
Using This Site Planning Guide

The purpose of this site-planning guide is not to address all site-specific considerations, but to provide you with general guidelines and layout suggestions to minimize difficulty in planning your site. Following the instructions in this guide will allow you to operate your E-SCAN safely and efficiently.

NOTE: This guide includes the most current architectural, electrical, and environmental guidelines for planning an E-SCAN site. All construction and/or room preparation shall be done to comply with all applicable codes and regulations.

If you have any questions regarding this site planning guide or the installation of the E-SCAN in general, contact the GEMS Orthopedics MRI Installation team at 800-365-8627 x 7230.



The information in this document is subject to change without notice and should not be construed as a commitment by GE Medical Systems. GEMS assumes no responsibility for any errors or omissions in this document.

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1 Space Requirements

There are several factors that influence the amount of space required to safely and efficiently operate the E-SCAN System:

- System components—the site must be able to accommodate all of the system components and any additional ancillary/support equipment.
- Magnetic fields—the site must take into account the magnetic fields extending from the E-SCAN.
- RF shielding – external RF screening is required. This can be in a completely modular form or a custom solution.
- Exam operational area—with the system components installed, space must be available for the patient and the exam specialist to move freely within the exam area.

GEMS Orthopedics will provide custom space plans addressing your particular needs. Contact the GEMS MRI Installation team for more information. 800-365-8627 x7230

1.1 System Components

The E-SCAN System is comprised of four (4) main components: Operator's Console, Magnet, Patient Support and an RF Electronics cabinet (not shown). Dimensional drawings can be found on pages 21 and 22.



E-SCAN Magnet and Patient Support



Operator Console

Figure 1-1: System Components

1.2 Accessories

In addition to the main system components, additional accessories such as RF coils and patient positioning pads are included with the system. Cabinetry or shelving should be provided in the scan room to accommodate these items.

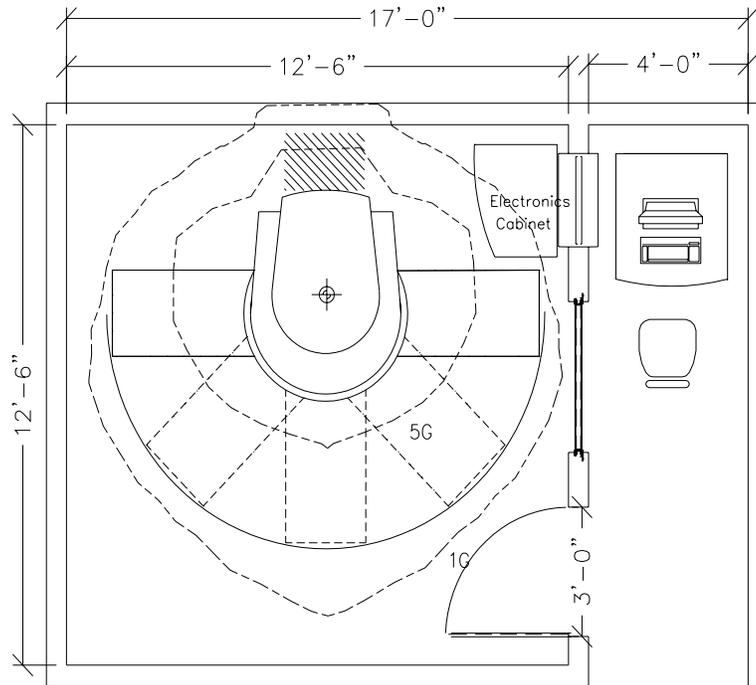


Figure 1-2: Typical layout

1.2 Magnetic Fields

The E-SCAN uses a strong magnetic field and RF energy to produce cross-sectional images of the internal structure of the limbs. The magnetic field strength of the E-SCAN magnet is 0.2 Tesla, or 2000 gauss. By comparison, the earth's natural magnetic field ranges between 0.5–0.7 gauss.

The magnetic field generated by the E-SCAN magnet is three dimensional, extending in vertical as well as horizontal planes (figure 1-2).

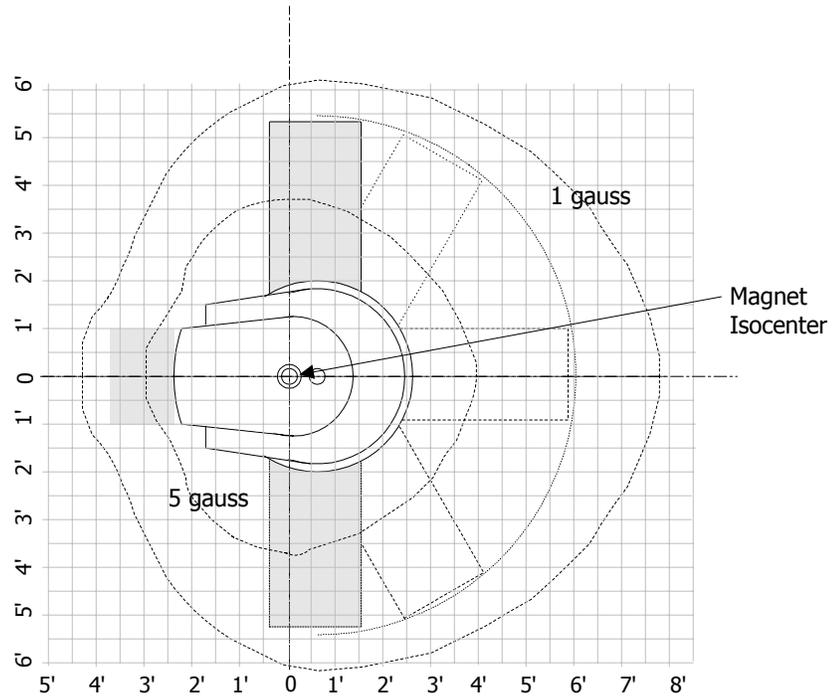


Figure 1-3: E-SCAN plan view (not to scale)

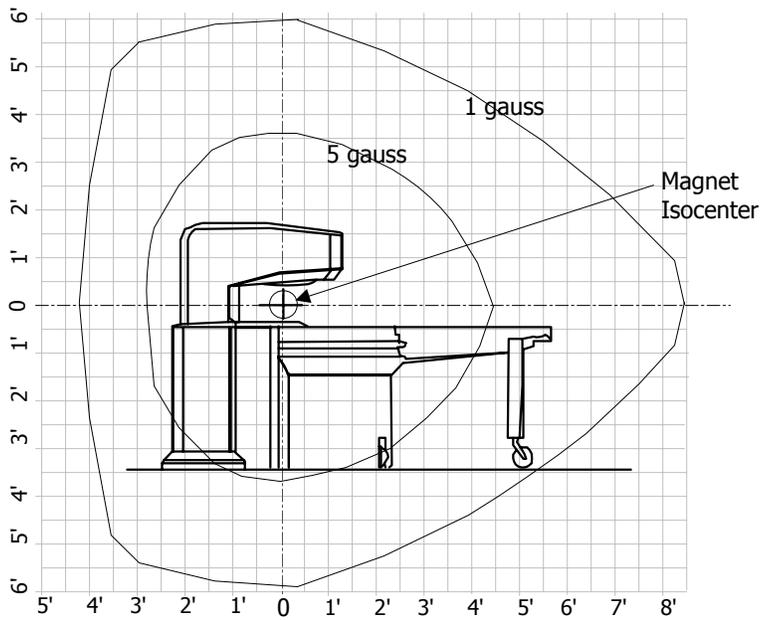


Figure 1-4: E-SCAN side view (not to scale)

1.2.1 Magnetic Field Safety

The doorways leading into the E-SCAN site should be labeled with a warning sign, notifying persons that there is a strong magnetic field. Figure 1-3 illustrates the warning sign shipped with each E-SCAN system. Additional copies are available from GEMS.



Figure 1-5: Magnetic field warning sign

WARNING: Adhere to the following safety precautions when operating the E-SCAN:

- For safety reasons persons with cardiac pacemakers or biomedical implants should be excluded from the 5 gauss zone of the exam area.
- Keep ferro-magnetic objects away from the magnet. The force of the magnet could pull such objects into the bore of the magnet, resulting in possible patient injury or equipment damage.

See Table 1-1 for a list of ferro-magnetic objects and the gauss levels that affect them.

1 gauss	Color Monitors/TV Image intensifiers Nuclear Cameras	10 gauss	Watches Credit Cards Small Electronic Motors
5 gauss	Biomedical Implants Cardiac Pacemakers Power Transformers HVAC Equipment Tape Storage	50 gauss	Small instruments Hand Tools Telephones Laser Imager

Table 1-1: Ferro-magnetic objects affected by magnetic fields according to gauss levels

1.3 Effect of the Environment on the E-SCAN

There can also be environmental effects to the E-SCAN magnetic field. Any changes to the magnetic field of the E-SCAN can adversely impact the image quality of the system. While planning a location to install the E-SCAN, you should avoid placing the magnet within 30' of elevators, subways, driveways or any other large moving ferro-magnetic objects. Also power transformers, air handlers, and main power lines in close proximity of the magnet can affect the magnetic field.

NOTE: GEMS MRI Installation team will test your intended site before installation to determine if there are any magnetic field or RF disturbances that could affect the operation of the E-SCAN system.

2 The Scan Room

The scan room houses the E-SCAN magnet. Radio frequency shielding is required inside the room to eliminate any external influences that could affect the image quality. The type of RF screening used will dictate the size of the room.

The E-SCAN magnet features a patented patient support. This support is manually pulled away from the magnet 20" to allow for patient positioning and slides back into the magnet during scanning. Sufficient space must be allotted for this movement.

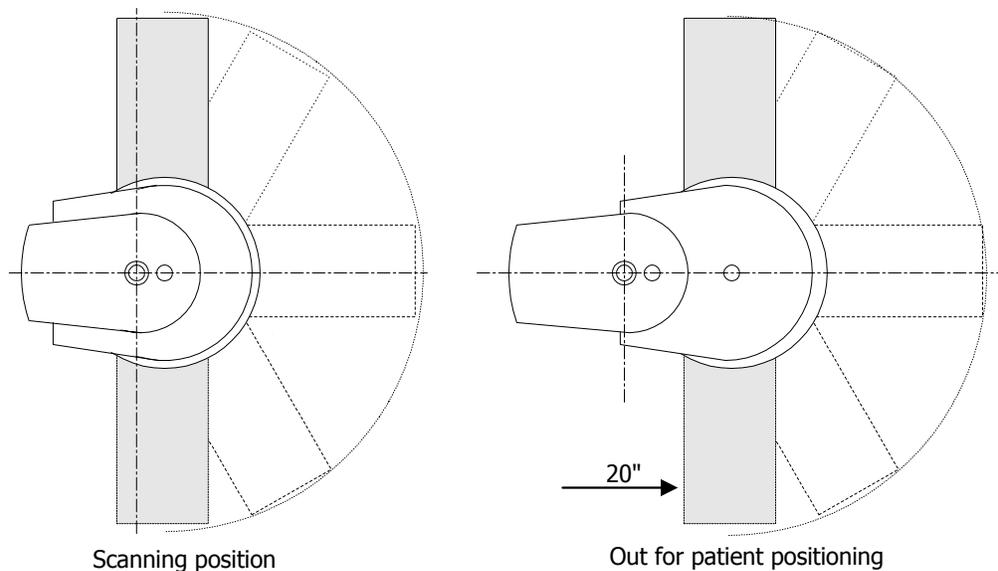


Figure 2-1: E-SCAN patient support movement

2.0.1 Planning Considerations/ Requirements

- Lighting: If lighting is necessary in the RF screen, incandescent lamps with switched lighting must be used. FLUORESCENT ARE NOT RECOMMENDED/DIMMERS MAY NOT BE USED SINCE THEY EMIT RF NOISE. Wiring for the lighting inside the Galvanized RF Shield must be provided through a lighting filter installed in the RF penetration panel.
- Door size: A 3'-0" minimum door width is required for delivery of the magnet and components.
- Floor levelness: 1/4" over 10' area for installation of RF shielding.

- Floor coverings: A conductive vinyl tile floor is recommended in the scan room. A non-waxing floor is preferred.
- Housekeeping: Steel wool is not to be used to clean or buff floors in the scan room. Use of non-ferrous cleaning equipment is recommended around the magnet.
- Environment: Maintain a comfortable temperature for both the patient and the operator. It is strongly recommended that the E-SCAN scan room and operator room contain individual environmental controls.
- Storage: Provide adequate storage space for the E-SCAN RF Coils, patient positioning devices and pads (typically 12 cu. ft.).
- Furniture: Any furniture used within 5' of the magnet should be of a non-ferrous variety (typically plastic or wood).
- Service Area: At least 16" must be left clear behind the E-SCAN magnet for installation and servicing of the magnet.

2.2 RF Shielding

RF shielding is a method of protecting the E-SCAN magnet from external radio frequency waves that can distort the MR image. This is accomplished by placing the magnet inside an environment that is completely enclosed (above, below, and on the walls) by a contiguous material that blocks the waves. The material is typically copper, aluminum or steel. Any openings in this contiguous "shield" will compromise the integrity of the environment, rendering the shield useless.

A specially designed RF penetration panel is included with the E-SCAN system. This panel includes special RF filters that allow cabling between the magnet and operator console.

Care must be taken to ensure that the RF shielding is not penetrated by workers when installing intercoms, closed circuit TV, hanging pictures, mounting switches, etc. Contact the GEMS MRI Installation team if there are questions.

There are two types of RF shielding solutions available for use with the E-SCAN system.

2.2.1 Modular RF Shield (Pavilion)

Available from GEMS Orthopedics, the modular RF screen is a self-supporting structure that can be easily erected in an existing facility. The screen is a good solution for Permanent and temporary siting locations.



Figure 2-1: Modular RF screen

The screen is comprised of a modular aluminum that supports perforated Aluminum walls. The screen is assembled with stainless steel bolts, from the inside of the structure, permitting assembly in areas slightly larger than the structure itself. There are two track-mounted doors that open to gain access. The perforation in the walls allows ventilation and light to enter the screen, eliminating the need for special lighting and ventilation systems in the screen.

RF Screen dimensions:	13'-1½" w. x 12'-6" d. x 7'-10" h.
Weight:	1102 lbs.
Space requirement:	14'-0" w. x 16'-0" d. x 8'-0" h. minimum
Floor levelness:	¼" over 10'
RF Attenuation:	75 dB

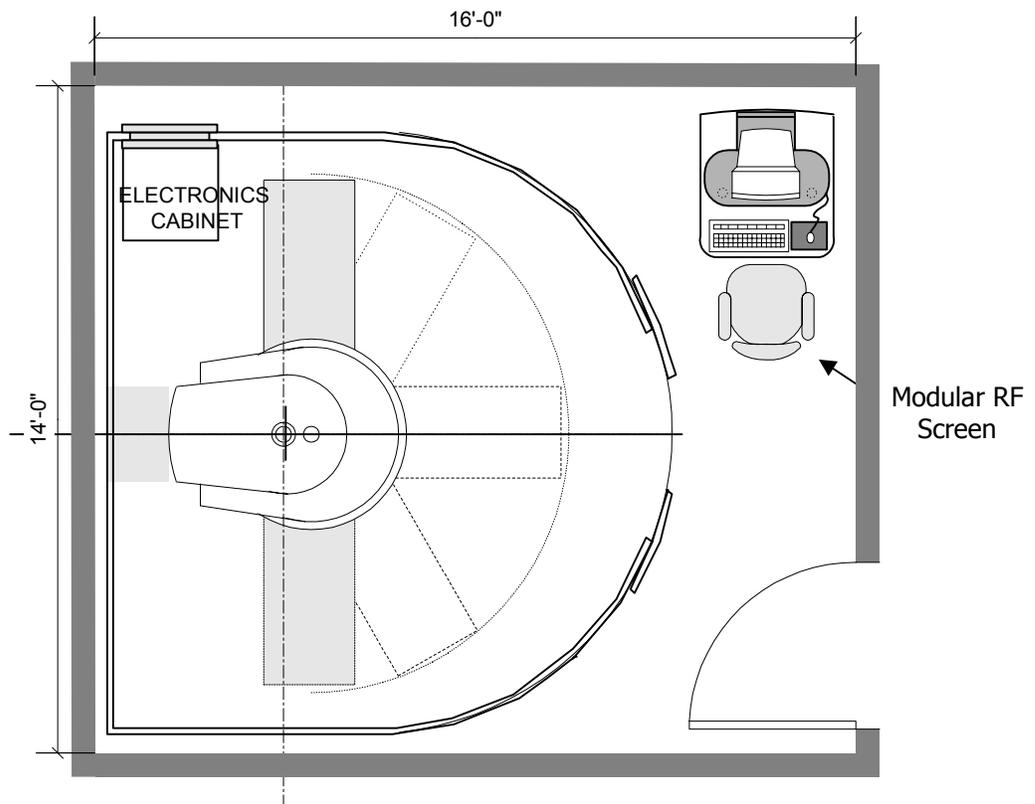


Figure 2-2: Plan view of modular RF screen in a room

2.2.2 Siting Considerations

- Patient Contact: When the doors are closed, you will not be able to see the patient. A closed circuit TV camera and monitor is recommended for continuous patient monitoring.
- Site Testing: This shielding scheme is designed for use in areas with medium external radio frequency noise (60 dB or less). GEMS will send a MR Installation Specialist to test the environment in your facility to determine if this solution will work.
- Housekeeping: Additional space should be left around the screen to allow for cleaning.
- Lighting – Lighting is necessary in the RF screen, incandescent lamps with switched lighting must be used. FLUORESCENT LIGHTS ARE NOT RECOMMENDED/DIMMERS MAY NOT BE USED SINCE THEY EMIT RF NOISE. Wiring for the lighting must be provided through the GEMS provided power filter installed on the ceiling of the RF room.

- Medical Gasses: If medical gas piping is required, contact the GEMS MRI Installation team for details.

2.2.3 Galvanized Steel RF Shielded Room

This RF screened room is comprised of modular wall, floor, and ceiling RF panels assembled on-site. The panels are 4' wide by 9' tall (8' finished interior height) and can be connected in any combination to accommodate specific floor plans. This “room within a room” features interior wall finishes and a finished front façade. Installation and delivery is included.

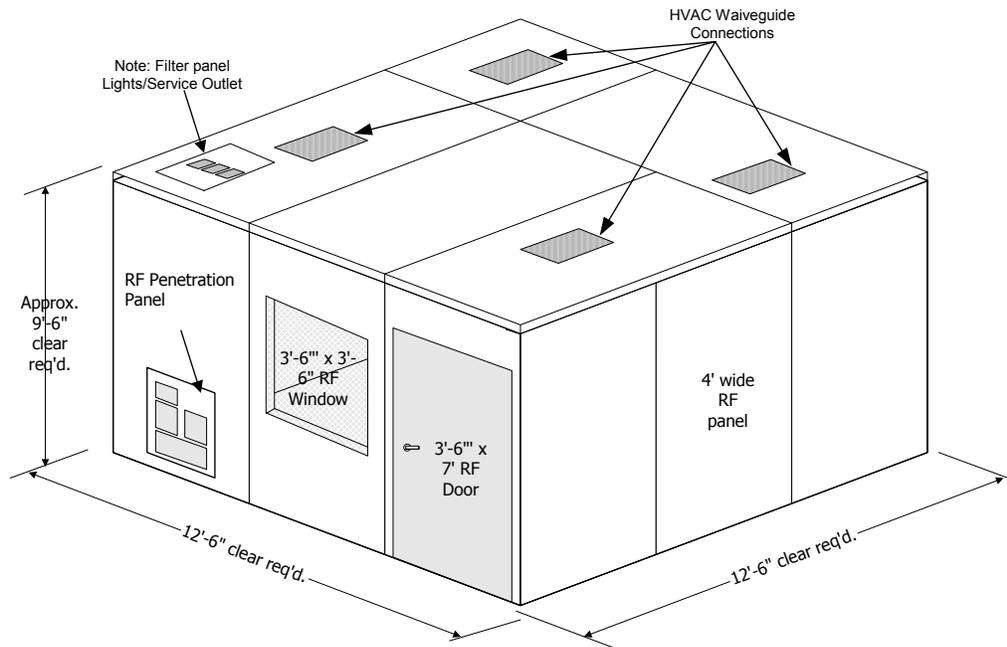


Figure 2-3: Modular RF room (no scale)

Space requirement: 12'-6" w. x 12'-6" d. x 9'-6" h. = 156 Sq. ft.

Finished interior dim.: 11'-7" w. x 11'-7" d. x 8'-0" h.

Weight: 5000 lbs. or 6 lb. per square foot

Floor levelness: ¼" over 10'

RF attenuation: 90 - 100 dB

Components included:

- One (1) exam room entrance door with safety lock. 3'-6" w. x 7'-0" h. equipped with hospital-style hardware, door ramp and wood look laminate finish on both sides.
- One (1) exam room patient observation window with laminated safety glass on both sides. 3'-6" w. x 3'-6" h.
- Four (4) 12" x 12" waveguide air vents with dielectric collars to permit connection of *HVAC ducting by customer's contractor.*
- One (1) single point electrical grounding stud. Connection to the earth rod *by customer's electrician.*
- Two (2) 20 amp, 3 wire, 110/220 VAC RF power line filters for exam room AC lighting and service outlets. *Connection by Customers electrician.*
- One (1) 1 amp, 2 wire, 24 VDC RF signal line filter for fire alarm/thermostat circuit. *Connection by Customers contractor.*
- Interior room finishing package including, *installed by customers contractors:*
 - 2' x 2' acoustic suspended ceiling tile system with aluminum air grilles.
 - Four (4) 75 – 100 watt recessed aluminum incandescent light fixture mounted within drop ceiling.
 - One (1) light switch and one (1) AC wall outlet.

Warranty: Five (5) year limited warranty on enclosure, one (1) year on doors and filters from manufacturer.

The following work is the responsibility of customer:

- HVAC, electrical connections to room.
- Interior/exterior room finishes, i.e. Drywall, Paint, Vinyl Flooring.
- Any demolition/preparation work required for individual site.
- Dumpster for removal of any crating materials and waste.
- Any state or local bonding fees, permits, union assistance/fees, professional engineers review or stamp.

GEMS will provide complete connection details as required. Contact the GEMS MRI Installation team for details.

NOTE: Modifications to the above package are available at additional cost. Contact your GEMS Orthopedic Sales Manager for further details.

2.2.4 Custom RF Screening

Custom RF screening is basically designed like the Modular RF Room, however the size can be varied to suit the specific characteristics of your site. Exterior windows can be accommodated. GEMS will provide you a list of recommended RF suppliers, upon request.

2.3 RF Penetration Panel

The RF penetration panel is supplied with the E-SCAN system and it allows cabling to enter the RF shielded enclosure without degrading the integrity of the room. The panel contains special RF filters designed specifically for the E-SCAN system. Additional filters may be added as needed. Contact the GESM MRI Installation team for details on the type of filtering required.

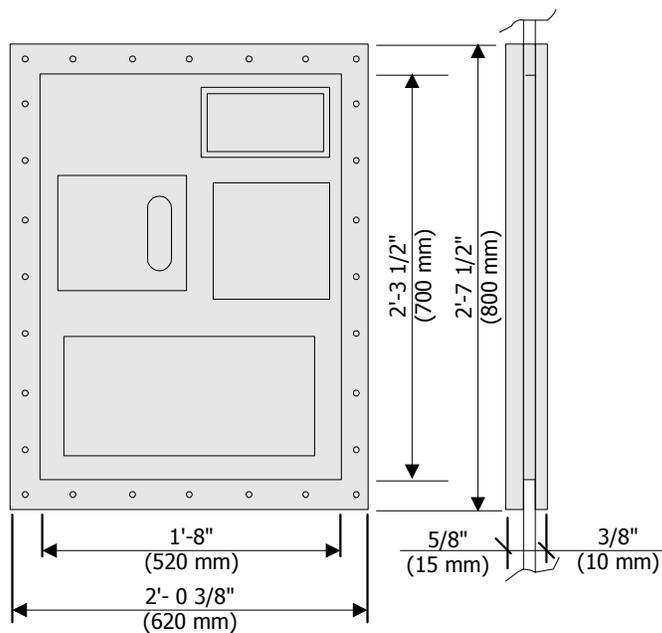


Figure 2-4: RF penetration panel

3 Operator Area

The operator area contains at least the operators console and an imaging camera, teleradiology workstation or other hardware, depending on the site's needs.

The space will be occupied by the operator, physicians and visitors so sufficient space must be allotted for ease of operation and movement.

A suggested room size for the equipment and operational staff is 6' x 12'. This space can also accommodate the entry into the scan room.

3.1 Planning Considerations/ Requirements

- **Cable lengths:** The maximum distance the operator can be located away from the RF penetration panel is 19 cable feet.
- **Flow:** The operator should have a direct path to the scan room.
- **Location:** The monitor on the operator console must be located outside the 1 gauss magnetic field of the magnet.
- **Window:** A view window should be provided between the operator area and the scan room. The operator must have direct visual contact with the patient throughout the scanning process. In cases where the operator does not have direct visual contact with the patient, a CCTV camera located in the scan room with a monitor in the operator area is recommended. An RF filter is required to penetrate the RF screen. Contact the GEMS MRI Installation team for filter details.
- **Intercom:** An intercom allowing interaction between the operator and patient is recommended. An RF filter is required to penetrate the RF screen. Contact the GEMS MRI Installation team for filter details.
- **Environment:** Maintain a comfortable temperature for both the patient and the operator. It is strongly recommended that the E-SCAN scan room and operator room contain individual environmental controls.
- **Flooring:** Carpeting may be used in the Operator Area. Ensure that the carpeting is low pile to maintain adequate ventilation of the electronics. Care must also be taken to ensure that static electricity, especially from newly installed carpet, is minimized. This may include using anti-static mats and sprays in the room.
- **Lighting:** Light sources should not be too strong or directed on the monitor. Dimmers are not recommended in the operator area.
- **Cabling:** The power cable to the operators console should be located so it does not represent a trip hazard. Cord covers should be used for the power cable.

- Seating: Sufficient space should be planned for at least two people to work around the operators console.
- Storage: Cabinetry and/or work surfaces should be planned to accommodate day-to-day paperwork and operator manuals.
- Telephone: A telephone is suggested in the operator area to expedite installation and periodic service of the MRI system.

4 Ancillary Spaces

There may be a need for additional support spaces to accommodate the E-SCAN unit. This could include dressing rooms, toilet facilities, waiting areas, linen storage (clean and soiled) and film reading areas. Consult your architect or space planner to determine your individual patient and workflow requirements.

5 Power Requirements

An ONEAC MODEL # ON1300A-HO Uninterruptable Power Supply (UPS) is included with the E-SCAN system. This unit is to be placed between the operator console and wall outlet to help eliminate harmful fluctuations. Contact the GEMS MRI Installation team for complete specifications of the unit.

Power Supply: 110 VAC \pm 10%, 60Hz. Grounded outlet required.

Power Service: The E-SCAN requires 24-hour electrical to power the magnet control. A green LED on the side of the operator console lights to indicate power is being supplied to the equipment. If electrical power is lost for longer than 8 hours, it may take up to 8 hours to prepare the system for operation. If power is cut for periods shorter than 8 hours, for every hour that the system is not powered it will take 1 hour to make the system operational.

Power consumption:

Scanning: 1.3 KVA

Waiting: 0.8 KVA

Fuse: 20 Amp. min.

Grounding: Outlet must be grounded per local codes (1.5 mm² wire size per IEC 601-1).

6 Environmental Requirements

The temperature and humidity requirements must be met 24 hours per day to ensure proper function of the equipment.

It is strongly recommended that the E-SCAN scan room and operator room contain individual environmental controls.

Requirements:

- **Temperature:** 68°– 79°F, 5°F per hour change maximum
- **Humidity:** 15% to 65%
- **Environmental Service:** 24-hour source
- **Heat Dissipation:**
E-SCAN 1365 BTU/hr.

NOTE: Avoid installing the E-SCAN system in areas where it may be exposed to direct sunlight, hot and cold sources, or where rapid changes in temperature can occur.

7 Modem Requirements

A modem is supplied with the E-SCAN system to allow remote service of the unit. The customer must furnish and maintain a dedicated modem line to the operator area suite. The line must not be in a PBX (or equal) network, and must have its own direct telephone number.

8 Floor Loading

The floor must be strong enough to withstand the weight of the magnet, patient table, operator console, RF shielding, plus live loads. Figure 8-1 & 8-2 illustrates the load points for each component, and Table 8-1 lists the load point and surface area totals. If there are any questions regarding your site, contact your building manager, architect, or a Licensed Structural Engineer to evaluate your facility.

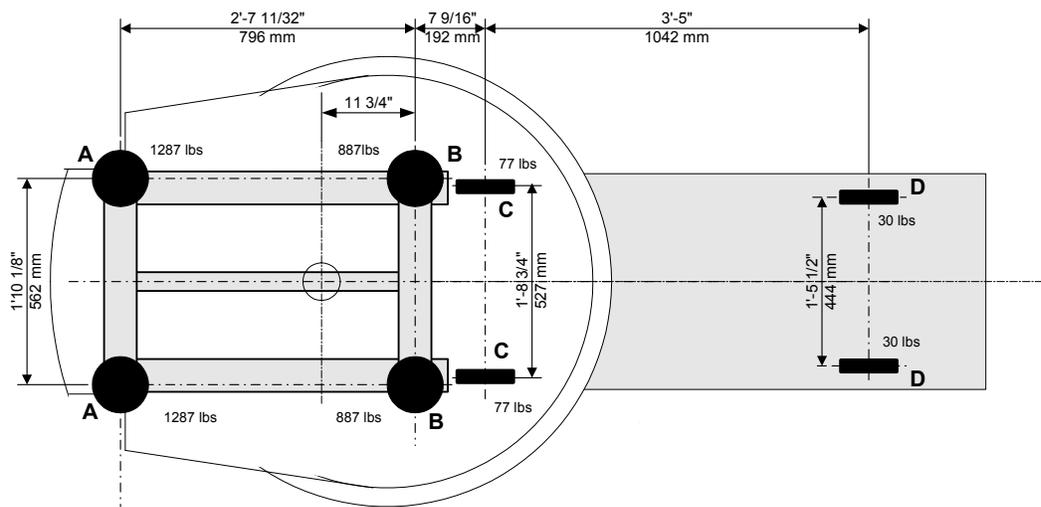


Figure 8-1: E-SCAN magnet and patient support load points (not to scale)

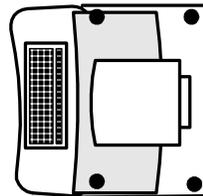


Figure 8-2: E-SCAN Operator console load points (not to scale)

UNIT	LOAD	NUMBER OF POINTS	SURFACE AREA PER POINT
Magnet:	4,348 lb.		
point A	1,287 lb.	2	27.44 in ²
point B	887 lb.	2	27.44 in ²
Table:			
wheel C	77 lb.	2	5" diameter x 1" wide nylon wheels
wheel D	33 lb.	2	
Operator's Console	143 lb.	4	1.26 in ²
Electronics Cabinet	462 lb.	4	1.26 in ²
RF Shielding	Dependent on type used. See section 2.2 RF Shielding to determine loads.		

Table 8-1: Load point and surface area totals

9 Delivery Requirements

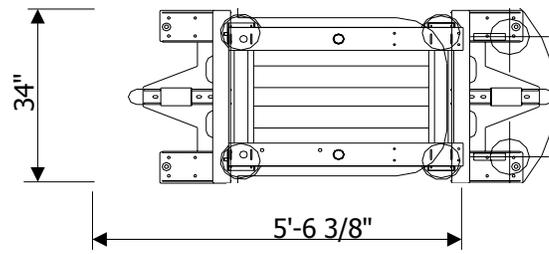
The E-SCAN system is delivered in 5 crates. Typically the system components are removed from the crates before being transported into the suite. The customer is responsible for any rigging or shoring of the delivery path.

The delivery pathway must be clear of obstructions:

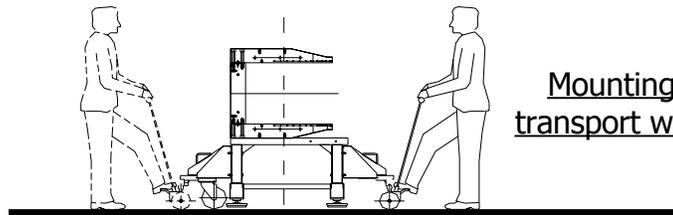
Hallway width: 4'-0" minimum

Doorways: 3'-0" x 6'-8" doors (34" min. width req'd.)

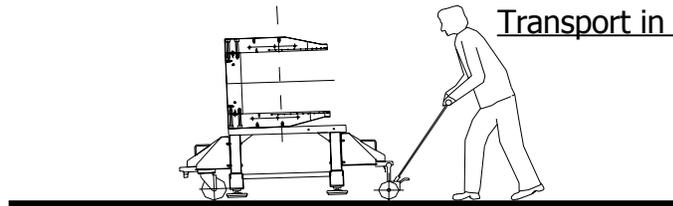
Elevator: 4,500 lb. minimum rating.



Magnet with covers removed - Top View

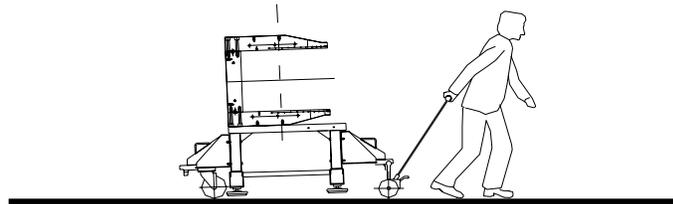


Mounting of transport wheels



Transport in facility

Figure 9-1: Delivery requirements



10 Equipment Specifications

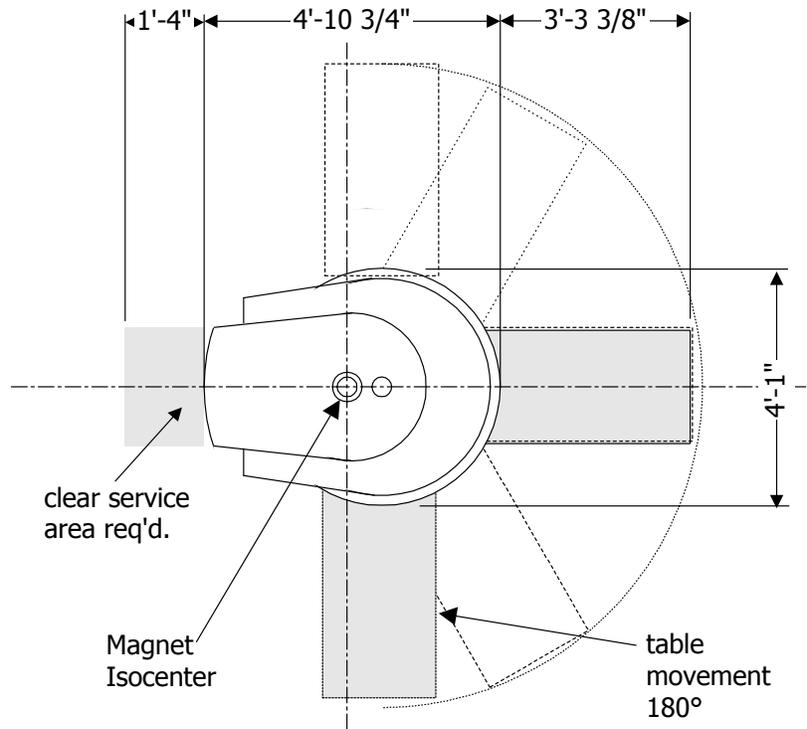


Figure 10-1: Plan view E-SCAN magnet (not to scale)

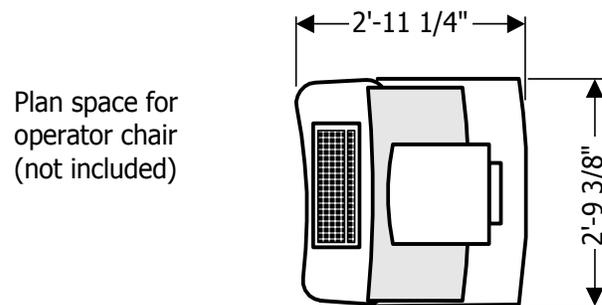


Figure 10-2: Plan view operator console (not to scale)

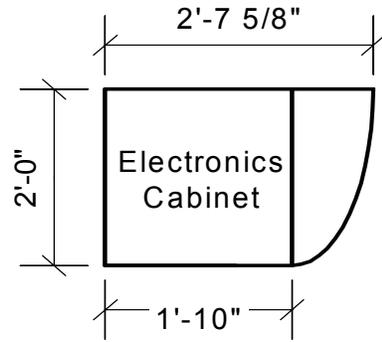


Figure 10-3: Plan view electronics cabinet (not to scale)

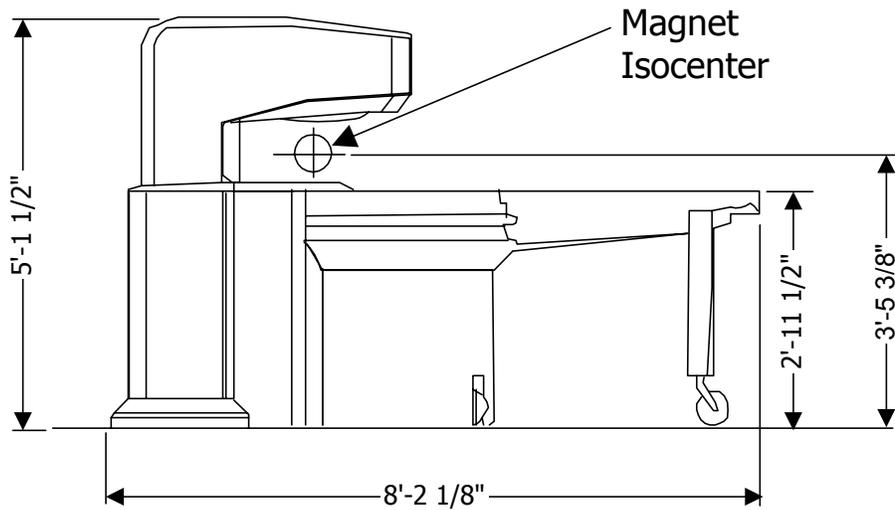


Figure 10-3: Side view E-SCAN magnet and patient support (not to scale)

11 Additional Information

Contact the GEMS MRI Installation Department at 800-365-8627 x7230 if you have any questions regarding site planning for the E-SCAN Open Dedicated MRI System.

END

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