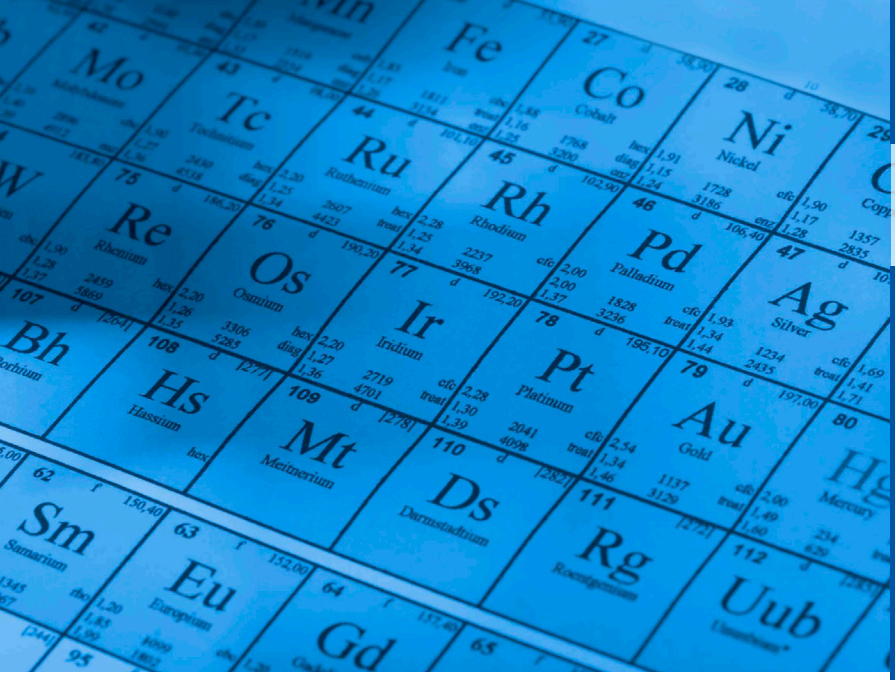

PREPARING YOUR LAB

ICP - Mass Spectrometry

Preparation Considerations

- Delivery and Installation
- Spatial and Environmental Requirements
- Facility Requirements and Consumables
  - Electrical Requirements
  - Ventilation Requirements
  - Coolant Requirements
  - Argon Gas Requirements
  - Cell Gas Requirements
- Cleanroom Setup and Offsite Control
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Introduction

This document provides information to assist in preparing your laboratory site for the PerkinElmer **NexION® 5000 ICP-MS** system prior to instrument delivery and installation. Read each section carefully to ensure that your laboratory is ready for the installation of your system. For additional information and pre-installation support, contact your PerkinElmer Service Representative.

This document is intended for laboratory and facility managers responsible for site planning and laboratory preparation. Following system installation, please keep this document for future reference in case your instrument needs to be relocated.

The PerkinElmer NexION 5000 ICP-MS is a complete system that works in conjunction with the following items which must be provided by your laboratory: electrical power, exhaust vents, argon gas supplies with an approved regulator, cell gas supply with approved regulators for reactive gases, and coolant system.

NexION 5000 ICP-MS

PerkinElmer®
For the Better

Preparing for Delivery and Installation

Contact your PerkinElmer Service Representative for assistance in uncrating, moving, and installing the system. The system weighs in excess of 200 kg (440 lb.); you will require a forklift, lifting table, or other mechanical aid to move the instrument off the shipping platform and onto the laboratory bench. A lifting kit with positioning handles is provided to safely help with this process. DO NOT move the instrument manually using these lifting handles; this would require in excess of six people, and would constitute a hazard to both personnel and the instrument. Table 1 lists the weight and dimensions of the system both in and out of the shipping crate.

Once uncrated, the instrument is designed to fit through all standard international door frames. With the instrument on the lifting handles, mechanically carried at an estimated height of 100 cm (39 in.), you can move the instrument through any opening that meets the minimum width of 76.2 cm (30 in.) and standard height of 207 cm (81.5 in.)

Table 1: Instrument Size and Weight Specifications.

Instrument in Crate*	
Width	163 cm (64 in.)
Height	122 cm (48 in.)
Depth	114.5 cm (45 in.)
Weight	258 kg (569 lb.)
Instrument with Lifting Handles	
Width	138.9 cm (55 in.)
Height	74.1 cm (30 in.)
Depth	75 cm (29.5 in.)
Weight	205 kg (453 lb.)
Instrument Alone	
Width	114.9 cm (46 in.)
Height	74.1 cm (30 in.) 84.7 cm (33.5 in.) with Exhaust Collar
Depth	74.3 cm (29.5 in.) 84.9 cm (33.5 in.) with Sample Tray
Weight	190.5 kg (420 lb.)

* Crate on 4-way entry plywood pallet with skid mates.

Storage Conditions

The following are the recommended long-term storage conditions for the instrument:

- Ambient temperature: -20 °C to +60 °C (-4 °F to +140 °F).
- Relative humidity 20% to 80%, without condensation.
- Altitude: In the range of 0 m to 12,000 m (sea level to 39,370 ft.)

Following any storage period, allow the instrument to sit for at least a day under the conditions specified in the *Laboratory Environment* section before plugging it into the mains power and putting it into operation.

Spatial and Environmental Requirements

Laboratory Environment

The NexION 5000 ICP-MS was designed to operate reliably under carefully controlled environmental conditions. Operating or maintaining the system in a condition outside of the power and operating environment specified herein may lead to system damage or failure. Note that any such damage is excluded from the standard warranty and service contract coverage.

The laboratory environment in which the NexION 5000 ICP-MS instrument is installed should meet the following conditions:

- For optimum performance, the room temperature must be maintained between 15 and 30 °C (59-86 °F) with a maximum rate of change of 3 °C (5 °F) per hour.
- The relative humidity should be maintained between 20 and 80%, non-condensing. For optimum performance, the room temperature should be controlled at 20 ±2 °C (68 ± 3.6 °F), and the relative humidity should be between 35 and 50%.
- The instrument is certified for operation at elevations up to 2000 meters (6562 ft.) above sea level.

The NexION 5000 ICP-MS should be located in an area that is:

- Indoors
- Out of direct sunlight
- Away from heat radiators
- Free of smoke, dust, and corrosive fumes

In order to minimize contamination problems, a dust- free environment is necessary. For ultra-trace techniques, environmental contamination becomes a limiting factor in the analysis. For SEMI-compliant labs, and to quantitate ubiquitous elements such as Fe, Ca, K, Na, etc. below 1 ppb (µg/L), a class 1000 environment (or better) is necessary for sample preparation and analysis. This is not an indication of the performance limitations of the instrument, but rather a recommendation for an ultra-clean environment.

AMBIENT DUST AND LIQUID: *This electrical equipment is not protected against excess ambient liquid or dust (IP-2X rating).*

If the laboratory is in an enclosed room, we strongly recommend that you install an oxygen depletion detector within the room.

EXPLOSIVE ATMOSHPERE: *This instrument is not intended for operation in an explosive atmosphere.*

Vibration

The instrument must be placed in a location that is not prone to excessive vibration. The adjoining area must be free of vibration caused by other laboratory equipment or ancillary components. The body of the vacuum pump must not be in contact with the ICP-MS and should not be placed on the same workbench. Locate the vacuum pump on the floor beneath the instrument bench.

The NexION 5000 ICP-MS may be installed in a mobile laboratory if any resultant vibration can be kept isolated; we recommend that the laboratory be stationary when the instrument is in operation.

Location and Space Requirements

You must locate the NexION 5000 ICP-MS system near the required electrical, gas, and coolant supplies (see Figure 3). The vacuum roughing pump can be located up to a distance of 200 cm (6.5 ft.) from the instrument — up to 300 cm (10 ft.) using an optional kit. There can be no more than three bends or couplings in the vacuum hose over its entire length. The diameter of the hose must remain at least 2.5 cm (1 in.) ID.

Electromagnetic interference (EMI) generated by NMRs, radio transmitters, and microwave links may interfere with system performance. Protect the system from static electricity by observing humidity and temperature requirements. Minimize the presence of non-conductive products, such as carpets and vinyl floor tiles.

The NexION 5000 ICP-MS is designed to operate on a bench 66-91 cm high (26-36 in.). PerkinElmer offers an optional bench appropriate for the NexION series ICP-MS (Part No. N8141230). This bench is 76 cm deep x 89 cm wide x 74 cm high (30 in. deep x 60 in. wide x 29 in. high) and provides an accessory shelf as well as an acoustic barrier to muffle the sound of the vacuum roughing pump.

SEMI Facility Note: If you have concerns about seismic activity and will be installing the optional SEMI kit and seismic safety components (Part No. N8160021), the optional bench described above will NOT be appropriate to your needs, as it rests on casters.

Allow space on the right and left sides of the instrument for the computer workstation and any accessories. The main air intake is on the right-hand side of the instrument and a minimum of 45 cm (18 in.) clearance is required. In operation, we recommend that the NexION 5000 ICP-MS be placed a minimum of 7.5 cm (3 in.) from a wall; however, it can be operated with the back positioned only 2.5 cm (1 in.) from a wall where space is limited.

Access for most service procedures is through the front of the instrument. However, some infrequent service procedures may require a space of at least 30 cm (12 in.) behind the instrument.

SEMI Facility Note: If you have installed the optional SEMI kit seismic safety components, you must permanently secure the instrument to the bench and the bench to the laboratory floor. As such, you must position the rear edge of the bench a minimum of 30 cm (12 in.) — or a recommended 45 cm (18 in.) — away from any wall or obstruction to ensure that PerkinElmer Service personnel are able to access the instrument backplane.

System Dimensions and Layout

The ICP-MS system consists of the main instrument, vacuum roughing pump, the instrument control computer, and a printer. Table 1 and Figure 1 provide the dimensions of the instrument. Table 2 lists the dimensions of the ancillary components.

There should be sufficient space near the spectrometer for the various accessories (autosampler, laser etc.). Depending on the bench used, some small accessories may fit beside the spectrometer; larger autosamplers and components may require their own furniture. We recommend that any such accessories be placed on a movable cart to allow for easy instrument service and maintenance access.

The system computer and printer should be placed on a separate computer table, with ergonomic considerations given for the personnel who will be using the system control software.

The system as a whole can be positioned in either an inline or an L-shaped configuration. In the L-shaped configuration, the instrument and an accessory cart are positioned on one leg of the L; the computer and printer station comprise the other leg. A sample inline workstation layout is shown in Figure 2, with recommended component spacing.

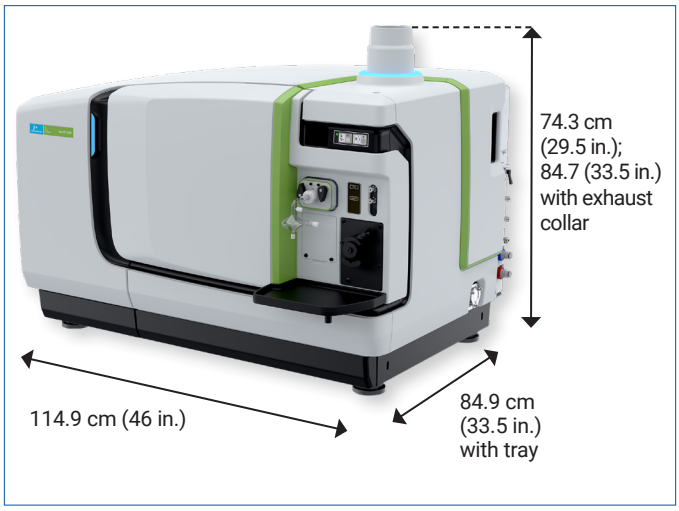


Figure 1: Dimensions of the NexION 5000 ICP-MS.

Table 2: Dimensions of the Standard Ancillary Components.

Ancillary Component	Width cm (in.)	Height cm (in.)	Depth cm (in.)	Weight kg (lb.)
Vacuum Roughing Pump	50 (20)	30 (12)	30 (12)	45 (100)
Refrigerated Chiller (Standard 50 Hz/60 Hz Models)	38.1 (15)	55.4 (21.8)	66 (26)	68.5 (151)
Optional Autosamplers* PerkinElmer S23 PerkinElmer S25	 57 (22.5) 79 (31.5)	 45 (18) 45 (18)	 53 (21) 53 (21)	 9.5 (21) 13.5 (30)

*Additional autosamplers are also compatible with the NexION 5000 system; contact PerkinElmer Customer Support for details.

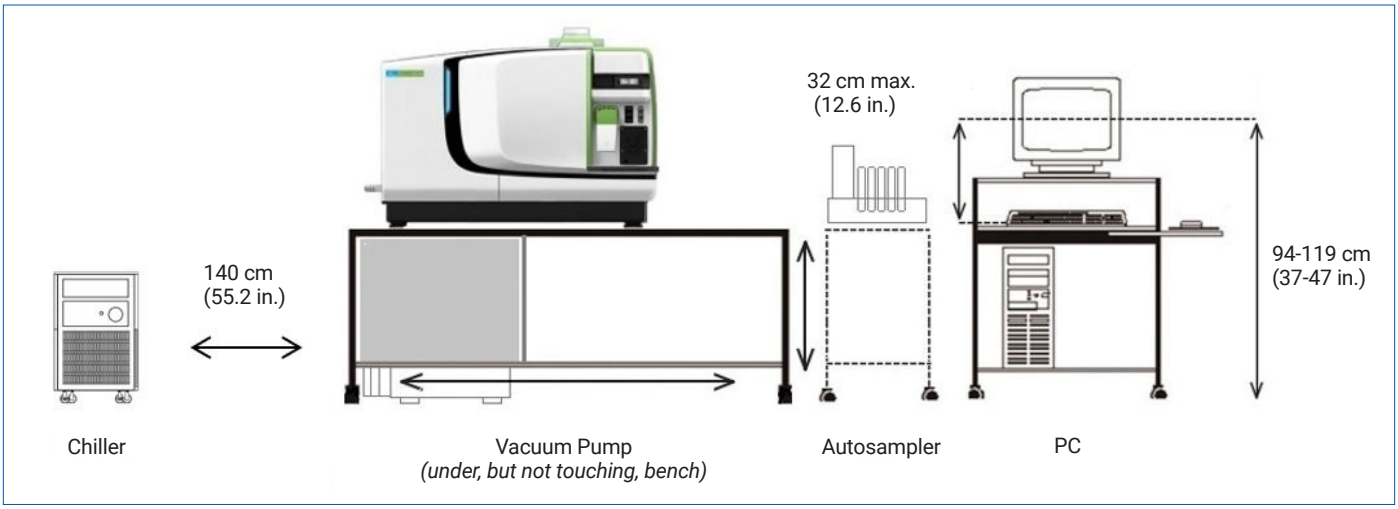


Figure 2: Recommended workstation layout — inline configuration.

Drainage and Overflows

A drain vessel is supplied with the NexION 5000 ICP-MS to collect waste liquid from the spray chamber of the sample-introduction system. The instrument also has a torch box drain with a drain line and a smaller waste bottle. Dispose of all liquid waste in accordance with laboratory and government environmental regulations.

The drain vessel should be placed to the right of the instrument, and must NOT be stored in an enclosed area. Check the drain system regularly, and replace when necessary. The vessel provided is made of HDPE (high density polyethylene); ensure that any replacement drain vessel is made from a material that is chemically resistant to the composition of the samples, acids, and solvents being used. Do NOT use a vessel made from glass or any other breakable material.

WARNING

LIFTING AND SPILL HAZARD: *Empty the drain vessel on a regular basis to ensure that the vessel does not overfill and thus present a spillage or possible lifting hazard. We recommend that the supplied bottle never be allowed to fill beyond the 2/3 point.*

Liquid waste must always be segregated and clearly labeled. Never mix organic and inorganic liquids in the same drain vessel. Do not store organic and inorganic drain vessels in the same area.

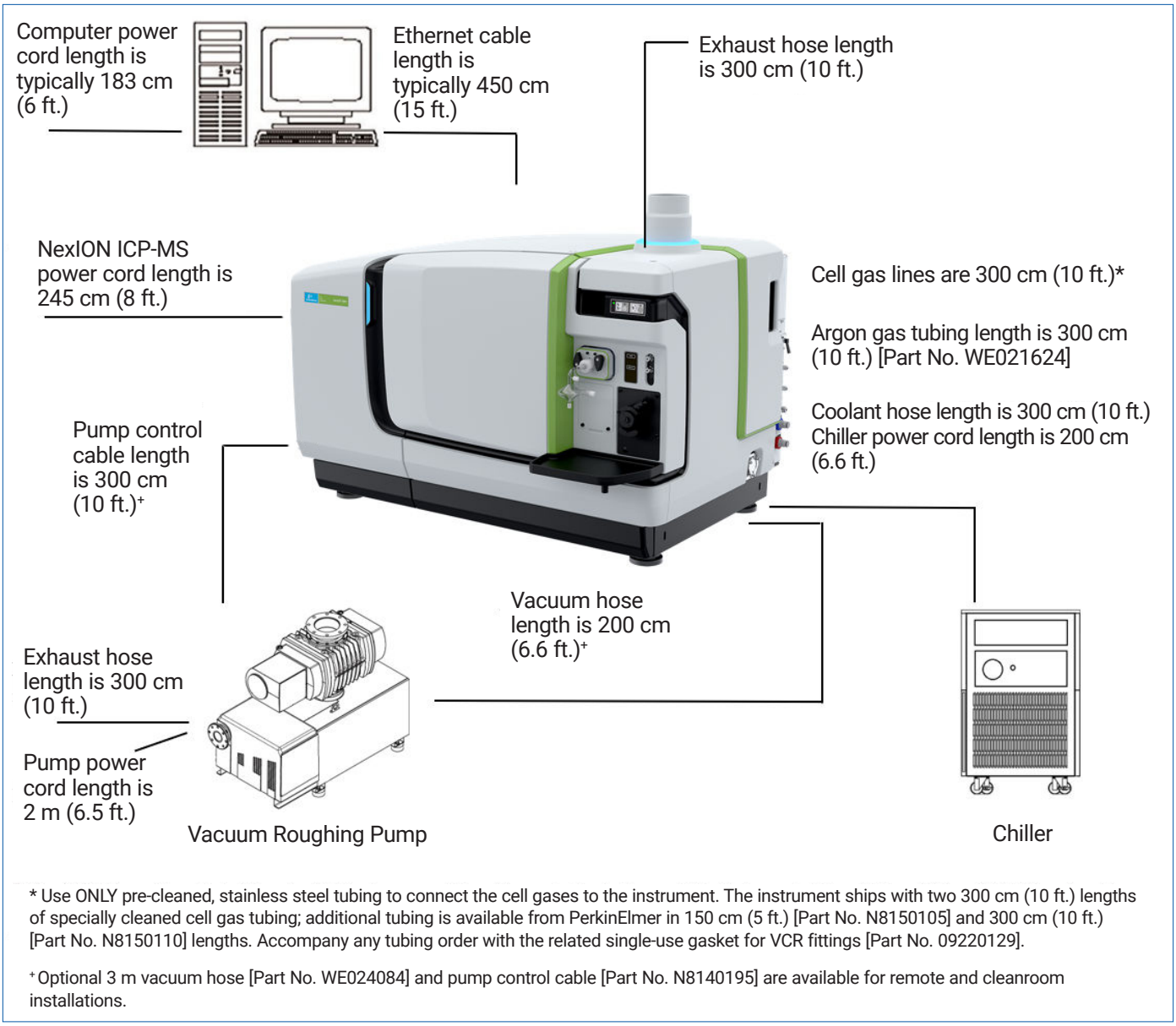
SEMI Facility Note: The optional semiconductor-compliant safety and seismic protection kit includes internal leak remediation wraps and a collection tray designed to capture 110% of the volume of coolant contained in the closed system (4.6 L / 1.25 gallons), as well as the smaller amounts of liquid introduced via the sample introduction system.

Facility Drainage

If your laboratory chooses to use an integrated facility drainage system, it is your responsibility to ensure that the system is adequate to both the potential volume of liquid (accrued via both operational drainage and potential leakage) and all environmental waste containment and disposal regulations in your region.

Connections

Illustrated below are the connection locations and lengths:



* Use ONLY pre-cleaned, stainless steel tubing to connect the cell gases to the instrument. The instrument ships with two 300 cm (10 ft.) lengths of specially cleaned cell gas tubing; additional tubing is available from PerkinElmer in 150 cm (5 ft.) [Part No. N8150105] and 300 cm (10 ft.) [Part No. N8150110] lengths. Accompany any tubing order with the related single-use gasket for VCR fittings [Part No. 09220129].

+ Optional 3 m vacuum hose [Part No. WE024084] and pump control cable [Part No. N8140195] are available for remote and cleanroom installations.

Figure 3: Locations and lengths of connections.

Computer Requirements

The NexION ICP-MS is operated via the Syngistix™ for ICP-MS instrument control software. The software and ancillary components require a specific operating system and computer hardware configuration in order to run; the latest requirements are detailed in the Release Notes that accompany the software.

The computer configuration recommended in the *Release Notes* reflects that used in the verification of the software and matches the computer systems optionally available through PerkinElmer. If you are using a computer provided by a third party, ensure that it meets these specifications. Contact your PerkinElmer Customer Support Representative for more information.

Facility Requirements and Consumables

Table 3 provides information on the primary gas and liquid services required for the NexION 5000 ICP-MS (these are described in further detail later in this document). Electrical requirements are described following.

Table 3: Primary Gas and Liquid Services Required for the NexION 5000 ICP-MS.

Item	Operating Pressure	Flow at Operating Pressure
Argon ≥ 99.996% Pure	@ 586 – 690 kPa (85 – 100 psig) min-max	15-20 L/min (typical)
Ammonia ≥ 99.9995% Pure	@ 69 – 103 kPa (10 – 15 psig) operating	0.6 mL/min (typical)
Helium ≥ 99.9999% Pure	@ 69 – 103 kPa (10 – 15 psig) operating	5 mL/min (typical)
Methane ≥ 99.999% Pure	@ 69 – 103 kPa (10 – 15 psig) operating	0.5 mL/min (typical)
Oxygen ≥ 99.9999% Pure	@ 69 – 103 kPa (10 – 15 psig) operating	0.5 mL/min (typical)
Cooling Liquid (WE016558)	@ 400 – 413 kPa (58 – 60 psig)	3.8 L/min (1.0 gpm) minimum 4.7 L/min (1.25 gpm) typical

Electrical Requirements

Power to the NexION ICP-MS must meet the requirements specified in Table 4. Table 5 provides the electrical supply requirements and approximate power consumption of the standard ancillary components.

Table 4: NexION 5000 ICP-MS Power Specifications.

Power Consumption	
Maximum Volt Amperes (Total)	3200 VA
Maximum Continuous Current	16 A
Voltage Amplitude Specification	
Operating Voltage	200-240 V
Allowable Voltage Variance	±10%
Maximum Allowable Percent Sag	5%
Maximum Allowable Percent Swell	5%
Frequency Specification	
Operating Frequency	50/60 Hz

If the power line is unstable, fluctuates in frequency, or is subject to surges or sags, additional control of the incoming power may be required. A means of electrically grounding the instruments and accessories must be available. Power to the instrument should be clean from excessive high frequency noise.

WARNING

MAGNETIC SUSCEPTIBILITY: *Do NOT place the NexION ICP-MS near any other instrumentation or equipment that emits high magnetic fields. External magnetic field strength must not exceed 10 Gauss at the instrument site.*

Table 5: Electrical Requirements for Ancillary Components.

Equipment	Voltage (AC)	Power
Roughing Pump*	200-240 V, 50/60 Hz 12 A	1500 W
Refrigerated Chiller Standard 50 Hz Model Standard 60 Hz Model	 240 V, 50 Hz, 13.5 A 230 V, 60 Hz, 13.5 A	 2650 W 2900 W
Computer (Typical)	100-127 V /200-240 V, 50/60 Hz	800 W
Printer (Typical)	100-127 V /220-240 V, 50/60 Hz	800 W

* NOTE: A minimum circuit rating of 15 amps is required for the Roughing Pump and Refrigerated Chiller mains connections.

The ANSI-IEEE C62.41* recommends <10 volts normal mode (signal to ground) and <1/2 volt common mode** (neutral to ground). These levels can be verified by an oscilloscope or power meter.

* The American National Standards Institute (ANSI) is a private, non-profit organization that administers and coordinates the U.S. voluntary standards. The Institute of Electrical and Electronics Engineers (IEEE) is a professional association with its corporate office in New York City.

** Excessive common mode (neutral to ground) noise can be caused by a poor building ground. The NEC (National Electrical Code) requires that the building ground resistance does not exceed 25 ohms. This can be verified with an earth ground test.

Mains Connection

The instrument is shipped with one 2.4-meter (8 ft.) AC mains cord terminated by an IEC 60309 connector rated 30 A by UL (North America) and 32 A by VDE (International) for 250 V as shown in Figure 4.

Figure 4: IEC 60309 connector.

SEMI Facility Note: In a semiconductor or S2/S8-compliant environment, your laboratory must procure and use a mains plug lockout box whenever instrument maintenance and service tasks are performed. Lockout protocols must be observed whenever the instrument covers are to be removed or otherwise breached.

Vacuum Roughing Pump Connection

The vacuum roughing pump is provided with a separate mains supply plug suitable for the country of installation (shown in Figure 5) and must be connected to a separate branch circuit/wall outlet. It requires one 12 A single-phase 200-240 V outlet — see Table 5. See Figure 3 for the location and lengths of hoses, lines, cords, and cables.

North America Japan NEMA 6-15P N8145006	Europe CEE 7 "Schuko" N8145007
Switzerland N8145009	United Kingdom BS 1363 N8145008
Rest of World No plug N8145010	

Figure 5: International vacuum pump mains supply plugs.

Chiller Connection and Coolant Requirements

The NexION 5000 ICP-MS system requires a regulated source of filtered coolant. To meet the required standard, a refrigerated chiller is required — a simple heat exchanger cannot be used. PerkinElmer offers a choice of two models of Refrigerated Chiller units for this purpose:

- The 60 Hz refrigerated chiller comes with a NEMA L6-15P connector.
- The 50 Hz refrigerated chiller comes with a CEE 7 connector.

The chiller requires its own electrical circuit (230 V circuit on a 12 A branch); DO NOT run the chiller on the same circuit as the NexION 5000 ICP-MS. The chiller operating pressure should be between 400 and 413 kPa (58-60 psig), with a coolant flow of between 3.8 and 4.75 L/min (1.0-1.25 gpm).

Use only PerkinElmer coolant (Part No. WE016558) with the NexION 5000 ICP-MS instrument. This cooling fluid contains a corrosion inhibitor specifically designed to protect the aluminum components of the cooling system and the interface. Six liters of pre-mixed coolant are supplied with the refrigerated chiller.

You must NOT use central facility cooling systems with the NexION 5000 ICP-MS. Contact your PerkinElmer Service Representative if you have any questions.

Exhaust and Ventilation Requirements

The NexION 5000 ICP-MS has a single exhaust port located on top of the instrument, at the front right (see Figure 6). The center of the exhaust port is located ≈ 13.4 cm (5.3 in.) from the right side of the instrument and ≈ 26.7 cm (10.5 in.) from the front of the instrument. The exhaust opening measures 9.2 cm (3.6 in.) in diameter.

WARNING

AIR QUALITY: The use of ICP-MS instruments without adequate ventilation to outside air may constitute a health hazard.

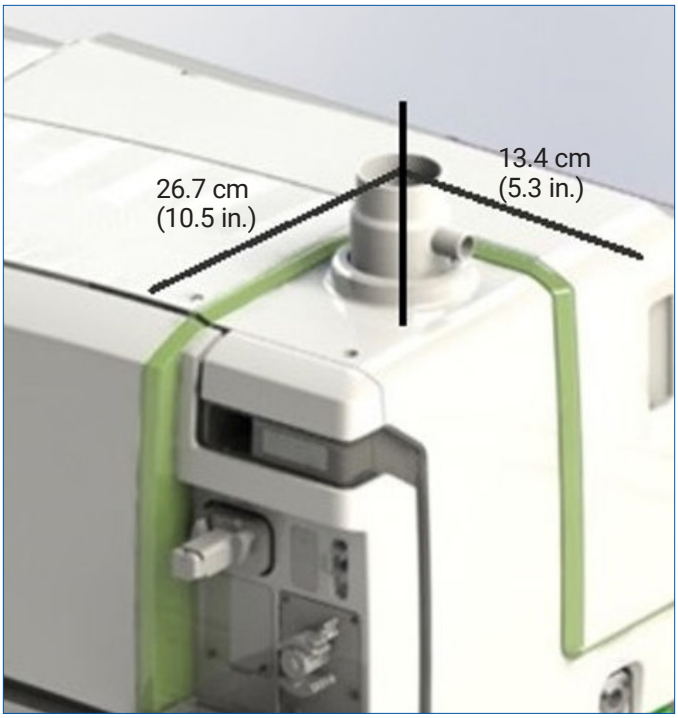


Figure 6: Location of exhaust port.

The exhaust port exhausts the following:

- Plasma heat and fumes;
- Vacuum pump – including cell gases;
- Cell gas assembly manual vent/purge switch.

The exhaust venting system is required to remove combustion fumes and vapors from the plasma torch region, and to remove reaction cell gas. Exhaust venting is important for the following reasons:

- It protects laboratory personnel from toxic vapors that may be produced by some samples;
- It minimizes the effects of room drafts and the laboratory atmosphere on plasma stability;
- It helps protect the instrument from corrosive vapors which may originate from the samples;
- It removes dissipated heat which is produced by the plasma and electronics.

The exhaust port always has 1.25 cm (0.5 in.) of water (125 Pa) static pressure. The exhaust ports should be directly connected to flexible exhaust hoses. Use the vent adapter to attach the roughing pump exhaust hose to the torch box exhaust port.

The torch box exhaust must be connected and set to the correct exhaust flow rate; otherwise the plasma will not light.

We recommend using the 10 cm (4 in.) exhaust hose shipped with the instrument. The NexION 5000 ICP-MS is supplied with 300 cm (11 ft.) of 10 cm (4 in.) flexible tubing. This tubing permits the movement of the instrument without disconnecting the vents from the laboratory system. See Tables 6 and 7 for vent specifications.

In operation, the roughing pump produces 1200-1500 W (4100- 5100 BTU/hr.) of heat. The heat from the roughing pump is released into the laboratory. Proper ventilation is required to remove this heat from the room or any enclosure in which the pump is situated. There must be a minimum of 15 cm (6 in.) clearance between the rear of the pump and any vertical surface as well as a minimum of 35 cm (14 in.) clearance in the front. It should be located away from other heat-generating sources, such as the liquid cooling system. The ambient air temperature must NOT exceed 40 °C at the roughing pump control electronics.

The heat from the refrigerated chiller is also released into the laboratory during operation. The refrigerated chiller will produce a maximum of 3000 W (10,000 BTU/hr.) of heat. Proper ventilation is required to remove this heat from the room or any enclosure in which the liquid cooling system is situated. Adequate clearance should be allowed on the front, sides, and rear of the unit for access to connections and components. The front and rear vents of the unit must be a minimum of 61 cm (2 ft.) away from walls or vertical surfaces so air flow is not restricted. It should be installed at least 140 cm (4.6 ft.) away from any heat-generating sources, such as the roughing pump or other instruments. Proper ventilation is critical for the chiller — its ambient air temperature must never exceed 30 °C (86 °F).

Venting System Recommendations

The exhaust flow rate at the instrument (the ability to vent the system) is dependent on the customer-provided blower, the duct length, the duct material, and the number of elbows or bends used. 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. 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*. 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 no more than 90 degrees between straight sections to reduce friction losses, and the number of elbows should be minimized.

Additional exhaust system recommendations include:

- The duct casing and venting system should be made of materials suitable for temperatures as high as 70 °C and be installed to meet local building code requirements.
- Locate the blower/extraction vent as close to the discharge outlet as possible. All joints on the discharge side should be airtight, especially if toxic vapors are expected byproducts.
- Equip the outlet end of the system with a backdraft damper and take the necessary precautions to keep the exhaust outlet away from open windows or inlet vents and to extend it above the roof of the building for proper dispersal of the exhaust fumes and heat.
- Equip the exhaust end of the system with an exhaust stack to improve the overall efficiency of the system.
- For best efficiency, 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 laboratory causes an efficiency loss in the exhaust system.
- Ensure that the system is drawing properly by placing a piece of cardboard over the mouth of the vent, while observing the flow. (Be sure to remove the cardboard before use and ensure that it does not get pulled up into the exhaust system.)
- Equip the blower/extraction vent with an indicator light located near the instrument to indicate to the operator when the blower is on.

Table 6: Instrument Exhaust Ventilation Requirements.

Power Consumption	
Required Airflow	**Required Air Velocity**
Measured with Hose Connected from NexION ICP-MS	
73 – 100 ft^3/min @ 0.5" H_2O (35 – 47 L/sec @ 125 Pa)	836 – 1145 ft/min @ 0.5" H_2O (4.3 – 5.8 m/sec @ 125 Pa)
Required Airflow	**Required Air Velocity**
Measured with Hose Disconnected from NexION ICP-MS	
110 – 150 cfm @ 0" H_2O (52 – 71 L/sec @ 0 Pa)	1260 – 1719 ft/min @ 0" H_2O (6.4 – 8.7 m/sec @ 0 Pa)

Table 7: Hose Diameter and Venting Capabilities.

Hose Venting Capabilities	
Hose	Instrument Exhaust
Hose Diameter	10 cm (4 in.)
Heat Vented Outside Laboratory	1800 Watts (6142 BTU/hr)

Argon and Cell Gas Requirements

Argon Requirements

Argon is used as the ICP torch gas with the NexION ICP-MS.

Either liquid or gaseous argon can be used with the NexION ICP-MS system. The choice of liquid argon or gaseous argon tanks is determined primarily by the availability of each and the usage rate. Liquid argon is usually less expensive per unit volume to purchase, but cannot be stored for extended periods. If liquid argon is used, the tank should be fitted with an over-pressure regulator which will vent the tank as necessary in order to prevent the tank from becoming a safety hazard. Gaseous argon tanks do not require venting and consequently can be stored for extended periods without loss. Either may be purchased from your gas supplier.

In terms of usage rate, liquid argon is a much better fit if your laboratory will be running the NexION ICP-MS on a continual or frequent basis. The typical argon usage rate is 14-20 L/min. A tank of liquid argon, which will produce 4300 ft^3 of argon gas, will last for approximately 100 hours of continuous ICP-MS running time, while a cylinder of gaseous argon will last only 5-6 hours of ICP-MS running time.

A recommended stainless steel single-stage argon regulator is available from PerkinElmer (Part No. N8160125); this must be installed within 3 m (10 ft.) of the instrument. A cylinder regulator for use with argon gas is also available through PerkinElmer (contact your Customer Support Representative).

PerkinElmer ICP-MS instruments include 300 cm (10 ft.) of the tubing necessary to connect your argon supply to the instrument (Part No. WE021624).

SEMI Facility Note: In a semiconductor or S2/S8-compliant environment, your laboratory must procure and use an argon gas lockout tagout capable supply whenever instrument maintenance and service tasks are performed.

Cell Gas Requirements

The NexION 5000 ICP-MS system is equipped with a four-channel Universal Cell Technology (UCT) gas manifold. Your laboratory is required to provide all reaction and collision gases (also referred to as cell gases) for introduction into the Universal Cell. Channel A is dedicated for ammonia gas with an inline regenerative getter. Channels B, C and D are used for any other required cell gases. The types of gas used varies with the application, but the cell gases most commonly used with the NexION ICP-MS are ammonia, oxygen, hydrogen/methane, and helium.

SEMI Facility Note: If you have purchased and installed the optional SEMI safety kit, a gas containment box provides an additional exhaust shield around the cell gas connections. This connects to the main instrument exhaust system. For additional safety, your laboratory must ensure that all connection points to the system are also adequately vented.

Depending on the types of gas selected and your laboratory configuration, you will need a selection of gas pressure regulators, gas delivery tubing, and conditioners for use with the instrument. PerkinElmer offers a number of optional pressure regulators capable of supplying the most frequently used cell gases at the working pressures listed in Table 8.

The cleanliness of the cell gas lines is critical for analytical performance. The NexION 5000 ICP-MS requires specially cleaned stainless steel cell gas lines. The instrument ships with two 3 m (10 ft.) lengths of this tubing; additional tubing is available from PerkinElmer in 1.5 m (5 ft.) (Part No. N8150105) and 3 m (10 ft.) (Part No. N8150110) lengths.

All of the tubing and regulators available from PerkinElmer ship with VCR regulator-to-cylinder fittings. Accordingly, the cell gas cylinders sourced from your local gas supplier must also use these same fittings. There can be no additional fittings between the regulator and the instrument.

IMPORTANT! VCR fittings have a single use metal seal that can only be used once; each time the fitting is disconnected (and the seal broken), the fitting must be replaced (Part No. 09220129).

The cell gases used by the Universal Cell must meet the specifications listed in Table 9. The purity of helium entering the instrument must be ≥ 99.9999% pure. This can be accomplished by using a gas cylinder with a built-in purifier, or by using ≥ 99.999% pure helium cylinder together with a gas purifier. **A dedicated UHP helium cylinder is required; house helium supplies must not be used.**

Helium mixed with 7% hydrogen can also be used as an effective cell gas. The purity of the helium/hydrogen gas must be ≥ 99.999% pure, with 7% hydrogen mixed into the helium.

Ammonia gas is consumed at a typical rate of 0.6 mL/min; therefore, only a very small cylinder (60 L, 2 ft3) of gas is required.

The purity of any other cell gas not mentioned in Table 9 must be ≥ 99.999% pure.

Cylinders should be secured upright in a ventilated enclosure such as a cabinet or fume hood. For additional types of cell gases not listed in Table 9, your laboratory must purchase a UHP double-stage regulator capable of supplying up to 7 mL/min at 103 kPa (15 psig). A suitable double-stage regulator with the correct cylinder fittings can be purchased from your local gas supplier.

Safe Handling of Gas Cylinders

The permanent installation of gas supplies is the responsibility of your laboratory; ensure that all gas installations conform to local safety and building codes.

IMPORTANT! The NexION Safety Practices Guide provides gas handling and hazard information for the most commonly used gases, and for those wherein usage has been anticipated; ensure that all laboratory personnel have read this guide prior to operating the instrument. Where a gas is not covered, or if you are using outliers or particularly hazardous gases, ensure that you read the accompanying SDSs (Safety Data Sheets) provided by your gas supplier and speak to your PerkinElmer Customer Support Representative to ensure that all materials meet any challenges presented.

IMPORTANT! You must install all cell gases in a gas cabinet with adequate ventilation and located within 300 cm (10 ft.) from the instrument. **It is your laboratory's responsibility to properly isolate all gas supplies.**

- Fasten all gas cylinders securely to an immovable bulkhead or a permanent wall.
- When gas cylinders are stored in confined areas, such as a room, ventilation should be adequate to prevent toxic or explosive accumulations.
- Move or store gas cylinders only in a vertical position with the valve cap in place. When in motion, the chain on the trolley should always be secured.
- Locate gas cylinders away from heat and ignition sources, including heat lamps. Cylinders have a pressure-relief device that will release the contents of the cylinder if the temperature exceeds 52 °C (125 °F).
- Locate ammonia, hydrogen, helium/hydrogen, methane, and other flammable gas cylinders in a ventilated area, away from oxygen supplies.
- When storing cylinders external to a building, the cylinders should be stored so that they are protected against temperature extremes (including the direct rays of the sun) and should be stored above ground on a suitable floor.
- Mark gas cylinders clearly to identify the contents and status (full, empty, etc.).
- Arrange gas tubes where they will not be damaged or stepped on and where nothing will be dropped on them.
- Use only approved regulators and hose connectors. Left-hand thread fittings are used for fuel gas tank connections, whereas right-hand fittings are used for oxidant and support gas connections.
- Do NOT attempt to refill gas cylinders yourself.

Table 8: Cell Gas Regulators and Related Gas Recommendations for the NexION 5000 ICP-MS.

Available Cell Gas Regulators	Regulator-to-Cylinder Connection	Cell Gas Used	Operating Flow Rate and Pressure
UHP Dual Stage for NH_3 with VCR Output (Part No. N8152566)	CGA 660	Ammonia	0.6 mL/min @ 69 – 103 kPa (10 – 15 psig)
UHP Dual Stage for He with VCR Output (Part No. N8152569)	CGA 580	Helium	5 mL/min @ 69 – 103 kPa (10 – 15 psig)
UHP Dual Stage for He + H_2 with VCR Output (Part No. N8152567)	CGA 350	Helium with 7% Hydrogen	5 mL/min @ 69 – 103 kPa (10 – 15 psig)
UHP Dual Stage for CH_4 with VCR Output (Part No. N8152567)	CGA 350	Methane	0.5 mL/min @ 69 – 103 kPa (10 – 15 psig)
UHP Dual Stage for O_2 with VCR Output (Part No. N8152568)	CGA 540	Oxygen	0.5 mL/min @ 69 – 103 kPa (10 – 15 psig)

Table 9: Detailed Cell Gas and Argon Purity Recommendations for the NexION 5000 ICP-MS.

Gas	Purity Grade	Impurities	Specification	Notes
Ammonia (NH_3)	≥ 99.999%	O_2 H_2O THC N_2	< 1 ppm < 1 ppm < 1 ppm < 1 ppm	This grade of ammonia gas can be input directly into the NexION ICP-MS via Channel A only (Channel A features an inline regenerative getter).
Helium (He)	≥ 99.9999%	O_2 H_2O THC N_2	< 0.1 ppm < 0.2 ppm < 0.1 ppm < 0.4 ppm	Can also use helium purity grade ≥ 99.999% if optional helium filter is purchased. (Part No. N8150302)
Helium with ≅7% Hydrogen	Helium ≥ 99.9999% mixed with ≅7% Hydrogen ≥ 99.9999%	O_2 H_2O THC N_2	< 1 ppm < 3 ppm < 0.5 ppm < 5 ppm	
Oxygen (O_2)	≥ 99.9999%	H_2O THC N_2 CO_2 Kr Ar	< 0.5 ppm < 5 ppm < 1 ppm < 1 ppm < 1 ppm < 5 ppm	
Argon	≥ 99.996%	O_2 H N_2 H_2O	< 5 ppm < 1 ppm < 20 ppm < 4 ppm	Low-grade argon can lead to instrument contamination and plasma ignition difficulties. Krypton impurities of > 0.1 ppb (0.0001 ppm) in the argon may negatively affect the ability of the instrument to quantitate selenium.

Any gas other than those listed above should be ≥ 99.999% pure.

All gas purity recommendations are ideals to aim for; work with your gas supplier and your PerkinElmer Product Specialist to find the best combination of purity, price, and availability for your laboratory's needs.

Additional Cell Gas Setup Considerations

The instrument automatically ships with two lengths of cell gas tubing. Depending on your laboratory setup and reaction gas needs, your PerkinElmer Sales Support contact will help you to order any additional tubing and fittings required for the remaining two gas channels, depending on the gases you expect to run.

The most common configuration supports the addition of helium and hydrogen and requires that you order one 3 m (10 ft.) length of stainless steel cell gas tubing for the hydrogen channel, and two 1.5 m (5 ft.) lengths of stainless steel cell gas tubing for the helium channel (if using purity grade ≥ 99.999% helium, a VCR-fitted helium filter — Part No. N8150302 — is also required). However, laboratory gas needs vary and should be discussed with your PerkinElmer Service Representative prior to installation day. Any hazardous gases should be used and installed with due care, and may require your laboratory to add additional safety systems and infrastructure (such as facility exhaust and detection alarms); these considerations are solely the responsibility of your facility.

Connecting the EMO to an External (Facility) Interface

You may also connect the EMO Emergency Off to an external (facility) interface via the two-pin screw terminal on the left side panel (on the Rear Plenum) using 24VDC wiring shorted with a jumper (shorting to grounded objects will shut off the instrument and may blow the internal fuse). The total length from the shutoff to the instrument must not be longer than 20 m (66 ft.). **We strongly recommend that all SEMI Safety and Seismic Options Kit components be installed by a trained PerkinElmer Service Representative at the time of system installation.**

Remote System Setup for Cleanroom and Offsite Control

The NexION 5000 system can be configured to be controlled from a distance — whether via a computer console located in an adjacent room (to operate an instrument placed in a controlled-access cleanroom, for example) or via a third-party software package designed for purpose, accessing the Syngistix instrument control software over the internet.

Adjacent (Cleanroom) System Control

While the usual NexION system configuration closely aligns the instrument and ancillary components in either an inline or L-shaped setup, optional connections and cordages are available to order from PerkinElmer, so that you may permanently locate the controlling computer as much as 10 m (32.5 ft.) away from the ICP-MS itself. This allows you to operate the Syngistix instrument control software from an adjacent room, preventing too-frequent incursions into the cleanroom environment. To further facilitate such operation, the NexION 5000 features a system of colored light indicators on the front cover and around the collar of the exhaust chimney to clearly communicate instrument status, even at a distance, if a viewing window is provided. Given the low-maintenance nature of the instrument, this means your scientists and technicians can run their analyses from an adjacent room, and still monitor progress and performance with confidence.

To further free up space in your cleanroom, and to remove an additional minor source of noise and vibration, you can also purchase a 10 m (30 ft.) — or longer — hose system for your system chiller or cooling system. Contact your PerkinElmer Customer Support and Service Representatives prior to installation for parts consultation and installation assistance (coolant hose assembly reference Part No. W1038962 — order to length). The vacuum roughing pump can also be distanced from the ICP-MS by up to 3 m (10 ft.) by using an optional long vacuum hose (Part No. WE024084) and pump control cable (Part No. N8140195).

Note: Coolant tubing can run as long as 30 m (100 ft.), but cannot be located at an elevation greater than 4.5 m (15 ft.) above that of the instrument; and the environment in which the hose and coolant source are located must be maintained at the same temperature as the ICP-MS itself.

Remote Internet Control

Preliminary testing with Syngistix for ICP-MS instrument control software suggests that it is readily compatible with many of the third-party remote access software packages available today. These products allow you to access your Syngistix software via the internet in order to monitor NexION analyses and system status from outside your laboratory offices. We recommend that you work with your company's IT administrator to select a suitable product and to configure it in a manner that is compatible with your company's work environment and network policies.

SEMI S2/S8 Safety, Ergonomics, and Seismic Protection

For laboratories operating in the semiconductor or other highly-regulated industries, or located within an active seismic zone, the instrument can be integrated at installation with an optional kit (Part No. N8160021), offering a series of redundant safety measures and seismic mitigation features, rendering the system S2/S8 compliant. The resulting configuration conforms to the stringent Environmental, Health and Safety (EHS) standards applicable to the semiconductor equipment manufacturing industries and semiconductor foundries.

To meet the stringent S2/S8 requirements, the instrument was actively designed with user safety and comfort in mind, so that all possible risks and hazards — from potential electrical shorts to flammability, awkward access angles

to earthquake topple probability — have been assessed and addressed, whether through material choice, interlock integration, or physical design.

IMPORTANT! The NexION 5000 ICP-MS SEMI-compliant options kit provides fastening plates and guidelines for securing the instrument to the laboratory bench to reduce the risk of toppling and injury during a seismic event. However, be aware that because several components of the physical setup — such as the instrument bench and the laboratory floor and structure surrounding — are lab-chosen and beyond the control of PerkinElmer, the responsibility for assessing your specific needs and correctly utilizing the relevant safety features rests solely with your company.

The options kit adds some or all of the following protections (as best suits your company's needs):

- **An EMO (Emergency Off) control button,** affixed to the top cover of the instrument, for sudden and safe severing of the instrument mains power in the event of an emergency. A pull and press reactivation sequence ensures a safe restart.
- **A gas connections cover,** intended to capture and safely expel any minor leaks in the region of the incoming gas fittings. The cover assembly includes a tee connection to the roughing pump exhaust duct, and exhausts an area around the gas connections of > 10 CFM.
- **Internal leakage protection channels,** which capture any potential drips from the internal lines and funnel them more directly away from the electronics toward a collection tray that sits beneath the instrument (capable of holding 110% of the possible sample introduction liquid load).
- **Heavy-duty stabilizing feet,** which work with the optional **seismic bolt-down plates** to provide extra security for the system as a whole, preventing toppling in the event of an earthquake (when fastened correctly to the instrument bench, and the bench in turn to the laboratory floor). **Requires that your laboratory source and purchase twelve (12) A2 or stronger M8 bolts suited to the surface of your instrument bench.**

Figure 7: NexION 5000 ICP-MS with SEMI S2/S8 compliance options installed.

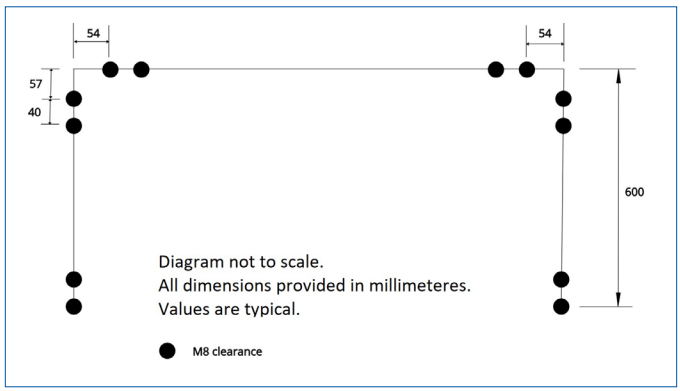


Figure 8: Seismic securement bolt diagram.

IMPORTANT! With the installation of the seismic bolt-down plates, **the footprint of the ICP-MS itself increases to 127 cm (50 in.) X 80.5 cm (31.5 in.).** Take these dimensions into account when sourcing your instrument bench.

Component Procurement Responsibility

The NexION 5000 ICP-MS system involves a number of components: some ship standard with the instrument; some are required, but variable, and can be purchased either from PerkinElmer or another vendor; some are required and must be sourced independently by your laboratory; and some are purely optional and may be available either via PerkinElmer or another source. The following table is designed to provide guidance around the sourcing of components and each party's responsibilities.

Note: A wide variety of additional ancillary components, applications, and consumables are compatible with the NexION 5000 system. Contact your PerkinElmer Customer Support Representative for details.

Table 10: Procurement Responsibility Chart.

Required Components			Optional Components	
Standard from PerkinElmer	**Available via PerkinElmer or Third-Party Vendor**	**Laboratory Must Source Independently**	**Available via PerkinElmer**	**Available via Third-Party Vendor**
• NexION 5000 ICP-MS* • Vacuum pump • Chiller • Sample waste bottle	• Bench • Computer desk • Computer (including monitor, keyboard, mouse, and printer)	• Bench for seismic zones • Computer desk for seismic zones (where required*)		• Other waste containers/facility drain
• Sample introduction system (standard)			• Sample introduction system (options) • Autosampler (a variety of options available) • HTS (High Throughput System)	• Autosampler (other compatible models) • Autodiluter (compatible models)
	• Argon gas regulator • Cell gas regulators • Additional lengths of cell gas tubing (if required) • Helium filter (if required)	• Argon supply • Cell gases • Gas storage cabinets • Facility gas safety infrastructure for hazardous gases	• SEMI S2/S8 safety and seismic options kit (as applicable)	• Seismic tiedown bolts (where required*) • Mains power cord lockout device • Argon supply lockout device
***Blue text items are REQUIRED to maintain SEMI S2/S8 system compliance (with the exception of seismic measures, which are region-dependent)**			• Extra-long cords and hoses for cleanroom configuration	• Remote monitoring software

IMPORTANT! All standard PerkinElmer components must be serviced and sourced as per PerkinElmer guidance, and repaired or maintained using PerkinElmer approved parts only. All consumables must be procured as per guidelines in the PerkinElmer Atomic Spectroscopy Consumables and Supplies Catalog. **All components identified as "Laboratory Sourced" or procured via third-party vendors are the sole responsibility of your laboratory**. PerkinElmer assumes no liability for third-party or non-standard materials or components. Materials or chemicals other than those specified in the NexION 5000 ICP-MS user documentation set may affect system functionality, longevity, or sensitivity. Consult your PerkinElmer Customer Support Representative to ensure system compatibility.

Site Preparation Validation — NexION 5000 ICP-MS

Please ensure that you have considered and met all of the following requirements as appropriate to your laboratory setup prior to the arrival of your PerkinElmer Service Representative on installation day:

☐	**Can you safely receive and move the instrument?** Shipping and storage considerations have been reviewed and a plan put in place to handle the safe movement of the instrument from truck to storage, and crate to bench. An appropriately rated mechanical lift has been sourced to move the instrument components safely, based on the weights provided herein.
☐	**Is there a clear, sufficiently spacious path to the proposed installation location?** All doorways and access ways have been mapped and measured to ensure that the instrument can be moved freely from truck to storage, and crate to bench, based on the dimensions provided herein.
☐	**Have you planned placement of the required system furniture within reach of facility connections?** Space requirements for the instrument, computer workstation, and ancillary components meet the requirements specified in this document. Where necessary, equipment compatible with safety and seismic kit components has been procured.
☐	**Have you ordered all required ancillary components?** All required ancillary components have been researched and sourced in consultation with your PerkinElmer Customer Support Representative. This includes the computer, printer, and refrigerated chiller or cooler, and may also include extension cables, additional tubes and hoses, an autosampler, and other devices. All components meet any specifications listed herein.
☐	**Have you checked your laboratory conditions?** Laboratory environmental conditions meet the requirements outlined herein.
☐	**Have you planned and positioned the necessary exhaust and ventilation components?** Facility ventilation and exhaust infrastructure meets the requirements outlined herein. Additional consideration has been made for potentially harmful gases, and their safe containment and mitigation.
☐	**Have you planned and positioned the necessary electrical outlets?** Facility electrical requirements meet the requirements outlined herein.
☐	**Have you sourced and installed your argon supply?** Your argon supply and regulator have been acquired and installed within 3 m (10 ft.) of the ICP-MS, in accordance with both the specifications outlined herein and the provider's recommendations. The applicable SDS has been reviewed by key personnel.
☐	**Have you sourced and installed your cell gas supplies?** Cell gas supplies and regulators have been acquired and installed in accordance with both the specifications outlined herein and the gas provider's recommendations. Additional tubing and VCR seals have been ordered as required. SDSs have been collected for all applicable gases, and have been reviewed by key laboratory setup and operations personnel. Additional consideration has been made for unusual or potentially harmful gases, and their safe containment and mitigation.
☐	**Are you installing the instrument in a cleanroom or in a remote operations configuration?** Any additional (longer) power cords, tubes, and hoses have been ordered, and the site has been prepared accordingly.
☐	**Are you installing the optional SEMI-compliant semiconductor safety and seismic control kit?** The appropriate kit components have been ordered, and the site has been prepared accordingly.

I confirm that the requirements specified above and described in this guide have been satisfied and the site is ready for the installation of the NexION 5000 ICP-MS. I understand that if any of the above requirements have not been met, there may be a delay in installation and activation of our system, and that additional costs may apply.

Please sign and date below.

Company

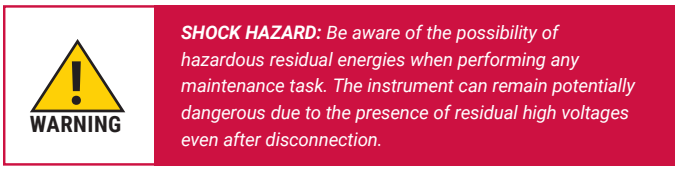
Signature

Date

Recommended Laboratory Practices

Safe Operation

- The NexION ICP-MS is intended for single operator use. Take care to keep the bench and the area surrounding the instrument clear. Alert any nearby laboratory personnel when the system doors are opening, closing, or when there is gross instrument movement of any kind.
- The system ships with a comprehensive Safety Practices guide, provided in multiple languages as part of the NexION 5000 Customer Document Pack. Encourage all laboratory personnel to review this guide prior to working with the instrument.



Cleaning the Instrument

Do not use any cleaning or decontamination methods except those specified in the NexION 5000 ICP-MS Maintenance Guide, as such methods may damage the equipment.

Laboratory Hygiene

- Keep the work area scrupulously clean to avoid contaminating your samples and to maintain a safe working environment.
- Clean up spills immediately using the appropriate equipment and supplies, such as spill-cleanup kits.
- Do not allow waste to accumulate in the work area. Dispose of waste correctly.
- Do not allow smoking in the work area. Smoking is a significant source of contamination and also a potential route for ingesting harmful chemicals.
- Do not store, handle, or consume food or beverages in the work area.
- Ensure that the area around, under, and behind the instrument is clear of any dirt and dust to prevent their entry into the instrument's interior, which could have a negative effect on performance.

Working with Chemicals

Some chemicals used with the instrument may be hazardous or may become hazardous after completion of an analysis.

- Use, store, and dispose of chemicals in accordance with the supplier's recommendations and the applicable national, state, and/or local regulations.
- Do NOT place open containers of solvent near the instrument.
- Store solvents away from the instrument in an approved cabinet with the appropriate ventilation.
- Wear appropriate eye protection at all times while handling chemicals. Depending on the types of chemicals you are handling, wear safety glasses with side shields, or goggles, or a full-face shield.
- Wear suitable protective clothing, and gloves at all times when handling chemicals. Ensure that all such PPE (*personal protective equipment*) is resistant to the chemicals you are handling.
- When preparing chemical solutions, always work in a fume hood that is suitable for the chemicals you are using.
- Perform sample preparation away from the instrument to minimize corrosion and contamination.

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