PREPARING YOUR LAB

ICP - Mass Spectrometry

Introduction

This document provides information to assist in preparing your laboratory site for the **NexION® 2200 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 the system installation, please keep this document for future reference in case your instrument needs to be relocated.

PREPARATION CONSIDERATIONS

- Environmental requirements
- General laboratory requirements
- Location and space requirements
- Connections
- Facilities requirements
- Electrical requirements
- Exhaust and ventilation requirements
- Laboratory air conditioning requirements
- Liquid cooling requirements
- Gas requirements
- Computer requirements
- Site validation checklist

The NexION 2200 ICP-MS is a complete system that works in conjunction with the following items which must be provided by your laboratory prior to scheduling installation of the system: electrical power, exhaust vents, argon gas supplies with an approved regulator, high-purity reaction cell gases with approved regulators for reactive gases and coolant system.

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 approximately 159 kg (350 lbs.) with lifting handles; it will require a forklift, lifting table, portable gantry crane, 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 lift the instrument manually using these lifting handles; this would require at least six people and would constitute a hazard to both personnel and the instrument.
- Table 1 (Page 4) lists the weight and dimensions of the system both with and without lifting 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.).

Note: transport on PerkinElmer-approved wheeled benches will allow the instrument and bench to pass through 91 cm (36 in.) wide doors.

Environmental Requirements

Laboratory Environment

The NexION 2200 ICP-MS system is 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.

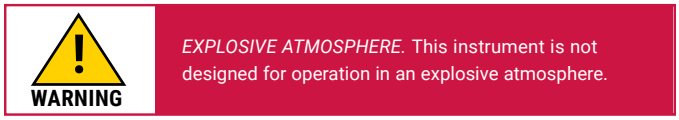
Temperature and Humidity

The laboratory environment in which the NexION 2200 ICP-MS instrument is installed should meet the following conditions:

- Temperature: 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. **For optimum performance, the room temperature should be controlled at 20 ± 2 °C (68 ± 3.6 °F).**
- Humidity: The relative humidity should be between 20 and 80%, non-condensing. **For optimum performance and prolonged instrument lifetime, the relative humidity should be between 35 and 50% non-condensing. High relative humidity and presence of corrosive fumes will adversely affect instrument lifetime.**
- 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 or pumps
- Out of direct sunlight
- Away from heat radiators and HVAC supply registers by at least 3 meters



Cleanroom Operation

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 2200 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.

The NexION 2200 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

For long-term storage or transport after use – ensure the NexION instrument has been drained of all internal coolant liquid to avoid freezing when exposed to low ambient temperatures.

The following conditions are the recommended long-term storage conditions for the instrument when not in operation:

- 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.

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 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 or 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.
- Always wear appropriate eye protection 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

General Space Considerations

The system should be located near the required electrical, gas, and coolant supplies.

- Allow space on the right and left sides of the instrument for the computer workstation or any accessories.
- The main air intake is on the right-hand side of the instrument and a minimum of 20 cm (8 in.) clearance is required from the intake.
- The NexION 2200 ICP-MS can be operated with the back within 2.5 cm (1 in.) 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 or the ability to move the instrument if on a wheeled bench away from the wall.

System Components

The ICP-MS system consists of the main instrument, roughing pump, the computer controller assembly, and a cooling device. The dimensions of the NexION 2200 instrument and GreenCT cooling system are given in Figures 1 and 2, respectively. Table 1 lists the dimensions of the instrument and the computer, along with the dimensions of the peripherals and accessories.

Figure 1. Dimensions of the NexION 2200 ICP-MS spectrometer.

Figure 2. Dimensions of the GreenCT cooling system.

Table 1. Dimensions of the instrument, computer, peripherals, and accessories.

Instrument	Width cm (in.)	Height cm (in.)	Depth cm (in.)	Weight kg (lb.)
NexION 2200 ICP-MS	81 (32)*	73 (29)	72 (28)*	150 (330)
Computer	Dimensions will vary by model			
Monitor	Dimensions will vary by model			
Vacuum Roughing Pump	50 (20)	30 (12)	30 (12)	45 (100)
GreenCT Cooling System	24 (9.5)	54 (21)	44 (17)	15 (33)
Refrigerated Chiller Standard 50/60 Hz Models	38.1 (15)	56 (22)	66 826)	68.5 (151)
Optional Autosamplers S23 Autosampler S25 Autosampler	57 (22.5) 79 (31.5)	45 (18) 45 (18)	53 (21) 53 (21)	9.5 (21) 13.5 (30)

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

System Layout

When considering layout of the NexION 2200 ICP-MS and associated components, include additional accessories required for analytical measurement. 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 ease of access.

Figure 3 depicts a system layout that incorporates typical system components. Note the NexION 2200 can operate with either a GreenCT cooling system or a refrigerated chiller. Refer to the *Liquid Cooling Requirements* section for more specific requirements.

System Benches

Table 2. Dimensions of the PerkinElmer-recommended benches.

Bench	Width cm (in.)	Height cm (in.)	Depth cm (in.)	Side Shelf	Acoustic Barrier	Casters	Vacuum Dolly	Storage Bins
N8142011	89 (35)*	74 (29)	76 (30)	2x (18x30 and 12x30)	✓	✓	**	
N8141230	152 (60)*	74 (29)	76 (30)	1x (18x30)	✓	✓	✓	✓

* Width of the N8142011/N8141230 can be extended with the use of a side shelf, it is not recommended using the shelving to support the instrument.
** We highly recommend the purchase of the pump dolly (N8142012) with bench N8142011.

PerkinElmer benches come standard with acoustic barriers for locating the roughing pump underneath. Benches are movable and can be utilized to transport instruments as well as adjusting for space constraints.

Roughing pump location:

- Recommended location is underneath the instrument.
- The vacuum line connects to the right side of the instrument and is 2 m (6.5 ft.) in length.
- Roughing pump can be located up to 3 m (10 ft.) away from the instrument with 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 25 mm (1 in.) i.d. The power cord for the roughing pump is 2 m (6.5 ft.) in length. The electrical receptacle for the roughing pump should be located within this distance.
- The communication cable for the roughing pump is 3 m (10 ft.) in length and the instrument must be located within this distance to the roughing pump.

GreenCT cooling system location:

- The coolant lines supplied with the instrument are 3 m (10 ft.) in length. Ensure the GreenCT is installed within this distance.
- The communication cable from the GreenCT to the left-hand side of the instrument is 3 m (10 ft.).
- The power cable for the GreenCT is 2 m (6.5 ft.) long. The electrical receptacle for the GreenCT must be located within this distance.

Chiller location:

- The coolant lines supplied with the instrument are 3 m (10 ft.) in length. If the chiller is to be located further away than approximately 2 m (6.5 ft.) from the instrument, longer lines will need to be provided - please consult your PerkinElmer Service Representative.
- The communication cable from the chiller to the left-hand side of the instrument is 3 m (10 ft.). If the chiller is to be placed remotely and a longer cable is necessary, please consult your PerkinElmer Service Representative.
- The power cable for the chiller is 2 m (6.5 ft.) long. The electrical receptacle for the chiller must be located within this distance.
- Computer location: 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.

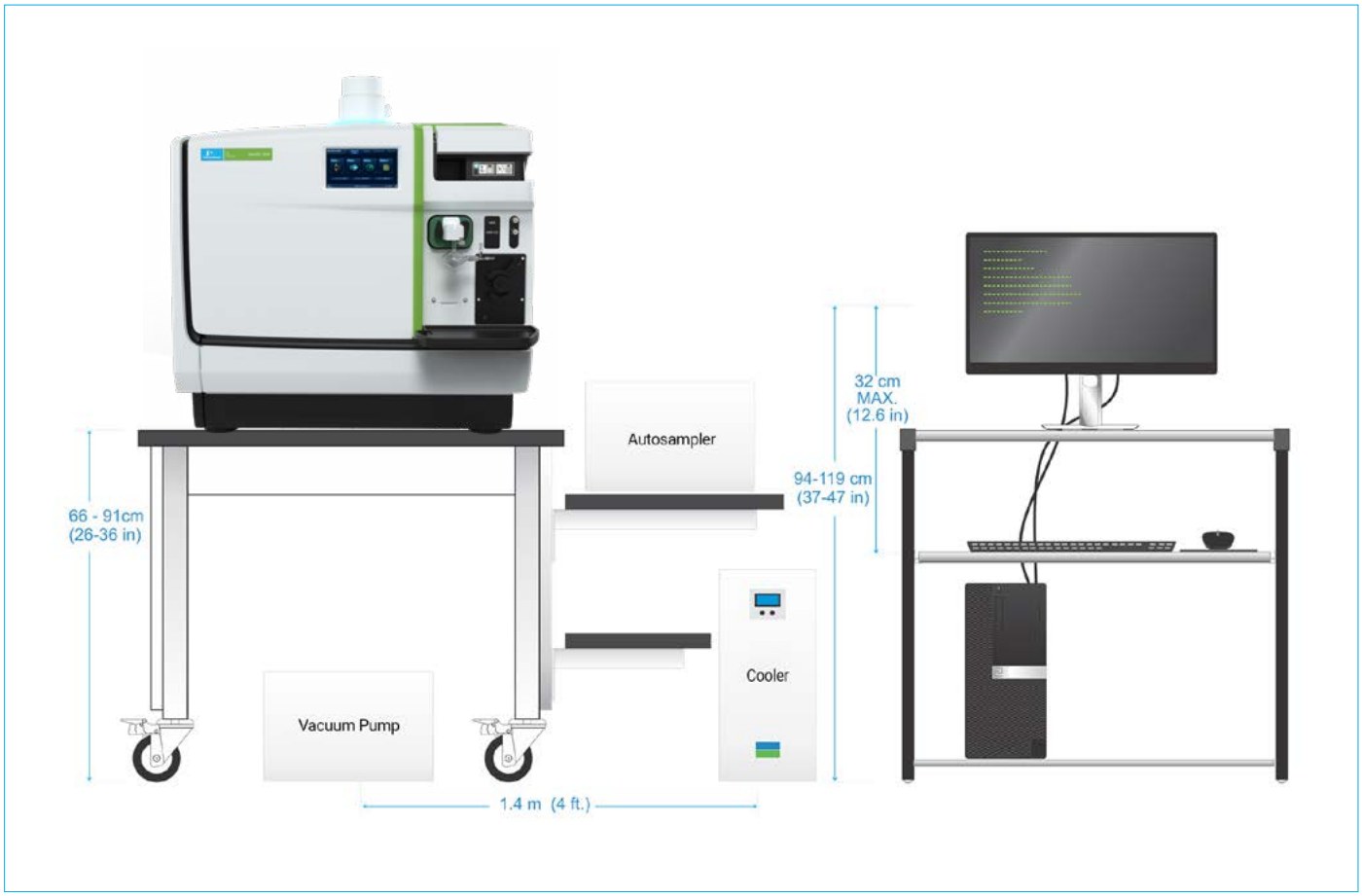


Figure 3. Recommended workstation layout.

The NexION 2200 ICP-MS can be positioned in either a linear or an L-shaped configuration. In the L-shaped configuration, the computer and monitor 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 3.

Connections

Illustrated in Figure 4 are the connection locations and lengths.

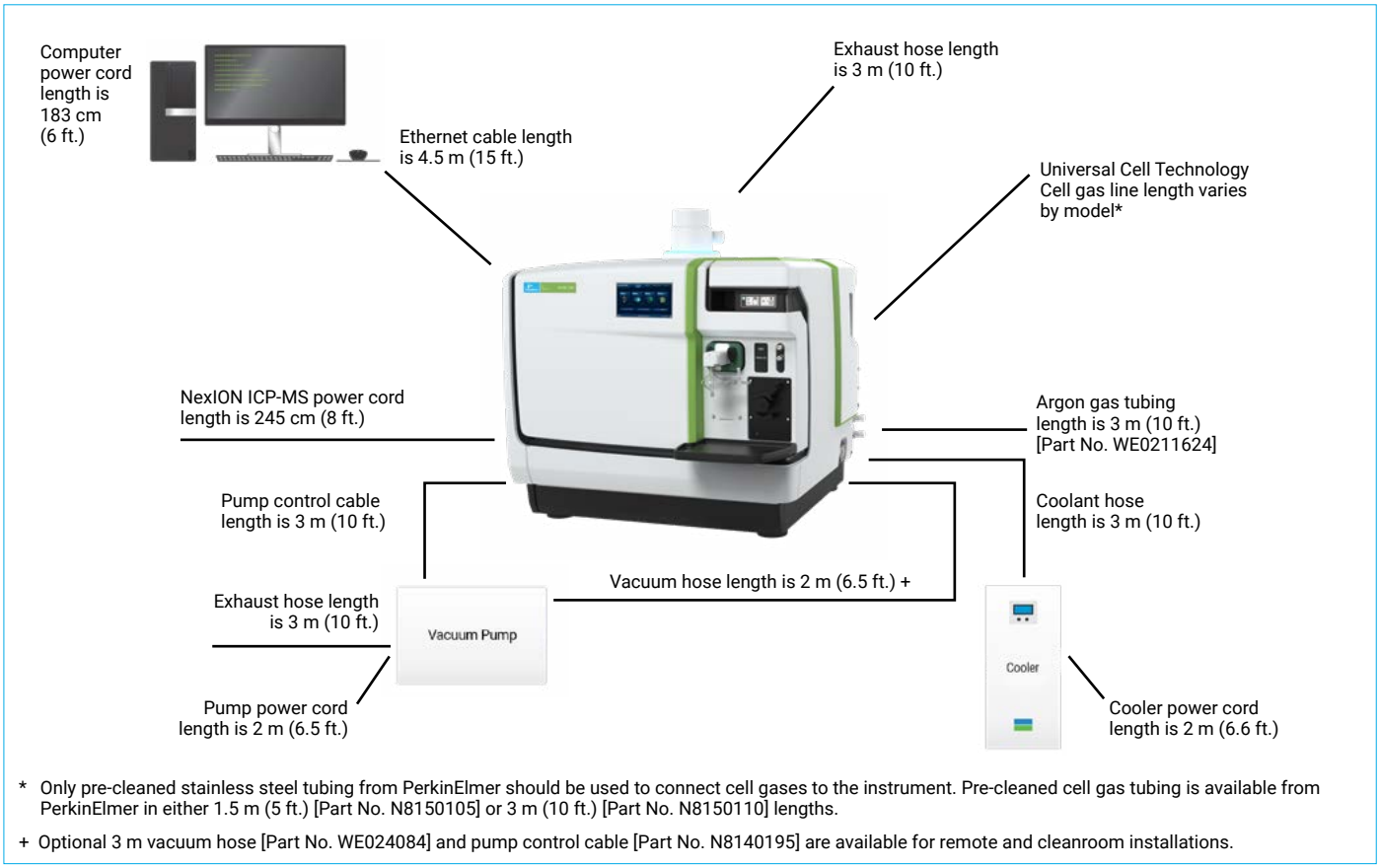


Figure 4. Location and length of connections.

Facility Requirements

Drainage and Overflows

A drain vessel is supplied with the NexION 2200 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 2200 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 in a secondary containment vessel (not provided). 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.

Electrical Requirements

Power to the NexION 2200 ICP-MS must meet the requirements specified in Table 3. Table 3 also provides the electrical supply requirements and approximate power consumption of the standard ancillary components. Number and type of receptacles depends upon the system components to be used. Review the system components.

The NexION 2200 ICP-MS will normally operate within ± 10% of the specified voltage range 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.

- 10% allowable voltage variance
- 5% maximum allowable percent sag
- 5% maximum allowable percent swell

Power to the instrument should be clean from excessive high-frequency noise. Please speak to a PerkinElmer Service Representative about your power conditioner and UPS options.

Table 3. Electrical requirements for NexION 2200 ICP-MS and peripherals

Equipment	Continuous Current	Circuit Breaker Rating	Voltage (AC)	Operating Frequency	Power
NexION 2200 ICP-MS*	16 A	20 A	200-240 V	50/60 Hz	
Computer/Monitor/Autosamplers			100-127/200-240 V	50/60 Hz	800 W typical
Roughing Pump**	12 A	15 A	200-240 V	50/60 Hz	1500 W
Chiller 50 Hz Model	13.5 A	15 A	240 V	50 Hz	2650 W
Chiller 60 Hz Model	13.5 A	15 A	230 V	60 Hz	2900 W
GreenCT Cooling System***			110-240 V	50/60 Hz	300 W

* NOTE: Ground fault circuit interrupters (GFCI) is not recommended to power the NexION 2200. It may cause nuisance power interruptions at power transitions. IEC 603309-1 connector on the power cord is equivalent to permanent wiring and provides reliable protection in case of ground fault conditions.
** NOTE: A minimum circuit rating of 15 amps is required for the Roughing Pump and Refrigerated Chiller mains connections.
*** NOTE: Operates on standard/typical receptacles that would normally operate Computer/Monitor/Autosamplers.

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.*

WARNING

MAGNETIC SUSCEPTIBILITY. Do NOT place NexION 2200 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 2200 ICP-MS.

Mains Connection

The instrument is shipped with one 2.4 m (8 ft.) AC mains cord terminated by an IEC 60309 connector rated 20 A by UL (North America) and 16 A by VDE (International) for 250 V, as shown in Figure 5. 16/20A A 230/250V EN60309 receptacle is included with the instrument installation kit.

Figure 5. IEC 60309 connector.

The vacuum roughing pump is provided with a mains supply plug suitable for the country of installation (shown in Figure 6) and must be connected to a separate branch circuit/wall outlet. It requires one 12 A single-phase 200-240 V outlet – see Table 4. See Figure 4 (page 6) 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 6. Vacuum roughing pump mains supply plugs.

Exhaust and Ventilation Requirements

Figure 7. Location of exhaust ports.

WARNING

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

The NexION 2200 ICP-MS has a single exhaust port, that has a 10 cm (4 in.) diameter. The NexION 2200 ICP-MS is supplied with 3 meters (11 ft.) of 10 cm (4 in.) flexible tubing. The exhaust port is located on the top of the instrument (Figure 7). The center of the exhaust port is located 39.9 cm (15.7 in.) from the left side of the instrument and 40.6 cm (16 in.) from the back of the instrument. This tubing permits the movement of the instrument without disconnecting the vents from the laboratory system. See Tables 4 and 5 for vent and cooling specifications.

The torch box exhaust must be connected and set to the correct exhaust flow rate, or the NexION 2200 ICP-MS will not ignite the plasma.

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 exhausts the following:

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

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.

Venting System Recommendations

The exhaust flow rate at the instrument (the ability to vent the system) is dependent on the laboratory-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 ducting should be used instead of flexible stainless steel ducting, 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 ducting 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:

- Ensure the instrument is on its own dedicated venting system to avoid flow disruptions caused by other equipment that may render the instrument inoperable.
- Ensure the duct casing and venting system are 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 10 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 4. NexION 2200 ICP-MS exhaust ventilation requirements.

	Reference Airflow	Reference Air Velocity
	Measured with hose disconnected from NexION	
Instrument Exhaust Port	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)

Note: If an in-line flow meter is used to monitor the airflow in real time, the airflow observed will typically be between 73 – 100 ft^3/min @ 0.5" H_2O (35 – 47 L/sec @ 125 Pa) or an air velocity of 836 – 1145 ft/min @ 0.5" H_2O (4.3 – 5.8 m/sec @125 Pa). These values will not be used for installation. Your service engineer will measure the flow with the exhaust disconnected to make sure it meets the values listed in Table 4 above.

Laboratory Air Conditioning Requirements

The NexION 2200 ICP-MS and system components will generate heat during operation and standby. The air conditioning system must be capable of maintaining a constant temperature during the operation of the instrument and system.

For approximate heat loading into the environment, Table 5 provides guidance on the maximum heat generation of the system and components. To understand the laboratory air conditioning needs, simply sum the devices located in each room or location to determine the heat dissipation and heat load into the local environment.

Table 5. System components and the maximum heat dissipation / generation in BTU.

System Component	Maximum Heat Dissipation (W)	Heat Generation (BTU/hr)
Instrument Exhaust	1800	6142 – Vented Outside
Instrument	1000	3400
Roughing Pump	1500	5100
Refrigerated Chiller	3000	10000
GreenCT Cooling System	300 + 1500 (during operation)	1100 (6100 during operation)
Monitor	30	100
Computer	450	1500

Roughing Pump Cooling Requirements

- The heat from the roughing pump is released into the laboratory.
- Proper air movement / 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 refrigerated chiller.
- The ambient air temperature must NOT exceed 40 °C at the roughing pump control electronics.

Refrigerated Chiller Cooling Requirements

- The heat from the refrigerated chiller is released into the laboratory during operation.
- The refrigerated chiller will produce a maximum of 3000 W (10,000 BTU/hr.) of heat.
- Proper air movement/ventilation is required to remove this heat from the room or any space 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.

GreenCT Cooling Requirements

- The heat from the GreenCT cooling system is released into the laboratory during operation.
- The GreenCT will produce a maximum of 1800 W (6,100 BTU/hr.) of heat during operation.
- Adequate clearance should be allowed on the front, sides, and rear of the unit for access to connections and components. The side vent of the unit must be a minimum of 61 cm (2 ft.) away from walls or vertical surfaces, so air flow is not restricted.
- Air intake should be at least 0.9 meters (3 ft.) away from any heat-generating sources, such as the roughing pump.
- Proper ventilation is critical for the GreenCT – its ambient air temperature must never exceed 30 °C.

Instrument and Peripheral Devices

- All components will produce heat during operation or idle state.
- Air conditioning should account for additional system components in operation.

Liquid Cooling Requirements

The NexION 2200 ICP-MS system requires a regulated source of filtered coolant. The system has been designed to operate with refrigerated chillers or PerkinElmer's GreenCT cooling system. A simple heat exchanger cannot be used.

Selecting your Cooling Device

Depending on the temperature control and stability of the laboratory environment, there are two options available for liquid cooling of the NexION 2200:

- If laboratory temperatures can be maintained consistently between 15 °C and 30 °C in a well-regulated control within (3-5 °C), then the GreenCT cooling system option is recommended. Laboratory temperatures must not exceed 30 °C when operating the GreenCT.

- If the laboratory temperature is not well regulated and fluctuates throughout the day, it is recommended to purchase a refrigerated chiller and locating away from the instrument due to the unregulated heat loading in the laboratory.

Cooling devices purchased from PerkinElmer will be supplied with the correct power connectors – power requirements are provided in the *Electrical Requirements* section.

- The 60 Hz refrigerated cooler comes with a NEMA L6-15P connector.
- The 50 Hz refrigerated cooler comes with a CEE 7 connector.
- The GreenCT cooling system comes with the connector suitable for your region.

Cooling Requirements

- Recommended new cooling systems GreenCT (N8170066), Polyscience (N0772050/N0772051, N0772045/N0772046), LabTech (N0791873) should use the new Green Coolant (N8171229).
- Note: GreenCT (N8170066) – must NOT be operated with PE Coolant (WE016558) and is incompatible.
- If not using a preferred PerkinElmer cooling system, PE Coolant (WE016558) must be used.
- If using legacy chillers or a central cooling system, it is recommended to stay with the coolant that is in use.

Table 6. Available cooling devices and coolant compatibility.

Cooling Device Part No.	Cooling Device	Green Coolant (N8171229)	PE Coolant (WE016558)
N8170066	GreenCT	Compatible	Not Compatible
N0772050/N0772051	Polyscience	Compatible	Compatible
N0772045/N0772046	Polyscience	Compatible	Compatible
N0791873	Lab Tech	Compatible	Compatible
OEM Cooling Device	n/a	Not Compatible	Compatible

Selecting your Coolant

Green Coolant:

- PerkinElmer's Green Coolant (Part No. N8171229) can be used with the GreenCT cooling system as well as certain refrigerated chillers. See Table 6 for more information.
- Operating pressure of cooling devices with the Green Coolant will be reduced approximately 30 psig with the GreenCT cooling system and 40-45 psig for refrigerated chillers at a coolant flow 3.8 L/min (1.0 gpm).
- Four liters of Green Coolant (Part No. N8171229) should be purchased for GreenCT and refrigerated chillers for the standard 3 m (10 ft.) chiller lines.
- Longer cooling lines only for the refrigerated chiller will require additional coolant.

PE Coolant:

- PerkinElmer's PE Coolant (Part No. WE016558) must only be used on refrigerated chillers.
- It must not be used on the GreenCT cooling system.
- The chiller's operating pressure must be 60 ± 2 psig to supply the coolant flow of at least 3.8 L/min (1.0 gpm).
- 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. WE106558) should be purchased for the refrigerated chiller only.

Gas Requirements

Before proceeding with any gas supplies, please consult your local and building requirements for safe handling of any pressurized gas cylinders or dewars. NOTE: The permanent installation of gas supplies is the responsibility of the laboratory and should conform to local safety and building codes.

Safe Handling of Gas Cylinders

- Fasten all gas cylinders securely to an immovable bulkhead or a permanent wall.
- All reaction/collision gas cylinders should ideally be located within 2.44 m (8 ft.) of the right-hand side of where the NexION ICP-MS is expected to be positioned. If cylinders need to be located further away, please consult with your PerkinElmer Service Representative.
- 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).
- 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 yourselves.
- 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.
- It is not recommended to use flashback arrestors when using flammable gases such as oxygen, hydrogen, methane etc. for ICP-MS applications, as the materials in these arrestors can introduce contamination into the ICP-MS system. Moreover, the typical flows of these gases in ICP-MS applications are very low, and consequently, flashback arrestors are unnecessary.
- Arrange gas lines 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 2.44 m (8 ft.) from the instrument.

Argon Gas Requirements

Argon is used as the ICP/system gas with the NexION 2200 ICP-MS. 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). Argon gas purity is provided in Table 7. 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.

Table 7. Argon purity requirements for the NexION 2200 ICP-MS.

Gas	Purity Grade	Impurity	Specification	Notes
Argon (Ar)	≥ 99.996%	O_2 H_2O THC N_2	< 5 ppm < 4 ppm < 1 ppm < 20 ppm	Main gas for plasma, nebulizer and AMS flows

Liquid Argon Supply

Liquid argon is usually less expensive per unit volume to purchase but cannot be stored for extended periods. Contact your gas supplier for liquid argon options. If liquid argon is used, the tank should be fitted with an over-pressure regulator which will vent the tank as necessary 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.

When using a liquid source of argon, a stainless steel single-stage argon regulator is highly recommended. The regulator must be installed within 3 m (10 ft.) of the instrument. PerkinElmer can supply the regulator on request (Part No. N8160125) and is available for purchase. Note: The NexION 2200 includes 3 m (10 ft.) of the tubing necessary to connect your argon supply to the instrument (Part No. WE021624).

Example of liquid argon consumption: The normal argon gas usage 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, however, it should be noted that these types of gas tanks vent naturally to the atmosphere, therefore depending on usage and rate of venting, a liquid argon tank will typically need to be replaced approximately every 2-3 weeks.

Gaseous Argon Supply (Cylinder)

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.

Example of cylinder argon consumption: The normal argon gas usage is 14-20 L/min: A standard compressed cylinder of gaseous argon will last 4-6 hours of ICP-MS running time.

UCT Gas Requirements

The NexION 2200 ICP-MS system is equipped with a triple channel Universal Cell Technology (UCT) gas manifold. The laboratory is required to supply any reaction or collision gases (also referred to as cell gases) required for the specific method or application for introduction into the Universal Cell. The type of gas used varies with the application, but the most common cell gases used with the NexION 2200 ICP-MS are ultra-pure helium, anhydrous ammonia, and oxygen.

Special Requirements for Connections

- Gas connections on the NexION 2200 ICP-MS are VCR-type gas fittings.
- All fittings and lines between the tank and the regulator (except the regulator-to-tank fitting) should be VCR fittings.
- In the event UltraTorr or Swagelok® fittings are present on the gas regulator, the following parts will need to be purchased per regulator to convert the regulator to VCR: 09920849 and 09220606.
- Plain, non-cleaned stainless steel cell gas tubing should never be used with the instrument.
- Only pre-cleaned stainless steel tubing from PerkinElmer should be used to connect cell gases to the instrument.
- Pre-cleaned cell gas tubing is available from PerkinElmer in either 1.5 m (5 ft.) [Part No. N8150105] or 3 m (10 ft.) [Part No. N8150110] lengths.
- If longer that 3 m (10 ft.) connections are required, please consult your local PerkinElmer Service Representative.
- There should be no additional fittings between the purifier/filter, and the instrument.

Cell Gas Regulators

Cell gas regulator connections vary by country and region. Consult your local supplier for regulators.

Requirements for cell gas regulators:

- Two-stage regulators
- Stainless steel diaphragms
- Output connection VCR fitting
- Working pressure of 15 ± 1 psig (103 ± 7 kPa) – most common regulator supply pressure will be 30 psig.
- Regulator-to-cylinder connection must match the gas cylinder to be used (confirm cylinder connection with your gas supplier)

Regulators purchased from PerkinElmer ship with the regulator-to-cylinder fittings listed in Table 8.

Table 8. Cell gas regulators and requirements for the NexION 2200 ICP-MS.

PerkinElmer Part No.	Gas Type	Working Range	Output Connection	Input Connection
N8152566	Ammonia	0-30 psig	VCR 1/8"	CGA 660
N8152567	Methane/Hydrogen	0-50 psig	VCR 1/8"	CGA 350
N8152569	Helium	0-50 psig	VCR 1/8"	CGA 580
N8152568	Oxygen	0-50 psig	VCR 1/8"	CGA 540

Cell Gas Purity

In addition to the cleanliness of the cell gas lines and regulators, purity of the cell gas is critical for analytical performance. The cell gases used by the Universal Cell must meet the specifications as shown in Table 9. The purity of any other cell gas not mentioned in Table 9 must be ≥ 99.999% pure.

Table 9. Cell gas purity requirements for the NexION 2200 ICP-MS.

UCT 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 2200 ICP-MS. External purifier not required.
Helium (He) with external gas purifier	≥ 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.
Ammonia (NH_3)	< 0.1 ppm	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 2200 ICP-MS.
Ammonia (NH_3) **with optional Getter Kit**		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 2200 ICP-MS once upgraded with getter.
Helium (He) with 7% Hydrogen (H_2)	UHP He (≥ 99.9999%) with ≥ 99.999% H_2 at ratio of 93:7, i.e. 7% H_2	O_2 H_2O THC N_2		This grade of gas can be input directly into the NexION 2200 ICP-MS.
Oxygen (O_2)	This grade of gas can be input directly into the NexION 2200 ICP-MS. External purifier not required.	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 2200 ICP-MS.

Helium Gas

The 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 special helium filter.

A dedicated UHP helium cylinder is required; house helium supplies must not be used.

A helium cell gas kit should be purchased (Part No. N8150123) which contains 2 x 5 ft. lengths of pre-cleaned stainless steel gas tubing and a specialized helium filter. To perform an IQ/OQ using helium, an IQ/OQ kit (Part No. N8150068) should be purchased.

Helium/Hydrogen Gas Mix

Helium mixed with 7% hydrogen can also be used as an effective cell gas. The helium/hydrogen gas must be ≥ 99.999% pure, with 7% hydrogen mixed into the helium (this mixture can be purchased from gas manufacturers using the purity of the gases listed in Table 9). The helium/hydrogen mixed cell gas also requires the use of a special helium gas purifier which can be found in the Helium Cell Gas Kit (Part No. N8150123).

Ammonia Gas

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.

UCT Gas Cylinders

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, the laboratory must purchase a UHP double-stage regulator capable of supplying up to 15 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.

Considerations on the size of the cylinders and location of the UCT gases is important for safety and frequency of replacement. Table 10 provides a recommendation on the typical gases that may be used during analysis. Please consult your local specialist for more information and cylinders that fit your requirements.

Table 10. Cell gas cylinder volume recommendation.

Gas	Purity Grade
Helium (He)	125-330 ft^3
Helium (He) with external gas purifier	125 -330 ft^3
Ammonia (NH_3)	20-30 ft^3
Helium with 7% hydrogen	125 -330 ft^3
Oxygen (O_2)	20-30 ft^3
Hydrogen (H_2)	20-50 ft^3

Computer Requirements

The NexION 2200 ICP-MS instrument 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 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 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.

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 2200 ICP-MS Maintenance Guide*.

Site Preparation Validation — NexION 2200 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, crate to bench, and bench to laboratory 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 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 air-conditioning, ventilation and exhaust infrastructure meet the requirements outlined herein and estimated heat loads generated by the system. 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 and all required receptacle types have been installed by your facility electrician.
☐	**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 of adequate quality and regulators have been acquired and installed in accordance with both the specifications outlined herein and the gas provider's recommendations. Pre-cleaned cell gas tubing, necessary filters 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.

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 2200 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

Component Procurement Responsibility

The NexION 2200 ICP-MS system involves several 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 2200 system. Contact your PerkinElmer Customer Support Representative for details.

Table 11: Component procurement responsibilities.

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 2200 ICP-MS* • Vacuum pump • Sample waste bottle	• Bench • Computer desk • Computer (including monitor, keyboard, mouse, and printer) • Chiller • GreenCT cooling system	• Bench for seismic zones • Computer desk for seismic zones (where required*)	• Power conditioner / UPS system • Enhanced Security software (to comply with 21 CFR Part 11) • IQ/OQ services	• Other waste containers/facility drain
• Sample introduction system (standard)		• HVAC and exhaust system • Power receptacles	• 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	• Argon supply • Cell gases • Gas storage cabinets • Facility gas safety infrastructure for hazardous gases	• Lengths of pre-cleaned cell gas tubing (5 ft; N8150105 or 10 ft; N8150110) • Longer-length cell gas tubing - consult your local PerkinElmer Service Representative • Helium cell gas kit (N8150123), if required	• Mains power cord lockout device • Argon supply lockout device
***Green 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 2200 ICP-MS user documentation set may affect system functionality, longevity, or sensitivity. Consult your PerkinElmer Customer Support Representative to ensure system compatibility.

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