PREPARING YOUR LAB

Gas Chromatography/Headspace/
Gas Chromatography-Mass Spectrometry

PerkinElmer GC 2400 Platform

Introduction

PerkinElmer GC 2400™ Platform features complete systems, with the exception of the following items, which must be provided by the customer: controlled operating environment (clean, dry and temperature controlled), supporting work surface (bench space), electrical power with correct voltage and current rating, gas supplies (compressed tank/generator) with approved regulators and filters, ventilation and exhaust vents as needed.

PREPARATION CHECKLIST

- Environmental Requirements
- Saftey Requirements
- Space Requirements
- General Electrical Requirements
- Specific Electrical Requirements
- Compressed Gas Requirements
- Ventilation Requirements

Environmental Requirements

The location where the GC 2400 Platform is to be installed must meet the following conditions:

- Before the instruments are installed, the area around, under and behind the instrument's planned location must be cleared of any dirt and dust to prevent their entry into the instrument's interior, which could cause a negative effect on performance.
- The location should be free of flammable, explosive, toxic, caustic, corrosive vapors or gases and should be relatively free of dust.
- Do not use these instruments in an area where explosion hazards may exist.
- These instruments will operate safely in environments that contain nonconductive foreign matter up to Pollution Degree 2 as defined in EN/IEC 61010-1.

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- The laboratory or installed location temperature should be controlled to be in the range of 10 - 35 °C (50 - 95 °F). However, the GC can be operated safely between 5 °C - 40 °C (41 °F - 104 °F).
- The MS 2400 SQ Detector diffusion pump models have an upper ambient temperature limit of 30 °C. For MS 2400 models, the ambient temperature should be controlled, in the range of 10 - 35 °C (50 – 95 °F).
- For optimum instrument performance, the room temperature should be controlled at 20° ±2 °C (68° ±4 °F).
- Relative humidity must be maintained between 20% and 80% with no condensation.
- Install the instruments in an indoor laboratory environment, on a sturdy operating support surface (lab bench) that is clean and is free of drafts, direct sunlight and free of excessive vibration.
- Altitude for operation in the range of -400 to 2,000 m (below sea level to 6,562 feet).

The use of the GC 2400 Platform without adequate ventilation to outside Air may constitute a Health Hazard.

Safety Requirements

- **Gas Cylinders and Gas Delivery Lines:** All gas cylinders should be firmly clamped to a suitable surface. Care must be taken not to kink or overstress the gas delivery lines. It is recommended that compressed gas cylinders be stored outside of the laboratory.
- **Hydrogen:** Ensure that all hydrogen lines and connections are leak-free. When using a compressed hydrogen tank, install an in-line hydrogen snubber (p/n 0009-0038) between the tank regulator and the delivery tubing.
- **Ventilation:** Always provide adequate ventilation. When analyzing hazardous compounds, such as pesticides, it may be necessary to arrange for venting the detector effluent into a fume hood.

The use of the GC 2400 Platform without adequate ventilation to outside Air may constitute a Health Hazard.

Space Requirements

- **Physical Configuration:** Single unit for use on standard laboratory bench.
- **Bench Space:** The laboratory bench should be sturdy enough to support the full weight of the GC 2400 System as well as additional equipment.
- Allow a minimum clearance of 10 cm (4 in) on each side, 15 cm (6 in) at the rear of the GC, and 137 cm (54 in) at the top of the GC. If this is not possible, install the GC on a bench that has wheels. Always leave at least 10 cm (4 in) around the instrument to allow adequate cooling. Do not position the equipment so that it is difficult to operate the AC power switch.
- **Peripherals, Printers, etc.:** Allow at least 61 cm (24 in) on either side of the GC to accommodate additional equipment. A desktop or laptop computer (PC) is required to run any of the GC 2400 System. However, operation with a PC and PerkinElmer SimplicityChrom™ Chromatography Data System Software or other equivalent CDS Software is recommended for the purpose of data collection and processing.

Table 1: GC 2400 System Component Dimensions and Weights.

GC 2400 Platform	Width (cm/in)	Depth (cm/in)	Height (cm/in)	Weight (kg/lbs)
GC 2400 System	50/20	74/29	52/20 60 with the detachable touchscreen	57/126
Autosampler (AS) Tower	25/10	8.0/3.2	53/21	4.1/9.0
GC 2400 System / AS 2400 Liquid Sampler / Small Carousel	68/27	74/29	105/41	63/138
GC 2400 System / AS 2400 Liquid Sampler / Large Carousel	76/30	74/29	105/41	64/140
HS 2400 M Headspace Sampler	58/23	51/20	64/26	38/84

Table 2: MS 2400 SQ System Dimensions and Weights.

GC 2400 Platform	Width (cm/in)	Depth (cm/in)	Height (cm/in)	Weight (kg/lbs)
MS 2400 SQ System with Transfer Line	31/12 43/17	65/26	48/19	Depending on the pump option, the weight will range from 47/103 to 50/110.
Fore Pump	30.5/12	72/28	44/17	26/57
GCMS 2400 System	81/32	74/29	105/41 *	Variable: 111/244 to 114/251 depending on injectors and other detectors installed.
Physical Configuration	For use on standard laboratory bench/counter that can be interfaced to a PC and printer.			
Bench Space	The laboratory bench/counter area should be able to support the full weight of the GC/MS system as well as additional equipment (PC, monitor, printer). Expect the total weight of the GC/MS and accessories to weigh at least 150 kg / 330 lbs). Allow a minimum clearance of 15 cm / 6 in on each side, 23 cm / 9 in at the rear and 120 cm / 47 in at the top of the GC/MS. If this is not possible, install the GC/MS on a bench/counter that has wheels. The bench/counter requires an area underneath for the fore pump. Do not position the MS 2400SQ so that it is difficult to operate the AC Power On/Off switch on the lower left side of the instrument.			
Peripherals, Printers, etc.	Allow at least 94cm (36 in) on either side of the GC/MS system to accommodate additional equipment (for example PC and Monitor). A desktop computer (PC) is required to operate the MS 2400 SQ GC/MS system and is included with the system along with the MS 2400SQ operating software. The computer may be located to either the right or left side of the GC/MS instrument.			

A desktop computer (PC) is required to operate the GCMS 2400 System and is included with the system along with the GCMS 2400 System operating software. The computer may be located to either the right or left side of the GC/MS instrument.

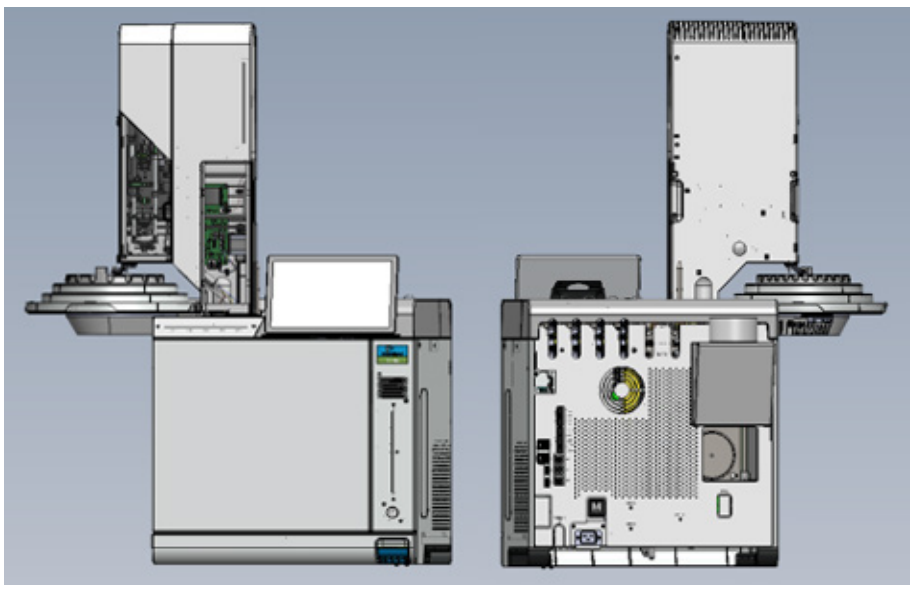

Figure 1: GC 2400 System with Autosampler – see dimensions above. GC 2400 oven vent duct work and rear cooling fans.

General Power Requirements

Electrical power must be made available in such a way that all components can be connected and operated on a dedicated AC power line of the proper volt-amp rating.

Fundamental Power Quality Requirements for the GC 2400 Platform.

Power Specification

All electrical supplies must be smooth, clean, and free of line transients greater than 40 V peak to peak and must meet and remain with the following tolerances:

120 VAC ±10% @ 50/60 Hz ±1%
220 VAC ±10% @ 50/60 Hz ±1%
230 VAC ±10% @ 50/60 Hz ±1%
240 VAC ±10% @ 50/60 Hz ±1%

Instruments and peripherals should not be connected to circuits with large inductive or large and frequent loads (i.e., large motors, discharge lamps, photocopy systems, radio transmitters, etc.).

Grounding circuit continuity is vital for the safe operation of all PerkinElmer instruments and their support equipment.All electrical outlets must have a properly wired protective earth connection.

GC Power Outlets

A minimum of one dedicated 120 VAC outlet at 20 A or one 210-240 VAC outlet at 15 A (minimum) is required for each GC 2400 Series System. This applies to single phase AC wiring only for other configurations. Consult your local electrician.

HS Power Outlets

A minimum of one dedicated 120 VAC outlet at 15 A or one 210-240 VAC outlet at 10 A (minimum) is required for the HS 2400 Headspace Sampler. This outlet must be separate from that for the GC 2400 System.

MS Power Outlets

A minimum of one dedicated 120 VAC outlet at 15 A or one 210-240 VAC outlet at 10 A (minimum) is required for the MS 2400 SQ Detector. This outlet must be separate from that for the GC 2400 System.

Specific GC Model Electrical Power Requirements

The GC 2400 Platform is designed for use only in an industrial environment.

GC Power Outlets

A minimum of one dedicated 120 VAC outlet at 20 A or one 210-240 VAC outlet at 15 A (minimum) is required for each GC 2400 System. This applies to single phase AC wiring only for other configurations. Consult your local electrician.

GC 2400 System Power Outlets

A minimum of one dedicated 120 VAC outlet at 20 amps or one 210 - 240 VAC outlet at 10 amps is required for each of the GC 2400 System. Additional equipment, such as computers, printers, etc., should be connected as directed by their respective specifications.

GC 2400 System electrical power must be made available such that each GC, HS, and MS unit can be connected and operated on a dedicated AC power line of the proper volt-amp rating.

NOTE: Do NOT attempt to operate photocopiers, discharge lamps, radio transmitters, stirrers, and other equipment with large or frequent transient loads on the same supply circuit as these systems.

GC 2400 System Power Outlets

GC 2400 System with Standard Heating: One outlet specifically dedicated for each GC 2400 System operation is required that is rated to supply 20 A at 120 VAC.

NOTE: The PerkinElmer Service Engineer may NOT install the electrical outlet at the site where the GC 2400 Systems are to be installed. The customer must arrange for a suitable outlet to be installed (if not already available) by a person qualified by the local regulations of the company site.

Important: Measure the nominal line voltage at the outlet from which these systems will be powered. This power connection is to be dedicated for use by the GC 2400 System only.

This measurement is important to ensure that the GC is ordered with the proper heater for the available line voltage.

For locations with 208 VAC nominal (e.g., USA) the customer will need to provide either a step-up or autotransformer with output wired to an AC outlet (correct for the country of use) which will provide 230 VAC (±5%) and is rated for 15 amps minimum. Customers should enlist the services of a licensed electrician for assistance with electrical power upgrades.

GC 2400 System Power Cord Plug

NOTE: GC 2400 System purchased to operate on 210 – 240 VAC do NOT come with a plug installed on the end of the power cord due to the variability of the plugs used at this voltage range. The customer must provide a plug for the power cord that is compatible with the types of outlets used at the location where the GC 2400 System is to be installed.

Table 3: Current draw ratings for GC 2400 System at common line voltage ratings and heat dissipation.

Oven Type	Voltage ± 10%	Frequency (Hz)	Max Continuous Power (VA)	Current (Amps)	Heat Dissipation Btu/hr (Max)
	120	50/60	1920	16.0	6,550
	230	50/60	3400	14.8	11,600
	220	230	240		
Component	**Voltage ± 10%**	**Frequency (Hz)**	**Max Continuous Power (VA)**	**Current (Amps)**	**Heat Dissipation Btu/hr (Max)**
	120	50/60	1920	16.0	6,550
	210	50/60	2830	13.5	9,660

Heat Dissipation: 1VA = 3.4121 Btu/h

Add 200 VA (Watts) for the computer and 150 VA for the printer.

NOTE: These additional electronic components must be supplied on a circuit different from that used for the GC.

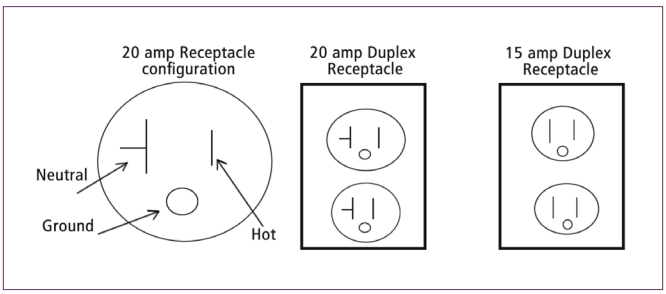

Figure 2: Differences between 20 amp and 15 amp receptacles for operation at 120 VAC.

Separate circuits are recommended for the complete system, including the computer and printer.

See line cord plugs used in the various countries below:

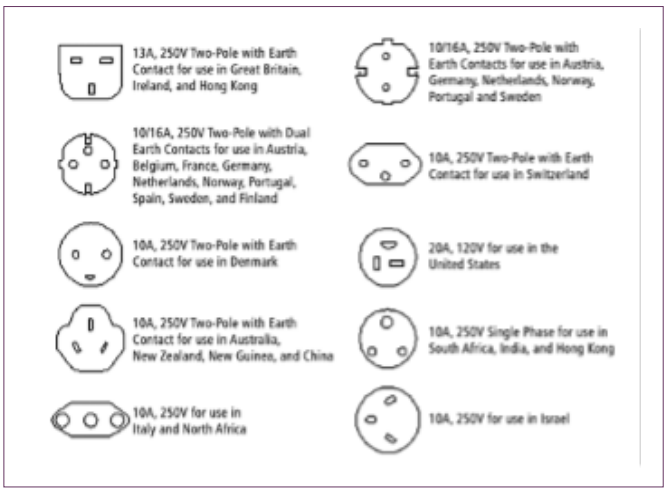

Figure 3: Line cord plugs used in the various countries.

Gas Requirements

Carrier and Makeup Gas Supplies

1. All gas supply resources, and appropriate filters required for GC operation must be available at site prior to beginning GC installation.
2. Compressed gas cylinders should always be stored and operated in the vertical position securely fastened to a solid wall. Cylinders should be located outside of the laboratory whenever possible.
3. Always use copper tubing that is free of grease, oil and organic material for all gases delivered to all GC 2400 System or associated external samplers. Minimum diameter tubing is 1/8 inch O.D., but 1/4 inch O.D. tubing can be used for longer delivery lines.
4. Any gas line made of 1/4 inch tubing will have to be terminated with a 1/4 to 1/8 inch reducing tube fitting in order to connect to gas line filters that need to be installed just before entry into the GC.
5. Gas delivery pressure should be 70 to 90 psig (480 to 620 kPa), but NEVER ABOVE 100 psig from any gas source connected to the GC 2400 System.
6. PerkinElmer recommends using gases with a purity of ≥99.999% for all GC 2400 System. The Split/Spiltless injectors can take up to 150psi.
7. It is highly recommended to use a triple filters of moisture, hydrocarbon, oxygen for all carrier gases, helium, hydrogen, or others. This is especially true when operating a mass spectrometer (MS).

WARNING

When using hydrogen (H2) as a carrier gas or fuel gas, hydrogen can flow into the GC oven and create an explosion hazard. Therefore, be certain that the hydrogen supply is turned off until all connections are made and ensure the injector and detector column fittings are either connected to a column or capped at all times when hydrogen is supplied to the instrument. Hydrogen is flammable. Leaks when confined in an enclosed space, can create a fire or explosion. 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. H2 leak sensor accessory is available for upgrade PN# N640-0177.

Never use any flammable gases for vial pressurization, as in a headspace application. Flammable gases, such as hydrogen or argon/methane can create an explosion hazard when used for vial pressurization. Use either helium or nitrogen as vial pressurization gases, along high quality traps to remove water, hydrocarbons, and oxygen.

8. Detector fuel gases of hydrogen and air must be filtered for moisture and hydrocarbons for FID, NPD, FPD. Stainless Steel lines are recommended for hydrogen.
9. Makeup gas for electron capture detector (ECD) may be pure nitrogen or P5 Gas (95% argon/5% methane). Highly recommended to use moisture, oxygen filters. The mass spectrometer (MS) vents to atmosphere. It's recommended that a nitrogen line be connected to the MS vent fitting. It should be regulated to a low pressure of 3-5 psi.

Air Supply

1. A clean, dry air supply is required for operation of some GC detectors (FID, NPD, FPD) and for pneumatically controlled gas sampling valves (GSVs). Separate gas pressure regulators are recommended to isolate GC detector air supplies from switching transients inherent in use of pneumatically controlled GSVs.
2. **DO NOT USE "MEDICAL AIR" OR "BREATHING AIR".**
3. Use a minimum of Zero Grade Air; Ultra Zero Grade Air is a better choice. Alternatively, an air compressor can be used if proper filters are fitted to remove moisture or any other contaminants.
4. Any compressed air line must be fitted with a moisture and hydrocarbon filter before it enters the GC. Gas delivery pressure should be 70 to 90 psig (480 to 620 kPa). Separate regulation may be required for detector air and pneumatic actuator air.

Table 4: GC 2400 Carrier – Detector Gases.

Detector	Carrier Gas	Make-up (Preferred)	Make-up (Alternative)	Purge or Reference
Electron Capture (ECD)	Hydrogen Helium Nitrogen Argon/Methane 5%	Nitrogen Nitrogen Nitrogen Nitrogen	Argon/Methane 5% Argon/Methane 5% Argon/Methane 5% Argon/Methane 5%	Nitrogen makeup provides maximum sensitivity Argon/Methane 5% makeup provides maximum dynamic range
Flame Ionization (FID)	Hydrogen Helium Nitrogen	Nitrogen Nitrogen Nitrogen	Helium Helium Helium	Hydrogen and Air used for detector fuel gases
Flame Ionization (FID) (for packed columns)	Hydrogen Helium Nitrogen Argon	None	None	Hydrogen and Air used for detector fuel gases

Ventilation Requirements

Exhaust venting is important for the following reasons:

- It protects laboratory personnel from toxic vapors that may be produced by some samples.
- It helps to protect the instrument from corrosive vapors that may originate from the sample(s).
- It removes dissipated heat produced by the instrument and power supply.

NOTE: Local electrical codes do not allow PerkinElmer Service Engineers to install the blower and vent assembly.

The blower capacity depends on the duct length and number of elbows or bends used to install the system. If an excessively long duct system or a system with many bends is used, a stronger blower may be necessary to provide sufficient exhaust volume at the instrument.

Alternatively, smooth stainless-steel tubing should be used instead of flexible stainless steel tubing where flexibility is not required to reduce system friction loss or "drag". If smooth stainless steel is used, there must be a way to move the vent hood out of the way for servicing. A length of smooth stainless steel ducting has 20-30% less friction loss than a comparable length of flexible ducting. When smooth stainless steel tubing is used, elbows must be used to turn corners. These elbows should turn at a centerline radius of 150 mm with a maximum bend angle of 45 degrees to reduce friction losses, and the number of elbows should be minimized.

Additional recommendations on the venting system include the following items:

- Make sure the duct casing is installed using fireproof construction. Route ducts away from sprinkler heads.
- The duct casing and venting system should be made of materials suitable for temperatures greater than 70 °C (158 °F). It should be installed to meet local building code requirements.
- Locate the blower as close to the discharge outlet as possible. All joints on the discharge side should be airtight, especially if toxic vapors are being carried.
- Equip the outlet end of the system with a back draft damper and take the necessary precautions to keep the exhaust outlet away from open windows or inlet vents. In addition, extend it above the roof of the building for proper dispersal of the exhaust.
- Equip the exhaust end of the system with an exhaust stack to improve the overall efficiency of the system.
- Make sure the length of the duct that enters into the blower is a straight length at least ten times the duct diameter. An elbow entrance into the blower inlet causes a loss in efficiency.
- Provide make-up air in the same quantity as is exhausted by the system. An "airtight" lab will cause an efficiency loss in the exhaust system.
- Ensure that the system is drawing properly by using an air flow meter.
- Equip the blower with a pilot light located near the instrument to indicate to the operator when the blower is on.

PLEASE NOTE: See pre-installation checklist on last page for signoff of site requirements.

Useful Accessories for GC Troubleshooting

PerkinElmer FlowMark Electronic Flowmeter

PerkinElmer's FlowMark™ flowmeter is specifically designed for use with gas chromatography (GC) instruments. The probe is applied directly to the gas flow stream and the measured flow rate is presented on the LCD screen.

Units of flow are measured in mL/min. This unit provides continuous real-time measurements of gas streams ranging from 0.50 mL/min to 500 mL/min. Because the technology uses volumetric flow measurement, the unit is compatible with all laboratory gases. The flowmeter is designed to measure clean, dry, non-corrosive gases.

Figure 4: PerkinElmer FlowMark Electronic Flowmeter.

Features and Benefits

- Measures volumetric flow for all gases across range of 0.5 - 500 mL/min
- NIST traceable calibration
- Explosion-proof rating for flammable and explosive gas atmospheres
- Accuracy of ±2% of flow or ±0.2 mL/min, whichever is greater
- Over range indicator
- Auto shut-off feature
- Ergonomic design and side grips for comfort
- Measures most gas types
- Convenient storage case included
- CE, Ex (Compliance: WEEE, RoHS) certified
- Uses 2-AA batteries
- Data output via USB port
- Re-calibration service available
- Designed to measure clean, dry, non-corrosive gases
- 1 year warranty

Description	Part No.
FlowMark Electronic Flowmeter	N9307086
Recalibration Service for FlowMark Flowmeter	N9307085
Soft Carrying Case	N9306142

PerkinElmer Portable Gas Leak Detector

The PerkinElmer compact handheld electronic gas leak detector is the ideal solution for detecting gas leaks in your GC systems. Leaks in your system waste gas and can cause detector noise, baseline instability, and shorter column life.

This portable unit detects minute leaks of any gas with thermal conductivity different from air. The reference gas inlet draws in ambient air for comparison to air drawn into the sample probe. A leak is detected by both LED bar graph display and audible alarm.

Figure 5: PerkinElmer Portable Gas Leak Detector.

Features and Benefits

- Sleek ergonomic, hand-held design with rugged side grips
- Automatic shut-off capabilities
- Optimized sample flow path
- LED readout and audible alarm

Description	Minimum Detectable Leak Rate (atm cc/sec)	Indicating LED Light Colour
Helium	1.0×10^{-5}	Red
Hydrogen*	1.0×10^{-5}	Red
Nitrogen	1.4×10^{-3}	Yellow
Argon	1.0×10^{-4}	Yellow
Carbon Dioxide	1.0×10^{-4}	Yellow

Description	Specification
Battery	Rechargeable Ni-MH internal battery pack (6 hours normal operation)
Universal Power Adapter Set	US, UK, European, Australian plugs included
Temperature Range	32 – 120 °F (0 – 48 °C)
Humidity Range	0 – 97%
Warranty	1 Year
Certifications	CE (EU, Korea, Japan, Australia); UKCA
Compliance	WEEE, CEC, China RoHS 2

Description	Part No.
Portable Electronic Leak Detector	N9306371
Soft Carrying Case	N9306142
Probe (Fine Tip)	N9306063

* Caution: The PerkinElmer leak detector is not designed for determining leaks in a combustible environment. This unit may be used for determining trace amounts of hydrogen in a GC environment only.

Pre-Installation Checklist

Model: _____ **Date:** _____

SPO#: _____ **Company:** _____

Location: _____ **Operator:** _____

Alternate Contact: _____ **Lab Manager:** _____

Telephone: _____ **Email:** _____

Installation Requirements	Completed Yes / No	If Not Completed, Additional Needs Prior to Installation
Safety Requirements		
Environmental Requirements		
Space Requirements for Instrument and Accessories, including External Samplers and External Detectors (i.e. MS) if Part of GC Analysis System		
Lab Space Requirements for Peripherals (Computers, Printers, etc.)		
Electrical Power Requirements		
Compressed Gas Requirements		
Ventilation Requirements		

Please complete both sides of this form, detach at perforation, and return to PerkinElmer Service Manager.

Pre-Installation Checklist

Additional Recommended Operating Resources	Completed Yes / No	If Not Completed, Additional Needs Prior to Installation
Sample Preparation Equipment and Facilities (Customer Responsibility)		
Additional Cooling Equipment (Water Cooling if Installed) and Miscellaneous		
Phone Line Near Instrument		
Internet Access Near Instrument for Remote Support		

Please be aware that signoff on this document is a requirement for scheduling installation of the instrument.

An installation scheduled after signoff of this document will be treated as a Billable Service Call if the site is not ready when the Service Engineer arrives to perform the scheduled installation.

Signatures:

Operator: _____ **Date:** _____

Alternate Contact: _____ **Date:** _____

Lab Manager: _____ **Date:** _____

Service Manager: _____ **Date:** _____

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