Agilent Intuvo 9000 GC, GC/MS, and ALS

Site Preparation Guide

Agilent Technologies

Notices

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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.

Contents

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Intuvo 9000 GC Site Preparation

This section outlines the space and resource requirements for GC, GC/MS, and automatic liquid sampler (ALS) installation. For a successful and timely installation of the instrument, the site must meet these requirements before beginning installation. Necessary supplies (gases, tubing, operating supplies, consumables, and other usage-dependent items such as columns, vials, syringes, and solvents) must also be available. Note that performance verification requires the use of helium carrier gas. For MS systems using chemical ionization, methane reagent gas is also required for performance verification. 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.

For 7697A Headspace Sampler site prep specifications, refer to the 7697A Site Prep Guide.

Getting Ready for Your Installation

This guide describes the necessary site preparation to facilitate the successful installation of your Agilent instruments and systems.

Review of the information in this guide and your completion of the site preparation prior to installation is recommended if you are installing the instrument on your own, and is required, if you are planning to use Agilent installation and familiarization services.

Inadequate site preparation at the scheduled date of your Agilent installation service could cause the loss of warranty coverage for the services.

Before your GC arrives

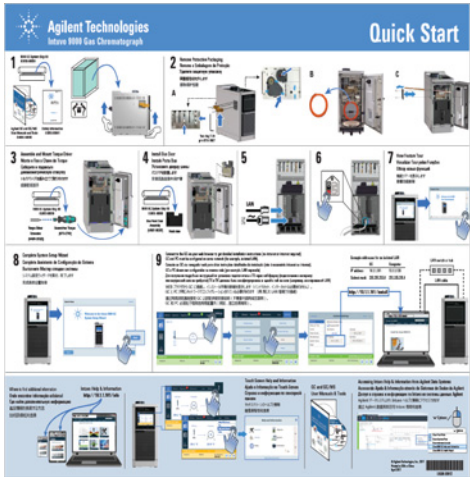
1. If you are scheduling an Agilent installation and familiarization services visit, commit an appropriate person in your organization to attend the appointment
2. A tubing cutter, a 7/16-inch open-end wrench, and a 9/16-inch open-end wrench are required for assembling the Swagelok fittings needed to connect to the GC. You may also consider ordering the optional "Installation Kit" on page 8.
3. Designate a clean, clear, and level bench space with the appropriate dimension requirements to accommodate the GC. See "Dimensions and Weight" on page 11
4. Verify that the required power outlets are available for your GC. See "Power Consumption" on page 15.
5. Verify that adequate ventilation systems are in place for your expected GC exhausts and that they comply with all local and safety codes. See "Exhaust Venting" on page 21.
6. Verify that adequate heating and air conditioning systems are in place and meet the required environmental conditions to operate the GC safely. See "Environmental Conditions" on page 24
7. Determine gas type, see "Gas Selection" on page 25, and verify that the necessary system and regulators, see "Gas Supplies" on page 28, and the appropriate gas requirements, see "GC/MS Gas Requirements" on page 31 are in place.

8 If you will be connecting your instrument to a local area network (LAN), obtain a shielded twisted pair network cable to make the connection. See "Site LAN Network" on page 49.

9 Obtain a compatible display device such as, a PC or tablet with an appropriate operating system, to operate the GC. See "PC Requirements" on page 50

When your GC arrives

Before you begin installation, look for the Intuvo 9000 ***Quick Start Poster*** included with your instrument to help you get started.



Installation Kit

Agilent offers an installation kit that provide parts useful during GC installation. **The kit is not supplied with the instrument.**

Table 1 Installation kit

Kit	Part number	Kit contents
Recommended for Intuvo 9000 GC		
GC Supply Gas Installation Kit	19199U	Includes 1/8-inch brass fittings, leak detector, 1/8-inch brass tees, copper tubing, 1/8-inch brass ball valve, and Intuvo tool kit (wrench, tube cutter, Torx T20 and T10 screwdriver, magnifying lens, knurled handle septum tool, tweezers, and needle nose pliers)

You must also provide the fittings and reducers required to convert the cylinder regulator fitting (for example, 1/4-inch male NPT) to the 1/8-inch female Swagelok fitting needed to connect to the instrument. These fittings are not included with the GC. These fittings are not included with the installation kits.

Hydrogen Carrier Gas

Refer to the Agilent Intuvo 9000 GC *Safety Manual* for important safety information about hydrogen gas.

If planning to use hydrogen carrier gas, note that 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 34.
- In addition to the supply pressure requirements listed in "Gas Supplies" on page 28, Agilent also recommends users of hydrogen carrier gas consider the gas source and purification needs. See the additional recommendations in "Requirements for hydrogen as a carrier gas" on page 30.
- 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 21.
- When using hydrogen carrier gas, also plan to safely vent inlet split vent flows and purge vent flows. See "Exhaust Venting" on page 21.

Dimensions and Weight

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

The instrument needs space for proper convection of heat and ventilation. Allow at least 12.5 cm (5 in) clearance from the end of the oven exhaust duct (20.3 cm or 8 in from the GC back panel) to dissipate hot air and allow for routine maintenance. Allow 7.6 cm (3 in) on the left and right sides for ventilation.

Table 2 Required instrument height, width, depth, and weight

Product	Height	Width	Depth	Weight
GC				
Intuvo 9000 GC	52 cm (20.5 in)	26.8 cm (10.6 in)	66.2 cm (27.2 in)	31.8 kg (70 lb)
With second detector	52 cm (20.5 in)	40.6 cm (16.0 in)	69 cm (27.2 in)	
GC operational oven access		Requires ≥ 27 cm (10.7 in) open space in front of the GC		
MSD				
5975 Series MSD				
• Diffusion pump	41 cm (16 in)	30 cm (12 in)	54 cm (22 in)	39 kg (85 lb)
• Standard turbo pump	41 cm (16 in)	30 cm (12 in)	54 cm (22 in)	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	21 cm (8 in)	13 cm (5 in)	31 cm (12 in)	11 kg (23.1 lb)
• GC/MS operational and maintenance access		Requires 30 cm (1 ft) to its left		
5977 Series MSD				
• Diffusion pump	41 cm (16 in)	30 cm (12 in)	54 cm (22 in)	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)

Table 2 Required instrument height, width, depth, and weight (continued)

Product	Height	Width	Depth	Weight
• Foreline pump				
Standard	21 cm (8 in)	13 cm (5 in)	31 cm (12 in)	11 kg (23.1 lb)
Oil-free (MVP-070)	19 cm (7.5 in)	32 cm (13 in)	28 cm (11 in)	16 kg (35.2 lb)
Oil-free (IDP3)	18 cm (7 in)	35 cm (14 in)	14 cm (6 in)	10 kg (21 lb)
• GC/MS operational and maintenance access		Requires 30 cm (1 ft) to its left		
MS				
7010 and 7000 Triple Quad MS				
• EI Mainframe	47 cm (18.5 in)	35 cm (14 in)	86 cm (34 in)	59 kg (130 lb)
• EI/CI Mainframe	47 cm (18.5 in)	35 cm (14 in)	86 cm (34 in)	63.5 kg (140 lb)
• Foreline pump	28 cm (11 in)	18 cm (7 in)	35 cm (14 in)	21.5 kg (47.3 lb)
• GC/MS operational and maintenance access		Requires 30 cm (1 ft) to its left		
ALS				
• GC with 7693A ALS injector		Requires 50 cm (19.5 in) above the GC		3.9 kg (8,6 lb) each
• GC with 7693A ALS tray		Requires 43 cm (16.8 in) 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 in) above the GC		4.4 kg (9.8 lb) each

A system that includes an Intuvo 9000 GC; a 5977, 5975, 7010 or 7000 MS; an ALS; and a computer would require about 136 cm (4.5 ft) of bench space (see Figure 1). Allowing for operational access and a printer, a total of 228 cm (7.5 ft) of bench space should be available for a quadrupole GC/MS system. Some repairs to the GC/MS or to the GC will also require access to the back of the instrument(s).

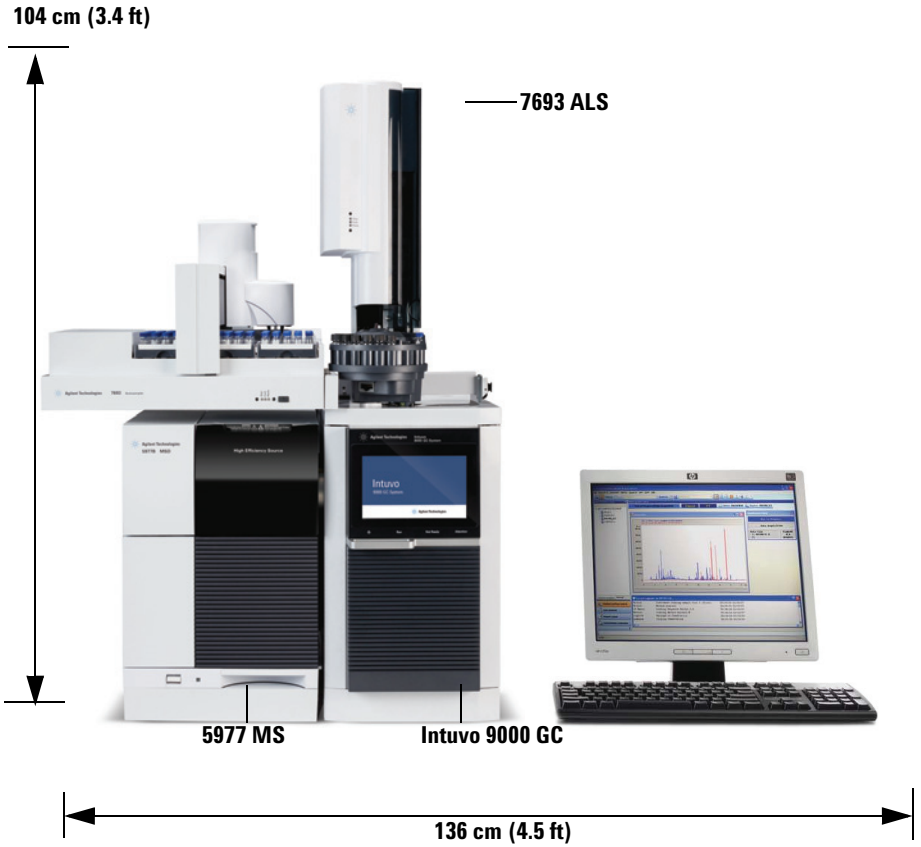


Figure 1 Front view of example installation, Intuvo 9000 GC/5977 MSD system with 7693A ALS. Note that GC and ALS bench space requirements are the same, with or without an MSD.

Note that the length of the quadrupole vacuum hose is 130 cm (4 ft 3 in) from the high vacuum pump to the foreline pump, and the length of the foreline pump power cord is 2 m (6 ft 6 in).

An Intuvo 9000 GC shipping container for a GC is approximately 76 cm × 86 cm × 10 cm (30 × 34 × 40.5 inches). If you purchased a second detector option, the second detector arrives separately in a shipping container is approximately 76 cm × 87 cm × 11 cm (30 × 34 × 42.5 inches).

Power Consumption

Table 3 lists site power requirements.

- The number and type of electrical outlets depend on the size and complexity of the system.
- Power consumption and requirements depend on the country to which the unit ships.
- The voltage requirements for your instrument are printed near the power cord attachment.
- The electrical outlet for the unit should have a dedicated ground.
- The Intuvo 9000 GC does not require a dedicated circuit, although instruments (a headspace sampler or MSD, for example) connected to it may require one.
- Power line conditioners should not be used with Agilent instruments.

Table 3 Power requirements

Product	Line voltage (VAC)	Frequency (Hz)	Maximum continuous power consumption (VA)	Current rating (amps)	Power outlet current rating
Intuvo 9000 GC	120 single phase (–10% / +10%)	50/60 (–5% / +5%)	1296	12	15 Amp
Intuvo 9000 GC	200-240 single/split phase (–10% / +10%)	50/60 (–5% / +5%)	1548	7.7 / 6.5	10 Amp
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

Table 3 Power requirements (continued)

Product	Line voltage (VAC)	Frequency (Hz)	Maximum continuous power consumption (VA)	Current rating (amps)	Power outlet current rating
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
HS					
7697A Headspace	Americas: 120 single phase (–10% / +10%)	48–63	2250	18.8	20 Amp Dedicated
7697A Headspace	220/230/240 single/split phase (–10% / +10%)	48–63	2250	10.2/9.8/ 9.4	10 Amp Dedicated
All					
Data system PC (monitor, CPU, printer)	100/120/200-240 (–10% / +5%)	50/60 ± 5%	1000	15	15 Amp Dedicated

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.**

Although your GC should arrive ready for operation in your country, compare its voltage requirements with those listed in Table 3. If the voltage option you ordered is not suitable for your installation, contact Agilent Technologies. Note that ALS instruments receive their power from the GC.

CAUTION 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.

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.

The three-conductor power line cord, when plugged into a properly grounded receptacle, grounds the instrument and minimizes shock hazard. A properly grounded receptacle is one that is connected to a suitable earth ground. Be sure to verify proper receptacle grounding. The GC requires an isolated ground.

Common instrument power cord plugs

Table 4 below shows common Agilent power cord plugs.

Table 4 Power cords and terminations

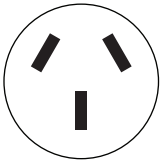
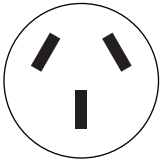
Country	Line Voltage	Amp Rating	Cable length (m)	Termination type	Plug Termination
Australia	240	10	2.5	AS 3112	
China	220	10	4.5	GB 1002	

Table 4 Power cords and terminations (continued)

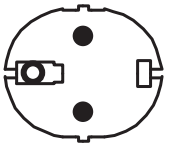
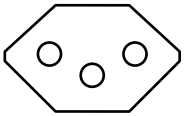
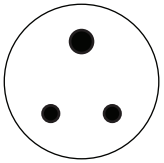
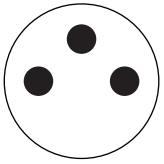
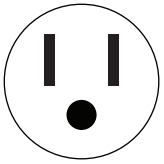
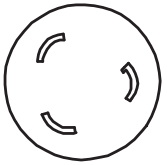
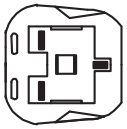
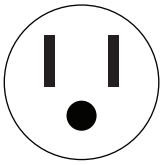
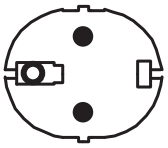
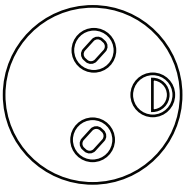
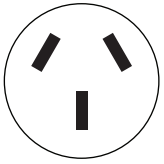
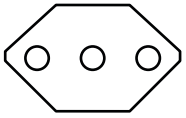
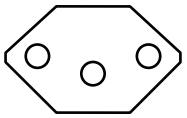
Country	Line Voltage	Amp Rating	Cable length (m)	Termination type	Plug Termination
Europe, Korea	220 / 230 / 240	10	2.5	CEE 7/7 Type F	
Switzerland	220	16	2.5	SEC Type 12	
India, South Africa	220 / 230 / 240	10	4.5	IEC 83-B1	
Israel	230	10	2.5	Israeli SI32	
Japan	120	15	2.5	NEMA 5-15P	
Japan	200	20	2.5	NEMA L6-20P	
United Kingdom, Hong Kong, Singapore, Malaysia	240	10	2.5	BS89/13	

Table 4 Power cords and terminations (continued)

Country	Line Voltage	Amp Rating	Cable length (m)	Termination type	Plug Termination
United States	120	15	2.5	NEMA 5-15P	
Europe	220 / 230 / 240	10	2.5	CEE 7/7 Type F	
Denmark / Greenland	220	10	2.5	SR 107-2-D1 DK2-5A	
Argentina	220	10		Type I	
Chile	220	10		CEI 23-16 Type L	
Brazil	230	10		NBR 14136 Type N	

Heat Dissipation

Use Table 5 to estimate the additional BTUs of heat dissipated from this equipment. Maximums represent the heat given off when heated zones are set for maximum temperatures.

Table 5 Heat dissipation

	Standard heater ramp
Intuvo 9000 GC	4424 BTU/hour maximum (4668 kJ.h) (120 V) 5285 BTU/hour maximum (5576 kJ/h) (200–240 V)
	Steady state, including MS interface
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)

Exhaust Venting

During normal operation, the GC exhausts hot 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.

Hot air

Hot air (up to 450 °C) from the GC exits through vents in the rear. Allow at least 12.5 cm (5 in) clearance from the end of the oven exhaust duct (20.3 cm or 8 in from the GC back panel) to dissipate hot air and allow for routine maintenance.

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.**

For most applications, an optional oven exhaust deflector (G4580-68300, or option 306) is available. The exhaust deflector extends 7.6 cm (3 in) beyond the standard GC exhaust duct s, and has an outlet diameter of 7.62 cm (3 in).

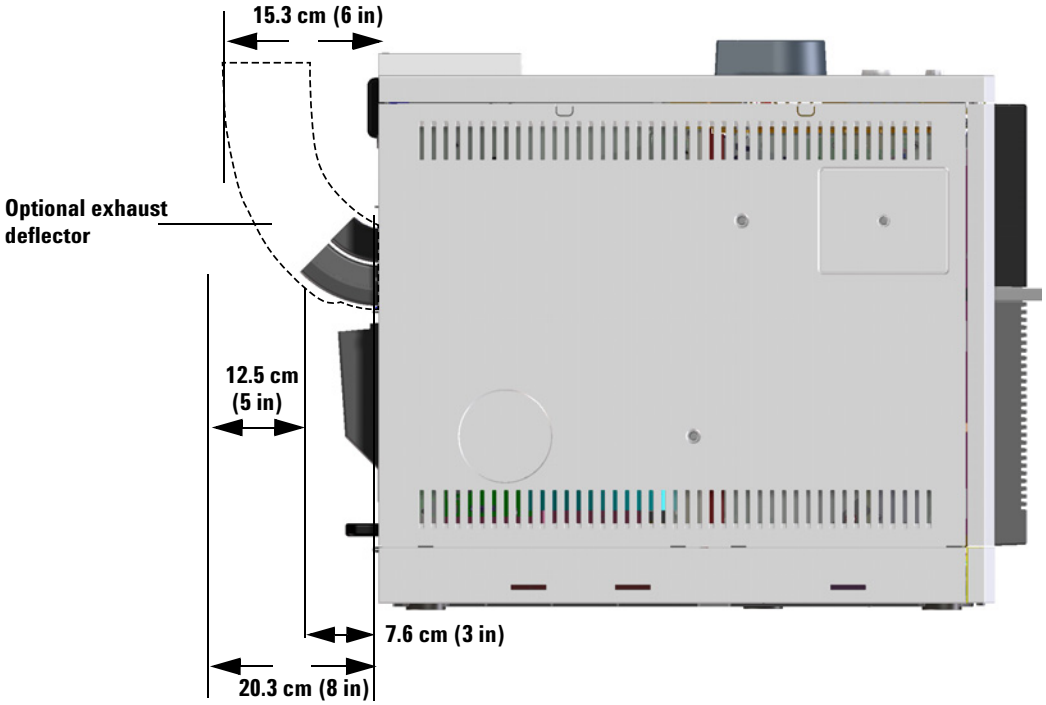


Figure 2 Exhaust deflector (G4580-68300)

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, trap exhaust detector, 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. Place the GC in the hood or attach a large diameter venting tube to the outlet for proper ventilation.

To further prevent contamination from noxious gases, attach a chemical trap to the vent(s).

If using a ECD, always plan to 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 other countries, 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.

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.

Note that an exhaust vent system is not part of the building environmental control system, which recirculates air.

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

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.
- SS, MMI: 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.

Environmental Conditions

Operating the instrument within the recommended ranges optimizes instrument performance and lifetime. Performance can be affected by sources of heat and cold from heating, air conditioning systems, or drafts. See Table 6. The conditions assume a noncondensing, noncorrosive atmosphere. The instrument meets the following International Electrotechnical Commission (IEC) classifications: Equipment Class I, Laboratory Equipment, Installation Category II, and Pollution Degree 2.

Table 6 Environmental conditions for operation and storage

Product	Condition	Temperature range	Humidity range	Maximum altitude
Intuvo 9000 GC	Operation	15 to 35 °C (59 to 95 °F)	15 to 90%	2,438 m (8,000 ft)
	Storage	–40 to 70 °C (–40 to 158 °F)	15 to 90%	
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%	

* 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

Gas Selection

Table 7 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 using any MS system, use of hydrogen as the carrier gas may require hardware modifications for best performance. Contact your Agilent service representative.

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

Table 7 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
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.

WARNING

When using hydrogen (H_2) as the carrier gas or fuel gas, be aware that hydrogen gas can create a fire hazard. Therefore, be sure that the supply is turned off until the guard chip, column, inlet chip, and other chips are properly installed before supplying hydrogen gas to the instrument.

Hydrogen is flammable. 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.

Please refer to the safety manual shipped with your instrument.

Gas Purity

Agilent recommends that carrier and detector gases be 99.9995% pure. See Table 8. Air needs to be zero grade or better. Agilent also recommends using high quality traps to remove hydrocarbons, water, and oxygen.

Table 8 Carrier and collision gas purity

Carrier and collision gas requirements	Purity	Notes
Helium (carrier and collision)	99.9995%	Hydrocarbon free
Hydrogen	99.9995%	
Nitrogen (collision)*	99.999%	Research grade
Nitrogen (drying gas, nebulizer pressure)†	99.999%	Research grade

* Nitrogen for the collision cell requires a separate supply from the nitrogen used for the drying gas. A separate pressure regulator is required. A high pressure bottle of nitrogen is recommended for the collision cell gas supply.

† 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.

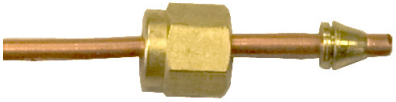
Gas Supplies

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 3.

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

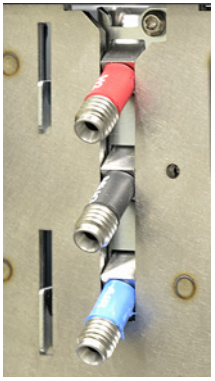


Figure 3 Example Swagelok connector and hardware

Table 9 lists available Agilent two-stage tank regulators. All Agilent regulators are supplied with the 1/8-inch Swagelok female connector.

Table 9 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 10 and Table 11 list minimum and maximum delivery pressures for inlets and detectors, measured at the bulkhead fittings on the back of the instrument.

Table 10 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**
Carrier (max)	1,172 (170) *	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 11 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 12 lists the maximum carrier pressure for Auxiliary EPC and PCM modules.

Table 12 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

Conversions: 1 psi = 6.8947 kPa = 0.068947 Bar = 0.068 ATM

Requirements for hydrogen as a carrier gas

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

See the appropriate tables for gas requirements.

5975 and 5977 Series MSD

7010 and 7000 Series MS

5975 and 5977 Series MSD

Table 13 lists the limits on total gas flow into the 5975 Series MSD.

Table 13 5975 Series MSD total gas flow limitations

Feature	G3170A	G3171A	G3172A	G3175A
High vacuum pump	Diffusion	Standard turbo	Performance turbo	Diffusion
Optimal gas flow mL/min*	1.0	1.0	1.0 to 2.0	1.0
Maximum recommended gas flow, mL/min	1.5	2.0	4.0	1.5
Maximum gas flow, mL/min†	2.0	2.4	6.5	2.0
Max column id	0.25 mm (30 m)	0.32 mm (30 m)	0.53 mm (30 m)	0.25 mm (30 m)

* Total gas flow into the MSD = column flow + reagent gas flow (if applicable) + Agilent CFT device flow (if applicable).

† Expect degradation of spectral performance and sensitivity.

Table 14 lists the limits on total gas flow into the 5977 Series MSD.

Table 14 5977 Series MSD total gas flow limitations

Feature	5977A MSD	G7037A	G7038A, G7039A, G7040A
	5977B MSD	G7080B	G7081B, G7077B, G7079B
High vacuum pump		Diffusion	Performance turbo
Optimal gas flow mL/min*		1.0	1.0 to 2.0

Table 14 5977 Series MSD total gas flow limitations (continued)

Feature	5977A MSD 5977B MSD	G7037A G7080B	G7038A, G7039A, G7040A G7081B, G7077B, G7079B
Maximum recommended gas flow, mL/min		1.5	4.0
Maximum gas flow, mL/min†		2.0	6.5
Max column id		0.25 mm (30 m)	0.53 mm (30 m)

* Total gas flow into the MSD = column flow + reagent gas flow (if applicable) + Agilent CFT device flow (if applicable). Instruments using a JetClean ion source system may also add a small (~0.075 mL/min) hydrogen flow.

† Expect degradation of spectral performance and sensitivity.

Table 15 lists typical flows resulting from selected carrier gas source pressures.

Table 15 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

* 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 16 lists the limits on total gas flow into the Triple Quad MS.

Table 16 7010 and 7000 Triple Quad MS total gas flow limitations

Feature	
High vacuum pump	Split-flow turbo
Optimal gas flow mL/min*	1.0 to 2.0

Table 16 7010 and 7000 Triple Quad MS total gas flow limitations (continued)

Feature	
Maximum recommended gas flow, mL/min	4.0
Maximum gas flow, mL/min†	6.5
Maximum column id	0.53 mm (30 m long)

* Total gas flow into the MS = column flow + reagent gas flow (if applicable) + Agilent CFT/IFT device flow (if applicable). Instruments using a JetClean ion source system may also add a small (~0.075 mL/min) hydrogen flow.

† Expect degradation of spectral performance and sensitivity.

Table 17 lists typical flows resulting from selected carrier gas source pressures.

Table 17 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
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.

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.

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.

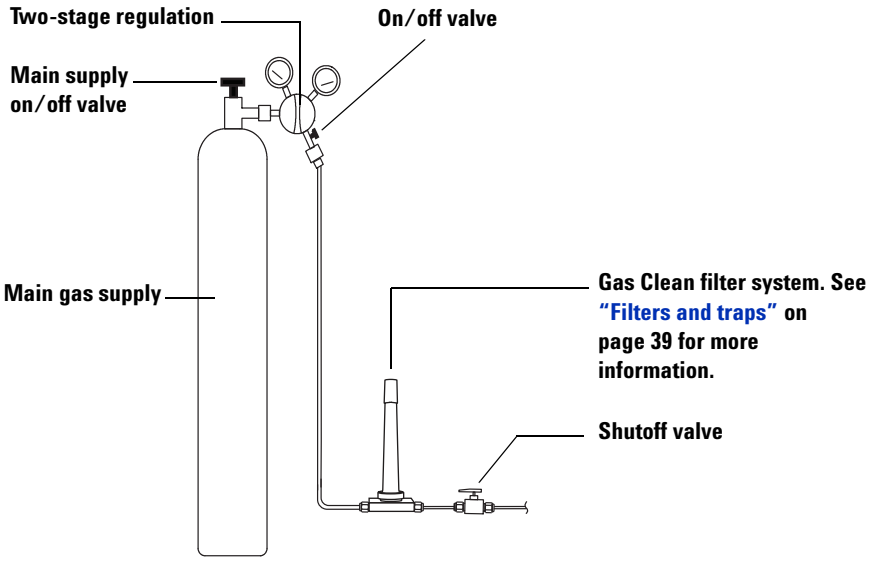


Figure 4 Recommended filters and plumbing configuration from a carrier gas cylinder

- 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.
- 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.)

- 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.**

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-in) 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

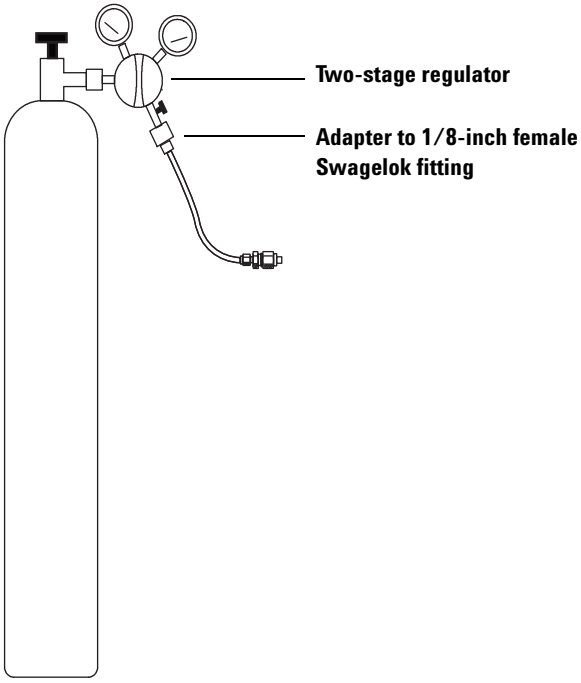
Agilent recommends using new chromatographic quality stainless steel tubing and fittings when using hydrogen.

- 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 18 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 18 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-in. to 1/8-in., 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 19 on page 41 shows recommended filter connection diagrams for common instrument configurations.

Table 19 Connection diagrams for common detectors

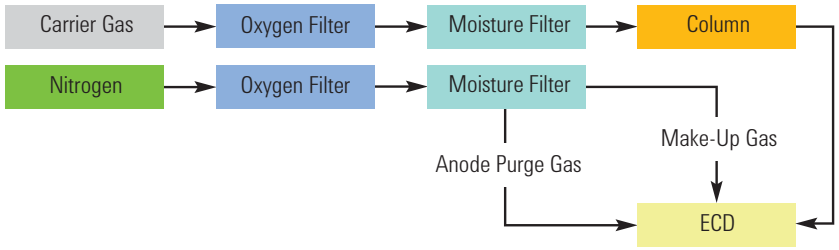
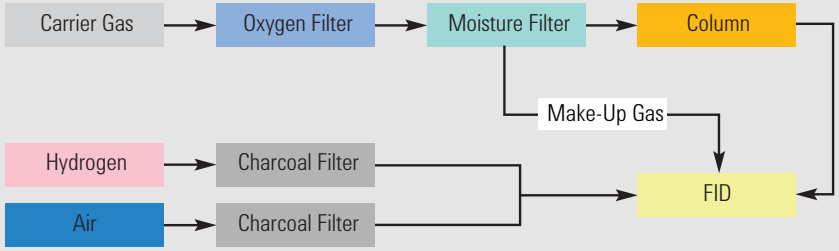
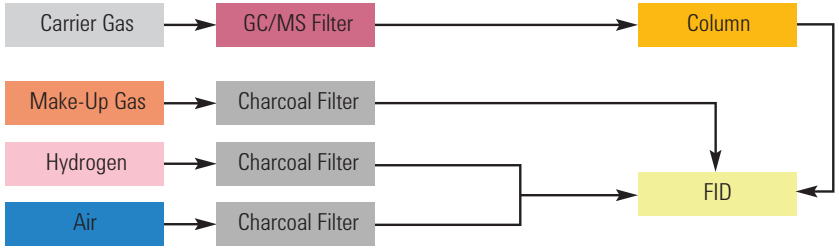
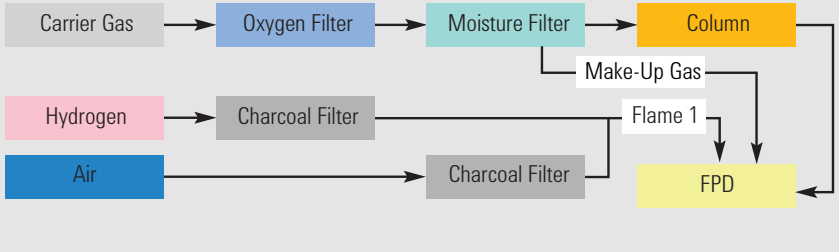
Detector	Connection Diagram
ECD Electron Capture Detector	
FID Flame Ionization Detector (Carrier Gas = Make-Up Gas)	
FID Flame Ionization Detector (Carrier Gas differs from Make-Up Gas)	
FPD Flame Photometric Detector	

Table 19 Connection diagrams for common detectors (continued)

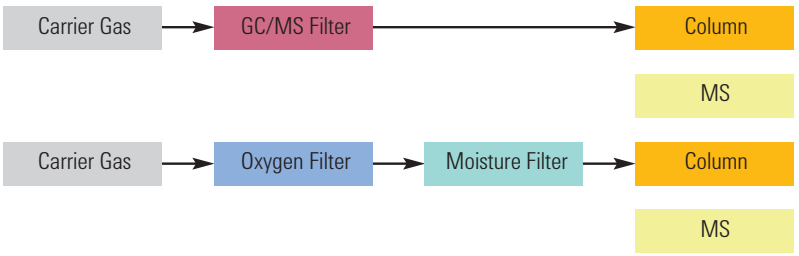
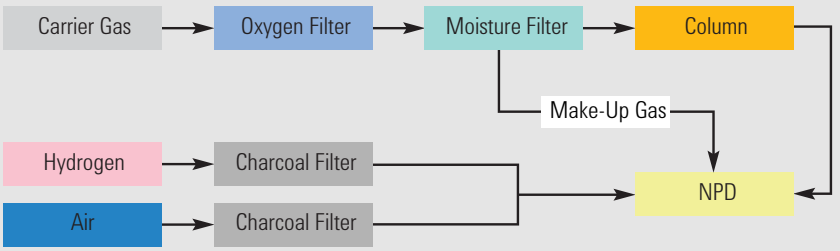
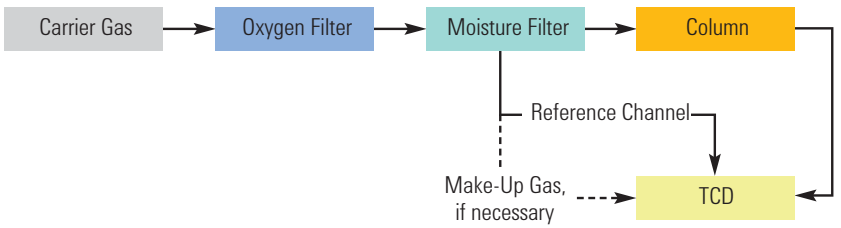
Detector	Connection Diagram
MS (MSD) Mass Selective Detector	
NPD Nitrogen-Phosphorous Detector (Carrier Gas = Make-Up Gas)	
TCD Thermal Conductivity Detector	

Table 20 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 20 Recommended Gas Clean Filter kits

Description	Part number	Use
Gas Clean Filter kit (connecting unit for one filter, including one moisture filter, 1/8-inch connections, and mounting bracket for the GC)	CP17995	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)	CO738408	TCD

Each separate gas supply requires its own filters.

Cryogenic Cooling Requirements

Cryogenic cooling allows you to cool the inlet, including cooling to setpoints below ambient temperature. A solenoid valve controls the flow of coolant. The oven can use either liquid carbon dioxide (CO_2) or liquid nitrogen (N_2) as a coolant.

N_2 coolant requires different hardware on the GC. You can use air cooling on a multimode inlet with the N_2 solenoid valves and hardware.

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.**

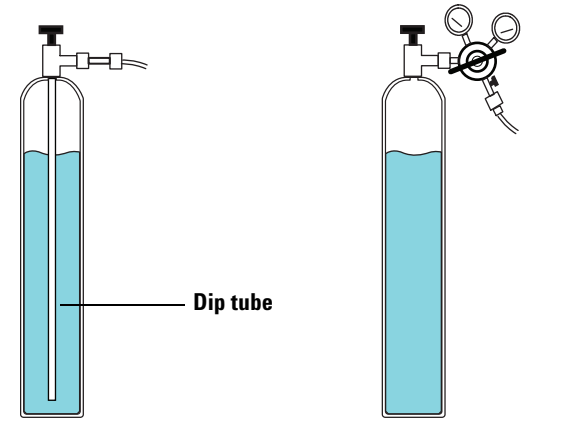
Liquid CO_2 is available in high-pressure tanks containing liquid. The CO_2 should be free of particulate material, oil, and other contaminants. These contaminants could clog the expansion orifice or affect the proper operation of the GC.

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).
- Typical liquid CO_2 tank pressure will be 4830 to 6900 kPa (700 to 1,000 psi) at a temperature of 25 °C.
- 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.
- 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 value or impact the proper operation of the GC.
- 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 the hardware (and appropriate fittings) noted below:

- Use 1/4-inch copper or stainless steel tubing for supply tubing to the N_2 valve

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.

- The length of the Agilent-supplied remote cable is 2 meters (6.6 feet).
- The length of the Agilent-supplied LAN cable is 10 meters (32.8 feet).
- The lengths of the power cords are 2 meters (6.6 feet).
- A quadrupole GC/MS system foreline pump can be located on the laboratory bench or on the floor. It must be close to the MS because it is connected by a hose. The hose is stiff and cannot be bent sharply. The length of the vacuum hose is 130 cm (4.24 feet) from the high vacuum pump to the foreline pump, while the length of the foreline pump power cord is 2 meters (6.6 feet).

Site LAN Network

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

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 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 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.

PC Requirements

If using an Agilent data system, refer to the data system documentation for PC requirements.

2
7693A and 7650 Automatic Liquid Sampler Site Preparation

This section outlines the space and resource requirements for a 7693A and 7650 automatic liquid sampler (ALS). For a successful and timely installation of the ALS, the site must meet these requirements before beginning installation. Necessary supplies (operating supplies, consumables, and other usage-dependent items such as vials, syringes, and solvents) must also be available. Refer to the Agilent Web site at www.agilent.com/chem for the most up-to-date listing of GC, GC/MS, and ALS supplies and consumables.

Refer to your GC documentation for compatibility with a specific ALS model.

Customer Responsibilities

The specifications in this manual outline the necessary space, electrical outlets, tubing, operating supplies, consumables, and other usage-dependent items such as vials, syringes, and solvents required for the successful installation of instruments and systems.

If Agilent is delivering installation and familiarization services, users of the instrument should be present throughout these services; otherwise, they will miss important operational, maintenance, and safety information.

If Agilent is delivering installation and familiarization services, delays due to inadequate site preparation could cause loss of instrument use during the warranty period. In extreme cases, Agilent Technologies may ask to be reimbursed for the additional time required to complete the installation. Agilent Technologies provides service during the warranty period and under maintenance agreements only if the specified site requirements are met.

Basic Tools and Consumable Supplies

The 7693A and 7650 ALS come with a few basic tools and consumables depending on the hardware that you ordered. Table 21 is a general list of what comes with the instrument.

Table 21 Basic tools and consumables

Tool or consumable	Used for
T10 Torx wrench	Replacing turret. Replacing syringe carriage.
T35 Torx wrench	Removing tray.
Sample vial starter pack	
Syringe, 10 µL	

Agilent also recommends ordering other useful supplies, listed in Table 22.

Table 22 Additional ALS supplies and parts

Part number	Description
Crimpers and decappers	
5062-0207	11 mm electronic crimper with 4.8 V rechargeable battery pack and charger.
5062-0210	11 mm electronic decapper with 4.8 V rechargeable battery pack and charger.
5040-4667	Ergonomic manual crimper for 11 mm caps.
5040-4668	Ergonomic manual decapper for 11 mm caps.
5040-4674	11 mm electronic crimper, manual decapper, and cap bundle. Includes 1 electronic crimper, 1 manual decapper, 100 silvertone aluminum caps with PTFE/rubber septa.
Vial racks (7693A)	
9301-0722	Rack for 12 mm, 2 mL vials, holds 50 vials per rack. 5/pk.
5182-0575	Vial storage container, holds 50 vials per container.

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 23.

Table 23 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[1]	29	44	43	6.8
G4515A Bar Code Reader[1]	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		Requires 50 cm (19.5 in) above the GC		
• GC with 7693A ALS tray		Requires 45 cm (17.5 in) left of the GC		
• GC with 7650 ALS injector		Requires 50 cm (19.5 in) above the GC Requires 9 cm (3.6 in) in front of the GC Requires 3 cm (1.2 in) to the left of the GC		

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

Power Consumption

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

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:

The conditions assume a noncondensing, noncorrosive atmosphere. See Table 24.

Table 24 Environmental conditions for operation and storage

Product	Conditions	Operating temp range	Operating humidity range	Maximum altitude
G4513A Injector G4514A Tray[1] G4515A Bar Code Reader[1]	Operation	0 to 40 °C	5–95%	4,300 m
7650 Injector	Operation	0 to 40 °C	5–95%	4,300 m

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

Chiller Supplies

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