Agilent Technologies

Agilent 400-MR DD2 NMR Spectrometer – Site Preparation Checklist

Thank you for purchasing an Agilent instrument. To get you started and to assure a successful and timely installation, please refer to this specification or set of requirements.

Correct site preparation is the key first step in ensuring that your instruments and software systems operate reliably over an extended lifetime. This document is an **information guide AND checklist** that outlines the supplies, consumables, space and utility requirements for your equipment on site. For details and additional information refer to the "400-MR DD2 Site Planning Guide" manual.

Additional site preparation requirements must be met if an Automated Sample Handling and/or Automated Probe Tuning accessories have been purchased with the instrument. Site preparation requirements for these accessories are provided in the "400-MR DD2 Site Planning Guide" manual **in addition** to the information provided below in this document.

For information about our solutions, please visit Agilent website at http://www.chem.agilent.com/en-US/Pages/HomePage.aspx

Customer Responsibilities

Make sure your site meets the following **prior to the installation date using the checklist below. For details see "400-MR DD2 Pre-Installation" manual and specific sections within this document**.

- ☐ The installation site is in compliance with all relevant safety regulations. [page 2]
- ☐ User Representative(s) will be available during the installation, calibration and acceptance. [page 2]
- ☐ Instrument will be installed far enough away from external sources of vibrations and electromagnetic fields. [page 2]
- ☐ Entrance and access to the installation location is adequate for system crates. [page 3]
- ☐ Sufficient laboratory space is available for the system, including applicable accessories, and for service access. [page 3]
- ☐ Floor can support system weight. [page 3]
- ☐ Ventilation is adequate to displace liquid helium gas during a possible magnet quench (please, consult with a safety engineer on this subject). [page 4]
- ☐ Floor vibrations are within the specified limits. [page 5]
- ☐ Relative humidity can be maintained within the specified range. [page 5]
- ☐ Laboratory temperature can be maintained within the specified range. [page 5]
- ☐ Laboratory is free of excessive particulate matter. [page 5]
- ☐ The background magnetic field fluctuations are acceptable. [pages 6]
- ☐ Specified electrical supply and power outlets are installed. [page 7]
- ☐ The necessary gases and cryogens will be available for the magnet installation. [page 8]
- ☐ Compressed air or nitrogen is clean and dry and the appropriate regulator and gas lines are installed. [pages 8-9]
- ☐ The shipping cartons were examined for damage; any damage was reported. [page 10]
- ☐ The appropriate facilities engineer and tools will be available to assist the field service engineer during magnet installation. [page 11]

Important Customer Information

1. If you have questions or problems in providing anything described as a *Customer Responsibilities* above, please contact your local Agilent or partner support/service organization for assistance prior to delivery. In addition, Agilent and/or its partners reserve the right to reschedule the installation dependent upon the readiness of your laboratory.

2. Should your site not be ready for whatever reasons, please contact Agilent as soon as possible to re-arrange any services that have been purchased.

3. Agilent is delivering installation and familiarization services, so users of the instrument should be present throughout these services; otherwise, they will miss important operational, maintenance and safety information

4. Other optional services such as additional training, operational qualification (OQ) and consultation for user-specific applications may also be provided at the time of installation when ordered with the system, but should be contracted separately.

General Site Considerations

1. Safety

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

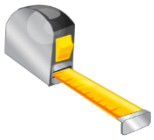
CAUTION:
All phases of the installation site preparation must conform to local safety, electrical and building codes. These codes take precedence over any recommendations in these instructions, and the customer is responsible for compliance.
The installation site must be in compliance with all relevant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

2. Outside Environmental Consideration

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

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

Detailed Environmental Requirements provided in this document below.



Dimensions and Weight

Identify the laboratory space before your system arrives based on the table below.
Pay special attention to the total height and total weight requirements for all system components you have ordered. Also pay special attention to the total weight of the system you have ordered to ensure your laboratory floor can support this weight.

Special Notes:

1. Laboratory Entrance Clearance Requirement
Entrance and access to the system installation location must be adequate for system crates.
Verify that there is sufficient entrance clearance to move shipping containers to the installation location before arranging for 400-MR DDR2delivery.

400-MR DD2 Shipping Crate Dimensions

Shipping Container	Weight		Height		Depth		Width	
	Kg	lbs.	cm	in	cm	in	cm	in
Magnet	615	1353	175	68.9	109	42.9	123	48.4
Antivibration Legs	156	344	22	55	105	41	129	47
Console	177	390	117	46	102	40	70	27.5
Ship Kit	105	230	107	42	105	41	120	51

2. Laboratory Space and Load Requirements
Sufficient laboratory space is available for the system, including service access: minimum space required for the system – about 104 sqft.
Floor in the lab should be able to support system weight. A host workstation worktable and chair are not included in the standard system. Avoid chairs that are constructed of significant amounts of ferromagnetic materials.
The Agilent Representative will unpack the boxes and place the modules in the final location.
Sufficient space must be maintained around the system for air circulation and service access. Examples of typical 400-MR DDR2 spectrometer layouts provided in "400-MR DD2 pre-Installation" manual and at the end of this document to help you plan the layout of your system.

Room Space and Floor Load

Component	Weight		Height		Depth		Width/Diameter	
	Kg	lbs.	cm	in	cm	in	cm	in
Console	177	390	40.5	102.9	77.5	30.5	55	22
Magnet*	630	1369	80.9	206	NA	NA	152	59

* Weight, height and diameter measurements for Magnet include anti-vibration legs. See the "400-MR DD2 Pre-Installation" manual for more information on Floor Loading Calculations.

3. Recommended Clearances around Components

Component	Purpose	Clearance	
		cm	in
Magnet, all sides	Service access	91.4	36
Magnet, above	Service and installation access; cryogens filling	294	116
	With optional low-ceiling kit	261	103
Console, back	Air circulation, pneumatic and electrical connections	91.4	36
Console, above	Air circulation and service access	91.4	36

Environmental Conditions

Operating your instrument in the laboratory with adequate environmental conditions is crucial to optimum instrument performance and lifetime. System performance can be affected by sources of heat & cold e.g. direct sunlight, heating/cooling from air conditioning outlets, drafts and/or vibrations, electro-magnetic field fluctuations, etc. All environmental requirements listed in the Special Notes below must be met before a system installation begins.

Special Notes:

1. Ventilation Requirement
Ventilation in the lab must be adequate to displace liquid helium gas during a magnet quench. In the unlikely event of a magnet failure, or quench, the evaporated helium is rapidly exhausted from the manifold by the pressure relief valves. The exhausted gas will displace oxygen and cause asphyxiation if the room is not properly ventilated. Review the following considerations with a safety engineer.

Ventilation System Efficiency

LHe Max. Volume in the 400/54/ASP Magnet	Minimum "Safe" Room Volume*
L (liters)	m3 (cubic meters)
121	1100

* based on 19.5% oxygen, and not considering the aspect ratio of the room.

Ventilation system must be able to displace evaporated helium gas. Ensure the room is adequately ventilated to maintain an oxygen level of 19.5% Oxygen in the room in the event of a magnet quench. The expansion ratio of liquid helium at room temperature is about 740:1, which means that one liter of liquid helium expands to about 740 liters of helium gas.
Note that magnet quench will not typically cause to boil off the entire 121 L of liquid helium.

Important:
During a quench, helium gas fills the room from the ceiling down, so fans must be set up accordingly.

2. Temperature and Humidity

Laboratory temperature should be maintained within the specified range (see table below).
The average steady-state heat load of the console is 500 watts. The host workstation heat load is approximately 400 watts.
NOTE: As laboratory temperature increases, system reliability decreases due to heat generated by electronic components. This heat must dissipate to the surrounding air for reliable operation.
The airflow around the system must be adequate. The air conditioning system must be capable of maintaining a constant temperature in the immediate vicinity of the system. The temperature around the magnet must be maintained within ±1.0 °C (±1.8 °F) during an experiment and during shimming. Do not place the system near air ducts, windows, or heating and cooling systems.
Operating the system at a very low humidity may result in the accumulation and discharge of static electricity, shortening the life of electronic components. Operating the system at high humidity may produce condensation and result in short circuits.

Temperature and Humidity Requirement

Instrument Description	Operating temperature range		Temperature Fluctuation (near the Magnet)		Operating humidity* range (%)
	°C	F	°C	F	
400-MR DD2 spectrometer	17 - 24	60 - 75	±1.0	±1.8	20 - 80

*Relative humidity, with no condensation.

3. Vibration

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

Floor Vibrations Limitations Requirements

Floor vibrations in the NMR lab must be within the limits specified below	
Greater than 15 Hz	no single peak greater than 400 µg
10 to 15 Hz	no single peak greater than 200 µg
5 to 10 Hz	no single peak greater than 75 µg
Less than 5 Hz	no single peak greater than 10 µg

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

4. Particulate Matter

The NMR Laboratory should be free of excessive particulate matter, such as dust, smoke, etc. Particulate matter can block airflow vents causing the electronics to overheat.

5. Magnetic Field

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

Maximum Allowable Oscillating Magnetic Field Limits

Frequency	Field
Grater the 10 Hz	Less than 10 mG
5 -10 Hz	Less than 5 mG
Less than 5 Hz	Less than 2mG

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

If you are concerned about background electromagnetic fields, you can order a site inspection. Contact Agilent Customer Service for more details.

Power Consumption

Special Notes:

1. **The 400-MR DD2 system requires a single-phase power source** with earth grounds hard-wired to the main power panel ground.
2. **The console and host workstation have standard IEC 60320 power inlets**. The system ships with 3 m (10 ft.) power cords for North America, Japan, Continental Europe, and United Kingdom.
3. **The quality of the power supplied to the laboratory must be stable and free of fluctuations** due to slow changes in the average voltage or to changes resulting from surges, sags, or transients. The power supplied to the system should meet IEC 1000-4-5 and IEC 1000-4-11 standards for voltage stability. If you are concerned about the quality of your power, consider installing an uninterrupted power supply, or a power conditioner, or both.
4. **Additional power outlets would be needed** for 7600-AS automatic sample handler and other accessories, if applicable.

Electrical Supply and Power Outlets Requirement

Instrument/ Component	Max Current Draw at 90 - 132 Vac (Amps)	Max Current Draw at 180 - 264 Vac (Amps)	Number of Outlets
Console	10	5	1
Magnet Cryogens Monitor	< 0.15	< 0.15	1
Host Workstation	3	1.5	1
Computer Monitor	3	1.5	1
Printer	3	1.5	1

Required Operating Supplies by Customer

Special Notes:

Please, refer to the information in tables below on REQUIRED supplies in order to ensure a successful installation of an instrument.

1. Helium and Nitrogen gases are required for the magnet installation. Gases could be supplied in magnetic containers, and in such case must be kept outside of the 5 gauss limit of the magnet. Magnetic gas cylinders must be firmly secured (with chains to the wall, or such).

Gases Requirement

Gas	Volume	Quality	Additional Requirements
Helium gas	2 cylinders, each about 8000 liters (285 ft³)	Purity: ≥99.995% or U.S. Bureau of Mines: Grade A	1) Low-pressure regulator < 30 psi. 2) He gas flow regulator and flow meter 0-40 LPM (0-80 CFH).
Nitrogen gas	1 cylinder, about 8000 liters (285 ft³)	Dry, oil-free, magnetically clean, dew point of -193°C (-315°F).	

2. Liquid Helium and Liquid Nitrogen are required for the magnet installation. In order to minimize loss due to boil off, delivery of the cryogens should be scheduled on the morning of, or on the day before the start of the installation.

Cryogens Requirement

Gas	Volume	Additional Volume (short notice delivery within 48 Hrs)	Additional Requirements
Liquid Helium	400 liters (14 ft³)	200 liters (7 ft³)	Supply dewar should be compatible with siphon diameter 12.7 mm (0.5 in.)
Liquid Nitrogen	700 liters (25ft³)	-	Low Pressure. Adapter for connecting 9 mm (3/8 in.) ID rubber tubing to the Liquid Nitrogen dewar.

3. Compressed Air for System Operation

400-MR DD2 system operation requires a constant flow rate of air or nitrogen. Install the air supply with ¼ in. (0.635 cm) connectors on the line's end. A larger pipe diameter would be required if the lab is far from the source of compressed air.

If compressed air will be used, it must be clean, dry, and oil-free, with less than 0.1 ppm total hydrocarbons, including methane, and a −40 °C dew point.

If compressed nitrogen will be used for the system supply (recommended), the gas must be dry, oil-free, and magnetically clean (for example, free of rust), with a dew point of –193 ºC (80 K).

Compressed Air Requirement for System Operation

Gas	Condition	Flow Rate	Additional Requirements
400-MR DD2	Sample Insertion	83 LPM (176 SCFH)	80 psig (585 kPa)
	Normal Operation	65 LPM (138 SCFH)	80 psig (585 kPa)
When purchasing a compressor system, use the following specification:			
Compressor system	With compress air dryer	100 LPM (212 SCFH)	80 psig (585 kPa)

Automatic sample changers and other accessories also use compressed gas for operation, but their air consumption is minimal. The general lab requirement above satisfies total compressed air consumption requirements.

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

Other/Special Requirements, Notes and Suggestions

1. Inspection of the Shipping Containers

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

- Water stains
- Cuts, punctures, or deep indentations
- Crushed corners or excessively abraded edges
- Check the Shockwatch indicator on the side of the shipping box

If the indicator is Red, the box was on its side or tipped in transit and instrument damage may have occurred.

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

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

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

Any damages incurred in shipment are the responsibility of the purchaser and the carrier. Contact local Customer Service for assistance with filing claims and billing repairs. If the system is shipped FOB Destination, contact local Customer Service for assistance with filing claims against the carrier and billing repairs.

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

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

Important:

Do not open any boxes until the Agilent Representative arrives to do the installation!

3. Magnet Support Requirements
Appropriate facilities engineer with tools should be available to assist the field service engineer during magnet installation.
The Magnet anti-vibration legs must be fastened to the floor. Agilent supplies four ½-inch diameter anchor bolts for each of three legs supporting the magnet. A minimum depth of 2.5 in is required for each bolt. Facilities personnel should be available to assist with drilling holes for anchor bolts.

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

4. Typical system layout.

A typical layout for 400-MR DD2 spectrometer without accessories is provided in the Figure below. The console might be placed to the any side of the magnet.

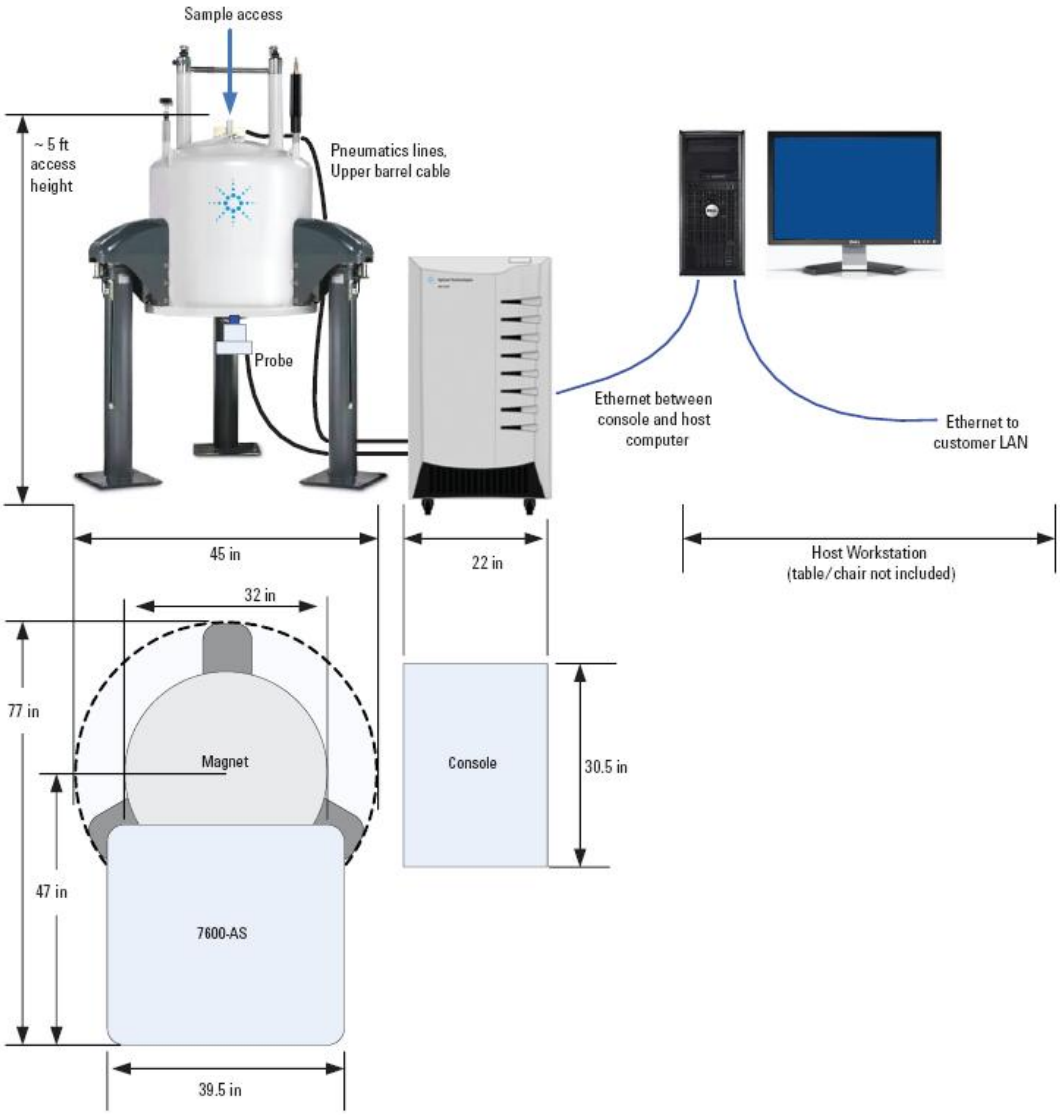


Figure 1. 400-MR DD2 System layout (typical; with optional 7600-AS Sample Changer)

5. Recommended Service access

Sufficient space must be maintained around the system for air circulation and service access.
Recommended service access is 36 in. around the system.
Example of positioning the system in the lab is shown in the Figure 2. (below).
Note that the console might also be placed to the left of the magnet.

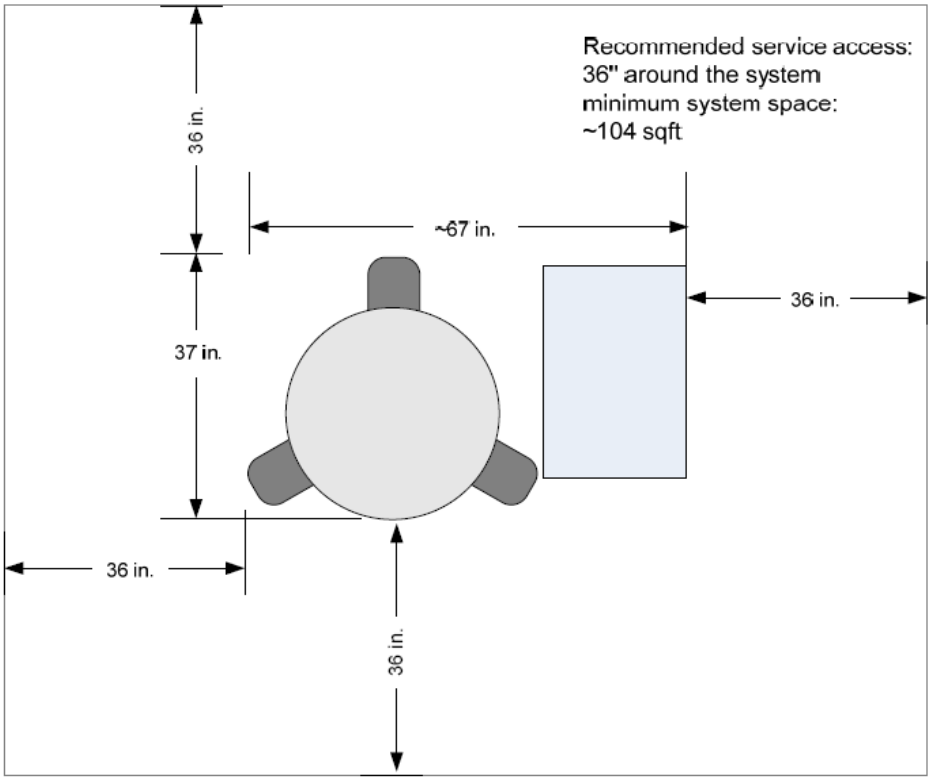


Figure 2. System placement in the lab

Document Control Logs

Revision Log:

Revision	Date	Reason For Update
00	20 Apr. 2011	Created
01	2 June 2011	Cross checked with data provided in Agilent 91001979 400-MR DD2 Pre-Installation
A	24 June 2011	Released Version
B	11 Sept 2013	Updated vibration spec.

Approval Log:

Revision	Approver(s)	Title of Approver
A	Kenneth Kezeor	Tech Support Manager
B	Dan Steele	Product Support Lead