PREPARING YOUR LAB

ICP - Mass Spectrometry

Preparation Considerations

- Environmental requirements
- General laboratory requirements
- Location and space requirements
- Computer requirements
- Electrical requirements
- Exhaust and ventilation requirements
- Coolant requirements
- Gas requirements

Introduction

This document provides information to assist in preparing your laboratory site for the **NexION® 1000/2000 ICP-MS** systems 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 NexION 1000/2000 ICP-MS are complete systems that work 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 2000 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 150 kg (331 lbs.); 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 instrument. Table 1 (page 3) lists the weight and dimensions of the system both with and without shipping handles.

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.)

Environmental Requirements

Laboratory Environment

The NexION 1000/2000 ICP-MS systems are designed to operate reliably under 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 1000/2000 ICP-MS instrument is installed should meet the following conditions:

- The room temperature should be 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 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.

In addition, the NexION ICP-MS instrument should be located in an area that is:

- Indoors
- Free of smoke, dust and corrosive fumes
- Apart from, and not sharing a bench with, potential sources of vibration, such as mechanical rotors and shakers
- Out of direct sunlight
- Away from heat radiators and HVAC supply registers by at least 3 meters

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. To quantitate ubiquitous elements such as Fe, Ca, K, Na, etc. below 1 ppb (µg/L), a class 1000 environment is necessary for sample preparation and analysis. This is not an indication of the performance limitations of the instrument, but a recommendation for an ultra-clean environment.

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

Vibration

The NexION 1000/2000 ICP-MS 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 1000/2000 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.

Storage Conditions

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 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 *Environmental Requirements* section before plugging it into the mains power and putting it into operation.

EXPLOSIVE ATMOSPHERE. This instrument is not designed for operation in an explosive atmosphere.

General Laboratory Requirements

Laboratory Hygiene

- Keep the work area scrupulously clean to avoid contaminating your samples and to maintain a safe working environment.
- Clean up spilled chemicals immediately and dispose of them properly.
- 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 source of significant contamination and also a potential route for ingesting harmful chemicals.
- Do not store, handle, or consume food 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 impact 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 put open containers of solvent near the instrument.
- Store solvents in an approved cabinet (with the appropriate ventilation) away from the instrument.
- 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, including gloves if necessary, 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.
- Clean up spills immediately using the appropriate equipment and supplies, such as spill-cleanup kits.

Location and Space Requirements

Space Requirements

The system should be located near the required electrical and gas supplies as well as the coolant supply. The roughing pump can be located up to a distance of 2 meters (6.5 ft.) from the instrument – up to 3 meters (10 ft.) using 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 25 mm (1 in.) ID.

The NexION 1000/2000 ICP-MS systems are designed to operate on a bench 66-91 cm high (26-36 in. high). PerkinElmer offers a bench designed for the NexION ICP-MS (Part No. N8142011). This bench is 76 cm deep x 89 cm wide (135 cm with shelf extended) x 74 cm high (30 in. deep x 35 in. wide [53 in. with shelf extended] x 29 in. high). This bench has an acoustic barrier to muffle the sound of the roughing pump.

Allow space on the right and left sides of the instrument for the workstation or any accessories. The main air intake is on the left-hand side of the instrument and a minimum of 45 cm (18 in.) clearance is required. In operation, the NexION ICP-MS can be operated with the back within 1 inch from a wall. 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.

System Layout

The ICP-MS system consists of the main instrument, roughing pump, the computer controller assembly, and a printer. The dimensions of the instrument are given in Figure 1. Table 1 lists the dimensions of the instrument and the computer. Table 2 lists the dimensions of the peripherals and accessories.

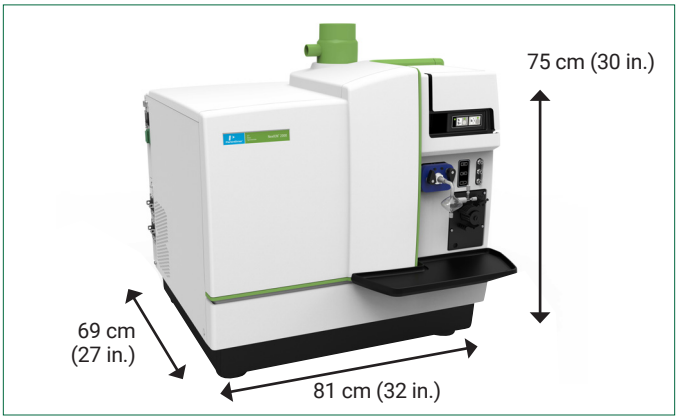


Figure 1. Dimensions of the NexION 1000/2000 ICP-MS spectrometers.

Table 1. Dimensions of the instrument and computer.

Instrument	Width cm (in.)	Height cm (in.)	Depth cm (in.)	Weight kg (lb.)
NexION 1000/2000 ICP-MS	81 (32)*	75 (30)	69 (27)	150 (330)
Computer	Dimensions will vary by model			
Monitor	Dimensions will vary by model			
Printer	Dimensions will vary by model			

*Width by Depth including the shipping handles is 105 cm (41 3/8 in.) x 76 cm (29 3/4 in.)

The NexION ICP-MS can be positioned in either a linear or an L-shaped configuration. In the L-shaped configuration, the computer and printer are positioned on one leg of the L. The instrument and an accessory table make up the other leg. A recommended workstation layout is shown in Figure 2.

There should be sufficient space near the spectrometer for the various accessories (autosampler, laser etc.). It is recommended that the accessories be placed on a movable cart or table to allow for easy service access.

The system computer may be placed on the instrument bench or a separate computer table with ergonomic considerations given for the personnel who will be using the instrument control software.

Table 2. Dimensions of the peripherals and accessories.

Peripherals	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 50/60 Hz Models	38.1 (15)	55.4 (21.8)	66 (26)	68.5 (151)
S23 Autosampler	57 (22.5)	45 (18)	53 (21)	9.5 (21)
S25 Autosampler	79 (31.5)	45 (18)	53 (21)	13.5 (30)

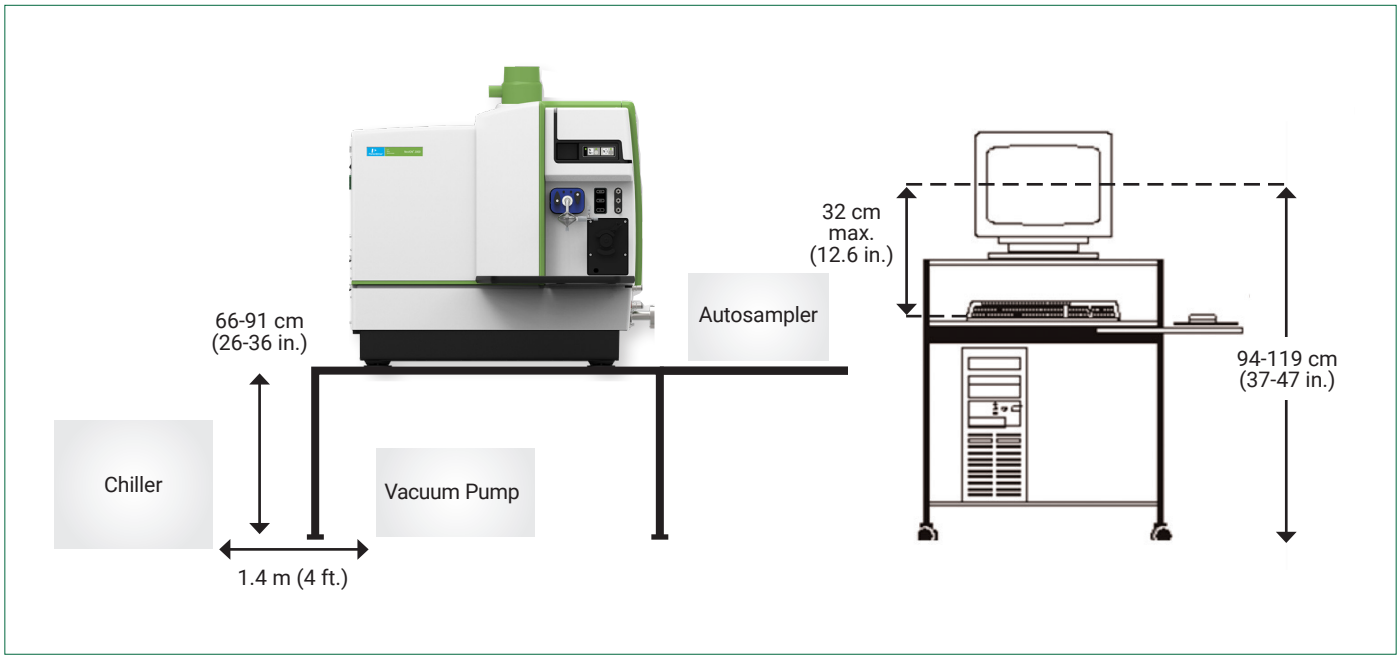


Figure 2. Recommended workstation layout.

Drainage and Overflows

A drain vessel is supplied with the NexION ICP-MS. The vessel is made of HDPE (high density polyethylene) and is used to collect the effluent from the sample-introduction system. The NexION ICP-MS also has a torch box drain with a drain line and a small waste bottle. Any waste accumulated in either of these bottles should be disposed of in compliance with your local environmental regulations.

The drain vessel should be placed to the right of the instrument. The drain vessel should NOT be stored in an enclosed storage area. The drain system should be checked regularly and replaced when necessary. Should it become necessary to replace the drain vessel, ensure that it is made from a material that is chemically resistant to the composition of the samples, acids, and solvents being used. Glass or other brittle materials must not be used.

Liquid waste should always be segregated and clearly labeled. Never mix organic and inorganic liquids in the same drain vessel. Organic and inorganic drain vessels should not be stored in the same area.

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.

Computer Requirements

NexION ICP-MS instruments are 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 these documents 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.

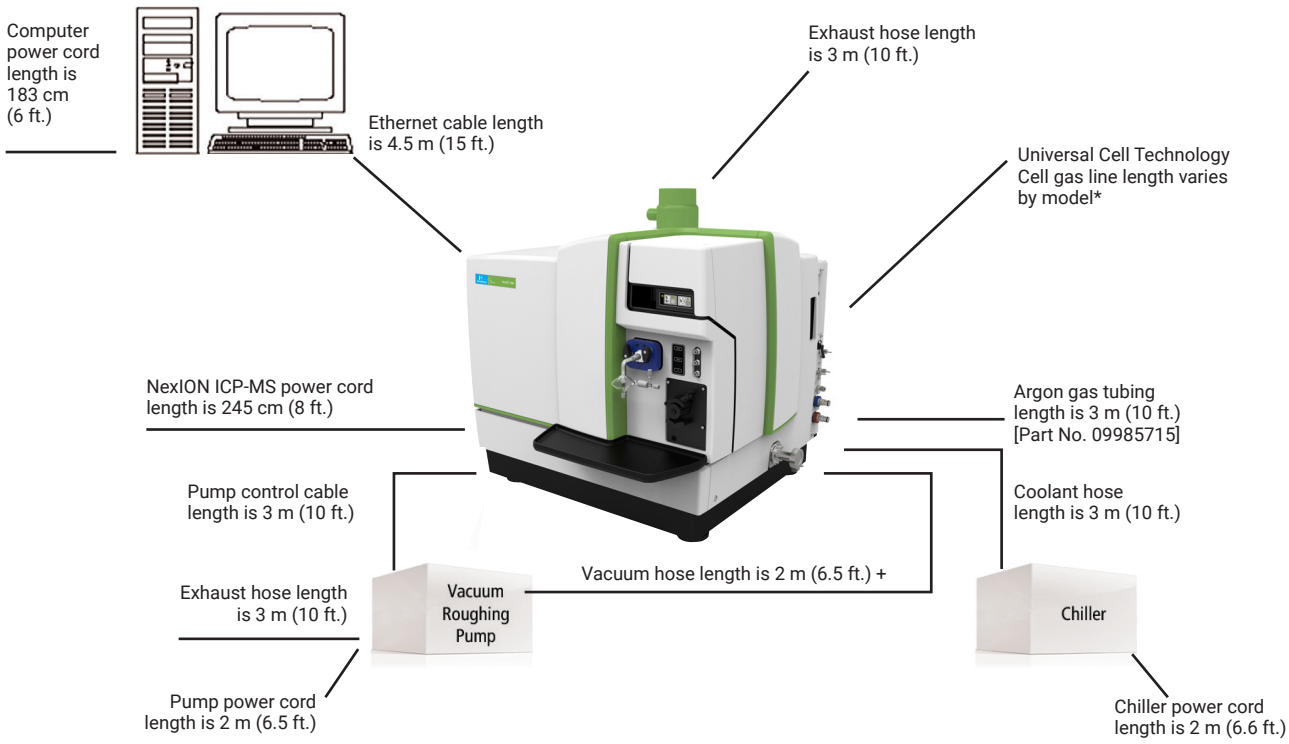
Connections

Illustrated in Figure 3 are the connection locations and lengths.

Safe Handling of Gas Cylinders

NOTE: The permanent installation of gas supplies is the responsibility of the user and should conform to local safety and building codes.

- 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.
- Locate gas cylinders away from heat or 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).



* Cell tubing shipped with the instruments is either 1.5 m (5 ft.) or 3 m (10 ft.) lengths. Two 1.5 meter lengths are shipped with each NexION 1000 and 2000B/C/P. The NexION 2000S ships with two 3 m lengths and two 1.5 m lengths of clean SS tubing. Additional lengths of specially cleaned cell gas tubing are available from PerkinElmer: 3 m (Part No. N8150110).

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

Only pre-cleaned stainless steel tubing should be used to connect the cell gases to the instrument.

Figure 3. Location and length of connections.

- 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.).
- Do NOT attempt to refill gas cylinders yourself.
- 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.
- Arrange gas hoses where they will not be damaged or stepped on and where things will not be dropped on them.
- It is strongly recommended that Universal Cell Technology™ (UCT) gases are installed in a gas cabinet with adequate ventilation and located within 3 m (10 ft.) from the instrument.

Facilities Requirements and Consumables

Table 3 provides information on the gas and liquid services required for the NexION ICP-MS. Tables 4 and 5 show the electrical supply requirements and approximate power consumption of the NexION ICP-MS and its major accessories.

Table 3. Gas and liquid services required for the NexION 1000/2000 ICP-MS.

Item	Operating Pressure	Flow at Operating Pressure
Argon (for purity, see page 9)	@ 586 – 690 kPa (85 – 100 psig) min-max	15-20 L/min (typical)
Ammonia ≥ 99.9995% pure (for 2000B/C/P instruments only)	@ 110 ± 7 kPa (16 ± 1 psig) operating	0.6 mL/min (typical)
Ammonia ≥ 99.999% pure (for 2000S instruments only)	@ 110 ± 7 kPa (16 ± 1 psig) operating	0.6 mL/min (typical)
Helium ≥ 99.9999% pure	@ 110 ± 7 kPa (16 ± 1 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	@ 413 ± 14 kPa (60 ± 2 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.

PerkinElmer instruments will normally operate within a ±10% range of the specified voltage and within ±1 Hz of the specified frequency, unless otherwise noted. 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 (please speak to a PerkinElmer Sales Specialist about your power conditioner and UPS options). A means of electrically grounding the instruments and accessories must be available. Power to the instrument should be clean from excessive high frequency noise.

Table 4. NexION 1000/2000 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

Table 5. Electrical requirements for NexION 1000/2000 ICP-MS peripherals.

Equipment	Voltage (AC)	Power
Computer	100-127/200-240 V, 50/60 Hz	800 W typical
Printer	100-127/200-240 V, 50/60 Hz	800 W typical
Roughing Pump*	200-240 V, 50/60 Hz, 12 A	1500 W
Refrigerated Chiller*		
Standard 50 Hz Model	240 V, 50 Hz, 13.5 A	2650 W
Standard 60 Hz Model	230 V, 60 Hz, 13.5 A	2900 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). Can be verified by an oscilloscope or power meter.

* *American National Standards Institute (ANSI) is a private, non-profit organization that administers and coordinates the U.S. voluntary standards.*

* *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.*

The vacuum roughing pump is provided with a mains supply plug suitable for the country of installation (shown in Figure 4) and must be connected to a separate branch circuit/wall outlet. It requires one 12A single-phase 200-240 V outlet – see Table 5. See Figure 3 (page 5) 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 4. Vacuum roughing pump mains supply plugs.

WARNING

MAGNETIC SUSCEPTIBILITY. Do NOT place NexION 1000/2000 ICP-MS close to any other instrumentation or equipment that emits high magnetic fields. External magnetic field strength must not exceed 10 Gauss at NexION 1000/2000 ICP-MS.

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 5.

Figure 5. IEC 60309 connector.

WARNING

EXPLOSIVE ATMOSPHERE. The use of ICP-MS instruments without adequate ventilation to outside air may constitute a health hazard.

Exhaust and Ventilation Requirements

Figure 6. Location of exhaust ports.

The NexION ICP-MS has a single exhaust port.

The NexION ICP-MS exhaust port is located on the top of the instrument (Figure 6). The center of the exhaust port is located 35.5 cm (14 in.) from the right side of the instrument and 35.5 cm (14 in.) from the back of the instrument.

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 torch housing, and to remove reaction cell gas. Exhaust venting is important for four 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 ICP torch stability.
- It helps protect the instrument from corrosive vapors which may originate from the samples.
- It removes dissipated heat which is produced by the ICP torch.

The exhaust port always has 1.25 cm (0.5 in.) of water (125 Pa) static pressure. The exhaust ports should be connected directly 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 or the NexION ICP-MS will not ignite the plasma.

We recommend using the 100 mm (4 in.) exhaust hose shipped with the instrument. The NexION ICP-MS is supplied with 3 meters (11 ft.) of 100 mm (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 1.4 meters (4 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.

Venting System Recommendations

The exhaust flow rate at the instrument (the ability to vent the system) is dependent on customer-provided blower, the duct length, 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 45 degrees between straight sections to reduce friction losses, and the number of elbows should be minimized.

Additional recommendations on the venting system 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 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 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.
- 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 lab 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 to check the flow, making sure that you remove this afterwards.
- Equip the blower with an indicator light located near the instrument to indicate to the operator when the blower is on.

Table 6. Instrument exhaust ventilation requirements.

	Required airflow Measured with hose connected to NexION	Required air velocity Measured with hose connected to NexION	Reference airflow Measured with hose disconnected from NexION	Reference air velocity Measured with hose disconnected from NexION
Instrument Exhaust Port	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)	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	Hose Diameter	Heat Vented Outside Lab Watts (BTU/hr)
Instrument Exhaust	10 cm (4 in.)	1800 (6142)

Cleaning the Instrument

Before using any cleaning or decontamination methods, except those specified by the manufacturer, users should check with the manufacturer that the proposed method will not damage the equipment.

Cleaning procedures can be found in the NexION ICP-MS Maintenance Guide.

Coolant Requirements

The NexION ICP-MS system requires a regulated source of filtered coolant. PerkinElmer coolant (Part No. WE016558) must be used on the NexION ICP-MS instrument. The chiller operating pressure should be 413 ± 14 kPa (60 ± 2 psig). A coolant flow of at least 3.8 L/min (1.0 gpm) is required.

A cooling fluid containing a corrosion inhibitor is specified to protect the aluminum components of the cooling system and the interface. Six liters of pre-mixed coolant (Part No. WE016558) are supplied for the refrigerated chiller. A refrigerated chiller is required. A simple heat exchanger cannot be used.

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

For 50 Hz installations, the refrigerated chiller comes with a CEE 7 connector.

Gas Requirements

Argon Gas Requirements

Argon is used as the torch gas with the NexION ICP-MS. The argon gas criteria are listed below.

Argon purity	≥ 99.996%
Oxygen	< 5 ppm
Hydrogen	< 1 ppm
Nitrogen	< 20 ppm
Water	< 4 ppm

It is also important to note that the amount of krypton impurity in the argon gas will negatively affect the ability of the instrument to quantitate selenium. The best selenium detection limits are achieved when krypton < 0.1 ppb (0.0001 ppm).

Either liquid or gaseous argon can be used with an 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. 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. A tank of gaseous argon will last 5 to 6 hours of ICP-MS running time. The normal argon gas usage is 14-20 L/min.

A cylinder regulator (Part No. 03030284), which can be used with argon, is available from PerkinElmer. The regulator can be used with CGA 580 fittings and includes a color-coded hose with 1/4-inch Swagelok® fittings to permit direct connection to the regulator and to the instrument gas controls. Liquid argon may be purchased from your gas supplier.

PerkinElmer ICP-MS instruments include 3 meters (10 ft.) of the tubing necessary for connecting argon to the instrument (Part No. 09985715).

Cell Gas Requirements

The NexION 1000/2000 ICP-MS systems are equipped with either a single channel (1000 instruments) or triple channel (2000 instruments) Universal Cell Technology gas manifold. The customer is required to supply the reaction or collision gas (also referred to as cell gas) for introduction into the Universal Cell. The type of gas used varies with the customer application, but the most common cell gas used with the NexION 1000 ICP-MS is ultra-pure helium; the most common cell gases used with the NexION 2000 ICP-MS are ultra-pure helium, anhydrous ammonia, and oxygen.

IMPORTANT! Ammonia must never be used with NexION 1000 instruments, as they do not include the necessary infrastructure.

Depending on the NexION ICP-MS configuration, PerkinElmer may provide the pressure regulator(s), gas delivery tubing, and purifier for use with UHP helium and/or UHP anhydrous ammonia. The pressure regulators are capable of supplying the cell gases at the working pressures listed in Table 8.

Regulators purchased from PerkinElmer ship with the regulator-to-cylinder fittings listed in Table 8. The cell gas cylinders should use these types of fittings when ordered from your local gas supplier. The cleanliness of the cell gas lines is critical for analytical performance. There should be no additional fittings between the regulator, purifier, and the instrument.

The NexION ICP-MS requires specially cleaned stainless steel VCR cell gas lines (included). Cell tubing shipped with the instruments is either 1.5 m (5 ft.) or 3 m (10 ft.) lengths. Two 1.5 m lengths are shipped with each NexION 1000 and 2000B/C/P. The NexION 2000S ships with two 3 m lengths and two 1.5 m lengths of clean SS tubing. Additional lengths of specially cleaned cell gas tubing are available from PerkinElmer: 3 m (Part No. N8150110).

The cell gases used by the Universal Cell must meet the specifications as shown 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 the special gas purifier provided with each instrument.

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. The helium/hydrogen mixed cell gas also uses the special helium gas purifier provided.

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

NexION 2000 ICP-MS instruments only: The ammonia gas is consumed at a typical rate of 0.6 mL/min; therefore, only a very small cylinder (60 L, 2 ft^3) of gas is required.

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 8, the customer 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.

Table 8. Cell gas regulators and requirements for the NexION 1000/2000 ICP-MS.

Available Cell Gas Regulators	Regulator-to-Cylinder Connection	Cell Gas Used and Purity Specification	Operating Flow Rate and Pressure
UHP dual stage for He with VCR output (Part No. N8152569)	CGA 580	Helium UHP He ≥ 99.9999% pure	5 mL/min @ 110 ± 7 kPa (16 ± 1 psig)
UHP dual stage for NH_3 *NexION 2000 ICP-MS instruments only* with VCR output (Part No. N8152566)	CGA 660	Ammonia UHP NH_3 ≥ 99.9995% pure (model dependent - see Table 9)	0.6 mL/min @ 110 ± 7 kPa (16 ± 1 psig)
UHP dual stage for He + H_2 with VCR output (Part No. N8152567)	CGA 350	Helium with 7% Hydrogen UHP He + 7% H ≥ 99.999% pure	5 mL/min @ 110 ± 7 kPa (16 ± 1 psig)
UHP dual stage for CH_4 with VCR output (Part No. N8152567)	CGA 350	Methane UHP CH_4 ≥ 99.999% pure	0.5 mL/min @ 110 ± 7 kPa (16 ± 1 psig)
UHP dual stage for O_2 with VCR output (Part No. N8152568)	CGA 540	Oxygen UHP O_2 ≥ 99.999% pure	0.5 mL/min @ 110 ± 7 kPa (16 ± 1 psig)

Table 9. Cell gas purity requirements for the NexION 1000/2000 ICP-MS.

Gas	Purity Grade	Impurity	Specification	Notes
Helium (He)	≥ 99.9999%	O_2 H_2O THC N_2	< 0.1 ppm < 0.2 ppm < 0.1 ppm < 0.4 ppm	This grade of gas can be input directly into the NexION ICP-MS. External purifier not required.
Helium (He)	≥ 99.999%	O_2 H_2O THC N_2	< 1 ppm < 2 ppm < 0.5 ppm < 5 ppm	This grade of gas requires the use of an external gas purifier (supplied).
Ammonia (NH_3) *NexION 2000B/C/P ICP-MS instruments only*	≥ 99.9995%	O_2 H_2O THC N_2	< 1 ppm < 1 ppm < 1 ppm < 1 ppm	This grade of gas can be input directly into the NexION ICP-MS.
Ammonia (NH_3) *NexION 2000S ICP-MS instruments only*	≥ 99.999%	O_2 H_2O THC N_2	< 2 ppm < 5 ppm < 1 ppm < 3 ppm	This grade of gas can be input directly into the NexION ICP-MS.
Helium with 7% Hydrogen	Helium ≥ 99.999% with 7% Hydrogen mixed in	O_2 H_2O THC N_2	< 1 ppm < 3 ppm < 0.5 ppm < 5 ppm	This grade of gas requires the use of an external gas purifier (supplied).
Oxygen (O_2)	≥ 99.999%	H_2O THC N_2 CO CO_2 Kr Ar	< 1 ppm < 0.5 ppm < 5 ppm < 1 ppm < 1 ppm < 1 ppm < 5 ppm	This grade of gas can be input directly into the NexION ICP-MS.

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