GEMINI 2000 Installation Planning Guide

GEMINI 2000 NMR Sprectrometer Systems

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GEMINI 2000 Installation Planning

This guide is intended to assist the customer in selecting and preparing a site to install a Varian *GEMINI 2000* Series NMR superconducting spectrometer system. By following the information presented, and by using the predelivery and postdelivery checklists provided in “Appendix A. Installation Checklists” on page 33, a smooth transition from delivery to installation will be made.

Keep in mind that Varian’s delivery responsibility ends at Varian’s factory shipping dock or at the customer’s receiving dock, depending upon the type of insurance obtained by the customer. In either case, the customer must provide a moving crew to move the shipping crates holding the system from the delivery truck (or storage location) to the installation site.

Certain supplies not provided by Varian, such as helium and nitrogen supplies, must be obtained by the customer before the Varian installation engineer can start the installation. This guide lists and describes these supplies in detail.

We at Varian will make every effort to ensure that the ownership of your new NMR spectrometer is a lasting and pleasurable experience. If you have any questions, do not hesitate to call your local sales representative or to contact us at the following location:

Varian, Inc., NMR Systems
Customer Support Group
3120 Hansen Way, MS D-421
Palo Alto, CA 94304-1030

Telephone: 1-800-356-4437

Safety Precautions

Throughout this guide are important warnings and cautions that you should read and follow carefully. These safety precautions have the following format and meaning:

WARNING ***Warnings* are used when failure to observe instructions or precautions could result in injury or death to humans or animals, *or significant property damage.***

CAUTION ***Cautions* are used when failure to observe instructions could result in permanent damage to equipment or loss of data.**

Installation Site Requirements

Check the “SHIP BY” date on the Varian Order Acknowledgment form. Use this date as a target for completing installation preparations. If you anticipate any delays in site readiness and need to delay shipment, notify the factory at *least* 90 days in advance.

Factors to consider when selecting the installation site include:

- Accessibility to the delivery location
- Site size and ceiling height
- Floor rigidity and structural strength
- Magnetic and radio frequency environment
- Ambient temperature and humidity
- Air ventilation

Each item is described further below.

Accessibility

The installation site must be accessible from the delivery location, with adequate clearance for system crates and moving equipment throughout the access route. Table 1 and Table 2 contain system dimensions and weights for calculating vertical, horizontal, and turning clearances, as well as evaluating the structural strength of passageways. Moving the larger crates of the system will require a forklift or hydraulic pallet mover, which must be considered when calculating accessibility.

For an installation site at a different level from the delivery location, be sure that the lifting equipment (such as an elevator) is capable of handling the combined weight and size of the shipping crates and the moving equipment.

If it is not possible to gain access to the installation site unless the system is uncrated, contact a Varian service representative for further instructions. Do not uncrate the system except with direct instructions from an authorized service representative.

The site must also provide adequate access for the routine delivery of supply dewars containing liquid helium and nitrogen.

Site Size

The site must be large enough to allow free access to all sides of the system and magnet for operation, maintenance, and cryogenic service. Table 1 and Table 2 contain the dimensions of the system components, and “Appendix D. Typical Room Layouts” on page 39 contains floor plans recommended for the NMR laboratory area or room. These plans are suggestions and not specifications.

All cabinets are mounted on casters for easy movement, which allows the system to be placed in a location as small as that illustrated in the “Minimum Size Laboratory Plan Possible” in Appendix D, as long as there is sufficient space for the cabinets to be moved to gain access on all sides. For comfort and convenience, however, and to provide space for an automatic sample changer or other options, the larger layouts shown in Appendix D are highly recommended. The minimum dimensions do *not* include compensation for external magnetic and rf interference that may be present. Each individual site must be analyzed to ensure optimum system performance.

Table 1. Magnet dimensions and weights

*Magnets as shipped with crate and pallet**

*Magnet type** (MHz/mm)*	*Height cm (in.)*	*Width cm (in.)*	*Depth cm (in.)*	*Weight kg (lb)*
200/54	120 (47)	79 (31)	88 (35)	132 (290)
200/54 LH235	200 (80)	95 (37.25)	95 (37.25)	468 (1030)
200/54 LH365	200 (80)	95 (37.25)	95 (37.25)	468 (1030)
300/54	120 (47)	79 (31)	88 (35)	142 (313)
300/54 LH235	200 (80)	95 (37.25)	95 (37.25)	468 (1030)
300/54 LH365	200 (80)	95 (37.25)	95 (37.25)	468 (1030)
400/54	200 (80)	95 (37.25)	95 (37.25)	468 (1030)
400/54 LH365	200 (800)	95 (37.25)	95 (37.25)	468 (1030)

*Magnets unpacked with crate and pallet removed and stand or legs attached**

*Magnet type** (MHz/mm)*	*Height cm (in.)*	*Width cm (in.)*	*Depth cm (in.)*	*Operational Weight kg (lb)*
200/54	158 (62)	76 (30)	66 (26)	136 (300)
200/54 LH235	228 (90)	78 (31)	78 (31)	268 (591)
200/54 LH365	235 (92.5)	78 (31)	78 (31)	278 (613)
300/54	168 (66)	69 (27)	69 (27)	152 (335)
300/54 LH235	235 (92.5)	78 (31)	78 (31)	278 (613)
300/54 LH365	235 (92.5)	78 (31)	78 (31)	278 (613)
400/54	235 (92.5)	69 (27)	69 (27)	400 (880)
400/54 LH365	235 (92.5)	78 (31)	78 (31)	380 (838)

* Dimensions and weights are approximate and subject to change. Height dimensions do not include optional accessories such as a siphon or plow-out tube.

** Long-hold magnets are designated by “LH” and a number that represents hold time in days.

Ceiling Height

The ceiling must provide sufficient headroom to insert the liquid helium transfer tube into the magnet dewar and the storage dewar. The height of the ceiling (or that part of the ceiling located directly above the magnet) without obstructions such as lighting and heating ducts *must* be equal to or greater than the minimum heights in Table 3.

These ceiling minimums allow enough headroom to insert the standard helium flutter tube and refill transfer tubes into the magnet dewar. They also allow use of the standard power stick for running up the magnet field. If one of the larger capacity liquid helium storage dewars is used with the magnet, however, additional ceiling clearance may be

Table 2. Cabinet and optional components dimensions and weights

*Components as shipped with carton and pallet**

Component	*Height cm (in.)*	*Width cm (in.)*	*Depth cm (in.)*	*Weight kg (lb)*
Electronics Cabinet	129.5 (51)	73.6 (29)	102 (40)	261 (575)
Autosampler				23 (50)
Work Table	31 (12)	198 (78)	91 (36)	53 (117)

*Components unpacked, carton and pallet removed**

Electronics Cabinet	115.6 (45.5)	55.9 (22)	83.2 (32.75)	227 (500)
Autosampler	71 (28)	34.3 (13.5)	34.3 (13.5)	17 (38)
Work Table	67 (26.5)	183 (72)	76 (30)	48 (107)

* Dimensions and weights are approximate and subject to change.

Table 3. Ceiling height minimum

Magnet Type MHz/mm	*Ceiling Minimum cm (in.)*	*With Optional Helium Level Sensor cm (in.)*
200/54	247 (97.4)	Not Applicable
200/54 LH235	314 (124)	365 (144)
200/54 LH365	321 (126.5)	365 (144)
300/54	252 (99)	Not Applicable
300/54 LH235	321 (126.5)	365 (144)
300/54 LH365	321 (126.5)	365 (144)
400/54	321 (126.5)	365 (144)
400/54 LH365	321 (126.5)	365 (144)

necessary. In general, the ceiling height must be at least twice the height of liquid helium storage dewar above the floor. Oxford magnets can be provided with optional hinged top-loading components that reduces the minimum ceiling height requirements. Contact Oxford for details.

Most of the antivibration (vibration isolation) systems do not change the ceiling height requirements, with the exception of the 200/51 and 300/51 magnets or any magnet with both the sample changer and an antivibration system. For these cases add 20 cm (8 in) to the ceiling height requirements.

Maximum Altitude

The maximum altitude during operation is 2440 m (8000 ft). The maximum during storage or transport is 9100 m (30,000 ft).

Structural Strength of Floor

Contact a plant engineer, structural engineer, or a registered civil engineer to confirm that the magnet does not exceed the structural floor loading rating. The site floor must have sufficient structural strength to support the combined weight of the spectrometer system and moving equipment used during installation. Table 1 and Table 2 list system weights and dimensions.

Magnet Weight Distribution—No Antivibration System

This section describes weight distribution for magnets without antivibration systems. The weights of the magnets, including stands, are given in Table 1.

200/54 and 300/54 magnets: The plan view of the magnet stand, illustrated in Figure 1A, shows how the two rectangular legs contact the floor. The magnet stand has four adjustable feet of 11.61 cm^2 (1.8 sq in.) each (total 45.16 cm^2 or 7 sq in.), so the “point loading” is relatively high. Because of the overall light weight of these magnets, however, this is usually not a concern except in areas with a soft floor covering.

400/54 and long-hold magnets: The stands for these magnets consist of three legs, as shown in the plan view in Figure 1B. Since the legs are hollow, the actual surface contact with the floor is only 167.74 cm^2 (26 sq in.) total, which creates relatively high “point loading.” This is only a concern, however, if the floor covering is soft.

Magnet Weight Distribution—With Antivibration System

This section describes weight distribution for magnets installed with antivibration systems. The weights of the magnets, including stands and antivibration systems, are given in Table 1.

200/54 and 300/54 magnets without the SMS autosampler: The antivibration system consists of a square table supported by three legs. See Figure 2 for leg placements and sizes.

400/54 magnet without the SMS autosampler: The antivibration system for this magnet consists of dampening equipment integrated into the magnet legs, as illustrated in Figure 3.

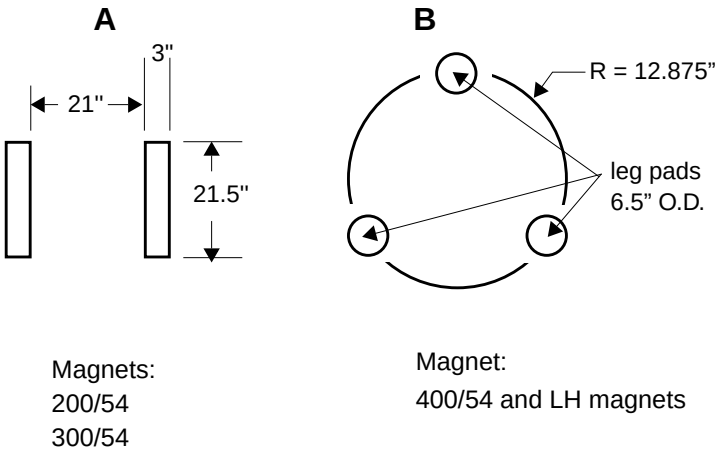


Figure 1. Plan views of floor contact points of magnet stands

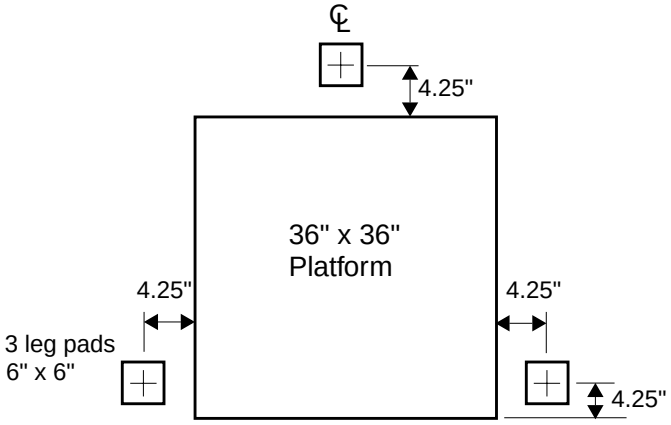


Figure 2. Platform antivibration system leg placements and sizes

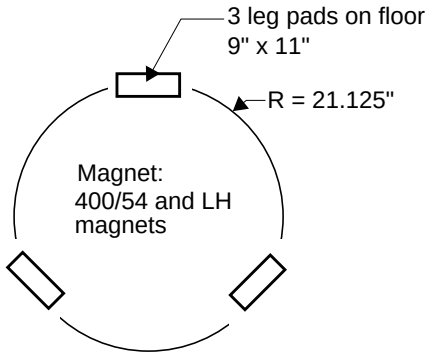


Figure 3. Magnet leg antivibration system leg placement and sizes

Antivibration Bolt-Down Requirement

For the 400/54 and long-hold magnets with an antivibration system, the magnet legs must be bolted to the floor. The antivibration system used with these magnets incorporates the dampening mechanism as an integral part of the magnet leg. Although in normal operation these antivibration legs are stable, for maximum safety Varian requires that they be anchored to the floor after installation.

Anchoring to a floor is a standard procedure for many types of equipment, and Varian expects that the customer's plant/maintenance personnel can usually accomplish it. The anchoring requires four 2.5-inch embedments for each leg, anchored using 0.5 inch bolts. Details are provided in the *Antivibration System Installation Manual*; this note is provided for information purposes only.

Floor Vibration Requirements

The floor must be sufficiently rigid to reduce the vibration from adjacent dynamic loads to a negligible level, defined as no single peak vibration greater than 20 µ*g* (400-MHz *GEMINI 2000*) or 100 µ*g* (200- and 300-MHz) acceleration, from 0 to 100 Hz.

Measurement is made with an Ono Sokki Model CF 200 field FFT analyzer using 16 rms time averages and a seismic accelerometer with 10 V/*g* sensitivity.

Magnetic Environment

The site must have a minimum of environmental magnetic fields. Common sources of magnetic interference are fluctuating loads on adjacent power lines, radio or television transmissions, heavy-duty transformers, elevator motors, and similar electromagnetic devices. Allow a separation of at least 4.6 m (15 ft) between the magnet and other high-field electromagnets, elevators, or forklift trucks.

Similar separation distances must also be maintained between the magnet and any object that can cause a detrimental effect on the field homogeneity or the structural integrity of the magnet. Conditions that could interfere with the magnet include (but are not limited to) a wall with metal sheathing or steel studding, a concrete support column with steel reinforcing bars, and a storage area containing steel dewars for cryogenic storage. Each site must be carefully analyzed to ensure optimum performance of the system. See Table 4 for examples of objects that affect or are affected by the magnetic field. In general, do not locate the magnet next to a wall if the opposite side of the wall is an area of general public access.

Color CRTs will need to be degaussed in magnetic fields above 1 to 2 gauss. Above 5 gauss, color CRTs may need additional shielding to prevent display distortion. Sun computers and peripherals are also affected by the magnetic field; refer to "Computer Preparation" on page 25 for a discussion of magnetic field considerations.

Table 4. Interaction between common objects and a magnetic field

Objects that affect the magnetic field	
15 gauss line or closer	All ferromagnetic construction materials except small amounts of steel reinforcing bar, normally not exceeding 11 kg/m^2 (2.5 lb/ft^2).
5 to 15 gauss	Presence or movement of ferromagnetic objects over 45 kg (100 lb) such as pushcarts, hand trucks, gas cylinders, and chairs.
2 to 5 gauss	Presence or movement of ferromagnetic objects over 450 kg (1000 lb) such as small delivery trucks, automobiles, pallet movers, forklifts, and elevators.
1 to 2 gauss	Presence or movement of ferromagnetic objects over 34,000 kg (75,000 lb) such as trains, and large trucks.
Objects affected by the magnetic field	
15 gauss line or closer	Cardiac pacemakers, ferromagnetic implants, unrestrained ferromagnetic objects such as tools, keys, electronic equipment, analog watches, magnetic data storage media, and credit cards.
5 to 15 gauss	Cardiac pacemakers, electronic equipment such as shielded CRTs, computers, shielded image intensifiers, and shielded photomultiplier tubes.
2 to 5 gauss	Very sensitive electronic equipment such as unshielded image intensifiers, and photomultiplier tubes.
1 to 2 gauss	Extremely sensitive electronic equipment such as linear accelerators, electron microscopes, and CRTs.

WARNING **Cardiac pacemaker or metalic implant wearers *must* remain outside the 5-gauss perimeter (see Appendix B) around the magnet until safety is clearly established. An NMR spectrometer system generates strong magnetic and electromagnetic fields that can inhibit operation of some cardiac pacemakers, resulting in death or serious injury to the user. Consult the user manual provided by the pacemaker manufacturer or contact the pacemaker manufacturer to determine the effect on a specific pacemaker. Varian provides signs with each system to warn pacemaker wearers of this hazard. Post the signs according to "Appendix C. Posting Requirements for Magnetic Field Warning Signs" on page 37.**

Safety Hazards of Strong Magnetic Fields

The potential safety hazards of strong magnetic fields to devices such as certain pacemakers must be understood and planned for. A set of plots indicating the magnitude of the stray fields for each type of magnet is included in “Appendix B. Stray Field Plots” on page 35. These plots show typical levels of stray field. Actual levels may vary and should be checked with a gaussmeter after a particular magnet has been installed.

Cardiac pacemaker wearers should refrain from entering a zone that would subject a cardiac pacemaker to a magnetic intensity that could cause adverse effects. In some instances, this zone might include space on the floors directly above and below the magnet. For assistance in determining the effect of a system on a pacemaker, consult the pacemaker user's manual, contact the manufacturer, or confer with a physician to determine the effect on a specific pacemaker. Actual levels vary and should be checked after a particular magnet has been installed.

Varian provides signs warning of magnetic field hazards. Refer to “Appendix C. Posting Requirements for Magnetic Field Warning Signs” on page 37 for an explanation of the types of signs and the sign posting requirements. Additional signs are available from Varian at no charge.

Since the magnetic field exists both horizontally and vertically, the effect of the field on persons, electronic equipment, computers, and other objects located above and below the magnet must also be considered. Pacemaker hazard and other signs warning that a magnetic field is present may be needed in the space on the next floor above the magnet and on the floor below the magnet.

NMR workers are exposed to high levels of static magnetic fields. At this time, no conclusive evidence exists indicating adverse health effects at current exposure levels. Current exposure levels are generally indicated as levels equal to or less than those listed in Table 5.

Table 5. Stray field data for Oxford magnets

Magnet Type	*Radial Distance (cm)*			*Axial Distance (cm)*				
(MHz/mm)	*0.6 kG*	*6 kG*	*20 kG*	*0.6 kG*	*6 kG*	*20 kG*	*Base to CL (cm)*	*Magnet Outside to CL (cm)*
400/54	39	*a*	*a*	59	*b*	*b*	33.2	36.2
300/54	*a*	*a*	*a*	38	*b*	*b*	23.9	24.7
200/54	*a*	*a*	*a*	33	*b*	*b*	23.9	24.7

a. Where no radial position is given, the point is within the cryostat body.
b. The axial point is in the cryostat bore. Compare with the magnet center line (CL) distance.

Although some studies suggest a link between magnetic field exposure and adverse reproductive effects, the body of medical data available is not clear enough to draw any firm conclusions regarding risks to pregnancy. In other words, static magnetic field associated with the NMR spectrometer magnets are not considered by the scientific community at this time to comprise a risk to pregnancy or a reproductive hazard.

The American Conference of Governmental Industrial Hygienists (ACGIH) article entitled *Threshold Limit Values and Biological Exposure Indices, 5th ed.*, states the following:

> "TLVs [Threshold Limit Values] refer to static magnetic flux densities to which it is believed that nearly all workers may be repeatedly exposed day after day without adverse health effects. These values should be used as guides in the control of exposure to static magnetic fields and should not be regarded as a fine line between safe and dangerous levels.
>
> "Routine occupational exposures should not exceed 60 milliteslas (mT)—equivalent to 600 gauss—whole body or 600 mT (6000 gauss) to the extremities on a daily [8 hour], time-weighted average basis. A flux density of 2 teslas (20,000 gauss) is recommended as a ceiling value."

Radio-Frequency Environment

The site should be checked for radio-frequency interference (rfi) at or near the operating frequencies of the spectrometer and most common nuclei. The level of any interference should be attenuated to an electrical field strength of less than 150 µV/m at the site of the magnet. Interference is not uncommon when two spectrometers are located in the same room, referenced to the same power system, or operating at the same frequency.

Radio-Frequency Emissions from Varian NMR Equipment

RF emissions from Varian NMR equipment has been measured and compared with the IEEE/ANSI C95.1–1991 "Standard for Safety Levels with Respect to Human Exposure to RF Radiation." The rf tests included general measurements of systems with particular interest directed toward amplifiers, transmitter boards, and probes. With maximum power applied (*tpwr=24* and *dpwr=47*), measurements were taken both one foot away and as close as possible to the rf source while the source was installed in the console or magnet.

The results of the tests on a 300 BB system (shown in Table 6) found that rf emissions from Varian NMR equipment were not detectable or at levels far below the IEEE/ANSI C95.1-1991 Standard levels, which are shown in Table 7.

Ambient Temperature and Humidity

Table 8 lists the required ambient temperature ranges, temperature stability, and humidity levels for the site. For optimal performance, the ambient temperature around the magnet should not vary. Magnet homogeneity is optimized if the ambient temperature stability listed in Table 8 is maintained for the duration of an experiment and between shimming. Sunlight should never shine on the magnet or the area surrounding the magnet.

If necessary, install an air conditioning system to maintain these conditions. Keep the air conditioning system operating continuously to stabilize the temperature and humidity surrounding the spectrometer system. *The air flow from the room heating and cooling system must not blow on the magnet.* Do not allow moisture to collect on, in, or around the system.

Table 6. Results of rf emissions tests on Varian NMR equipment

NMR Experiment System: 300 BB	*Frequency (MHz)*	*RF at Probe (mW/cm^2)*	*RF at Amplifier (mW/cm^2)*	*IEEE/ANSI C95.1-1991 (mW/cm^2)*
Carbon observe *tpwr*=24 pulse *dpwr*=47 pulse	75	0.05 E-field 0.05 H-field	0 E-field 0 H-field	1.0 E-field 1.8 H-field
Carbon observe *tpwr*=63 pulse *dpwr*=63 pulse 50-ohm load	75	0 E-field 0.05 H-field	0 E-field 0 H-field	1.0 E-field 1.8 H-field
Proton observe *tpwr*=24 pulse	300	1.0 E-field 1.0 H-field	0.05 E-field 0.05 H-field	1.0 E-field 1.0 H-field
Proton observe *tpwr*=24 pulse *dpwr*=47 pulse 50-ohm load	300	0.1 E-field 0.1 H-field	0 E-field 0 H-field	1.0 E-field 1.0 H-field

Table 7. IEEE/ANSI C95.1-1991 standard for rf radiation levels

Frequency (MHz)	*E-Field (mW/cm^2)*	*H-Field (mW/cm^2)*
50	1.0	4.0
75	1.0	1.8
125	1.0	1.0
150	1.0	1.0
200	1.0	1.0
300	1.0	1.0
500	1.7	1.7
600	2.0	2.0
750	2.5	2.5

Ventilation

Air ventilation must be adequate to displace the liquid helium gas during a quench, especially when using any type of volatile liquid for variable temperature experiments. Consult with a safety engineer on this subject. See also Table 9, which lists the amount of liquid helium for each magnet.

Table 8. Ambient temperature and relative humidity

Mode	*Temperature*		*Relative Humidity*
	°C	*°F*	*Noncondensing*
Operational	17 to 24	60 to 75	20% to 80%
Optimum	20	68	40% to 60%
Stability	±1.1	±2.0	
Non-operational			
Entire system	–40 to 60	–40 to 140	8% to 80%
Floppy disks	10 to 52	50 to 125	8% to 80%

Table 9. Liquid helium displacement for room ventilation considerations

Magnet/Bore (MHz/mm)	*LHe Max. Volume (liters)*
200/54	25
200/54 LH235	74
200/54 LH365	74
300/54	22
300/54 LH235	74
300/54 LH365	74
400/54	74
400/54 LH365	74

Installation Site Preparation

Before designing the room layout, verify the configuration with a Varian representative. Site preparation must conform with national and local codes, which take precedence over any recommendations in this guide. Approval by a building inspector may be necessary.

Line Voltage Variation

Measure and record the ac line voltage for 48 hours using a suitable power line analyzer such as the BMI model 4800 power line disturbance analyzer. Provide a copy for the Varian installation engineer. Requirements are the following:

- Long-term voltage variations (slow average) do not exceed 8% of nominal line tap voltages (117 ± 15 Vac).
- Short-term voltage variations (sag or surge), with a duration between several milliseconds and several seconds, do not exceed 10% of nominal line tap voltage (117 ± 15 Vac).

- Line transients (impulse) with a duration between 1 sand 800 µs, not to exceed 50 V peak above or below nominal line tap voltage (117 ± 15 Vac). These transients must be measured at the power plug with a load connected that simulates the spectrometer load.
- AC line frequency does not vary by more than +0.5 to –1.0 Hz.

The purchase of a line conditioner and regulator is strongly recommended. By providing protection against transients and improving line regulation, total system "up-time" will improve and the electronic components within the system will last longer. In many locations, a good power conditioning system will pay for itself within a few years. Contact a local power consultant for suitable equipment in your area.

In areas where the primary line voltage is not 117 Vac, a user-supplied step-down isolation transformer of sufficient capacity (2.0 kW) is required. A suitable isolation transformer is available from Varian.

Electrical Outlets

Standard System requires a dedicated single-phase, continuous-duty 117 ± 15 Vac, 50/60 Hz power line. The basic system draws less than 1 kW for 117 Vac so a 15 A circuit is adequate. Terminate the line within 2.7 m (9 ft) of the rear of the electronics cabinet with a duplex receptacle connected to a fused, quick-disconnect switch box or circuit breaker. Run a separate, insulated, low-resistance earth ground to the main electrical service entrance ground. The console's input power cable is terminated with a NEMA 5-15P plug.

Accessories and Test Equipment requires t least six ac outlets within 2 m (6 ft) of the host computer, electronics cabinet, and magnet. The outlets must have ground connections and should provide a minimum of 2.30 kVA at the local single-phase line voltage (115 Vac at 20 A, or 230 Vac at 10 A).

SMS Autosampler System requires a 120 or 220 Vac, single-phase, continuous-duty 50/60 Hz power line 15 A minimum service within 2.7 m (9 ft) of the magnet.

Compressed Air Supply

The house air supply must provide air that is clean, dry, and free of contaminants, with a dew point of –40°C (–40°F) minimum. It must also be capable of delivering the air pressures (in kilopascals or pounds per square inch gauge) and flow rates (in liters per minute or standard cubic feet per hour) after filtering, as listed in Table 10.

The typical flow rate listed above was measured with the source pressure set to 30 psig, spin rate set to 20 rps, bearing air set to minimum value for proper sample spinning, and probe body cooling air set to 5 LPM (10.6 SCFH).

Install a gate valve on the permanent outlet of the house compressed air supply line. The valve should be rated at a minimum of 860 kPa (125 psi or 9 kg/cm^2). If house pressure is greater than this level, the valve must be rated at a level higher than the house pressure. Attach to the gate valve a 1/4-in high-pressure pipe terminating with a 1/4-in male NPT fitting. Provide a long enough length of the high-pressure pipe from the gate valve so that the NPT fitting is located within 4.5 m (15 ft) of the proposed magnet site. The installation engineer will connect the NPT fitting to a Varian-supplied filter assembly and air hose to the magnet. The filter assembly includes a 0 to 400 kPa (0 to 60 psi) pressure gauge, a reduction valve, a standard 20 micron air filter, and a

Table 10. Compressed air supply source

GEMINI 2000 Configuration	*Source Pressure (Maximum)*	*Flow Rate (Typical)*
200-, 300-, or 400-MHz, without options:		
Normal operation	240 kPa (35 psig)	20 LPM (42 SCFH)
During sample eject	240 kPa (35 psig)	50 LPM (106 SCFH)
200-, 300-, or 400-MHz, with VT accessory (set 20°C to 100°C):		
Normal operation	240 kPa (35 psig)	30 LPM (64 SCFH)
During sample eject	240 kPa (35 psig)	60 LPM (128 SCFH)

coalescing oil filter (99.9 percent oil removal efficiency). The maximum input to the reducer is 100 psi (690 kPa, 7 kg/cm^2).

In areas where humidity is high or where moisture in the air supply is a problem, a prefilter with an automatic drain can help prevent overload of the filter. In extreme cases, an air dryer assembly is necessary. These units must be provided by the customer. The source should include a reservoir and be capable of delivering the air pressures (in kilopascals or pounds-per-square-inch-gauge) and flow rates (in liters-per-minute or standard cubic-feet-per-hour) after filtering as given in Table 10.

If a portable compressor is used as the air supply, the unit should have a holding tank capacity of 80 gallons (303 liters) to avoid the compressor cycling off and on. In moist environments, an air dryer is also usually necessary as well as an automatic drain on the holding tank.

Compressed Nitrogen Gas

During operation of the variable temperature accessory, a compressed nitrogen gas supply (from a cylinder or a fixed line) is required. The gas must be dry, oil-free, magnetically clean (e.g., free of rust), and with a dew point of –193°F (–80 K). The flow and pressure rates through the regulators are the same as those listed for the compressed air supply.

Air Conditioning

The air conditioning system requires a power line separate from the spectrometer. Include total heat dissipation from the spectrometer when calculating air conditioner capacity. The following table will help determine air conditioning requirements.

System	*kW*	*Btu/hr*
200-, 300-, or 400-MHz *GEMINI 2000* without options	1.5	5120
SMS Autosampler	0.18	615
All other options and accessories	0.6	2050

A filter on the intake and special air filtration is required in installations that are exposed to corrosive gases, salt air, or unusual dirt or dust conditions.

Telephone

We strongly recommend installing a telephone within easy reach of an operator when seated at the console. Not only is this a generally useful tool, but if an instrument problem develops or if application assistance is needed, it is very helpful if the operator can talk to a service engineer or applications chemist while operating the instrument.

Magnetic Field Considerations

To prevent damage to the stored data, the host computer, SMS controller, and the data storage media (e.g., floppy disks, streaming tape cartridge) must *not* be located in a field that exceeds 10 gauss. Refer to "Appendix B. Stray Field Plots" on page 35 for stray magnetic field plots.

Electrostatic Discharges

When selecting an installation site, remember that electrostatic discharges can result in loss of data and damage to the equipment. The system should be installed on vinyl covered floors and be properly grounded. If a printed circuit board must be touched or handled, the person should wear grounded wrist straps. If carpeting is installed, it should contain only a small percentage of nylon and be installed over antistatic pads. Alternately, regular use of a good quality antistatic spray will help considerably in alleviating electrostatic buildup.

Installation Supplies and Equipment

The installation engineer will need the following non-Varian supplies and equipment during installation:

- Liquid helium supply
- Liquid nitrogen supply
- Helium gas supply
- Nitrogen gas supply
- Face mask and thermal gloves
- Heat gun
- Non-magnetic ladder

In addition, the following items are recommended:

- Cryogenic equipment rack
- Electrical power surge protector
- Monitor degaussing coil

Details about each item are presented below.

Note: Locating a reliable local source of liquid helium and nitrogen is particularly important. As soon as possible after ordering a system, make arrangements for an initial delivery and an on-going supply of liquid helium and nitrogen.

Liquid Helium Supply

Liquid helium storage containers (dewars) have a normal loss of helium from boiloff and varies with the quality of the container, the distance from the supplier to the site, and the time between delivery and use. Also, some boiloff occurs during the magnet cooldown process. Table 11 lists the quantities of liquid helium recommended at installation. To prevent unnecessary loss of the supply, request delivery just prior to the scheduled visit of the Varian installation engineer.

Table 11. Initial on-site and short-notice liquid helium supplies

Magnet (MHz/mm)	*Initial Supply (liters)*	*Short-Notice Supply (liters)*
200/54	200	150
200/54 LH235	300	300
200/54 LH365	300	300
300/54	200	150
300/54 LH235	300	300
300/54 LH365	300	300
400/54	300	300
400/54 LH365	300	300

An additional amount of liquid helium should be available for delivery on short notice in case the initial amount is insufficient to complete the installation. Table 11 lists a recommended short-notice supply.

CAUTION **Specify that supply dewars are made of nonmagnetic materials. A magnetic supply dewar can be pulled into the magnet, possibly damaging the magnet or causing the magnet to quench. A magnetic supply dewar next to the magnet can damage the solenoid of the magnet.**

Liquid helium is transferred from the storage dewar to the magnet dewar using a transfer tube supplied with the system. The 200-MHz and 300-MHz magnets use a rigid transfer tube that must be inserted into the storage dewar and magnet dewar simultaneously without bending. For that reason, when ordering liquid helium, be sure that the supply dewar has a diameter less than 70 cm (27.5 in.). The 400-MHz magnet uses a flexible transfer tube that inserts into most sizes of supply dewars.

Liquid Nitrogen Supply

Table 12 lists the recommended quantities of liquid nitrogen. Liquid nitrogen storage containers suffer a loss of contents from boiloff, so request delivery of the supply just prior to the scheduled visit of the installation engineer. Provide an adaptor for connecting 9 mm (3/8 in.) ID rubber tubing to the container.

Table 12. Initial on-site liquid nitrogen supply

Magnet Field (MHz/mm)	*Initial Supply (liters)*
200/54	130
200/54 LH235	325
200/54 LH365	325
300/54	130
300/54 LH235	325
300/54 LH365	325
400/54	325
400/54 LH365	325

For low-temperature operation using the variable temperature accessory, a refrigerant is required. Most commonly, this is liquid nitrogen in the VT cooling bucket.

Helium Gas Supply

Table 13 lists the recommended number of helium gas cylinders. Each cylinder should hold at least 8000 liters (285 ft^3). The helium gas must be the highest purity available: no less than 99.995% or U.S. Bureau of Mines Grade A.

Helium gas can be supplied in a *magnetic* container provided the unit remains outside the 5 gauss limit of the magnet and the cylinder is firmly secured to avoid movement caused by magnetic field attraction.

Provide a flowmeter that measures 280 to 1400 liter/hr (10 to 50 ft^3/hr) and a hose barb that fits 5 mm (3/16 in.) ID Tygon tubing.

Table 13. Helium gas supply

Magnet field (MHz)	*Helium gas (cylinders)*
200/54	1
200/54 LH235	2
200/54 LH365	2
300/54	1
300/54 LH235	2
300/54 LH365	2
400/54	1
400/54 LH235	2

Nitrogen Gas Required for Magnet Installation

During installation, one cylinder of nitrogen gas is required for precooling the magnet and for transfer of liquid nitrogen. Nitrogen gas can be supplied in a *magnetic* container provided the unit remains outside the 5 gauss limit of the magnet and the cylinder is firmly secured to prevent attraction to the magnet.

If the system is equipped with the variable temperature accessory, a nitrogen gas supply is required. If a fixed source is not available, obtain a nitrogen gas cylinder with pressure regulator. The gas must be dry and chemically pure with a flow rate through the pressure of 19 LPM (40 SCFH) at 207 kPa (30 psig). For low-temperature operation, use prepurified grade gas (99.99%, –85°C dew point).

CAUTION **To avoid movement caused by magnetic field attraction, helium gas and nitrogen gas cylinders made of magnetic material must be kept outside the 5-gauss limit of the magnet and firmly secured.**

Face Mask and Thermal Gloves

If cryogenic helium or nitrogen contact living tissue, a *serious injury* (similar to a burn) can occur. Order appropriate safety coverings for use during dewar servicing, including a mask that protects the face completely and loose-fitting thermal gloves.

WARNING **Avoid helium or liquid nitrogen contact with any part of the body. If liquid helium or nitrogen contact living tissue, a *serious injury* (similar to a burn) can occur. Never place your head over the helium and nitrogen exit tubes on top of the magnet. If helium or nitrogen contacts the body, seek medical attention, especially if the skin is blistered or the eyes are affected.**

Heat Gun

Order a 120 Vac, 20 A heat gun (Dayton Model 27046 or equivalent) for thawing ice accumulation and drying out moisture on dewar servicing equipment.

Ladder (non-magnetic)

Acquire a 90 to 120 cm (3 to 4 ft) nonferromagnetic ladder for reaching the top of the dewar while inserting and removing the helium transfer tube. The ladder should be sturdy and self-supporting with rubber feet.

Hoist

For installing the Oxford magnet, a hoist is required to remove the magnet from the crate, assemble it, and move it into place. The capacity of the hoist depends on the weight of the magnet being installed. Table 1 on page 9 specifies magnet weights. Allow a safety factor of at least 100% above the weight specified in Table 1 on page 9.

Cryogenic Equipment Rack (Recommended)

Various items are used around the magnet for routine maintenance and handling. These include helium transfer tube, flutter tube, Tygon tubing, stingers, and so on. To protect the cryogenic equipment from damage and to keep it conveniently available, provide a rack to hold the items. A 1.2 m × 2.4 m (4 ft × 8 ft) peg board hung on a laboratory wall, with wood or plastic pegs, works very well.

Electrical Power Surge Protector (Recommended)

To protect the delicate electrical components of the computer system (monitor, disk drive unit, CPU base, etc.), a good quality surge protector should be inserted in the power circuit serving the components. A single surge protector with six outlets will suffice if the components are located relatively close to one another. Contact an electronic professional for advice on quality surge protection in your area.

Computer Preparation

GEMINI 2000 NMR spectrometers are operated using a Sun Microsystems computer, which may have been purchased from Varian or separately. In either case, certain preparations are required. Some of these preparations were outlined previously in the section “Electrical Outlets.” The following sections contain additional considerations.

Magnetic Field Precautions for Computers and Peripherals

The spectrometer host computer system and storage media (in other words, streaming magnetic tape cartridge) must be located at a sufficient distance from the magnet that the magnetic field cannot damage the data. For a Sun workstation, this specification is less than 5 gauss. The distances at which this gauss level is present are different for each kind of magnet and must be taken into account when planning the room size. See the field plots in “Appendix B. Stray Field Plots” on page 35 for typical distances at which various gauss levels exist for particular magnets, but be aware that these distances vary somewhat for each magnet and should be checked after a magnet is installed.

Configuring the Sun Computer

The *GEMINI 2000*system uses a Sun SPARCstation as a host computer.

The host computer must have 16 megabytes (MB) of RAM or more. One or more (up to three) hard disks (internal and/or external) can be present, with a minimum total disk space of 535 MB. Graphics can be “plain” or the GX version (the GX version provides higher performance). Graphics higher than GX (that is, GXplus, GS, GT) are not supported by Varian software. Varian has not performed a full evaluation of higher lever graphics boards and cannot guarantee complete compatibility.

Purchasing Software Media

Sun computers, whether purchased from Sun or from Varian, include the UNIX “right-to-use” license. In general, they do *not* have the operating system *media* included (some Sun computers purchased through Varian do include a CD-ROM); that is, a CD-ROM containing the relevant version of Solaris.

Media is *separately purchased*. One copy of the media on hand for the installation is *required*, and this media *must* be for the relevant version of Solaris (currently 2.3 for all computers). You may purchase the CD-ROM from Varian, you may purchase it from Sun through “SunExpress” (phone 1-800-USA4SUN, or you may borrow it from another computer (this is completely legal because of your right-to-use license).

Installing Sun and VNMR Software

Sun operating system software (SunOS), as discussed below, is shipped on a CD-ROM and can be installed either locally (on a computer to which the CD-ROM unit is attached) or remotely. You must have a CD-ROM drive available for installation of SunOS—a CD-ROM drive is not automatically included with the computer or with a spectrometer purchase.

Varian VNMR software is provided on 1/4-inch and 8-mm tape, and instructions are provided for installing it locally or remotely. To install VNMR software, you must have

available, either directly connected to the computer or to a computer to which that computer is networked, a 1/4-inch or 8-mm tape drive.

The *Software Installation Manual*, Pub. No. 87-190130-00, contains complete instructions for configuring the Sun computer and installing the Sun operating system software according to Varian specifications. Sun computers operating either as a host or as a separate data station require specific setup and configuration for Solaris installation that are *not* met by the "preloaded" configuration supplied by Sun with the computer.

If you have purchased your Sun computer from Varian, Varian assumes full responsibility and will install both the Sun operating system software and the VNMR software, subject to the constraints discussed above.

If you have purchased your Sun computer from another source, you are responsible for configuring the hardware and installing the software according to the instructions contained in the *Software Installation Manual* (you can request a free copy through Varian Technical Support or through your local Varian sales and service organization). *Installation will not start until the computer system is properly configured;* however, you are *not* expected to install the Varian VNMR software.

There is an exception: If you have purchased a Sun computer from a source other than Varian *and* if you have a knowledge of UNIX system administration *and* if that computer came with the Sun operating system preloaded, it *is* possible to reconfigure the operating system so that it can be used for VNMR operation. In this case only, a copy of the Solaris media is not required. Guidelines (but *not* step-by-step instructions) are contained in the *Software Installation Manual* for the case of a two-disk system. *Varian installers are not trained to perform these operations. If you have purchased the Sun computer from Varian, you* must *have a copy of the Solaris CD-ROM available for the installer to use.*

The Varian manual *Software Installation Manual* contains full, step-by-step instructions for installing Solaris and VNMR, and the *System Operation Manual* (Pub. No. 87-190100-00) contains information to operate your spectrometer and interact with UNIX. The Sun computer also comes with the "Desktop SPARC manual set," which provides user-level documentation on the basic features of UNIX. Additionally, Solaris contains extensive on-line documentation (accessed by the *man* command). For these reasons, full Sun UNIX documentation is *not* included with the purchase of a Sun computer (whether from Varian or another source).

Full documentation *is* available from Sun through SunExpress (SX-09), but such documentation is definitely *not* required for installation or use of the system.

Computer Preparation Checklist

- ❑ Sun computer is SPARCstation.
- ❑ Hard disk drive is 535 MB or larger.
- ❑ Tape unit (150-MB, 1/4-inch or 8-mm) is installed or available on a networked computer.
- ❑ CD-ROM drive is installed or available on a networked computer.

- ❑ Solaris media is available (CD-ROM).

If you have purchased the Sun computer from a source other than Varian:

- ❑ Copy of current *Software Installation Manual* is available.
- ❑ Computer installed and configured according to Varian specifications.
- ❑ Solaris installed and configured according to Varian specifications.

Peripherals Available

"Appendix E. Peripheral Compatibility" on page 49 lists peripherals that can be used with *GEMINI 2000*NMR spectrometers. These devices fall into a number of compatibility categories, ranging from "fully tested" to "unknown," which are described in Appendix F. Most of the products in the "fully tested" category are available from Varian.

This information is provided solely as a courtesy to those users who wish to purchase their own peripherals (or who may already have these items). Products in other categories are not sold by Varian, and Varian assumes no responsibility for their purchase or use, but provides this information solely for your discretionary use.

If the Varian installer is to install the system, and you want to connect to a LAN, you must provide the following information.

Collecting System and Network Information

The Solaris installation program asks you to supply some system and network information before installation begins. You can save time by collecting this information now, before booting from the Solaris 2.3 CD-ROM.

Use the "Pre-Installation Worksheet" on page 29 to record your system information. Each field on the worksheet is described below.

If your system is not connected to a network, you need to know or create only the hostname, root password, and the time zone. If your system is on a network, you need additional information that is described in this section. If unsure, contact your network administrator.

System Configuration Type

You are asked to configure your computer as one of the following: server, standalone, or dataless client. A server is a system that provides network services such as file transfer and storage space. A standalone system is a system that contains its own hard disk and bootup files. A dataless client, sometimes called diskless client, is a system without its own hard disk and uses an NFS server for the operating system, storage, and other services. For the purposes of VNMR, you will install your system as a standalone system.

Selecting a Hostname

A computer on a network is often called a host. Its hostname is the name that uniquely identifies the computer. If you already have a version of UNIX installed, you can use the command *uname -n* from within a C Shell to display this information for a Sun computer.

When choosing a hostname, make sure the name you select is unique within both your local area network and, if applicable, your name service domain.

In many networks, the choice of a hostname is left up to the owner of the computer (subject to the requirement of uniqueness). A hostname can be up to 64 upper case or lower case characters. It is strongly recommended that you use all lower case characters in the hostname because some networking software that might be used in other computers on the network could require lower case hostnames. Choose a name that starts with a lower case letter, followed by any combination of lower case letters, numbers, or hyphens. The name, however, cannot end with a hyphen.

Obtaining the IP Address

Your computer must have a unique Internet Protocol ((IP) network address if your computer is to be attached to a network. Consult your network administrator about the address. If the software is being installed on a computer that is already connected to a network, the command *ypcat hosts | grep `uname -n`* can be used to display the IP address of your computer. Note the use of back quotes (`) in this command.

Selecting a Subnet Mask

The subnet mask is a number that is used to split IP addresses into the network (Internet) and host parts. If your site does not use multiple subnets, use the default number, otherwise consult your network administrator. For a computer connected to a network, the command *cat /etc/netmasks* can be used.

Selecting the Name Service Type

The name service prompt allows choosing between NIS, NIS+, and none. If you choose NIS or NIS+, you need to enter the hostname and the IP address of the computer from which you receive the service. If you choose none, you are not prompted for additional information. Ask your network administrator what name service the network uses.

Entering the Hostname and IP Address of the Name Server

If you select either NIS or NIS+ as the name service type, it is assumed that there is a different computer on the network that is the current NIS or NIS+ server. You are asked to enter the hostname and IP address of the server that provides the name service. On an existing computer, the server's name can be displayed by entering the command *ypwhich*. The server's IP address, and other information, can be displayed by entering the command *ypcat hosts | grep `ypwhich`*. Again, note the use of back quotes (`).

Domain Name

The domain name is the name assigned to a group of computers that are administered together. All computers in the group (domain) are accessed by the same NIS or NIS+ maps. Your network administrator should be able to provide the domain name. Or the domain name can be found by entering the command *domainname*.

Setting the Time Zone

Solaris software uses world time zones and automatically adjusts the system clock for daylight-savings time if appropriate. Time zones are specified by name, such as "US/Central."

Disk Layout

Your computer must contain at least one hard disk drive. If only one disk drive is installed, use the default layout provided by the software. If more than one drive is installed, accept the default layout or select the drive to receive the software during the installation process. See the *Software Installation Manual*.

Pre-Installation Worksheet

Write down your system and network information here in preparation for the questions that are asked during the installation process.

Category	*Your Configuration*
System Configuration Type Choices: *Server, Standalone,* or *Dataless Client*	Stand-alone
Hostname Example: *mysystem*	
IP Address Example: *195.5.2.15*	
Subnet Mask Example: *255.255.255.0*	
Name Service Choices: *NIS*, *NIS+*, or *none*	
Name Server Hostname Example: *ourserver*	
Name Server IP Address Example: *195.5.2.25*	
Domain Name Example: *our.domain*	
Time Zone Examples: *US/Mountain, US/Pacific, US/Eastern*	
Disk Layout Examples: */ = c0t0d0s0, swap = c0t0d0s1, /usr = c0t0d0s6* *Use the default proposed by the installation program*	

Receiving Preparations

The method of shipping and the current conditions at the destination determine the extent of the receiving preparations. The Varian Order Acknowledgment form indicates the shipping method for the order. The following service is usually provided:

- *Air Freight.* System is delivered to unloading dock or other easily accessible outside unloading point. Factory to destination transit time is about two days (not including time to clear customs).
- *Motor or Moving Van.* System is delivered to an easily accessible interior location or any interior location to which freight can be easily transported by movable dolly. Excluded is transport in elevators that cannot support the weight of the shipment or up stairways. Factory to destination within the United States is about eight days.

Confirm that the local shipping company uses a vehicle that will allow the magnet to be transported in an *upright* position for all transport methods that will be used. See Table 1 on page 9, Table 2 on page 10, and Table 3 on page 10 for dimensions and weights of major system components.

Contact the shipping company locally about the service usually rendered. If moving equipment will be required at the site, obtain help from the plant facilities department or an outside moving service.

Sea freight or motor freight without air cushion suspension is not recommended for long distance delivery of systems.

Postdelivery Instructions

When the system is delivered, follow the instructions below to inspect for shipping damage before moving the crates. *Do not open any crate.*

Inspecting for Shipping Damage

CAUTION **Do *not* open any crate except with direct instructions from an authorized Varian service representative. In particular, the crate containing the magnet has components that could be irreparably damaged if opened incorrectly.**

When the shipment arrives, make an immediate visual inspection of the outside of each crate for damage. Take the following steps if any damage is found:

1. Note the nature of the damage on the carrier's waybill.
2. Request an inspection and written damage report by a representative of the carrier.
3. Forward a copy of the damage report to the local Varian representative.

In case of damage, the FOB block on the Varian Order Acknowledgment form determines owner responsibility:

- *FOB PALO ALTO.* Transfer of ownership occurs when the shipment leaves the factory. The customer is responsible for claims for shipping damage. Upon request, Varian will provide assistance in filing claims.
- *FOB DESTINATION.* Transfer of ownership occurs at customer's point of receipt. Varian is responsible for claims for shipping damage.

Damage discovered fifteen or more days after delivery generally cannot be recovered. Such damage will be at the expense of the customer.

Moving the System

CAUTION **Move the crates in an upright position. Do not drop or mishandle. The crates are packed with G-force and “tip-and-tell” indicators that record mishandling. Be especially careful about moving the magnet crate. If one or more crates cannot be moved into the installation site because of doorway clearance, leave the affected crates in a clean, safe, dry location. Do not open any crate except with direct instructions from an authorized service representative.**

If possible, move the crates in an upright position, with a forklift or hydraulic pallet mover, directly to the installation site. Should it appear necessary to uncrate one or more units because of doorway or passage clearance, contact your Varian service representative for further instructions.

To avoid unnecessary expense, be sure moving personnel and equipment are ready for the shipment on the delivery day.

Appendix A. Installation Checklists

Predelivery Checklist

The following checklist will help you prepare for delivery of the system. Refer to the sections in this manual for additional instructions and safety precautions. Consult knowledgeable individuals, such as plant facilities personnel, for assistance in implementing these instructions.

- ❑ 1. Check the “SHIP BY” date on the Varian Order Acknowledgment form. Use this date as a target for completing installation preparations.
- ❑ 2. Select the site for installing and operating the system.
- ❑ 3. Prepare the installation site, including electrical outlets, compressed air supply, air conditioning, and host computer setup form. If you anticipate any delays in site readiness and need to delay shipment, notify the factory at *least* 90 days in advance.
- ❑ 4. Order the supplies and equipment needed for installation and startup operation.
- ❑ 5. Make arrangements for workers and equipment to move the system upon delivery to the installation site.

Postdelivery Checklist

Use the checklist below to plan for handling the instrument after it is delivered. Refer to the “Postdelivery Instructions” section of this manual for additional instructions and related safety precautions.

- ❑ 1. Check for shipping damage upon delivery, but do not open the shipping crates except with direct instructions from an authorized service representative. Examine each crate for shipping damage. Note any apparent damage on the carrier's waybill and contact the insurance company.
- ❑ 2. As soon as possible, move the shipment to a clean, dry location (preferably the installation site). Move the crates in an upright position. Do not drop or mishandle. The crates are packed with G-force and “tip-and-tell” indicators that record mishandling. If one or more crates cannot be moved into the installation site because of doorway clearance, leave the affected crates in a clean, safe, dry location. Again, do not open any crate except with direct instructions from an authorized service representative. *In particular, the crate containing the magnet has components that could be irreparably damaged if opened incorrectly.*
- ❑ 3. Contact Varian to schedule the visit of an installation engineer *after* the shipment is moved to the installation site, the utilities are installed, and non-Varian installation parts and supplies (listed in the “Installation Supplies and Equipment” section) are received. For installations in the United States, telephone the Installation Departmen.

For installations at other locations, contact the nearest Varian sales or service office, listed in Appendix E of this guide.

Appendix B. Stray Field Plots

This appendix shows stray field plots for each system. The axial (vertical) and radial (horizontal) distances shown are measured in meters from the magnet centerline (CL). The values are typical but may vary between individual magnets. Gauss levels should be checked after a particular magnet has been installed.

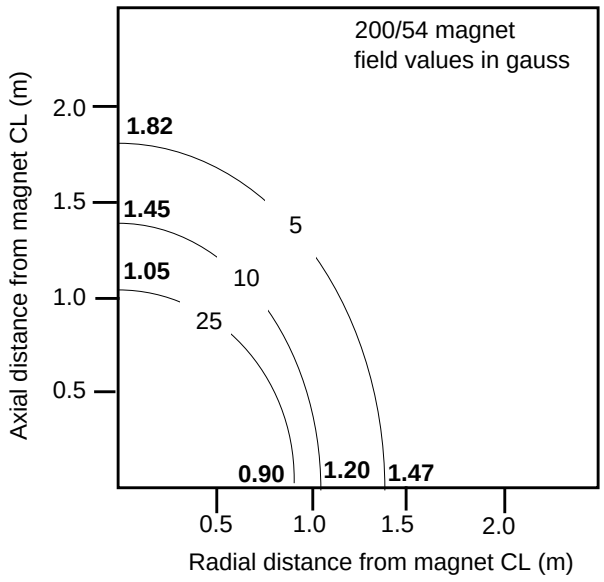


Figure 4. Stray field plots for 200-MHz magnets

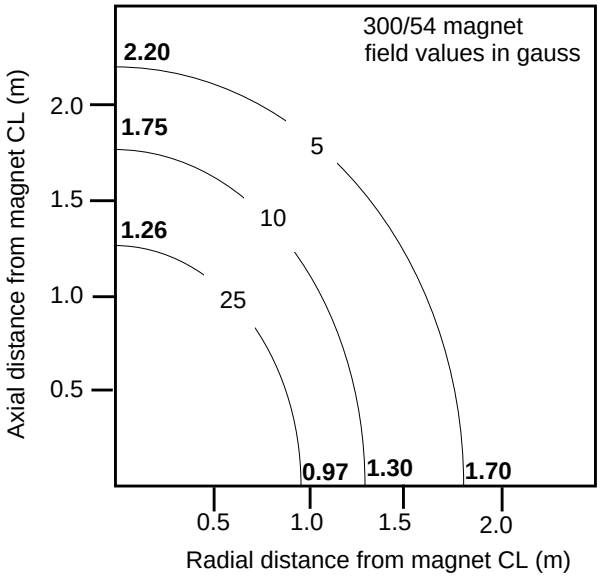


Figure 5. Stray field plots for 300-MHz magnets

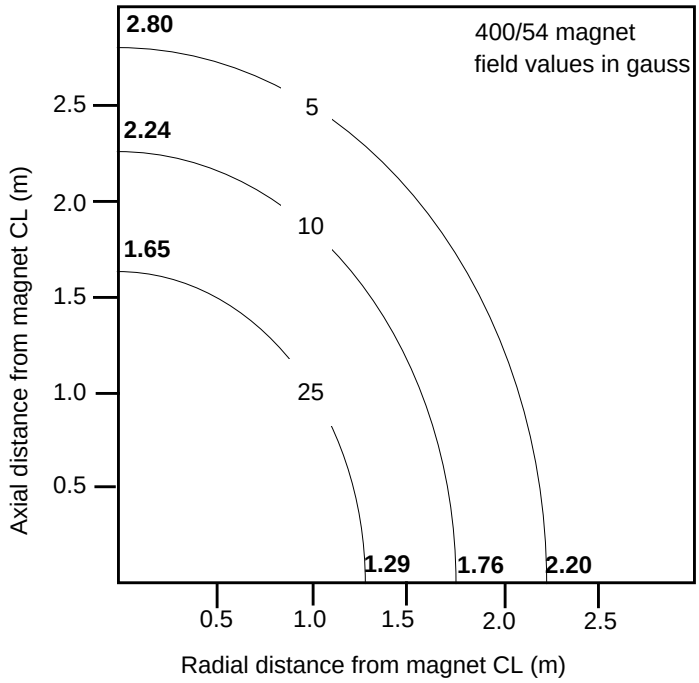


Figure 6. Stray field plots for 400-MHz magnets

Appendix C. Posting Requirements for Magnetic Field Warning Signs

The strong magnetic fields that surround a superconducting magnet are capable of causing death or serious injury to individuals with implanted or attached medical devices such as pacemakers or prosthetic parts. Such fields can also suddenly pull nearby magnetic tools, equipment, or dewars into the magnet body with considerable force, which could cause personal injury or serious damage. Moreover, strong magnetic fields can erase magnetic media such as tapes and floppy disks, disable the information stored on the magnetic strip of automated teller machine (ATM) and credit cards, and damage some watches.

To warn of the presence and hazard of strong magnetic fields, the customer is responsible for posting clearly visible signs warning of magnetic field hazards. This responsibility includes measuring stray fields with a gaussmeter.

Radio-frequency emissions may also pose a danger to some individuals. The rf emission levels from Varian NMR equipment have been measured and compared to the IEEE/ANSI C95.1-1991 standard. For further information, refer to the *Installation Planning Guide* for the system.

Warning Signs

Varian provides signs to help customers meet this posting responsibility. These signs *must* be posted according to the following requirements *before the magnet is energized*:

1. *10-gauss warning signs* (Figure A) – Post along the 10-gauss perimeter of the magnet so that a sign can be easily seen by any person about to enter the 10-gauss field from any direction. Refer to the manuals supplied with the magnet for the size of a typical 10-gauss stray field. Check this gauss level after the magnet is installed. Note that the stray field may extend vertically to adjacent floors, and additional signs may be needed there. A sign is not required if the 10-gauss field extends less than 30 cm (12 in.) beyond a permanent wall or less than 61 cm (24 in.) beyond the floor above the magnet.
2. *5-gauss warning signs* (Figure B) – Post along the 5 -gauss perimeter of the magnet so that a sign can be easily seen by any person about to enter the 5-gauss field from any direction. Refer to the manuals supplied with the magnet for the size of a typical 5-gauss stray field. Check this gauss level after the magnet is installed. Note that the stray field may extend vertically to adjacent floors and additional signs may be needed there.
3. *Magnet area danger signs* (Figure C) – Post at each entrance to the magnet area. Be sure each sign is outside the 5-gauss perimeter.

Stray magnetic fields can reach beyond the published distances when two or more magnetic fields intersect or when the field extends over large ferromagnetic masses or structures (steel doors, steel construction beams, etc.). In this case, the customer *must* measure the stray field using a gaussmeter to determine how the 5- and 10-gauss fields are altered (contact a scientific instrumentation supplier for information on acquiring a gaussmeter).

You can request additional signs from Varian by telephoning 1-800-356-4437 in the United States or by contacting your local Varian office in other countries.

Public Access Areas

In addition to posting signs, Varian strongly recommends that customers block or restrict access to public areas containing a 5-gauss or higher stray field. In some facilities, these areas might include company lobbies or sidewalks outside the building.

Safety Training

Customers must provide on-site training about magnetic field hazards to any person who may be exposed to 5-gauss or stronger stray fields.

Figure A. 10-Gauss Warning Sign

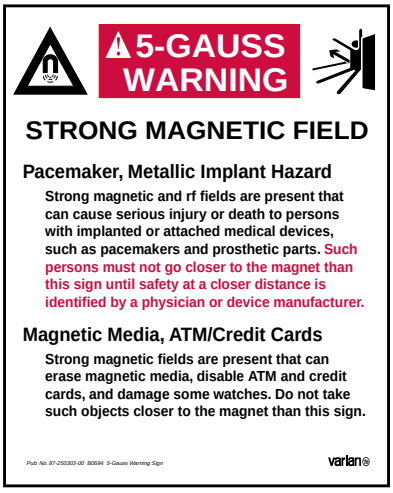


Figure B. 5-Gauss Warning Sign

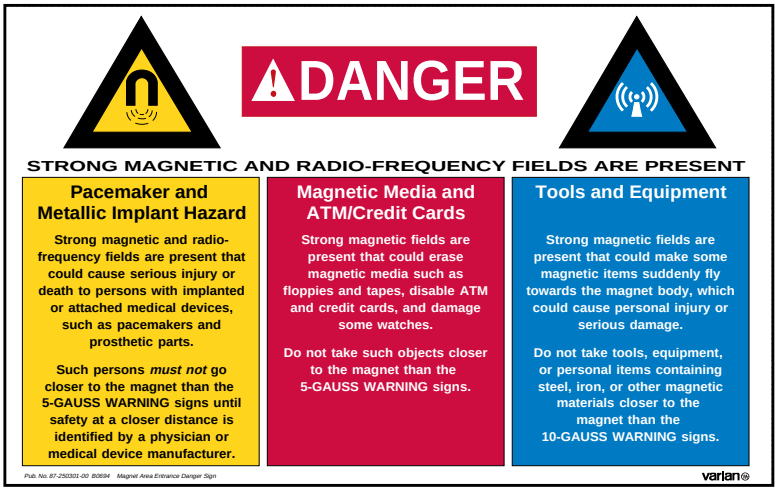


Figure C. Magnet Area Danger Sign

Appendix D. Typical Room Layouts

This appendix provides possible room layouts for *GEMINI 2000*NMR Spectrometers. The following layouts are shown:

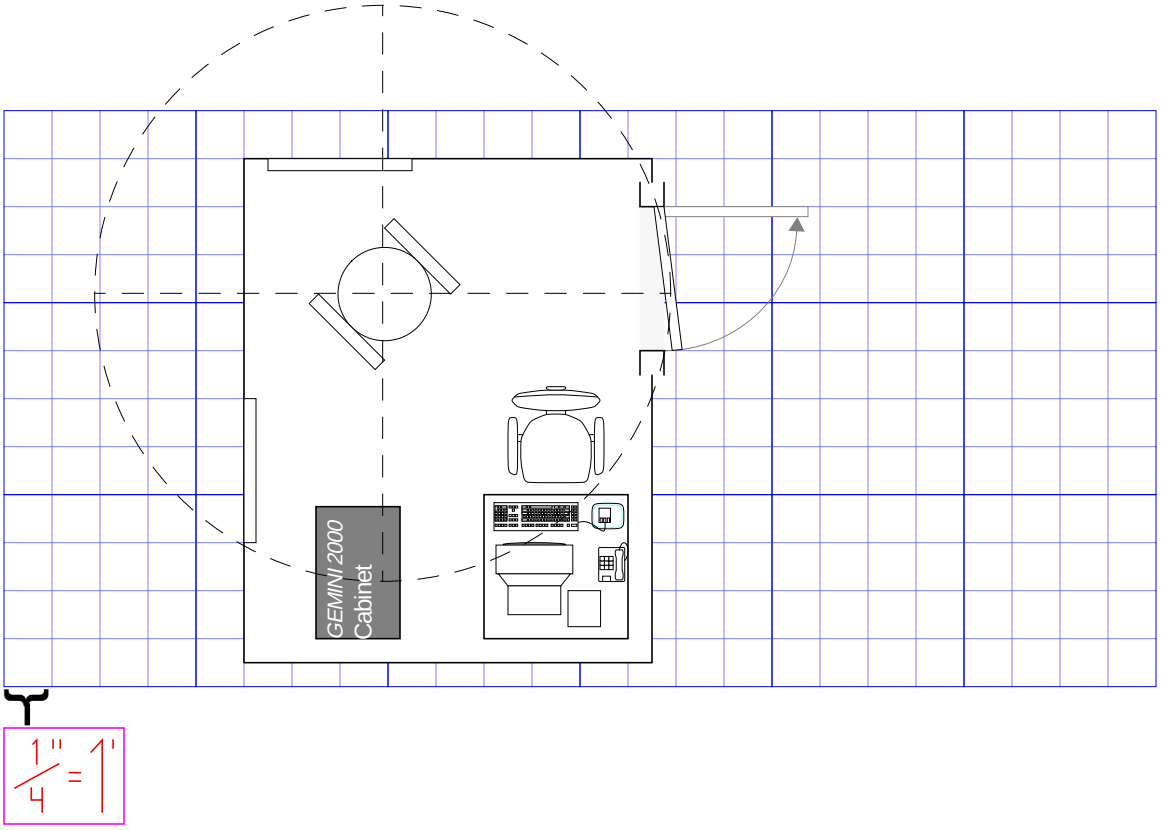
- “Minimum Possible Room Size—200- and 300-MHz” on page 40.
- “Recommended Room Layout—200- and 300-MHz” on page 42.
- “Recommended Layout with SMS Autosampler—200- and 300-MHz” on page 43.
- “Recommended Room Layout—400-MHz” on page 44.
- “Recommended Room Layout with SMS Autosampler—400-MHz” on page 45.

In the room layout illustrations, the dotted circles around the magnets represents the possible radial extent of the 5-gauss stray field. In the room layouts with the optional SMS autosampler, the location of the autosampler depends on the orientation of the magnet.

This appendix also provides a blank grid and illustrations of the *GEMINI 2000*system that you can cut out and use to set up a rough room layout.

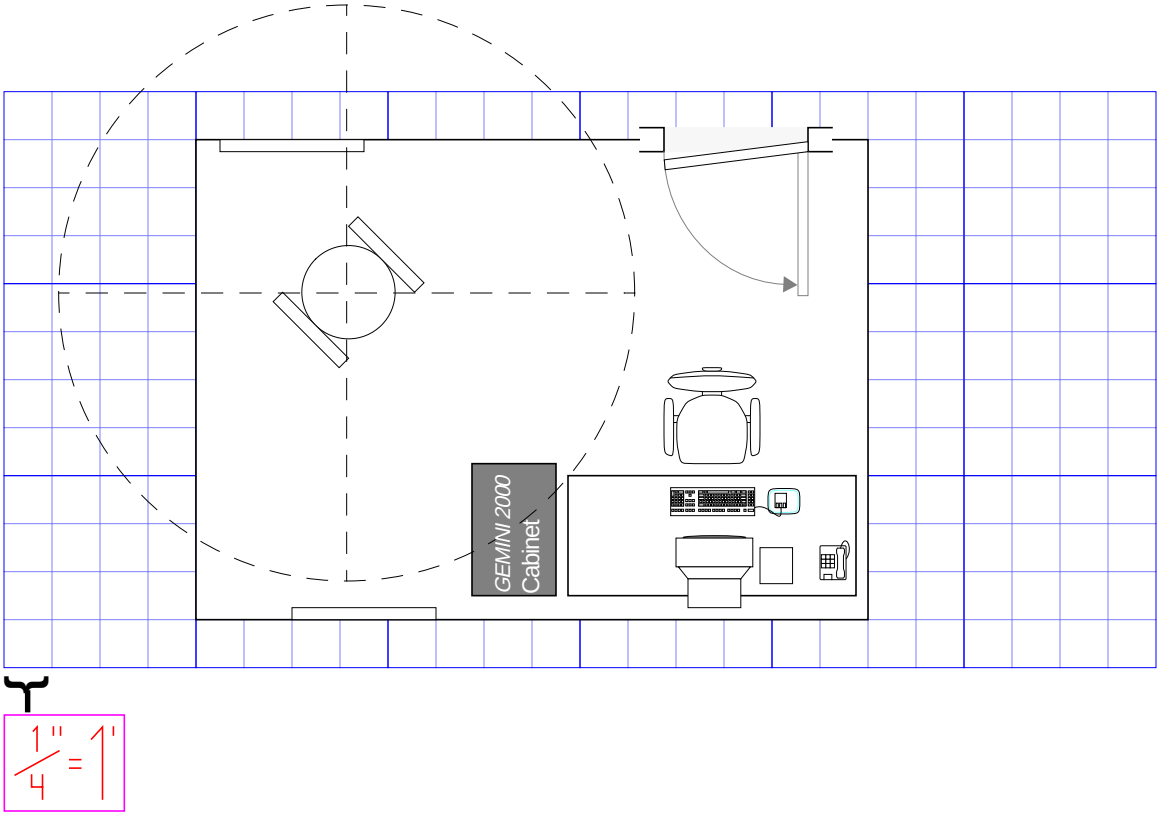
Note that long-hold magnets are the same size as the 400/54 cryostat—use the circle representing the 400 to plan your room layout for a long-hold magnet.

Minimum Possible Room Size—200- and 300-MHz



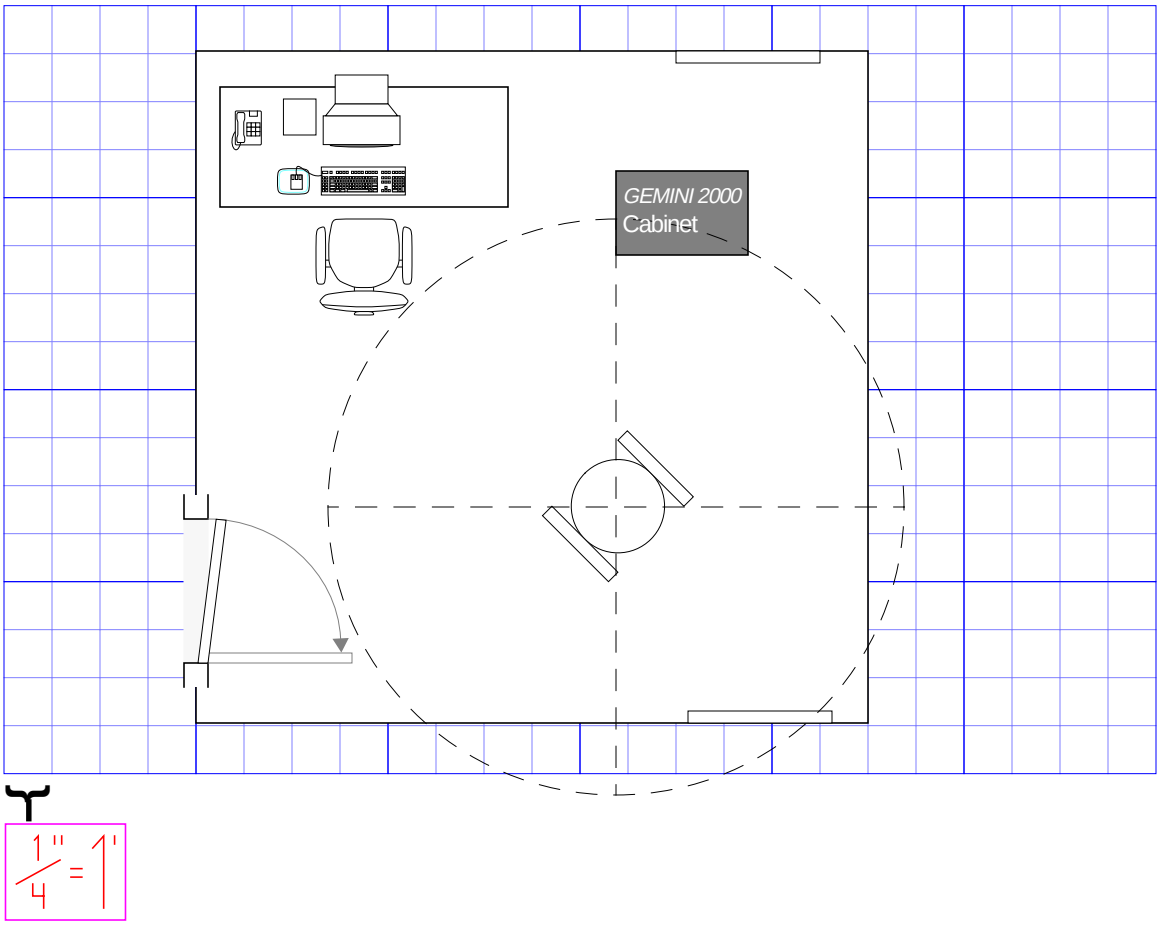
Room dimensions are about 2.6 m × 2.9 m (8.5 ft × 9.5 ft). A distance of 1.7 m (5 3/4 ft) should be maintained around the magnet to prevent interference with electronic components. A distance of 1 m (3 ft) should be maintained around the standard cabinet. If space permits, the alternate arrangements shown in the following sections of this appendix are recommended. Drawn approximately to scale.

Recommended Room Layout—200- and 300-MHz



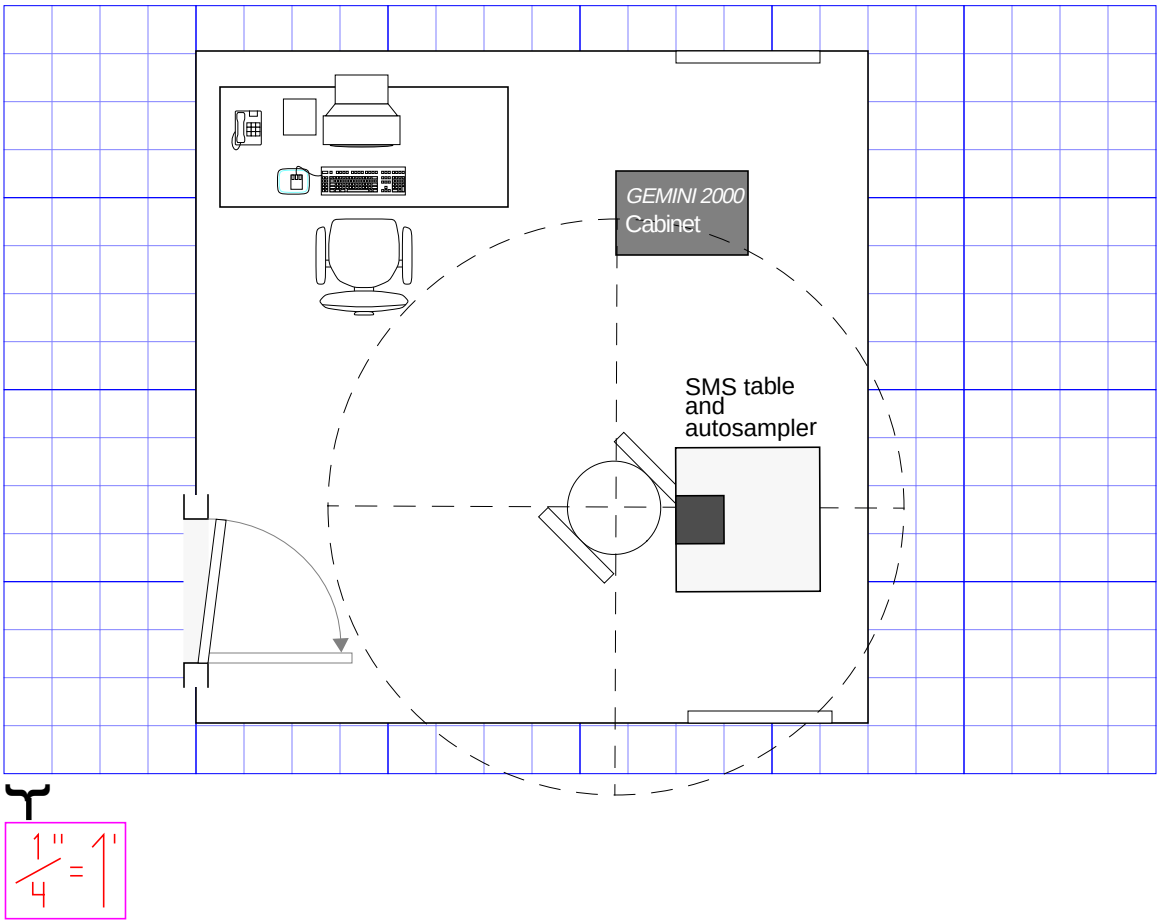
The room dimensions are about 3 m × 4.3 m (10 ft × 14 ft). This arrangement provides comfortable access for operator and service personnel. A distance of 1.7 m (5 3/4 ft) should be maintained around the magnet to prevent interference with electronic components. A distance of 1 m (3 ft) should be maintained around the standard cabinet. Drawn approximately to scale.

Recommended Room Layout—200- and 300-MHz



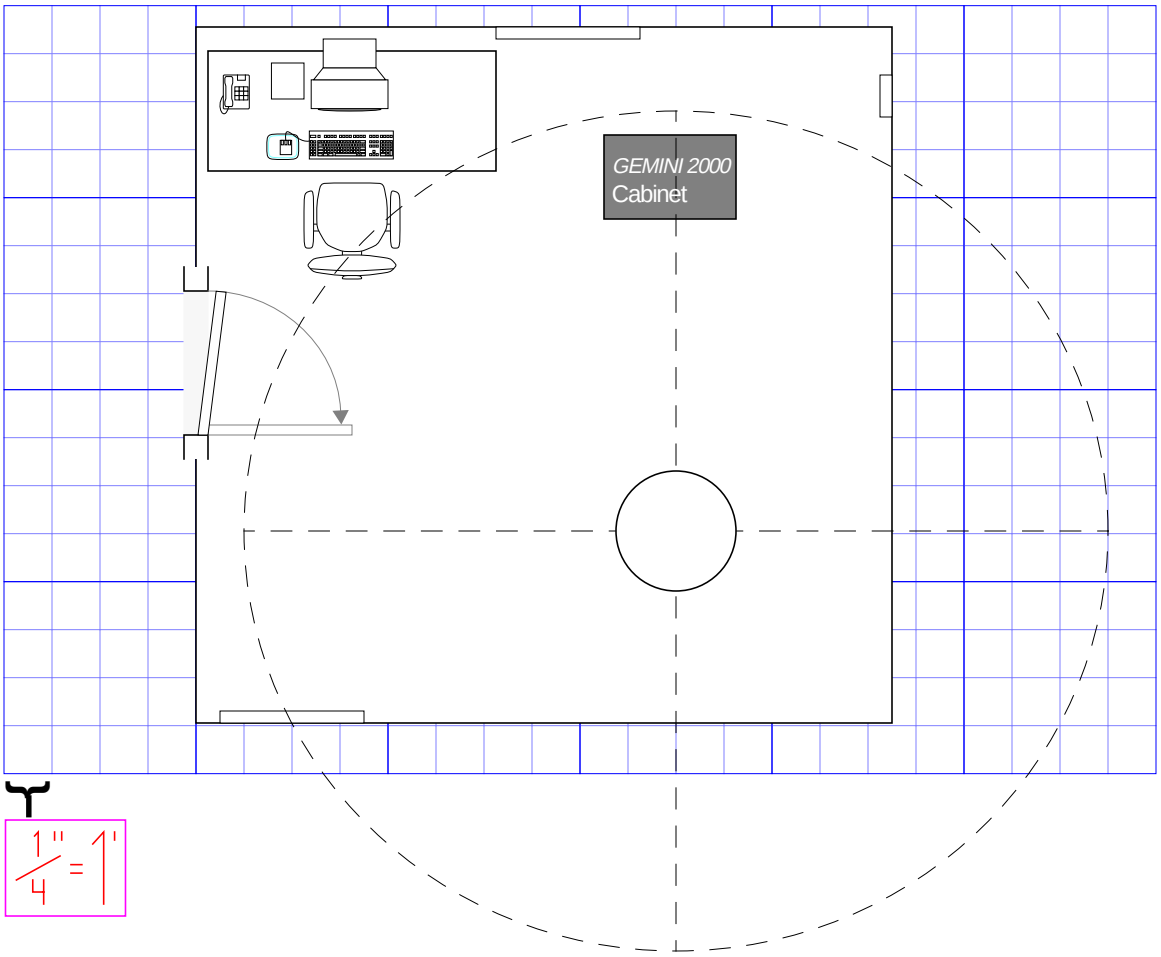
The room dimensions are about 4.3 m × 4.3 m (14 ft × 14 ft). This arrangement provides comfortable access for operator and service personnel. A distance of 1.7 m (5 3/4 ft) should be maintained around the magnet to prevent interference with electronic components. A distance of 1 m (3 ft) should be maintained around the electronics cabinet. Drawn approximately to scale.

Recommended Layout with SMS Autosampler—200- and 300-MHz



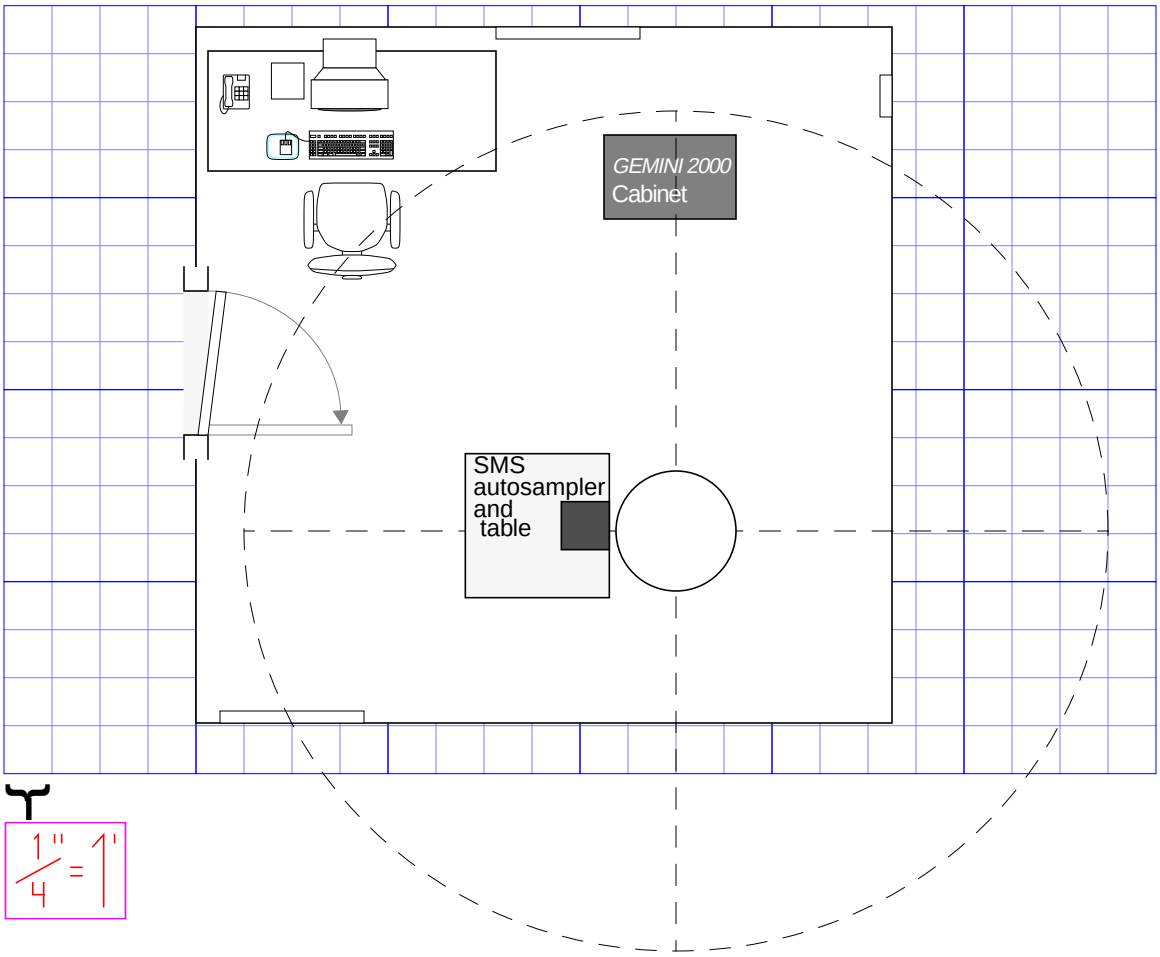
The room dimensions are about 4.3 m × 4.3 m (14 ft × 14 ft). A distance of 1.7 m (5 3/4 ft) should be maintained around the magnet to prevent interference with electronic components. A distance of 1 m (3 ft) should be maintained around the cabinets. The table on which the SMS autosampler sits is 1 m × 1 m (3 ft × 3 ft). Drawn approximately to scale.

Recommended Room Layout—400-MHz



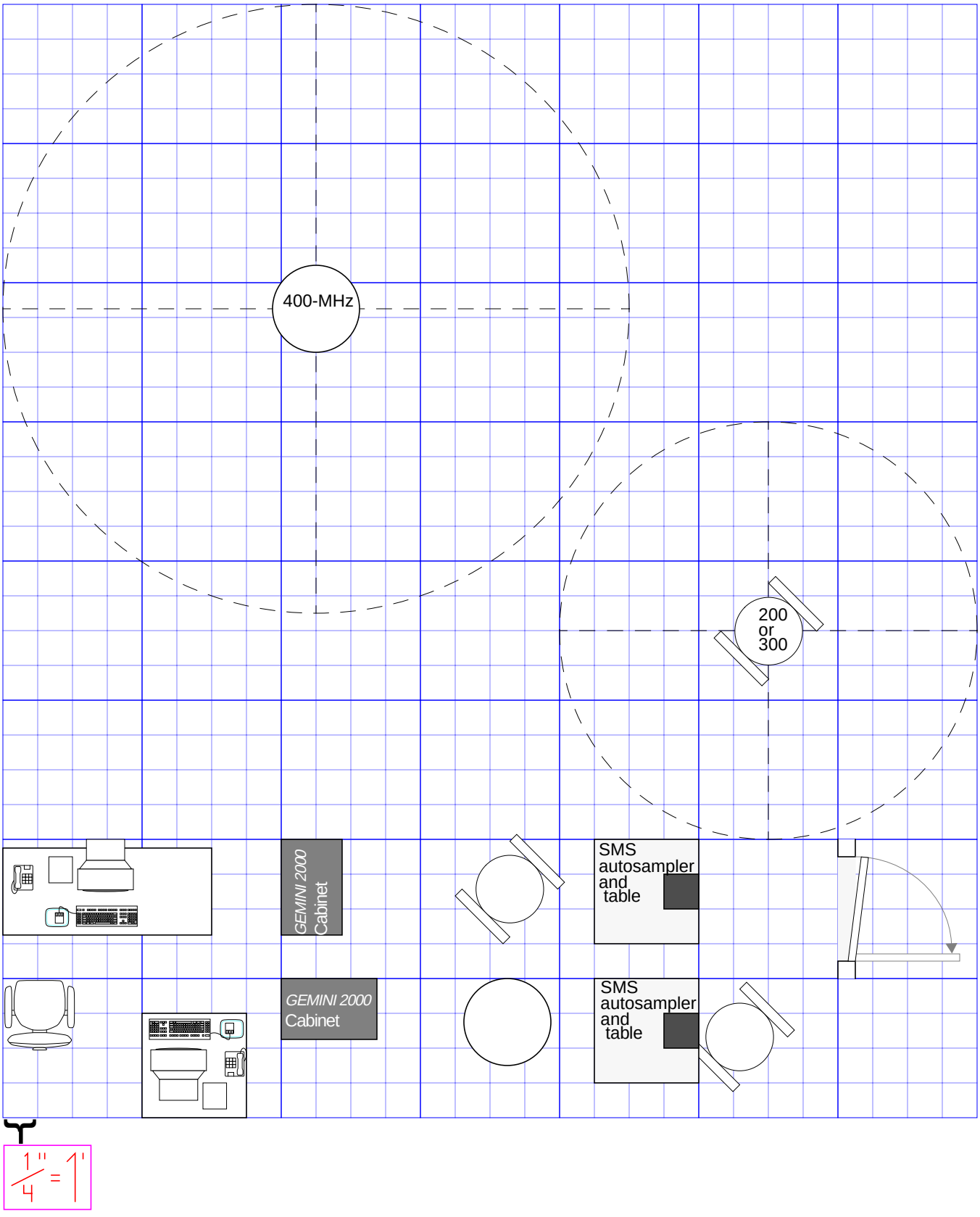
The room dimensions are about 4.4 m × 4.6 m (14.5 ft × 15.2 ft). The magnet is 80 cm (32 in.) in diameter. A minimum of 3 m (10 ft) should be maintained around the magnet to prevent interference with electronic components. A distance of 1 m (3 ft) should be maintained around the standard cabinet. Drawn approximately to scale.

Recommended Room Layout with SMS Autosampler—400-MHz

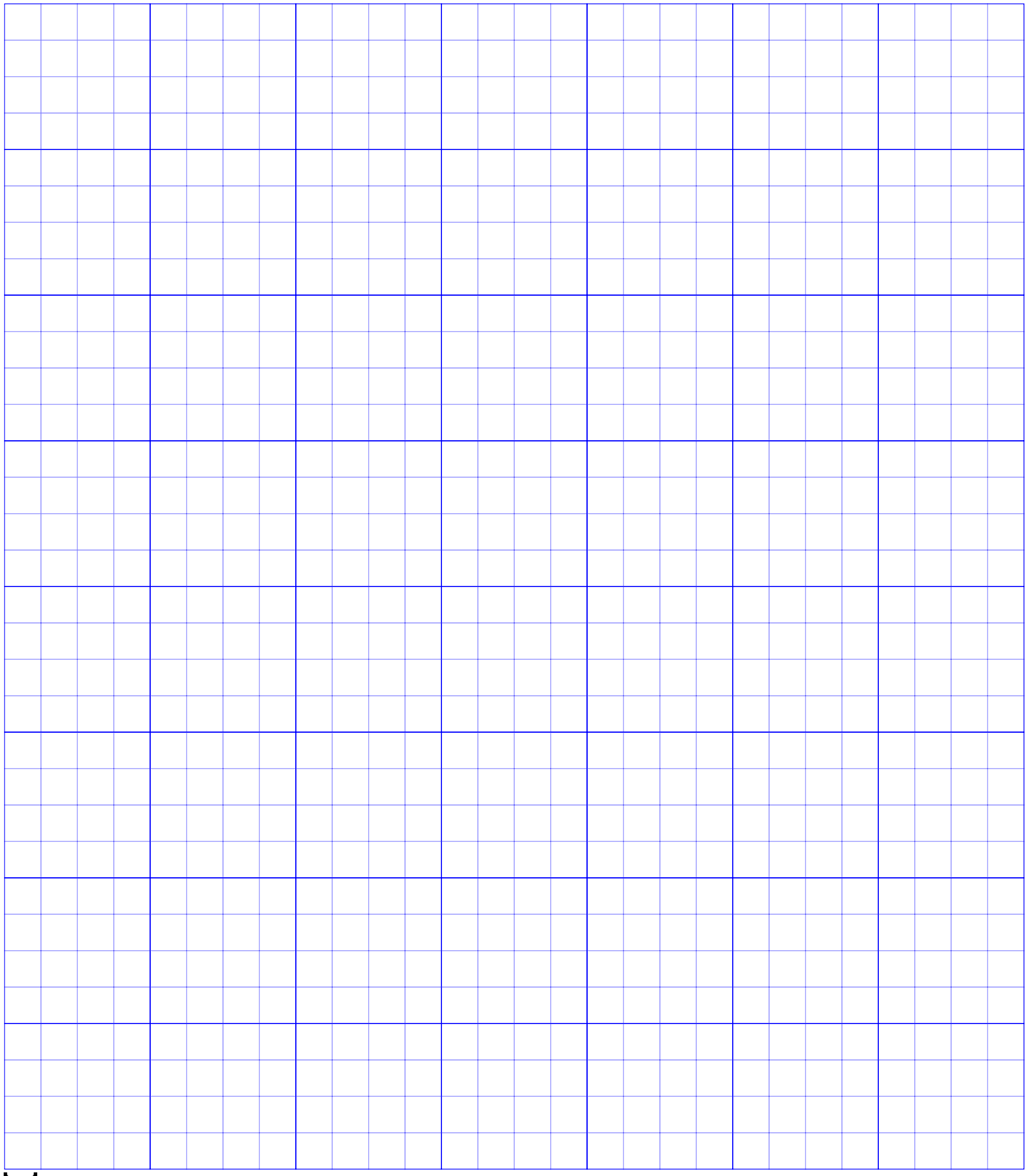


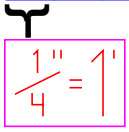
The room dimensions are about 4.4 m × 4.6 m (14.5 ft × 15.2 ft). The magnet is 80 cm (32 in.) in diameter. A minimum of 3 m (10 ft) should be maintained around the magnet to prevent interference with electronic components. A distance of 1 m (3 ft) should be maintained around the standard cabinet. The table on which the SMS autosampler sits is 1 m × 1 m (3 ft × 3 ft). Drawn approximately to scale.

GEMINI 2000 Illustrations for Room Layout



Blank Grid for Room Layout





Appendix E. Peripheral Compatibility

Explanation of Status Listing

Fully tested: Varian has fully tested this product and believes it to be fully compatible. Configuration and use of the product is documented in Varian manuals. We guarantee current compatibility, and every effort will be made to ensure compatibility with future products (e.g., future software releases).

Compatibility tested: Varian has performed a brief compatibility test of this product and knows of no incompatibilities, but does not support the product nor guarantee current or future compatibility.

Customer tested: At least one Varian customer has reported successfully using this product; no Varian experience.

Non-functional: Varian has reason to believe that this product will not work with our products.

Unknown: Varian has no experience with this product.

Printer and Plotter Compatibility

Hewlett-Packard ThinkJet (HP2225D)

Description:	Dot matrix printer/plotter
Required configuration:	Serial interface
Status:	Fully tested

Hewlett-Packard QuietJet (HP2227A)

Description:	Dot matrix printer/plotter
Status:	Fully tested

Hewlett-Packard DeskJet

Description:	Ink jet printer/plotter
Status:	Fully tested

Hewlett-Packard LaserJet III (HP33449A)

Description:	Laser printer/plotter
Required configuration:	2 MB memory expansion
Status:	Fully tested
Comments:	PostScript cartridge can be used and produces faster plotting.

Hewlett-Packard LaserJet 4

Description:	Laser printer/plotter
Required configuration:	Standard (2 MB memory)
Status:	Fully tested

IBM/Lexmark Color Jetprinter (PS 4079)

Description:	Inkjet printer/plotter
Required configuration:	Standard (4 MB memory)
Status:	Fully tested

Hewlett-Packard HP7475 (HP7475A)

Description:	Single-sheet 11x17 plotter
Required configuration:	Interface option 001 (RS-232C/CCITT)
Status:	Fully tested

Hewlett-Packard HP7550 (HP7550B)

Description:	11x17 plotter with automatic sheet feed
Required configuration:	B-size media handling kit (P/N 17092A) recommended
Status:	Fully tested

Hewlett-Packard DraftPro (HP7570A)

Description:	D-size (25x39) plotter
Status:	Fully tested

Computer Compatibility

Sun SPARCsystem 600 MP series

Description:	Sun multiprocessor server computers
Status:	Compatibility tested
Comments:	Tested as workstation only; status as host unknown. Tested running SunOS 4.1.2

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