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Varian 400-MR Magnetic Resonance Spectrometer Pre-installation Instructions

Checklist

NOTE: Do not unpack the boxes.

Mark the check box after satisfying each requirement as described in the instructions. All requirements must be met before requesting installation.

NOTE: If the laboratory is not ready for installation when the Varian Representative arrives, Varian, Inc. reserves the right to invoice for the Representative's time.

REQUIREMENTS	<input checked="" type="checkbox"/>
The installation site is in compliance with all relevant safety regulations. [page 3]	<input type="checkbox"/>
User Representative will be available during the installation, calibration, and acceptance. [page 3]	<input type="checkbox"/>
Instrument will be far enough away from external sources of vibrations and electromagnetic fields. [page 7]	<input type="checkbox"/>
Entrance and access to the installation location is adequate for system crates. [page 7]	<input type="checkbox"/>
Sufficient laboratory space is available for the system, including service access. [page 8]	<input type="checkbox"/>
Floor can support system weight. [page 8]	<input type="checkbox"/>
Ventilation is adequate to displace liquid helium gas during a quench. Consult with a safety engineer on this subject. [page 11]	<input type="checkbox"/>
Floor vibrations are within the specified limits. [page 11]	<input type="checkbox"/>
Relative humidity can be maintained within the specified range. [page 11]	<input type="checkbox"/>
Laboratory temperature can be maintained within the specified range. [page 12]	<input type="checkbox"/>
Laboratory is free of excessive particulate matter. [page 12]	<input type="checkbox"/>
Compressed air or nitrogen is clean and dry and the appropriate regulator and gas lines are installed. [page 12]	<input type="checkbox"/>
Specified electrical supply and power outlets are installed. [page 13]	<input type="checkbox"/>
The background magnetic field fluctuations are acceptable. [page 14]	<input type="checkbox"/>
The necessary supplies and equipment will be available for the installation. [page 15]	<input type="checkbox"/>
The appropriate facilities engineer and tools will be available to assist the field service engineer during magnet installation. [page 15]	<input type="checkbox"/>
The shipping cartons were examined for damage; any damage was reported. [page 18]	<input type="checkbox"/>

Request for Installation

After you prepare the site, contact Varian Customer Service in your region to schedule an installation. A list of contact numbers is on the Varian Web site:

http://www.varianinc.com/products/nmr/serv_supp/service_contacts.html

Keep this checklist nearby and review it with the Field Service Representative when you call.

Fax the completed pre-installation checklist to +1 866 262 3605.

Sales Order Number _____

Customer Name _____ Date ____/____/____

Contents

Introduction.....	3	Particulate Matter	12
Safety.....	3	Compressed Air for System Operation.....	12
User Representative.....	3	Electrical Power.....	13
400-MR Automation Suite.....	4	Magnetic Field	14
Installation Process Overview.....	5	Installation Requirements.....	15
Installation Site Requirements	6	Helium and Nitrogen Gas for Magnet Installation ..	15
General Site Considerations	7	Cryogenics for Magnet Installation.....	15
Laboratory Entrance Clearance	7	Magnet and 7600-AS Support Requirements.....	16
Laboratory Space and Load Requirements	8	Instrument Arrival	18
Ventilation	11	Inspection	18
Vibration	11	Unpacking and Installing	19
Humidity	11	Cryogenic Equipment Rack.....	19
Temperature.....	12	Preventive Maintenance.....	19

Introduction

The *Pre-installation Instructions* guide you through each requirement on the checklist. Have the completed checklist available when you call to schedule the installation. If you have any questions about the requirements listed in this document, contact Varian Customer Service.

The 400-MR operates under the environmental conditions specified in this document. The *Warranty and Service* contract specifically excludes the repair of failures caused by nonconforming environmental conditions.



All phases of the installation site preparation must conform to local safety, electrical, and building codes. These codes take precedence over any recommendations in these instructions, and the customer is responsible for compliance.

Safety

- Requirement: *The installation site is in compliance with all relevant safety regulations.***

Safety is the most important consideration for instrument installation and use. Determine if the installation site complies with all relevant local safety regulations and codes.

User Representative

- Requirement: *User Representative will be available during installation, calibration, and acceptance.***

Schedule the installation when the User Representative is available, because one of the important duties of the Varian Representative is to familiarize the User Representative with the basic functions of the 400-MR.

400-MR Automation Suite

The 400-MR Automation Suite is a collection of accessories that enhance the flexibility, ease-of-use, and sample throughput of the 400-MR system. The accessories provide:

- Automated probe tuning – OneNMR™ probe with ProTune-PZT.
- Automated sample handling – two sample handling options are the 96-sample 7600-AS or the 12-sample 7510-AS.

Site preparation requirements for these accessories are provided in this document. The OneNMR probe with ProTune-PZT and the 7519-AS have no requirements that are not covered by the 400-MR. The 7600-AS has additional site preparation requirements, including location, electrical, and compressed air.



400-MR System



7600-AS Autosampler



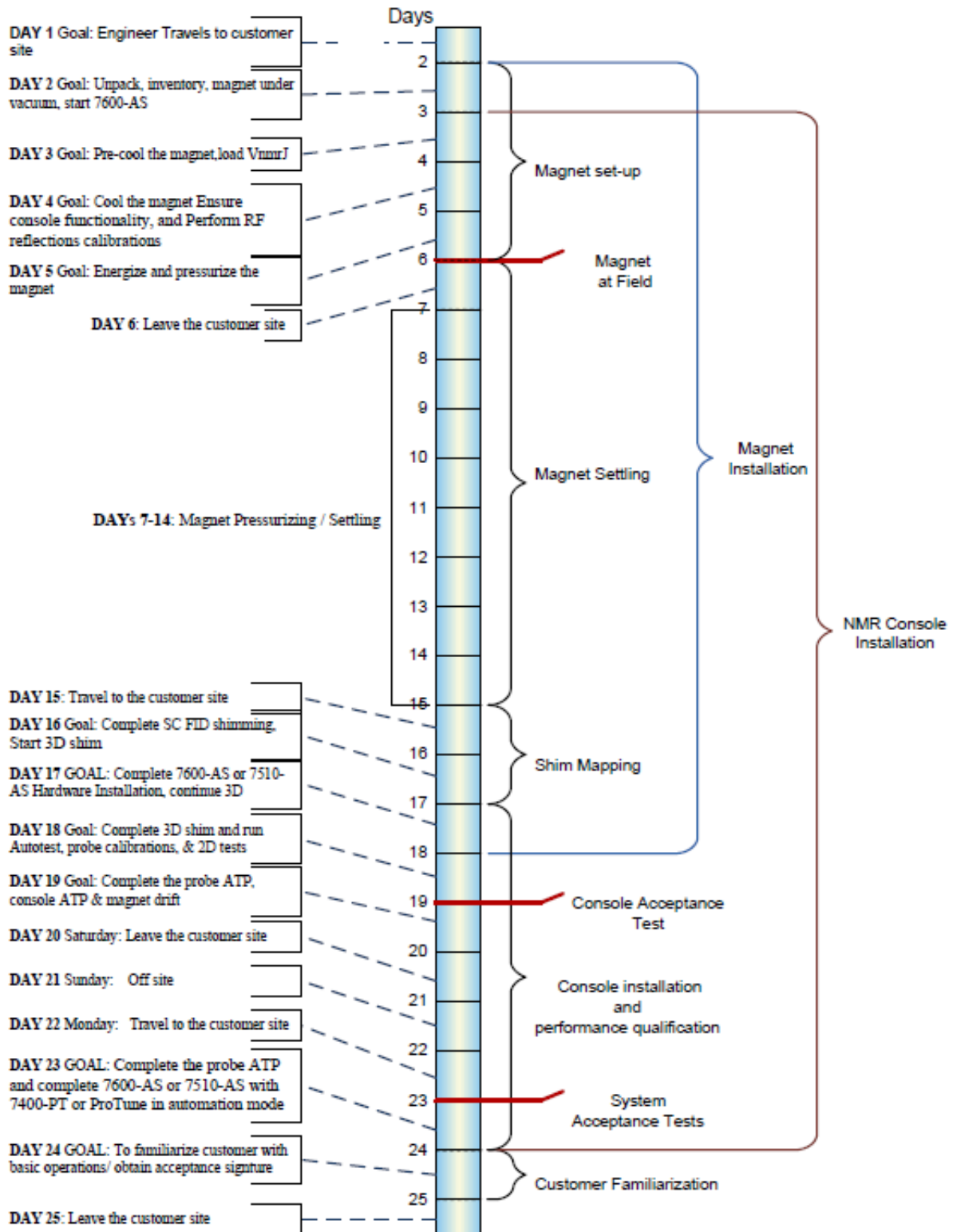
OneNMR Probe with ProTune-PZT



7510-AS Autosampler

Installation Process Overview

The duration of the complete 400-MR system installation, including Automation Suite accessories, is 25 days. The daily installation milestones are shown below.



Installation Site Requirements

This section describes requirements for the system installation site. Each requirement must be met before an installation can be scheduled. Contact your installation coordinator if you have any questions about the requirements.

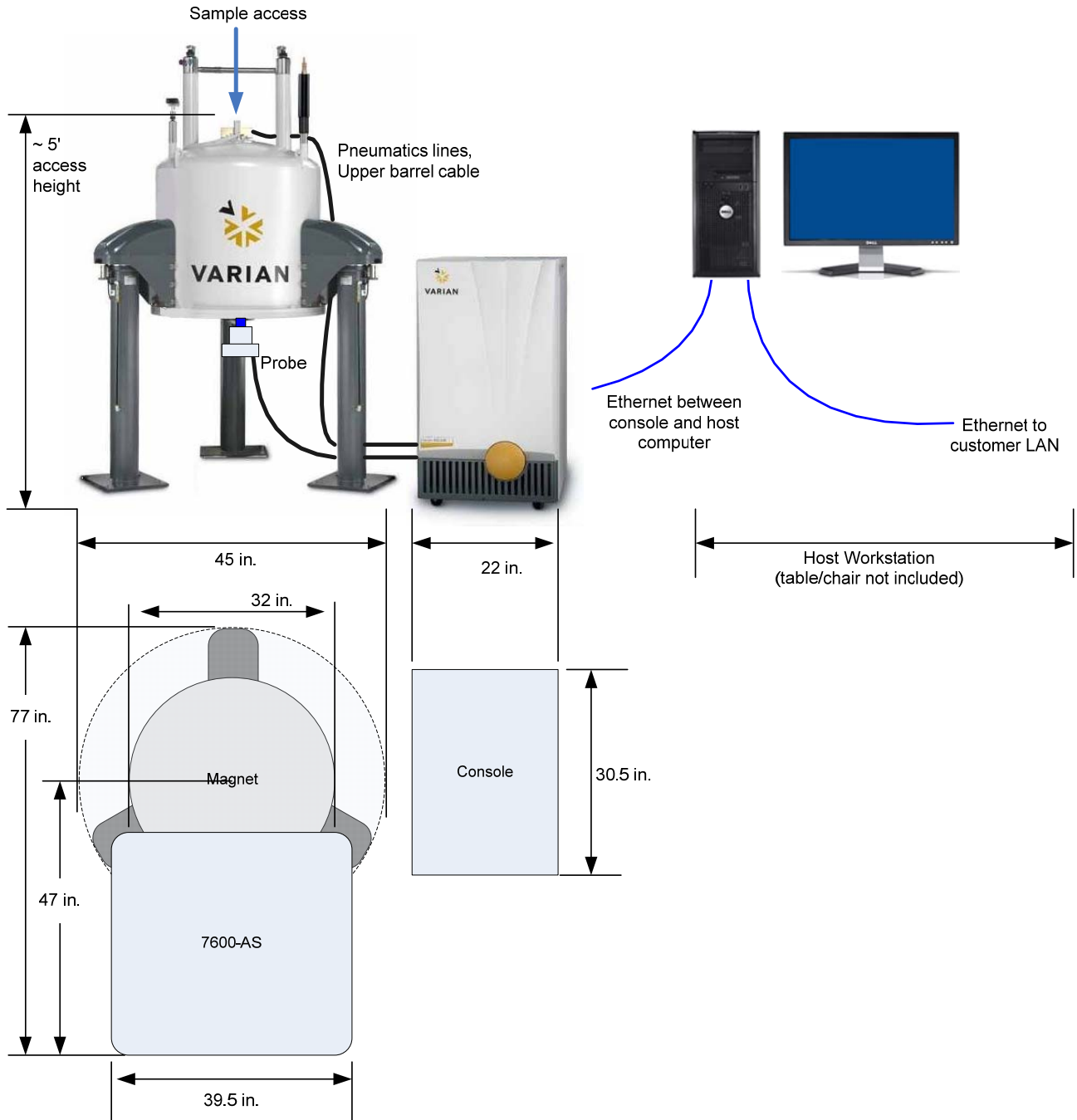


Figure 1. 400-MR System Layout (typical)

General Site Considerations

- Requirement: *Instrument will be far enough away from external sources of vibrations and electromagnetic fields.*

When choosing an installation site for the system, consider how the external environment, particularly external sources of vibrations and electromagnetic fields, might affect the system.

Outside Environmental Considerations

Consideration	Minimum Distance from System		Possible Effect on System
	ft.	m	
Elevators	25	7.6	Vibrations, magnetic field
Stairwells, loading docks, compressors, heavy equipment/machinery	25	7.6	Vibrations
Electric trains/trams	1640	500	Magnetic field
High voltage lines & transformers	164	50	Magnetic field
High-field electromagnets, forklift trucks	15	4.6	Magnetic field

Laboratory Entrance Clearance

- Requirement: *Entrance and access to the installation location is adequate for system crates.*

Verify that there is sufficient entrance clearance to move the shipping container to the installation location before arranging for 400-MR delivery.

400-MR Shipping Crate Dimensions

Shipping Container	Height		Width		Depth		Weight	
	in.	cm	in.	cm	in.	cm	lb.	kg
Magnet	68	171	44	110	49	124	1353	615
AV legs	55	22	47	129	41	105	344	156
Console	46	117	27.5	70	40	102	390	177
Ship Kit	42	107	51	120	41	105	230	105

7600-AS Shipping Crate Dimensions

Shipping Container	Height		Width		Depth		Weight	
	in.	cm	in.	cm	in.	cm	lb.	kg
Support tower	55	140	36	96	77	196	500	230
Robot	45	114	41	104	24	61	154	70

The 7510-AS, OneNMR probe and ProTune-PZT will be packed into one of the standard 400-MR shipping crates, for example the Ship Kit container.

Laboratory Space and Load Requirements

- ☑ Requirement: *Sufficient laboratory space is available for the system, including service access.*
- ☑ Requirement: *Floor can support system weight.*

The following information is provided to help you plan the layout of your system. The Varian Representative will unpack the boxes and place the modules in the final location. The console might also be placed to the left of the magnet.

Sufficient space must be maintained around the system for air circulation and service access.

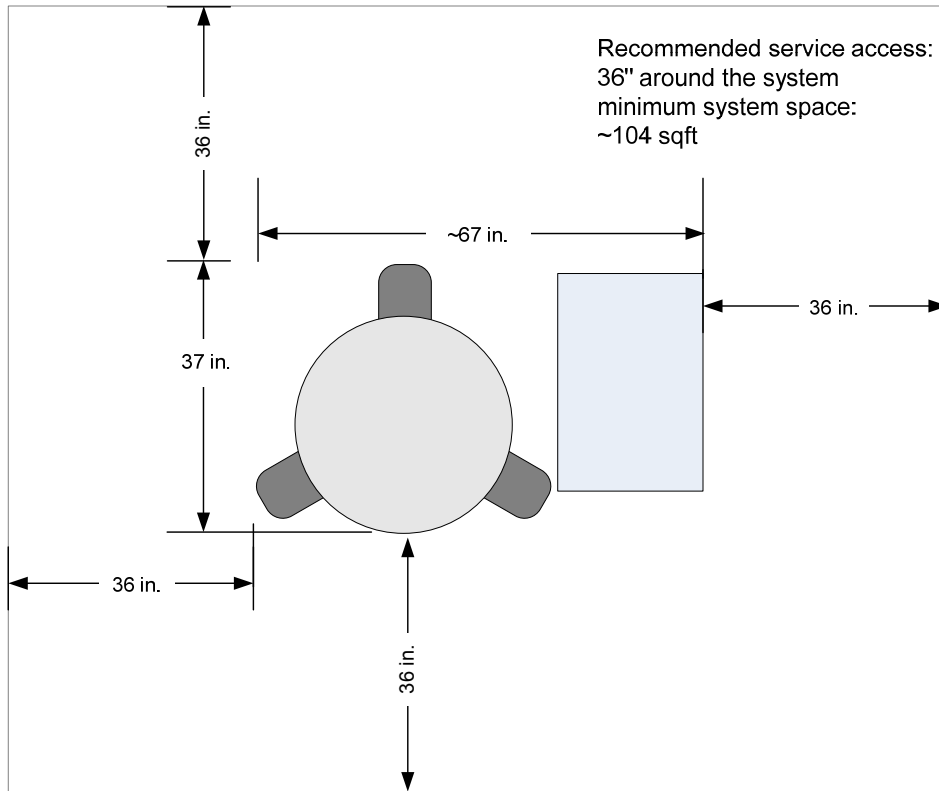


Figure 2. 400-MR

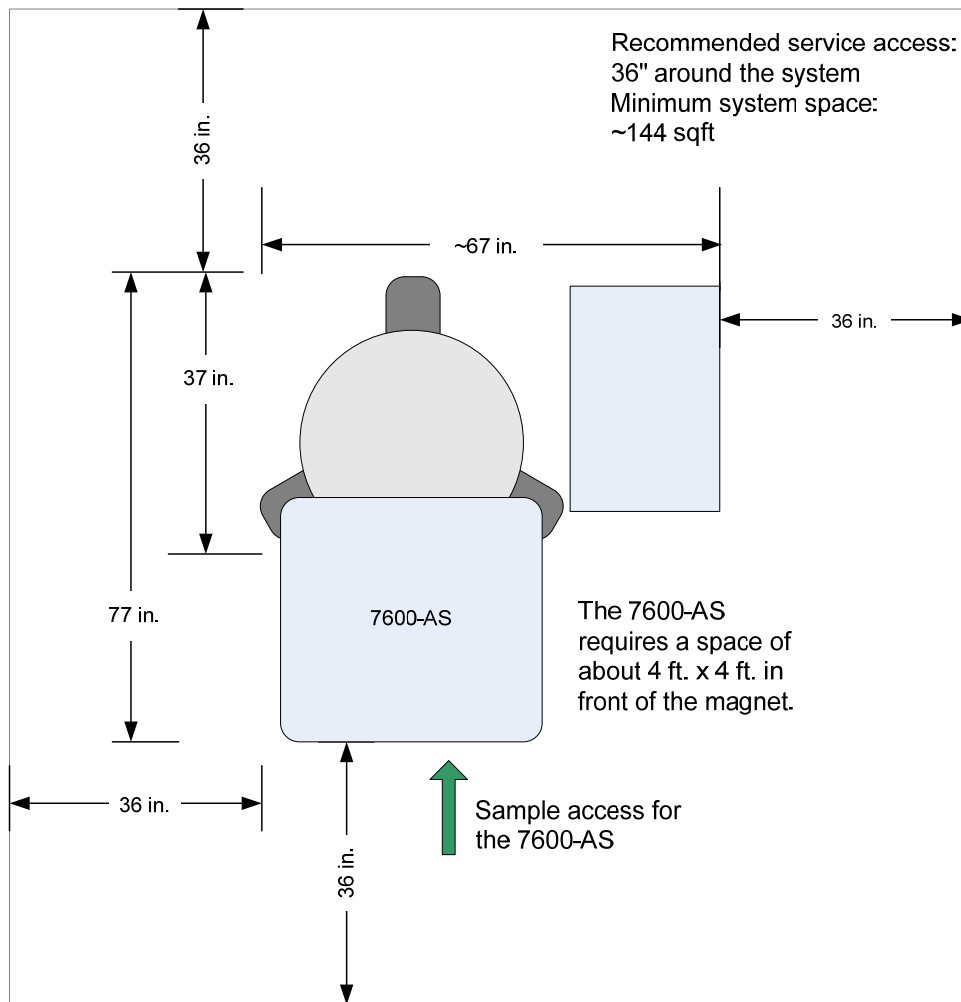


Figure 3. 400-MR with 7600-AS

The floor must be able to support the system weight.

Room Space and Floor Load

Component	Height		Width/Diameter		Depth		Weight	
	in.	cm	in.	cm	in.	cm	lb.	kg
Console	40.5	102.9	22	55	30.5	77.5	390	177
Magnet*	80.7	205	59	152	NA	NA	1430	650
7600-AS**	64.3	163.3	24	61	25	63.5	654	297

* Weight, diameter, and height include anti-vibration legs.

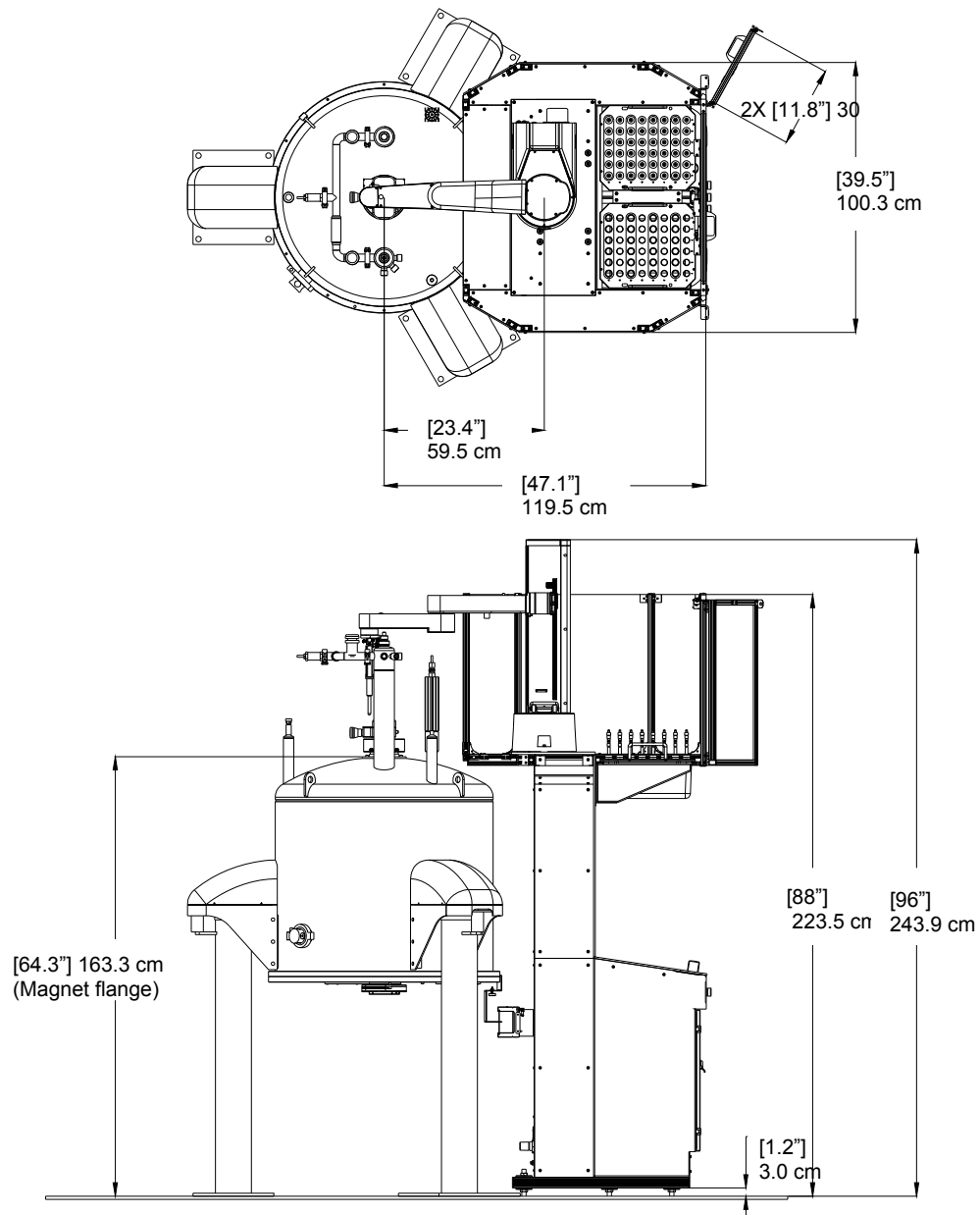
** The 7600-AS dimensions are for the assembled system: tower assembly, safety enclosure, and SCARA robot.

A host workstation worktable and chair are not included in the standard system. Avoid chairs that are constructed of significant amounts of ferromagnetic materials.

Recommended Clearances around Components

Component	Purpose	Clearance	
		cm	in.
Magnet, all sides	Service access	91.4	36
Console, back	Air circulation, pneumatic and electrical connections	91.4	36
Console, above	Air circulation and service access	91.4	36
Magnet, above	Service & installation access; cryogen filling	295	116
	With optional low-ceiling kit	262	103
7600-AS, above	Service & installation access	262	103
7600-AS, sides	Service access (fits within systems space)	61	24

7600-AS Details



Ventilation

- Requirement: Ventilation is adequate to displace liquid helium gas during a quench. Consult with a safety engineer on this subject.**

In the unlikely event of a magnet failure, or quench, the evaporated helium is rapidly exhausted from the manifold by the pressure relief valves. The exhausted gas will displace oxygen and cause asphyxiation if the room is not properly ventilated. Review the following considerations with a safety engineer:

Ventilation system must be able to displace evaporated helium gas:	<i>LPM</i>	<i>CFM</i>	<i>LHe volume in magnet</i>
	44,400	1,568	60 L
Calculation	60L x 740	60L x 26.13	

- The magnet holds about 60 L of liquid helium. A magnet quench will not typically boil off the entire 60 L.
- During a quench, helium gas fills the room from the ceiling down, so set up fans accordingly.
- The expansion ratio of liquid helium at room temperature is about 740:1, which means that one liter of liquid helium expands to about 740 liters of helium gas. To calculate CFM, use 26.13, which includes the expansion ratio.

Vibration

- Requirement: Floor vibrations are within the specified limits.**

High levels of vibration can have an adverse affect on the quality of NMR data. The 400-MR is equipped with state-of-the-art vibration isolation equipment. Ground floor or basement sites are generally preferred for systems because the natural resonant frequencies of most building structures are typically at low frequencies and horizontal in direction. Also, cement slabs on grade are generally stiffer with less low-frequency vibrations and preferred to suspended floors.

Limitations on Floor Vibration

Greater than 15 Hz	no single peak greater than 400 μ g
10 to 15 Hz	no single peak greater than 200 μ g
5 to 10 Hz	no single peak greater than 75 μ g
Less than 5 Hz	no single peak greater than 10 μ g

You can order a site inspection before the installation if there are any concerns relating to possible vibrations (especially older construction buildings and/ or laboratories sited on third floors or higher). Contact Customer Service for more details.

Humidity

- Requirement: Relative humidity can be maintained within the specified range.**

Operating the system at a very low humidity may result in the accumulation and discharge of static electricity, shortening the life of electronic components. Operating the system at high humidity may produce condensation and result in short circuits.

<i>Specification</i>	<i>Range</i>
Relative humidity, with no condensation	20% to 80%

Temperature

- Requirement: *Laboratory temperature can be maintained within the specified range.*

Specification	Temperature range	
	°F	°C
Optimal operating temperature	60-75	17-24

The average steady-state heat load of the console is 500 watts. The host workstation heat load is approximately 400 watts.

NOTE: As laboratory temperature increases, system reliability decreases due to heat generated by electronic components. This heat must dissipate to the surrounding air for reliable operation.

The airflow around the system must be adequate. The air conditioning system must be capable of maintaining a constant temperature in the immediate vicinity of the system. The temperature around the magnet must be maintained within ± 1.0 °C (± 1.8 °F) during an experiment and during shimming. Do not place the system near air ducts, windows, or heating and cooling systems.

Particulate Matter

- Requirement: *Laboratory is free of excessive particulate matter.*

The laboratory must not have excessive dust, smoke, or other particulate matter. Particulate matter can block airflow vents causing the electronics to overheat.

Compressed Air for System Operation

- Requirement: *Compressed air or nitrogen is clean and dry, and the appropriate regulator and gas lines are installed.*

400-MR system operation requires a constant flow rate of air or nitrogen. Install the air supply with $\frac{1}{4}$ in. (0.635 cm) connectors.

- If compressed air will be used, it must be clean, dry, and oil-free, with less than 0.1 ppm total hydrocarbons, including methane, and a -40 °C dew point.
- If compressed nitrogen will be used for the system supply, the gas must be dry, oil-free, and magnetically clean (for example, free of rust), with a dew point of -193 °C (80 K).

Requirement/ Specification	Condition	Flow Rate	Pressure
400-MR system	Sample insert	45 LPM (95 SCFH)	80 psig (585 kPa)
	Normal operation	27 LPM (57 SCFH)	80 psig (585 kPa)
When purchasing a compressor system, use the following specification:			
Compressor system	With compressed air dryer	60 LPM (127 SCFH)	80 psig (585 kPa)

The 7600-AS and the 7510-AS use compressed gas for operation, but air consumption is minimal. The general lab requirement above satisfies the 7600-AS and the 7510-AS requirements.

You are responsible for conforming to all regulations regarding the installation and operation of the compressed air system.

Electrical Power

Requirement: *Specified electrical supply and power outlets are installed.*

The 400-MR system requires a single-phase power source with earth grounds hard-wired to the main power panel ground.

Power Requirements for 400-MR Components

<i>Instrument / Component</i>	<i>Max Current Draw (Amps) 90-132V ac System</i>	<i>Max Current Draw (Amps) 180-264V ac System</i>	<i>Number of Outlets</i>
Console	10	5	1
Cryogen Monitor	<0.15	<0.15	1
Computer	3	1.5	1
Monitor	3	1.5	1
Printer	3	1.5	1
7600-AS*	15	7.5	1

* Use a separate, dedicated power source for the 7600-AS.

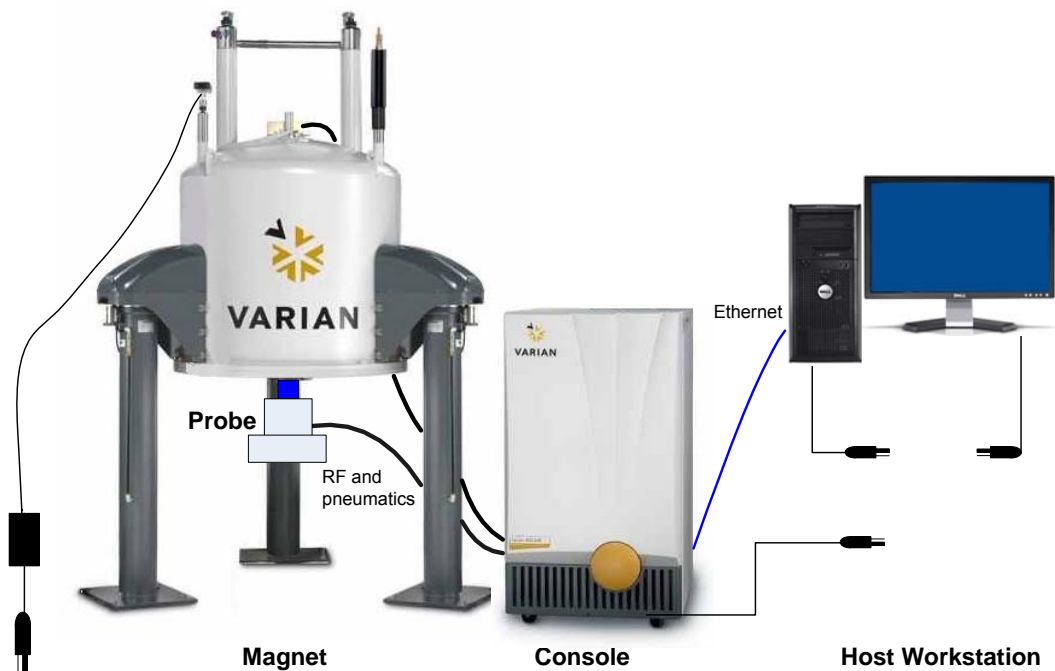
The console and host workstation have standard IEC 60320 power inlets. The system ships with 3 m (10 ft.) power cords for North America, Japan, Continental Europe, and United Kingdom.

The 7600-AS has standard IEC 60320 power inlets. The system ships with 3 m (10 ft.) power cords for North America/Japan, Continental Europe, and United Kingdom.

The 7510-AS and ProTune-PZT get electrical power from the console.

NOTE: If you are concerned about the quality of your power, consider installing an uninterrupted power supply, or a power conditioner, or both.

The quality of the power supplied to the laboratory must be stable and free of fluctuations due to slow changes in the average voltage or to changes resulting from surges, sags, or transients. The power supplied should meet IEC 1000-4-5 and IEC 1000-4-11 standards for voltage stability.



Magnetic Field



Requirement: *The background magnetic field fluctuations are acceptable.*

The 400-MR is susceptible to strong background electromagnetic fields. These fields can emanate from overhead power lines or electric trains and trams. The most important consideration is usually the earth return loop. In general, the worst case scenarios are provided by electric trains and trams. High voltage power lines, transformers, other high-field electromagnets, elevators, and forklift trucks also produce background magnetic fields that can affect the NMR magnet.

Maximum Allowable Oscillating Magnetic Field Limits

<i>Frequency</i>	<i>Field</i>
Greater than 10 Hz	Less than 10 mG
5 - 10 Hz	Less than 5 mG
Less than 5 Hz	Less than 2 mG

These specifications assume that the NMR experiments will be run in locked mode, that is, the system compensates for small changes in the magnetic field during the experiment by locking to the D₂O resonance of the deuterium solvent. NMR experiments run on samples that are incompatible (chemically) with deuterium solvents must be run unlocked. Unlocked experiments may require limits on the frequency-oscillating magnetic field to be less than 100 micro gauss.

NOTE: If you are concerned about background electromagnetic fields, you can order a site inspection. Contact the local Field Service Representative for more details.

Installation Requirements

- Requirement: *The necessary supplies and equipment will be available for the system installation.*

This section describes the requirements to ensure an expedient and successful installation.

Helium and Nitrogen Gas for Magnet Installation

Helium and nitrogen gas is required for the magnet installation. A magnetic helium gas container can be used provided the unit remains outside the 5 gauss limit of the magnet and the cylinder is firmly secured.

Helium Gas Required for Installation	
Helium gas	2 cylinders, each about 8000 liters (285 ft ³). Low-pressure regulator < 30 psi. He gas flow regulator and flow meter 0-40 LPM (0-80 CFH). Purity ≥99.995% or U.S. Bureau of Mines Grade A.
Nitrogen gas	1 cylinder, or from a fixed source. Dry, oil-free, magnetically clean, dew point of -193°C.

Cryogenics for Magnet Installation

Liquid helium and liquid nitrogen are required for the magnet installation. You should request delivery of the cryogenics on the morning of, or on the day before the start of the installation to minimize loss due to boil off.

Cryogenics Required for Installation	
Liquid helium	400 liters (14 ft ³). 200 liters (7 ft ³) at short notice delivery within 48 hours. Supply dewar compatible with siphon diameter 12.7 mm (0.5 in.)
Liquid nitrogen	700 liters (25 ft ³). Adapter for connecting 9 mm (3/8 in.) ID rubber tubing to the LN container.

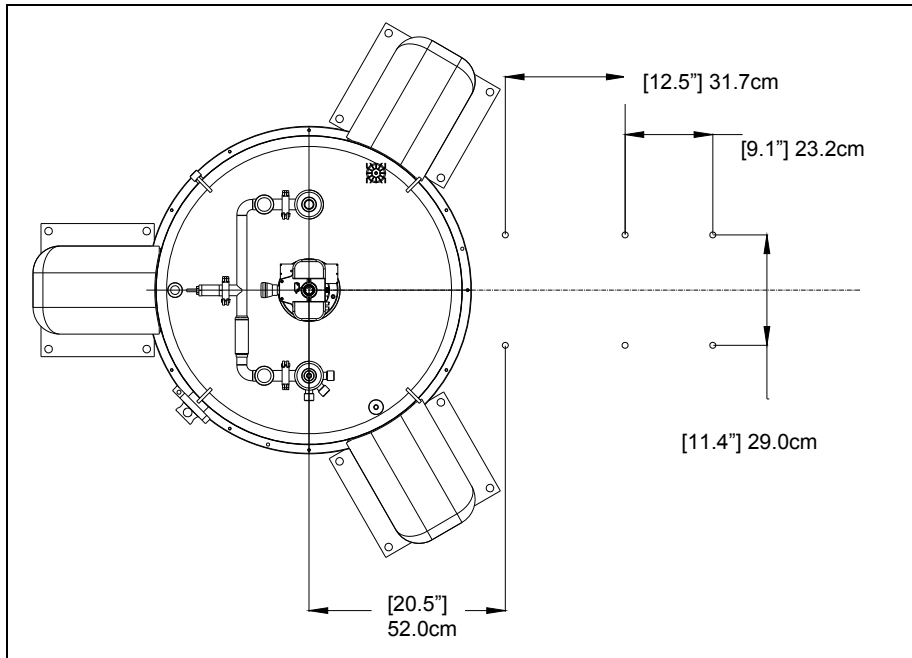


Figure 3. Robot Base Mounting Holes Pattern.

Make sure you are able to satisfy all system anchoring requirements listed on this page.

NOTE: If you are unable to satisfy any of these requirements, please notify Varian MR Installations before your 7600-AS system installation is scheduled.

Instrument Arrival

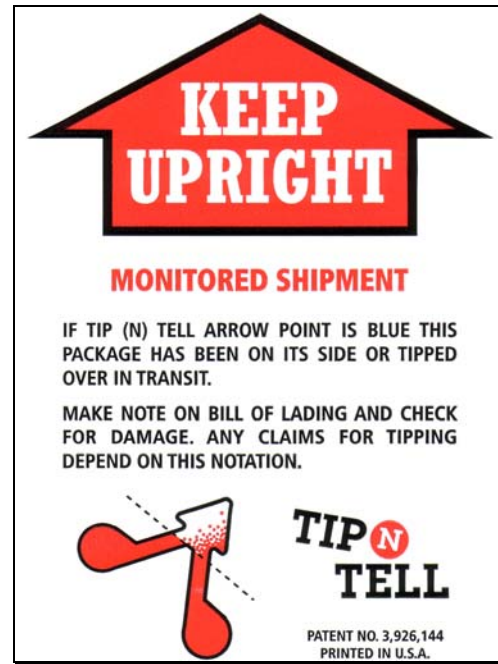
- Requirement: *The shipping cartons were examined for damage, and if damaged, the conditions were reported.*

Inspection

When the 400-MR arrives, carefully inspect the exterior of the shipping cartons for evidence of any damage that might have occurred during shipment. Inspect the cartons for the following:

- Water stains
- Cuts, punctures, or deep indentations
- Crushed corners or excessively abraded edges
- Blue beads in the Tip (N) Tell arrow point

Two Tip (N) Tell indicators and labels are on the exterior of the shipping boxes. Read and follow the instructions on the label. If the Tip (N) Tell arrow point is blue, the box was on its side or tipped in transit and instrument damage may have occurred.



If you see one or more of these conditions on any shipping carton:

- Report the conditions to the carrier when you receive the shipment
- Note the damage on all copies of the shipping documents
- Write a brief description of the damage
- Tell the driver to sign next to your comments to signify agreement with the observations
- Contact local Customer Service to report the damage

If no external damage is apparent, sign the receiving documents "*Received but not inspected*" to indicate that the boxes have not been opened.

Systems are shipped either **FOB Varian** or **FOB Destination**. The manner of shipment determines who is responsible for filing a claim against the carrier if the system was damaged in transit. Most systems are shipped **FOB Varian**, so any damages incurred in shipment are the responsibility of the purchaser and the carrier. Contact local Customer Service for assistance with filing claims and billing repairs. If the system is shipped **FOB Destination**, contact local Customer Service, which will file a claim against the carrier.

Varian will not accept liability for damage if obviously received damaged materials were received without noting the damage on the receiving documents.

Move the shipping containers to a warm, dry, secure area near the place of installation.

Do not open any boxes until the Varian Representative arrives to do the installation.

Unpacking and Installing

The Installation Coordinator will review the pre-installation checklist with you to ensure that you have satisfied all of the site requirements. The Installation Engineer will unpack and install the instrument and demonstrate the fundamental operation and maintenance procedures. The Principal Operator must be available during the installation.

The Installation Engineer will follow an installation process that leaves the system calibrated and optimized for standard NMR experiments. The Installation Engineer will then demonstrate magnet safety and maintenance and basic NMR operation.

Plan to analyze your samples only after the installation is completed and you have accepted the system.

Cryogenic Equipment Rack

Various items are used around the magnet for routine maintenance and cryogen handling, including a helium transfer tube, Tygon® tubing, and insertion tubes. Protect the cryogenic equipment from damage and keep it conveniently available. Provide a rack to hold the items. A 1.2 m x 2.4 m (4 ft x 8 ft) pegboard hung on a wall, with wood/plastic pegs, works very well.

Preventive Maintenance

Routine and preventive maintenance is the customer's responsibility. Any instrument problems resulting from, for example, contaminated gas or cryogen supplies, poorly controlled line voltage, and so on, are billable and not included in the warranty.

Perform regular preventive maintenance to increase the life of the system, maximize system uptime, and maintain system performance. Your Varian Representative will describe and demonstrate these procedures during the installation.

Varian offers a wide variety of service and maintenance plans that will ensure system operation. Contact your local Varian Representative for details.