# Technical Publications

**DIRECTION 2302042-100**

**Revision 3**

# *Millennium VG* Nuclear Imaging System Site Preparation Manual

**Printed for**

***GE Medical Systems***

*GE Medical Systems: telex 3797371*
*P.O. Box 414, Milwaukee, Wisconsin, 53201 U.S.A.*
*(Asia, Pacific, Latin America, North America)*

*GE Medical Systems - Europe: Telex 698626*
*283 rue de la Miniere, B.P.34, 78533, Buc Cedex, France*

## *DISCLAIMER*

***ELGEMS Ltd.*** *shall not be liable nor obligated in any manner in respect of bodily injury and/or property damage arising from the use of this software if such use is not in strict compliance with instructions and safety precautions contained in the relevant operating manuals and in all supplements thereto, in all product labels, and according to all terms of warranty and sale of this software, nor if any change not authorized by* ***ELGEMS Ltd.*** *is made to the software contained herein.*

## *WARNING*

*User provided programs or protocols are NOT validated nor warranted by* ***ELGEMS Ltd.***

*The use of data obtained using such user provided programs or protocols is the sole responsibility of the party using such programs or protocols.*

*Users exchanging files and diskettes should beware of the risk of software viruses.*

CE 0459

**Authorized CE Representative:**
*GE Medical Systems Europe*
Quality Assurance Manager
BP 34, F 78533 BUC CEDEX France
Tel: +33 (0)1 30 70 40 40

Published by ELGEMS Ltd. P.O. Box 170 Tirat Hacarmel 30200 Israel.
Tel: 972-4-8563666 Fax: 972-4-8577663

ELGEMS Publication Number MAN000122

**CERTIFIED ELECTRICAL CONTRACTOR STATEMENT**

All electrical installations that are preliminary to positioning of the equipment at the site prepared for the equipment shall be performed by licensed electrical contractors. In addition, electrical feeds into the Power Distribution Unit shall be performed by licensed electrical contractors. Other connections between pieces of electrical equipment, calibration and testing shall be performed by qualified Medical personnel. The products involved (and the accompanying electrical installations) are highly sophisticated, and special engineering competence is required. In performing all electrical work on these products, GE will use its own specially trained field engineer. All of Vendor's electrical work on these products will comply with the requirements of the applicable electrical codes.

The purchase of equipment shall only utilize qualified personnel (i.e., Vendor's field engineers, personnel of third-party service companies with equivalent training, or licensed electricians) to perform electrical servicing on the equipment.

**DAMAGE IN TRANSPORTATION**

All packages should be closely examined at time of delivery. If damage is apparent write "Damage in Shipment" on ALL copies of the freight or express bill BEFORE delivery is accepted or "signed for" by a Vendor's representative or hospital receiving agent. Whether noted or concealed, damage MUST be reported to the carrier immediately upon discovery, or in any event, within 14 days after receipt, and the contents and containers held for inspection by the carrier. A transportation company will not pay a claim for damage if an inspection is not requested within this 14 day period.

Call Vendor's representative immediately after damage is found. At this time be ready to supply name of carrier, delivery date, consignee name, freight or express bill number, item damaged and extend of damage.

注意

本维修手册只有英文本.
客户维修员需要非英文的维修手册，必须自行负责翻译.在详细阅读和理解本手册之前，不得对设备进行维修.
不遵守本注意事项，会对维修员、操作员或病人造成触电、机械碰撞或其它伤害.

警告

このサービスマニュアルは英語版のみです。

GEメディカルシステム以外の業者がサービスを行うに当たって、英語版以外の版が必要な場合は、その業者の責任で翻訳サービスを行って下さい。

装置類の保守サービスを行う前に必ずサービスマニュアルをよく参照し、内容を理解して下さい。

この警告を遵守しない場合、サービス員、取扱者、あるいは患者に、感電や機械的な危険を及ぼす可能性がありますのでご注意下さい。

**WARNING**

THIS SERVICE MANUAL IS AVAILABLE IN ENGLISH ONLY IF A CUSTOMER´S SERVICE PROVIDER REQUIRES A LANGUAGE OTHER THAN ENGLISH. IT IS THE CUSTOMER´S RESPONSIBILITY TO PROVIDE TRANSLATION SERVICES. DO NOT ATTEMPT TO SERVICE THE EQUIPMENT UNLESS THIS SERVICE MANUAL HAS BEEN CONSULTED AND IS UNDERSTOOD.
FAILURE TO HEED THIS WARNING MAY RESULT IN INJURY TO THE SERVICE PROVIDER, OPERATOR OR PATIENT FROM ELECTRIC SHOCK, MECHANICAL OR OTHER HAZARDS.

**AVERTISSEMENT**

CE MANUEL DE MAINTENANCE N´EST DISPONIBLE QU´EN ANGLAIS.
SI LE TECHNICIEN DU CLIENT A BESOIN DE CE MANUEL DANS UNE AUTRE LANGUE QUE L´ANGLAIS, C´EST AU CLIENT QU´IL INCOMBE DE LE FAIRE TRADUIRE.
NE PAS TENTER D´INTERVENTION SUR LES EQUIPEMENTS TANT QUE LE MANUEL SERVICE N´A PAS ETE CONSULTE ET COMPRIS.
LE NON-RESPECT DE CET AVERTISSEMENT PEUT ENTRAÎNER CHEZ LE TECHNICIEN, L´OPERATEUR OU LE PATIENT DES BLESSURES DUES A DES DANGERS ELECTRIQUES, MECANIQUES OU AUTRES.

**WARNUNG**

DIESES KUNDENDIENST-HANDBUCH EXISTIERT NUR IN ENGLISCHER SPRACHE.
FALLS EIN FREMDER KUNDENDIENST EINE ANDERE SPRACHE BENÖTIGT, IST ES AUFGABE DES KUNDEN FÜR EINE ENTSPRECHENDE ÜBERSETZUNG ZU SORGEN.
VERSUCHEN SIE NICHT, DAS GERÄT ZU REPARIEREN, BEVOR DIESES KUNDENDIENST-HANDBUCH NICHT ZU RATE GEZOGEN UND VERSTANDEN WURDE.
WIRD DIESE WARNUNG NICHT BEACHTET, SO KANN ES ZU VERLETZUNGEN DES KUNDENDIENSTTECHNIKERS, DES BEDIENERS ODER DES PATIENTEN DURCH ELEKTRISCHE SCHLÄGE, MECHANISCHE ODER SONSTIGE GEFAHREN KOMMEN.

**ATENÇÃO**

ESTE MANUAL DE SERVIÇO SÓ ÉDISPONÍVEL EM INGLÊS. CASO O PROVEDOR DE SERVIÇOS DO USUÁRIO NECESSITE DE UMA TRADUÇÃO, ESTA É DE RESPONSABILIDADE DO CLIENTE.
NÃO TENTE UTILIZAR O EQUIPAMENTO ANTES DE CONSULTAR E COMPREENDER O MANUAL DE SERVIÇO.
A NÃO OBSERVÂNCIA DESTE PODE ACARRETAR LESÕES AO PROVEDOR DE SERVIÇOS, OPERADOR OU PACIENTE CAUSADAS POR CHOQUE ELÉTRICO, MECÂNICO OU DE OUTRA NATUREZA.

**AVVERTENZA**

IL PRESENTE MANUALE DI MANUTENZIONE È DISPONIBILE SOLO IN LINGUA INGLESE.
SPETTA ALL´UTENTE PROCURARSI UNA VERSIONE TRADOTTA NEL CASO IN CUI L´ADDETTO ALLA MANUTENZIONE DOVESSE RICHIEDERLA.
NON TENTARE DI METTERE IN FUNZIONE L´APPARECCHIATURA PRIMA DI AVER CONSULTATO IL MANUALE DI MANUTENZIONE ED AVERNE COMPRESO PIENAMENTE IL CONTENUTO.
LA MANCATA OSSERVANZA DI QUESTA AVVERTENZA PUÒ PROVOCARE LESIONI AL PERSONALE DI MANUTENZIONE, ALL´OPERATORE O AL PAZIENTE, DERIVANTI DA SCOSSE ELETTRICHE, URTI O RISCHI DI ALTRA NATURA.

**AVISO**

IESTE MANUAL DE SERVICIO SÓLO EXISTE EN INGLÉS.
SI ALGÚN PROVEEDOR DE SERVICIOS AJENO A GEMS SOLICITA UN IDIOMA QUE NO SEA EL INGLÉS, ES RESPONSABILIDAD DEL CLIENTE OFRECER UN SERVICIO DE TRADUCCIÓN.
NO SE DEBERÁ DAR SERVICIO TÉCNICO AL EQUIPO, SIN HABER CONSULTADO Y COMPRENDIDO ESTE MANUAL DE SERVICIO.
LA NO OBSERVANCIA DEL PRESENTE AVISO PUEDE DAR LUGAR A QUE EL PROVEEDOR DE SERVICIOS, EL
OPERADOR O EL PACIENTE SUFRAN LESIONES PROVOCADAS POR CAUSAS ELÉCTRICAS, MECÁNICAS O DE OTRA NATURALEZA.

# LIST OF REVISIONS

| ECO | REV | DATE | DESCRIPTION | AFFECTED PAGES | APPR. |
|---|---|---|---|---|---|
| P9852905 | 0 | May 1998 | Generic ELGEMS Release | All | |
| E9952901 | 1 | Oct. 1998 | Corrections | 3-3, 4-7, C-4 | S. Yarmush |
| EO-00423 | 2 | July 2000 | Addition of requirements for Hawkeye Option<br><br>Corrections<br><br>Change of Manual number from 490-3100-11 to MAN000122. | 1-1, 4-3, 4-4, 4-6, Addition of Appendix D<br>3-3, 3-4 | A. Sherman |
| EO-00533 | 3 | Feb. 2001 | Addition of checklist | Appendix D | A. Sherman |
| | | | | | |

## *Notes*

# TABLE OF CONTENTS

# TABLE OF CONTENTS (Continued)

# TABLE OF CONTENTS (Continued)

# LIST OF FIGURES

**FIGURES** **PAGE**

# LIST OF TABLES

**TABLE** **PAGE**

# CHAPTER 1
# INTRODUCTION

This manual provides all the information necessary to prepare the site for the dual-head, variable-angle gamma camera.

The information contained herein will assist the site preparation team in the following subjects:

- Planning the site
- Accessibility to the site
- Physical layout of the site
- Construction, mechanical, electrical and environmental specifications
- Cables routing
- Connectivity

The guidelines contained in this manual provide necessary electrical and mechanical information and serve as support data for determining construction requirements and cost evaluation.

The information contained herein should be used in conjunction with drawings, prepared specifically for each site.

The equipment and tools required to unpack, convey and install the Imaging System, as well as unpacking and conveying instructions are detailed in the Imaging System Installation Manual.

**Requirements for the Hawkeye option are specified in Appendix D.**

| **Note** | The Hawkeye option effects the room layout and introduces additional electrical and environmental requirements. |
|---|---|

# CHAPTER 2
# SYSTEM SPECIFICATIONS

This chapter provides the physical, electrical and environmental specifications of the Nuclear Imaging System.

The measurements of the Gantry, Table and Collimator Cart are shown in Figure 2-1.

The weights and the measurements of the various Nuclear Imaging System units are given in Table 2-1.

The electrical and environmental specifications of the system are given in Table 2-2.

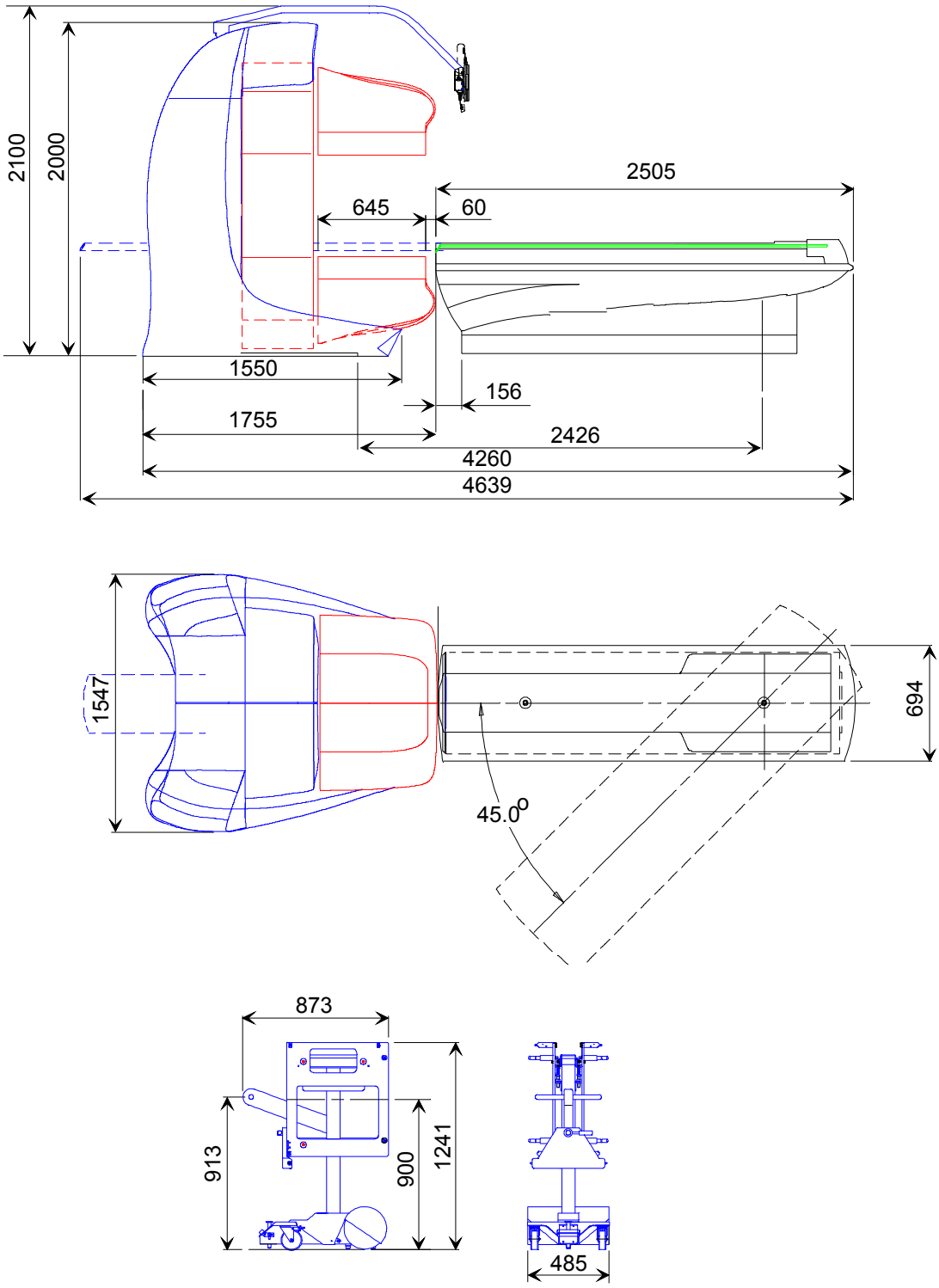


**Figure 2-1.** Measurements of Gantry, Table and Collimator Cart

**Table 2-1.** Nuclear Imaging System Units - Actual Weights and Dimensions

| UNIT | NET WEIGHT | | DIMENSIONS given in cm (in) | | |
|---|---|---|---|---|---|
| | kg | lb | H | W | D |
| Gantry | 2,400 | 5,291 | 210 (82.7") | 155 (61") | 175 (69") |
| Table + Stretcher | 400 | 880 | | 70 (27.5") | 250 (99") |
| Collimator Cart | 100 | 220 | 124 (49") | 87 (34.2") | 49 (19.3") |
| Collimator (each)<br>VPC 35, 45, 46<br>VUFB-75 | 43 - 60 | 95 - 132 | | | |
| Heavy Collimator (each)<br>VPC-5, VPC-6 | 85 - 190 | 187 - 419 | | | |
| Detector | 75 | 155 | | | |
| Transportation Kit | 180 | 396 | | | |
| Computer | 30.5 | 66 | 52 (20.5") | 22 (8.7") | 66 (26") |
| Monitor | 37 | 80.8 | 49 (19.3") | 43 (17") | 46 (18") |

**Table 2-2.** Electrical and Environmental Specifications

| | |
|---|---|
| **Electrical Specifications** | |
| Voltage | Three phase, one hook-up of 208/400 Vac |
| Frequency | 50 / 60 Hz |
| Power Consumption | 4.5 kVA |
| Maximum Load Current | **European Standard**:<br>15 A per phase in case of 3-phase star, 400 V ac line voltage<br><br>**American Standard**:<br>17 A per phase in case of 3-phase delta, 208 V ac line voltage |
| **Environmental Specifications** | |
| Temperature | 20 - 25 $^{o}$C (68 - 77 $^{o}$F) |
| Maximum Temp. Gradient | 3 $^{o}$C/hour (5 $^{o}$F/hour) |
| Relative Humidity | 40 - 60% non-condensing |
| **Thermal Load** | |
| Gantry | 1900 W / 6500 BTU/H |
| Computer | 500 W / 1700 BTU/H |
| Monitor | 100 W / 342 BTU/H |

# CHAPTER 3
# ACCESSIBILITY TO THE SITE

## 3.1 UNLOADING AREA

The unloading area must be capable to accommodate the packed units, and allow for system unpacking and attachment of the Moving Wheels to the Gantry and the Table. The Weight and dimensions of the shipped packages are given in Table 3-1.

From the unloading site, there must be a free path to roll the units into the installation room or into a lift which will carry them to the installation site. The path specifications are given in Section 3.3. Special facilities must be provided if the units are to be transferred from an unloading site outside the building.

**Table 3-1.** Shipment Packages - Weights and Dimensions

| UNIT | PACKAGE WEIGHT | PACKAGE EXTERNAL MEASUREMENTS | | |
|---|---|---|---|---|
| | | H | W | D |
| Gantry | 3000 kg (6,614 lb) | 225 cm (88.5”) | 179 cm (70.4”) | 189 cm (74.5”) |
| Covers | 250 kg (551 lb) | 173 cm (68”) | 148 cm (58”) | 218 cm (83.5”) |
| Cart | 120 kg (264.4 lb) | 155 cm (61”) | 60 cm (23.6”) | 110 cm (43.3”) |
| Collimator (each)<br>VPC 35, 45, 46, VUFB-75 | 58 - 75 kg (127.9 - 165.4 lb) | 79 cm (31") | 25.4 cm (10") | 79 cm (31") |
| Heavy Collimator (each)<br>VPC-5, VPC-6, VPC-93 | 110 - 215 kg (242.5 - 474 lb) | 79 cm (31") | 25.4 (10") | 79 cm (31") |
| Transportation Kit | 230 kg (506 lb) | 49 cm (19.3”) | 119 cm (46.8”) | 100 cm (39.4”) |
| Detector | 160 kg (353 lb) | 104 cm (41”) | 100 cm (39.4”) | 96 cm (37.8”) |
| Table + Stretcher | 550 kg (1,213 lb) | 117 cm (46”) | 266 cm (105”) | 91 cm (36”) |
| Computer | 80 kg (176 lb) | 142 cm (56”) | 104 cm (41”) | 104 cm (56”) |
| Monitor | 45 kg (99 lb) | 60 cm (23.6”) | 77 cm (30.3”) | 60 cm (23.6”) |

## 3.2 UNLOADING FROM THE TRUCK

Unloading of the Nuclear Imaging System Gantry, Table and Collimator Cart(s) from the truck requires a lifting equipment with appropriate lifting capacity.

The system is shipped in crates with specific arrangements for fork lift unloading. Therefore, the recommended lifting equipment is a fork lift with a lifting capacity of 3000 kg (6600 lb) (weight of fully crated Gantry) at least.

Nevertheless, if a fork lift is not available, the system can be unloaded with a crane. To lift the Gantry by a crane, the upper and side panels of the crate must be removed on the truck, and a lifting bracket, supplied in the Imaging System Moving Kit, must be attached to the Gantry. Unloading of Table and Collimator Carts by a crane requires appropriate straps.

## 3.3 MOVING THE SYSTEM TO THE SITE

The Imaging System Moving Kit must be available at the unloading site in order to convey the Gantry and Table into the installation/storage site. Be sure to order the complete Moving Kit from your subsidiary in advance, so that it will be available at the scheduled unloading time. The content of the Moving Kit is detailed in the Nuclear Imaging System Installation Manual, Table 1-1.

After the units are placed on the floor, special equipment is to be used (jack, etc.) to lift it a few centimeters off the ground and attach the special moving wheels (a hydraulic jack is included in the Moving Kit).

From the unloading site, a suitable pathway must be prepared to roll the units into the installation room or into a lift which will carry them to the installation site. Halls and doors along the pathway must be large enough for passage of the Gantry and Table mounted on moving wheels, and must tolerate their weights. Elevators if needed, must accommodate the mounted Gantry and Table with regard to their dimensions and weights. Any item along the course which may be damaged, such as carpets, frame heads, low lights, should be removed.

Measurements and weights applicable for Gantry and Table conveyance are specified in Table 3-2.

Detailed measurements of the Moving Kit assembled onto the Gantry are shown in Figure 3-1 (side and front views) and in Figure 3-2 (top view).

Table package and measurements are shown in Figure 3-3.

**Table 3-2.** Gantry and Table - Conveyance Specifications

| PROPERTY | MEASUREMENT |
|---|---|
| Height of Gantry mounted on moving wheels | 1,794 mm (70.63”) |
| Weight of Gantry mounted on moving wheels | 2,550 kg (5610 lb) |
| Point load of Gantry mounted on moving wheels | 70 kg/cm$^2$ |
| Minimum hall width allowing to roll the Gantry around 90$^o$ corners | 1,600 mm (63”) |
| Minimum hall width allowing to roll the Table around 90$^o$ corners | 2,000 mm (78.74”) |
| Path slope | < 4% (4 cm / 100 cm; 1.57” / 39.37”) |
| Table length | 2,505 mm (98.62”) |
| Weight of Table mounted on moving wheels | 410 kg (902 lb) |
| Point load of Table mounted on moving wheels | 40 kg/cm$^2$ |

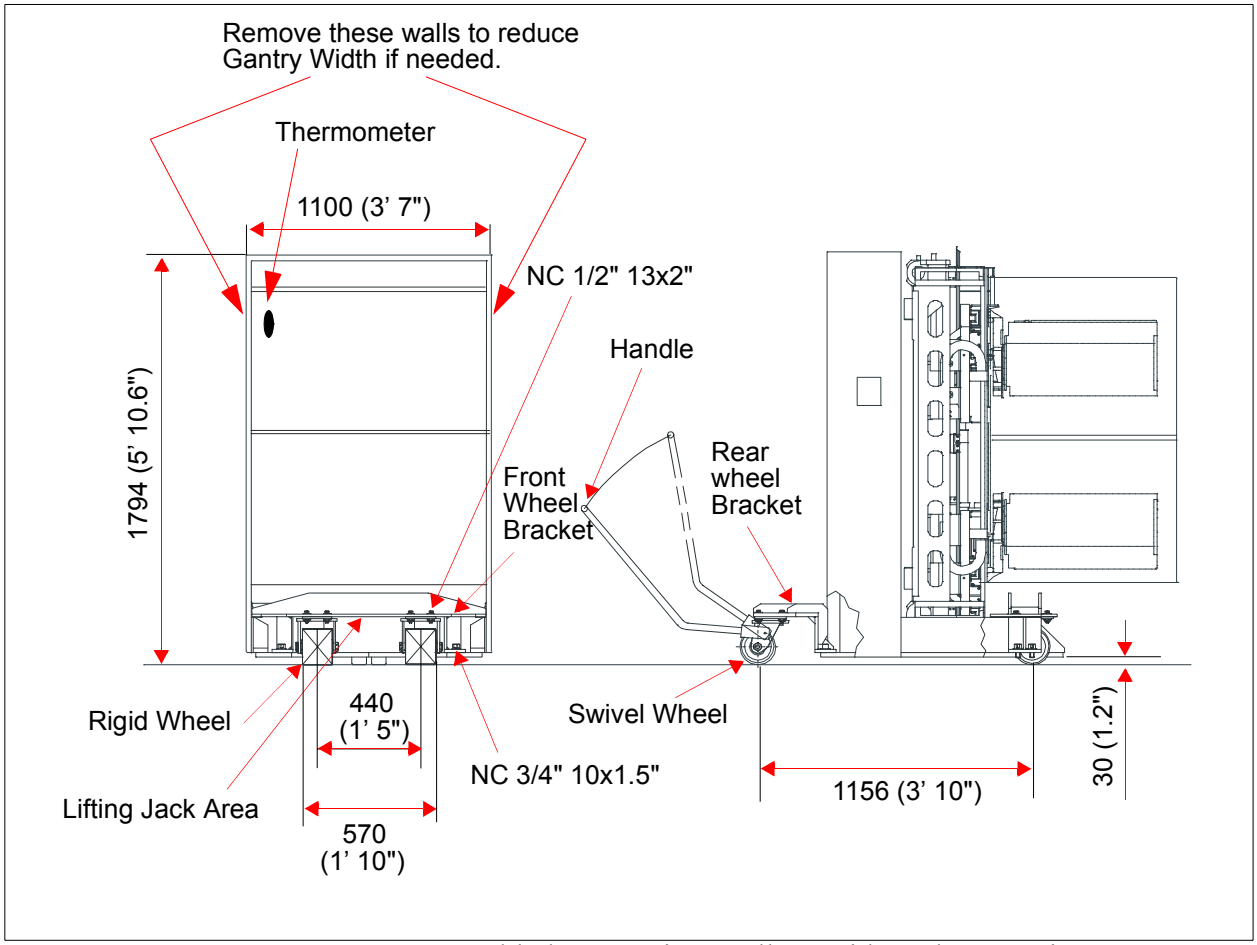


**Figure 3-1.** Gantry Assembled on Moving Trolley - Side and Front Views

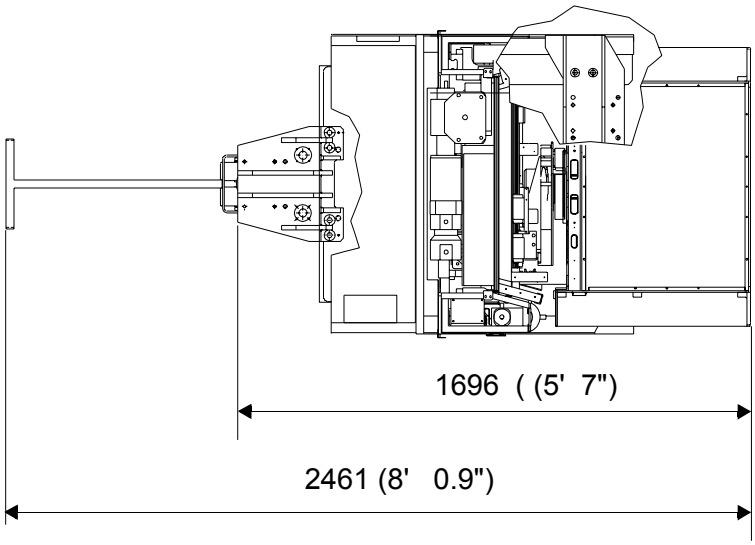


**Figure 3-2.** Gantry Assembled on Moving Trolley - Top Views

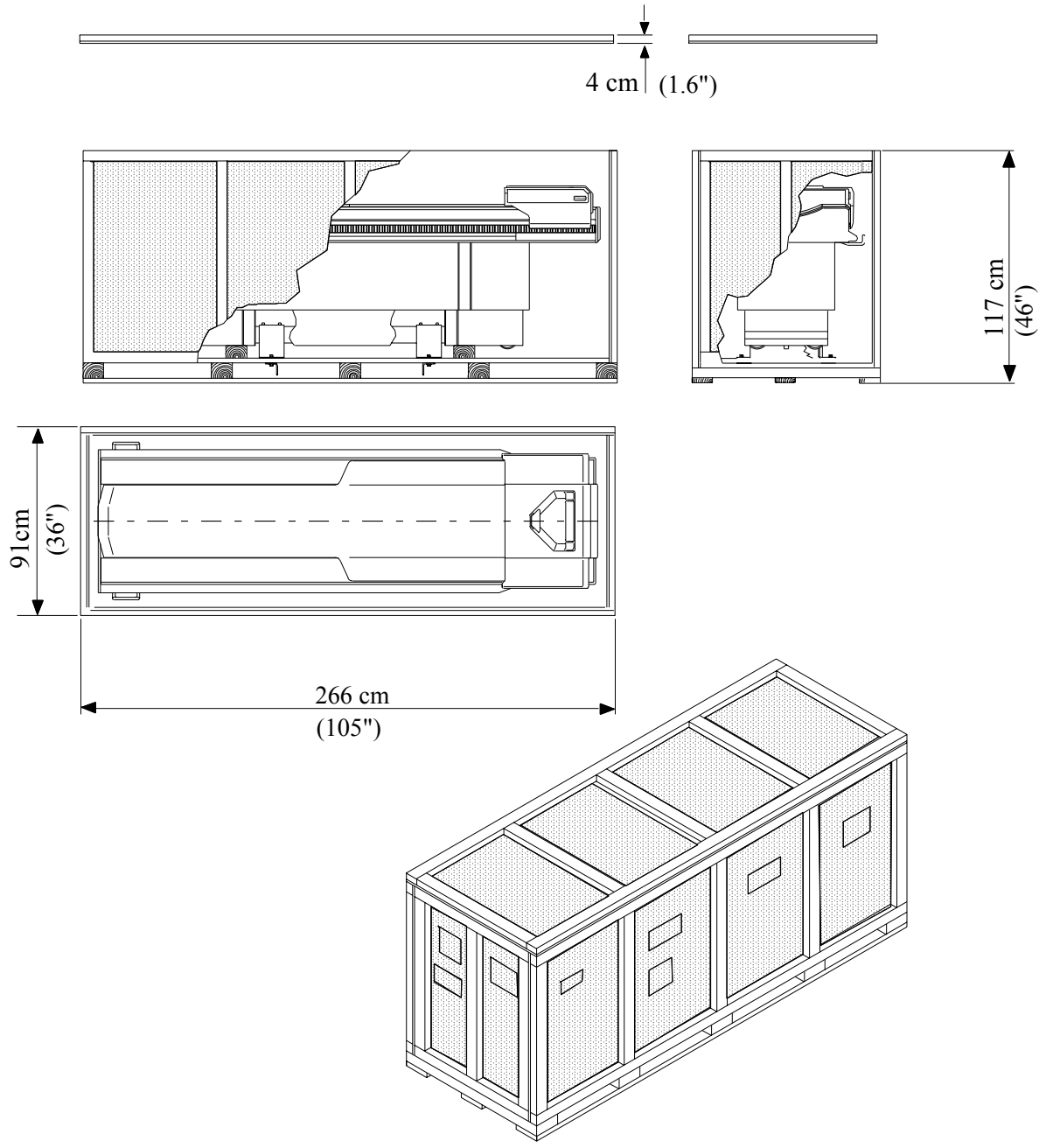


**Figure 3-3.** Table Transportation Packaging

# CHAPTER 4
# PHYSICAL PLANNING OF THE SITE

## 4.1 SELECTING THE SITE

The Nuclear Imaging System requires one room, which will contain the following sub-systems:

- Gantry
- Table
- Computer + Monitor
- Collimator Cart(s)

Separate rooms are recommended for the following utilities:

- Office/Viewing/Processing Room
- Patient waiting room
- Patient preparation room
- Hot lab
- Dark room

Figure 4-1 shows typical site layout.

The selection of the scan area should be based on the following considerations:

- ***Easy access to Emergency Switch***
- Influence of the surrounding rooms
- Camera heads should not face any radioactive source
- Distance to "hot areas" such as:
  - Hot laboratory
  - Patient toilets
  - Patient waiting/preparation rooms
- Distance from diagnostic area such as:
  - Processing room
  - Viewing room
- If the patient is rolled in on a bed, facilities should be provided to "slide" the patient onto the Scanning Table.
- Floor loading capacity, as per Section 4.3 and Figure 4-5.

The selection of the Acquisition Station area should be based on the following considerations:

- Position relative to the camera:
  - Gantry - Acquisition Station cable limitations
  - Convenient accessibility to Gantry and Table for daily activity
- Access to communication lines (for details refer to Chapter 7):
  - Ethernet connection
  - Telephone connection for Modem, if relevant
  - Connection to hardcopy device, if it is to be directly connected to the system
- Feasibility of Emergency Unit installation within operator reach

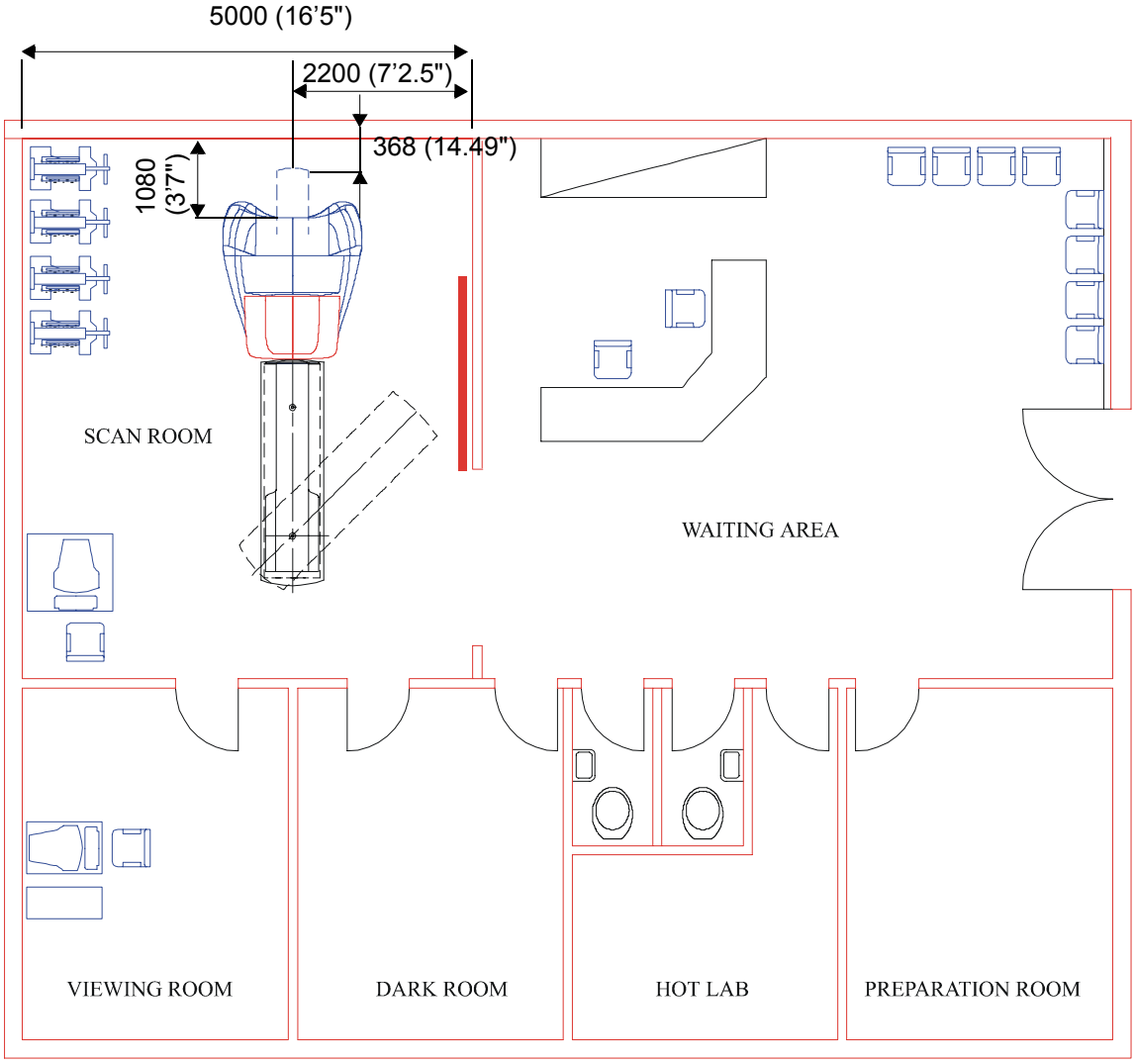


**Figure 4-1.** Typical Area Layout

**Note**

Clearance of 1080 mm (3 7") includes maximum Stretcher extension for systems with the Hawkeye option.

For systems without the Hawkeye option, clearance of 880 mm (34.65") is sufficient for maximum Stretcher extenstion.

## 4.2 ROOM SIZE

Examples of optimum and minimum room layouts are shown in Figure 4-2, and Figure 4-3, respectively. The examples include the following items:

- Gantry
- Table
- Collimator Carts
- Acquisition Station
- Multi Imager
- Operator's Chair
- Emergency Button

When planning your room layout you must take into consideration the clearance area required for servicing the imaging system (see Figure 4-4), and the **room height**, which should be minimum 2.5 meters. This height is required for mounting the Crane used to lift and install the Detectors.

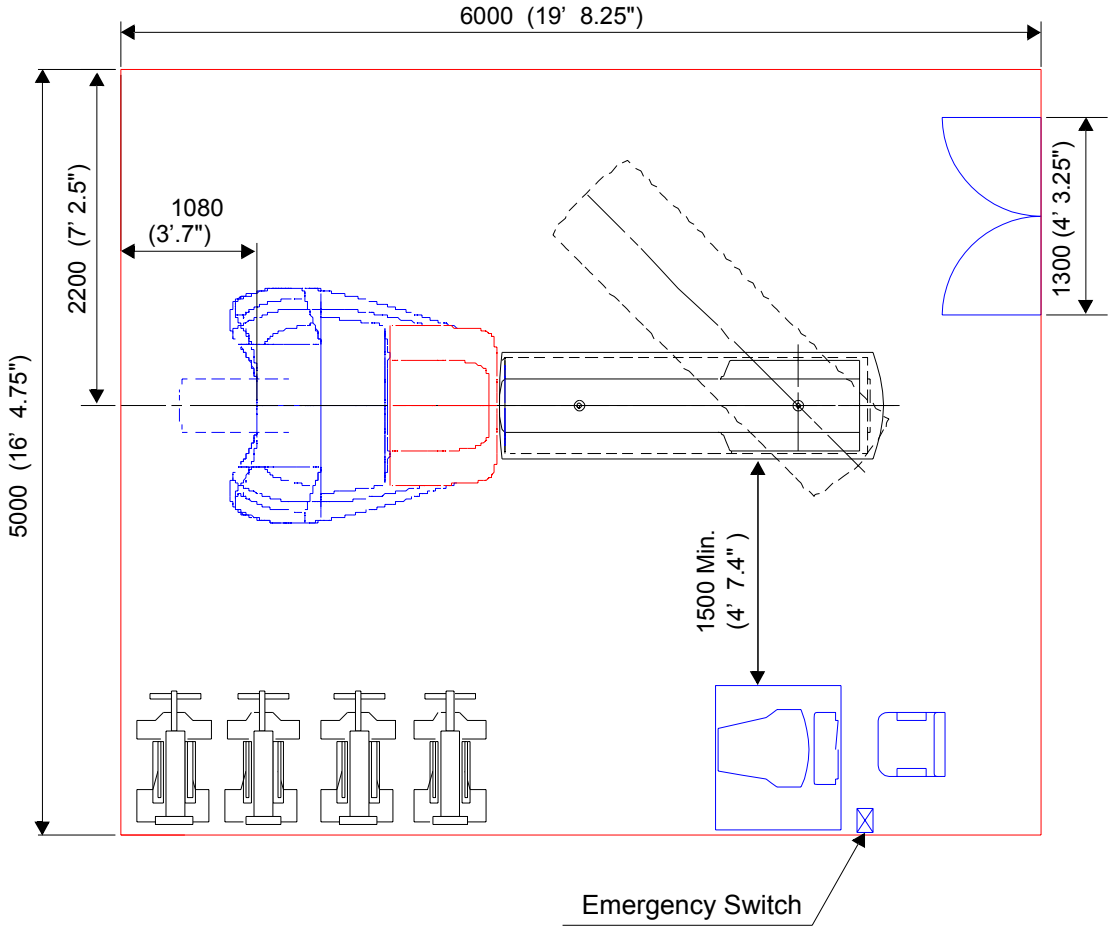


**Figure 4-2.** Optimum Room Size

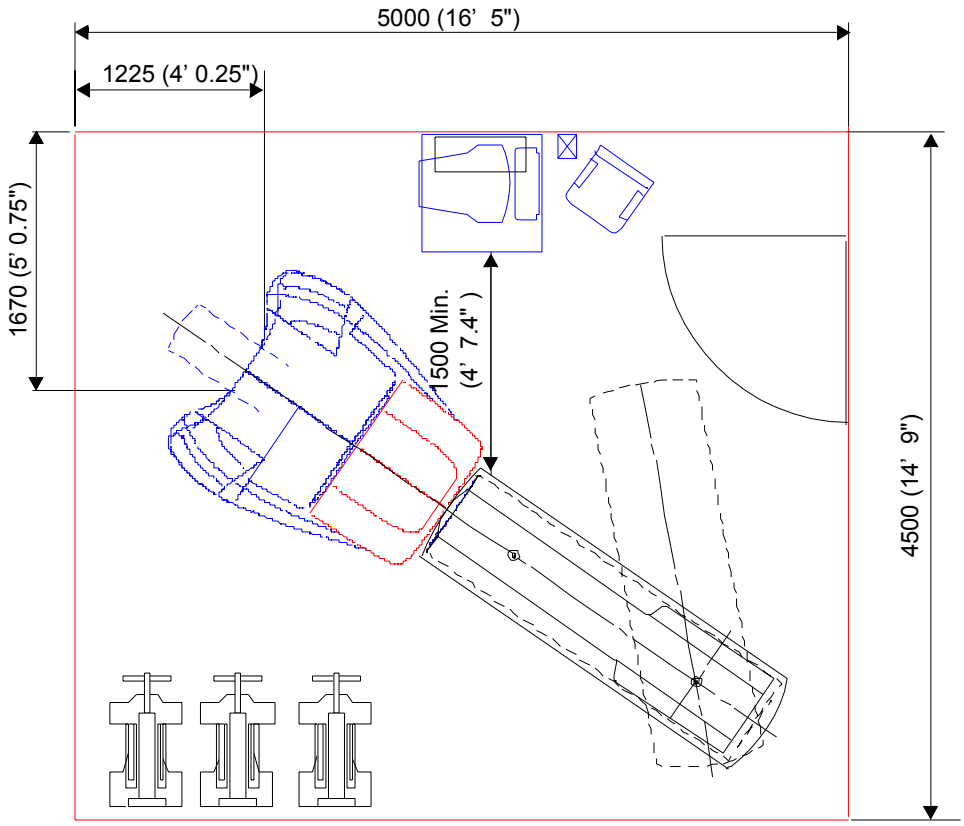


**Figure 4-3.** Minimum Room Size

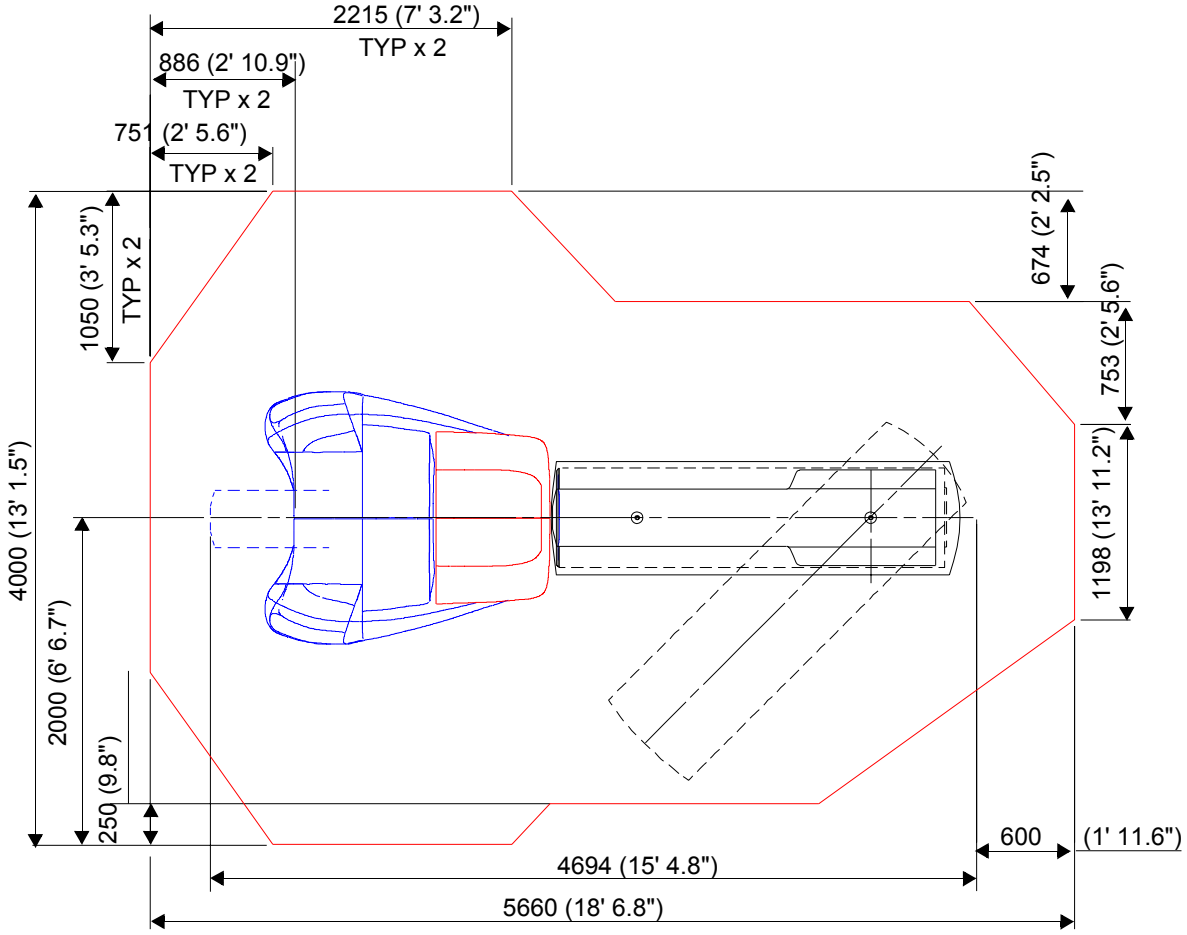


**Figure 4-4.** Recommended Clearance Area for Service

## 4.3 FLOOR PREPARATION

### 4.3.1 General

The floor must be prepared so that it will support the floor loading as described in Section 4.3.1.1.

***Floor loading capability must be confirmed by a local construction engineer.***

In addition, the floor slope and flatness must meet the requirements mentioned in Section 4.3.1.2, to ensure smooth access for loading/unloading collimators and phantoms to/from Collimator Carts and Heads.

Floor preparation differs according to its construction and level:

- Floor preparation of site where the construction is made of concrete and the site is on ground level (and on real ground), or where there is a possibility to cast concrete. See Section 4.3.2 for an example.
- Floor preparation of site where the floor is made of a thin layer of concrete and is supported by a beam construction. See Section 4.3.3 for an example.

To avoid damage to system cables during Table motion or Collimators loading/unloading, it is recommended that all cables should lie in sunken ducts when the site is on ground level, or under the floor in case of floors supported by beam construction.

#### 4.3.1.1 Floor Loading

The Gantry weighs approximately 2650 kg (5842 lb) static weight and about 2850 kg (6283 lb) dynamic weight (at maximum rotation speed and asymmetric heads positioning). The Gantry applies a point loading of 7 kg/cm$^2$ (15.43 lb / 0.155 sq." ).

The Scanning Table weighs about 400 kg (882 lb).

The Collimator Cart loaded with two Collimators weighs between 150 to 450 kg (331 - 992 lb), depending on the Collimators' type. The Collimator Cart applies a floor loading of 50 kg/cm$^2$ (110.23 lb / 0.155 sq").

The entire room floor must tolerate the load of the loaded Collimator Cart.

The floor loading areas for the Gantry, Table and Collimator Carts (floor loading areas A, B, and C, respectively) are shown in Figure 4-5.

#### 4.3.1.2 Floor Slope and Flattened Area

To ensure proper Gantry motion and collimator exchange, the room floor must be leveled, and its surface must be smooth.

It is recommended that the entire room will be leveled and flattened, according to the specifications given below. If this is not possible, at least the Gantry areas must be leveled and flattened. The dimensions of the minimum leveled and flattened area is shown in Figure 4-5, as Floor Loading Area A.

The floor slope should be within ± 0.5 cm / 430 cm (± 3/16" / 170").

The floor surface should be smooth and have no more than 0.2 cm (1/16") deviation in any 457 cm (15’) radius.

To verify surface flatness of the entire room, use a straight edge of 15’ long ruler upon completion of the room (see Figure 4-6).

No fill material is allowed to compensate for surface deviations.

#### 4.3.1.3 Floor Material

To reinforce the required floor area, it is recommended to use casted concrete B-300 or stronger.

To level and flatten the floor it is recommended to use Micorox X-tra Fluid Grout, or Mipolam 410 (both described in Appendix B), or any other similar material. The material used to flatten the floor must be anti static.

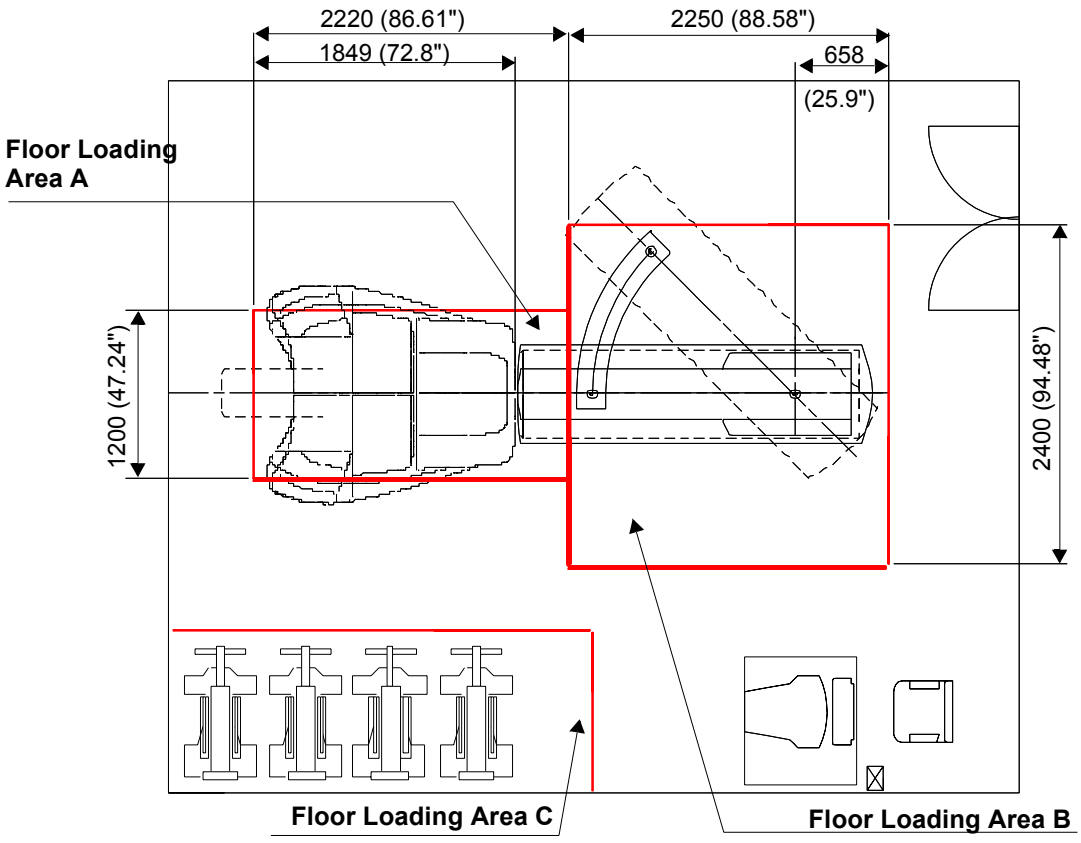


**Figure 4-5.** Floor Loading

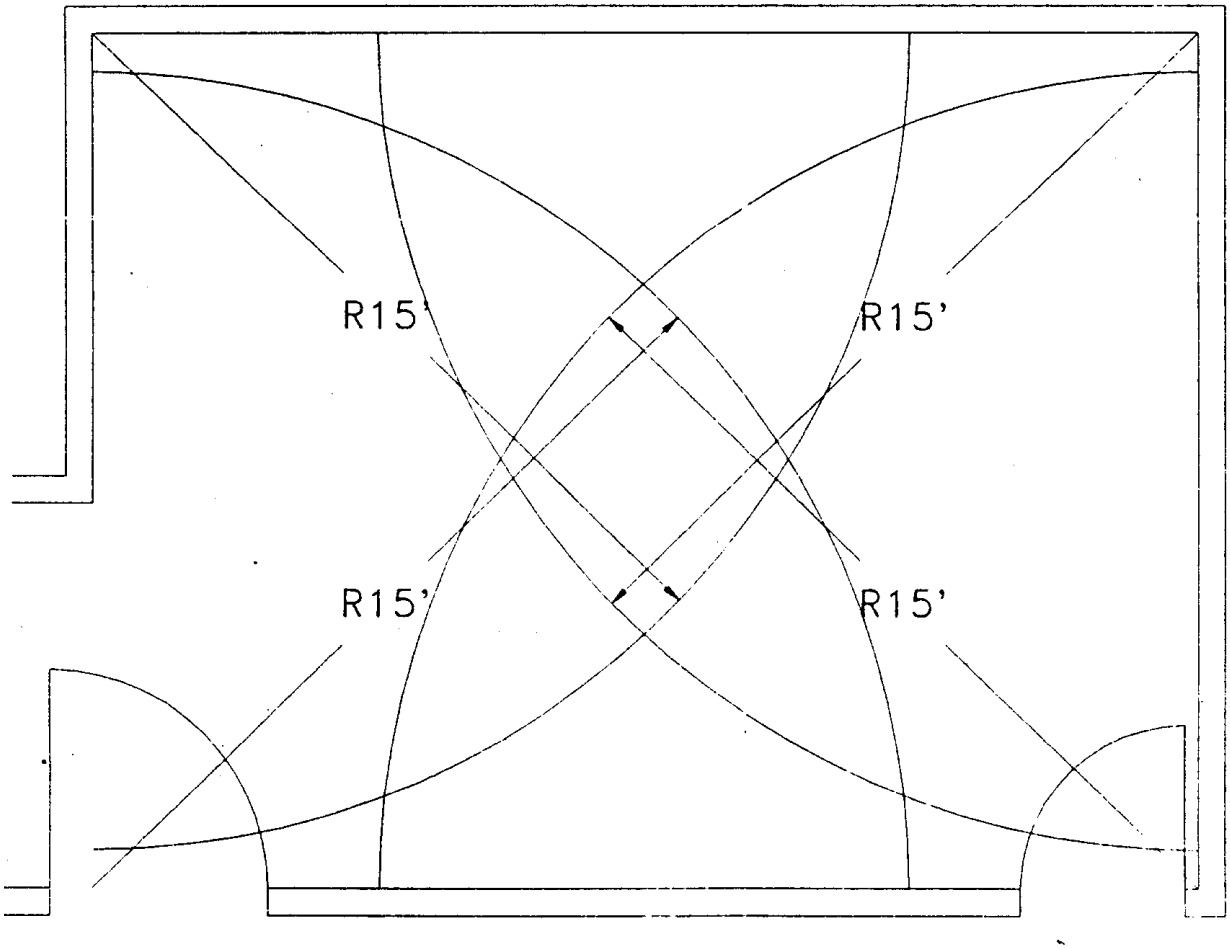


**Figure 4-6.** Ensuring Floor Flatness of Entire Room

## 4.3.2 Ground Floor Site

Preparation of ground floor consists of:

- Floor reinforcement, if needed.
- Preparation of built-in ducts
- Floor leveling and surface flattening

### 4.3.2.1 Reinforced Area

In case the Imaging System is to be installed on ground level and the floor is of concrete, a proper reinforced area must be prepared. It is recommended that the reinforced area be of casted concrete B-300 or stronger. The size and shape of the area should be according to Figure 4-5.

### 4.3.2.2 Preparation of Built-in Floor Ducts

The Gantry-Table cable must be routed within a duct either built-in or beneath the floor.

The Gantry-Computer cable should also be routed within a duct, or at least part of it between the Gantry and the near-by wall.

Ducts built in the floor should be beneath the floor surface, at 75 mm depth, at least.

The minimum duct width is 70 mm.

The optional Persistence Monitor (AXM-15) can be installed on a mechanical arm attached to any wall in the Gantry room according to the customer requirements. The Persistence Monitor cable of 15 meters length (49.215 ft) may be routed in a plastic duct attached to the wall.

An example of locations and measurements of ducts built in the floor is provided in Figure 4-7. An example for ducts routed beneath the floor is provided in Figure 4-8.

A hole with a depth of 40 mm must be dug in the floor for the Cart Plate Switch Cavity as shown in Figure 4-7.

**A few recommendation for duct preparation are given below**:

1. If the concrete can not accommodate the ducts, drill through the floor and route the ducts beneath the floor as shown in Figure 4-8.
2. The Table/Gantry cable must reach the Table from behind.
3. The duct containing the Table cable should be accurate in length: 9.5 ± 0.5 meters (31.17 + 1.64 ft).
4. Building ducts under the Floor Plates should be avoided, except for the back Table Plate.
5. Ducts should not be built under the Gantry.

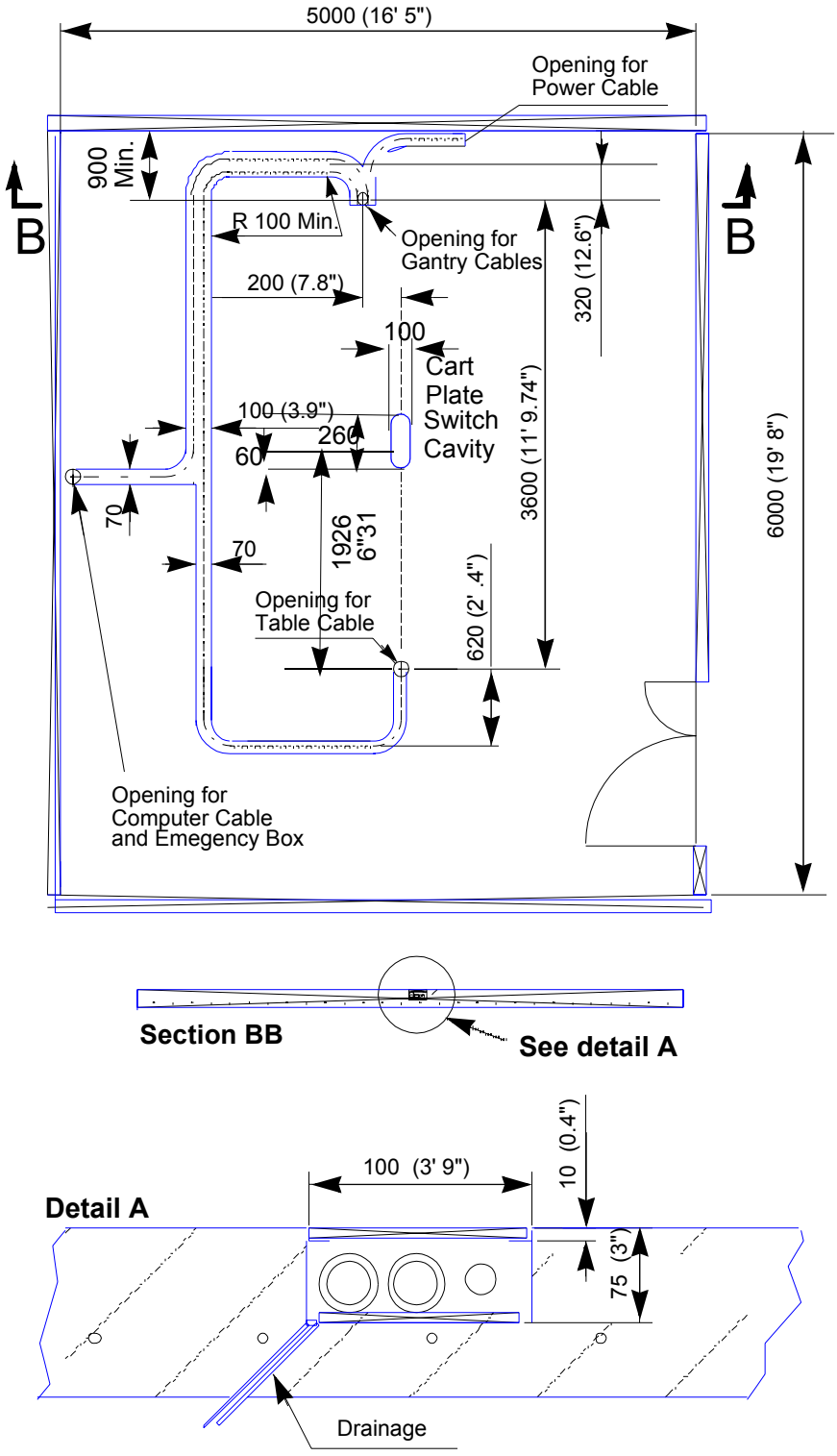


**Figure 4-7.** Example of Built-in Ducts Location and Measurements

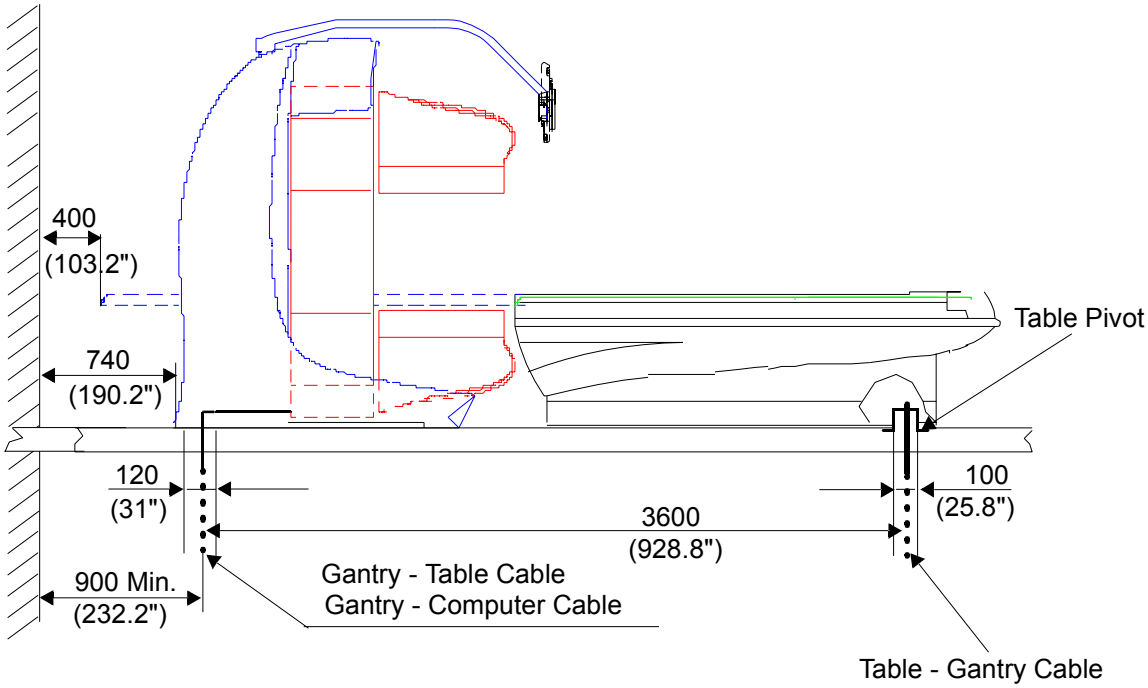


**Figure 4-8.** Cables Penetration Through the Floor

### 4.3.3 Preparation of Floor Supported by Beam Construction

Preparation of floor supported by beam construction consists of:

- Confirmation of loading capability.
- Cables routing
  The cables should be routed under the floor. For floor drilling see Figure 4-8. **Keep in mind that drilling can be done only in between beams**.
- Floor leveling and surface flattening

# CHAPTER 5
# ELECTRIC INSTALLATION REQUIREMENTS

## 5.1 VOLTAGE REQUIREMENTS

The Imaging System is applicable to world wide main supplies. Three phase, one hookup of 208 or 400 Vac; 50/60 Hz (see Table 2-2, page 2-3 for details).
Voltage variations should not exceed ±10% from zero to maximal load.

## 5.2 POWER REQUIREMENTS

Power consumption is 4.5 kVA. Maximum load (current) is:

- 15 A per phase in case of three-phase star, 400 V ac line voltage (3 x 230 V for Europe), 20 A Circuit Breaker
- 17 A per phase in case of three-phase delta, 208 V ac line voltage (3 x120 V for USA), 20 A Circuit Breaker

The power source must be independent of all other loads.

The three-phase power must be dedicated circuit and include the following:

1. Permanent - not plug-in connection.

2. The connection must include THREE PHASE lines, NEUTRAL line and INSOLATED Ground line. The ground wire is same as/larger than the power wire.

3. The connection must include an ON/OFF switch, with phase indicator for each phase, located at the mains power supply box mounted on the wall. Type of ON/OFF switch should be determined by a local specialist according to local regulations (Us code requires a lockable switch).

In addition, the camera room should have several single phase wall outlets to be used for connection of general use. The location of these outlets depends on the specific site equipment and room layout.

The Gantry - Computer cable is terminated by a 3-outlets power box. One to connect the computer, one to connect the monitor and one free. The free outlet provides maximum 5 A.

## 5.3 FREQUENCY STABILITY REQUIREMENTS

The frequency must be 50 or 60 Hz ± 1 Hz.

## 5.4 NOISE / SPIKE DEFINITION

Transient spikes are defined as deviations from the ideal sine wave with a duration less than one cycle of line frequency. Normally these spikes have a duration of a few hundred nano-seconds. The following table defines the maximum spike energy allowed:

**Table 5-1.** Spike Energy Allowed

| SPIKE TYPE | PHASE VOLTAGE | |
|---|---|---|
| | 220 V AC | 110 V AC |
| Spike “A”<br>Pulse Width<br>Rise Time | < 1200 V<br>< 10 µs<br>< 1 µs | < 900 V<br>< 10 µs<br>< 1 µs |
| Spike “B”<br>Pulse Width | < 800 V<br>< 100 µs | < 400 V<br>< 100 µs |
| Spike “C”<br>Pulse Width | < 400 V<br>< 200 µs | < 200 V<br>< 200 µs |

To meet the above requirements without noise and spike interferences, refer to your local service for recommendations.

A local supplier should be able to provide such equipment.

## 5.5 INTER-CABLING

There are four major cables in the Imaging System, as specified in Table 5-2 below:

**Table 5-2.** Major Cables List

| CABLE TYPE | LENGTH |
|---|---|
| A. Table Cable (from Gantry to Table) | 11.0 m (36.1 ft) |
| B. Computer Cable (from Gantry to Computer) | 9.5 m (31.17 ft) |
| C. Main Power Cable (from Power Outlet to Gantry) | 9.4 m (30.84 ft) |
| D. Computer to Persistence Monitor (optional) | 15.0 m (49.22 ft) |

For cable routing, refer to Figure 4-7 and Figure 4-8, which ever applies to your site.

## 5.6 SYSTEM GROUNDING AND ELECTRICAL POWER DISTRIBUTION

In the Imaging System, the frame ground of the Table and the frame ground of the Computer are connected to the Gantry frame ground to form a common ground. The Gantry frame ground is connected via the main ground screw to the main Earth Ground in the mains power outlet. System grounding and power distribution are shown in Figure 5-1.

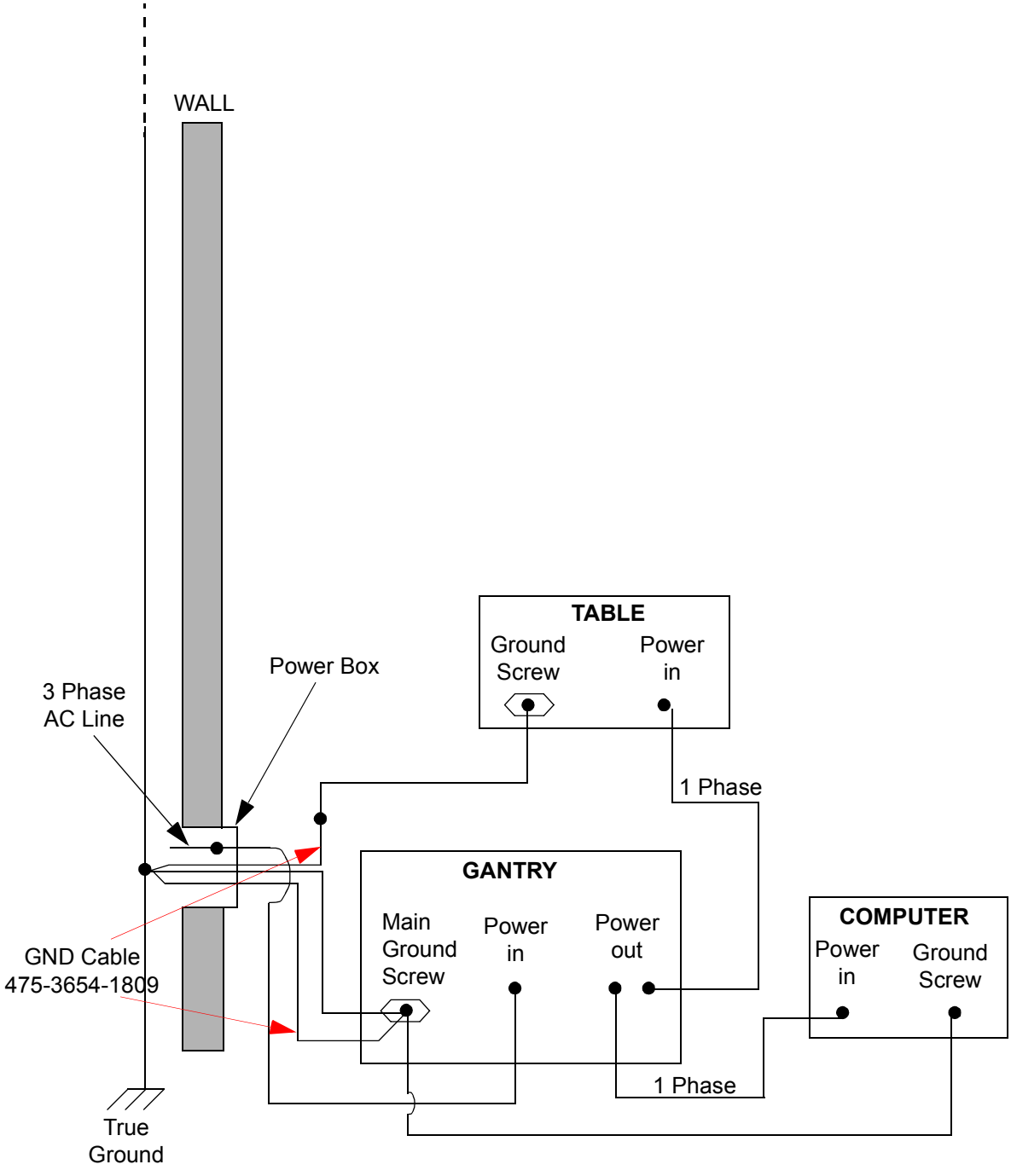


**Figure 5-1.** System Grounding and Power Distribution

# CHAPTER 6
# ENVIRONMENTAL CONDITIONS

## 6.1 RECOMMENDED SITE ENVIRONMENT SPECIFICATIONS

Each system module comprises numerous electronic and mechanical components, which are sensitive to extreme temperatures, humidity, dirt and air pollution. The environment of any Nuclear Medicine system inevitably has a noticeable effect on its reliability. High temperatures increase the failure rate of almost any electronic component. Temperature cycling may induce temporary or permanent changes in electronic equipment and/or mechanical components and can influence the performance of the system. Fast temperature changes can cause physical damage to the Detector's crystal. Unfiltered air in the room can cause damage to the hard disk, floppy disk drive, optical disk, etc.

Therefore, the units of the Imaging System should be installed only in a clean, dust-free, temperature-controlled environment, as specified in Table 6-1.

**Table 6-1.** Environment Specifications

| PARAMETER | REQUIRED ENVIONMENT SPECIFICATIONs |
|---|---|
| Temperature | 20 - 25 $^{o}$C (68 - 77 $^{o}$F) |
| Maximum Gradient | 3 $^{o}$C / hour (5.4 $^{o}$F / hour) |
| Humidity | 40 - 60% RH non-condensing |

In addition to the specifications listed in Table 6-1, free flow of air is required around the Computer. The Scan Room temperature and humidity are influenced by such factors as volume, temperature, humidity and flow pattern of incoming room air.

Operation is guaranteed up to 27 $^{o}$C (81 $^{o}$F). When designing the equipment control system, it should be noted that system cooling is required even in winter months.

Many sites have shut down their cooling facilities in the past and have used external atmospheric air to cool the system. The use of external cold air must be carefully controlled, to correct the temperature, humidity and air cleanliness levels, and ensure proper operation of scanner system.

## 6.2 THERMAL LOADS

The following thermal loads are relevant to the site environment:

- Equipment heat dissipation
- Room heaters and lights
- Number of persons in the scan room
- Dissipation through walls, ceilings, floors, doors, windows
- The thermal loads of the camera main units are listed in Table 6-2 below.

**Table 6-2.** Equipment Thermal Loads

| EQUIPMENT | WATTS | BTU/HOUR |
|---|---|---|
| GANTRY | 1,900 | 6,500 |
| COMPUTER | 500 | 1,710 |
| MONITOR | 100 | 342 |
| **TOTAL** | **2,500** | **8,552** |

**Note** Any additional equipment such as processing station or multi imager should be considered while calculating the total thermal load.

In addition to the heat generation specifications listed in Table 6-2, the amount of heat dissipated through walls, ceilings, and floors due to lighting, air ducting, heating, air conditioning, etc., should also be considered. The number of persons in the Scanning Site any given moment, will also have an effect on heat buildup.

As environmental factors change, varying levels of heat and humidity will be introduced or dissipate. Heating, cooling and humidity control equipment should therefore be used to maintain the required environmental conditions.

In order to maintain a proper air flow, the air conditioning duct arrangement should be planned so that cool air is not directed to the computer and the Gantry. Exhaust or return air vents should be located in the ceiling above the computer system. Air should be supplied by an overhead duct and diffuser or through a low wall system.

In planning the air conditioning installation, space must be provided for camera maintenance and environmental control system. Environmental control system installation plans must be submitted to the Vendor’s Installation Department, in order to facilitate complete site planning.

## 6.3 ENVIRONMENTAL TESTS

### 6.3.1 Power Source Test

Tests must be performed on site main supplies, prior to the camera installation. The mains tests can be done with a unit Power-line Disturbance analyzer such as “DRANETZ - series 606”. Surveillance requires seven working days on site, on all three phases. Voltage measurements are as follows:

1. Slow average of mains voltage beyond ± 10%.
2. Surge or sag of RMS voltage beyond ± 10%.
3. Frequency variations beyond ± 1%.
4. Spikes higher than 400 V (230 V line), 200 V (120 V line), their amplitude and time duration.
5. Line regulation tests - should be performed after loading each phase (at the point where the camera switchboard will be connected).
6. Ground Conductivity - the resistance between True Ground point and the Electrical connection to the equipment must be less than 1.2 Ohm.

### 6.3.2 Temperature Tests

Prior to installing the Imaging System, humidity and temperature tests must be performed at the site area. Surveillance requires seven working days on site (refer to Table 2-2, page 2-3).

CAMERA WARRANTY AND
SERVICE AGREEMENTS ARE CONTINGET
UPON MAINTAINING THE SITE ENVIRONMENT
ACCORDING TO THE ABOVE SPECIFICATIONS.

## 6.4 FIRE FIGHTING / WARNING

Fire fighting equipment and fire warning systems should be installed on the site, in accordance with local regulations.

# CHAPTER 7
# CONNECTIVITY

## 7.1 GENERAL

The gamma camera is designed to be connected to a Local Area Network (LAN) and a Remote Area Network (WAN) in order to transfer studies to Processing & Reviewing (P&R) stations, viewing stations and hardcopy devices. For the LAN Ethernet is used, while WAN connectivity is provided via Modem. Both LAN and WAN use the Transmission Control Protocol / Internet Protocol (TCP/IP) or File Transfer Protocol (FTP).

Towards this goal the following must be prepared:

- Network connection
- IP Address
- Telephone line for modem connectivity, if relevant

In addition, network information, hardcopy devices data and DICOM data must be prepared prior to system installation, to ensure that the system can be configured properly without delay. Refer to Chapter 2 in the Installation Manual for the required information.

## 7.2 LAN CONNECTION

The connection to the LAN is done via an Ethernet Adapter installed in the Acquisition Station. Therefore, the LAN connection must be on the wall next to the Acquisition station, so that the cable is not in the path of the Collimator Carts, or patient and operator access to the Table.

The actual connection to the network depends on the physical network media of the hospital, which can be one of the following:

- Thin Ethernet, implementing the 10Base-2 standard.
- Twisted Pair Cable, implementing the 10Base-T standard.
- Thick Ethernet implementing the 10Base-5 standard.

The LAN connection must meet the requirements of the standard used in your hospital or clinic. Consult the hospital network specialist or your local service for specific instructions.

## 7.3 IP ADDRESS

An IP address identifies both the network and the host attached to it.

Network IDs for networks that connect to the worldwide Internet are allocated by a central authority, the Internet Network Information Center (InterNIC), while the Host IDs are allocated by the Local Network Administrator.

For Internet connected networks, ask your local LAN Administrator to allocate an IP address for the camera or contact the InterNIC for allocating an IP address space for your hospital/clinic, whichever applies to your site.

For a camera to be connected over an internal network (that does not connect to the Internet), ask your local LAN Administrator, if any, for allocation of an IP address or consult your local service.

For description of the IP Address structure, refer to Chapter 2 in the Installation Manual.

## 7.4 TELEPHONE LINE & SOCKET FOR MODEM CONNECTION

For Modem connection a telephone line must be installed.

Since the Modem is installed in the Acquisition Station, the telephone socket must be installed on the wall next to the Acquisition station, so that the cable is not in the path of the Collimator Carts, or patient and operator access to the Table. If a telephone is connected to the modem line, the operator must have convenient access to the telephone.

# APPENDIX A
# CUT-OUT TEMPLATES

Below are given cut-out templates, used to assist in planning the scanning room.

Figure A-1 provides cutout templates in a metric scale of 1:50.

Figure A-2 provides templates cutout templates in an inch scale of 1:48.

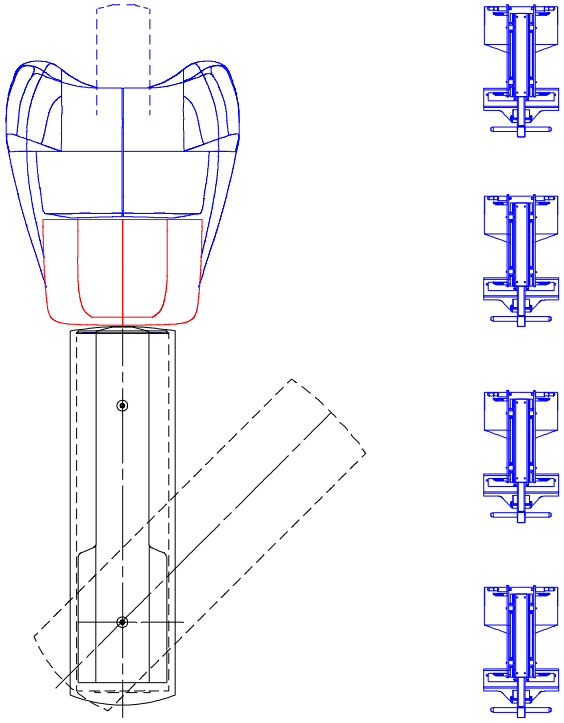

**Figure A-1.** Cut-out Templates in 1:50 Scale (Metric)

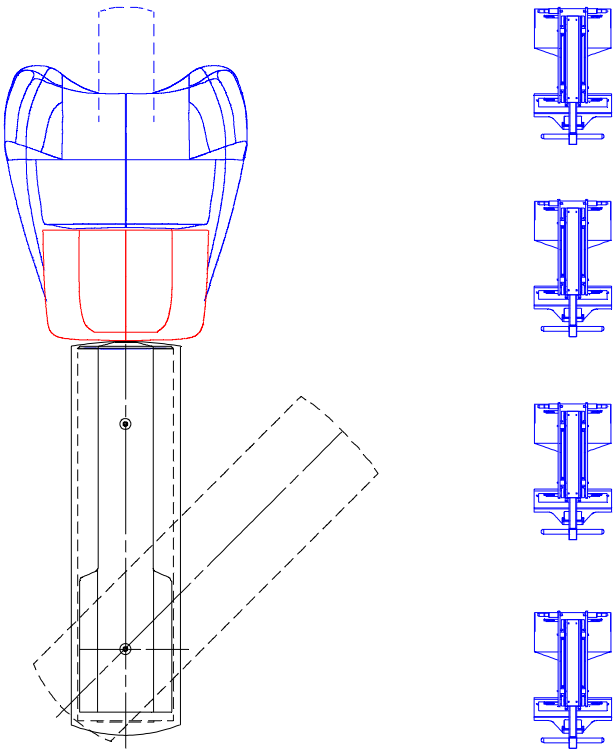

**Figure A-2.** Cut-out Templates in 1:48 Scale (Inch)

# APPENDIX B
# EXAMPLES FOR FLOOR COVERING MATERIALS

| | |
|---|---|
|   | **CAUTION**<br>Materials should be handled according to manufacturer instructions |

## B.1 Type of Materials

Below are described two types of recommended floor covering materials for Camera sites:

- Micorox X-tra Fluid Grount - a casted material, described in Section B.2
- Mipolam 410 - a covering material supplied in tiles or rolls, described in Section B.3

## B.2 Micorox X-tra Fluid Grout

Micorox X-tra Fluid Grout is a leveling and flattening material manufactured by:

Micor Company Inc.
3232 North 31st Street
Milwaukee, Wisconsin 53216, USA
Tel: 414-873-2071

## B.2.1 Micorox X-tra Fluid Grout Specifications

### Hardening and Cure

Mocorox X-tra Fluid grout will harden to 9,000 compressive strength, suitable for operation, within 6 hours at 77$^{o}$F. Complete cure may require 24 to 72 hours, depending upon temperatures.

### Temperature Limitations

Once cured, Micorox X-tra Fluid Grout is ideal for applications in freezing temperatures or as high as 160$^{o}$F. During the installation and cure of Micorox X-tra Fluid Grout, surface and air temperatures should be between 60$^{o}$F to 90$^{o}$F. Materials should be stored at 70$^{o}$F to 90$^{o}$F for at least 3 to 4 days prior to installation.

**Clean Up**

Clean tools immediately with hot soap water. For further details refer to the label.

**Specification Data**

Packing: Micorox X-tra Fluid Grout is packaged and sold in 11, 25 and 50 pound kits.

Yield:

| Kit Weight | Yield in cubic inches |
|---|---|
| 11 lbs | 175 |
| 25 lbs | 400 |
| 50 lbs | 800 |

**Working Life**

Mixed components have a working life of approximately 13 minutes at 75°F.

**Storage and Shelf Life**

Materials should be stored at 70°F to 90°F for at least 3 to 4 days prior to use. Stored at room temperature, the materials should have a shelf life of one year.

**Handling Precautions**

Prolonged contact with skin can cause irritation. Wear protective clothing and goggles to avoid eye contact. Do not recap a container of mixed components as the continuing reaction may cause an explosion.

## B.2.2 Installation Instructions

1. If you intend to flatten a designated area, mark it, and dam the area perimeter leaving adequate venting.
   If you intend to flatten the entire room, dam its entrance.

2. Calculate the required amount of the covering material, considering the area to be covered, and its surface waviness. The average cover thickness is between 2 to 3 mm.

3. Mix Micorox Grout as per the instructions given in Section B.3 (4-5 minutes).

|  | **CAUTION**<br><br>After mixing, the covering material should be pored immediately, since its working life time is approximately 13 minutes. |
|---|---|

4. Pour the mixture and let it harden.

## B.2.3 Mixing Instructions


**CAUTION**

Wear splash goggles and other protective clothing

1. Open all Part A-resin containers to be used and pre-mix each container for at least 1 minute, paying particular attention to the bottom and corners of the pail, as filler and pigments may have settled.

2. Add 1/2 of the hardener-Part B to the resin container and mix for 1 minute, while moving the mixer up and down and around the sides of the container. Add the remainder of the hardener and continue mixing for 3 additional minutes. It is important that all areas of the container are agitated during the mixing process.

**Note**

Due to the clarity of the L/O hardener it is difficult to determine by sight when you are done mixing. The result of incomplete mixing will be soft areas on the surface of the grout. Be very careful to mix this product exactly as described!

## B.3 MIPOLAM 410

Mipolam 410 is a floor covering material supplied in tiles or rolls, manufactured by:

Huls Troisdorf AG

Export MIPOLAM

Postfach 1165-D-5210

Troisdorf

Germany

Tel: 02241-853642

Subsidiaries are located at Italy, Singapore, Spain and USA.

Agents can be find in many countries all over the world. Contact the nearest subsidiary for your local agent.

Mipolam 410 can be used only on a properly leveled floors. Its purpose is to provide a smooth surface.

## B.3.1 Mipolam 410 Specifications

| | |
|---|---|
| Floor Covering: | Homogeneous one-layered, electrically conductive PVC floor covering |
| Design: | Directional design, marbled throughout |
| Total Thickness: | 2 mm |
| Weight: | 3,000 g/$m^2$ |
| Available sizes: | Tiles: 60,8 x 60,8 cm<br>Roles: 15 x 1,25 m |
| Colors: | 5 |
| Electrical Resistance Value: | about $10^7$ Ω semi-conductive |
| Electrical Insulation Value: | $10^5$ Ω |
| Sound Absorption: | about 4 dB |
| Thermal Conductivity: | 55 kJ/$m^2$ |
| Floor Heat: | 390 kJ/$m^2$ |
| Thermal Resistance: | 0.01 $m^2$ K/W |
| Chemical Resistance: | B1 |
| Fire Resistance: | Resistance to common non-organic acids, bases and salts, limited resistance to organic solvents |
| Short-time Influence of Oils and Fats: | Resistant |
| Disinfectants: | Resistant |
| Abrasion Test, Loss of Thickness: | about 0.18 mm |
| Point Load Resistance: | 0.02 mm |
| Gliding Security: | Non-slippery |
| Underfloor Heating: | Suitable |
| Total Elastic Sport Floor Construction | Suitable |

# APPENDIX C
# PRE-INSTALLATION CHECKLIST

The following checklist should be completed by both the customer and the Vendor's representative. Mark each **Yes** or **No** box, then sign the checklist.

**Equipment Arrival Date:** _____

**Planned Installation Date**: _____

**Site Information**

| | |
|---|---|
| Site Name | |
| Department | |
| Street | |
| City, State, Zip | |
| Country | |
| Telephone | |

**Site Contact Persons**

| | |
|---|---|
| System Administrator | |
| Chief Technologist | |
| Facilities Engineer | |
| Shipping/Receiving | |
| Physician | |

The questions to be answered are arranged according to four topics:

- Site preparation and required cables
- Unloading and conveyance to installation site
- Networking
- Radionuclides licenses

| Site Planning | | Yes | No | Comment |
|---|---|---|---|---|
| Room Measurements | Does the camera room meet minimum size requirements? | ☐ | ☐ | |
| | Does room height meet the minimum height requirement? | ☐ | ☐ | |
| | Does the room layout leave sufficient free space for servicing? | ☐ | ☐ | |
| Room Layout | Are final Site Layout drawings completed and approved by the customer? | ☐ | ☐ | |
| | Are final Site Layout drawings approved by the Vendor? | ☐ | ☐ | |
| Floor Preparation | Can the floor tolerate the specified loads? | ☐ | ☐ | |
| | Is construction necessary? | ☐ | ☐ | |
| | If yes, what is the scheduled completion date? | _____ | | |
| | Does floor leveling meet the requirements? | ☐ | ☐ | |
| | Does floor flatness meet the specified requirements? | ☐ | ☐ | |
| Ducts | Is installation of the necessary ducts completed? | ☐ | ☐ | |
| | Do the ducts meet the required specifications? | ☐ | ☐ | |
| Emergency Button | Is the planned location of the emergency button easily accessible by the operator? | ☐ | ☐ | |
| Power Requirements | Does the three-phase wall outlet meet the specified requirements? | ☐ | ☐ | |
| | Is the three-phase power line stabilized? | ☐ | ☐ | |
| | Is a wall outlet available for installation tools? | ☐ | ☐ | |
| Environmental Conditions | Are the specified requirements met, considering the system's thermal loads? | ☐ | ☐ | |
| | Is the magnetic field in the camera and workstation room less than 2 Gauss? | ☐ | ☐ | |

| Unloading and Conveyance to Installation Site | | Yes | No | Comments |
|---|---|---|---|---|
| Loading Dock | Does the institution have a truck-height (44") loading dock? | ☐ | ☐ | |
| | Can a full-size truck access the truck-height loading dock? | ☐ | ☐ | |
| | If not, will institution arrange for a short truck delivery? | ☐ | ☐ | |
| Unloading by fork lift: | Does institution have a fork lift with weight capacity to lift a fully crated Gantry? | ☐ | ☐ | |
| | If not, will institution arrange for an appropriate fork lift? | ☐ | ☐ | |
| Unloading by crane | Is an area for crane hoisting planned? | ☐ | ☐ | |
| | Is closing off of this area for the required period of time approved by the authorities? | ☐ | ☐ | |
| | Please provide the following information:<br>Name of rigging company: _____<br>Contact name: _____<br>Phone:_____ | | | |
| Halls, Elevators and Doors | Are <u>all</u> door openings/hallways from loading dock to the camera room large enough for passage of the Gantry and/or the patient table mounted on the moving kit/wheels? | ☐ | ☐ | |
| | Can all pathways tolerate the weight of the Gantry mounted on Moving Kit/Wheels? | ☐ | ☐ | |
| | If elevator passage is required, can the elevator tolerate the weight and size of the Gantry + Moving Kit/wheels and the length of the Table? | ☐ | ☐ | |
| | Will the Patient Table clear all $90^{o}$ corners? | ☐ | ☐ | |
| | Will the Gantry assembled on Moving Kit/Wheels clear all corners? | ☐ | ☐ | |
| | **<u>Inclines</u>**: Are there any inclines on the route to the camera room? | ☐ | ☐ | |
| | If so, what is the angle of incline | _____ | | |
| | **<u>Carpet & Tile</u>**: Will the camera be pushed across delicate carpets or tiles, requiring floor protection? | ☐ | ☐ | |

| Unloading and Conveyance to Installation Site (Continued) | | Yes | No | Comments |
|---|---|---|---|---|
| Riggers | If camera can not pass through halls, elevators or doors, a rigging company must be employ.<br><br>Will a rigging company be hired? | ☐ | ☐ | |
| | If so, please provide this information:<br>Name of rigging company: _____<br>Contact name: _____<br>Phone:_____<br><br>Attach a copy of the riggers company insurance policy. | | | |
| Temporary Storage | Will institution store the crated camera in the department? | ☐ | ☐ | |
| | If not, will institution arrange for delivery on first install day? | ☐ | ☐ | |
| Existing Equipment Moves | Does the institution want the Vendor to move existing equipment? | ☐ | ☐ | |
| | If yes, list the equipment and its required working conditions.<br><br>**Equipment** **Working Conditions**<br><br>**Note that this may result in additional charges**. | | | |
| **Networking** | | | | |
| | Are network site name, hostname and IP address defined? | ☐ | ☐ | |
| | Is network cabling and hardware installation complete or has contractor been scheduled to complete work as required? | ☐ | ☐ | |
| | Is a phone line installed for the Modem? | ☐ | ☐ | |
| | If so, the telephone number is: | _____ | | |

| License | | Yes | No | Comments |
|---|---|---|---|---|
| | Does the site have a licenser for the radionuclides used for system calibration ($^{99m}$Tc)? | ☐ | ☐ | |
| | If not, when will license be obtained? | _____ | | |
| | Will customer insure that $^{99m}$Tc is available during installation? | ☐ | ☐ | |
| | If Attenuation Correction option was ordered, has the site license for handling $^{153}$Gd? | ☐ | ☐ | |
| | If Coincidence option was ordered: Has the site license for handling $^{18}$FDG or $^{68}$Ge? | ☐ | ☐ | |
| | If Coincidence option was ordered: Has the site license for handling $^{131}$I? | ☐ | ☐ | |
| | If Coincidence option was ordered, will customer insure that $^{18}$FDG/$^{68}$Ge and $^{131}$I are available during the installation? | | | |

**Completion Sign Off**

Pre-installation completed: Date: _____

Customer: _____

Vendor's Representative: _____

# APPENDIX D
# HAWKEYE REQUIREMENTS

The requirements listed in this appendix are in addition to the requirements for the basic Millennium VG system.

## D.1 ROOM SHIELDING

Appropriate barriers such as walls, lead-shielded glass, lead-shields, etc. must be installed to protect staff from unnecessary exposure to radiation. Since Millennium VG suite will involve the use and storage of radionuclides, a qualified radiological health physicist must be consulted in the design of walls, and safety barriers, to assure appropriate attenuation.

Keep in mind that patients become significant sources of radioactivity. Consideration should be given to maximize the distance between the patient and operator during the uptake and acquisition phases of scan procedures.

## D.2 ROOM LAYOUT

The room layout for the Millennium VG with Hawkeye option differs from that recommended for the basic system in Chapter 4 in two respects:

- Location of the Acquisition Station. This change is required to protect the operator from exposure to X-ray radiation
- Distance of Gantry from the rear wall
- For system positioning in order to avoid X-ray penetration to adjacent rooms, please refer to Figure D-1, X-Ray Scatter Radiation Isocontours.
  Note that 10 µGray = 1 mRem.

**Note** The dose values in Figure D-1 were measured while scanning a phantom, and represent the dose rate from leakage and scatter from the phantom while X-rays are ON.

Figure D-2 and Figure D-3 show the Optimum Room Size and Minimum Room Size, respectively, for Millennium VG Systems with the Hawkeye option.

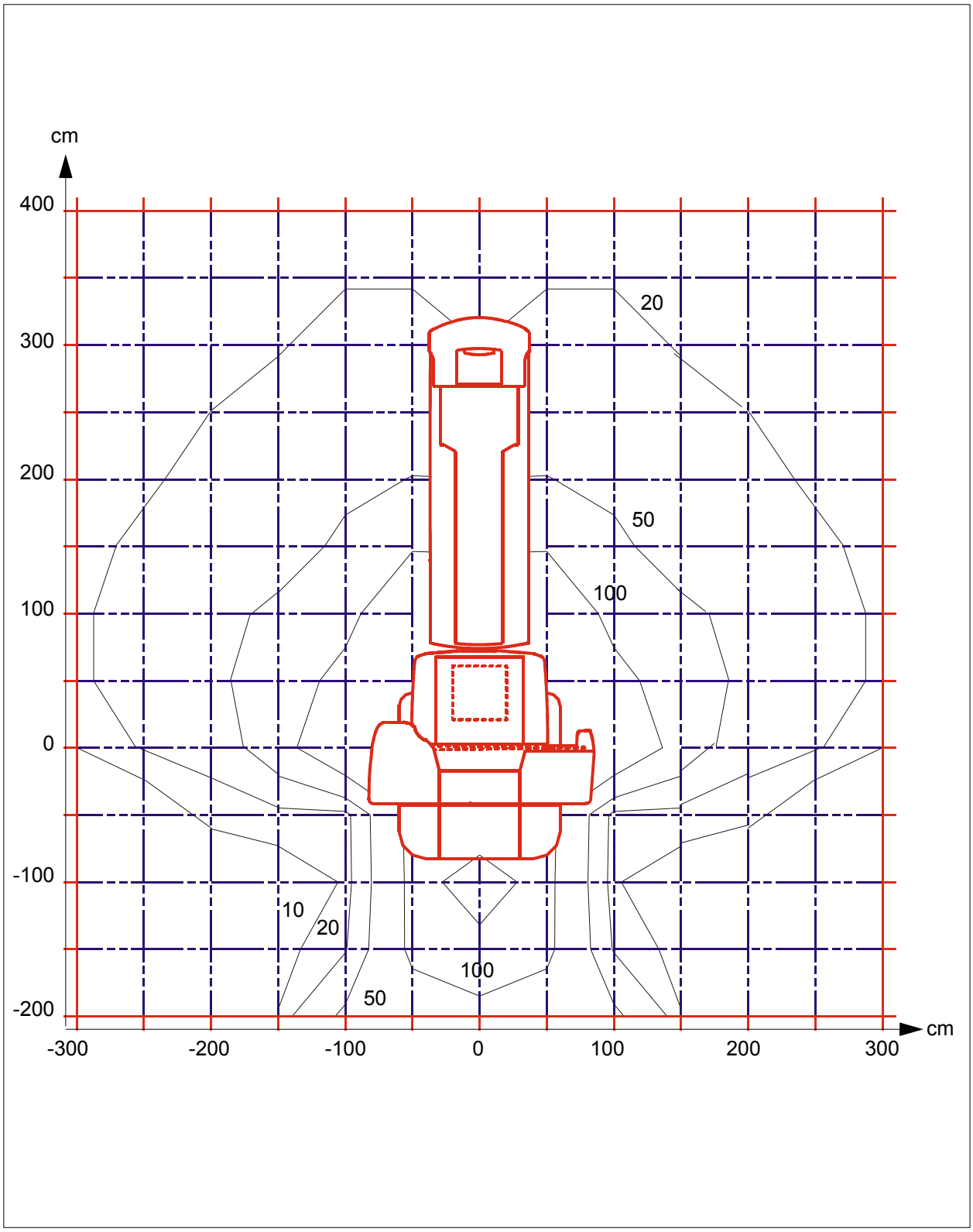


**Figure D-1.** X-Ray Scatter Radiation Isocontours in µGy/hr

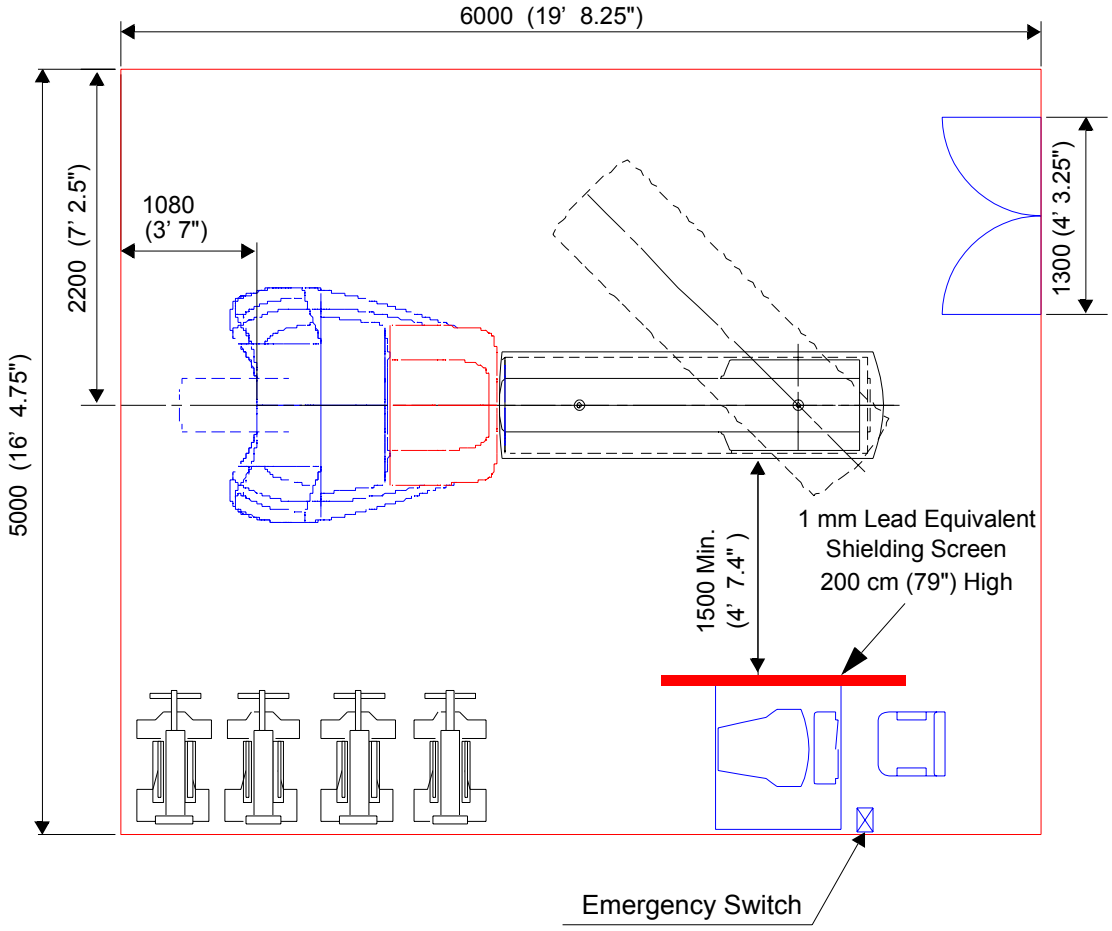


**Figure D-2.** Optimum Room Size for Millennium VG Systems with Hawkeye Option

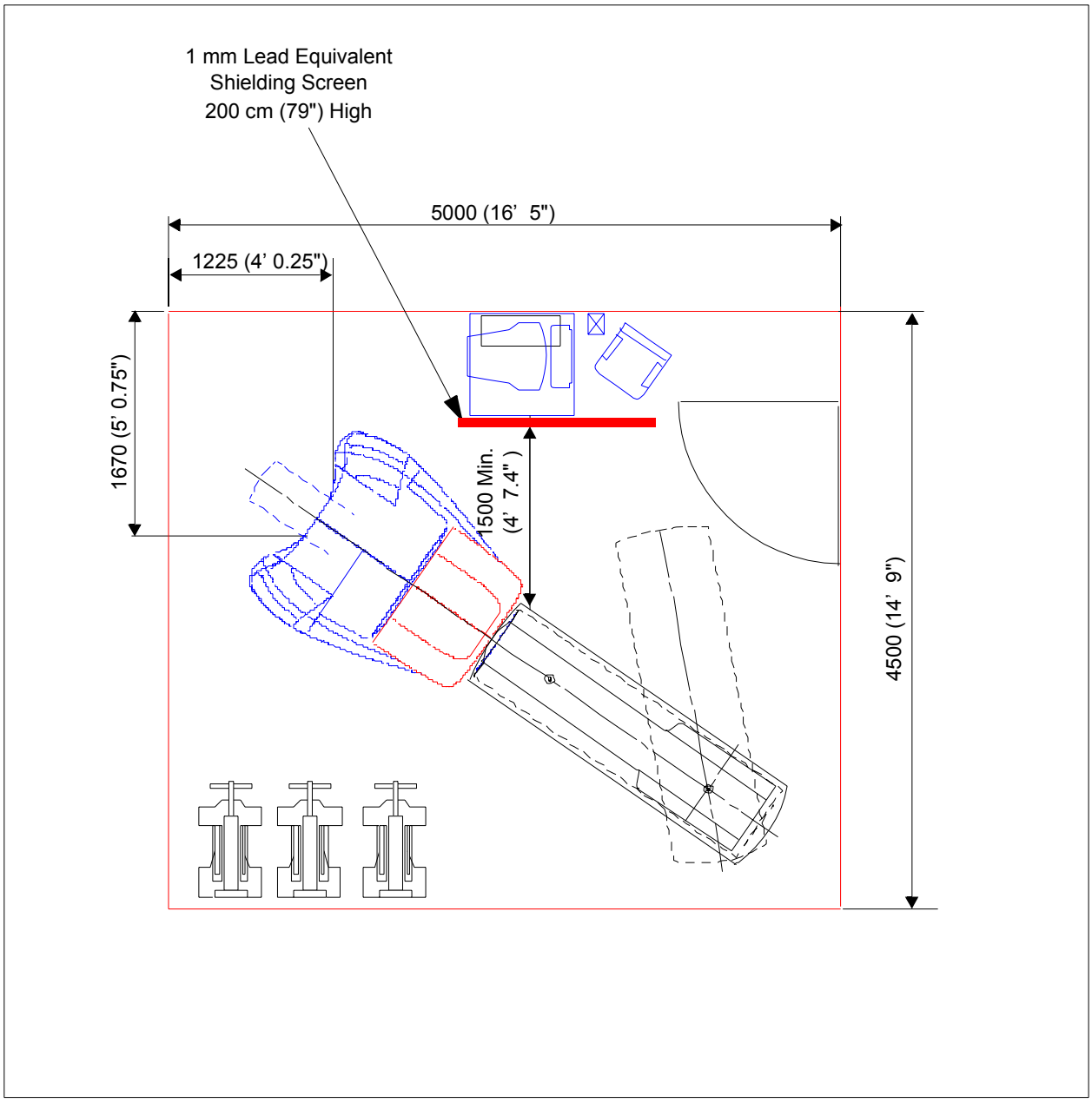


**Figure D-3.** Minimum Room Size for Millennium VG Systems with Hawkeye Option

### D.2.1 Acquisition Station Positioning

The recommendations for positioning the Acquisition Station in order to protect the operator from exposure to X-ray radiation, are given below in a top-down order of priorities:

- Positioning the Acquisition Station outside of the scan room behind a radiation shielded wall with a transparent "window".
- If this is not possible, it is recommended to position the Acquisition Station at the far end of the Table.
- If this is not possible, the minimum distance between the Acquisition Station and the Gantry specified in Chapter 4 (1500 mm; 4’ 7.4") must be increased to enable the positioning of a shielded transparent screen between the Acquisition Station and the X-Ray FOV.

### D.2.2 Gantry Position

To enable Hawkeye torso scanning of tall patients in Legs IN orientation, the Gantry should be positioned at a distance of 108 cm (3’ 7"). i.e., an addition of 20 cm (8") to the distance required in Chapter 4 for the basic system.

If this is not possible, part of torso scans will have to be done in Legs OUT orientation.

### D.2.3 Shielding Screen

If the Acquisition Station is placed in the same room as the camera, an attenuation screen must be placed between the Gantry and the Operator’s Console. Clear glass or plastic screens are available with 1 mm lead equivalent attenuation, which will reduce the dose from low energy X-ray scatter by a factor of 10, at least.

The shielding screen is ***not*** a part of Hawkeye option. Therefore, if needed, it must be provided by the customer.

## D.3 GANTRY WEIGHT

There is an addition of about 100 kg (220.5 Lb) to the weight of the basic Gantry.

# D.4 ELECTRICAL AND ENVIRONMENTAL REQUIREMENTS

## D.4.1 Power Consumption

The power consumption of the Minimums VG system with the Hawkeye option is 5.0 kVA.

## D.4.2 Thermal Loads

The thermal load of the Millennium VG Gantry with the Hawkeye option is 2100 W / 7200 BTU/H

## D.4.3 X-ray Exposure Warning Lights

The Hawkeye option provides the ability to power a series of exposure warning lights, which can be sited at the entry points to the scan room. Power is applied to the designated outlets on the rear gantry panel when the X-rays are ON. The light fittings are not part of the Hawkeye option and should be procured by the customer. The external wiring to the lights is also not part of the Hawkeye option.

### D.4.3.1 Exposure Light Specifications

- Voltage : 110 V ac
- Current : Up to 2 A
- Fuse: 2.5 A S.B.
- Connector: 3 bare wire screw clamp
- Location: the connectors are located on the X-ray Accessories Board, which is installed on the rear panel of the Electric Unit.

### D.4.3.2 Exposure Lights Cable

- The customer should provide a cable to the light fitting.
- The cable should have 3 wires.
- The nominal cross-sectional area of conductors of the power supply cords should not be less than 0.75 $mm^2$ Cu, and insulation 600 V.

## D.4.4 X-ray Exposure Interlock

To prevent accidental exposure of someone entering the scan room when X-rays are ON, provision for an interlock system is made. When activated, the interlock issues an X-ray Disable signal. The interlock switch can be installed on any barrier such as a door, which limits access to the camera room. If the switch is open, the X-rays are disabled.

The interlock switch and associated cabling are ***not*** part of the Hawkeye option.

### D.4.4.1 Interlock Signal Specifications

- Voltage : 5 V
- Current : 50 mA
- Connector: 2 bare wire connectors
- Location: the connectors are located on the X-Ray Accessories Board, which is installed on the rear panel of the Electric Unit.

### D.4.4.2 Customer's Responsibility

To ensure a successful installation of the Hawkeye option, the customer is required to:

- Schedule a service survey to verify that the system is working properly and meets the pre-requisites listed in Section 2.1.2 of the Hawkeye Option Service Manual, ***before*** scheduling the installation of the Hawkeye option.
- Ensure that the camera room can be locked during the installation procedure, and that it will not be accessed by unauthorized people.
- Provide space for storing the removed system covers.
- Provide a vacuum cleaner; applicable only for filed upgrades on old gantries

Failing to meet the above requirements will prolong the installation period.

## D.5 HAWKEYE FACTORY FITTED SITE PREPARATION CHECKLIST

The following checklist must be completed in addition to the Pre-Installation Checklist located in Appendix C.

| ACTION | MANUAL & LOCATION | TIME | COMMENTS |
|---|---|---|---|
| **Accessibility to the Site** | | | |
| Site Readiness | VG Site Preparation MAN000122 or 2287360-100 Chapter 3 | | |
| Moving Kit Availability | VG Site Preparation MAN000122 or 2287360-100 Section 3.3 | | |
| **Room Readiness** | | | |
| PDB lockout / tag-out | Nuclear Site Preparation 2123282-100 Gen. Room Requirements Chapter 6, Available on www site: http://3.7.192.186/cgi_bin/nm/docs/docslisting.cgi?pmode=listdir&dir=2123282-100 | | |
| Ground resistance | Nuclear Site Preparation 2123282-100 Gen. Room Requirements Chapter 6 | | |
| Main Power Quality Plots | 2278970-100, Section 3.4.1 | | |
| Temperature Plots | 2278970-100, Section 3.4.2 | | |
| Humidity Plots | VG Site Preparation MAN000122 or 2287360-100, Chapter 2 | | |
| Phone Line for Insite | Nuclear Site Preparation 46-291000G10 or 2123282-100 Gen. Room Requirements Chapter 6 | | |
| Network Readiness | 2278970-100, Table Below | | |
| Radioisotopes Availability | VG SM, System Calibration MAN000124, Chapter 2 | | |
| | Maps Creation MAN000125, Section 4.1.1 & Section 4.2.4 | | |
| X-Ray door interlock switch | 2278970-100, Section 3.4.4 | | |
| X-Ray On door lamp | 2278970-100, Section 3.4.3 | | |
| Shielding Screen | 2278970-100, Section 3.2.3 | | |
| Room Shielding | 2278970-100, Section 3-1 | | |
| 3m x 3m Storage Area Availability | 2278970-100, Section 3.4.4.2 | | |

## D.6 NETWORK READINESS CHART

**Please fill in this table before equipment arrival**

| *Assigned by the Hospital Net Admin if connecting to the Hospital LAN. Otherwise assigned by local GE On-Line Center* | HOSTNAME | IP | AE TITLE | DICOM PORT | WIRED (Y/N)? |
|---|---|---|---|---|---|
| Acquisition Host | | | | | |
| Processing Host | | | | | |
| Hardcopy Host | | | | | |
| LAN Net Mask | | | | | |
| Gateway to other networks | | | | | |
| Other | | | | | |
| Insite phone line | | | | | |
| Hub or Switch | | | | | |