 kg (100 lb)
• Foreline pump Standard Oil-free	 21 cm (8-inch) 19 cm (7.5-inch)	 13 cm (5-inch) 32 cm (13-inch)	 31 cm (12-inch) 28 cm (11-inch)	 11 kg (23.1 lb) 16 kg (35.2 lb)
• GC/MS operational and maintenance access		Requires 30 cm (1 ft) to the left of the unit.		

Table 4 Instrument dimensions, weights, and required clearances (continued)

Product	Height	Width	Depth	Weight
5977 Series MSD				
• Diffusion pump	41 cm (16-inch)	30 cm (12-inch)	54 cm (22-inch)	39 kg (85 lb)
• Performance turbo pump	41 cm (16-inch)	30 cm (12-inch)	54 cm (22-inch)	41 kg (90 lb)
• Performance CI/EI turbo pump	41 cm (16 in)	30 cm (12 in)	54 cm (22 in)	46 kg (100 lb)
• Foreline pump Standard Oil-free (MVP-070) Oil-free (IDP3)	 21 cm (8-inch) 19 cm (7.5-inch) 18 cm (7-inch)	 13 cm (5-inch) 32 cm (13-inch) 35 cm (14-incn)	 31 cm (12-inch) 28 cm (11-inch) 14 cm (6-inch)	 11 kg (23.1 lb) 16 kg (35.2 lb) 10 kg (21 lb)
• GC/MS operational and maintenance access		Requires 30 cm (1 ft) to the left of the unit.		
MS				
7000 and 7010 Triple Quad MS				
• EI Mainframe	47 cm (18.5-inch)	35 cm (14-inch)	86 cm (34-inch)	59 kg (130 lb)
• EI/CI Mainframe	47 cm (18.5-inch)	35 cm (14-inch)	86 cm (34-inch)	63.5 kg (140 lb)
• Foreline pump	28 cm (11-inch)	18 cm (7-inch)	35 cm (14-inch)	21.5 kg (47.3 lb)
• GC/MS operational and maintenance access		Requires 30 cm (1 ft) to the left of the unit.		
7200 Q-TOF MS				
• Mainframe	133 cm (52.5-inch)	90 cm (34.5-inch)	100 cm (39.5-inch)	138 kg (305 lb)
• Foreline pump	28 cm (11-inch)	18 cm (7-inch)	35 cm (14-inch)	21.5 kg (47.3 lb)
7250 Q-TOF MS				
• Mainframe	190 cm (74.8-inch)	90 cm (34.5-inch)	100 cm (39.5-inch)	138 kg (350 lb)
• Foreline pump DS202	28 cm (11-inch)	18 cm (7-inch)	35 cm (14-inch)	21.5 kg (47.3 lb)
• Foreline pump IDP-15	36.4 cm (14.3-inch)	33.3 cm (13.1-inch)	48.5 cm (19.1-inch)	45.5 kg (100 lb)
• GC/Q-TOF operational and maintenance access		Requires 40 cm (16-inch) clearance on both sides of the unit. Requires 30 cm (12-inch) clearance behind the unit.		
Headspace sampler (HS)				
7697A Headspace sampler 111 vial model 12 vial model	 80 cm (32-inch) 61 cm (24-inch)	 69 cm (27-inch) 64 cm (25-inch)	 70 cm (27.5-inch) 69 cm (27-inch)	 46 kg (101 lb) 38.2 kg (84 lb)
• GC with 7697A Headspace sampler		Requires 69 cm (27-inch) to the right of the GC (G4557A), or 64 cm (25-inch) to the right of the GC (G4556A).		
G1888 Headspace sampler	56 cm (22-inch)	46 cm (18.1-inch)	64 cm (25-inch)	46.3 kg (102 lb)

Table 4 Instrument dimensions, weights, and required clearances (continued)

Product	Height	Width	Depth	Weight
ALS				
• GC with 7693A ALS injector		Requires 50 cm (19.5-inch) above the GC		3.9 kg (8.6 lb) each
• GC with 7693A ALS tray		Requires 43 cm (16.8-inch) left of the GC Requires 4.2 cm (1.7-inch) in front of GC		6.8 kg (15 lb) each
• GC with 7650A ALS injector		Requires 50 cm (19.5-inch) above the GC		3.9 kg (8.6 lb) each
• GC with CTC PAL Autosampler		Requires 76.6 cm (30.2-inch) above the GC and 65 to 98 cm (25.6 to 38.6-inch) to the right of the GC, depending on configuration		

Foreline Pump Requirements for Systems Including an MSD

1. If using a 7200 or 7250 Q-TOF MS, the length of the quadrupole vacuum hose is 130 cm (4 ft 3-inch) from the high vacuum pump to the foreline pump, and the length of the foreline pump power cord is 2 m (6 ft 6-inch).
2. If your bench abuts a wall, drill 4 cm (1.5-inch) diameter holes through the rear of the bench for the vacuum hose and power cord.

CAUTION

Make sure the 7200/7250 Q-TOF GC/MS foreline pump is located where it is not likely to be touched by operators.

ALS Dimensions and Weight

Select the laboratory bench space before the system arrives. Pay special attention to the total height requirements. Avoid bench space with overhanging shelves. See **Table 5**.

The instrument needs space for proper convection of heat and ventilation. Allow at least 20 cm clearance between the back of the instrument and wall to dissipate hot air.

Table 5 Required height, width, depth, and weight

Product	Height (cm)	Width (cm)	Depth (cm)	Weight (kg)
G4513A Injector	51	16.5	16.5	3.9
G4514A Tray*	29	44	43	6.8
G4515A Bar Code Reader*	not applicable	not applicable	not applicable	0.3
G4522A Cooling Accessory	not applicable	not applicable	not applicable	2.2 (plus water weight)
7650A Injector	51	22	24	4.5
Additional space requirements				
• GC with 7693A ALS injector		50 cm (19.5-inch) above the GC		
• GC with 7693A ALS tray		45 cm (17.5-inch) left of the GC		
• GC with 7650 ALS injector		50 cm (19.5-inch) above the GC 9 cm (3.6-inch) in front of the GC 3 cm (1.2-inch) to the left of the GC		

* The G4520A Tray with a bar code reader is available with a G4514A Tray and G4515A bar code reader.

4 Environmental Conditions

This section outlines the environmental requirements for use or storage of the GC, GC/MS, and automatic liquid sampler (ALS). Heat dissipation information is also provided.

Environmental Conditions

Ensure that the instrument will be operated or stored within the recommended environmental ranges. This optimizes instrument performance and lifetime. The specified conditions assume a non-condensing, non-corrosive atmosphere. See **Table 6**.

Also, see **"Heat Dissipation"** on page 25.

NOTE

Performance can be affected by sources of heat and cold from heating, air conditioning systems, or drafts.

Table 6 Environmental conditions for operation and storage

Product	Condition	Temperature range	Humidity range	Maximum altitude
8890 GC	Standard oven ramp	15 to 35 °C	5 to 95%	4,615 m
	Fast oven ramp (options 002 and 003)	15 to 35 °C	5 to 95%	4,615 m
	Storage	–40 to 70 °C	5 to 95%	
MSD				
5975 Series MSD	Operation	15 to 35 °C * (59 to 95 °F)	20 to 80%	4,615 m
	Storage	–20 to 70 °C (–4 to 158 °F)	0 to 95%	
5977 Series MSD	Operation	15 to 35 °C * (59 to 95 °F)	20 to 80%	4,615 m
	Storage	–20 to 70 °C (–4 to 158 °F)	0 to 95%	
MS				
7010 or 7000 Triple Quad MS	Operation	15 to 35 °C † (59 to 95 °F)	40 to 80%	5,000 m ‡
	Storage	–20 to 70 °C (–4 to 158 °F)	0 to 95%	
7200 or 7250 Q-TOF MS	Operation	15 to 35 °C † (59 to 95 °F)	20 to 80%	2,500 m
	Storage	–20 to 70 °C (–4 to 158 °F)	0 to 95%	

* Operation requires constant temperature (variations < 2 °C/hour)

† Operation requires constant temperature (variations < 2 °C/hour)

‡ An altitude of 3,700 meters (12,000 feet) is supported if the ambient temperature is less than 30 °C

NOTE

Air pressure 75 kPa to 106 kPa. No hoar-frost, dew, water, rain, or percolating

Heat Dissipation

- Use **Table 7** to estimate the additional heat dissipated from the equipment. Maximums represent the heat given off when heated zones are set for maximum temperatures.

Table 7 Heat dissipation

Instrument	Oven type	
	Standard heater ramp	Fast oven ramp (option 002 or 003) Fast oven ramp (option 002 or 003)
8890 GC	7681 BTU/hour maximum (8103 kJ/h)	10,071 BTU/hour maximum (10,626 kJ/h)
5975 Series MSD	3000 BTU/hour (3165 kJ/h)	
5977 Series MSD	3000 BTU/hour (3165 kJ/h)	
7010 or 7000 Triple Quad MS	3700 BTU/hour (3904 kJ/h)	
7200 or 7250 Q-TOF MS	6200 BTU/hour (6541 kJ/h)	

If using the optional G4522A Cooling Accessory, you will need to supply:

- A water chiller.
- Tubing and 1/8-inch Swagelok fittings to connect the chilled water and return water to the chiller.

A container or drain to dispose of condensate from the tray.

ALS Environmental Conditions

Operating the instrument within the recommended ranges optimizes instrument performance and lifetime. The sampler system operates in the same environment as its parent GC.
See **"Environmental Conditions"** on page 24.

The conditions assume a non-condensing, noncorrosive atmosphere.

Table 8 Environmental conditions for operation and storage

Product	Conditions	Operating temp range	Operating humidity range	Maximum altitude
G4513A Injector G4514A Tray* G4515A Bar Code Reader*	Operation	0 to 40 °C	5–95%	4,300 m
7650 Injector	Operation	0 to 40 °C	5–95%	4,300 m
G4517A Controller	Operation	–5 to 45 °C	Maximum relative humidity of 80% for temperatures up to 31 °C decreasing linearly to 50% relative humidity at 40 °C	2,000 m
	Storage			

* The G4520A Tray with a bar code reader is available with a G4514A Tray and G4515A bar code reader.

5 Exhaust Venting

This section outlines the exhaust venting requirements for GC, GC/MS, and automatic liquid sampler (ALS) installation.

Exhaust Venting

During normal operation, the GC exhausts hot oven air. Depending on the installed inlet and detector types, the GC can also exhaust (or vent) uncombusted carrier gas and sample. Proper venting of these exhausts is required for operation and safety.

Venting hot air

WARNING

Do not place temperature-sensitive items (for example, gas cylinders, chemicals, regulators, and plastic tubing) in the path of the heated exhaust. These items will be damaged and plastic tubing will melt. Be careful when working behind the instrument during cool-down cycles to avoid burns from the hot exhaust.

1 Hot air (up to 450 °C) from the oven exits through a vent in the rear of the instrument. Allow at least 25 cm (10-inch) clearance behind the instrument, or 30 cm (12-inch) behind a Q-TOF GC/MS to dissipate this hot air. See **Figure 4**.

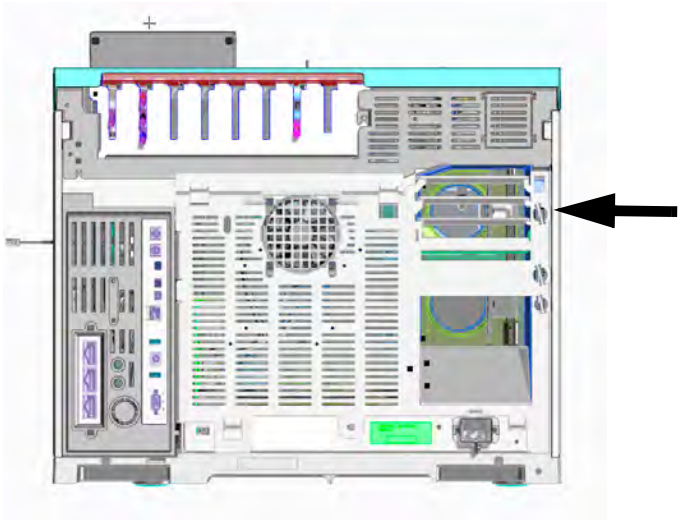


Figure 4. Exhaust outlet.

2 For most applications, an optional oven exhaust deflector is available. The exhaust deflector allows for less bench depth than a GC without the exhaust deflector installed.

- The GC exhaust deflector is included if GC option 306 is ordered. The exhaust deflector requires 14 cm (5.5 inches) behind the instrument. For GCs with the exhaust deflector option installed, the exhaust rate is about 65 ft^3/min (1.84 m^3/min). Without the deflector, the exhaust rate is about 99 ft^3/min (2.8 m^3/min). The deflector outlet diameter is 10 cm (4 in). See **Figure 5**.
- For part numbers for the exhaust deflectors, see **Table 9**.

Table 9 Exhaust deflector part numbers

Instrument	Part number
GC	G1530-80650
7200/7250 Q-TOF GC/MS, GC Q-TOF	G3850-80650

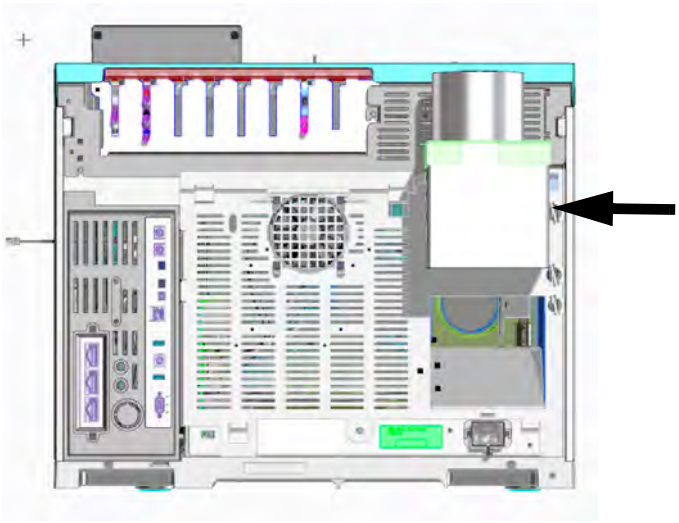


Figure 5. Exhaust deflector G1530-80650

Venting other gases

During normal operation of the GC with many detector and inlet types, some of the carrier gas and sample vents outside the instrument through the split vent, septum purge vent, and detector exhaust. If any sample components are toxic or noxious, or if hydrogen is used as the carrier gas or detector fuel gas, these exhausts must be vented to a fume hood.

NOTE

Exhaust venting must comply with all local environmental and safety codes. Contact your Environmental Health & Safety (EHS) specialist.

1. Place the GC in the hood or attach a large diameter venting tube to the relevant outlet for proper ventilation. See **"Exhaust vent fittings"** on page 30.
2. To further prevent contamination from noxious gases, attach a chemical trap to the vent(s).
3. If using an ECD, always connect the ECD exhaust vent to a fume hood or vent it to the outside. See the latest revision of 10 CFR Part 20 (including Appendix B), or the applicable state regulation. For countries other than the United States, consult with the appropriate agency for equivalent requirements. Agilent 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.

4 Vent the GC/MS system externally to the building via an ambient-pressure vent system, within 460 cm (15 ft) of both the GC split vent and GC/MS foreline pump, or vent to a fume hood.

Exhaust vent fittings

The various inlet and detector vents terminate in the following fittings:

- TCD, ECD: The detector exhaust terminates in a 1/8-inch od tube.
- SSL, MMI, PTV, VI: The split vent terminates in a 1/8-inch Swagelok female fitting.
- All inlets: The septum purge vent terminates in 1/8-inch od tubing.

6 GC System Power Requirements

This section details the power requirements for GC, GC/MS, and automatic liquid sampler (ALS) installation.

Power Requirements

Power consumption and requirements depend on the country to which the unit ships.

The number and type of electrical outlets depend on the size and complexity of the system.

WARNING

To protect users, the metal instrument panels and cabinet are grounded through the three-conductor power line cord in accordance with International Electrotechnical Commission (IEC) requirements.

A proper earth ground is required for GC operations. Any interruption of the grounding conductor or disconnection of the power cord could cause a shock that could result in personal injury.

Be sure to verify proper receptacle grounding.

WARNING

Do not use extension cords with Agilent instruments. Extension cords normally are not rated to carry enough power and can be a safety hazard.

The length of the power cord is 2 meters (6.6 feet).

CAUTION

Do not use power line conditioners with Agilent instruments. Doing so may cause damage to the equipment.

1 Ensure that each instrument in your GC system can be connected to a dedicated circuit with an isolated ground. (Note that ALS instruments receive their power from the GC.)

2 Power requirements are printed near the power cord attachment on the rear panel of each instrument. Although your GC should arrive ready for operation in your country, compare its power requirements with those listed in **Table 10**. If the voltage option you ordered is not suitable for your installation, contact Agilent Technologies.

Table 10 Power requirements

Product	Oven type	Line voltage (VAC)	Frequency (Hz)	Maximum continuous power consumption (VA)	Current rating (amps)	Power outlet current rating
8890 GC	Standard	Americas: 120 single phase (−10% / +10%)	50/60 ± 5%	2250	18.8	20 Amp Dedicated
8890 GC	Standard	220/230/240 single/split phase (−10% / +10%)	50/60 ± 5%	2250	10.2/9.8/ 9.4	10 Amp Dedicated
8890 GC	Fast	Japan 200 split phase (−10% / +10%)	50/60 ± 5%	2950	14.8	15 Amp Dedicated

Table 10 Power requirements (continued)

Product	Oven type	Line voltage (VAC)	Frequency (Hz)	Maximum continuous power consumption (VA)	Current rating (amps)	Power outlet current rating
8890 GC	Fast	220/230/240 single/split phase (−10% / +10%)*	50/60 ± 5%	2950	13.4/12.8/ 12.3	15 Amp Dedicated
MSD						
5975 Series MSD		120 (−10% / +5%)	50/60 ± 5%	1100 (400 for foreline pump only)	8	10 Amp Dedicated
5975 Series MSD		220–240 (−10% / +5%)	50/60 ± 5%	1100 (400 for foreline pump only)	8	10 Amp Dedicated
5975 Series MSD		200 (−10% / +5%)	50/60 ± 5%	1100 (400 for foreline pump only)	8	10 Amp Dedicated
5977 Series MSD		120 (−10% / +5%)	50/60 ± 5%	1100 (400 for foreline pump only)	8	10 Amp Dedicated
5977 Series MSD		220–240 (−10% / +5%)	50/60 ± 5%	1100 (400 for foreline pump only)	8	10 Amp Dedicated
5977 Series MSD		200 (−10% / +5%)	50/60 ± 5%	1100 (400 for foreline pump only)	8	10 Amp Dedicated
MS						
7010 or 7000 Triple Quad MS		120 (−10% / +5%)	50/60 ± 5%	1600	15	15 Amp Dedicated
7010 or 7000 Triple Quad MS		220–240 (−10% / +5%)	50/60 ± 5%	1600	15	15 Amp Dedicated
7010 or 7000 Triple Quad MS		200 (−10% / +5%)	50/60 ± 5%	1600	15	15 Amp Dedicated
7200 or 7250 Q-TOF MS		200–240 (−10% / +5%)	50/60 ± 5%	1800 (1200 for foreline pump)	15	15 Amp Dedicated
HS						
7697A Headspace		Americas: 120 single phase (−10% / +10%)	50/60 ± 5%	850	6.2	15 Amp Dedicated
7697A Headspace		200/220/230/240 single/split phase (−10% / +10%)	50/60 ± 5%	850	3.8/3.4/ 3.3/3.1	10 Amp Dedicated
All						
Data system PC (monitor, CPU, printer)		100/120 (−10% / +5%)	50/60 ± 5%	1000	10/8.3	15 Amp Dedicated
Data system PC (monitor, CPU, printer)		200-240 (−10% / +5%)	50/60 ± 5%	1000	4.1-5	10 Amp Dedicated

* Option 003, 208 VAC fast oven, uses a 220 VAC unit with operating range of 198 to 242 VAC. Most labs have 4-wire service resulting in 208 VAC at the wall receptacle. It is important to measure the line voltage at the receptacle for the GC.

NOTE

The GC and related equipment meet the following International Electrotechnical Commission (IEC) classifications: Equipment Class I, Laboratory Equipment, Installation Category II, and Pollution Degree 2.

USA fast heating oven, 240 V

The 240 V fast heating oven requires 240 V/15 A power. Do not use 208 V power. Lower voltage causes slow oven ramps and prevents proper temperature control. The power cord supplied with your GC is rated for 250 V/15 A, and is a two-pole, three-wire cord with grounding (type L6-15R/L6-15P).

Canadian installation

When installing a GC in Canada, make sure your GC power supply circuit meets the following additional requirements:

- The circuit breaker for the branch circuit, which is dedicated to the instrument, is rated for continuous operation.
- The service box branch circuit is marked as a “Dedicated Circuit.”

Common instrument power cord plugs

Table 11 shows common Agilent power cord plugs.

Table 11 Power cord terminations

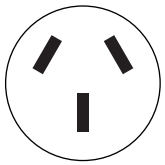
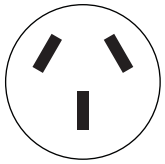
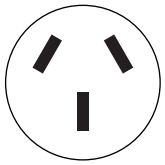
Part number	Country	Voltage	Amps	Cable length (m)	GC connector type	Termination type	Plug
8121-0675	Argentina	240	16	4.5	C19	AS 3112	
8120-1369	Australia, New Zealand	240	10	2.5	C13	AS 3112	
8120-8619	Australia	240	16	2.5	C19	AS 3112	

Table 11 Power cord terminations

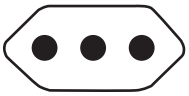
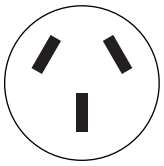
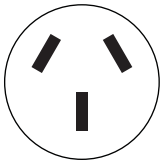
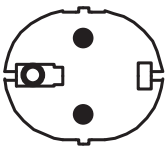
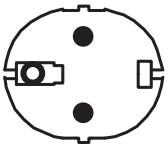
Part number	Country	Voltage	Amps	Cable length (m)	GC connector type	Termination type	Plug
8121-1787	Brazil	240	16	2.5	C19	IEC 60906-1	
8121-1809	Brazil	240	10	2.5	C13	IEC 60906-1	
8120-6978	Chile	240	10	2.5	C13	CEI 23-16	
8121-0070	China	220	16	2.5	C19	GB 1002	
8121-0723	China	220	10	2.5	C13	GB 1002	
8120-3997	Denmark, Greenland	230	10	2.5	C13	AFSNIT 107-2-01	
8120-8622	Denmark, Switzerland	230	16	2.5	C19	Swiss/Denmark 1302	
8120-8621	Europe	220 / 230 / 240	16	2.5	C19	CEE/7/V11	
8121-1222	Korea	220 / 230 / 240	16	2.5	C19	CEE/7/V11	

Table 11 Power cord terminations

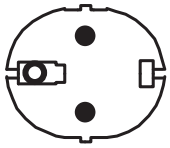
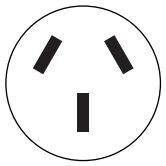
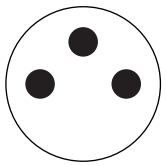
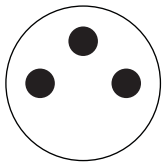
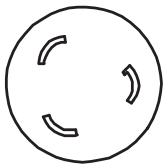
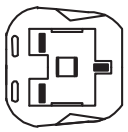
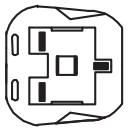
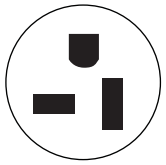
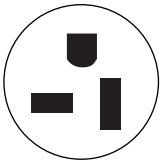
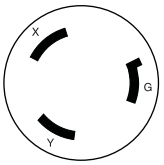
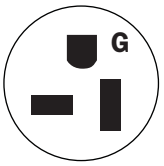
Part number	Country	Voltage	Amps	Cable length (m)	GC connector type	Termination type	Plug
8121-1226	Korea	220 / 230 / 240	10	2.5	C13	CEE/7/V11	
8121-0710	India, South Africa	240	15	2.5	C19	AS 3112	
8120-5182	Israel	230	10	2.5	C13	Israeli SI32	
8120-0161	Israel	230	16, 16 AWG	2.5	C19	Israeli SI32	
8120-6903	Japan	200	20	4.5	C19	NEMA L6-20P	
8120-8620	United Kingdom, Hong Kong, Singapore, Malaysia	240	13	2.5	C19	BS1363/A	
8120-8705	United Kingdom, Hong Kong, Singapore, Malaysia	240	10	2.3	C13	BS1363/A	
8120-6894	United States	120	20	2.5	C19	NEMA 5-20P	

Table 11 Power cord terminations

Part number	Country	Voltage	Amps	Cable length (m)	GC connector type	Termination type	Plug
8120-1992	United States	120	13	2.5	C13	NEMA 5-20P	
8121-0075	United States	240	15	2.5	C19	NEMA L6-15P	
8120-6360	Taiwan, South America	120	20	2.5	C19	NEMA 5-20P	
8121-1301	Thailand	220	15	1.8	C19		

ALS Power Requirements

The ALS components draw power from the GC. No other power source is required.

The G4517A controller, used with the 8890 series GC, requires one electrical outlet with a dedicated ground. The controller can be set for either 100-120 V or 200-240 V.

WARNING

Do not use extension cords with Agilent instruments. Extension cords normally are not rated to carry enough power and can be a safety hazard.

The length of the power cord is 2 meters (6.6 feet).

7 Gas Selection and Plumbing

This section outlines the requirements for gas selection and plumbing.

Refer to the Agilent Web site at **www.agilent.com** for the most up-to-date listing of GC, GC/MS, and ALS supplies and consumables.

Gas and Reagent Selection

Table 12 lists gases usable with Agilent GCs and capillary columns. When used with capillary columns, GC detectors require a separate makeup gas for optimum sensitivity. The MS and MSD use GC carrier gas.

If you are using any MS system, use of hydrogen as the carrier gas may require hardware modifications for the best performance. Contact your Agilent service representative. Hydrogen is not supported as a carrier gas with the 7200/7250 GC/Q-TOF system.

WARNING

When using hydrogen (H_2) as the carrier gas or fuel gas, be aware that hydrogen gas can flow into the GC and create an explosion hazard. Therefore, be sure that the supply is turned off until all connections are made and ensure 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, periodically leak test all connections, lines, and valves before operating the instrument or after maintenance. Always turn off the hydrogen supply at its source before working on the instrument.

Please refer to the Hydrogen Safety Guide shipped with your instrument.

Hydrogen use is specifically prohibited with the 7200 or 7250 GC/Q-TOF system.

NOTE

Nitrogen and Argon/Methane are generally not suitable for GC/MS carrier gas.

Table 12 Gases usable with Agilent GCs and capillary columns

Detector type	Carrier	Preferred makeup	Alternate choice	Detector, anode purge, or reference
Electron capture (ECD)	Hydrogen Helium Nitrogen Argon/Methane (5%)	Nitrogen	Nitrogen Nitrogen Argon/Methane (5%) Nitrogen	Anode purge must be same as makeup
Flame ionization (FID)	Hydrogen Helium Nitrogen	Nitrogen Nitrogen Nitrogen	Helium Helium Helium	Hydrogen and air for detector
Flame photometric (FPD)	Hydrogen Helium Nitrogen Argon	Nitrogen Nitrogen Nitrogen Nitrogen		Hydrogen and air for detector
Nitrogen-Phosphorus (NPD)	Helium Nitrogen	Nitrogen Nitrogen	Helium* Helium	Hydrogen and air for detector

Table 12 Gases usable with Agilent GCs and capillary columns (continued)

Detector type	Carrier	Preferred makeup	Alternate choice	Detector, anode purge, or reference
Thermal conductivity (TCD)	Hydrogen Helium Nitrogen	Must be same as carrier and reference	Must be same as carrier and reference	Reference must be same as carrier and makeup

* Depending on bead type, higher makeup gas flow rates (> 5 mL/min) may introduce cooling effects or shorten bead life.

Table 13 lists gas recommendations for packed column use. In general, makeup gases are not required with packed columns.

Table 13 Gases usable with Agilent GCs and packed columns

Detector type	Carrier gas	Comments	Detector, anode purge, or reference
Electron capture (ECD)	Nitrogen Argon/methane	Maximum sensitivity Maximum dynamic range	Nitrogen Argon/Methane
Flame ionization (FID)	Nitrogen Helium	Maximum sensitivity Acceptable alternative	Hydrogen and air for detector.
Flame photometric (FPD)	Hydrogen Helium Nitrogen Argon		Hydrogen and air for detector.
Nitrogen-Phosphorus (NPD)	Helium Nitrogen	Optimum performance Acceptable alternative	Hydrogen and air for detector.
Thermal conductivity (TCD)	Helium Hydrogen Nitrogen Argon	General use Maximum sensitivity* Hydrogen detection† Maximum hydrogen sensitivity*	Reference must be same as carrier and makeup.

* Slightly greater sensitivity than helium. Incompatible with some compounds.

† For analysis of hydrogen or helium. Greatly reduces sensitivity for other compounds.

For installation checkout, Agilent requires the gas types shown in **Table 14**.

Table 14 Gases and reagents required for checkout

Detector	Gases required
FID	Carrier: helium Makeup: nitrogen Fuel: hydrogen Aux gas: Air
TCD	Carrier and reference: helium

Table 14 Gases and reagents required for checkout (continued)

Detector	Gases required
NPD	Carrier: helium Makeup: nitrogen Fuel: hydrogen Aux gas: Air
ECD	Carrier: helium Anode purge and makeup: nitrogen
FPD	Carrier: helium Makeup: nitrogen Fuel: hydrogen Aux gas: Air
CI MS (external)	Reagent gas: methane
CI MS (internal)	Reagent: methanol

MS and MSD systems purchased with a Self-Cleaning Ion Source also require a source of hydrogen gas in addition to helium carrier gas. This source can be shared but must meet carrier gas purity requirements.

Hydrogen Carrier Gas

Refer to the Agilent 8890 GC *Safety Manual* for important safety information about hydrogen gas.

If hydrogen is being used as a carrier gas, or for the JetClean ion source system, special considerations apply due to hydrogen's flammability and chromatographic properties.

- Agilent highly recommends the G3388B Leak Detector to safely check for leaks.
- Hydrogen carrier gas requires special considerations for supply tubing. See **"Gas Plumbing"** on page 49.
- In addition to the supply pressure requirements listed in **"Gas Supplies"** on page 43, Agilent also recommends users of hydrogen gas consider gas source and purification needs. See the additional recommendations in **"Requirements for hydrogen as a carrier gas or for use in JetClean systems"** on page 45.
- When using hydrogen carrier gas with a ECD, TCD, or any other detector that vents uncombusted gases, plan to vent the detector output to a fume hood or similar location. Uncombusted hydrogen can present a safety hazard. See **"Exhaust Venting"** on page 28.
- When using hydrogen carrier gas, also plan to safely vent inlet split vent flows and purge vent flows. See **"Exhaust Venting"** on page 28.

Gas and Reagent Purity

Agilent recommends that carrier and detector gases be 99.9995% pure. See **Table 15**. Air needs to be zero grade or better. Agilent also recommends using high quality traps to remove hydrocarbons, water, and oxygen.

Table 15 Carrier, collision and reagent gas purity

Carrier, collision and reagent gas requirements	Purity	Notes
Helium (carrier and collision)	99.9995%	Hydrocarbon free
Hydrogen (carrier) (carrier and self-cleaning ion source)	99.9995%	SFC grade
Nitrogen (carrier)	99.9995%	
Nitrogen (drying gas, nebulizer pressure)*	99.999%	Research grade
Methane reagent gas†	99.999%	Research or SFC grade
Isobutane reagent gas‡	99.99%	Instrument grade
Ammonia reagent gas‡	99.9995%	Research or SFC grade
Carbon dioxide reagent gas‡	99.995%	SFC grade
Methanol**	99.9%	Reagent grade. Purge and trap grade recommended.

* Purity specification is the minimum acceptable purity. Major contaminants can be water, oxygen, or air. Drying gas and nebulizer pressure gas can be supplied by a nitrogen gas generator, house nitrogen system, or liquid nitrogen dewar.

† Required reagent gas for installation and performance verification, external CI MS only. The 5975 and 5977 operate in an external CI mode. The 5975, 5977, 7000 GC/MS, and 7200 Q-TOF MS operate in an external CI mode. The 5975 operates in an external CI mode.

‡ Optional reagent gases, CI mode only.

** Required reagent for performance verification in internal CI mode only. Evaporation residue <.0001%.

Gas Supplies

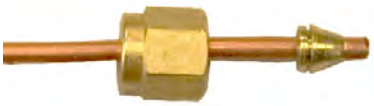
General requirements

Supply instrument gases using tanks, an internal distribution system, or gas generators. If used, tanks require two-stage pressure regulators with packless, stainless steel diaphragms. The instrument requires 1/8-inch Swagelok connections to its gas supply fittings. See **Figure 6**.

NOTE

Plumb the gas supply tubing/regulators so that one 1/8-inch Swagelok female connector is available for each gas needed at the instrument.

Swagelok nut and ferrules



Female Swagelok fittings on GC

Figure 6. Example Swagelok connector and hardware

Table 16 lists available Agilent two-stage tank regulators. All Agilent regulators are supplied with the 1/8-inch Swagelok female connector.

Table 16 Tank regulators

Gas type	CGA number	Max pressure	Part number
Air	346	125 psig (8.6 Bar)	5183-4641
Industrial Air	590	125 psig (8.6 Bar)	5183-4645
Hydrogen, Argon/Methane	350	125 psig (8.6 Bar)	5183-4642
Oxygen	540	125 psig (8.6 Bar)	5183-4643
Helium, Argon, Nitrogen	580	125 psig (8.6 Bar)	5183-4644

Table 17 and **Table 18** list minimum and maximum delivery pressures for inlets and detectors, measured at the bulkhead fittings on the back of the instrument.

Table 17 Delivery pressures for inlets required at the GC/MS, in kPa (psig)

	Inlet type					
	Split/Splitless 150 psi	Split/Splitless 100 psi	Multimode 100 psi	On-column	Purged packed	PTV
Carrier (max)	1,172 (170) *	827 (120)	1,172 (170)	827 (120)	827 (120)	827 (120)
Carrier (min)	(20 psi) above maximum pressure used in method. (If using constant flow control in the inlet, the maximum column pressure occurs at the final oven temperature.)					

* Japan only: 1013 (147)

Table 18 Maximum delivery pressures for detectors, at the GC/MS, in kPa (psig)

	Detector type				
	FID	NPD	TCD	ECD	FPD
Hydrogen	240–690 (35–100)	240–690 (35–100)			310–690 (45–100)
Air	380–690 (55–100)	380–690 (55–100)			690–827 (100–120)
Makeup	380–690 (55–100)	380–690 (55–100)	380–690 (55–100)	380–690 (55–100)	380–690 (55–100)
Reference			380–690 (55–100)		

The minimum supply pressure for Auxiliary EPC and PCM modules is 138 kPa (20 psi) greater than the pressure used in your method. For example, if you need a pressure of 138 kPa (20 psi) for the method, the supply pressure must be at least 276 kPa (40 psi). **Table 19** lists the maximum carrier pressure for Auxiliary EPC and PCM modules.

Table 19 Delivery pressures for Auxiliary EPC and PCM modules, in kPa (psig)

	Aux EPC	PCM 1	PCM 2 or PCM Aux
Carrier (max)	827 (120)	827 (120)	827 (120) with Forward pressure control 345 (50) with Backpressure control

Requirements for hydrogen as a carrier gas or for use in JetClean systems

Not all systems can use hydrogen as a carrier gas. See **Gas Selection**.

Hydrogen can be supplied from a generator or from a cylinder.

Agilent recommends use of a high-quality hydrogen gas generator. A high-quality generator can consistently produce purity > 99.9999%, and the generator can include built-in safety features such as limited storage, limited flow rates, and auto-shutdown. Select a hydrogen generator that provides low (good) specifications for water and oxygen content.

If using a hydrogen gas cylinder, Agilent recommends use of Gas Clean Filters to purify the gas. Consider additional safety equipment as recommended by your company safety personnel.

GC/MS Gas Requirements

Table 20 lists typical flows resulting from selected carrier gas source pressures.

Table 20 5977 and 5975 Series MSD carrier gases

Carrier gas requirements	Typical pressure range	Typical flow (mL/min)
Helium (required) (column and split flow)	345 to 552 kPa (50 to 80 psi)	20 to 50
Hydrogen (optional)* (column and split flow)	345 to 552 kPa (50 to 80 psi)	20 to 50

Table 20 5977 and 5975 Series MSD carrier gases (continued)

Carrier gas requirements	Typical pressure range	Typical flow (mL/min)
Methane reagent gas (required for CI operation)	103 to 172 kPa (15 to 25 psi)	1 to 2
Isobutane reagent gas (optional)	103 to 172 kPa (15 to 25 psi)	1 to 2
Ammonia reagent gas (optional)	34 to 55 kPa (5 to 8 psi)	1 to 2
Carbon dioxide reagent gas (optional)	103 to 138 kPa (15 to 0 psi)	1 to 2

* Hydrogen gas can be used for the carrier gas but specifications are based on helium as the carrier gas. Please observe all hydrogen gas safety cautions.

7010 and 7000 Series MS

Table 21 lists typical flows resulting from selected carrier gas source pressures.

Table 21 7010 and 7000 Triple Quad MS carrier gases

Carrier gas requirements	Typical pressure range	Typical flow (mL/min)
Helium (required) (column and split flow)	345 to 552 kPa (50 to 80 psi)	20 to 50
Hydrogen (optional)* (column and split flow)	345 to 552 kPa (50 to 80 psi)	20 to 50
Methane reagent gas (required for CI operation)	103 to 172 kPa (15 to 25 psi)	1 to 2
Ammonia reagent gas (optional)	34 to 55 kPa (5 to 8 psi)	1 to 2
Isobutane reagent gas (optional)†	103 to 172 kPa (15 to 25 psi)	1 to 2
Carbon dioxide reagent gas (optional)†	103 to 138 kPa (15 to 20 psi)	1 to 2
Nitrogen for collision cell (nitrogen source is supplied to EPC module in GC.)	1.03 to 1.72 bar (104 to 172 kPa, or 15 to 25 psi)	1 to 2 (mL/min)

* Hydrogen gas can be used for the carrier gas but specifications are based on helium as the carrier gas. Please observe all hydrogen gas safety cautions.

† Reagent available with manual tune only.

7200 and 7250 Series Q-TOF MS

Table 22 lists the limits on total gas flow into the 7200/7250 Q-TOF GC/MS.

Table 22 7200/7250 Q-TOF GC/MS total gas flow limitations

Feature	7200	7250
High vacuum pump 1	Split-flow turbo	Split-flow turbo
High vacuum pump 2	Split-flow turbo	Turbo

Table 22 7200/7250 Q-TOF GC/MS total gas flow limitations (continued)

Feature	7200	7250
High vacuum pump 3	Turbo	Turbo
Carrier gas optimal gas flow, mL/min*	1.0 to 1.5	1.0 to 1.5
Carrier gas maximum recommended gas flow, mL/min	2.0	2.0
Carrier gas maximum gas flow, mL/min†	2.4	2.4
Reagent gas flow (EI/CI – CI application)	1.0 to 2.0	NA
Collision cell gas flow rate, mL/min (Nitrogen)	1.5	1.0
Collision cell gas flow rate, mL/min (Helium)		4.0
Maximum column id	0.32 mm (30 m long)	0.32 mm (30 m long)

* Total gas flow into the MS = column flow + reagent gas flow (if applicable) + collision cell gas flow.

† Expect degradation of spectral performance and sensitivity.

Table 23 lists typical flows resulting from selected carrier and reagent gas source pressures.

Table 23 7200/7250 Q-TOF GC/MS carrier and reagent gas flows

Carrier and reagent gas requirements	Q-TOF	Typical pressure range	Typical flow
Helium (required for carrier and IRM)	7200	173 to 207 kPa (25 to 30 psi)	1.0 to 2.0 (mL/min)
Nitrogen for RIS transfer line actuator	7200	6.1 to 6.8 bar (612 to 690 kPa, or (90 to 100 psi)	Up to 30 L/min
Nitrogen for collision cell (nitrogen source is supplied to EPC module in GC.)	7200/7250	0.7 to 2.0 ar (70 to 207 kPa, or 10 to 30 psi)	1 to 2 (mL/min)
Helium for collision cell (helium source is supplied to EPC module in GC.)	7250	0.7 to 2.0 bar (70 to 207 kPa, or 10 to 30 psi)	4 (mL/min)

WARNING **The use of hydrogen is specifically prohibited with the 7200/7250 GC/Q-TOF.**

GC/MS systems with a JetClean ion source system installed use helium as the GC carrier gas and an additional supply of hydrogen gas to the MS analyzer. **Table 24** shows typical supply pressures needed for operation. These values reflect the pressures supplied to the instruments, not setpoints.

Table 24 JetClean ion source system gas supply pressures

Gas supply	Pressure delivered at the GC
Helium	690 kPa (100 psi)
Hydrogen	≤ 621 kPa (90 psi)*

* Any delivery pressure ≤ 621 kPa (90 psi) is acceptable as long as it is 69 kPa (10 psi) higher than the maximum hydrogen pressure needed during operation.

Performance verification

Performance verification requires the following:

- Helium carrier gas.
- For MS systems using chemical ionization or methane reagent gas.

Gas Plumbing

WARNING

All compressed gas cylinders should be securely fastened to an immovable structure or permanent wall. Compressed gases should be stored and handled in accordance with the relevant safety codes.

Gas cylinders should not be located in the path of heated oven exhaust.

To avoid possible eye injury, wear eye protection when using compressed gas.

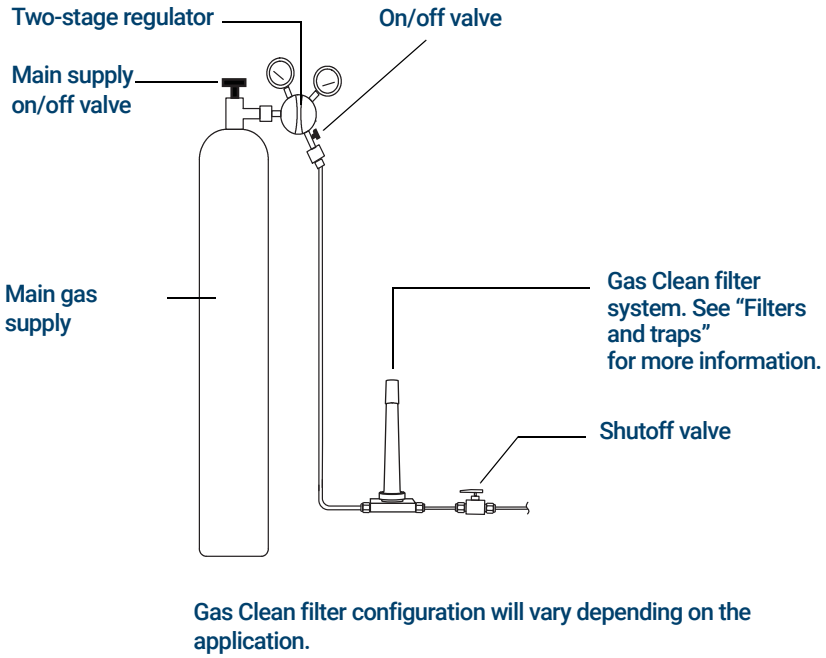


Figure 7. Recommended filters and plumbing configuration from a carrier gas cylinder

- If you have not requested option 305 (pre-plumbed tubing), you must supply pre-cleaned, 1/8-inch copper tubing and a variety of 1/8-inch Swagelok fittings to connect the GC to inlet and detector gas supplies. See the **Installation Kits** for recommended parts.
- Agilent strongly recommends two-stage regulators to eliminate pressure surges. High-quality, stainless-steel diaphragm-type regulators are especially recommended.
- On/off valves mounted on the outlet fitting of the two-stage regulator are not essential but are very useful. Be sure the valves have stainless-steel, packless diaphragms.
- Agilent strongly recommends installation of shut-off valves at each GC inlet supply fitting to allow the GC to be isolated for maintenance and troubleshooting. Order part number 0100-2144. (Note that some optional installation kits include one shut-off valve. See **"Installation Kits"** on page 14 for more information.)
- If you purchased automated valving, the valve actuation requires a **separate** pressurized, dry air supply at 380 kPa (55 psig). This air supply must end in a male fitting compatible with a 1/4-inch id plastic tube at the GC.

- FID, FPD, and NPD detectors require a dedicated air supply. Operation may be affected by pressure pulses in air lines shared with other devices.
- Flow- and pressure-controlling devices require at least 10 psi (138 kPa) pressure differential across them to operate properly. Set source pressures and capacities high enough to ensure this.
- Situate auxiliary pressure regulators close to the GC inlet fittings. This ensures that the supply pressure is measured at the instrument (rather than at the source); pressure at the source may be different if the gas supply lines are long or narrow.
- **Never use liquid thread sealer to connect fittings.**
- **Never use chlorinated solvents to clean tubing or fittings.**

See **"Installation Kits"** on page 14 for more information.

Supply tubing for most carrier and detector gases

Use only preconditioned copper tubing (part number 5180-4196) to supply gases to the instrument. Do not use ordinary copper tubing—it contains oils and contaminants.

CAUTION

Do not use methylene chloride or other halogenated solvent to clean tubing that will be used with an electron capture detector. They will cause elevated baselines and detector noise until they are completely flushed out of the system.

CAUTION

Do not use plastic tubing for suppling detector and inlet gases to the GC. It is permeable to oxygen and other contaminants that can damage columns and detectors.

Plastic tubing can melt if near hot exhaust or components.

The tubing diameter depends on the distance between the supply gas and the GC and the total flow rate for the particular gas. Tubing of 1/8-in diameter is adequate when the supply line is less than 15 feet (4.6 m) long.

Use larger diameter tubing (1/4-inch) for distances greater then 15 feet (4.6 m) or when multiple instruments are connected to the same source. Use larger diameter tubing if high demand is anticipated (for example, air for an FID).

Be generous when cutting tubing for local supply lines—a coil of flexible tubing between the supply and the instrument lets you move the GC without moving the gas supply. Take this extra length into account when choosing the tubing diameter.

Supply tubing for hydrogen gas

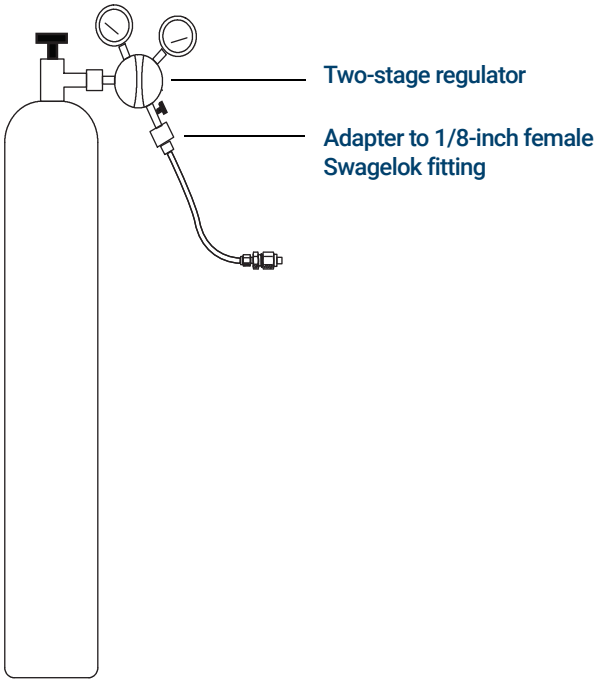
Agilent recommends using new chromatographic quality stainless steel tubing and fittings when using hydrogen.

- Do not re-use old tubing when installing or switching to hydrogen supply lines for carrier gas or the JetClean ion source system. Hydrogen gas tends to remove contaminants left on old tubing by previous gases (by helium, for example). These contaminants can appear in output as high background noise or hydrocarbon contamination for several weeks.
- Especially do not use old copper tubing, which can become brittle.

WARNING **Do not use old copper tubing with hydrogen gas. Old copper tubing can become brittle and create a safety hazard.**

Two-stage pressure regulators

To eliminate pressure surges, use a two-stage regulator with each gas tank. Stainless steel, diaphragm-type regulators are recommended.



The type of regulator you use depends on the gas type and supplier. The Agilent catalog for consumables and supplies contains information to help you identify the correct regulator, as determined by the Compressed Gas Association (CGA). Agilent Technologies offers pressure-regulator kits that contain all the materials needed to install regulators properly.

Pressure regulator-gas supply tubing connections

Use PTFE tape to seal the pipe-thread connection between the pressure regulator outlet and the fitting to which you connect the gas tubing. Instrument grade PTFE tape (part number 0460-1266), from which volatiles have been removed, is recommended for all fittings. **Do not use pipe dope to seal the threads**; it contains volatile materials that will contaminate the tubing.

Pressure regulators typically end in fittings that must be adapted to the correct style or size. **Table 25** lists parts needed to adapt a standard 1/4-inch male NPT fitting to a 1/8-inch or 1/4-inch Swagelok fitting.

Table 25 Parts for adapting NPT fittings

Description	Part number
Swagelok 1/8-inch to female 1/4-inch NPT, brass	0100-0118
Swagelok 1/4-inch to female 1/4-inch NPT, brass	0100-0119
Reducing union, 1/4-inch to 1/8-inch, brass, 2/pk	5180-4131

Filters and traps

Using chromatographic-grade gases ensures that the gas in your system is pure. However, for optimum sensitivity, install high-quality filters or traps to remove traces of water or other contaminants. After installing a filter, check the gas supply lines for leaks.

Agilent recommends the Gas Clean Filter system. The Gas Clean Filter system delivers high purity gases to your analytical instruments, reducing the risk of column damage, sensitivity loss, and instrument downtime. The filters are designed for use with the GC, GC/MS, ICP-OES, ICP-MS, LC/MS, and any other analysis instrument using carrier gas. Six filters are available, including CO2, oxygen, moisture, and organics trap (charcoal).

Filter types

Each Gas Clean Filter type is designed to filter out a specific impurity that may exist in the gas supply. The following filter types are available:

- **Oxygen** - Prevents oxidation of the GC column, septum, liner, and glass wool.
- **Moisture** - Delivers fast stabilization times for increased GC productivity, and prevents hydrolization damage to the stationary phase, column, liner, glass wool, or septum in the GC.
- **Process Moisture** - Prevents oxidation of GC components and is safe to use with acetylene in process GC applications.
- **Charcoal** - Removes organic compounds and ensures correct performance of FID detectors in the GC.
- **GC/MS** - Delivers fast stabilization times for increased GC productivity, removes oxygen, moisture, and hydrocarbons from the carrier gas for MS applications, and provides ultimate GC column protection.

Table 26 lists the most common Gas Clean Filter system kits. See the Agilent online store or contact your local Agilent sales representative for additional filters, parts, and accessories applicable to your instrument configuration.

Table 26 Recommended Gas Clean Filter kits

Description	Part number	Use
Gas Clean Filter kit (connecting unit for one filter, including one carrier gas filter, 1/8-inch connections, a smart sensor, and mounting bracket for the GC)	CP179880	Carrier gas only
Gas Clean Filter kit (connecting unit for four filters, including four filters, 1/4-inch connections)	CP7995	FID, FPD, NPD
Gas Clean Filter kit (connecting unit for four filters, including four filters, 1/8-inch connections)	CP736530	FID, FPD, NPD
GC/MS Gas Clean Filter kit (includes one connecting unit and two GC/MS filters, 1/8-inch connections)	CP17976	ECD, GC/MS
GC/MS Gas Clean Filter kit (includes one connecting unit and two GC/MS filters, 1/4-inch connections)	CP17977	ECD, GC/MS
GC/MS Gas Clean Filter installation kit (includes CP17976, 1 m copper tubing, and two 1/8-inch nuts and ferrules)	CP17978	ECD, GC/MS
TCD filter kit (with oxygen and moisture filters)	CP738408	TCD

Each separate gas supply requires its own filters.

See also **“Installation Kits”** on page 14.

8 Cryogenic Cooling Requirements

This section outlines the site requirements for cryogenic cooling for the GC inlets and oven.

Refer to the Agilent Web site at **www.agilent.com** for the most up-to-date listing of GC, GC/MS, and ALS supplies and consumables.

Cryogenic Cooling Requirements

Cryogenic cooling allows you to cool the oven or inlet, including cooling to setpoints below ambient temperature. A solenoid valve controls the flow of coolant to the inlet or oven. The oven can use either liquid carbon dioxide (CO_2) or liquid nitrogen (N_2) as a coolant. All inlets except the multimode inlet must use the same coolant type as the oven. (The multimode inlet can use a different coolant than configured for the oven, and can also use compressed air as a coolant.)

CO_2 and N_2 coolants require different hardware on the GC. (You can use air cooling on a multimode inlet, with either the CO_2 or N_2 solenoid valves and hardware.)

Oven cryogenic cooling is not compatible with the 7000 Triple Quad MS or 7200/7250 Q-TOF MS. If your application requires GC oven cryogenic cooling, contact your Agilent sales representative.

Using carbon dioxide

WARNING

Pressurized liquid CO_2 is a hazardous material. Take precautions to protect personnel from high pressures and low temperatures. CO_2 in high concentrations is toxic to humans; take precautions to prevent hazardous concentrations. Consult your local supplier for recommended safety precautions and delivery system design.

CAUTION

Liquid CO_2 should not be used as a coolant for oven temperatures below –40 °C because the expanding liquid may form solid CO_2—dry ice—in the GC oven. If dry ice builds up in the oven, it can seriously damage the GC.

Liquid CO_2 is available in high-pressure tanks containing liquid. Typical liquid CO_2 tank pressure will be 4830 to 6900 kPa (700 to 1,000 psi) at a temperature of 25 °C. The CO_2 should be free of particulate material, oil, and other contaminants. These contaminants could clog the expansion orifice or affect the proper operation of the GC.

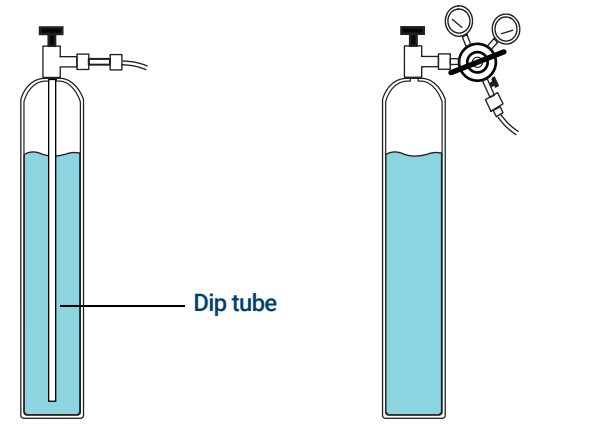
WARNING

Do not use copper tubing or thin-wall stainless steel tubing with liquid CO_2. Both harden at stress points and may explode.

Additional requirements for the liquid CO_2 system include:

- The tank must have an internal dip tube or eductor tube to deliver liquid CO_2 instead of gas (see the figure below).
- Use 1/8-inch diameter heavy-wall stainless steel tubing for supply tubing. The tubing should be between 1.5 and 15 m (5 and 50 feet) long. (Agilent part number 7157-0210, 20 ft)
- Coil and fasten the ends of the tubing to prevent it from “whipping” if it breaks.

- Do not install a pressure regulator on the CO_2 tank, as vaporization and cooling would occur in the regulator instead of the oven.
- Do not use a padded tank (one to which another gas is added to increase the pressure).



Using liquid nitrogen

WARNING

Liquid nitrogen is a hazard because of the extremely low temperatures and high pressures that may occur in improperly designed supply systems.

Liquid nitrogen can present an asphyxiant hazard if vaporizing nitrogen displaces oxygen in the air. Consult local suppliers for safety precautions and design information.

Liquid nitrogen is supplied in insulated Dewar tanks. The correct type for cooling purposes is a low-pressure Dewar equipped with a dip tube—to deliver liquid rather than gas—and a safety relief valve to prevent pressure build-up. The relief valve is set by the supplier at 138 to 172 kPa (20 to 25 psi).

WARNING

If liquid nitrogen is trapped between a closed tank valve and the cryo valve on the GC, tremendous pressure will develop and may cause an explosion. For this reason, keep the delivery valve on the tank open so that the entire system is protected by the pressure relief valve.

To move or replace a tank, close the delivery valve and carefully disconnect the line at either end to let residual nitrogen escape.

Additional requirements for the liquid N_2 system include:

- Cryogenic cooling with Liquid N_2 requires 1/4-inch insulated copper tubing.
- If needed, set the liquid N_2 pressure to the GC at 138 to 207 kPa (20 to 30 psi). Follow the manufacturer's directions.

- Make sure the supply tubing for liquid N_2 is insulated. Foam tubing used for refrigeration and air-conditioning lines is suitable for insulation. (Foam tubing insulation is not supplied by Agilent. Contact a local supplier.) Since pressures are low, insulated copper tubing is adequate.
- Situate the liquid nitrogen tank close (within 1.5 to 3 m, or 5 to 10 feet) to the GC to ensure that liquid, not gas, is supplied to the inlet.

Using compressed air

The multimode inlet can also use compressed air cooling with the liquid N_2 inlet cooling option. Requirements for compressed air cooling:

- The compressed air should be free of particulate material, oil, and other contaminants. These contaminants could clog the inlet's cryo valve and expansion orifice or impact the proper operation of the GC.
- The required air supply pressure depends on the installed solenoid valve type. For a multimode inlet with N_2 cooling, set the air supply pressure to 138 to 208 kPa (20 and 30 psig).

While air supplied from tanks can meet these criteria, the consumption rate of air can be 80 L/min, varying based on supply pressure.

Installation of a compressed air line to the inlet cryo coolant valve requires 1/4-inch copper or stainless steel tubing for supply tubing to the N_2 valve.

A LAN Requirements

This section outlines the site LAN requirements for GC, GC/MS, and automatic liquid sampler (ALS) installation.

Site LAN Network

NOTE

Agilent Technologies is not responsible for connecting to or establishing communication with your site LAN network. The Agilent representative will test the system's ability to communicate on a mini-hub or LAN switch only.

If you intend to connect your system to your site's LAN network, you must have an additional shielded twisted pair network cable (8121-0940).

NOTE

The IP addresses assigned to the instrument(s) must be fixed (permanently assigned) addresses. If you intend to connect your system to your site's network, each piece of equipment must have a unique, fixed (static) IP address assigned to it.

NOTE

For a Single Quad GC/MS system, Agilent recommends, sells, and supports the use of a PC with one (1) network interface card (NIC) and a network switch to isolate the GC/MS system from the site LAN. The network switch supplied with Agilent systems prevents instrument-to-PC network traffic from entering the site LAN and keeps site LAN network traffic from interfering with instrument-to-PC communications. Agilent develops and tests all Single Quad GC/MS hardware and software using the single NIC configuration and has no known network configuration issues. Alternate network configurations can be configured and managed by the end user at their own risk and expense.

NOTE

For Triple Quad and 7200 Q-TOF GC/MS systems, Agilent recommends, sells, and supports the use of a PC with two network interface cards (NIC) to provide both a site LAN connection and an isolated GC/MS system connection. Agilent develops and tests all Triple Quad and Q-TOF GC/MS hardware and software using the dual NIC configuration, and has no known network configuration issues. Alternate network configurations can be configured and managed by the end user at their own risk and expense.

NOTE

For the 7250 Q-TOF GC/MS systems, Agilent recommends, sells, and supports the use of a PC with three network interface cards (NIC) to provide a site LAN connection, MS only connection, and an isolated GC/MS system connection. Agilent develops and tests Q-TOF GC/MS hardware and software using the triple NIC configuration, and has no known network configuration issues. Alternate network configurations can be configured and managed by the end user at their own risk and expense.

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