Cryogenic System Site Requirements

Varian, Inc. MR Systems

Pub. No. 01-999350-00, Rev. C 0208

NOTICE: This document contains references to Varian. Please note that Varian, Inc. is now part of Agilent Technologies. For more information, go to **www.agilent.com/chem.**

Agilent Technologies

Cryogenic System Site Requirements

Varian, Inc. MR Systems
Pub. No. 01-999350-00, Rev. C 0208

VARIAN

Cryogenic System Site Requirements
Varian, Inc. MR Systems
Pub. No. 01-999350-00, Rev. C 0208

Revision History:
A 0407 – Initial Release
B 0907 – Update contact information
C 0208 – Updated per ECO 14553

Applicability of manual:
Varian NMR systems and UNITY*INOVA* systems

Technical contributor: Susan Klein, Jason Cosman, Judit Losonczi,
Illustrations and Graphics: Everett Schreiber
Technical writer: Everett Schreiber
Technical editor: Everett Schreiber

3120 Hansen Way, Palo Alto, California 94304
1-800-356-4437
http://www.varianinc.com

Table of Contents

List of Figures

List of Tables

Chapter 1. Introduction

A Varian Cryogenic system consists of a Cold Probe and closed-cycle cryogenic system:

- “Varian, Inc. Pump Cold Probes,” next
- “Closed-Cycle Cryogenic System” on page 4

The cryogenic system, Figure 1, circulates cold He gas to maintain key probe components at an operating temperature of approximately 25 Kelvin.

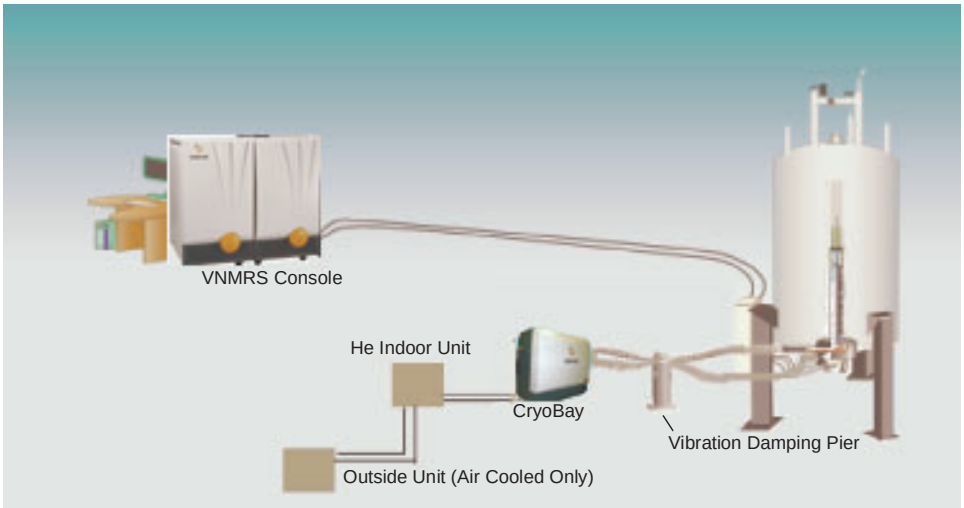


Figure 1. Varian, Inc. Cold Probe and Cryogenic System

1.1 Varian, Inc. Pump Cold Probes

Varian, Inc. Cold Probes (Figure 2) achieve significant sensitivity gains through the application of advanced cryogenic technologies for cooling key probe components.

The probe is mounted to the magnet or magnet shim set (depending on the shim set manufacturer). The probe contains the RF coils and some amplifier stages. Internally the components within the cryostat are at cryogenic temperatures. These temperatures are produced by cold helium gas coming from the CryoBay via a vacuum-insulated helium transfer line. Probe thermal isolation is achieved by vacuum. A vacuum line connects the probe vacuum space to vacuum pumps in the CryoBay. An air line automates the probe vacuum valve to permit CryoBay control and easier installation.

RF tuning adjustments are accessed at the base of the probe using either an automated or a manual tuning module. The probe features a hermetically sealed, clear-through bore, which has significant advantages for probe cleaning in the event of sample contamination or for use with a flow-cell accessory. Continuous flow of dry nitrogen or dry air is required

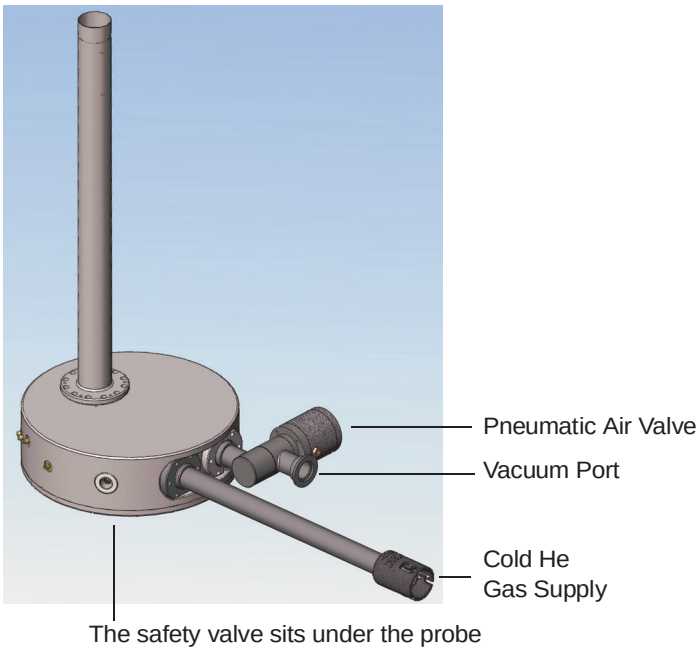


Figure 2. Varian, Inc. Pump Cold Probes

through the center-tube while the probe is cold to ensure sample temperature regulation and to prevent the cool center tube from forming ice.

1.2 Closed-Cycle Cryogenic System

The Varian closed-cycle cryogenic system, described in Table 1, is designed for continuous long-term operation. During normal operations, the system does not consume or require additional He after initial setup. Routine service operations use some He gas. The system cools the probe components to their operating temperature in about 4 hours. Optimal performance is realized when the system is allowed to stabilize overnight.

Table 1. Closed-Cycle Cryogenic System Components

Component	*Description*
CryoBay (Cryogenics Bay)	Contains a closed-cycle cryogenic refrigerator, vacuum pumps and control electronics.
Helium Compressor	Supplies the CryoBay with high pressure helium gas. **Water-cooled option** (indoors) - The water cooled compressor sits on a vibration isolation plate inside. **Air-cooled option** (outdoors) - The air-cooled compressor consists of an indoor component and an outdoor component.
Damping Pier	Reduces the transmission of vibrations from the CryoBay to the probe.
Spectrometer Host or Stand Alone Computer	User interface for CryoBay control software.

Chapter 2. Site Planning

Sections in this chapter

2.1 Assistance

Contact Varian, Inc. NMR TAC / Cold Probe Site Planning for assistance:

Fax: 866-262-3605
Tel: 1 (800) 356-4437
E-mail: mr.coldprobe-support@varianinc.com

2.2 General Site Planning and Spectrometer Requirements

All sites require the development of site plans that are specific to each facility. Sites with magnets located in pits require special planning. Use the blank grids provided in Chapter 3 “Site Survey,” page 19, to arrange the cryogenic system.

Probe mounting arrangements are provided by Varian and determined by the site's magnet and room temperature shim configuration. Pre-amplifier interfaces are provided by Varian and are determined by the site spectrometer.

The location of the magnet and magnetic field determines the placement of certain system components. Complete the site survey in Chapter 3 “Site Survey,” page 19, and fax or send the survey to Varian, Inc. Customer Support. Contact Varian, Inc. Customer Support for assistance in completing this survey.

CAUTION: **Incomplete or inaccurate information can delay the installation of the Varian, Inc. Cryogenic system.**

Site-Planning Considerations

Consider the following when planning a site for the Varian, Inc. Cryogenic system:

- A 28–channel Varian or 40 Channel Oxford room temperature shim system is the minimum shim system for which Varian, Inc. Cold Probe line shape specifications are guaranteed.
- The Varian, Inc. Cryogenic system and probe requires either:

  VnmrJ 2.1B or higher with current patches or VNMR 6.1C with current patches. The user interface to the CryoBay is integrated within the VnmrJ software.

  or

  A stand-alone PC with CryoBay control software (available from Varian).
- Components listed in Table 7 are sensitive to stray magnetic fields, see “Magnetic Field Considerations,” page 12.
- The flexible helium transfer line has a minimum bending radius of 19.7 inches (50 cm), extends from the CryoBay to the probe, and requires an unobstructed path. A bend of 90^{o} from the probe to the CryoBay is recommended for the flexible helium transfer line installation. The flexible helium transfer line from the CryoBay ends in a rigid pipe that penetrates the sidearm of the probe and is secured by a bayonet connector.
- The selection of an air-cooled (outdoors) or water-cooled (indoors) helium compressor.

  Water-Cooled Compressor - The He compressor generates a significant amount of heat and requires a continuous supply of cooling water to operate. Water is supplied from site cooling water sources or by using a closed-cycle water chiller, see “Cooling Water Requirements,” page 12.

  Air-Cooled Compressor - The air-cooled system utilizes an indoor and an outdoor unit. The outdoor unit is part of a two-part compressor system with the majority of the heat generated by the outdoor unit and is powered by the indoor unit.
- The operating environment temperature must be maintained at less than 28º C.

  Locate all equipment with high heat loads outside of the room with the magnet and spectrometer, if possible, for optimal system stability. Examples of high heat load equipment are: the outdoor unit of the air cooled helium compressor and the air cooled water chiller.

Typical Installation, Water-Cooled Compressor

A typical site plan is shown in Figure 3; refer to "Component-to-Component Distances," page 13, for hose lengths and maximum component-to-component distances. The compressor and optional water chiller may be located in either a utilities room or service chase.

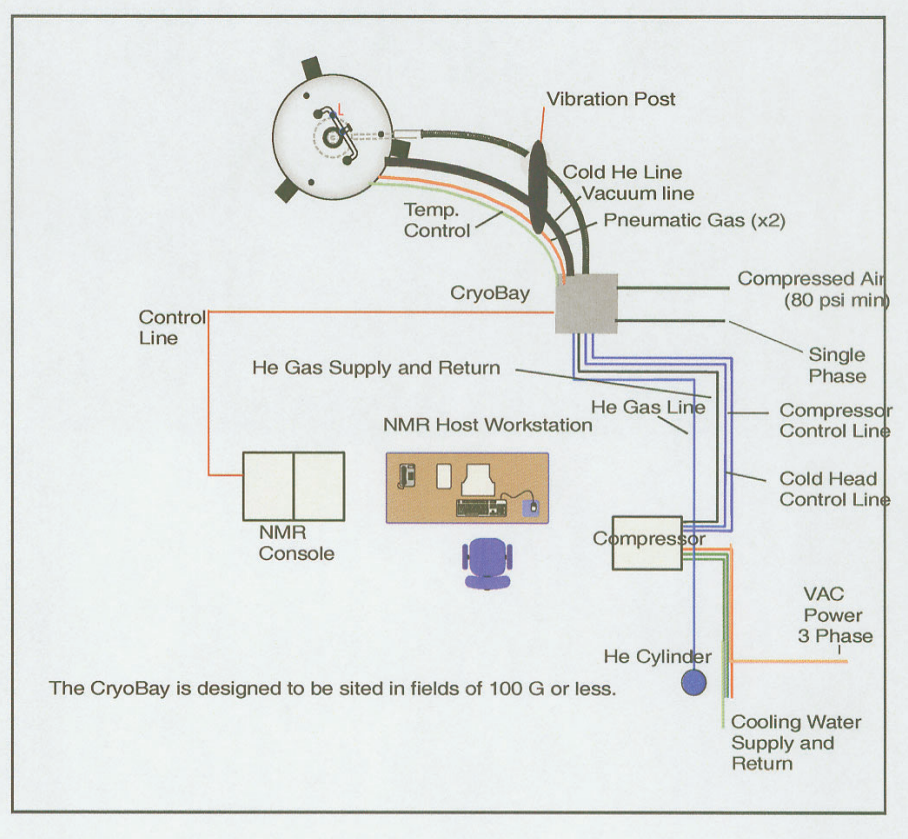


Figure 3. General Floor Plan for Typical Cryogenic System with a Water-Cooled Compressor

Typical Installation, Air-Cooled Compressor

A typical site plan is shown in Figure 4; refer to "Component-to-Component Distances," page 13, for hose lengths and maximum component-to-component distances. The air-cooled compressor is composed of an indoor and an outdoor unit. The outdoor unit is powered by the indoor unit.

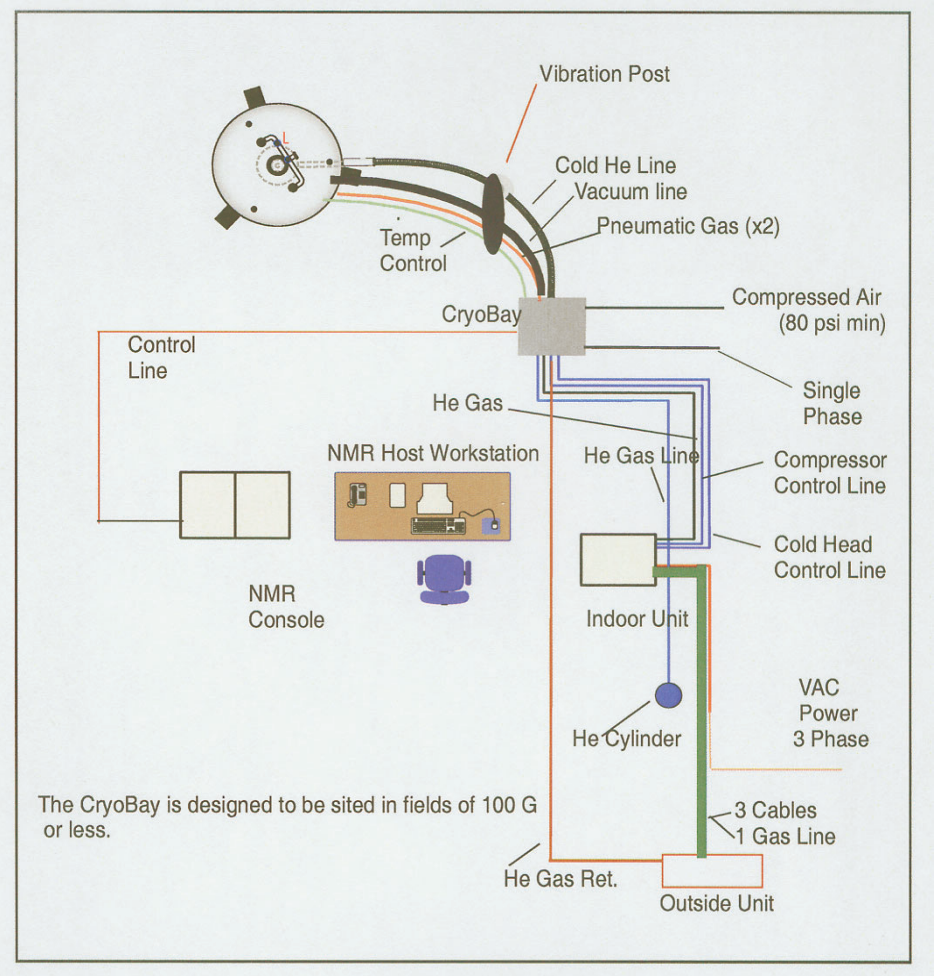


Figure 4. General Floor Plan for Typical Cryogenic System with an Air-Cooled Compressor

2.3 Installation Supplies and Hardware

Customer-Supplied Equipment and Hardware

Table 2 lists the equipment and supplies that the customer must provide for the installation of the cryogenic system. The customer must supply electrical plugs and sockets that are in compliance with local ordinances. An electrician and, in some cases, a plumber should be available at the beginning of the installation to make the utility connections.

Additional electrical routing is required to connect the power from the indoor unit to the outdoor unit when using the air-cooled compressor option. Contact Varian for the relevant requirements. An electrician familiar with local ordinances must be available to perform the appropriate utility work.

Table 2. Customer-Supplied Equipment and Material

Requirement	*Specification*
Electrical connects	All connections must conform to local electrical codes.
AC CryoBay power connector	**220 V single phase:** 14 AWG, 3-conductor wire with ground (US and North America), see "Electrical Requirements," page 11 for VA requirements. or **110 V single phase:** NEMA (5-15 plug 15A/125 VAC) compliant outlet required.
AC compressor power connector	**3 phase:** 4-conductor wire including ground. 220V - 8 AWG (8.3mm2) or larger. or 400V - 12 AWG (3.3mm2) or larger. (VA depends on compressor chosen.)
AC standalone computer power cable (non-VNMRS systems)	Single phase, IEC14 compliant connector.
Compressed Air or N_2 gas	Clean, dry, compressed air or N_2, 80 - 110 psi (5.5 - 7.5 bar). Dew point -40^{o}C.
High pressure He gas	He gas (99.999% purity) — full and unopened cylinder (>500 psi, 35 bar).
Pressure regulator for He gas	Helium cylinder regulator compatible with high purity, 400 psi (28 bar) with Swagelok fitting for 1/4" copper tubing. (Supplied to North American customers.)
Water-Cooled compressor water	See "Cooling Water Requirements," page 12, and "Water Chiller Specifications," Table 15 on page 16.
5-micron water filter	Serfilco PL-P 5 x 9 3/4 pleated polyester filter cartridge and GSO 10-3/4 filter chamber (www.serfilco.com) or equivalent.
Water flow control and pressure regulator	Flow control located on the outlet side of the helium compressor. Water pressure regulation located on the inlet side of the helium compressor.
Equipment for system installation in a pit or below the main laboratory grade locations.	Cranes and related equipment are required for vertical movement and placement of the CryoBay and compressor in pits or other below elevation locations. All equipment must be safe to operate in a magnetic environment and near the magnet. Sites using the air cooled compressor require appropriate equipment for mounting the outdoor unit.

Varian, Inc.-Supplied Equipment and Hardware

Varian, Inc. provides an installation kit with the system; the contents are listed in Table 3.

Table 3. Installation Components Supplied with the System

Component	*Components (quantity and description)*
Copper tubing, ASTM-B280 high purity	50 feet (15.2 meters) 1/4-inch OD for Helium gas
Compressed air gauge	
North American orders only: Helium Pressure Regulator	Includes 1/4-inch Swagelok connector.
Water-cooled compressor only: Quick disconnects	2 pair 1/2-inch female pipe threaded; four 1/2-inch hose barb/ 1/2-inch male pipe thread adapters with hose clamps
Water hose, 1/2-inch ID	150 feet (45.7 meters)

2.4 Site Requirements

The cryogenic system electrical, water cooling (if applicable), compressed gas, and air-conditioning requirements must be met before the installation engineer arrives on site. These requirements are in addition to the requirements of the NMR console.

The site must meet all requirements for temperature, humidity, etc. as specified in the current *Site Planning Guide* and specifications contained in this, the *Cryogenic Systems Site Requirements*. The more stringent specification takes precedence where there are potential conflicts in the specifications.

- “Electrical Requirements,” this page
- “Cooling Water Requirements,” page 12
- “Compressed Gas Requirements,” page 12
- “Component Heat Dissipation,” page 11
- “Magnetic Field Considerations,” page 12

Electrical Requirements

Determine the electrical power that is provided locally. Specify the power available in the space provided in the "Site Survey," page 19 if the local power does not conform to the specifications in Table 4.

Table 4. Power Requirements

Component	*Phase VAC*	*Voltage (V)*	*Current (A)*	*Line Frequency*	*Power Consumption*
CryoBay	Single Phase	84 - 144 or 160-285	7 A 4 A	50/60 *Hz*	0.75 kW
Compressor Water Cooled	3 Phase	180 -220 or 342 -456 or 414 - 528	min 3A max fuse 60A min 17A max fuse 30A min 17A max fuse 30A	50/60 *Hz* 50 *Hz* 60 *Hz*	8.3 kW 7.2 kW
Compressor Air Cooled —Indoor Unit	3 Phase	180 -220 or 342-456 or 414-528	27 A (recommended 50 A, max fuse 50 A) 13 A (recommended 30 A, max fuse 30 A) 13 A (recommended 30 A, max fuse 30 A)	50/60 *Hz* 50 *Hz* 60 *Hz*	9.2 kW 8.0 kW
Compressor Air Cooled – Outdoor Unit			Power Supplied by Indoor Unit		

The version of the CryoBay and compressor are determined by the voltable available at the site. Do not use an invertor for the compressor's 3 phase main power. Most uninteruptible power supplies are not acceptable

Component Heat Dissipation

Table 5 provides heat dissipation data for the cryogenic system components to determine the air-conditioning load. Site cooling system must be able to maintian the temperature of the room in which the cryogenic system is installed at 28°C or lower.

Table 5. Component Heat Dissipation

Component	*Watts (line frequency.)*	*BTUs / hour*
CryoBay	500 W	1706
Compressor—Water Cooled (total load)	7.2 kW (50Hz)	24570
	8.3 kW (60 Hz)	28320
Compressor —Air Cooled—Indoor Unit	150 W	515
Compressor—Air Cooled —Outdoor Unit	8 kW (50 Hz) 9.2 kW (60 Hz)	27300 31400

Compressed Gas Requirements

The cryogenic system requires compressed gas as listed in Table 6:

Table 6. Compressed Gas Requirements

Gas	*Supply*	*Specification*
Air or Nitrogen	House (independent of the magnet leg) or Cylinder	Minimum 80 - 110 psi (5.5 - 7.5 bar), clean and dry (dew point -40°C)
Helium	Full Cylinder	99.999% purity (>500 psi, 35 bar)

Magnetic Field Considerations

Detailed magnetic field data is listed in the site-planning guide supplied for the NMR spectrometer (the current spectrometer site-planning guide is available online; go to the NMR User Pages at www.varianinc.com or to the site-planning guide supplied with the magnet).

Cryogenic systems components that are sensitive to magnetic fields; these components are listed in Table 7.

Table 7. System Components Affected by Magnetic Fields

Component	*Maximum Magnetic Field (Gauss)*
CryoBay	100
Compressor - water cooled	5
Compressor - air cooled - indoor unit	5
Host or laptop computer	5

Cooling Water Requirements

Use house water supply or a recirculating water chiller, see “Water Chiller Specifications,” page 16. The maximum cooling water pressure drop across the compressor is approximately 14.5 psig (1 bar) at the flow rate of 9 L/min (2.4 gal/min).

Review the vendor’s cooling water specifications for the water cooled compressor and confirm that the vendor’s cooling water specifications at the compressor inlet (not the source) are achieved. All the specifications supplied by the vendor for the cooling water must be met. Failure to meet the vendor’s inlet specifications may void the compressor warranty. Use the requirements in Table 8 only as a guide.

CAUTION: **Do not use demineralized water for cooling water.**

Table 8. Cooling Water Requirements

Requirement	*Specification at the Compressor Inlet*
Inlet temperature	+4°C to +28°C (+39°F to +82°F)
Flow rate @ 28° C (82°F)	7 - 10 L/min (1.85 - 2.6 gal/min)
Inlet pressure	29 - 100 psig (2.0 - 6.9 bar)
Antifreeze (ethylene glycol) / Water ratio	≤ 50% (50/50%, 10% higher coolant flow required)

Table 8. Cooling Water Requirements

Requirement	*Specification at the Compressor Inlet*
Suspended matter	<10 mg / L Maximum particulate matter is less than 100 micron. Requirement is met if recommended filter is installed on the supply line.
pH Value	6.5 - 8.2
Hardness	<200 mg$CaCo_3$/L
Molybdate-Reactive Silicate	<50 mg/L
Compressor inlet and outlet connectors	1/2 inch (12.7 mm) hose barb, 3/8-inch pipe thread

2.5 System Component Specifications

This section lists the specifications of the individual system components.

Component manufacturer's requirements take precedence if the component manufacturer's requirements are more stringent than those presented here. The manufacturers of the individual components used in the Varian, Inc. Cryogenic System may have additional requirements not listed here. Use these requirements as a guide.

Component-to-Component Distances

Table 9 lists the approximate maximum separation between components (or cabinets and components). The distances specified do not include a service or routing loss for the cable, hose, or tubing that connects the components or cabinets. All distances are straight line distances. Routing around obstacles, traffic paths, or for appearance reduces the distance between components. An extension kit can be purchased to locate the CryoBay further from the compressor. Alternative lengths for other connections may be custom ordered.

Table 9. Component-to-Component Distances

Components or Cabinets	*Distance*
CryoBay to Compressor (Water Cooled)	33 ft (10 m) minus 3 ft (1 m) for routing
CryoBay to Compressor (Air Cooled, Indoor Unit)	33 ft (10 m) minus 3 ft (1 m) for routing
Air Cooled Compressor, Indoor Unit to Outdoor Unit	33 ft (10 m)
CryoBay to Probe	6 ft (1.8 m)
CryoBay to Pneumatics Gas Supply	30 ft (9.1 m)
CryoBay to Helium Gas Cylinder	50 ft (15 m)
CryoBay to Spectrometer Computer	50 ft (15 m)
CryoBay to Single Phase 220V VAC	30 ft (9.1 m)

Table 9. Component-to-Component Distances

Components or Cabinets	*Distance*
Compressor to 3 Phase VAC	16 ft (5 m)
Compressor to Cooling Water (Water Cooled)	75 ft (22 m)

Cold Probe

The probe requires a minimum clearance between the floor and bottom of the RT shim tube, Table 10. The orientation of the probe is limited by the position of the cryogenic sidearm of the probe in relation to the magnet legs.

Table 10. Cold Probe Floor Clearance

Magnet	*Manufacturer*	*Minimum Clearance*
500 MHz		25.1 inches (638 mm)
600 MHz		25.1 inches (638 mm)
700 MHz	Oxford	27.6 inches (702 mm)
700 MHz	Varian	25.1 inches (638 mm)
800 MHz (54)	Oxford	27.6 inches (702 mm)
800 MHz (63 4 K)	Oxford	30.65 inches (778 mm)
800 MHz (63 2.2K)	Oxford	27.6 inches (702 mm)
800 MHz (AS Magnet)	Varian	39.9 inches (1013 mm)
900 MHz	Oxford	39.9 inches (1013 mm)

Note: Additional clearance is of 2 inches (51 mm) of cold probe floor clearance is required if the removable probe accessory used. This may not be compatible with all installations.

CryoBay Specifications

Table 11 lists the CryoBay specifications.

Table 11. CryoBay Specifications

	Specification
Height x Length x Width (cabinet)	41 inches x 45 inches x 32 inches (105 cm x 115 cm x 82 cm) 24-inch (61 cm) width with panels removed
Weight	510 lbs (232 kg)
Minimum Clearance—Front (where vacuum lines go to probe) Utilities Access	3 ft (1 m)
Minimum Clearance—One side service access	3 ft (1 m)

Vibration-Damping Pier Specifications

The vibration-damping pier has a footprint of 8 x 10 inches (21 cm x 26 cm). The pier is located between the CryoBay and the probe. The height is determined by magnet type, Table 12.

Table 12. Damping Pier Specifications

Magnet	*Height*
500 / 600 / 700 MHz Varian or Oxford Magnets	29 inches
800 MHz Oxford Magnets	31.5 inches
800 MHz Varian Magnets	35 inches
900 MHz Varian or Oxford Magnets	35 inches (two used)

Water-Cooled Helium Compressor Specifications

The water-cooled helium compressor, Table 13, is installed on an anti-vibration plate.

Table 13. Helium Compressor Specifications (Water Cooled)

Compressor Dimension or Requirement	*Specification*
Height x Depth x Width	27 inches x 19.7 inches x 17.7 inches (68.65 cm x 50.0 cm x 45.0 cm)
Weight	264 lb. (120 kg)
Environment Operating Temperature	5^{o} C - 28^{o} C (41^{o} F - 82.4^{o} F)
Minimum Clearance—Front Utilities Access	3 ft (1 m)
Minimum Clearance—Right Side (as viewed from front) Service Access	3 ft (1 m)
Lines:	
Flexible Helium Hose Max Diameter (fitting)	1.4 inches (43.6 cm)
Water Hose Quick Disconnects	1.76 inches (4.5 cm)

Air-Cooled Helium Compressor Specifications

The air-cooled compressor, Table 14, is composed of an indoor and an outdoor unit. The outdoor unit is powered by the indoor unit.

The noise level of the combined units may exceed 70 dBA.

Table 14. Helium Compressor Specification (Air Cooled)

Compressor Dimension or Requirement	*Specification*
Indoor Unit	
Height x Depth x Width	24.8 inches x 22.4 inches x 10.6 inches (63.0 cm x 57.0 cm x 27.0 cm)
Weight	99 lb. (45 kg)
Minimum Clearance—Front and Rear Utilities Access	3 ft (1 m)
Minimum Clearance—Left and Right-Side Service Access	3 ft (1 m)
Environment Operating Temperature	5^{o} C - 28^{o} C (41^{o} F - 82^{o} F)

Table 14. Helium Compressor Specification (Air Cooled)

Compressor Dimension or Requirement	*Specification*
Outdoor Unit	
Height x Depth x Width	41.3 inches x 15.7 inches x 35.8 inches (105.0 cm x 40.0 cm x 99.0 cm)
Weight	254 lb (115 kg)
Minimum Clearance—Front Utilities Access	3 ft (1 m)
Minimum Clearance—Rear	6 inch (15 cm)
Minimum Clearance—Right-Side Air Suction	12 inch (30 cm)
Minimum Clearance—Left-Side Air Discharge	3 ft (1 m)
Minimum Clearance—Above	8 inch (20 cm)
Environment Operating Temperature	-30°C to +45°C (-22°F to +113°F)
Humidity Range	20 to 95% RH (Rain condition acceptable)
Lines	
Flexible Helium Hose Diameter	1.1 inches

This is a summary of the air-cooled compressor requirements. Contact Varian for complete details on outdoor unit requirements.

- The outdoor unit should be mounted on a level concrete base.
- A clean environment is recommended otherwise frequent cleaning of the heat exchanger will be required.
- Do not expose the outdoor unit to direct sunlight.
- Install a snow guard over the unit if the outdoor unit is placed in a snowfall region.
- Adequate ventilation must be available.

Water Chiller Specifications

The water chiller must meet the following specifications, Table 15:

Table 15. Water Chiller Specifications

	Specification
Cooling Capacity	9 kW (31,000 BTU)
Temperature Range	+4°C to +28°C
Pressure, Minimum (pumping)	29 psi (2 bar)
Flow Rate (minimum)	7 L/min (1.85 gal/min)

The customer is responsible for verifying that the water chiller specifications meet the Helium compressor requirements.

Several vendors offer compatible water chillers. Haskris Co. Cooling Systems is the Varian recommended supplier for water chillers. Haskris has provided the following information, Table 16, on chillers that meet the Varian requirements — these water chillers can be purchased from Varian Inc. or Haskris Co. Cooling Systems.

Table 16. Haskris Water Chiller Specifications

Model	*Description*	*Heat Dissipation*	*Site Requirements*	*Voltage/Current (phase) @ 60 Hz*	*Fusing (Slow Blow)*
R300-R or R300-KR	Refrigerated water chiller with an air-cooled condenser	Heat load of 10.4 kW from the compressor and chiller is transferred to room ambient air.	Room/Lab ambient air temperature min. 40°F, max. 100°F	208/230 V 18.0 A (3 phase)	25 A
R300-CR or R300-CKR	Refrigerated water chiller with a water-cooled condenser	Heat load from the compressor and Haskris chiller is transferred to building water source.	Requires a source of building water 29°C (85°F) or colder	208/230 V 15.4 A (3 phase)	20 A
WW1-R or WW1-KR	Non-Refrigerated, water-to-water heat exchanger	Heat load from the compressor and chiller is transferred to building water source.	Requires a source of building water 12°C (55°F) or colder	115 V 6.87 A(1 phase) 208/240 V 3.4 A (1 phase)	10 A 5 A

Contact Haskris Co. Cooling Systems for any additional information.

Haskris Co. Cooling Systems
100 Kelly Street
Elk Grove Village, Il 60007
www.haskris.com
Contact:
Dan Falotico, Jr.
Telephone: (847)-956-6420 ext. 222
E-mail: dan@haskris.com

Chapter 3. Site Survey

The site survey requests information on the nominal or proposed site configuration. This allows Varian to ensure that the correct site compatible parts are supplied. The customer is responsible to confirm that all site requirements are met before installation. (See "Site Planning," page 5.)

Due to the time necessary to procure compatible parts, delay in Varian's receipt of the Site Survey may cause delivery delays of the Varian Cryogenic System and Cold Probe.

Fill out the following survey and attach all pertinent information. Mail, email, or FAX a copy of the survey to:

NMR Technical Assistance Center/Cold Probe Site Planning
Varian Inc., NMR Systems
3120 Hansen Way
Palo Alto, CA 94304
800-356-4437 Voice 866-262-3605 Fax
mr.coldprobe-support@varianinc.com

If information provided on the site survey changes (i.e. system, accessories, layout), resubmit the site survey.

Contact Information

Customer/Facility Name: _____

Name: _____

Email address: _____

Phone number: _____

Fax Number: _____

Street Address: _____

Street Address: _____

City/State/Zip / Country: _____

Site Survey

Site Requirements

Cryogenic System Sales Order Number applicable to this site _____

Predicted Site Readiness Date, if known. (mm/dd/yy) _____

1. Fill out the Vertical Magnet Data Sheet.

   Use the Varian Sales Order number in place of serial numbers if the system has not been installed.

   a. General Information / Magnet Dimensions - Questions #1 - 9, 15, 19, 20
   b. General Information / Magnet Dimensions - Requests A, B, C (data)
   c. Anti-Vibration System

2. Magnet (Additional)

   RT Shim Set

RT Shim Manufacturer	Varian (Magnex) ( ) Oxford ( )	Other (specify) ( ) _____
RT Shim Part Number (if known)		_____
RT Shim Set - Serial Number		_____
RT Shim Set - Number of channels		14 ( ) 40 ( ) 28 ( ) Other (specify) ( ) _____
RT Shim Bore Diameter		_____ ( ) inches ( ) mm
Distance from floor to the bottom of the RT Shim Tube		_____ ( ) inches ( ) mm
Upper Barrel		Fixed ( ) Vertically adjustable (slides) ( )

3. NMR Spectrometer System (Additional)

   Console

Console Type	VNMRS ( )	_____	Unity Inova ( )	_____
Software	VnmrJ Version:	_____	Patch Revision:	_____
	VNMR Version:	_____	Patch Revision:	_____

   Other: _____

   Pulse Field Gradient Amplifier

PFG Amplifier Part Number (model) _____

Highland L650 (Performa IV)	( )
L700 (Performa II)	( )
L200 (XYZ, Performa III)	( )
Other (specify)	( ) _____

   Sample Management Accessories

SMS ( ) Carousel ( ) AS768) ( )

Other (specify) ( ) _____

   Other Accessories

LC-NMR ( ) VAST ( )

Other (specify) ( ) _____

4. Utilities

   AC Power

   Only nominal values needed at this time. Values must meet specifications before install.

   Consult your facilities personnel if you are unsure regarding the nominal 3 phase voltage at your site.

Line frequency	50 Hz ( )	60 Hz ( )
Single phase voltage (CryoBay)	V	V
Single phase current (CryoBay)	Amp	Amp
Three phase voltage (Compressor)	V	V
Three phase current (Compressor)	Amp	Amp

   Water (water cooled compressor option only)

   Water must meet specifications before install.

Water source	House (wall)	( )
Water Chiller	Vendor	_____
	Model	_____

   Customer is responsible for the following before cryogenic system installation:

   - Water chiller used meets the necessary requirements, including compressor heat load and water requirements.
   - Installation of water chiller (unless other arrangements have been made with Varian). Site requirements for water chiller are NOT included in the Cryogenic System Site Requirements manual. See water chiller specifications for requirements.

   Air conditioning

   Customer is responsible for the following:

   - Verifying site air conditioning is adequate for the additional heat load (see Cryogenic Site Requirements).
   - Locating the air cooled helium compressor or air cooled water chiller in a location separate from the NMR Magnet.

5. Site Layout

   a. Provide digital pictures of the site

   b. Include sketch of the cryogenic system layout. Include distances for CryoBay and compressor, locations of other NMR system components, obstructions, magnets, etc. in the sketch.

   Complete the corresponding section if any of the following are "Yes".

Single Level	Yes ( )	No ( )
Magnet in Pit	Yes ( )	No ( )
Multi Level	Yes ( )	No ( )
Obstructions	Yes ( )	No ( )
Additional Magnets in Room	Yes ( )	No ( )
Floor Type	Raised ( )	Solid ( )

Single Level Room Information

Units used for measurements	Feet ( )	Meters ( )
Room dimensions	Length	_____
	Width	_____
Obstructions / Additional magnets in room		_____

Pit Information

Units used for measurements	Feet ( )	Meters ( )
Rectangular Pit	Length	_____
	Width	_____
	Depth	_____
Round Pit	Diameter	_____
	Depth	_____
Main floor elevation relative to magnet base		_____
Location of magnet in pit		
Center line of magnet relative to pit		
Center line		_____
Diameter of magnet		_____
Obstructions	Inside	_____
	Outside	_____

Multi Level Room Information

Units used for measurements	Feet ( )	Meters ( )
Room upper level dimensions	Length	_____
	Width	_____
Lower level dimensions	Length	_____
	Width	_____
	Depth	_____
Main floor elevation relative to magnet base		_____
Main floor elevation relative to magnet floor		_____
Obstructions, level	Upper	_____
	Lower	_____
Additional magnets in room		_____

6. Air Cooled Helium Compressor

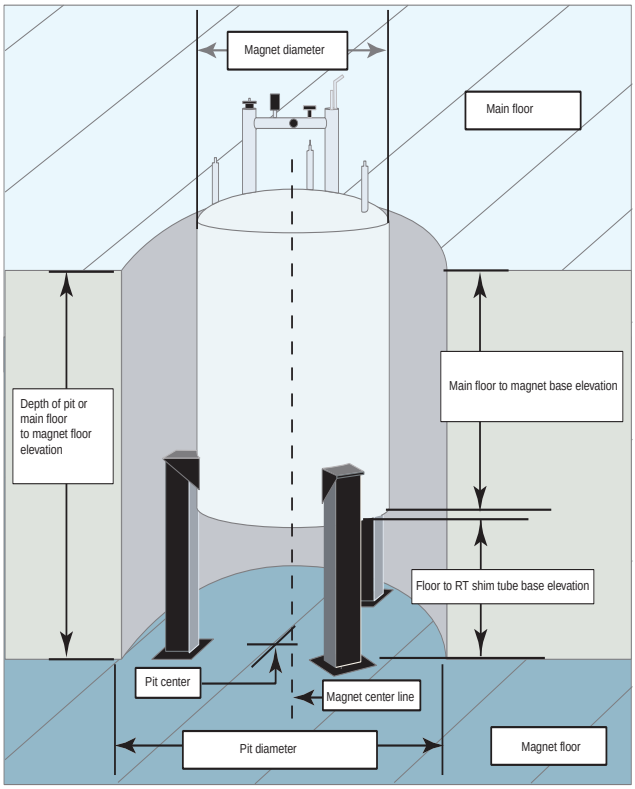
   Outdoor Unit Siting (Air Cooled Compressor Option Only). Air cooled helium compressor must be located in room other than NMR magnet.

   a. Provide a sketch of location of air cooled compressor outdoor unit with respect to magnet, CryoBay and indoor compressor unit. Include distances.

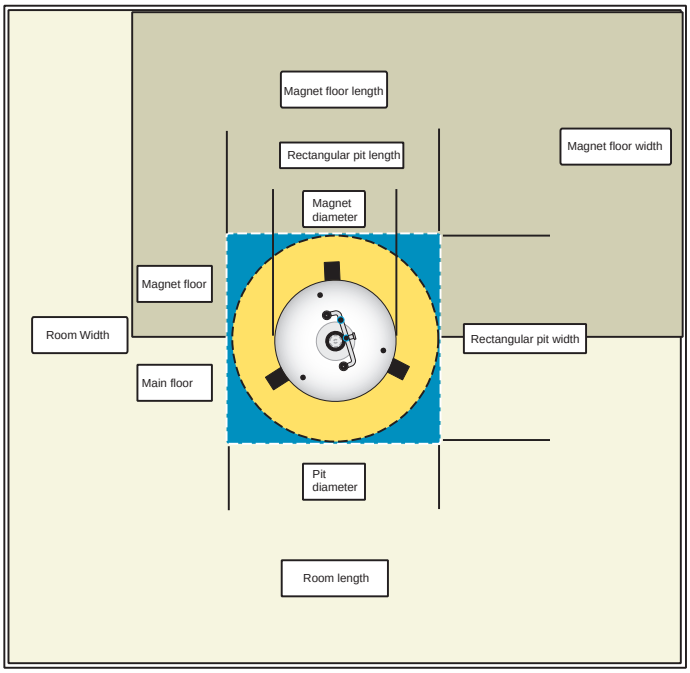
   b. Provide preliminary information on siting of air cooled compressor outdoor unit. Include environment and planned through wall access in the sketch.

7. Critical Measurements

a. Side View

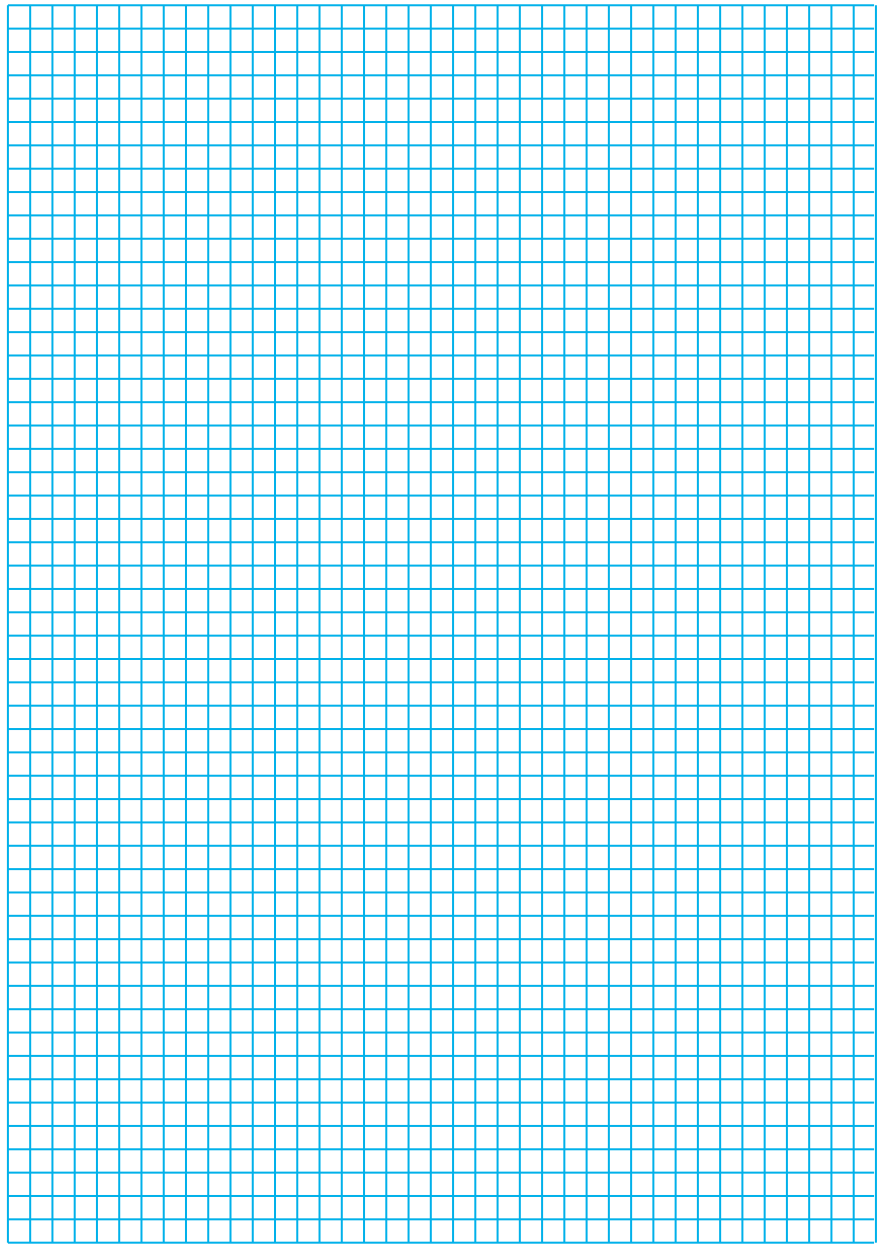


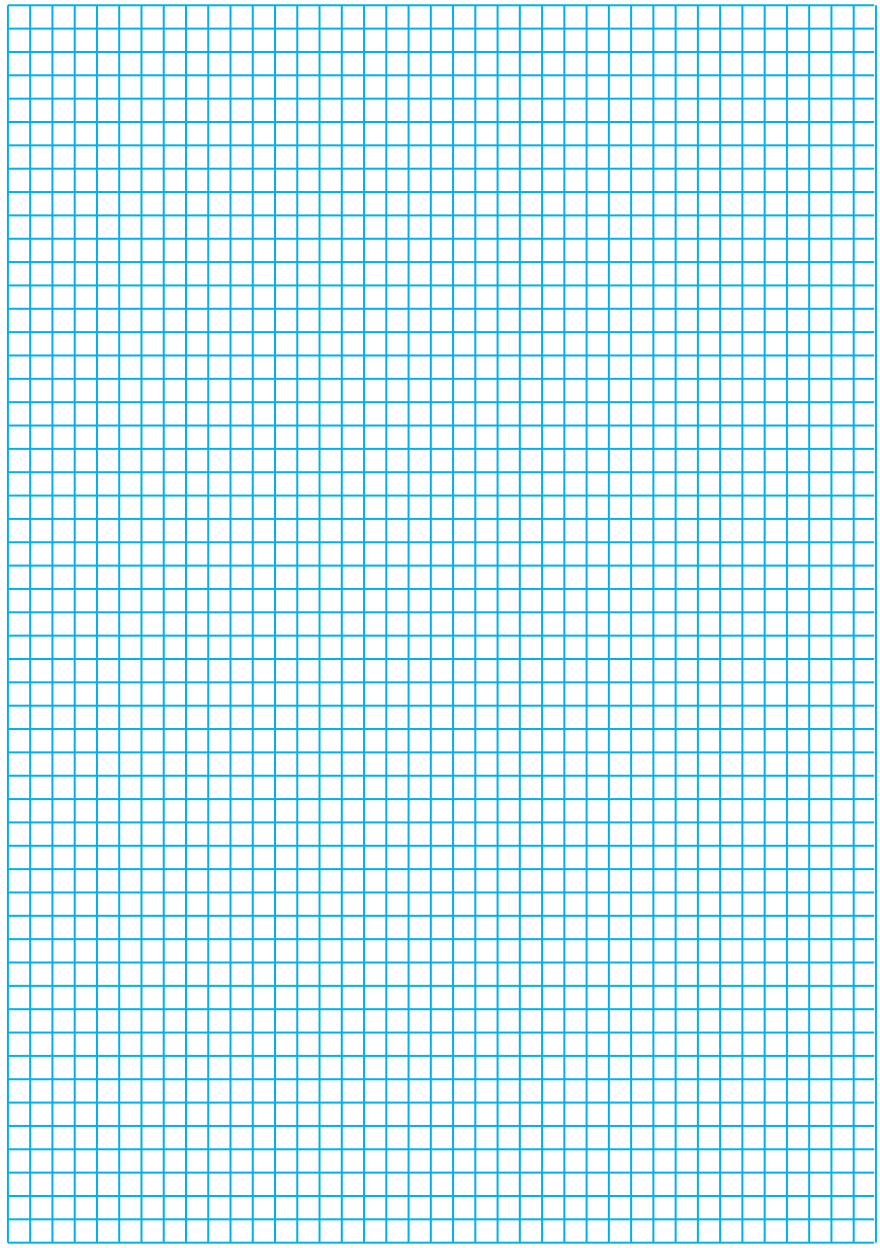
b. Top View



c. Room Layout Grids

Room layout grid for horizontal floor plan. Use the grids provided to sketch the floor plan. Include proposed location of cryogenic system components


Scale



Scale _____

d. Magnet

Vertical Magnet Data Sheet

General Information/Magnet Dimensions

1. Customer _____
2. Manufacturer of current console _____
3. Model of current console _____
   a. If Varian, console serial #_____
4. Magnet manufacturer _____
5. Magnet serial* #_____
6. Dewar/Cryostat *#_____
7. Project/Job* # _____
8. Magnet age_____ years
9. Magnet 1H freq. (Ex. 399.12MHz)** _____ MHz
10. Helium boil-off rate _____ cc/hr
11. Room temp bore diameter _____ mm
12. Helium transfer tube length _____ mm
13. Ceiling height_____ mm
14. Centerline to bottom flange _____ mm
15. Floor to bottom flange _____ mm
16. Stand height _____ mm
17. Top flange to bottom flange_____ mm
18. Top flange to top of He fill port_____ mm
19. Safety drop-off plate: YES _ NO _____ X one
20. Magnet bottom plate: FLAT ROUND__ X one
21. Magnet stand bolt size: 8mm __ 10mm _ X one

**From tag on magnet flange or installation manual.*

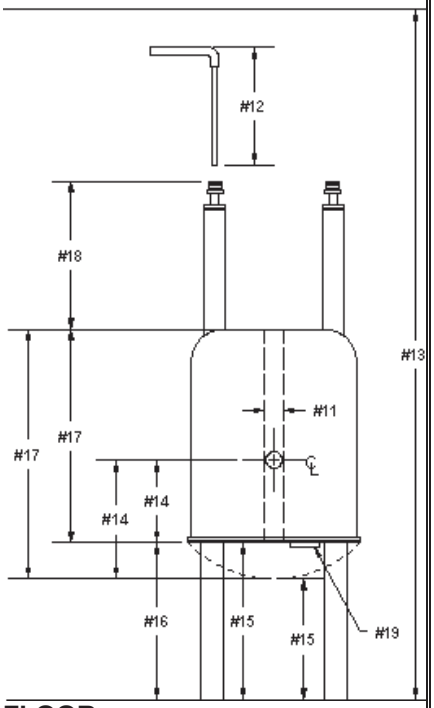
***If microimaging, field may need adjusting - 250KHz, Liquids /solids -50kHz*

A. Provide a copy of the magnet dimensional drawing from the magnet manual if available.

B. Provide a list of the superconducting shims and the most recent current settings or field plots.

C. Provide a copy of the magnet's most recent H1 lineshape test spectra, include date, scale, and parameter set.

CEILING



FLOOR

#14 & 15 Note – Round or Flat bottom.

Anti-Vibration System

1. A/V system installed: YES _____NO _____ X one
2. If installed, what type: TIRE _____POST ____ TABLE _____ X one
3. Manufacturer _____
4. Model # _____
5. Serial #_____

Provide a copy of the A/V system dimensional drawing from the manual or attach a sketch, including dimensions, of the A/V system.

Additional Information

1. Your name _____
2. Date _____
3. Telephone # _____
4. Does the existing system have Solids? YES _____ NO _____ X one
5. Does the existing system have Imaging? YES _____ NO _____ X one

_____

_____

_____