Technical Publications

Direction 5426783-1EN, Rev.4

Optima NM/CT 640

Nuclear Medicine Imaging System

Pre-Installation Manual

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Revision History

Revision	Date	Description of Changes	Chapter/Pages
5426783_r4	January 2018	■ Added rigging information in page 1-9 ■ Added a description of the NM Gantry configuration during the transportation in Ch.1.3.4, Crated and Uncrated Weights, Measurements and Clearance ■ Added new Center Of Gravity diagram for the NM gantry in Figure 2-11 ■ Fixed previous revision history ■ Corrected the Pass/Fail values for the example in the Floor Flatness & Slope specification in Table 2-4 ■ Updated Altitude requirements in Table 4-1 ■ General – updated the system diagrams to show only one cable duct in the table pivot plate ■ Modified a typo that removed the detector-less configuration from previous revision ■ Modified a typo in the Hybrid Table weight ■ Updated the Table Center of Gravity diagram in Figure 2-12	
5426783_r3	September 2016	■ Updated table and detector weight in Table 1-1, p.1-11, Table 1-2, p.1-13, Table 2-2, p.2-20 ■ Updated COG values in Figure 2-9, p.2-22, Figure 2-12, p.2-25, Table 2-5, p.2-40 ■ Updated center of gravity values in Subsystem Centers of Gravity and Anchoring Points, p.2-40 ■ Updated the maximum allowed altitude in Table 4-1	

Revision	Date	Description of Changes	Chapter/Pages
5426783_r2	April 2015	■ Ch.1, General System Requirements: ■ Addition of IMPORTANT note to 1.3.1.2 Detector Head Precautions, p.1-6 ■ Update of corridor width for gantry and UPS specifications in Table 1-1, Components and Clearance — Metric, p.1-11 and Table 1-2, Components and Clearance — Imperial, p.1-13 ■ Update of Figure 1-3: Relative Required Width for Corridor and Scan Room Door to Convey NM Sub-systems, p.1-17 and Required Corridor Width for 90° Turns to Convey NM Sub-systems, p.1-18 ■ Ch.2, Equipment Description and General Construction Requirements: ■ Addition of acquisition station cart, ups, EMO and head holder to Figure 2-1: O640 System Components, p.2-3 ■ Update of Table 2-1, O640 Components in Scan and Other Rooms, p.2-7 ■ Update of Figure 2-6: Minimal Room Layout, p.2-11 ■ Update of Figure 2-7: Typical Layout, p.2-12 ■ Addition of upgrade and safety considerations in 2.2.4 Layout Considerations, p.2-15 ■ Update of UPS specifications in Table 2-2, Weight of Components, p.2-20 ■ Update of Figure 2-9: Floor Loading and Center of Gravity Points for Gantry, Table and Cart, p.2-22 ■ Update of Figure 2-14: Main Drills and Cable Ducts, p.2-28 ■ Update of Figure 2-16: Patient Table Pivot Floor-Plate Anchoring Holes, p.2-31	

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		■ Update of Table 2-4, Floor Leveling Specifications, p.2-33 ■ Update of 2.3.5 Vibration Specifications, p.2-37 ■ Update of 2.4 Seismic Requirements, p.2-39 and Table 2-5: Subsystem Centers of Gravity and Anchoring Points, p.2-40 ■ Ch.4, Environmental HVAC Requirements: ■ Addition of UPS to Table 4-2, O640 Heat Output in Scan Room, p.4-4 ■ Appendices: ■ Removal of Cable Wiring Diagram from Chapter 5 ■ Addition of App.B, Measuring Floor Flatness	
5426783_r1	August 2012	New manual	

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ATENCION (ES)	Este manual de servicio sólo existe en inglés. • Si el encargado de mantenimiento de un cliente necesita un idioma que no sea el inglés, el cliente deberá encargarse de la traducción del manual. • 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.
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OPOZORILO (SL)	Ta servisni priročnik je na voljo samo v angleškem jeziku. • če ponudnik storitve stranke potrebuje priročnik v drugem jeziku, mora stranka zagotoviti prevod. • Ne poskušajte servisirati opreme, če tega priročnika niste v celoti prebrali in razumeli. • če tega opozorila ne upoštevate, se lahko zaradi električnega udara, mehanskih ali drugih nevarnosti poškoduje ponudnik storitev, operater ali bolnik.
DIKKAT (TR)	Bu servis kılavuzunun sadece ingilizcesi mevcuttur. • Eğer müşteri teknisyeni bu kılavuzu ingilizce dışında bir başka lisandan talep ederse, bunu tercüme ettirmek müşteriye düşer. • Servis kılavuzunu okuyup anlamadan ekipmanlara müdahale etmeyiniz. • Bu uyarıya uyulmaması, elektrik, mekanik veya diğer tehlikelerden dolayı teknisyen, operatör veya hastanın yaralanmasına yol açabilir.

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Safety Information in the System Documentation Set

WARNING

- Before any attempt is made to use/service the system, the operator and service personnel must be trained, and must read and be acquainted with all **safety-related documents**.
- This information will prepare all users to operate the equipment safely and correctly in order to ensure the well-being of the patient, operator and service personnel.
- This document **must** be read in conjunction with the Safety and Regulatory information and the System Description provided within the operator manual set. These, in conjunction with the *Service Safety Manual*, provide you with all necessary safety-related safety information.

NOTE

- A list of the documents in the Service Documentation Set is provided in the *Service Safety Manual*.
- The images in this manual are for demonstration only. There may be minor differences that do not affect functionality.

Safety Labels in This Document

This manual addresses the following safety classifications:

DANGER

Danger is used to identify conditions or actions for which a **specific hazard** is known to exist, which **will cause severe or fatal personal injury** or substantial property damage if the instructions are ignored.

WARNING

Warnings are used to identify conditions or actions for which a **specific hazard** is known to exist, which **may cause severe or fatal personal injury** or substantial property damage if the instructions are ignored.

CAUTION

Cautions are used to identify conditions or actions for which a **potential hazard** may exist, which **may cause minor personal injury** or property damage if the instructions are ignored.

System Names, Conventions and Images

- The images in this manual are for demonstration only. There may be minor differences that do not affect functionality.
- Some of the described features may be optional, depending on system model/configuration.
- The terms **Hybrid** and **SPECT/CT** are used to designate a combination of SPECT and CT imaging modalities.

How To Print this Document

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Print Dialog	**Property***	**Two pages per sheet (A4/Letter)**	**One page per sheet (A5 or A4/Letter)** **A5** is recommended for a compact book and paper saving **A4/Letter** is recommended when large format and print are needed	
Main	Page Scaling	**Fit to Printable Area** (removes extra white margins)		

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Printer Properties (Advanced)	Orientation	**Landscape**		
	Double-sided	**Double-sided** or **Print on Both Sides**		
	Page direction / Binding	**Open to Side** or **Open to Left**	**Open to Top** or **Flip pages Up**	**Open to Side** or **Open to Left**
	Number of pages per sheet	**2**	**1**	**1**
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* Names of properties and options can differ, depending on your specific printer driver

Conventions in This Document

IMPORTANT
Calls attention to important comments.

NOTE
Contains tips and general comments.

The following conventions are used throughout the manual:

Description	Example
Keys on the operator keyboard, hand-held controller and gantry	**<SET>**, **<Ctrl>**
Software interface buttons	**[OK]**, **[Apply]**, **[Cancel]**
Names of items in the graphical interface including: ■ Names of dialog boxes, windows, tabs, areas and lists ■ Menu items ■ Field and icon labels	**Configuration** tab; **To Do List** **File** menu **Gantry** icon; **Properties** field
System messages	`Press Y to continue.`
System parameters whose actual values must be defined by the user	Type-in the *`Patient ID`*
Hyperlinks	Figure 3-1
Paths	`root/opt/tacqdb/manuals`
References to other documents	*Operator Manual*
End of a procedure	◆

Chapter 1: General System Requirements

1.1 Objectives and Overview

This manual provides all information necessary to prepare the site for the installation of the system, taking into consideration the information required for different professionals such as architects, construction engineers, electrical contractors, and all other personnel involved in construction and preparation of the site.

IMPORTANT

- Good site preparation is essential for a smooth and efficient installation and for proper functioning of the system. Poor site planning may compromise system efficiency and/or patient comfort.
- The information provided in this *Pre-Installation Manual* is general in its nature, and must always be used in conjunction with the drawings and specifications prepared specifically for your site.
- If the site is considering a future system upgrade, use the pre-installation manual of the intended system type, during site planning. Special attention should be paid to room size, floor requirements, electrical power requirements, cable paths (ducts), and environmental requirements (air conditioning for heat dissipation).
- When upgrading a system, the site's power, structure and floor loading requirements must be evaluated for upgrade suitability according to this manual.

1.2 Customer Responsibilities

It is the customer's responsibility to prepare the site in accordance with all the specifications provided in this manual, and in conjunction with the site-specific drawings. It is essential to verify all aspects of the site configuration before construction is started, as subsequent changes can be costly or impractical.

A detailed checklist is provided in App.A, Customer Checklist. It is the customer's responsibility to ensure that all requirements in the checklist are fulfilled and that the site conforms with all the specifications and requirements in this manual.

The customer is responsible for all aspects of site preparation, including, but not limited to, the following tasks:

- Assigning a project coordinator (see Project Coordination, p.1-4)
- Planning and construction or renovations required for installation of the system, in accordance with the specifications included in this manual, including:
  - Room Size, Layout and Considerations, p.2-7
  - Equipment Description and General Construction Requirements, p.2-1
  - Special Construction Requirements, p.3-1
  - Environmental HVAC Requirements, p.4-1
  - Electrical Requirements, p.5-1
  - Network Requirements, p.6-1

- Complying with all national, state, or local regulatory requirements for the country in which the installation occurs, for example:
  - Fire control devices as required by local codes
  - Permits, inspections, radiation licensing etc.
  - Earthquake-related regulations
  - Local regulations for Service Clearance & Egress
- Assuring regulatory compliance for the use of radioactive isotopes and preparation of the required isotopes (see Using Radioactive Isotopes, p.1-3)
- Safe storage of the system and auxiliary equipment prior to and during installation
- Floor tile removal and replacement in area of table and gantry
- Ensuring adequate accessibility for all system components and auxiliary equipment to the site

1.2.1 Using Radioactive Isotopes

Since the system involves the use of radioactive isotopes, compliance with Nuclear Regulatory Commission regulations, or similar regulatory requirements (depending on the country), must be adhered to and all permissions obtained well in advance. It is recommended that regulatory compliance is arranged early in the site planning process.

It is essential that all preparations are completed so that required source materials can be obtained prior to installation, including calibration sources. Take into consideration that these sources may have fairly long delivery lead times, yet may also have a short half life, so that it may not be advisable to store them over long periods of time.

1.2.2 Project Coordination

The site project coordinator is the primary contact and liaison between GE and all site-related functions, including the purchaser, the construction planners, architects and contractors, and other site administrative personnel.

To insure a successful installation, it recommended that the site nominates a single site project coordinator, preferably a person familiar with similar medical construction projects, manages the entire project. Ideally, the project coordinator is involved in every phase from pre-installation and installation, from conceptual planning through to system start up, working closely with GE to ensure that the client upholds all requirements in this *Pre-Installation Manual*.

1.3 Delivery Requirements

The system is packed for shipment with minimum tear-down of components.

⚠ CAUTION

The system components are sensitive to excessive mishandling, including dropping, shock, vibration, tipping or hoisting. Vibration damage to components may not be evident until after system installation is complete.

- The system components must **never** be dropped. A drop from a height greater than 1 cm (½") may induce structural damage to the frame or other major components.
- To avoid damage to sensitive components, dock-to-dock shipment is recommended. Other methods are acceptable, provided the system is not dropped or otherwise mishandled.

1.3.1 General Transportation and Delivery Precautions

1.3.1.1 General Temperature Precautions

Extreme temperatures must be avoided during system transportation and delivery. Ensure that the system is not exposed, for an extended period of time, to temperatures or humidity outside the following specifications.

- Temperature range -15ºC: - to +60ºC (+5ºF/+140ºF)
- Humidity range (non-condensing): 10% to 85% at up to 45ºC (113ºF)

NOTE

Component freezing occurs if the system is exposed to temperatures below -18ºC (0ºF) for a period of longer than two days. Allow a minimum of 12 hours for the system to adjust to ambient room temperature, prior to installation.

1.3.1.2 Detector Head Precautions

⚠ CAUTION

- Detector heads are very fragile and must always be handled with extra care.
- Detector heads are extremely sensitive to temperature gradients (sudden changes in temperature).

Failing to comply with the following instructions could cause irreversible damage to the detector heads.

IMPORTANT

The conveyance path from the unloading area to the temperature-controlled area must be wide enough to allow passage of the detector heads packed in the original containers.

The detector heads must be transported in their original packages, which are designed to provide good mechanical stabilization as well as a certain amount of thermal insulation.

- As soon as the detector heads are unloaded from the transportation vehicles, they must be moved to a temperature-controlled area while still in their original containers, until they are ready to be installed into the system.
- If the temperature in the storage or installation areas differs from that of the delivery route and/or ambient temperature, a stabilization period of 1 hour per 3°C (5.4°F) difference must be allowed.

1.3.2 Delivery Unloading Area and Equipment

- The minimal unload area adjacent to the delivery truck is 15m×15m (50'×50'). Make sure that the unloading and storage areas are large enough to maneuver a forklift with crates.
- It is recommended that the delivery site is selected to provide the shortest and smoothest route for component conveyance:
  - If delivered on the installation day, as close as possible to the scan room for installation
  - If delivered prior to the installation day, as close as possible to the storage area
- If a forklift is required in order to unload or move system components:
    - Allocate a forklift that is capable of lifting more than the maximum weight of the heaviest unit; seeTable 1-1, Components and Clearance — Metric, p.1-11 or Table 1-2, Components and Clearance — Imperial, p.1-13.
  - Take into account sufficient floor space to maneuver the forklift near the delivery truck.

1.3.3 Conveyance of Crated System Components Within the Site

Regardless of whether the system is being delivered from the unloading area to storage, from the unloading area to unpacking area for installation or from storage to the installation area, take care to adhere to the following guidelines:

- Ensure that there is a free path, including an elevator if necessary, to wheel the components to the installation area.
- Verify that the route selected has sufficient clearance and load carrying capacity (see Table 1-1, Components and Clearance — Metric, p.1-11 or Table 1-2, Components and Clearance — Imperial, p.1-13).
- The subsystems may be lifted only with a forklift and only when attached to their original shipping pallets.

⚠ CAUTION

Lifting of the gantry without its original shipping pallet or using a crane may damage the system and is prohibited.

- If the outer crating is removed after delivery, do not detach the subsystems from their original shipping pallets before they are conveyed to the scan room for installation.
- The center of gravity of each item, including lifting height and position, is marked on the subsystem crate. When conveying the subsystems within the site, and particularly if there are slopes in the delivery path, make sure to take the center of gravity into account.

- Always lower system components at the slowest reasonable rate.
- If the system components are to be transferred from an unloading site outside the building, special facilities must be provided to ensure smooth conveyance.
- Uneven temporary ramps may cause vibrations that could damage some components.
- System components may be moved via flat-bed tow truck or by rolling them across **smooth** sidewalks or other paved surfaces.
- When moving the gantry off a flat-bed tow truck, attach the straps to the lowest point possible on the dolly.

Rigging

The gantry assemblies shall not be lifted by their dollies. The gantry assemblies shall not be transported across any surface by any means other than the dollies provided by GE. The gantry assemblies have no lifting points on them and are not designed to be lifted by any special rigging attached to the gantry assemblies themselves.

DANGER

POSSIBLE SEVERE PERSONAL INJURY OR DEATH.

THE DOLLIES ARE NOT DESIGNED TO BE USED AS AN ATTACHMENT POINT FOR ANY METHOD OF LIFTING THE SUBSYSTEMS.

ATTACHING LIFTING STRAPS, CABLES OR MECHANISMS TO THE DOLLY HANDLES OR ANY OTHER PART OF THE DOLLY IS STRICTLY PROHIBITED.

NOTE

If it is determined that the subsystems must be lifted by crane or other lifting method the PM or person responsible for local siting of the system shall NOT proceed with the installation without consulting directly with GE Engineering.

Lifting the subsystems by crane or other lifting method should always be avoided. All alternate methods of delivery should be evaluated including the removal of any obstructions, doorways, walls, and windows.

If lifting is still required:

1. The entire gantry assembly and both gantry transport side dollies must be placed on a lifting platform. GE does not provide a lifting platform.
2. The entire patient table must be lifted while sitting on a lifting platform. The patient table shall be lowered to its transport position so the table base is in contact with the platform.
3. The platform must be designed so no lifting straps or cables come in contact with any part of the gantry or table subsystems or its side dollies.
4. The lifting platform shall bear the entire load. No part of the subsystem shall bear any load during the lift.

1.3.4 Crated and Uncrated Weights, Measurements and Clearance

The following tables provide you with crate and component measurements, weights and other data, in order to assist you in planning conveyance routes and storage areas. The order of the components in the list constitutes the recommended order of conveyance and delivery to the scan room for installation. The information is provided in metric and imperial formats, as follows:

- Table 1-1, Components and Clearance — Metric, p.1-11
- Table 1-2, Components and Clearance — Imperial, p.1-13

Table 1-1: Components and Clearance — Metric

Component name	Crated		Uncrated					
	Crate size (Dollies not attached) (cm) (Height × Width × Depth/Length)	**Weight** (kg)	**Minimal dimensions** (cm)*					**Weight** (kg)
			Door width	Corridor / elevator width	Corridor / elevator length	Width of corridors with 90° turns†	Height	
Pre-installation kit‡	75×40×175	15	any	any	any	any	any	15
NM gantry with detectors and dollies; **without collimators**	220×120×225	2413	140	140	222	250	200	2238
Table	140×90×300	785	100	100	283	250	any	557
Acquisition station	80×60×60	30	any	any	any	any	any	20
Peripherals and accessories	115×100×150	50	any	any	any	any	any	50
Collimators on cart/s	170×90×115	370 (for heaviest set)	55	55	100	112	150	330 (heaviest set)
CT gantry including dollies	220×120×225	1050	110	110	270	205	200	1100
Connecting Kit	169×136×193	500	any	any	any	any	any	350
Optional Items								
NM UPS	May vary but not more than 60×40×80	May vary but not more than 150	any	any	any	any	any	May vary but not more than 130

Table 1-1: Components and Clearance — Metric (Continued)

Component name	Crated		Uncrated					
	Crate size (Dollies not attached) (cm) (Height × Width × Depth/Length)	Weight (kg)	Minimal dimensions (cm)*					Weight (kg)
			Door width	Corridor / elevator width	Corridor / elevator length	Width of corridors with 90° turns†	Height	
ECG Trigger Monitor Xeleris Monitors	May vary but not more than 80×80×80	May vary but not more than 15	any	any	any	any	any	<13
NM600 Detectors Dismount Option								
NM gantry without detectors; with dollies	220×150×168	2175	94.5	94.5	222	188	195**	1690††
Detector 1	93×86×100	320	86	86	100	100	98‡‡	320***
Detector 2	93×86×100	320	86	86	100	100	98‡‡	320***

* The minimum door width required in order to bring the system components into the scan room also depends on the width of the corridor leading to the room. When planning or measuring the width of the scan room door, use the graphs provided in Figure 1-3: Relative Required Width for Corridor and Scan Room Door to Convey NM Sub-systems, p.1-17 in order to verify that the measurements comply with the requirements.

† The corridor width required in order to move the system components from the unloading area to the scan room depends on the angles of turns on the corridor. See Figure 1-4: Required Corridor Width for 90° Turns to Convey NM Sub-systems, p.1-18 for the required width when the angle is 90°.

‡ May be delivered a few days prior to system delivery, as part of the final room check and preparation for installation.

** 20 mm clearance above the floor

†† Weight of gantry without detectors in the in-site transportation configuration: 1380 kg + weight of the dolly: 310 kg

‡‡ 50 mm clearance above the floor

*** The specified weight includes the packing. The detectors must be conveyed crated (unpacking is allowed only at the room or designated area where the detectors to be installed)

Table 1-2: Components and Clearance — Imperial

Component name	Crated		Uncrated					
	Crate size (") (Height × Width × Depth/Length)	Weight (lb)	Minimal dimensions (")*					Weight (lb)
			Door width	Corridor / elevator width	Corridor / elevator length	Width of corridors with 90° turns†	Height	
Pre-installation kit‡	29.5×5.7×68.9	33	any	any	any	any	any	33
NM gantry with dollies; **without collimators**	86.6×59×66.1	5320	55.1	55.1	88.6	98.4	78.75	4934
Table	55×35.4×118.1	1731	39.4	39.4	111.4	98.4	any	1228
Acquisition station	31.5×23.62×23.62	66	any	any	any	any	any	44
Peripherals and accessories	45.3×39.4×59	110	any	any	any	any	any	110
Collimators on cart/s	67×35.4×45.3	816 (heaviest coll. set)	22	22	39.4	45.3	59	727.5 (heaviest coll. set)
CT gantry, including dollies	87×47×89	2315	43.3	43.3	106.3	80.7	78.75	2425
Connecting Kit	66 ×53×76	1102	any	any	any	any	any	771
Optional Items								
NM UPS	May vary but not more than 23.6x15.7x31.5	May vary but not more than 330.7	any	any	any	any	any	May vary but not more than 286.6
ECG Trigger Monitor	May vary but not more than 31.5x31.5x31.5	May vary but not more than 33	any	any	any	any	any	<28.6
Xeleris								
Monitor								

Table 1-2: Components and Clearance — Imperial(Continued)

Component name	Crated		Uncrated					
	Crate size (") (Height × Width × Depth/Length)	Weight (lb)	Minimal dimensions (")*					Weight (lb)
			Door width	Corridor / elevator width	Corridor / elevator length	Width of corridors with 90° turns†	Height	
NM600 Detectors Dismount Option								
NM gantry without detectors and with dollies	86.6×59×66.1	4795	37.2	37.2	87.4	74	76.7**	3726††
Detector 1	36.6×33.8×39.4	705	33.8	33.8	39.3	39.3	38.5‡‡	705***
Detector 2	36.6×33.8×39.4	705	33.8	33.8	39.3	39.3	38.5‡‡	705***

* The minimum door width required in order to bring the system components into the scan room also depends on the width of the corridor leading to the room. When planning or measuring the width of the scan room door, use the graphs provided in Figure 1-3: Relative Required Width for Corridor and Scan Room Door to Convey NM Sub-systems, p.1-17 in order to verify that the measurements comply with the requirements.

† The corridor width required in order to move the system components from the unloading area to the scan room depends on the angles of turns on the corridor. See Figure 1-4: Required Corridor Width for 90° Turns to Convey NM Sub-systems, p.1-18 for the required width when the angle is 90°.

‡ May be delivered a few days prior to system delivery, as part of the final room check and preparation for installation.

** 20 mm clearance above the floor

†† Weight of gantry in the in-site transportation configuration: 1380 kg + weight of the dolly: 310 kg

‡‡ 50 mm clearance above the floor

*** The specified weight includes the packing. The detectors must be conveyed crated (unpacking is allowed only at the room or designated area where the detectors to be installed)

With detectors

Without detectors

Figure 1-1:NM Gantry on Dolly Measurements (mm)

Figure 1-2:O640 CT Gantry on Dolly Measurements

Metric

Imperial

Figure 1-3:Relative Required Width for Corridor and Scan Room Door to Convey NM Sub-systems

Metric

Imperial

Figure 1-4:Required Corridor Width for 90° Turns to Convey NM Sub-systems

1.4 Product Storage and Handling Requirements

All components must be stored in their original crating.

1.4.1 Storage Requirements

If the system is to be stored before installation, store in a temperature and humidity controlled environment, and protect from weather, dirt and dust. Storage longer than 12 months is not recommended. Meeting these requirements prevents rust and corrosion from forming on bearing surfaces due to condensation.

⚠ CAUTION

Component freezing occurs if the system is exposed to temperatures below -18°C (0°F) for a period of longer than two days.
Gradually adjust the system to ambient room temperature prior to installation, with a change of no more than 3°C (5.4°F) per hour.

Table 1-3: Storage Conditions

Conditions	Short term storage (1-12 months)	
Storage temperature	+4°C to +27°C	+40°F to +80°F
Maximum temperature rate of change	3°C/hr.	5°F/hr.
Relative humidity (non-condensing)	Between 20% and 60%	
Maximum relative humidity rate of change	5%/hr	
Air pressure	Between 700 hPa and 1060 hPa	

Chapter 2: Equipment Description and General Construction Requirements

This chapter provides the following:

- Equipment and System Components, p.2-2

  Describes the system and its components.

- Room Size, Layout and Considerations, p.2-7

  Provides guidelines for determining the size and layout of the scan room and of the above components, including example layouts of typical rooms, illustrating the position and dimensions of the components.

- Room Structural Requirements, p.2-18

  Provides floor, ceiling and wall requirements, and acoustic and vibration specifications for the scan room.

- Seismic Requirements, p.2-39

  Provides center of gravity information for the different system components.

2.1 Equipment and System Components

The Optima NM/CT 640 is an NM and CT hybrid system, comprised of an NM camera and a CT scanner. The following figures illustrate the different system components:

- Figure 2-1: O640 System Components, p.2-3
- Figure 2-2: Gantry, p.2-4
- Figure 2-3: Table Views, p.2-5
- Figure 2-4: Collimator Cart, p.2-6

Collimator carts (see Figure 2-4, p.2-6)

Acquisition station cart (optional)

NM UPS (optional)

Head holder extender (optional)

Acquisition and processing workstations

NM acquisition computer

Xeleris workstation (optional)

Note:
The Xeleris workstation can be located in a remote location such as a reading room.

Emergency Stop and Emergency OFF buttons

Figure 2-1:O640 System Components

Note:
Dimensions are in cm (")

Figure 2-2: Gantry

Figure 2-3:Table Views

Side view **Front view**

Top view

Note:
Dimensions are in cm (")

Figure 2-4:Collimator Cart

2.2 Room Size, Layout and Considerations

The system requires a Scan Room, which contains the following sub-systems:

Table 2-1: O640 Components in Scan and Other Rooms

Scan Room (see Figure 2-1, p.2-3)		**Variable Location**
NM gantry	Collimator carts	Storage cabinet (not supplied with the system)
Patient table	UPS (optional)	Xeleris workstation (optional)
CT gantry	MDP (not supplied with the system)	EMO
Acquisition station		E-stop
		Acquisition cart (optional)

This section provides guidelines for determining the size and layout of the scan room and of the above components, and example layouts of typical rooms, illustrating the position and dimensions of the components.

The room layouts provided take into consideration all aspects of operation, operator and patient requirements and service clearance requirements.

Egress

The room layouts, diagrams and dimensions in this manual provide the required clearances for proper equipment operation and service only. The customer/purchaser is responsible for compliance with federal, state and/or local codes regarding facility egress and related facility requirements (see App.D, Regulatory Clearances).

2.2.1 Room Dimension Requirements

NOTE

The minimal and standard system layouts described in this manual may not comply with specific local/regional/country/state requirements (such as OSHA in the USA).

Take into consideration the local regulations in force when planning room dimensions and layout (see App.D, Regulatory Clearances).

Minimal room size (L × W × H)

5.76 m×3.63 m×2.3 m (18' 11"×11' 11"×7' 7")
(see Figure 2-6: Minimal Room Layout, p.2-11)

2.2.2 System Layout Drawings

This section provides typical sample layouts, illustrating the position and dimensions of the scan room and of the system components, including:

- Figure 2-6: Minimal Room Layout, p.2-11
- Figure 2-7: Typical Layout, p.2-12

The room layout dimensions take into consideration all aspects of operation, operator and patient requirements and service clearance requirements (see Layout Considerations, p.2-15).

Sufficient regulatory and service clearances must be maintained around the equipment for full operation, service, and safety.

In addition, a system footprint is provided below, to facilitate site planning. This illustration does not contain information regarding service clearance areas around the system.

Note:
- Dimensions are in mm.
- This drawing represents the **optional** short scan length, 1200 mm. (Standard scan length is 1600 mm).
- This drawing does not show service clearances or CT service position.

Figure 2-5:System Footprint

- NM/CT scan length 120 cm (table not fully extended).
- Defines the minimum area required to enable installation, operation and service of the system in safe conditions.
- Does not take into account local requirements.
- Operator movement around the system is limited.
- There is space for only one collimator cart.
- Cannot use table extender
- Radiation shielding regulations differ from one country or state to another. It is the customer's responsibility to ensure that radiation protection and shielding comply with such regulations and requirements during site preparation, system installation, operation and service.

Note: You must allocate at least one of the two areas marked "Service Clearance for CT Heavy Components replacement".

Note: Dimensions are in mm (feet, inches)

Figure 2-6:Minimal Room Layout

- Table can be fully extended
- Leg extender is supported with scan range of 120 cm
- Rooms with larger length (by at least 30 cm): it is recommended to increase the "rear cover to the back wall" distance by 30 cm (12") to allow fully extended table with leg extender.
- Can keep two collimator carts in the room
- Workstations can be installed in the room
- Does not take into account local requirements
- Radiation shielding regulations differ from one country or state to another.
  It is the customer's responsibility to ensure that radiation protection and shielding comply with such regulations and requirements during site preparation, system installation, operation and service.

Note: You must allocate at least one of the two areas marked "Service Clearance for CT Heavy Components replacement".

Note:
Dimensions are in mm (feet, inches)

Figure 2-7:Typical Layout

2.2.3 System Mechanical Curves

Figure 2-8: Component Movement Curves, p.2-14 illustrates the table and gantry movement. In addition, the collimator carts can be moved to different locations in the scan room, as demonstrated in the layout illustrations in Figure 2-6: Minimal Room Layout, p.2-11.

NOTE
In order to prevent collision with the gantry display boom, do not mount any equipment from the ceiling.

Table slanted at	Farthest point relative to system's center line
67.5°	190.5 cm (75")
55°	181.5 cm (71.5")
42.5°	157.5 cm (62")

Note:
Dimensions are in feet, inches (mm)

Figure 2-8:Component Movement Curves

2.2.4 Layout Considerations

This section describes the considerations you must take into account when selecting a site and planning the room size and layout. In addition, it is the responsibility of the customer to ensure that all aspects of the scan and operator rooms conform with the local requirements.

Room Dimensions and System Placement

The room size and shape and the placement of the system components must enable optimal functional and working conditions, including the best possible relative positioning of the gantry, patient table and acquisition console in operator room, including:

- **Operator access in scan room**, around the gantry and patient table in order to:
  - Assist patient positioning
  - Perform examination routines
  - Act efficiently and quickly in case of an emergency, including easy access to emergency switch
- **Upgrade considerations:**
  - If a system upgrade is planned or possible, the requirements for the larger system should be assessed to avoid unnecessary future rework:
    - Room dimensions
    - Power requirements
    - HVAC requirements
    - Floor loading requirements
- **Seismic considerations**:
  The room dimension requirements are different for seismic systems. For example, the table must have the clearance necessary to swing both ways in order to access all anchoring.

- **Safety zone considerations**:

  The safety zone is designated by tape on the floor, usually yellow (can also be differentiated by a change in floor coloring). This designates the area that must be free of obstructions to avoid a collision during an automatic motion.

- **Operation-related considerations**:
  - Enable access for hospital beds, including maneuvering and positioning the bed and moving the front of the patient table during collimator exchange.
  - Storage of collimator cart/s when not in use
  - ECG Trigger Monitor– cable position and lengths and storage when not in use
  - Space for storage and usage of ECG Trigger Monitor
  - Installation and service considerations:
  - Location of power connections
  - Access to communication lines (Ethernet, external hardcopy device)
  - Floor loading capacity and weight of system components, including storage and path of collimator carts
  - Service clearance areas (see App.D, Regulatory Clearances)
  - Storage cabinet for storage of service tools (optional). Depending on the room layout, it is recommended that sufficient area is allocated for the cabinet.

- **Operator room** (if applicable)
  - Operator field of view, enabling direct view of patient in bore, or taking into consideration viewing via remote closed-circuit camera in the scan room and screen in the operator room
  - Radiation shielding, electromagnetic shielding, etc.
  - Space, power and network connections for additional equipment such as PACS workstation, archiving devices, etc.
- **Proximity of scan room to other utilities**
  - Avoid detrimental influences from surrounding rooms and activities, such as:
    - Radioactive or magnetic sources
    - A local wireless environment
    - Vibrations
    - Transformers from elevators, compressors, or other high power devices.
  - Plan the optimal proximity of the scan room to related utilities. In addition to patient comfort, take into consideration that background radiation activity from such utilities could negatively affect image quality and system calibration. These utilities include:
    - Waiting/injection areas, toilets
    - Viewing and processing rooms
    - Radionuclide storage and preparation area
    - Office facilities
    - Smoke detectors that use/have radioactive activity

2.3 Room Structural Requirements

Room requirements consist of the following:

- Floor Requirements, p.2-19, including floor strength, anchoring, levelness and flatness, vibration and conductivity
- Floor Loading Requirements, p.2-20
- Ceiling Requirements, p.2-35
- Wall Requirements, p.2-35
- Acoustic Specifications, p.2-36
- Vibration Specifications, p.2-37

2.3.1 Floor Requirements

IMPORTANT

It is the customer's responsibility to have appropriate tests performed and to obtain a construction engineer's assessment of the floor's suitability to meet the requirements of this section.

2.3.1.1 Floor Strength

In order to enable system mounting using the supplied floor anchors, concrete floors must have a minimum cube strength of f'c = 4350 psi (30 MPa) at 28 days (curing time) for 25/30 concrete.

NOTE

- Concrete strength is determined by the "Cylinder Test" (used in the USA) or "Cube Test" (used in Europe), where a cylinder or cube of concrete is cast, cured for the appropriate time and then compressed between two parallel faces until failure. The stress at the failure is taken to be the compressive strength of the concrete. The 25/30 concrete required for the system installation is concrete with a strength of 25 in the cylinder test (resulting 3625 psi), or strength of 30 in the cube test (resulting 4350 psi).
- If the system is expected to be upgraded in the future, the floor strength requirements for the larger model should be used.

It is the customer's responsibility to have appropriate tests performed to determine and measure concrete strength, and to obtain a construction engineer's assessment of the floor load capability.

2.3.1.2 Floor Loading Requirements

Table 2-2: Weight of Components

Component	Weight (kg)	Weight (lb)	Load Distribution	Comments
NM gantry (with HEGP collimators mounted on system)	2190	4828	4 pads, Ø83 mm each: +845 kg each on front pads +250 kg each on rear pads	
Patient table (without patient)	557	1228	2 wheels + axis anchored to floor	Weight of table without patient
CT gantry	900	1984	4 pads, Ø70 mm each: +220 kg each on front pads +180 kg each on rear pads	
Collimator cart (with 2 HEGPs on cart)	330	728	4 wheels	COG point at 99 cm height
Acquisition station	(insignificant)			
Personnel and patient	< 500	< 1102	Variable	Normally 3-4 people in room during scan/service operations
LEHR collimator	62	137		2 per system/cart
LEGP collimator	55	121		2 per system/cart
ELEGP collimator	62	137		2 per system/cart
MEGP collimator	103	227		2 per system/cart
HEGP collimator	131	288		2 per system/cart
NM UPS (optional)	May vary but no more than 130	May vary but no more than 287	4 feet	Refer to App.E, D670 NM Partial UPS

Table 2-2: Weight of Components (Continued)

Component	Weight (kg)	Weight (lb)	Load Distribution	Comments
CT UPS (optional)	(57 / 115)	(125 / 253)	Anchored to floor	
Xeleris workstation	(insignificant)			

⚠ CAUTION

If the system is installed on a floor type thinner than a 140 mm (5.5") concrete floor, the customer shall, at their expense, provide acceptable anchoring and mounting methods that meet all structural specifications provided in sections 2.3.1.2 and 2.3.1.3 of this manual.

The customer shall ensure that the floor strength in the collimator cart storage area and along the movement routes for collimator exchange are suitable for the collimator cart load (approx. 250 kg each).

Figure 2-9:Floor Loading and Center of Gravity Points for Gantry, Table and Cart

Figure 2-10:O640 CT and NM Gantries Floor Loading

Figure 2-11:NM Gantry with HEGP Collimators Center of Gravity Points

Figure 2-12:Table Center of Gravity Points

Case #1 (Tx1, Ty1):

- Table loaded with 350 lb.
- Cradle retracted, Maximum UP

Case #2 (Tx2, Ty2):

- Table loaded with 350 lb.
- Cradle fully expanded (inside gantry), Maximum UP

Case #3 (Tx3, Ty3):

- Table unloaded (no patient)
- Cradle retracted and at Maximum UP

2.3.1.3 Floor Anchoring

The system's floor anchors are designed for use **only** on concrete floors that meet the minimal 140 mm (5.5") concrete floor requirements.

⚠ CAUTION

For concrete floors thinner than 140 mm or different floor types other anchoring methods might be required. These must comply with the minimum load requirements (see Floor Loading Requirements, p.2-20) and must be installed and tested at the customer's expense, by the customer's structural contractor. The selected anchoring method must have a pulling tensile force of 19.7 kN on each of the anchors bolting the NM gantry to the floor.

In such a case, the alternative anchors shall be installed during system installation, and this must be coordinated with the installation team. For anchor point information, see Figure 2-13: Floor Anchor Points, p.2-27.

Figure 2-13:Floor Anchor Points

Note:
Dimensions are in mm

Figure 2-14:Main Drills and Cable Ducts

Figure 2-15:Anchoring Methods

Table 2-3: O640 Drilling and Anchor Chart

No.	X	Y	Drill Hole	Hole Depth	Anchored Part	Hole Purpose	Drilling Method	Anchor Type	Torque Nm.	Section
1	0.00	405.00	Ø15.0 mm	100 mm	NM gantry	Main anchor	Metal drilling template	HILTI HSL-3 M10/40	50	Figure 2-15
2	0.00	-405.00								
3	-810.00	405.00								
4	-810.00	-405.00								
5	-80.00	365.00				Alternative anchor				
6	-80.00	-365.00								
7	-810.00	530.00								
8	-810.00	-530.00								
9	-884.00	740.00		110 mm	CT transporter plates	Main anchor	Drilling through the plates using NM/CT positioning jig			
10	-884.00	-738.00								
11	-1364.00	740.00								
12	-1364.00	-738.00								
13	-884.00	890.00				Alternative anchor				
14	-884.00	-908.00								
15	-1364.00	890.00								
16	-1364.00	-908.00								

Figure 2-16: Patient Table Pivot Floor-Plate Anchoring Holes

2.3.1.4 Floor Levelness and Flatness

The scan room floor must be leveled, and its surface must be smooth.

It is recommended that the floor in the entire scan room is leveled and flattened. If this is not possible, it is a minimum requirement for the gantry/table installation area to be level and flat.

The floor levelness requirement is essential for proper alignment of the table and the gantry, which affects accurate patient positioning, collimator exchange and other aspects of system functionality. Table level may not be achievable if overall floor levelness does not conform to these specifications. For more details, see App.B, Measuring Floor Flatness.

⚠ CAUTION

- The use of floor shims is not suitable to achieve floor levelness.
- Do not use fill material to compensate for holes or depressions in the floor surface.
  If necessary, level and flatten the entire floor area.

Table 2-4: Floor Leveling Specifications

Item	Requirement
Floor leveling area	576 cm×363 cm (18.9'×11.9') (covering the entire planned area of table and gantry installation, depending on room layout)
Slope	3 mm (0.125") over 3048 mm (120")
Floor surface	A single poured surface
Flatness	The surface must be smooth and without significant valleys or peaks. The entire surface area must have an overall flatness of 5 mm over 1500 mm in any direction (see App.B, Measuring Floor Flatness for measurement procedure).

2.3.1.5 Floor Vibration

Floor vibration requirements are included in the general vibration requirements (see Vibration Specifications, p.2-37).

2.3.1.6 Floor Conductivity Recommendations

The purpose of this section is to measure the electrical conductivity of the floor surface to the "GND" (Ground).

- The surface of the conductive floor shall provide a patch of electrical conductivity between all persons and equipment making contact with the floor.
- Using a DVM, measure the impedance between the upper surface of the floor – where the NM gantry is planned to be positioned, and the system power supply GND terminal in the room. The readout should be <35 M Ohm.
- Repeat the measurement in the area where the patient table will be positioned. The readout should be < 35 M Ohm.
- Repeat the measurement in the area where CT gantry will be positioned. The readout should be < 35 M Ohm.

2.3.1.7 Additional Floor Requirements

The floor finish must take into consideration magnetic field and EMI considerations (see Special Construction Requirements, p.3-1 and EMI Considerations, p.3-9).

2.3.2 Ceiling Requirements

Scan room height must be at least 2.3 meters (7' 6.5").

2.3.3 Wall Requirements

Operator room window

If there is an operator room, the operator must be able to view the patient from the operator room during a scan. The location of the window depends on the position of operator room relative to the scan room. It is recommended that the window is positioned in front of the console so that the operator can look down the length of the bore.

The recommended patient viewing window dimensions are approximately 120 cm wide by 110 cm high (48"×42").

Consult a qualified radiological health physicist for radiation protection requirements for the window glass (lead content and thickness), in accordance with Radiation Protection and Shielding Requirements, p.3-1 and with local requirements.

Radiation protection

For details on wall, door and window radiation protection, see Radiation Protection and Shielding Requirements, p.3-1.

Other

Verify that all walls conform with local regulations, such as washability.

2.3.4 Acoustic Specifications

The system creates acoustic noise. In compliance with IEC 601-1-1 standard the measured noise (at 1m distance away from the system) is less than 70 db. It is recommended that the wall and ceiling surface is of a sound dampening material to avoid noise reverberation and amplification.

Take into account that the system includes an intercom communication system connecting the Operator room and the Scan room, to enable the operator to give the patient instructions during the examination.

2.3.5 Vibration Specifications

The system components are sensitive to vibration in the frequency range of 0.5 to 20 Hz, depending on the amplitude of the vibration. It is the customer's responsibility to contract a vibration consultant or qualified engineer to verify that these specifications are met and implement an appropriate solution.

To minimize vibrations, the system must be installed on a solid floor, as far as possible from the following vibration sources:

Outside building	Inside building	Other
■ Parking lots	■ Hallways	■ Hospital power plants containing pumps, motors, air handling equipment and air conditioning units
■ Roadways	■ Elevators	
■ Subways		
■ Heliports		
■ Trains		

Note: D670 in these graphs refers equally to all systems

Figure 2-17:Speed and Vibration Specifications

2.4 Seismic Requirements

IMPORTANT
For special seismic kit details and information please see the specific ITF released for the system seismic install.

Seismic requirements are determined and specified by the hospital design professional of record and must be approved by the specific state or country agency. Seismic attachment hardware shown on seismic calculations may differ from hardware supplied with system. Any additional hardware that is required will be the responsibility of the institution and/or their contractor.
For additional center of gravity information, see Table 2-5, p.2-40.

Table 2-5: Subsystem Centers of Gravity and Anchoring Points

IMPORTANT

For special seismic kit details and information, refer to the specific ITF released for the system seismic install.

Component	Center of Gravity Location (cm)			Anchoring Method	See also
	X	Y	Z		
Patient table	See Figure 2-12, p.2-25			Anchor plate + 6 × Hex Head Sleeve Bolt 0.25" × 1.75" anchor screws	Figure 2-16, p.2-31; Figure 2-12, p.2-25
NM gantry with heaviest collimators	See Figure 2-11, p.2-24			4×HILTI HSL-3-G M 12/25	Figure 2-13, p.2-27
CT gantry on floor plates	See Figure 2-10, p.2-23			4 × HILTI HSL-3 M10/40 anchors	Figure 2-13, p.2-27
NM acquisition station				None	
Collimator cart/s	48.5	26.5	99	Carts cannot be anchored, as they must move freely in the room for collimator exchange.	Figure 2-4, p.2-6

Chapter 3: Special Construction Requirements

3.1 Radiation Protection and Shielding Requirements

⚠ CAUTION

Specific room shielding requirements should be determined by local regulatory considerations, facility policy and if available, the facility physicist.

Radiation shielding regulations differ from one country or state to another. It is the customer's responsibility to ensure that radiation protection and shielding comply with such regulations and requirements during site preparation and system installation and operation.

The system produces x-ray radiation and involves the use and storage of radionuclides. Appropriate barriers such as walls, lead-shielded glass, lead shields, etc. can be installed to protect staff from unnecessary exposure to radiation.

Patients become significant sources of radioactivity; therefore consideration should be given to maximize the distance between the patient and operator during the uptake and acquisition phases of scan procedures.

Scatter-room shielding requirements must be reviewed by a qualified radiological health physicist taking into consideration:

- Scatter radiation levels within the scan room (see O640 Scatter Radiation, p.3-4)
- Equipment placement
- Weekly projected workloads (#patient/day technique (kvp*ma))

- Materials used for construction of walls, floors, ceilings, doors and windows
- Access to surrounding scan room areas
- Equipment in surrounding scan room area (for example: film developer, film storage)

3.1.1 Background Radiation

When the system is calibrated, background radiation from surrounding areas may adversely affect calibration. Therefore all radiation sources must be suitably shielded, including:

- Waiting/Injection areas
- Radionuclide storage and preparation area (sometimes known as “hot lab”)

As a general guideline, if the anticipated background radiation in the Scan Room will be higher than 0.1mR/h (1microGy/h), then appropriate additional shielding should be installed.

3.2 O640 Scatter Radiation

The x-ray Scatter Plots shown in Figure 3-1, p.3-4 through Figure 3-4, p.3-7 were created using the following parameters:

- 32 cm body phantom
- 60 RPM
- High voltage: 120 kV
- Current: 20 mA

IMPORTANT :
All scatter radiation measurements have an accuracy of ±20%.

Figure 3-1:O640 X-ray Scatter Radiation Isocontours in µGray/hr – Elevation Plot

Note: All values on the right are identical symmetrically to those provided on the left

Figure 3-2:O640 X-ray Scatter Radiation Isocontours in µGray/hr at 50 cm Below ISO Center

Figure 3-3:O640 X-ray Scatter Radiation Isocontours in µGray/hr at ISO Center

Figure 3-4:O640 X-ray Scatter Radiation Isocontours in µGray/hr at 50 cm Above ISO Center

3.3 Magnetic Field Considerations

The ambient static magnetic field in the system location must be less than 10^{-4} tesla (1,000 milligauss). The ambient AC magnetic fields must be below the 10^{-6} tesla (10 milligauss) peak.

IMPORTANT
The system must be installed in an x-ray protected room providing an attenuation of at least 12 db for radio disturbances from 30 MHz to 1 GHz.

Low Frequency Magnetic Field

N/A

Static Magnetic Field Limits

In order to avoid interference on the system, the static field limits from the surrounding environment must be less than 1 Gauss in both the scan and the operator rooms.

3.4 EMI Considerations

3.4.1 Electrostatic Discharge Environment & Recommendations

In order to reduce electrostatic discharge interference, install a charge dissipative floor material to avoid electrostatic charge buildup.

The relative humidity shall be at least 30 percent.

The dissipative material shall be connected to the system ground reference, if applicable.

3.4.2 Electro-Magnetic Interference (EMI)

NOTE

If power sub-stations exist under or above the scan room, or near the operator room, consider EMI testing to determine if your proposed room meets the published acceptable EMI room limits. This also includes high voltage lines under the scan or operator room floor.

EMI Reduction

If fields of excessive EMI are known or suspected to be present, consult GE Sales & Service for recommendations. Consider the following if you attempt to reduce EMI:

- External field strength decreases rapidly with distance from source of magnetic field.
- External magnetic field leakage of a three-phase transformer is much less than that of a bank of three single phase transformers of equivalent power rating.
- Large electric motors are a source of substantial EMI.
- High-powered radio signals are a source of EMI. Ensure sufficiently good screening of cables and cabinets.

Table 3-1: Electro-Magnetic Interference (EMI) Constraints

Component	Ambient magnetic fields		System attributes affected	Comments
	Static	AC		
Gantry and Table	< 10^{-4} tesla (1,000 milligauss)	< 10^{-6} tesla (10 milligauss) peak	Imaging performance	**WARNING** The gantry produces an electromagnetic field that radiates outward in all directions. The UPS provides a consistent power supply in normal conditions and during a site-wide power outage. Do not place sensitive electronics, for example console or computer equipment within 1 m of the gantry or 1 m of the UPS, in any direction (including above or below) **Note:** The UPS and gantry are not classified as sensitive electronics.
Color Monitor	< 10^{-3} tesla (10,000 milligauss)	NA	Color purity and display geometry	
Console / Computer Equipment	< 10^{-3} tesla (10,000 milligauss)	NA	Data integrity	
Magnetic Media	< 10^{-3} tesla (10,000 milligauss)	NA	Data integrity	

3.4.3 Electromagnetic Immunity

The system is intended for use in the electromagnetic environment specified in App.C, EMC Compliance, Table C-2, EMC Immunity Guidance and Declaration, p.C-2. The customer must assure that the system is installed and used in such an environment.

The system should not be used adjacent to or stacked with other equipment. If adjacent or stacked use is necessary, the system should be observed to verify normal operation.

3.4.4 Recommended Separation Distances

The system is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The customer can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the system as recommended below, according to the maximum output power of the communications equipment.

NOTE

These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects, and people.

For transmissions between 150 kHz and 2.5 GHz, adhering to the recommended distance separation will reduce disturbances recorded at the image level, but may not eliminate all disturbances. However, when installed and operated as specified herein, the system will maintain its essential performance by continuing to acquire, display, and store diagnostic quality images safely. For example, in order to avoid image interference risks, a 1 W mobile phone (800 MHz to 2.5 GHz carrier frequency) must be placed 2.3 meters away from the system.

Chapter 4: Environmental HVAC Requirements

WARNING

Ratings and duty cycles of the system apply only if site environment meets the standards of this section. If environmental specifications are not respected, system operation and image quality may be affected.

The environmental conditions listed in this chapter are essential to maintain proper cooling for the system. These conditions must be maintained at all times, including overnight, weekends and holidays. Only when the system is shut down, for example for major repair, may the air conditioning also be shut down.

Failure to adhere to these requirements can lead to image quality issues.

WARNING

If air conditioning is not functioning correctly, the system must be shut down.

4.1 General Guidelines

Maintaining constant temperature and humidity levels is essential in order to ensure system functionality over time.

Overheating or underheating, or changes in humidity that exceed the requirements provided in this section can cause technical difficulties and system failures and can cause damage to system components. You must conform to the requirements in Table 4-1, p.4-2 both during system storage and in as long as the system is operational after installation.

Cooling requirements do not include cooling for room lighting, personnel or other equipment.

Locate a wall air-conditioning vent at floor level beside and behind gantry to meet gantry cooling needs and to provide patient comfort. Do not locate any cooling vents directly above the gantry. Air returns above the gantry are recommended.

Table 4-1: Requirements for Ambient Temperature, Humidity and Altitude

	Maximum	Minimum	Recommended	Maximum rate of change
Temperature	26°C (79°F)	18°C (64°F)	22°C (72°F)	3°C/hr (5°F/hr)
Humidity	60% non-condensing relative humidity	30% non-condensing relative humidity		5%/hr
Altitude	4100 m (13,451 ft.)	-150 m (-492 ft.)		

Figure 4-1:O640 Air-conditioning Ducts

4.2 Heat Output

Table 4-2: O640 Heat Output in Scan Room

System Component	BTU/hr	Watt	Comments
Scan Room			
Table	682	200	
CT gantry	3,140	920	The CT gantry includes tube heat output based on the following typical protocol: 20 sec, 120 KV, 30 mA, 6 scans/hour For other protocols, calculate as follows: 800 + (T×K×M×S) Watt/h where **T**=scan time, **K**=kV, M: mA, **S**=scans/hour
NM gantry	4,500	1,320	
Recommended subtotal	8,322	2,440	
Operator Room (if applicable)			
Acquisition station	256	75	(computer only)
System total	8,578	2,515	Cooling requirements do not include cooling for room lighting, personnel or non-CT equipment
NM UPS (optional)	< 1500	< 440	

4.3 Air Quality

The system is especially sensitive to the presence of sulfide, chloride and nitrate contaminates, with sulfur being the most damaging element. If high levels of contaminates exist, it is recommended that appropriate air filtration systems are installed.

If the system will be used for aerosol/gas ventilation studies, special precautions must be taken:

- Local laws and regulations must be reviewed for compliance.
- Room planning should be evaluated by a Radiation Safety Officer.

Consult your local radiation safety officer or regulatory body for best practices to minimize aerosol leakage and subsequent contamination.

Chapter 5: Electrical Requirements

5.1 Power Feed

A dedicated feeder run from the facility main isolation transformer is recommended to power the system. If the system must be powered from an existing distribution transformer and secondary feeder, such as the equipment distribution panel of an x-ray department, installation with other x-ray equipment that uses rapid film changers should be avoided. These changers use a large number of high powered, closely spaced exposures, which may coincide with the CT scan and produce image artifacts. If a dedicated distribution transformer is provided for the scanner, the minimum recommended transformer size is 24 kVA, rated 2.4% regulation at unity power factor. For this configuration, the minimum recommended feeder size and overcurrent protection device based on line voltage is shown in Table 5-3, Minimum Feeder Wire Size, p.5-3.

In all cases, qualified personnel must verify that the transformer and feeder, at point of take-off, plus the run to the system meet all the requirements provided in this document.

Table 5-1: System Power Characteristics

Selected Technique	140 kV, 30 mA	Comments
Maximum power demand	19 kVA @ 0.85 PF	
Continuous (average) power demand at maximum duty cycle	10 kVA	
Maximum allowable total source regulation	6%	
Minimum recommended transformer size	24 kVA	With 2.4% rated regulation at unity power factor. Resultant maximum allowable feeder regulation is 3.4%

The following tables (Table 5-2, Nominal Line Voltage Ranges, p.5-2 Table 5-3, Minimum Feeder Wire Size, p.5-3and Table 5-4, Power Supply Requirements, p.5-4) are based on the use of copper wire, rated 75 C and run in steel conduit. The current rating (ampacity) is determined in accordance with the National Electrical Code (NFPA 70), Table 310-16 (2002).

NOTE

Ampacity, or Current Rating, is the RMS current which a device can carry within specified temperature limitations in a specified environment, depending upon: a) temperature rating, b) power loss, c) heat dissipation.

The ampacity for a power cable depends on properties of the conductor and the insulation and on environmental conditions adjacent to the cable.

The minimum feeder size is determined by the current rating (ampacity) of the circuit protection device listed below. In some cases a larger size may be necessary in accordance with local regulations for total source.

A 6AWG (16 sq. mm) ground wire is recommended in all cases.

Table 5-2: Nominal Line Voltage Ranges

The nominal line voltage must fall within one of the ranges listed below						
Nominal line voltage (Volt)	380	400	420	440	460	480
Hi-Line Limit, +10% (Volt)	418	440	462	484	506	528
Lo-Line Limit, -10% (Volt)	342	360	378	396	414	432
Continuous line current (Amp)	16	16	15	14	13	12

Table 5-2: Nominal Line Voltage Ranges

The nominal line voltage must fall within one of the ranges listed below						
Momentary line current (Amp)	28	28	26	25	24	23
Maximum line current	30	30	28	27	26	25
Minimum recommended circuit protection rating (Amp)	30	30	28	28	26	25

Table 5-3: Minimum Feeder Wire Size

Feeder Length (MDA to MDP) Feet (Meters)	**Minimum feeder wire size, AWG or MCM (Sq. MM)/ VAC**					
	380 VAC	400 VAC	420 VAC	440 VAC	460 VAC	480 VAC
50 (15)	6 (16)					
100 (30)	6 (16)					
150 (46)	4 (25)					

5.2 Power Supply Requirements

The system must receive its power supply via a dedicated feeder run from the nearest Main Distribution Panel (MDP).

NOTE
According to local regulations, a primary power disconnect device must be provided on the power line supplying the gantry.

The system is designed to operate on a three-phase plus neutral, five-wire Wye power source (preferably a solidly grounded Wye source).

Table 5-4: Power Supply Requirements

	Characteristics	Comments		
Line voltage specifications	380 to 480 VAC	The difference between the highest line-to-line voltage and lowest line-to-line voltage must not exceed 2% of the lowest line-to-line voltage. The power input is a three phase + neutral + ground.		
Line frequency specifications	50-60 Hz ± 3 Hz			
Measured kVa load characteristics	19	Maximum power demand	19	@ 0.85 PF, at a selected technique of 30mA@140KV X-ray scan
		Average (continuous) power demand	10 kVA	at maximum duty cycle
Line impedance	0.4 Ohm			

Table 5-4: Power Supply Requirements (Continued)

	Characteristics	Comments
Fuse or Circuit Breaker Ratings	30 A	
Power requirements for equipment not powered from the system	In scan room and in operator room: 2 one-phase regular power outlets for service tools (such as vacuum cleaner, electric drill, soldering iron etc.)	For service activities
Power stability (transient etc) requirements	Maximum transient voltages should be limited to 1500 V peak	Sags and surges of the power line must not exceed the absolute range limits shown in Table 5-2, Nominal Line Voltage Ranges, p.5-2.

Total load regulation as measured at the system mains input terminals must not exceed 6%. The capacity of the facility transformer and the size and length of feeder wires directly affect the load regulation presented to the system.

NOTE

- The system includes a remote Emergency OFF button to cut off all system power (EMO).
- The electrical rating is described on the system rating label attached to the gantry.

5.3 Grounding

The system has been designed to use an equal potential grounding system. The required ground system is shown in Figure 5-1: System Grounding Map, p.5-7.

The system includes 2 primary grounding points:

- System power ground point, located in the CT gantry stator base
- NM Reference ground point, located at the side of the NM gantry base

All exposed metal surfaces in the patient vicinity are grounded to the reference ground point.

Note: Shield/signal grounds are not shown

Figure 5-1:System Grounding Map

5.3.1 Grounding of System Input Power

Make sure to comply with both of the following grounding requirements:

- **Connecting to the CT gantry stator base**

  Connect the metal conduit, raceway, or the armor of the armored cable used to power the system, to the CT gantry stator base.

- **Grounding wire**
  - Run a dedicated 6 (16 mm^2) or larger insulated copper ground wire with the phase wires from the main distribution panel to the main facility ground.
  - Connect the ground wire to the MDP (A1) through which it passes, in accordance with local codes.
  - Ensure that the resistance between the gantry ground and the facility earth ground at the MDP does not exceed 0.5 Ohm. Measure with an ohm meter and a piece of wire.
  - Ensure that the total resistance between the gantry ground and earth does not exceed 2 Ohm. The system's ground conductor must be in the same conduit as the system phase conductors. This ground conductor must be bonded to the main facility ground.

NOTE
The shield or armor of armored cable is not sufficient for this purpose.

5.4 Interconnections

It is recommended that all cables are run inside ducts or conduits, as indicated in Figure 5-2: Examples of Suggested Cable Ducts Routing, p.5-10, which illustrates cable ducts for the recommended scan room size.

Ensure adequate duct or conduit sealing to prevent penetration of liquids or other objects that may damage the cables.

Figure 5-2: Examples of Suggested Cable Ducts Routing

5.5 System Cable Information

This section provides technical information regarding system cables connecting different subsystems, in order to facilitate the planning of cable routing.

Table 5-5: Sub-system Inter-connection Cables

Start / Destination		H/V Separation (Y or N)	Run #	Bundle	Length (working lengths)		Description
From	To				Meters	Feet	
CT gantry EUB	Mains (MDP/A1)	Y	1	(Bundle 1)	16.0	52.5	Mains to CT EUB–AC power cable
CT gantry EUB	Room door and warning light	N	2		23.0	75.4	Room door and x-ray light cable
CT gantry EUB	Room EMO switch	N	3		24.0	78.7	EMO dual switch assembly
CT gantry EUB	NM gantry EUB	N	4		4.7	15.4	UPS EMO to NM EUB cable
CT gantry EUB	NM gantry mains	Y	5		4.7	15.4	CT EUB to NM power cable
CT gantry EUB	NM gantry EUB	Y	6		5.7	18.7	NM EUB to CT EUB–rotation HPM VBUS cable
CT gantry CSSB	NM gantry SSB	N	7		7.1	23.3	MCB to CSIB control cable
CT gantry CSSB	NM gantry SSB	N	8		7.1	23.3	CSSB to SSB 1G Ethernet cable
NM gantry SSB	Patient table TSB	N	10	(Bundle 2)	17.5	57.4	SSB to TSB 24 VDC cable
NM gantry SSB	Patient table TSB	N	11		17.5	57.4	SSB to TTSB data signals cable
NM gantry SSB	Patient table TSB	N	12		17.5	57.4	TTSB to SSB Ethernet cable
NM gantry Motion PS	Patient table TB1	Y	13		17.5	57.4	Gantry stator to table base motion bus voltage
NM gantry ground bar	Patient table GND	N	14		17.5	57.4	Main to table base ground cable

Table 5-5: Sub-system Inter-connection Cables(Continued)

Start / Destination		H/V Separation (Y or N)	Run #	Bundle	Length (working lengths)		Description
From	To				Meters	Feet	
NM gantry VGA cable	Operator console PC VGA2	N	15	(Bundle 3)	15.0	49.2	Gantry display VGA cable
NM gantry TB4	Operator console AC splitter	Y	16		15.6	51.2	Operator console AC power cable
NM gantry ground bar	Operator console GND	N	17		15.5	50.9	Operator console ground cable
NM gantry SSB	Operator console LAN switch	N	18		16.8	55.1	Operator console NM Ethernet cable
NM gantry SSB	Operator console e-stop	N	19		18.0	59.1	Operator console E-stop assembly
CT gantry CSSB	Operator console LAN switch	N	20		16.8	55.1	Operator console CT Ethernet cable
NM power cable (run #5)	NM UPS power IN	Y	21	UPS	3.5	11.5	UPS input power cable
NM gantry mains CB	NM UPS power OUT	Y	22		4.5	14.7	UPS output power cable
NM gantry EUB	NM UPS EMO	N	23		4.5	14.7	UPS EMO control cable
Main ground	NM UPS GND	N	24		4.5	14.7	UPS ground cable

5.6 Typical Customer Supplied Cables and Wiring

MDP with lockout /tagout (LOTO):

In order to install the system, the customer must have a lockout /tagout (LOTO) compatible Main Disconnect Panel (MDP) installed in the room.

The MPD and the lockout /tagout must be visible when servicing the system.

Note:

- Warning light and door interlock are not mandatory in some countries. If you install an x-ray warning light in the room, it is recommended that you use the 4-wire method which:
  - Minimizes EMC interference
  - Increases contact life of the relay used in the CT EUB
- If a door switch will not be used, an additional jumper must be added to P18 in the CT EUB during installation. If the jumper is not in place, exposures will not be made.

Figure 5-3:Typical Warning Light and Door Interlock Connections

5.7 Lighting Specifications

5.7.1 Scan Room Lighting

The lighting should be planned so there is sufficient light for:

- Scan preparation
- Scan setup
- Patient unloading
- Working light for service and maintenance activities

The lighting should be designed so that it can be dimmed or otherwise changed in order to minimize discomfort for patients lying supine for extended periods on the patient table with the ceiling in view.

NOTE

- Scan room lighting above the gantries and patient table area should consist of fluorescent lights only (no direct sunlight or direct bright light from filament light bulbs).
- During system servicing in the scan room, a relatively bright light is required in the area behind and around the gantry.

5.7.2 Operator Room Lighting (if applicable)

The lighting should be planned taking into account that operators will be working with computer monitors and reading digital images during much of the day. Reflections in monitors should be avoided, and other ergonomic factors taken into account.

The operator room lighting must also take into account that relatively bright light is required while servicing the acquisition station.

5.8 Power Line Outlets for Service

It is recommended to install at least two standard power outlets in the scan room and in the operator room, to be used for electrically powered service tools. The exact location of these outlets should be defined according to regulatory and service clearances around the system.

Chapter 6: Network Requirements

The system requires the following network connections:

- Broad-Band Network Connection (BBNC) (required): broad-band network connection wall jack, located within 1 m (39") of console location, for internal hospital networking and InSite broadband connectivity.
- Local Area Network (LAN) (required)
  - LAN connections are usually required in the operator room for:
    - Xeleris processing station
    - Main system
    - DICOM LAN printer (optional)

    The LAN and WAN Networks sockets/outlets (minimum 3) must be available in the operator room within a distance of 1 m (39") from the designated location of the operator console, processing workstations (Xeleris) and LAN printer installed in the operator room.
  - In the scan room it is recommended to have one LAN socket/outlet available in close proximity to the gantry for service engineer activities actions.
- Wide Area Network (WAN) (optional)

Appendix A: Customer Checklist

The checklist must be completed by the customer and delivered to GE prior to installation.

IMPORTANT

This checklist is general in nature and is intended to assist the customer in verifying site preparation. The checklist does not cover all details in this manual, and it is the customer's responsibility to fully prepare the site, taking into account all details and specifications set out in this manual.

Site Information Contact Information		Contact Persons	Name	Telephone	email
Site name		Site project coordinator			
Department		System administrator			
Street		Chief technologist			
City, State, Zip		Facilities engineer			
Country		Shipping/Receiving			
Telephone		Physician			
Fax		Other			

Safety Declaration		
I hereby confirm that the relevant site personnel have read the *Safety and System Overview Manual*, in conjunction with this Site Preparation Manual.	Name	
	Position	
	Signature	
Completion Sign Off		
I hereby confirm that pre-installation is complete and that I have examined and confirmed all items in the Pre-Installation Customer Checklist	Name	
	Position	
	Signature	

Table A-1: Deviation from Specifications in Site Preparation Manual

Description		Personal Details	
Floor and anchoring	I hereby confirm that the site takes full responsibility for the floor and anchoring methods differing from the specifications in this manual	Name	
		Position	
		Signature	

Table A-2: Site Preparation Timetable

Description		Status	See	Comments
Scheduling	Project schedule verified with GE			
	3rd party vendors scheduled			
	Can meet the committed site ready date			
	Construction completion date matches delivery date			
	System delivery date scheduled for			
	Detectors delivery date scheduled for			
	Installation dates scheduled for			
	Applications/Training date scheduled for			
	Site Ready date scheduled for			
	First Use date scheduled for			

Table A-3: Room Preparation

Description		Status	See	Comments
Pre-construction	Site layout drawings completed and approved			
	Radiologist health physician has reviewed the room layout			
	3rd party vendors identified: _____ _____ _____			
Post-construction: Room measurements and layout	■ Length			
	■ Height			
	■ Width			
Servicing clearance	Meets all requirements, including local codes and local regulatory requirements as detailed in App.D, Regulatory Clearances. No grounded walls are present in the regulatory clearance areas.			
Egress	Sufficient egress space per local regulatory requirements			

Table A-3: Room Preparation (Continued)

Description		Status	See	Comments
Structural and floor preparation	Floor tolerates specified loads			
	Floor meets thickness requirements or alternate anchoring has been specified and is available from the customer's structural engineer			
	Floor meets leveling requirements			
	Floor meets flatness requirements			
	Floor meets vibration requirements			
Ducts	Ducts installed in floor, according to approved room layout			
	Ducts meet requirements (size, depth, sealing, high voltage separation)			
Electricity requirements	Three-phase Main Distribution Panel (MDP (A1)) meets requirements and is installed			
	Three-phase power line meets requirements			
	Wall outlets are live and available for installation and service tools			

Table A-3: Room Preparation (Continued)

Description		Status	See	Comments
Environmental conditions	Ample working light is available for service			
	Air-conditioning meets requirements for system thermal loads			
	Air-conditioning meets humidity requirements			
	Magnetic field in camera room is < 1 Gauss			
	Room is clean and free of dust, ready for installation			
Room shielding	Shielding of scan room meets requirements			
	Shielding of operator room (if applicable) meets requirements			
	External exposure x-ray light installed			
Safety	Planned location of emergency button in scan room is easily accessible by operator			
	Interlock system installed			
Customer-Provided Cabling and Connections	Door switch			
	Warning lights, including relay 24 VAC			

Table A-4: Unloading, Conveyance and Storage

Description		Status	See	Comments
Temporary storage	System will be delivered on first install day **or** Some or all crated components will be stored until installation date			
	If stored, storage area meets requirements			
	Site has sufficient storage area			
Staging area	If a staging area is required, its size and all environmental conditions meet the system's requirements.			
Loading dock	Is a loading dock with 112 cm (44") truck-height available?			
	Full-size truck can access loading dock **or** Site will arrange for short truck delivery			
Unloading by forklift	Site has forklift with weight capacity to lift a fully crated gantry (2230 kg) (4917 lbs.) **or** Site will arrange for appropriate forklift			

Table A-4: Unloading, Conveyance and Storage (Continued)

Description		Status	See	Comments
Rigging (required if halls/ elevator/doors access is not available)	Rigging company details: Name: _____ Contact person: _____ Phone: _____			
	Rigging company has insurance policy			
	Insurance policy of rigger company is attached			
Pallet truck	Site has pallet truck **or** Site will arrange for pallet truck			
Delivery route	Delivery route is defined by site and meets requirements			
	Delivery route is tested by site			
Installation room	Room can be locked during installation			

Table A-4: Unloading, Conveyance and Storage (Continued)

Description		Status	See	Comments
Suitability of halls, elevators and doors for conveyance of all components, when mounted on moving kit/wheels **Note:** All items must refer to conveyance as follows: ■ From truck to installation room (crated or uncrated) or ■ From truck to storage (crated) and from storage to installation room (crated or uncrated)	All door openings, hallways are large enough			
	Pathways can tolerate weight			
	Elevator openings and size are large enough			
	Elevator can tolerate weight			
	Gantry can clear all corners			
	Inclines on the route to the camera room are suitable (weight, size and incline angle)			
	State the incline angle			
	There are delicate carpets or tiles along the conveyance route			
	Floor protection is supplied for delicate surfaces			
	Patient table can clear all 90° corners			
Waste materials	Site has arranged for disposal of empty wooden cases, foam blocks and large cardboard boxes after installation			

Table A-5: Network

Description		Status	See	Comments
Network cabling and hardware	Installation complete			
Broadband	Installed and tested			
Network definitions and testing	Acquisition station site name, hostname and IP address defined and tested			
	Xeleris workstation site name, hostname and IP address defined and tested			

Network Definition Details					
Item	**Hostname**	**IP**	**Wired (Y/N)**	**DICOM Port**	**AE Title**
NM Acquisition Station					
Processing host					
Hardcopy host					
LAN Net Mask					
Gateway to other networks					

Table A-6: Radioactive Isotopes for System Calibration

Description		Status	See	Comments
Basic calibration	Site has license for Tc^{99m}			
	Tc^{99m} will be available during installation			
Isotopes to be used at site are available for installation. **Note:** Specify age and strength in Comments	Co^{57} (Rectangular Flood Source)			
	Tl^{201}			
	I^{131}			
	I^{123}			
	In^{111}			
	Ga^{67}			
	Xe^{133} (inhalation gas)			

Appendix B: Measuring Floor Flatness

The floor must meet strict flatness specifications. The information in this appendix is provided as a tool for accurate measurement of the floor flatness.

Required Tools

- Self-leveling fan beam laser tool (self-leveling for at least 3 degrees)
- Masking tape
- Chalk line
- 1 m (3') level with minimum 1 mm (1/16") gradations (alternatively, use a tape measure securely taped to a spirit level)

1. Map the floor as follows:

   a. Using a chalk line, mark the center line A (refer to site drawings or proposal for exact location).

   b. Using masking tape, place × marks at 30 cm (1 ft) intervals along the center line.

   c. Add × marks at 30 cm (1 ft) intervals from center line, so that the system footprint is covered with a grid of × marks C.

   d. Place the level flat on the floor and move it around the footprint area. Visually inspect the floor for any significant highs/lows, and add × marks B to identify them.

2. Place the laser D at the end of the center line. The laser must be high enough for the fan beam to be visible over the entire footprint area E, but no more than 10 cm (4") high (the closer to the floor the more accurate).

3. Keeping the measuring stick F exactly perpendicular to the floor, at each tape mark record the height at which the laser hits the ruler.

Note: The "interest area" that needs to be checked differs depending on the system type. The example below demonstrates the area for D670 systems.

4. Record the measurements in a table that represents the system footprint. Add notes for any significant high/low measurements found in between the grid locations.

The table provides a visual contour of the floor, where each cell in the grid represents 30 cm (1 ft). Compare to the system specifications to determine whether the floor meets the requirements.

Table B-1, p.B-3 shows a floor that meets the specification of 0.5 cm over 150 cm: there is no deviation greater than 0.5 between any 5 cells in the grid.
Table B-2, p.B-4 shows a floor with three areas out of specification.

Table B-1: Floor Flatness Conforming with 0.5 cm over 150 cm Specifications (0.5 Deviation)

Measurements in CM					Center						Notes
	1.3	1.2	1.1	1.1	1	1.1	0.9	0.9	1		Greatest Deviation: 1.4 - 0.9 = 0.5
	1.2	1.1	1.1	1.1	1	1	1	0.9	1		
	1.2	1	1	1	1	1	1	1	1		
	1.1	1	1	1	1	1	1.1	1.1	1.1		
	1	1	1	1	1	1	1.1	1.2	1.2		
	1	1	1	1	1	1	1.2	1.2	1.3		
	1.1	1.1	1.1	1	1	1.1	1.2	1.3	1.3		
		1.1	1.1	1.1	1.1	1.1	1.2	1.3			
		1.2	1.2	1.1	1.1	1.1	1.2	1.2			
		1.2	1.2	1.2	1.1	1.1	1.2	1.2			
				1.2	1.2	1.2					
		1.2	1.2	1.2	1.2	1.2	1.2	1.2			
1.3	1.3	1.2	1.2	1.2	1.3	1.3	1.2	1.2	1.1	1	
1.3	1.3	1.2	1.2	1.2	1.3	1.3	1.2	1.2	1.1	1	
	1.2	1.2	1.2	1.3	1.3	1.3	1.3	1.3	1.1		
		1.2	1.3	1.3	1.3	1.3	1.3	1.3			
			1.3	1.4	1.3	1.3	1.3				
				1.4	1.4	1.3					

Table B-2: Floor Flatness Outside 0.5 cm over 150 cm Specifications (1.1 Deviation)

Measurements in CM					Center						Notes
	5.2	5.3	5.4	5.4	5.4	5.4	5.4	5.4	5.5		Greatest Deviation: 5.9 - 4.8 = 1.1
	5.3	5.4	5.4	5.3	5.4	5.4	5.4	5.4	5.4		
	5.4	5.4	5.3	5.2	5.2	5.3	5.1	5.3	5.4		
	5.3	5.3	5.2	5.1	5.1	5.2	5	5.3	5.6		
	5.4	5.4	5.4	5.2	5	5.1	5.2	5.2	5.3		
	5.3	5.3	5.3	5.1	5	5	5.1	5.2	5.2		
		5.1	5.1	5	5	5.1	5.3	5.3			
		5	5	5.1	5.1	5.3	5.4	5.6			
		4.8	4.9	5.1	5.2	5.4	5.6	5.9			
				5.1	5.2	5.3					
		5.1	5.2	5.2	5.2	5.3	5.4	5.5			High spot between orange blocks = 4.8
5.1	5.1	5.1	5.2	5.2	5.3	5.3	5.5	5.6	5.8	5.9	
5	5.1	5.2	5.2	5.3	5.4	5.4	5.5	5.6	5.8	5.9	
	5.2	5.2	5.3	5.4	5.5	5.5	5.6	5.6	5.7		
		5.3	5.4	5.5	5.6	5.6	5.6	5.7			
			5.5	5.6	5.7	5.6	5.7				
				5.7	5.8	5.7					
	5.2	5.3	5.4	5.4	5.4	5.4	5.4	5.4	5.5		

Table B-3: Blank Table for Measurements

Measurements in CM					Center						Notes
											Greatest Deviation:

Appendix C: EMC Compliance

This equipment complies with IEC60601-1-2 Edition 2 and Edition 3 EMC standard for medical electrical equipment.

The system is suitable to be used in an electromagnetic environment, in compliance with the limits and recommendations provided in the following tables:

- Emission compliance level and limits
- Immunity compliance level and recommendations to maintain equipment clinical utility

Table C-1: EMC Emission Declaration

Emissions Test	Compliance	Electromagnetic Environment Guidance
RF emissions CISPR 11	Group 1	The system uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
RF emissions CISPR 11	Class A	
Harmonic emissions IEC 61000-3-2	NA	The system is suitable for use in all establishments other than domestic and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Voltage fluctuations/ flicker emissions IEC 61000-3-2	NA	

Table C-2: EMC Immunity Guidance and Declaration *

Immunity Test	IEC 60601-1-2 Test Level	Compliance Level	Electromagnetic Environment Guidance
Electrostatic discharge (ESD) IEC 61000-4-2	**Contact**: ± 6 kV **Air:** ± 8 kV	**Contact**: ± 6 kV **Air:** ± 8 kV	Floors must be wood, concrete, or ceramic tile. If floors are covered with synthetic material, the relative humidity must be at least 30%.
Electrical fast transient/burst IEC 61000-4-4	**Power supply lines:** ± 2 kV **Input/output lines:** ± 1 kV	**Power supply lines:** ± 2 kV **Input/output lines:** ± 1 kV	Mains power quality should be that of typical commercial or hospital environment.
Surge IEC 61000-4-5	**Line-line:** ± 1 kV **Line-earth:** ± 2 kV	**Line-line:** ± 1 kV **Line-earth:** ± 2 kV	Mains power quality should be that of typical commercial or hospital environment.
Voltage dips, short interruptions and voltage variations on power supply input lines IEC 61000-4-11	< 5% U_T† (> 95% dip in U_T) for 5 sec	< 5% U_T† (> 95% dip in U_T) for 5 sec	Mains power quality should be that of a typical commercial or hospital environment. If the user of the system requires continued operation during power mains interruptions, it is recommended that the system be powered from an uninterruptible power supply or a battery.

Table C-2: EMC Immunity Guidance and Declaration (Continued)*

Immunity Test	IEC 60601-1-2 Test Level	Compliance Level	Electromagnetic Environment Guidance
Power frequency (50/60 Hz) magnetic field IEC 61000-4-8	3 A/m	3 A/m	Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment. **Note:** U_T is the AC mains voltage prior to application of the test level.
Conducted RF IEC 61000-4-6	3 VRMS 150 kHz to 80 MHz	3 VRMS 150 kHz to 80 MHz	Portable and mobile RF communications equipment should be used no closer to any part of the system, including cables, than the recommended separation distance calculated from the equation appropriate for the frequency of the transmitter. For recommended separation distances, see Table C-3, p.C-4.
Radiated RF IEC 61000-4-3 (alternative method: IEC 61000-4-21)	3 V/m 80 kHz to 2.5 GHz	3 V/m 80 kHz to 2.5 GHz	

* These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects, and people.

† UT is the AC mains voltage prior to application of the test level.

Table C-3: Separation Distances for Portable and Mobile RF Communications Equipment

Rated Max Transmitter Output (Watts)	Separation distance according to frequency of transmitter (meters)			Comments
	150 kHz to 80 MHz $d = \left[\frac{3.5}{3}\right]\sqrt{P}$	80 MHz to 800 MHz $d = \left[\frac{3.5}{3}\right]\sqrt{P}$	800 MHz to 2.5 GHz $d = \left[\frac{7}{3}\right]\sqrt{P}$	Where **P** is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and **d** is the recommended separation distance in meters (m).
0.01	0.12		0.23	Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey*, should be less than the compliance level in each frequency range†.
0.1	0.37		0.74	
1	1.17		2.33	
10	3.69		7.38	Interference may occur in the vicinity of equipment marked accordingly.
100	11.7		23.3	

* Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast, and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, and electromagnetic site survey should be considered. If the measured field strength in the location in which the system is used exceeds the applicable RF compliance level above, the system should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as re-orienting or relocation the system.

† Over the frequency range 150 kHz to 80 MHz, field strengths should be less than 3 V/m.

Appendix D: Regulatory Clearances

D.1 Regulatory Clearances

MINIMUM CLEARANCES UNDER U.S. FEDERAL REGULATIONS AND NATIONAL STANDARDS: 29 CFR 1910 (OSHA), NFPA 70E (STANDARD FOR ELECTRICAL SAFETY IN THE WORKPLACE), AND NFPA 101 (LIFE SAFETY CODE):

Figure D-1: O640 Regulatory Clearance Requirements, p.D-1 is a map of clearance requirements for U.S. regulatory compliance. See clearance tables on the following pages for detailed dimensional clearances. Please note all systems installed in the United States must comply with all Federal and local regulations. For installations outside the United States, country-specific or other local regulatory clearance requirements must be met. See Service Clearances, p.12 for additional information.

Figure D-1:O640 Regulatory Clearance Requirements

D.1.1 Regulatory Code Description

Egress: 29 CFR 1910 Subpart E (OSHA) and NFPA 101 (Life Safety Code) define the minimum requirements for means of egress. The requirement most applicable to equipment installation and room layout is minimum width of exit access. Under OSHA 1910.37(f)(6), the minimum width of exit access shall in no case be less than 28 in. from any potentially occupied point in the room.

Under NFPA 101 (2006 edition) 7.3.4.1, the minimum width of any means of egress is 36 in. However, NFPA allows this to be reduced to 28 in. around furniture or equipment, provided that a 36 in. clearance would otherwise be available without moving permanent walls.

Electrical Clearance: 29 CFR 1910 Subpart S (OSHA) and NFPA 70E (Standard for Electrical Safety in the Workplace) define minimum clearance requirements for the workspace around electrical equipment. Under both OSHA 1910.303(g)(1) and NFPA 70E (2004 edition) 400.15, a minimum clear space of 36" depth (with minimum 30" width and 78" height) must be provided in front of electrical equipment with parts operating at 600 volts or below and likely to require examination, adjustment, servicing, or maintenance while energized.

This safety clearance requirement applies to all GEHC equipment. Although 36 in. is the minimum clearance for most installations, the standards require an increased minimum clearance distance where parts operate above 150 volts (but still below 600 volts) under the following circumstances:

- If the wall or surface directly facing the electrical equipment is grounded (for example: brick, concrete, or tile) or includes grounded protrusions (such as medical gas ports, metal door or window frames, water sources and metallic sink structures, metallic cabinetry, electrical disconnects or emergency off panels, air conditioners or vents), then a 42" clearance depth is required.
- If the possibility exists of exposed and unguarded live parts on both sides of the workspace (for example if a power distribution unit were positioned on the wall directly facing the GEHC equipment), then a 48" clearance depth is required.

D.1.2 Regulated Minimum Working Clearance by Major Subsystem

Requirements apply to equipment operating at 600V or less, where examination, adjustment, servicing, or maintenance is likely to be performed while live parts are exposed.

Direction of Service Access is defined as perpendicular to the surface of the equipment being serviced. Required regulatory clearance distances must be maintained and may not be used for storage. This includes normal system operation as well as service inspection or maintenance.

For the gantry and table, distances are measured from the enclosure, not the finish covers.

Table D-1: Gantry Subsystem

Work Space Requirement	Minimum Clear Space	Additional Conditions
Direction of service access (all sides)	914 mm (36")	If exposed live parts of 151 - 600 volts are present, 1219 mm (48 in.) on both sides of workspace with the operator between is required. If the opposite wall is grounded and exposed live parts of 151 - 600 volts are present, 1067 mm (42 in.) is required.
Service access width (left-right of workspace)	762 mm (30")	This is the width of the working space in front of the equipment. A minimum of 762 mm (30 in.) or the width of the equipment, whichever is greater, is required.

Table D-2: Table Subsystem

Work Space Requirement	Minimum Clear Space	Additional Conditions
Direction of service access (table head or foot)	914 mm (36")	There are no exposed live parts hazards with the cover in place. This component is typically serviced from all four sides. This is the width of the workspace on each side of the equipment. A minimum of 914.4 mm (36 in.), or the width of the equipment, whichever is greater, is required.
Direction of service access (table sides)	914 mm (36")*	*This distance can be reduced to 711 mm (28 in.) provided a written and signed approval is obtained by the local team from the local AHJ (Authority Having Jurisdiction). The signed document must be on file with GE.
Direction of Service access (table foot)	711 mm (28")	For the front gantry cover removal, a minimum of 457 mm (18 in.) is allowed only if an unobstructed egress space of 711 mm (28 in.) is maintained around the equipment for room exit. This also means no trip hazards exist along the path of egress.
Service access width (left-right of workspace)	762 mm (30")	This is the width of the working space in front of the equipment. A minimum of 762 mm (30 in.) or the width of the equipment, whichever is greater, is required.

Table D-3: Console Subsystem

Work Space Requirement	Minimum Clear Space	Additional Conditions
Direction of service access: front of console	914 mm (36")	There are no exposed live part hazards with the cover in place. If the console is placed under a counter, the front edge of the console must be even with the vertical edge of the console workspace. **Note:** This component is typically serviced from the front with access to the rear.
Service access width: Front of console	762 mm (30")	This is the width of the workspace in front of the equipment. A minimum of 762 mm (30 in.) or the width of the equipment, whichever is greater, is required.
Head clearance	1981.2 mm (78")	This is the height of the workspace measured from the floor at the front edge of the equipment to the ceiling or overhead obstruction(s). A minimum of 1981.2 mm (78 in.) or the height of the equipment, whichever is greater, is required.

Table D-4: UPS Subsystem

Work Space Requirement	Minimum Clear Space	Additional Conditions
Direction of service access (front of UPS)	914.4 mm (36)*	There are no exposed live part hazards with the cover in place. This component is typically serviced from the front with access to the rear. ■ If exposed live parts of 151 - 600 volts are present, 1219 mm (48 in.) is required on both sides of the workspace with the operator between. ■ If the opposite wall is grounded and exposed live parts of 151 - 600 volts are present, 1067 mm (42 in.) is required.
Service access width (right side and length of UPS)	762 mm (30")	This is the width of the working space in front of the equipment. A minimum of 762 mm (30 in.) or the width of the equipment, whichever is greater, is required
Head clearance	1981 mm (78")	This is the height of the workspace measured from the floor at the front edge of the equipment to the ceiling or overhead obstruction(s). A minimum of 1981 mm (78 in.) or the height of the equipment, whichever is greater, is required.

Table D-5: MDP (A1) Disconnect Subsystem

Work Space Requirement	Minimum Clear Space	Additional Conditions
Direction of service access (front of MDP/A1)	914.4 mm (36")*	There are no exposed live part hazards with the cover in place. This component is typically serviced from the front with access to the rear. ■ If exposed live parts of 151 - 600 volts are present, 1219 mm (48 in.) is required on both sides of the workspace with the operator between. ■ If the opposite wall is grounded and exposed live parts of 151 - 600 volts are present, 1067 mm (42 in.) is required.
Service access width (right side and length of MDP/A1)	762 mm (30")	This is the width of the working space in front of the equipment. A minimum of 762 mm (30 in.) or the width of the equipment, whichever is greater, is required.
Head clearance	1981 mm (78")	This is the height of the workspace measured from the floor at the front edge of the equipment to the ceiling or overhead obstruction(s). A minimum of 1981 mm (78 in.) or the height of the equipment, whichever is greater, is required.

D.1.3 Terms and Definitions

Egress: The path of exit from within any room, constituting a continuous and unobstructed space, without trip hazards along the path of exit.

Workspace: The dimensional box required for safe inspection or service of energized equipment. It consists of depth, width, and height. The depth dimension is measured perpendicular to the direction of access. Additional conditions can increase the minimum dimension requirement. GE defines this as the envelope of the component superstructure with the external covers in place.

Service Access Width: The width of the workspace in front of the equipment. A minimum of 762 mm (30"), or the width of the equipment, whichever is greater.

Head Clearance: The height dimension of the workspace. The height of the workspace measured from the floor at the front edge of the equipment to the ceiling or overhead obstruction(s). 1981.2 mm (78"), or the height of the equipment, whichever is greater.

Grounded Wall: Any wall that can be electrically conductive to earth ground. Masonry, concrete, and tile are considered conductive. Additional commonly found aspects of a wall should also be considered grounded.

The following is not an all-inclusive list:

- Medical gas ports and plates
- Metal doors and window frames
- Water sources and metallic sink structures
- Metallic wall-mounted cabinetry
- MDP (A1)
- Equipment Emergency OFF panels
- Industrial equipment (such as air conditioners and vents)
- Expansion joints
- Surface raceway
- Exposed wall conduits
- Floor outlets boxes

The following are not considered as grounded elements of a common wall:

- Standard wall outlet
- Light switches
- Telephones
- Communication wall jacks
- Ceiling tile grids

D.1.4 Additional Regulatory Clearance Information

D.1.4.1 Regulatory Caution

Site prints are required for all system installations including relocation and moves. The room layout, as shown on your site print, shall meet all regulatory requirements as described in the installation manual. Additional room components, such as cabinets, reduce room size. Equipment not shown on the site print may void the caution statement, making the room non-compliant. Actual site measurements before installation will be taken to determine room size and compliance.

D.1.4.2 Egress Clearance

Egress requires a clear, unobstructed route out of the room, either around the back of the gantry or around the back of the table. If your egress route is not around the back of the table, maintain 457 mm (18″) of clearance between the back of the table, with a continuous width of 3200 mm (126″), 1600 mm (63″) on each side of the table center line, on each side to any obstruction so that the front cover can be removed. Refer to the Pre-Installation manual for more details on service clearances.

Exceptions

Rooms smaller than 576 cm×363 cm (18' 11"×11' 11"), require construction to meet the minimum requirements. The design center or your GE PMI may have additional recommendations for your room size.

D.2 Service Clearances

Servicing of the system can be safely performed within the regulatory envelopes defined in D.1 Regulatory Clearances; however sufficient space must be maintained to remove the covers from the system.

To achieve this clearance for the gantry, clear space must be available to maneuver the gantry rear covers mounted on the service dollies. One Service Engineer can accomplish this.