GE Medical Systems

Technical Publication

Direction 2404435-100
Revision 4

GE Medical Systems
Precision MPi® Pre-Installation Manual

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This Service Manual is available in english only.

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IF A CUSTOMER'S SERVICE PROVIDER REQUIRES A LANGUAGE OTHER THAN ENGLISH, IT IS THE CUSTOMER'S RESPONSIBILITY TO PROVIDE TRANSLATION SERVICES.

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CE MANUEL DE MAINTENANCE N'EST DISPONIBLE QU'EN ANGLAIS.

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SI PROCEDA ALLA MANUTENZIONE DELL'APPARECCHIATURA SOLO DOPO AVER CONSULTATO IL PRESENTE MANUALE ED AVERNE COMPRESO IL CONTENUTO.

NON TENERE CONTO DELLA PRESENTE AVVERTENZA POTREBBE FAR COMPIERE OPERAZIONI DA CUI DERIVINO LESIONI ALL'ADDETTO ALLA MANUTENZIONE, ALL'UTILIZZATORE ED AL PAZIENTE PER FOLGORAZIONE ELETTRICA, PER URTI MECCANICI OD ALTRI RISCHI.

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- **本维修手册仅存有英文本。**
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- **未详细阅读和完全了解本手册之前，不得进行维修。**
- **忽略本注意事项会对维修员，操作员或病人造成触电，机械伤害或其他伤害。**

IMPORTANT! . . . X–RAY PROTECTION

X–ray equipment if not properly used may cause injury. Accordingly, the instructions herein contained should be thoroughly read and understood by everyone who will use the equipment before you attempt to place this equipment in operation. The General Electric Company, Medical Systems Group, will be glad to assist and cooperate in placing this equipment in use.

Although this apparatus incorporates a high degree of protection against x–radiation other than the useful beam, no practical design of equipment can provide complete protection. Nor can any practical design compel the operator to take adequate precautions to prevent the possibility of any persons carelessly exposing themselves or others to radiation.

It is important that everyone having anything to do with x–radiation be properly trained and fully acquainted with the recommendations of the National Council on Radiation Protection and Measurements as published in NCRP Reports available from NCRP Publications, 7910 Woodmont Avenue, Room 1016, Bethesda, Maryland 20814, and of the International Commission on Radiation Protection, and take adequate steps to protect against injury.

The equipment is sold with the understanding that the General Electric Company, Medical Systems Group, its agents, and representatives have no responsibility for injury or damage, which may result from improper use of the equipment.

Various protective material and devices are available. It is urged that such materials or devices be used.

CAUTION: United States Federal law restricts this device to use by or on the order of a physician.

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REVISION HISTORY

REV	DATE	REASON FOR CHANGE
0	April 22, 2004	Preliminary Release
1	June 17, 2004	Initial Release
2	September 08, 2005	Data update (sections 1-5, 2-1-1, 2-1-2, 3-4-2, 8)
3	November 30, 2005	Correction of top view in Dimensioned Drawings (section 3-2)
4	October 17, 2007	Section 2-1 Environmental data corrected Section 2-1-3 Heat output, Total values added. (max./standby /normal use) Section 2-2-1 Room sizes are corrected Section 3-4-1-1 Base plate information updated Section 4-1-6 PDB schematic for Europe added Section 5-3 room layout sizes corrected Section 7-1-1 Contents of the transportation pallets defined Section 8-1 Cable length overview added Section 8-3 Cable entrances added Section 9 Anchoring and seismic details added

1 Introduction

1-1 Objective and Scope of Pre-Installation Document

This document is intended as a guide and informational resource for planning and properly preparing a location for the installation of Precision MPi system. This document is intended to assist the customer and installer in properly preparing a site for product installation.

1-2 Avoid Unnecessary Expenses and Delays.

To avoid unnecessary expenses and delays, use the "Pre-Installation" checklist located in Section 7 to determine if you are ready for the installation to begin. Once you believe that your room /location is ready for installation to begin, complete the "Pre-Installation" checklist. The checklist is an important tool that helps verify that nothing has been missed. The checklist summarizes the preparations and allows you to record a permanent record of the activities that have taken place.

1-3 Overview of the Pre-Installation Process

Pre-installation is a co-operative effort between the customer/purchaser and GE Medical Systems (GEMS). Figure 1-1 outlines the information in this document and its place in the pre-installation process.

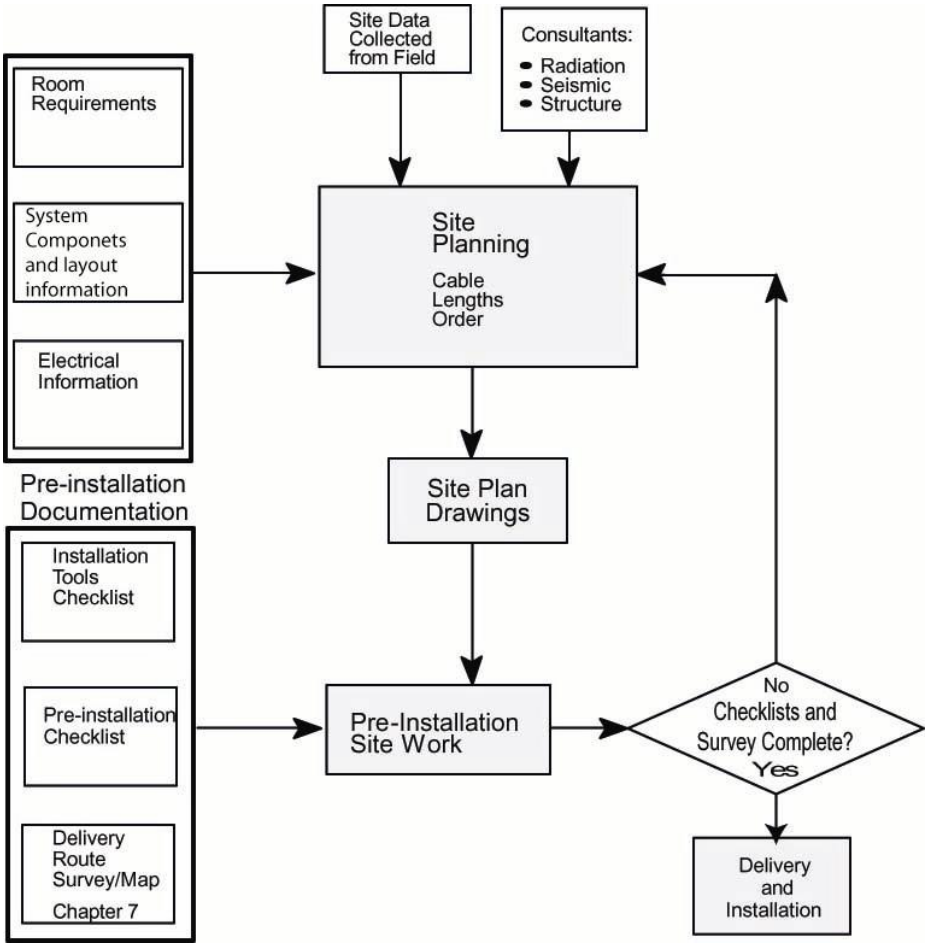


Figure 1-2 Pre-Installation Process

1-4 Responsibilities of the Purchaser

The purchaser is responsible for completion of "Pre-installation". This includes the procurement and installation of all required materials and services to get the room ready for installation of the product. This responsibility includes providing:

- A clean and and safe work environment for installation of the product (finished floor, ceiling, walls, and proper room lighting).
- A location suitable for the installation of the product. See Section 2 – Suite/Room Requirements.
  - Suitable support structures in the floor, walls, or ceiling necessary for the mounting of the product and/or its components. Installation of conduit, ducts and/or raceways necessary to route cables safely. See Section 3 – System Physical Characteristics and Section 4 – Planning Electrical Connections.
  - Electrical power and grounds of specified quality and reliability. See Section 6 – System Facility Power and Grounds.
    - Electrical power of the required voltage, including emergency-off safety switch in the room.
    - Properly installed and sized junction boxes, including covers and fittings at locations required and called out in architectural drawings.

1-5 What You Will Receive (System Components)

The following components comprise the Precision MPi system.

- NRT Multiflex Positioner (Table, C-arm, and Base Unit)
- X-ray room mobile positioner control panel
- X-ray room generator and digital control console (Optional)
- Thales QX Image Intensifier (with Heliflex Optics)
- Ralco R806 ASFL Collimator
- Collimator Control Cabinet
- CPI SP100 Generator (Electronics & HV tank)
- Varian G1092 (for R&F) or G1592 (for DSA) X-ray Tube
- X-ray Tube Heater Exchanger (optional for RF systems)
- VacuDAP 2004 Dose area product meter (Optional for systems outside USA)
- Infimed Innovision CCD camera
- Infimed PlatinumOne computer (Tower, Keyboard, Mouse)
- Infimed Power Transformer
- Control room generator control touchscreen
- Control room positioner control panel
- 2 or 3 Totoku LCD Display Monitors (1 or 2 for In-Room display, 1 for Control Room display)

COMPONENT	MODEL NUMBER	PLATE TYPE	LOCATION
Positioner	Multiflex	Type / Rating	Rear of base unit
Image Intensifier	TH 9436 QXH310MVR14 (32 cm) TH 9447QXH413 MVR70 (40 cm)	Type / Rating	Front or rear of Housing
II Mounted Control	TH 7222-1	Type / Rating	Side of Module
II Power Supply	TH 7195-4 (TH 9436) TH 7198 TH 9447)	Type / Rating	Front of Module
X-ray Room Remote Touch Panel	PPC – LI 26	Type / Rating	Bottom of Panel
X-ray Room LCD Monitor	Totoku 18”	Type / Rating	Back of Monitor
Collimator Control Module	RS 588 RS 589	Type / Rating	Back of Module
HV Generator	Indico 100	Type / Rating	Side of Module
Generator Control Touch Screen	Indico Plus	Type /Rating	Back of Panel
Platinum Computer	Platinum One	Type / Rating	Top or side of PC Tower
Platinum One Power Transformer	735-222-G1	Type / Rating	Side of Module
Control Room LCD Monitors	Totoku 18”	Type / Rating	Back of Monitor
Monitor Suspension	Single and Double Monitor		Ceiling Mounted
Monitor Cart	Single Monitor Cart		Mobile on wheels

2 Suite/room requirements

2-1 Environmental

2-1-1 Relative Humidity and Temperature

PRECISION MPi COMPONENT	**HUMIDITY (Non Condensing)**				**TEMPERATURE**			
	STORAGE		IN-USE		STORAGE		IN-USE	
	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX
Positioner	0 %	90 %	30 %	75 %	32° F 0° C	104° F 40° C	50° F 10° C	104° F 40 ° C
X-ray Room Positioner Control Panel (include mobile stand)	0 %	90 %	30 %	75 %	32° F 0° C	104° F 40° C	50° F 10° C	104° F 40 ° C
X-ray Room Generator & Digital Control Console (mounted to Positioner Control Panel)	10 %	80 %	20 %	80 %	32° F 0° C	104° F 40° C	64° F 18° C	86° F 30 ° C
Image Intensifier	20 %	80 %	30 %	75 %	14° F -10° C	131° F 55° C	41° F 5° C	104° F 40 ° C
Collimator	20 %	80 %	30 %	75 %	32° F 0° C	104° F 40° C	50° F 10° C	104° F 40 ° C
Collimator Control Cabinet	10 %	80 %	30 %	75 %	32° F 0° C	104° F 40° C	50° F 10° C	104° F 40 ° C
Generator Module	10 %	80 %	20 %	80 %	14° F -10° C	104° F 40° C	50° F 10° C	104° F 40 ° C
X-ray Tube	10 %	80 %	20 %	80 %	14° F -10° C	104° F 40° C	50° F 10° C	104° F 40 ° C
Oil Chiller – XRT heat exchanger	10 %	80 %	20 %	80 %	14° F -10° C	104° F 40° C	50° F 10° C	104° F 40 ° C
Dose Area Product Meter	10 %	80 %	10 %	75 %	32° F 0° C	104° F 40° C	50° F 10° C	104° F 40 ° C
CCD Camera	10 %	80 %	20 %	80 %	32° F 0° C	104° F 40° C	50° F 10° C	104° F 40 ° C
PlatinumOne Computer	10 %	80 %	20 %	80 %	32° F 0° C	104° F 40° C	50° F 10° C	104° F 40 ° C
PlatinumOne Power Transformer	10 %	80 %	20 %	80 %	32° F 0° C	104° F 40° C	50° F 10° C	104° F 40 ° C
Control Room Generator Control Touch screen	10 %	95 %	30 %	75 %	-4° F -20° C	158° F 70° C	50° F 10° C	104° F 40 ° C
X-ray Room LCD Display Monitor(s)	10 %	85 %	30 %	80 %	-4° F -20° C	140° F 60° C	41° F 5° C	95° F 35 ° C
Control Room LCD Display Monitor	10 %	85 %	30 %	80 %	-4° F -20° C	140° F 60° C	41° F 5° C	95° F 35 ° C

PRECISION MPi COMPONENT	**HUMIDITY (Non Condensing)**				**TEMPERATURE**			
	STORAGE		IN-USE		STORAGE		IN-USE	
	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX
X-ray Room Overhead Monitor Suspension with Fixed Ceiling Rails (without monitors)	20 %	80 %	30 %	75 %	32° F 0° C	104° F 40° C	64° F 18° C	86° F 30 ° C
X-ray Room Monitor Cart (without monitors)	20 %	80 %	30 %	75 %	32° F 0° C	104° F 40° C	64° F 18° C	86° F 30 ° C

2-1-2 Altitude and Atmospheric Pressure

PRECISION MPi COMPONENT	**ATMOSPHERIC PRESSURE**				**ALTITUDE**			
	IN-USE		STORAGE		IN_USE		STORAGE	
	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX
Positioner	700 hPa 525mmHg	1060 hPa 795mmHg	700 hPa 525mmHg	1060 hPa 795mmHg	0m 0 ft.	3048m 10000ft	0m 0 ft.	12192m 40000ft
X-ray Room Positioner Control Panel (include mobile stand)	700 hPa 525mmHg	1060 hPa 795mmHg	700 hPa 525mmHg	1060 hPa 795mmHg	0m 0 ft.	3048m 10000ft	0m 0 ft.	12192m 40000ft
X-ray Room Generator & Digital Control Console (mounted to Positioner Control Panel)	700 hPa 525mmHg	1060 hPa 795mmHg	700 hPa 525mmHg	1060 hPa 795mmHg	0m 0 ft.	3048m 10000ft	0m 0 ft.	12192m 40000ft
Image Intensifier	700 hPa 525mmHg	1060 hPa 795mmHg	700 hPa 525mmHg	1060 hPa 795mmHg	0m 0 ft.	3048m 10000ft	0m 0 ft.	12192m 40000ft
Collimator	700 hPa 525mmHg	1060 hPa 795mmHg	700 hPa 525mmHg	1060 hPa 795mmHg	0m 0 ft.	3048m 10000ft	0m 0 ft.	12192m 40000ft
Collimator Control Cabinet	700 hPa 525mmHg	1060 hPa 795mmHg	700 hPa 525mmHg	1060 hPa 795mmHg	0m 0 ft.	3048m 10000ft	0m 0 ft.	12192m 40000ft
Generator Module	700 hPa 525mmHg	1060 hPa 795mmHg	700 hPa 525mmHg	1060 hPa 795mmHg	0m 0 ft.	3048m 10000ft	0m 0 ft.	12192m 40000ft

PRECISION MPi COMPONENT	**ATMOSPHERIC PRESSURE**				**ALTITUDE**			
	IN-USE		STORAGE		IN_USE		STORAGE	
	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX
X-ray Tube (G1092)	700 hPa 525mmHg	1060 hPa 795mmHg	700 hPa 525mmHg	1060 hPa 795mmHg	0m 0 ft.	3048m 10000ft	0m 0 ft.	12192m 40000ft
X-ray Tube (G1592)	700 hPa 525mmHg	1060 hPa 795mmHg	700 hPa 525mmHg	1060 hPa 795mmHg	0m 0 ft.	3048m 10000ft	0m 0 ft.	12192m 40000ft
XRT heat exchanger (for G1592 only)	700 hPa 525mmHg	1060 hPa 795mmHg	700 hPa 525mmHg	1060 hPa 795mmHg	0m 0 ft.	3048m 10000ft	0m 0 ft.	12192m 40000ft
CCD Camera	700 hPa 525mmHg	1060 hPa 795mmHg	700 hPa 525mmHg	1060 hPa 795mmHg	0m 0 ft.	3048m 10000ft	0m 0 ft.	12192m 40000ft
PlatinumOne Computer	700 hPa 525mmHg	1060 hPa 795mmHg	700 hPa 525mmHg	1060 hPa 795mmHg	0m 0 ft.	3048m 10000ft	0m 0 ft.	12192m 40000ft
PlatinumOne Power Transformer	700 hPa 525mmHg	1060 hPa 795mmHg	700 hPa 525mmHg	1060 hPa 795mmHg	0m 0 ft.	3048m 10000ft	0m 0 ft.	12192m 40000ft
Control Room Generator Control Touch screen	700 hPa 525mmHg	1060 hPa 795mmHg	700 hPa 525mmHg	1060 hPa 795mmHg	0m 0 ft.	3048m 10000ft	0m 0 ft.	12192m 40000ft
X-ray Room LCD Display Monitor(s)	700 hPa 525mmHg	1013 hPa 760mmHg	266 hPa 200mmHg	1013 hPa 760mmHg	0m 0 ft.	3048m 10000ft	0m 0 ft.	12192m 40000ft
Control Room LCD Display Monitor	700 hPa 525mmHg	1013 hPa 760mmHg	266 hPa 200mmHg	1013 hPa 760mmHg	0m 0 ft.	3048m 10000ft	0m 0 ft.	12192m 40000ft
X-ray Room Overhead Monitor Suspension with Fixed Ceiling Rails (without monitors)	700 hPa 525mmHg	1060 hPa 795mmHg	700 hPa 525mmHg	1060 hPa 795mmHg	0m 0 ft.	3048m 10000ft	0m 0 ft.	12192m 40000ft
X-ray Room Monitor Cart (optional)	500 hPa 375mmHg	1060 hPa 795mmHg	500 hPa 375mmHg	1060 hPa 795mmHg	-305m -1000 ft	4572m 15000ft	-305m -1000 ft	4572m 15000ft
Complete System (standard configuration)	700 hPa 525mmHg	1013 hPa 760mmHg	700 hPa 525mmHg	1013 hPa 760mmHg	0m 0 ft.	3048m 10000ft	0m 0 ft.	12192m 40000ft

2-1-3 Heat Output

Exam Room

Precision MPi COMPONENT	**Standby**	**In Use**
Generator	720W 2457 BTU/hr	960W 3276 BTU/hr
X-ray Tube Heat Exchanger	1000W 3412 BTU/hr	2400W 8160 BTU/hr
Positioner	1000 W 3412 BTU/hr	2500W 8530 BTU/hr
Collimator Controller	Negligible	Negligible
Image Intensifier	5W 17 BTU/hr	5W 17 BTU/hr
Exam Room Control Console	53 W 181 BTU/hr	56 W 191 BTU/hr
LCD Display Monitors (1 or 2)	Negligible	Negligible

Total heat output for the exam room with system in standby: 9479 BTU/hr / 2778 W

Maximum heat output for the exam room with system in use: 19994 BTU/hr / 5921 W

Typical heat output in normal use: 11582 BTU/hr / 3407 W

Control Room

Precision MPi COMPONENT	**Standby**	**In Use**
Generator Touchscreen	53 W 181 BTU/hr	56 W 191 BTU/hr
Digital Subsystem (PC Tower)	75 W 256 BTU/hr	300 W 1024 BTU/hr
Isolation Transformer	N/A	960W (Max) 3276 BTU/hr
LCD Display Monitor	Negligible	Negligible

Total heat output for the control room with system in standby: 437 BTU/hr / 128 W

Total heat output for the control room with system in use: 4491 BTU/hr / 1316 W

Typical heat output in normal use: 1247 BTU/hr / 366 W

Note! Heat output in normal use is defined as 8 cases in 10 hours.

2-1-4 Magnetic/Electrical Field Sensitivity and Electromagnetic Emissions

All the products or components of the Precision MPi R&F system meet EMI and EMC requirements 46-319024 and IEC 601-1-2 (International).

Because X-ray equipment produces radiation, special precautions may need to be taken or special site modifications may be required. GE Medical Systems does not make recommendations regarding radiation protection. It is the purchaser's responsibility to consult a radiation physicist for advice on radiation protection in X-ray rooms.

2-2 Structural

This section contains the physical room requirements characteristics.

2-2-1 Exam Room Size

Length		Width		Ceiling Height (without monitor suspension)		Ceiling Height (with monitor suspension)	
Recommended	Minimum	Recommended	Minimum	Recommended	Minimum	Recommended	Minimum
18 ft. 6 in.	15 ft. 9 in.	16 ft. 0 in.	12 ft. 3 in.	9ft 6in	9ft	10ft 10in	9 ft.8 in.
5.6m	4.8m	4.9m	3.7m	2.9m	2.75m	3.15m	2.9m

NOTE 1! The minimum requirements for the room size refer to top view drawings on page 24

NOTE 2! The recommended and minimum room sizes are valid for the exam room only. Control room is not included. To include the control room, the minimum room size will be 19 ft. x 18 ft.

2-2-2 Floor, Ceiling and Walls

2-2-2-1 Seismic Requirements

Seismic requirements are determined and specified by the hospital structural engineer of record and approved by the specific state or country agency. GE Provides Service Marketing catalogs ("R" Catalogs) which contain seismic mounting information and kits, if required.
All seismic information is available at the end of the documentation.

2-2-2-2 Floor Mounting Requirements

Anchors or through bolt mountings. Go to chapter 9 for seismic details and drawings.

Pull out effort for the bolts, depending on the mounting option, is also available in the seismic drawings in chapter 9.

Go to section 3-4-1-1 for base plate (mounting plate) details.

2-2-2-3 Ceiling

Aluminum rails support the In-Room TV Monitor Bridge optional in Precision MPi R&F system X-ray rooms.

2-2-2-3-1 Stationary rails

Stationary rails are designed for top (ceiling) mounting. Rails can be ordered and are supplied in 4" (10.2 cm) increments between 134" (3.4 m) and 222" (5.64 m), plus a 228" (5.79 m) length totalling 24 different sizes. The choice of length depends on room size, configuration and the presence of obstructions.

Complete details of room dimensions must be known when planning an installation. Work with your architect or building engineer and obtain approval before proceeding.

Methods of support that permit attachment to structural steel or "through-bolts" in concrete construction are favored. Do not use anchors in direct tension.

Each rail has mounting holes on 26" (66 cm) centers with the first hole located 2" (5.1 cm) from the rail end. The last hole is located either 2" (5.1 cm) or 4" (10.2 cm) from the other end with a variable space of less than 26" (66 cm) between it and the second last hole.

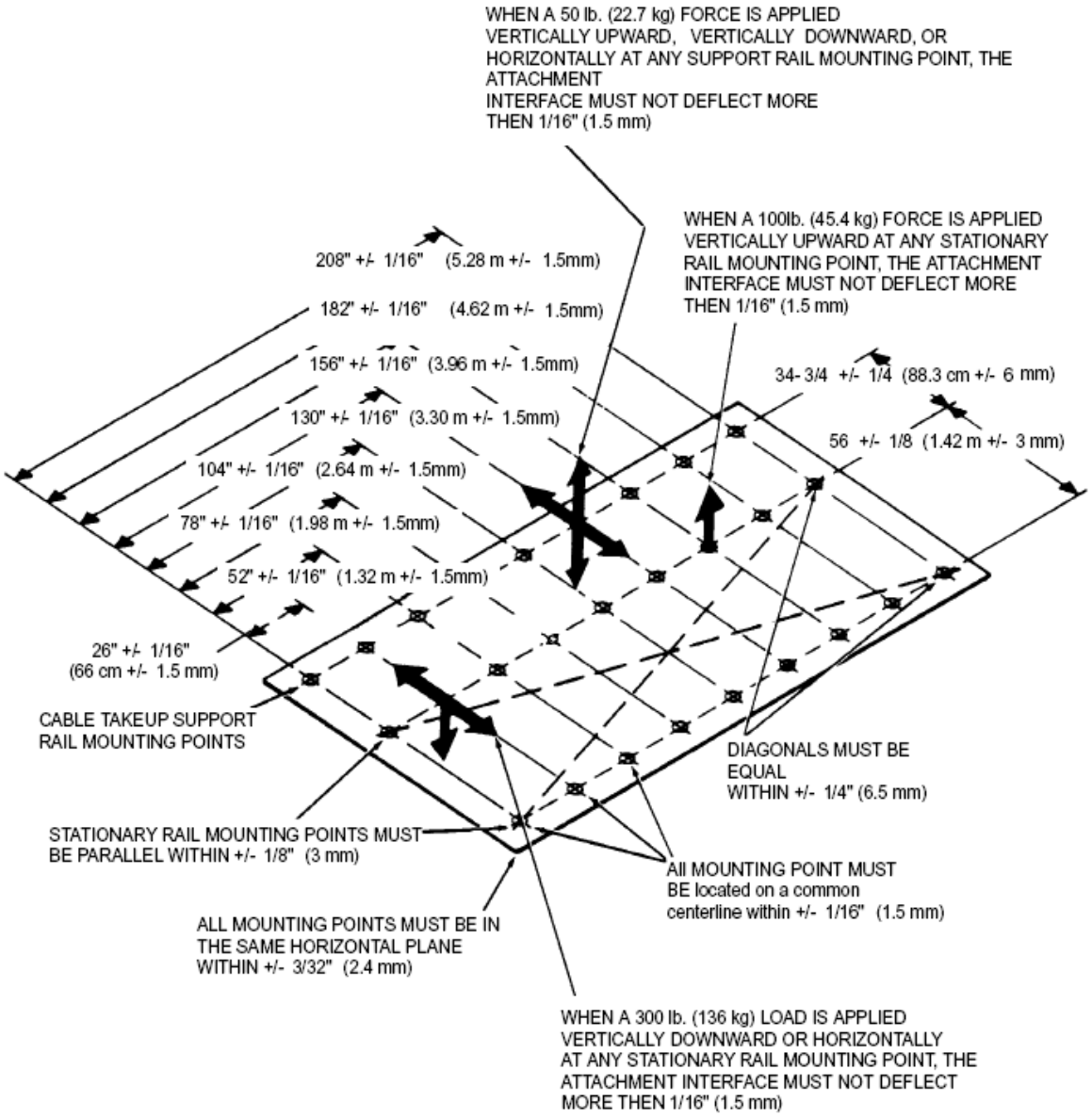
⚠ CAUTION
Structure must support rails.

Rails are mounted on 1/2" (12.7 mm) bolts. Maximum load per bolt is 350 lbs. (159 kg); however, each mounting bolt must not "pull-out" or otherwise fail under a vertically downward "dead" load of 1,400 lbs. (636 kg).

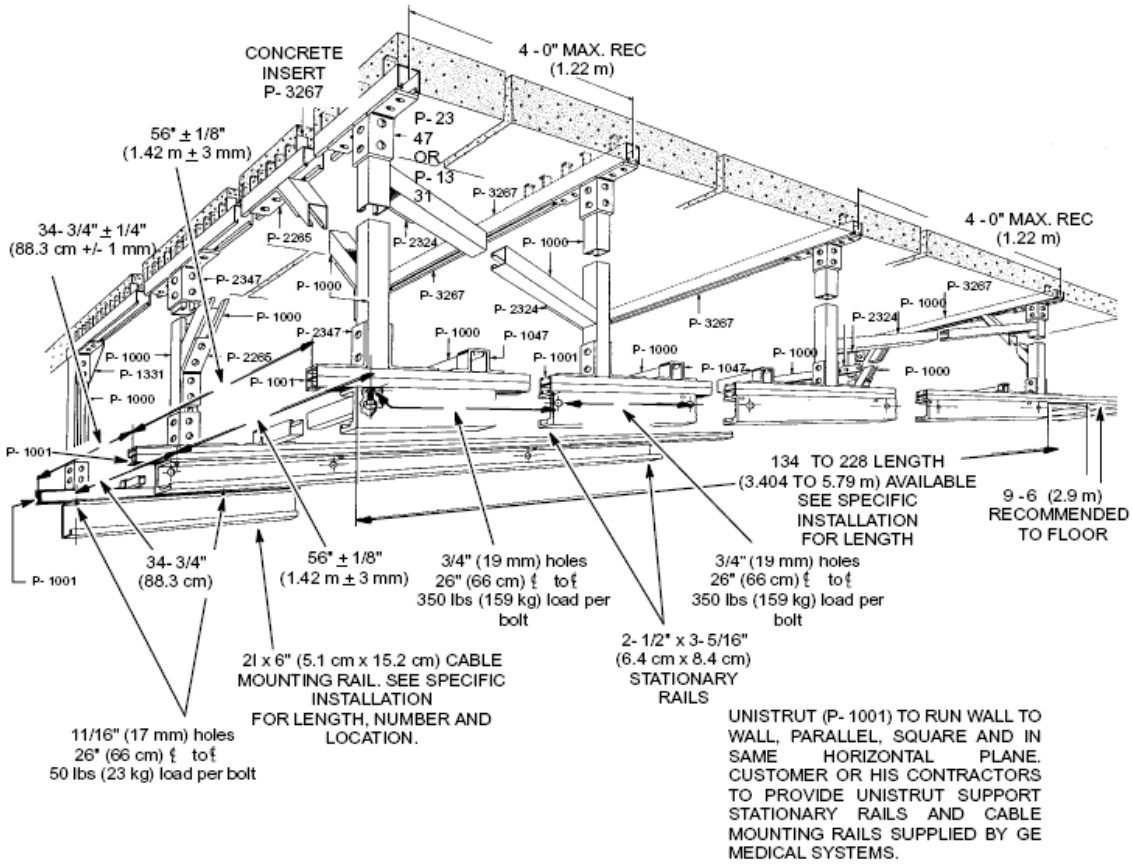
Referring to the layout drawings, the +/- 1/8" (3 mm) requirement for parallelism of the stationary rails is critical. Therefore, great care must be exercised in locating the mounting points. Figures 3-27 and 3-28 outline requirements that the stationary rail mounting interface must meet.

For low ceiling height, the stationary rails may be mounted directly to the ceiling slab or to flush-mounted "Unistrut" or similar structure. For higher rooms in which a false ceiling is to be used, the stationary rails may be attached to rigid vertical members hung from the ceiling slab. A supplementary channel may be secured to the bottom of the vertical members to facilitate provision for mounting holes. A Unistrut system or equivalent is a convenient type of support to employ. Refer to drawings on the following pages.

2-2-2-3-2 Specifications for a typical 17' – 10" stationary rail mounting interface



2-2-2-3-3 Unistrut structure for OTS suspension

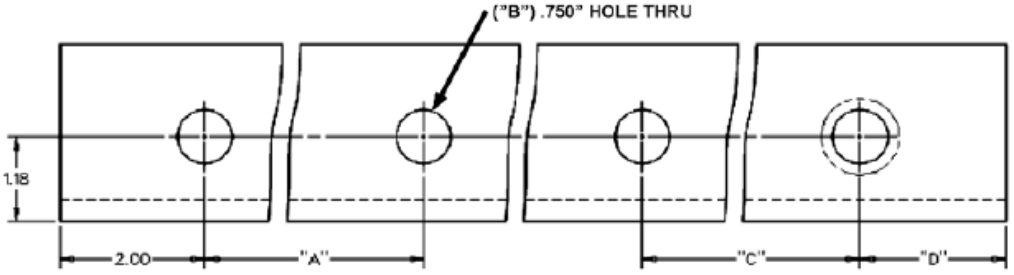


Suggested Unistrut Structure for OTS Suspension

2-2-2-3-4 Available bridge lengths

MODEL NUMBER	DESIGNATION
From B0134JA to B0228JA	Inboard stationary rails (1 pair)
Bridge with carriage plate(1). Choices are:	
B2057AG	7'–9" (2,36 m) length, or
B2057AE	9'–6" (2,90 m) length.

2-2-2-3-4 Stationary rail selection



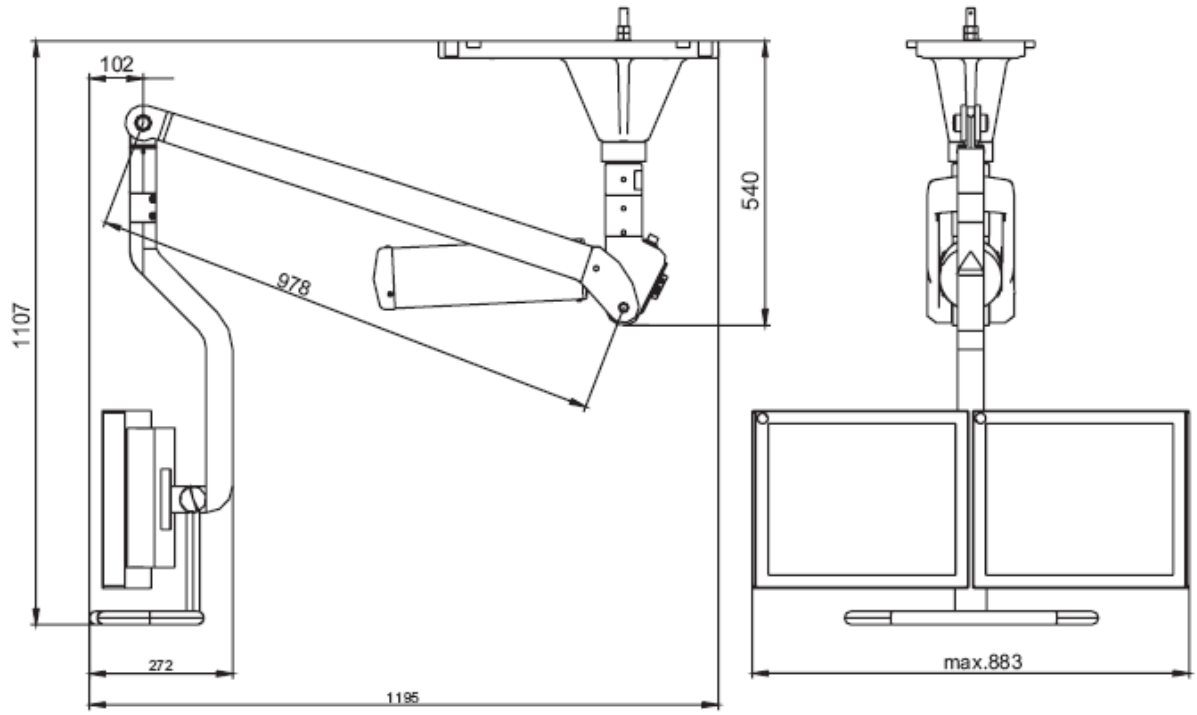
Rail Dimensions

Select rail lengths, ranging from 3.404 m (134 inches) to 5.791 m (228 inches), in increments of 4 inches (102 mm). Depending on the length, the origin of several holes is the same, but the ending may differ. It is recommended to check the reference number on the layout.

Rail length m (ft.)	A	C	D	INBOARD RAILS
3.404 (11'2")	5*660.4=3,302	--	51	B0134JA
3.505 (11'6")	5*660.4=3,302	102	51	B0138JA
3.607 (11'10")	5*660.4=3,302	203	51	B0142JA
3.708 (12'2")	5*660.4=3,302	305	51	B0146JA
3.810 (12'6")	5*660.4=3,302	406	51	B0150JA
3.912 (12'10")	5*660.4=3,302	508	51	B0154JA
4.013 (13'2")	5*660.4=3,302	610	51	B0158JA
4.115 (13'6")	6*660.4=3,962	—	102	B0162JA
4.216 (13'10")	6*660.4=3,962	152	51	B0166JA
4.318 (14'2")	6*660.4=3,962	254	51	B0170JA
4.420 (14'6")	6*660.4=3,962	356	51	B0174JA
4.521 (14'10")	6*660.4=3,962	457	51	B0178JA
4.623 (15'2")	6*660.4=3,962 559		51	B0182JA
4.724 (15'6")	7*660.4=4,623	—	51	B0186JA
4.826 (15'10")	7*660.4=4,623	102	51	B0190JA
4.928 (16'2")	7*660.4=4,623	203	51	B0194JA
5.029 (16'6")	7*660.4=4,623	305	51	B0198JA
5.131 (16'10")	7*660.4=4,623	406	51	B0202JA
5.232 (17'2")	7*660.4=4,623	508	51	B0206JA
5.334 (17'6")	7*660.4=4,623	610	51	B0210JA
5.436 (17'10")	8*660.4=5,283	—	102	B0214JA
5.537 (18'2")	8*660.4=5,283	152	51	B0218JA
5.639 (18'6")	8*660.4=5,283	254	51	B0222JA
5.791 (19')	8*660.4=5,283	406	51	B0228JA

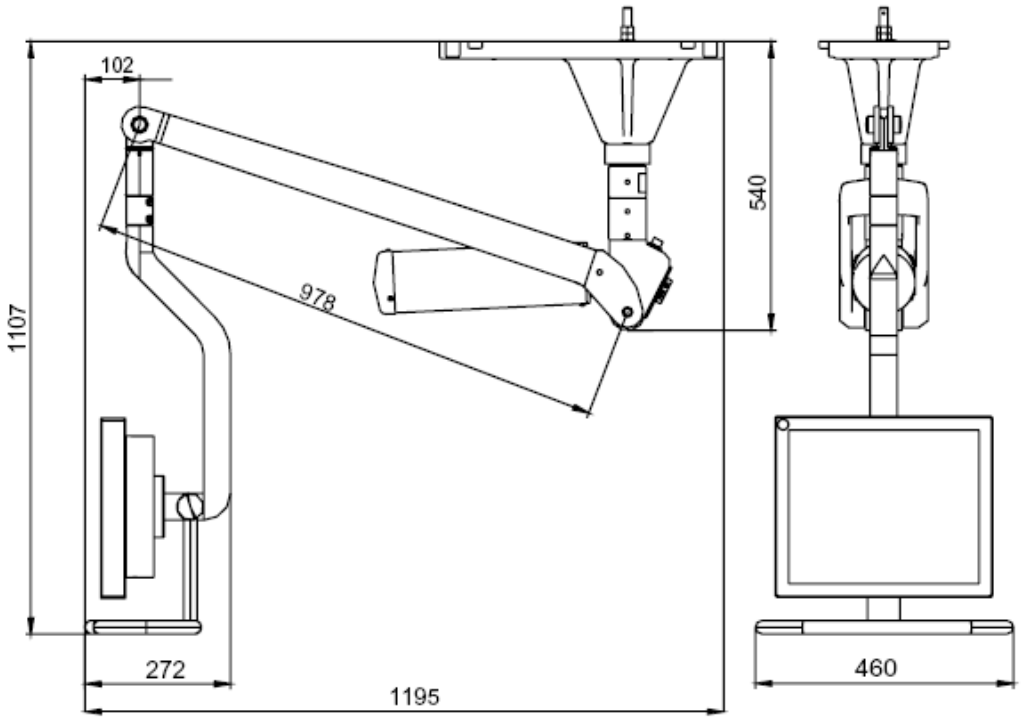
2-2-2-3-5 Dimensions and layout for monitor suspension

Dimensions and layout of the Double Monitor Suspension



Double Monitor

Dimensions and layout of the Single Monitor Suspension

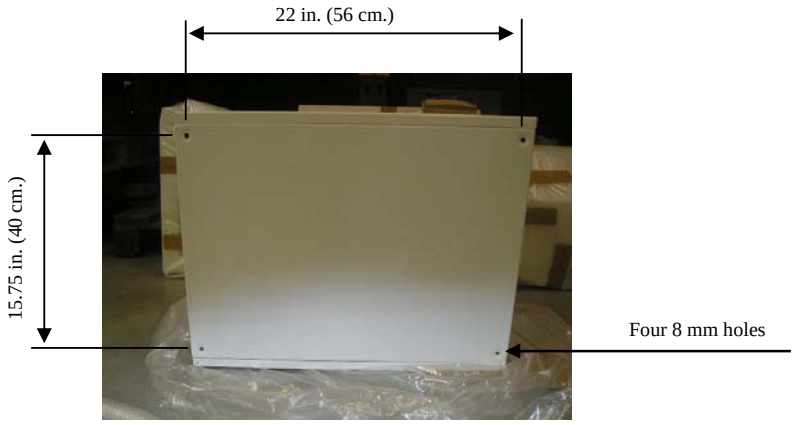


Single Monitor

2-2-2-4 Walls

2-2-2-4-1 Collimator Control Module

The Collimator Control Module must be securely fastened to the wall.



For seismic details and pull out strength for the bolts, go to chapter 9

3 System Physical Characteristics

3-1 Component Dimensions and Weights

3-1-1 Dimensions

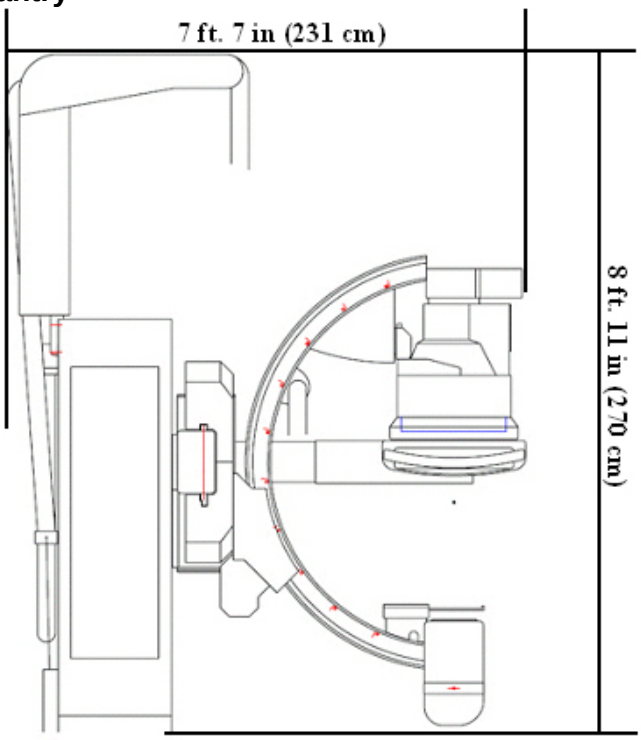
PRODUCT/PHYSICAL CHARACTERISTICS

Precision MPi COMPONENT	**DIMENSIONS**			**WEIGHT (approx)**	**FLOOR LOADING**	**REFERENCE DWG**
	MaxLength / MaxDepth	**MaxWidth**	**MaxHeight**		**Weight/Area**	
Positioner Gantry	8 ft. 6 in. (255 cm)	7 ft. 7in. (231 cm)	8 ft. 11 in. (270 cm)	3087 lbs 1400 kg	708 lb/ ft^2 3457 kg/ m^2	Illustrations Page 21 and 22 Section 3-2-1
Positioner Cabinet	17.2 in. (45 cm)	35.4 in. (90 cm)	63.4 in. (161 cm)	662 lbs 300kg		Illustrations Page 22 Section 3-2-2
Exam Room Control Console/Panel With remote touch panel	19.5 in. (49.5cm) 23.7 in. (60 cm)	17.3 in. (44cm) 17.4 in. (44 cm)	39 in. (99 cm) 48.9 in. (124 cm)	106 lbs 48 Kg		Illustrations Page 23 Section 3-2-3
Generator	16 in. (40.7 cm)	18 in (45.7 cm)	48.7 in (123.7 cm)	236 lbs 107 kg	128 lb/ ft^2 624 kg/ m^2	Illustrations Page 24 Section 3-2-4
Generator Interface Module (GIM)	2.5625 in. (6.51 cm)	12.5 in. (31.75 cm)	12.125 in (30.8 cm)	5.15 lbs 2.3 kg		Illustrations Page 25 Section 3-2-5
Heat Exchanger (HE320/321)	16 in. (40.6 cm)	9.125 in. (23.2 cm)	5.25 in. (13.3 cm)	26 lbs 11.8 kg		Illustrations Page 25 Section 3-2-6
Collimator Control Module	15 in. (37.25 cm)	24 in. (60 cm)	19 in. (47.8 cm)	106 lbs 48kg		Illustrations Page 25 Section 3-2-7
Control Room Generator Touchscreen	143 in. (363cm)	164 in. (417cm)	164 in. (417cm)	25 lbs 11kg		Illustrations Page 26 Section 3-2-8
PlatininumOne PC Cabinet	18.125 in. (46 cm)	7.75 in. (20 cm)	16.5 in. (42 cm)	28.2 lbs 13 kg		Illustrations Page 26 Section 3-2-9
Digital Isolation Transformer	12.25 in. (32.2 cm)	8.5 in. (21.6 cm)	7.25 in (18.5 cm)	32 lbs 14.5 kg		Illustrations Page 26 Section 3-2-10
Flat Panel Monitor	9.9 in. (25 cm)	17 in. (43 cm)	21.3 in. (54 cm)	19 lbs 8.8 kg		Illustrations Page 27 Section 3-2-11
Keyboard	6.7 in. (17 cm)	18.1 in (46 cm)	1.5 in (3.8 cm)	1.8 lbs 0.8 kg		Illustration Page 27 Section 3-2-12

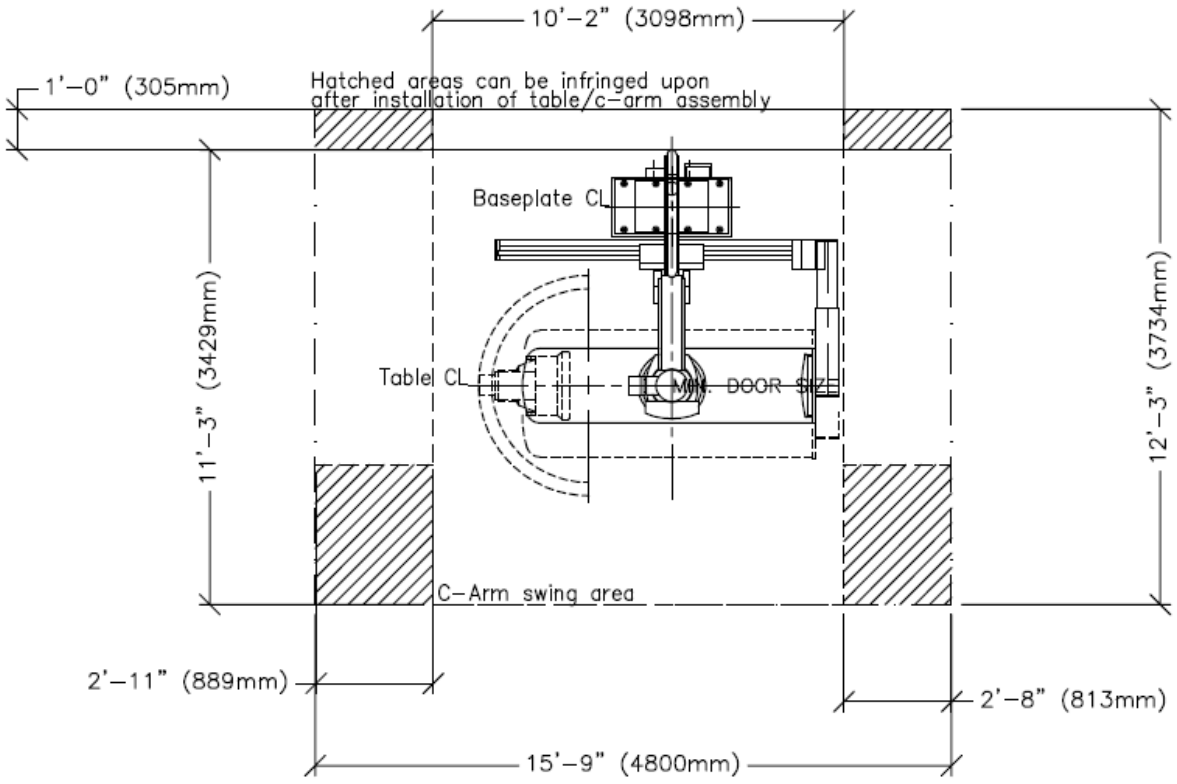
Precision MPi COMPONENT	**DIMENSIONS**			**WEIGHT (approx)**	**FLOOR LOADING**	**REFERENCE DWG**
	MaxLength / MaxDepth	**MaxWidth**	**MaxHeight**		**Weight/Area**	
Inboard stationary rails (Rail length selection required)	228 in. (579 cm)	2.5 in. (6.3 cm)	3.3 in (8.4 cm)	110 lbs (50 kg) (Valid for 5.79 m.)		
Bridge with carriage plate	94.1 in (239 cm)	25.7 in (65.2 cm)	6.1 in (15.5 cm)	140 lbs (63.5 kg)		
Monitor suspension with counterbalanced boom and two LCD's	27.2 in (119.5 cm) (depth instead of length)	35 in (88.3 cm)	42.7 in (110.7 cm)	165 lbs 75 kg		
X-ray room monitor cart	26.5 in. (67.31 cm)	25.5 in. (64.77 cm)	60.5 in. (153.67 cm)	99 lbs 45 kg		Illustration Page 27 Section 3-2-13
Positioner base plate	35.1 in (89.2 cm)	14.8 in (37.5 cm)	0.78 in (2.0 cm)	159 lbs 72 kg		

3-2 Dimensioned Drawings

3-2-1 Positioner Gantry

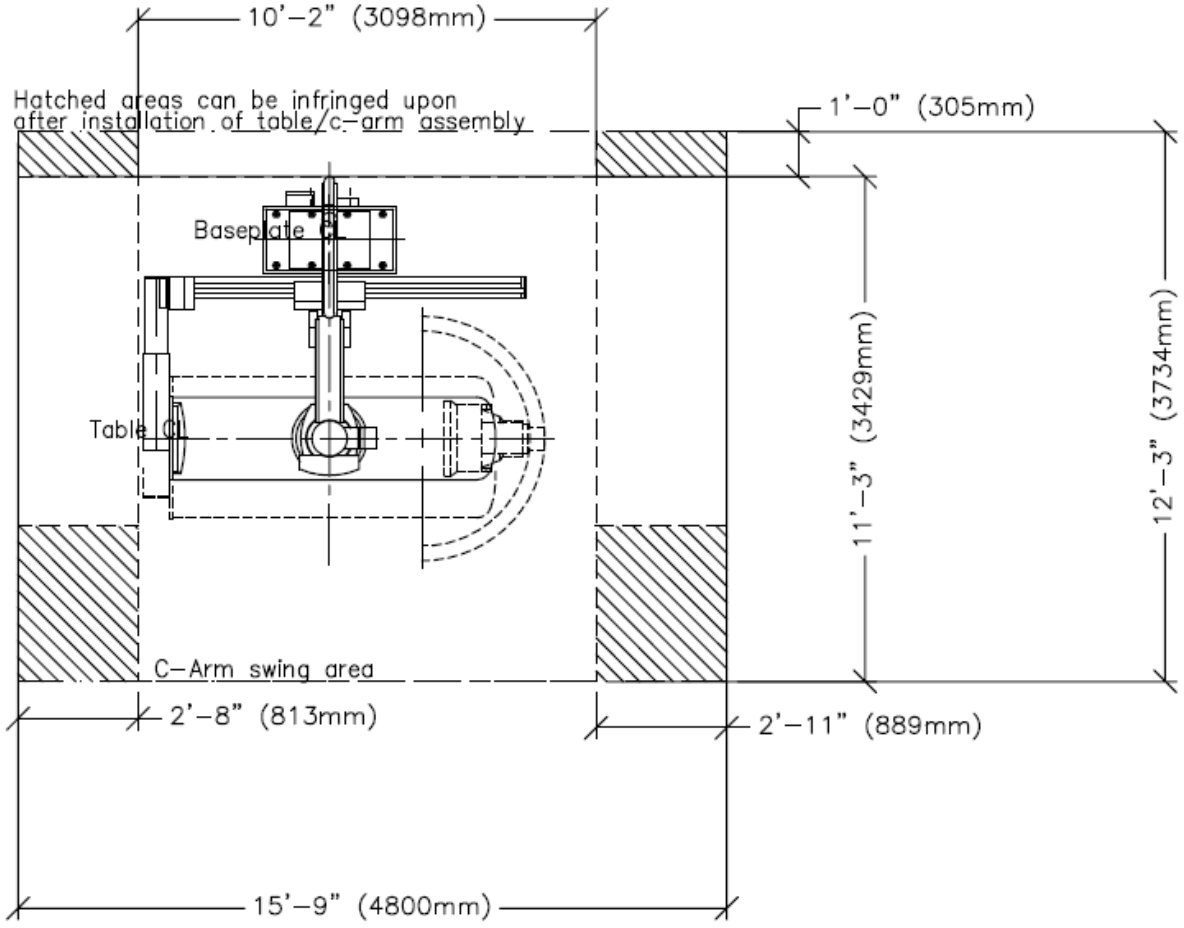


Side View



Top View (with clearances) – table mount on the right side

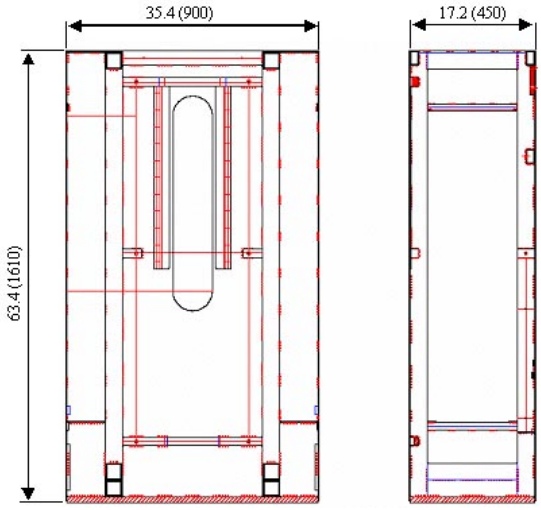
NOTE ! All clearances need to be met for installation and delivery of equipment



Top View (with clearances) – table mount on the left side

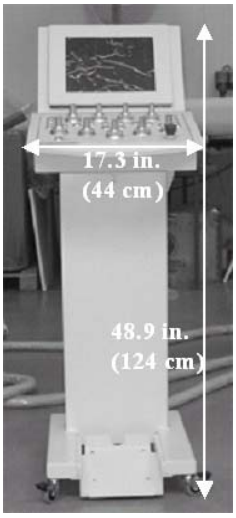
NOTE! These clearances are based on installation using the install dollies and must be met.

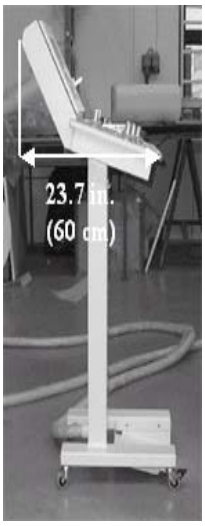
3-2-2 Positioner Cabinet (Base unit of positioner)



Front View Side View

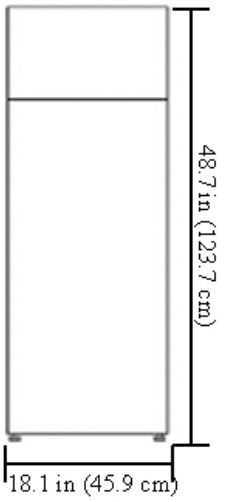
3-2-3 Exam Room Control Console/Panel





Front View (w/RTP) Side View (w/RTP)

3-2-4 Generator



Front View

Right Side View

Generator with GIM (as shipped)

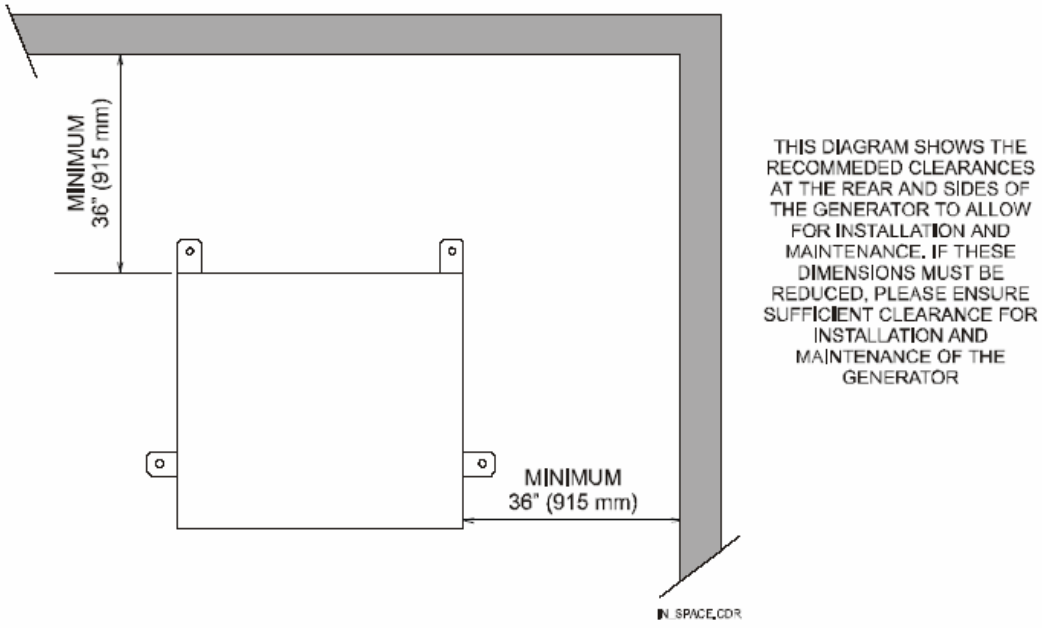
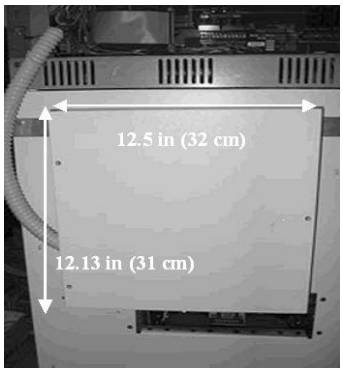
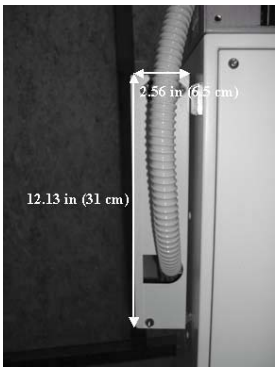


Figure 1C-3: Generator clearances

3-2-5 Generator Interface Module



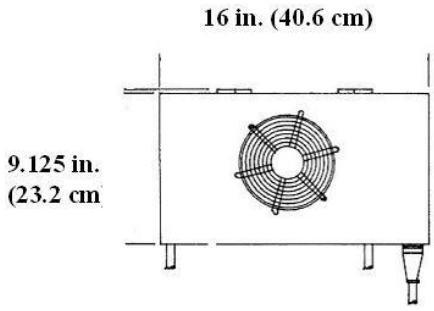
Rear Upper View of Generator

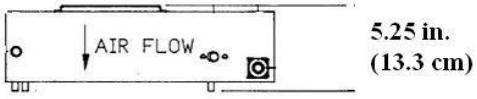


Side View of Generator

3-2-6 Heat Exchanger

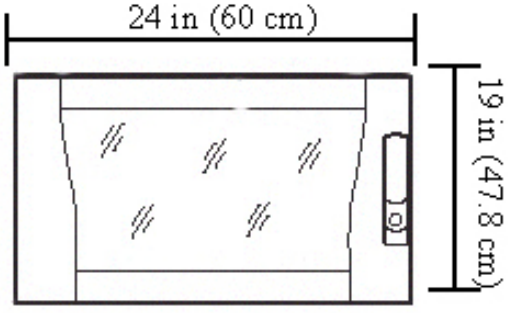
Top View



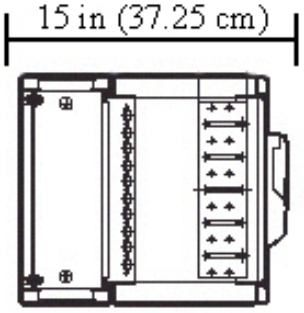


Side View

3-2-7 Collimator Control Module



Front View

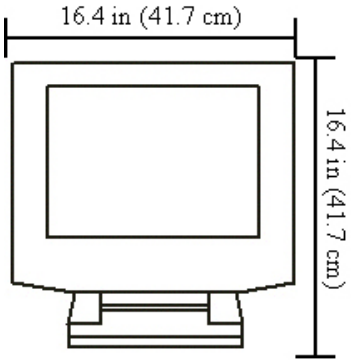


Side View

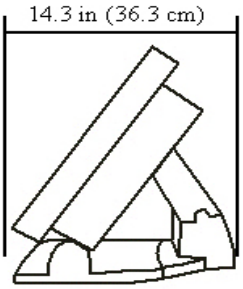
Service Clearances : Sides - 19.7 in (50 cm)
Front - 17.8 in (45 cm)

3-2-8 Control Room Generator Touchscreen

Front View



Schematic Front View

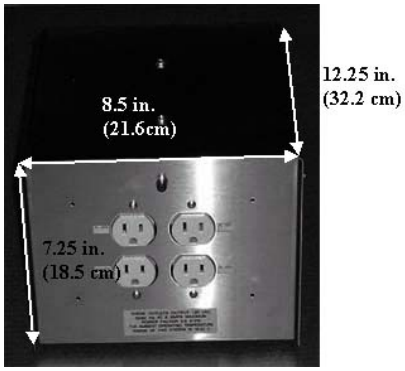


Left Side View

3-2-9 PlatinumOne PC Cabinet

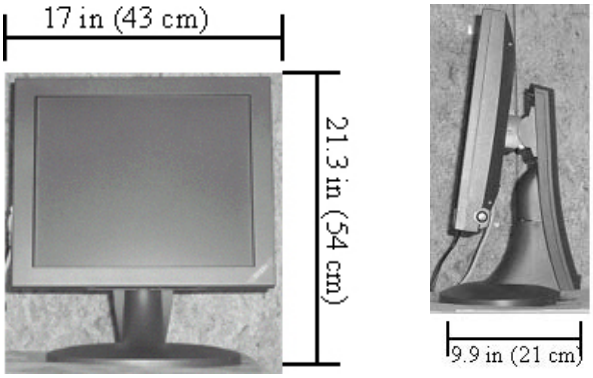
Elevated View

3-2-10 Digital Isolation Transformer



Elevated View

3-2-11 Flat Panel Monitor

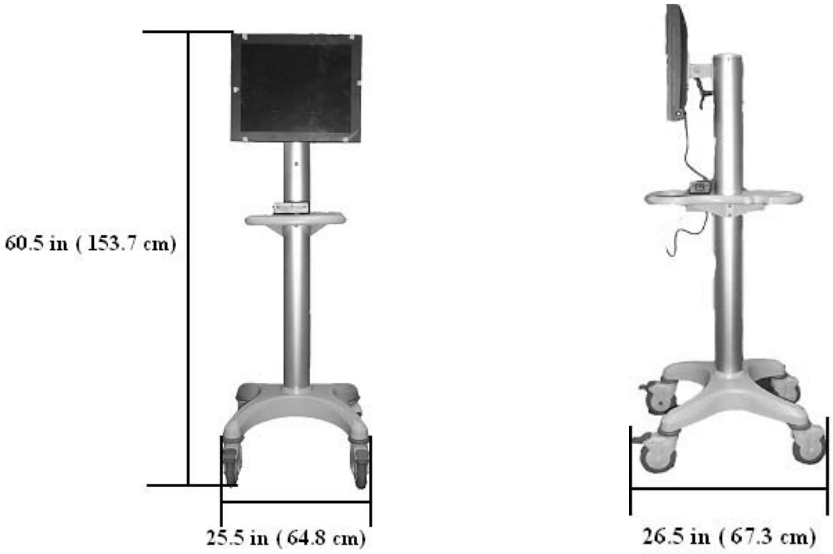


Front View Side View

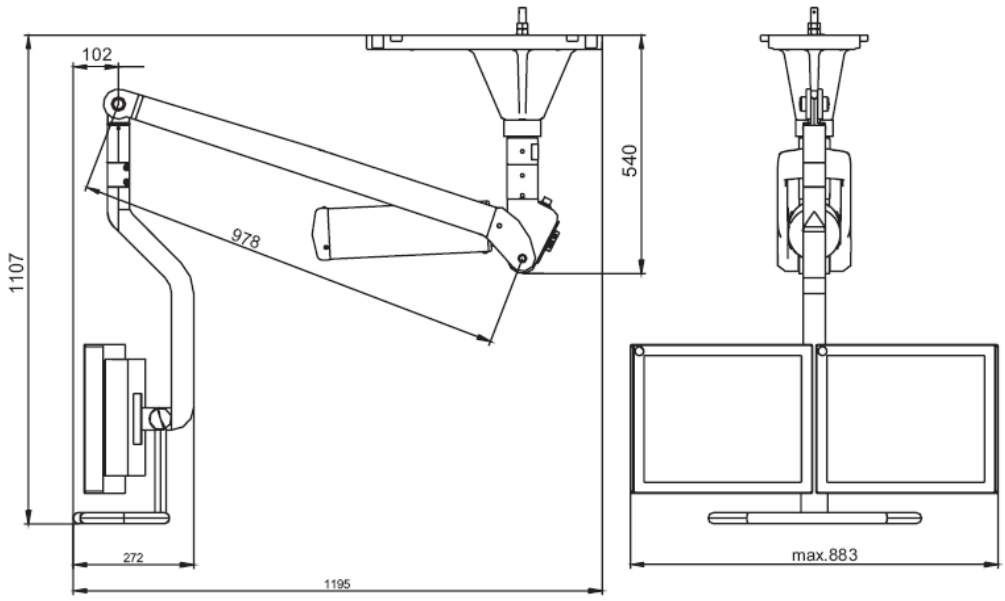
3-2-12 Keyboard

Top View

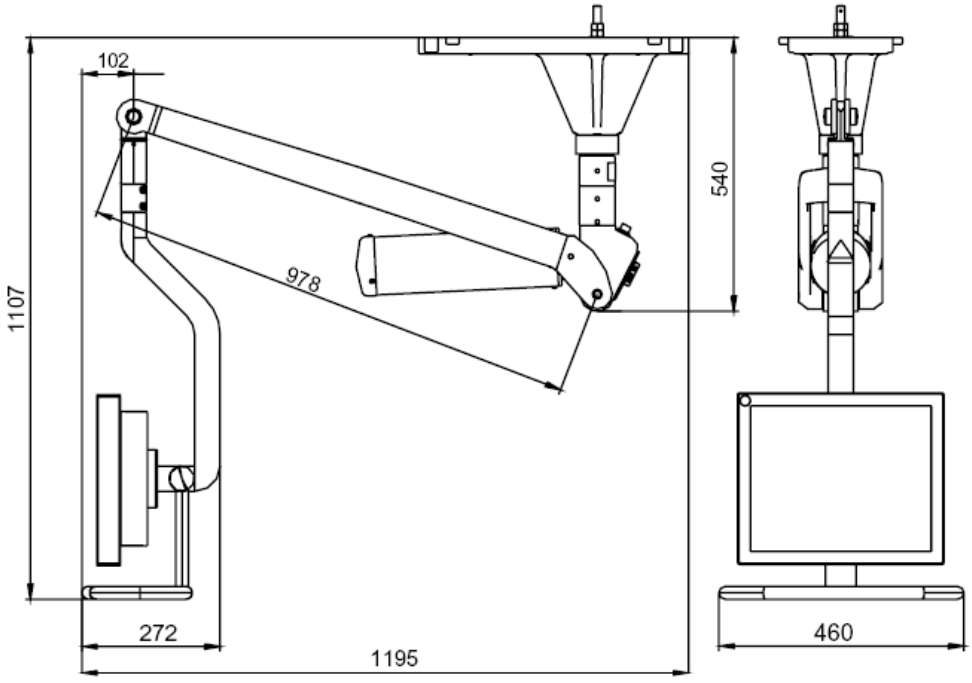
3-2-13 Monitor Cart



3-2-14 LCD monitor suspension

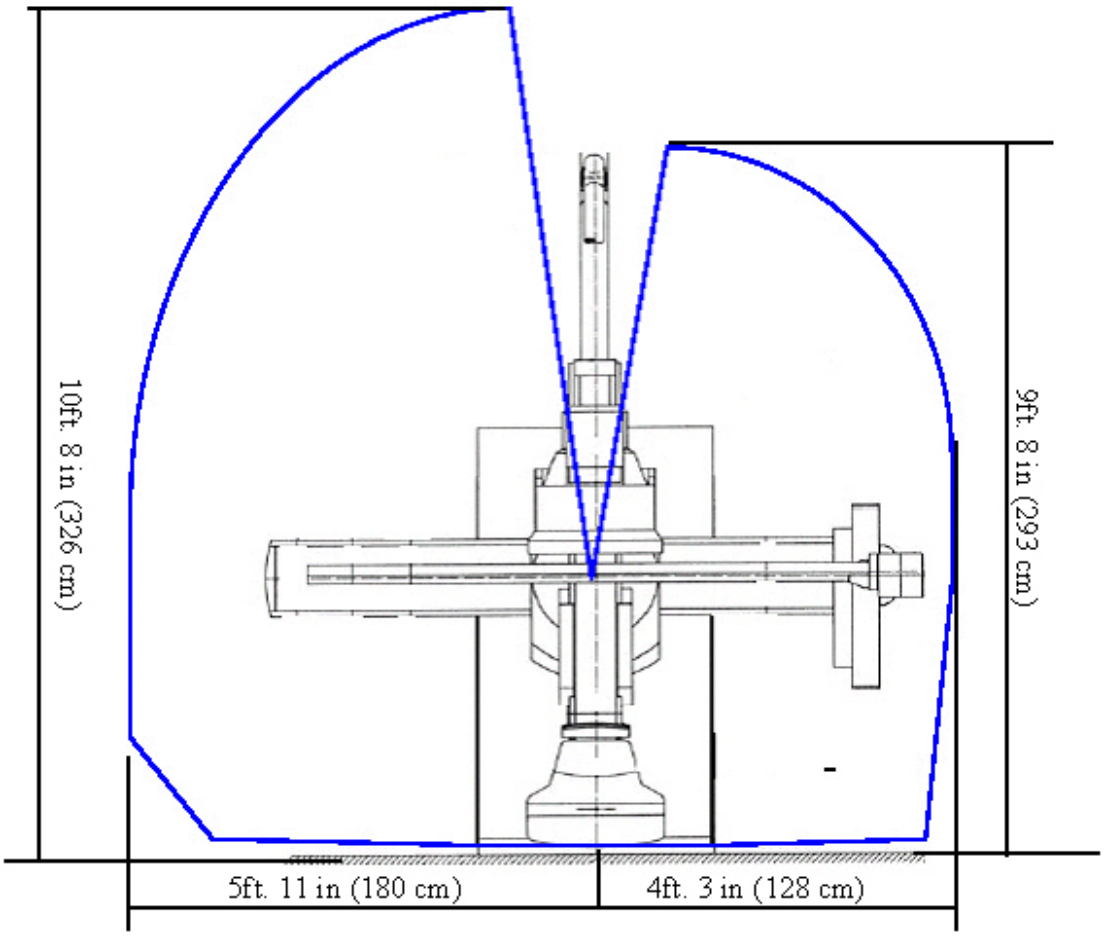


Double monitor suspension



Single monitor suspension

3-3 Volume Curves



Front View

3-4 Positioning and Mounting Equipment

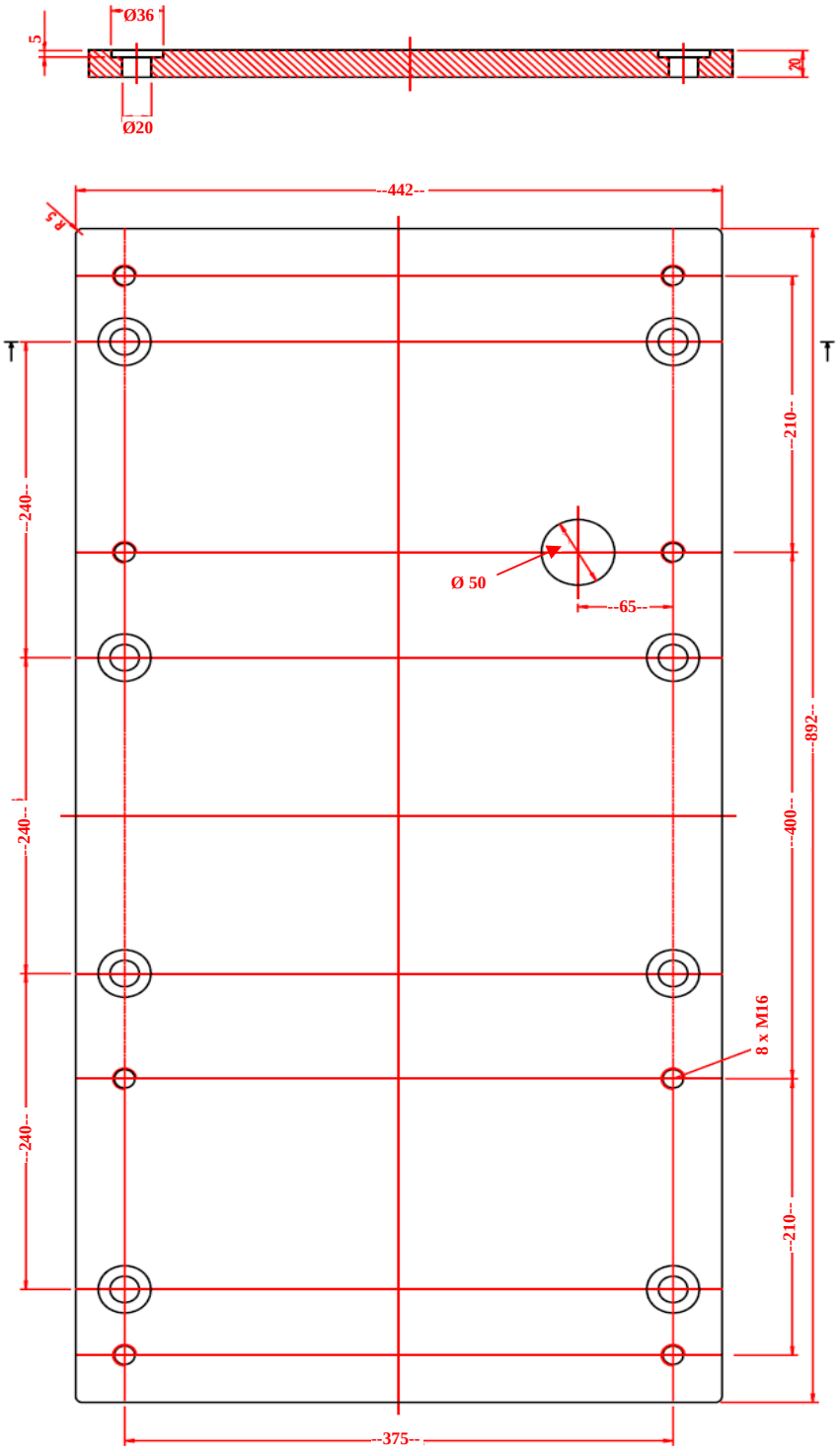
3-4-1 Floor Loading and Recommended Mounting Methods

Go to chapter 9 for floor loading data and bolt pull out strength.

NOTE! This base plate is intended to be installed on the floor. If this base plate is required to be embedded into the floor, then it is required to adjust the positioner cabinet legs accordingly during installation.

3-4-1-1 Positioner Base Plate

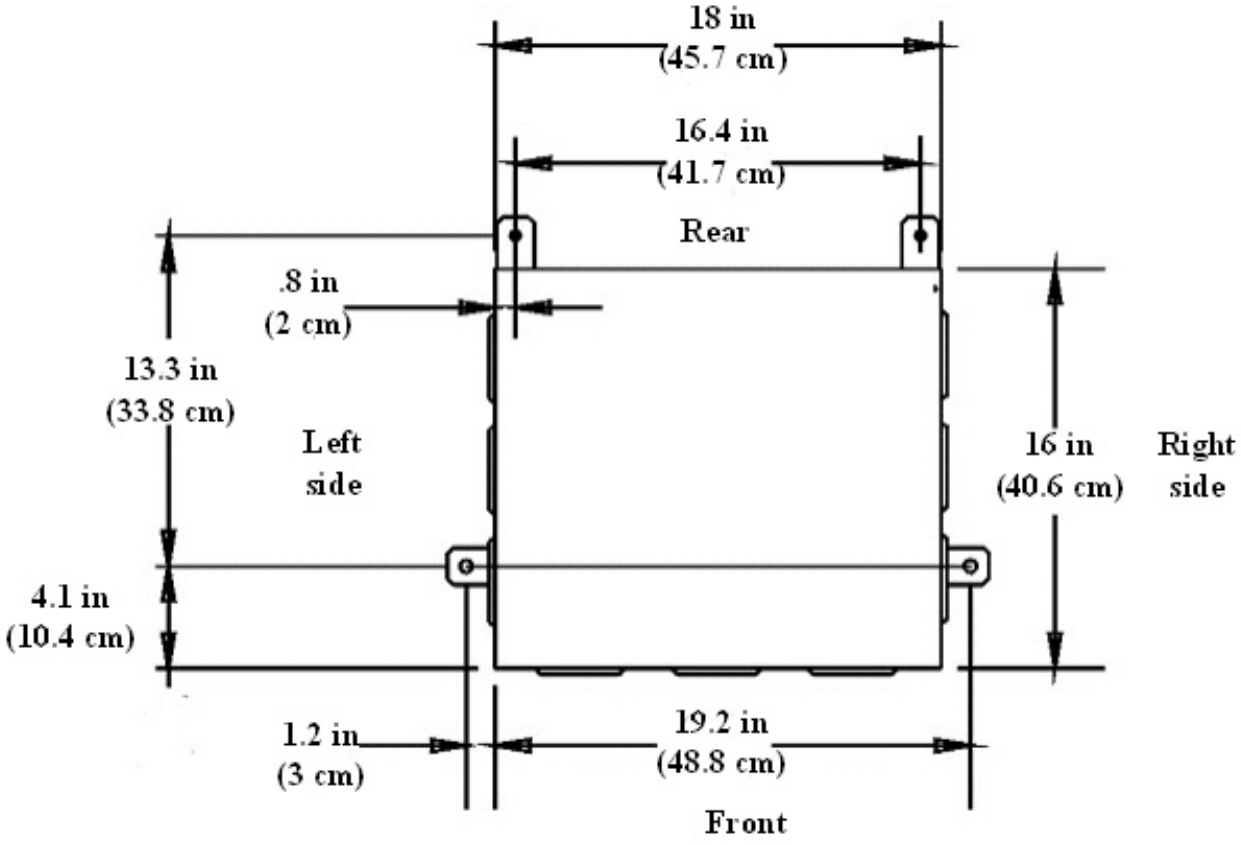
The positioner base plate is normally shipped with the system. Dimensions are shown in the drawing below. The weight of the base plate is 159 lbs (72 kg)



All measurements in mm

3-4-1-2 Generator Base Plate

Dimensions for the generator mounting holes are shown in the drawing below. Mounting holes have a diameter of 10 mm.



3-4-2 Wall Mounting Methods

3-4-2-1 Collimator Control Module

For bolt pull out strength and seismic data, go to chapter 9.

4 Planning Electrical Connections

4-1 Routing Cables

4-1-1 General

Whenever possible, keep high-voltage and power cables away from any other cables. Use separate trough in duct system. Minimize cable length between the line disconnect and the system cabinet power unit to reduce voltage regulation problems and wiring costs. For information about the cables supplied with your system, please refer to section 8.

4-1-2 Conduit

Using conduit imposes some important considerations when used in this system. Of primary concern, the majority of cables used are pre-terminated. Pre-termination greatly simplifies interconnection, but makes cable-pulling difficult because of the added dimensions of the connectors.

Conduit must be large enough to pass the cable and connector through with all other cables already in the conduit. Also, the size of conduit chosen must allow for future growth. There the possibility of additional cables being added later as the system is developed and options are added. The use of conduit is recommended for cables running overhead between rooms, especially when a diagonal run provides the shortest cable path.

4-1-3 Floor Ducts

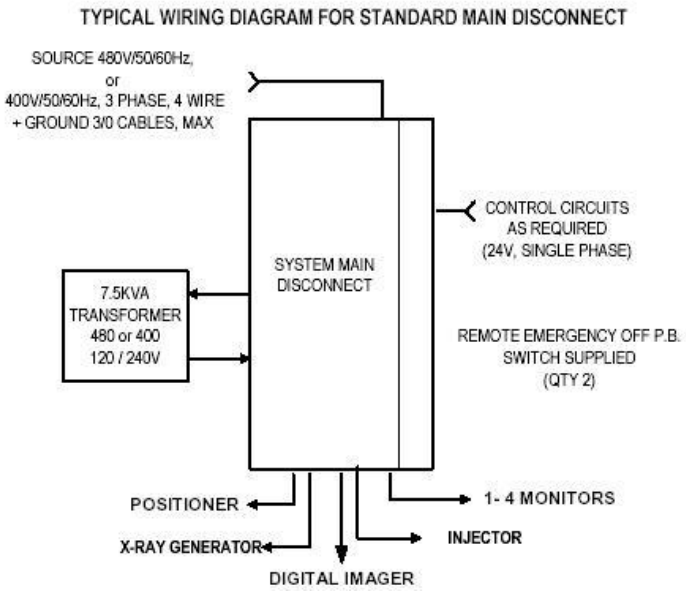
Floor ducts have advantages when used with a single room or adjacent rooms. Floor duct combines cabling in a neat, functional appearance with accessibility and room for expansion. The disadvantage is the amount of work required to install it, which is generally prohibitive in existing installations. For the same reason, it is impractical to attempt to add on to existing floor duct systems.

4-1-4 Raceways

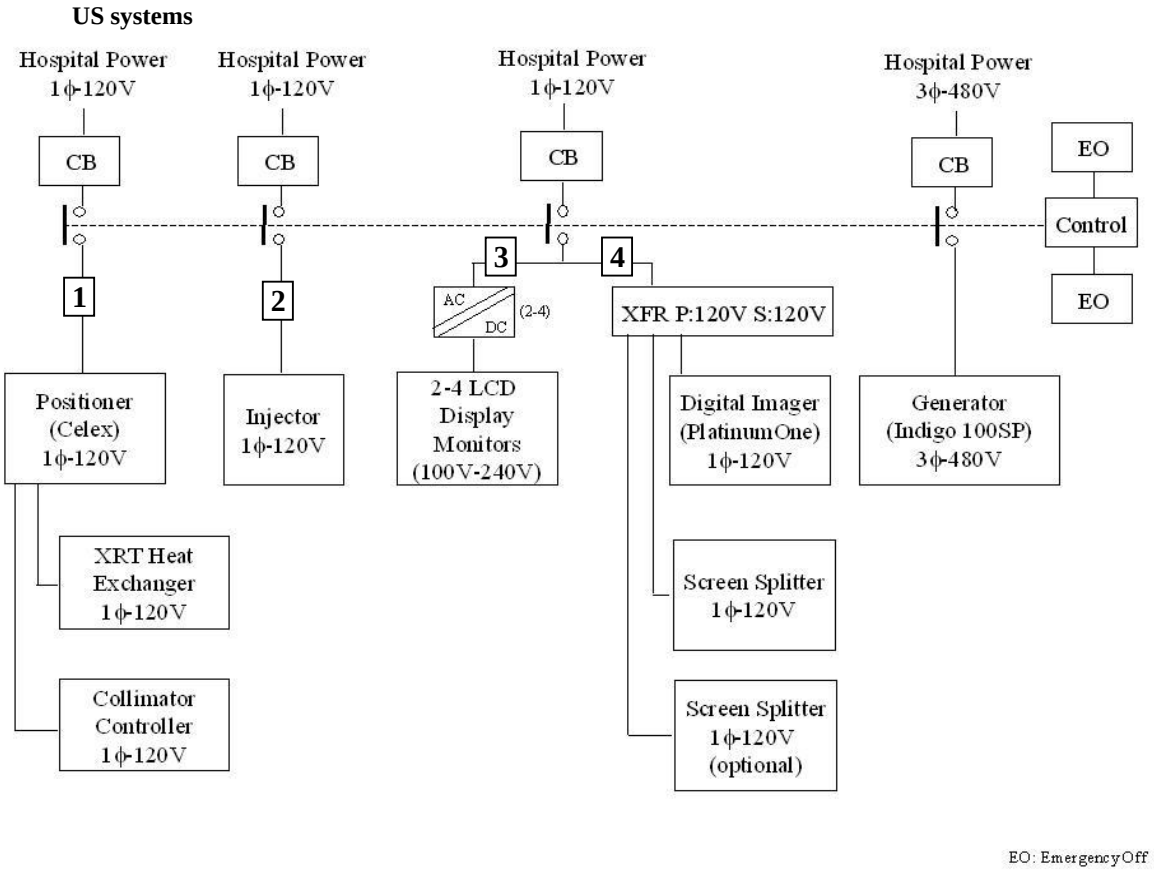
Surface mounted raceways offer some unique advantages. It's very practical for existing structures, since it is surface-mounted. There is no problem with pre-terminated cables, since the entire raceway system can be opened. They are easy to expand compared to other means of routing cables.

4-1-5 Power Distribution

Catalog #: E4502KM

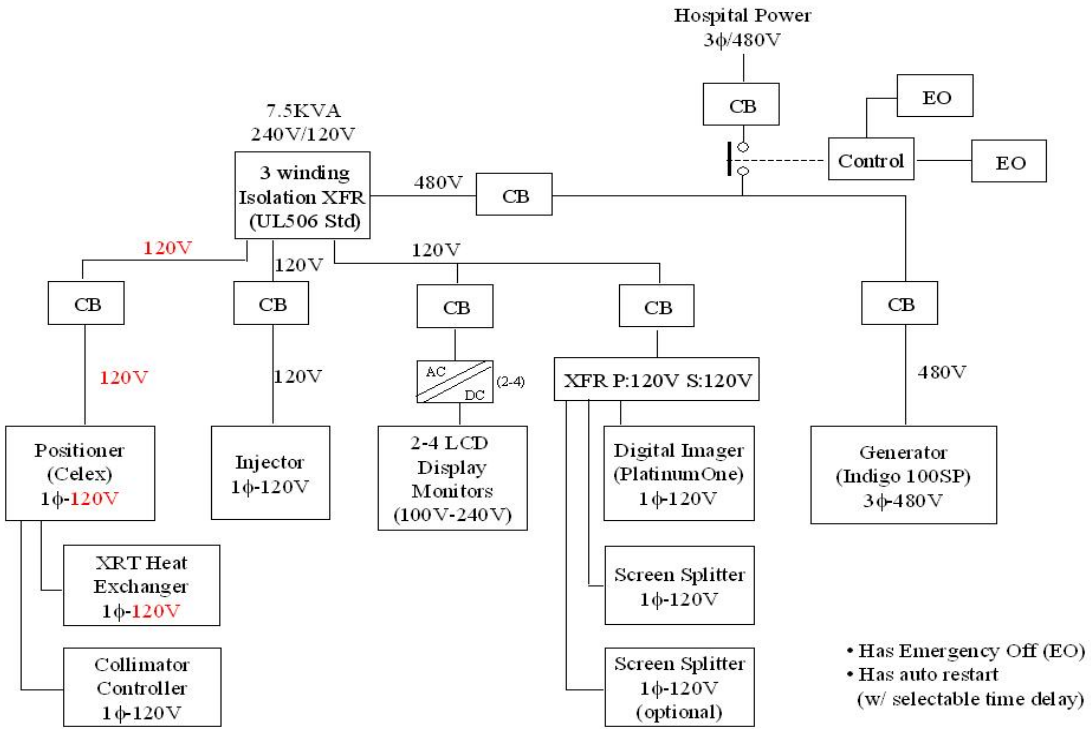


4-1-6 Power



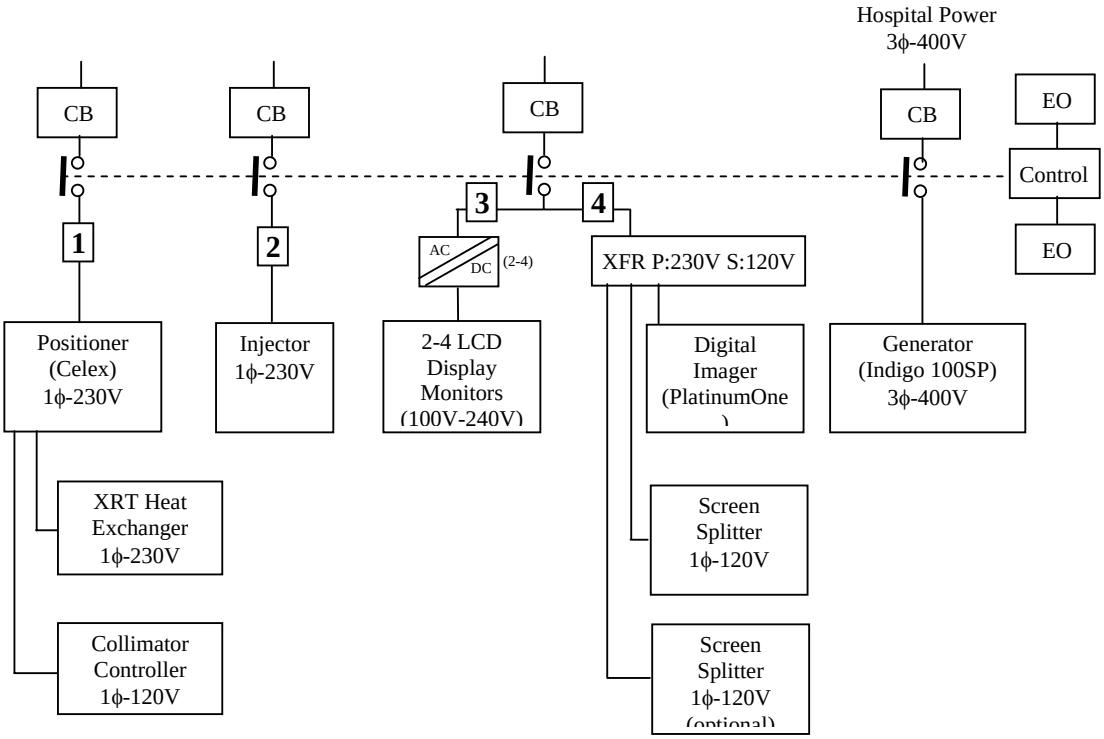
Note! Connections 1 – 4 are field supplied

Power requirements without industrial panel
(North Amerika – 480 V, 60 Hz)



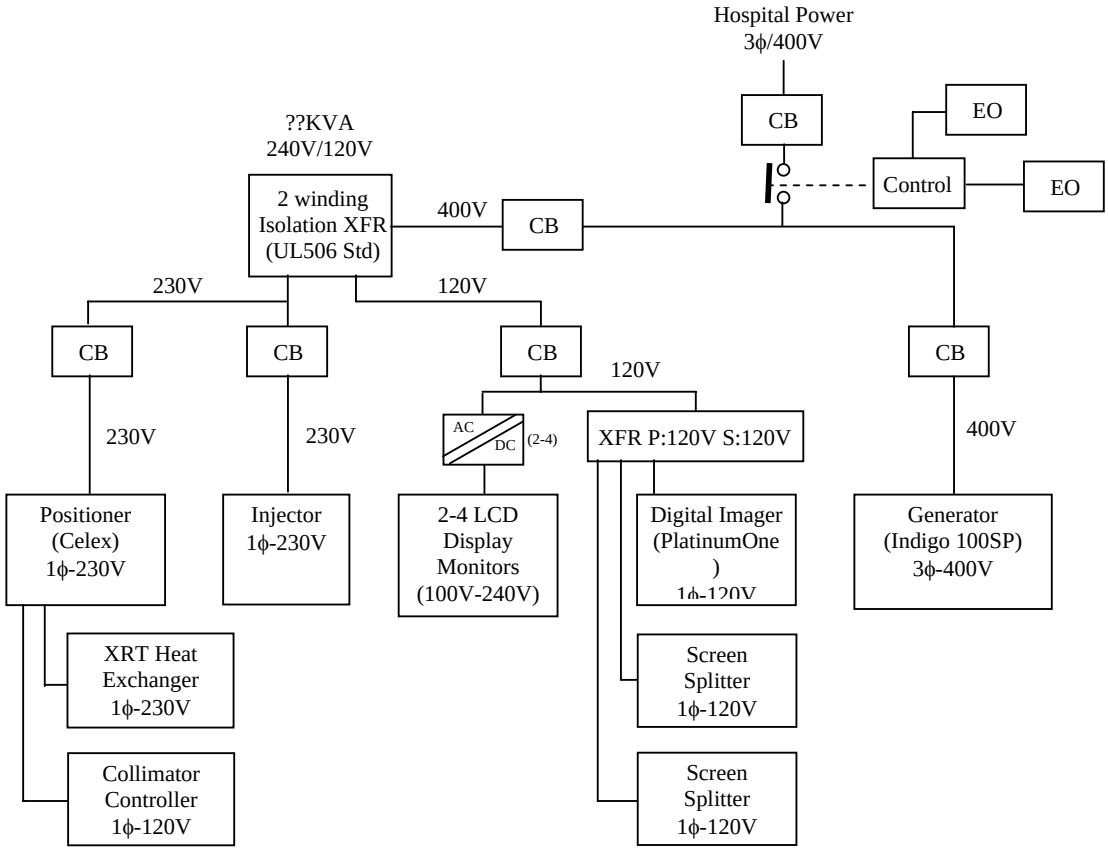
Power requirements with industrial panel
(North Amerika – 480 V, 60 Hz)

European systems



Note! Connections 1 – 4 are field supplied

Power requirements without industrial panel
(Europe – 400 V, 50 Hz)



Power requirements with industrial panel
(Europe – 400 V, 50 Hz)

4-2 Master Interconnect System (MIS)

System interconnect cables are described in MIS (Master Interconnect System) documents shipped with the system. These documents specify all interconnections between components within the system and its options.

For Specific Precision MPi R&F system interconnect maps and connection details, please refer to the following service Manuals:

- Direction 2404511-100TPH
- Direction 2404512-100TPH

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5 Laying Out the Room

5-1 Considerations

5-1-1 Radiation Protection

Because X-ray equipment produces radiation, you may need to take special precautions or make special site modifications. GE Medical Systems does not make recommendations regarding radiation protection. It is the purchaser's responsibility to consult a radiation physicist for advisement on radiation protection in X-ray rooms. Remember to locate the User Interface per local codes and regulations. The User Interface must not be located anywhere there's a possibility of exposing the operator to radiation during use.

5-1-2 Service Access

Allow appropriate space for service access of equipment. Consult component pre-installation direction for clearance in formation.

5-1-3 Clinical Access

Make sure the you plan the room with the following access requirements:

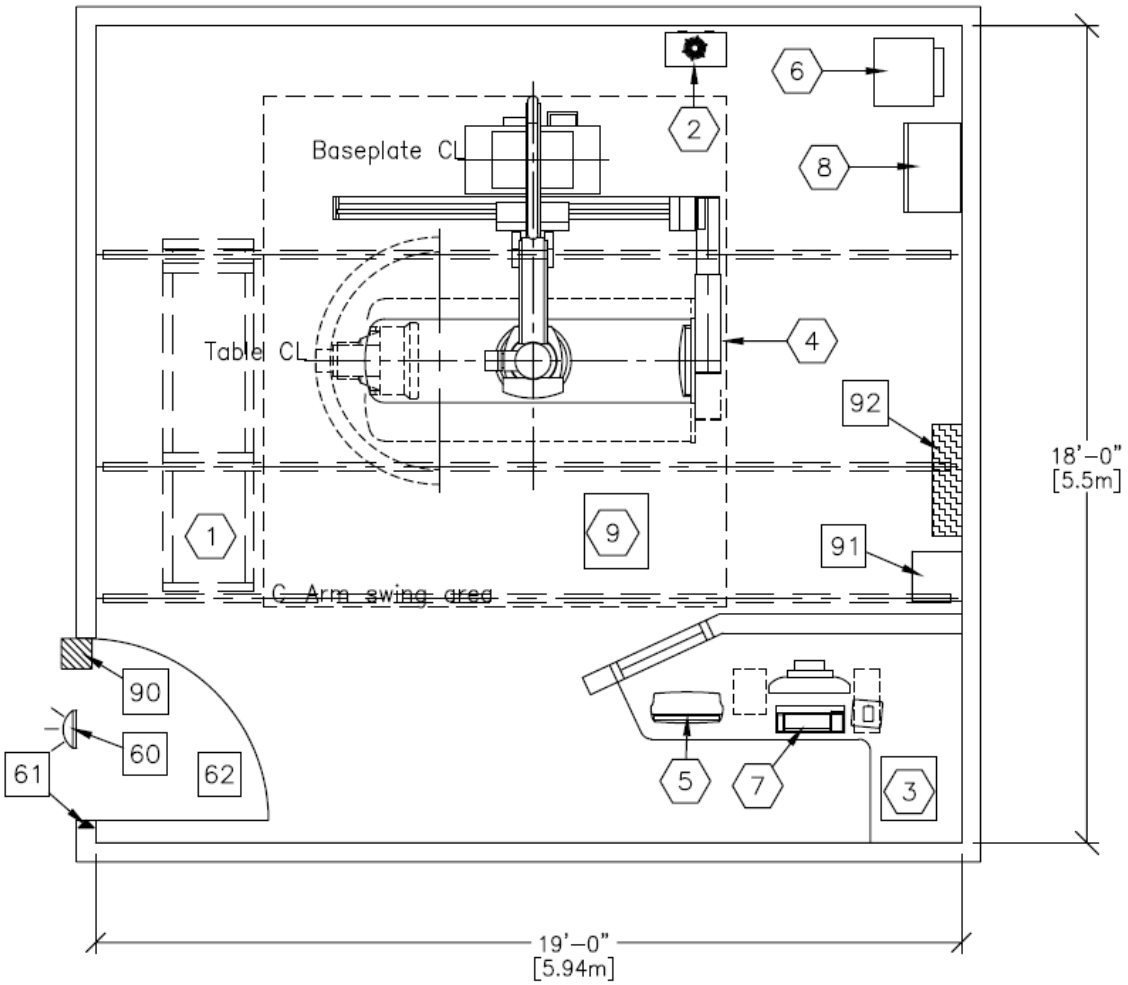
- Provide easy access to the patient table. Stretchers and other mobile hospital equipment must reach the table quickly.
- Clinicians at the patient table must be able to communicate with assistants in the control area monitoring equipment from the R&F table.
- Operators in the control area must have easy access to the control console. However, position the controls so the operator cannot take exposures while looking around or standing outside the control booth's lead glass window.
- Operators in the control area must have easy access to video recorders and injector programmers, film and video storage cabinets, and service and operating manuals.
- Consult customer on the number and location of non-electrical lines (air, oxygen, vacuum, water, etc.) in the R&F room.

5-1-4 Peripheral Equipment

Consult hospital personnel regarding additional space requirements for the following types of hospital equipment:

- Storage cabinets
- Sinks
- Oxygen stations
- IV apparatus
- Injectors
- Heart monitoring equipment
- Crash cart

5-3 Typical Room Layout



Recommended minimum room size incl. Control room

1. LCD monitor suspension on XT inboard bridge
2. Heat exchanger
3. Positioner control panel
4. Precision MPi Positioner
5. Generator touch screen
6. Precision MPi generator
7. Digital review station
8. Collimator control cabinet
9. Mobile Positioner control panel
60. X-ray on warning light – Available from GE supply, call 800-200-9760 ext. 3985
    GE CAT no. WXIABWW-OF-XIU
61. Door limit switch
62. Minimum door opening for equipment delivery: W 48 in x H 80 in
90. X-ray room warning light / room lighting control panel. GE CAT no. E4500AL
91. Step down transformer, reference junction point “tran” on sheet E1 for description,
    part of CAT no. E4502KM / E4502KN
92. Main disconnect, reference junction point “A” on sheet E1, CAT no. E4502KM / E4502KN

6 System Facility Power & Grounds

6-1 Introduction

The purpose of this section is to ensure that the product is properly powered and grounded. Thus ensuring the proper operation of the product installed. The information in this chapter should be adhered to, unless there are written deviations approved by GE Medical Systems.
This section gives the sizes and procedures, on how to power and ground your system if these power and grounding instructions are not adhered to, proper operation cannot be guaranteed. Any cost associated and found to be result of non-conformity, as stated in this section may result in additional cost charged back to the institution and/or their contractor.

6-2 Electrical Power and Disconnects

6-2-1 Power Quality

The electrical power from its origination to the system, must adhere to the wire size and transformer sizes, as prescribed in the installation drawings. The feeder voltage-drops as well as the supplying power must be given within the parameters. Sizing for feeder is usually calculated for a maximum of 2% voltage drop at the minimum voltage range. The actual feeder size may vary from the installation drawing for a facilities voltage.

Calculate feeder losses before you begin. Total feeder losses must be calculated to ensure that the losses are less than those specified in the installation drawings. Calculating the recommended minimum transformer sizing feeding a system, ensure the transformer losses are less than half of the maximum regulation for the system.

Regulation is the calculated voltage losses for the entire power distribution system (No-Load Voltage minus Full-Load Voltage) divided by the no-load voltage minus the system losses (Full-Load Voltage)

$$\text{Regulation} = \frac{NoLoadVoltage - FullLoadVoltage}{FullLoadVoltage} \times 100$$

In the X-ray room, there must be a lockable facility power disconnect. It must be installed electrically before the equipment, for the purpose of locking out the power. This must be done before service to the high voltage is performed.

6-2-2 Electrical Requirements

6-2-2-1 Generator Electrical Requirements

Note: Shunt trip circuit breaker required.
The main circuit breaker supplied by the customer must be sized in accordance with local regulations and have remote (shunt) trip.

6-2-2-1-1 System Power Specifications

VOLTAGE AND FREQUENCY REQUIREMENTS – US Systems

Precision MPi COMPONENT	**VOLTAGE**			**FREQUENCY**			**POWER FACTOR**	**INPUT IMPEDANCE**	**% REG**
	NOM	MIN	MAX	NOM.	MIN	MAX			
Generator	480 VAC, 3 phase	-10%	+10%	60 Hz	N/A	N/A	N/A	0.12 ohms	x % 2A
Heat Exchanger (HE320) powered by Positioner	115 VAC, single phase	110 VAC	120 VAC	50/60 Hz			N/A	N/A	N/A
Positioner	115 VAC, single phase	-10%	+10%	60 Hz	N/A	N/A	N/A	N/A	N/A
Digital Transformer	115 VAC, single phase	-10%	+10%	60 Hz	59.5 Hz	60.5 Hz	N/A	N/A	N/A
LCD Monitors (2 or 3) – powered by the Digital Xformer	115 VAC	100 VAC	240 VAC	50/60 Hz	59.5 Hz	60.5 Hz	N/A	N/A	N/A

VOLTAGE AND FREQUENCY REQUIREMENTS – European Systems

Precision MPi COMPONENT	**VOLTAGE**			**FREQUENCY**			**POWER FACTOR**	**INPUT IMPEDANCE**	**% REG**
	NOM	MIN	MAX	NOM.	MIN	MAX			
Generator	400 VAC, 3- phase	-10%	+10%	50 Hz	N/A	N/A	N/A	0.09 ohms	
Heat Exchanger (HE321) – powered by the Generator	230 VAC, single phase	220 VAC	230 VAC	50/60 Hz	xx Hz	xx Hz	N/A	N/A	N/A
Positioner	230 VAC, single phase	-10%	+10%	50 Hz	N/A	N/A	N/A	N/A	N/A
Digital Transformer	230 VAC, single phase	-10%	+10%	50 Hz	49.5 Hz	50.5Hz	N/A	N/A	N/A
LCD Monitors (2 or 3) – powered by the Digital Transformer	230 VAC, single phase	100 VAC	240 VAC	50/60 Hz	49.5 Hz	50.5Hz	N/A	N/A	N/A

CURRENT REQUIREMENT – European System

Precision MPi Component	**Voltage [V]**	**Maximum input power [kVA]**	**Maximum input current [A]**	**Rated input current [A]**
Positioner unit	**230**	**2.5**	**11**	**16**
Generator	**400**	**130**	**195**	**100**
Injector (values depend on which option selected)	**230**	**1.0**	**4.3**	
Digital system (supplied through the isolation transformer) and the LCD image monitors	**230**	**1.0**	**4.3**	

CURRENT REQUIREMENT – US System

Precision MPi Component	**Voltage [V]**	**Maximum input power [kVA]**	**Maximum input current [A]**	**Rated input current [A]**
Positioner unit	**120**	**2.5**	**11**	**32**
Generator	**480**	**130**	**160**	**100**
Injector (values depend on which option selected)	**120**	**1.0**	**8.3**	
Digital system (supplied through the isolation transformer) and the LCD image monitors	**120**	**1.0**	**8.3**	

6-2-2-2 Recommended Wall "Circuit Breaker" Ratings

The wall circuit breaker for the generator must be 100A for US systems and 80A for EU systems.

6-3 Electrical Grounds

6-3-1 System and Facility Grounds

The ground for this system must originate at the system's power source and be continuous (i.e., transformer or first access point of power into a facility, and be continuous to the system power disconnect in the room.) Ground connection at the power source must be at the grounding point of the "Neutral/Ground" if a "Wye" transformer is used, or typical grounding points of a separately derived system. In the case of an external facility, it must be bonded to the facility ground point at the electrical service entrance.

The "system" ground can be splice using "High Compression Fittings" but must be properly terminated at each distribution panel it passes through. When it's terminated, it must be connected into an approved grounding block. Incoming and outgoing grounds must terminate at this same grounding block. Grounds must only be terminated to approved grounding blocks. Grounds must never connect directly to he panel, frames or other materials in a cabinet or distribution panel.

6-3-2 Recommended Ground Wire Sizes

The ground wire must be copper and never smaller than 1/0 AWG.

The ground wire impedance from the system disconnect (including the ground rod) measured to earth, must not exceed 2 ohms (as measured by one of the applicable techniques described in Section 4 of ANSI/IEEE Standard 142-19820. Refer to Figure 6-5 and Figure 6-6 for typical equipment and methods to measure the different portions of the 2-ohm impedance.

6-3-2 Grounding the Invasive Procedure Room

Invasive procedure room shall have all exposed metal parts that are likely to become energized, grounded to an approved grounding bus located near the patient ground point (room ground point). Parts that are likely to become energized include such things as high intensity lights or injectors, but would not include doorframes or monitor booms. All room outlets and emergency power sources in the room shall have isolated ground receptacles with the primary grounding coming from the power source and a secondary ground bonded to the room ground point. For the receptacle or the electrical box which powers the injector power module there must be one ground wire back to the room ground point even if the power module is in a separate room. The ground wire between the room ground point and the patient ground point shall be copper wire of AWG #2 and not more than 10 feet long.

Where a ground fault circuit is used for room outlets, the ground wire to the room ground point shall be connected on the primary ground of the ground fault detector to prevent tripping the detector. All ground wire impedances shall be less than 0.1 ohms, when measured to the room ground point.

6-3-2 Grounding Critical Care Areas

Typically, R&F rooms are used as a critical care area and require a special grounding system for patient safety. An equi-potential grounding system is recommended for meeting patient safety requirements.

For some general system grounding requirements and information on establishing an equi-potential grounding system, refer to:

- Direction 46-104505, Electrical Safety – Equipment Grounding
- Direction 46-104506, Electrical Safety – Leakage Currents

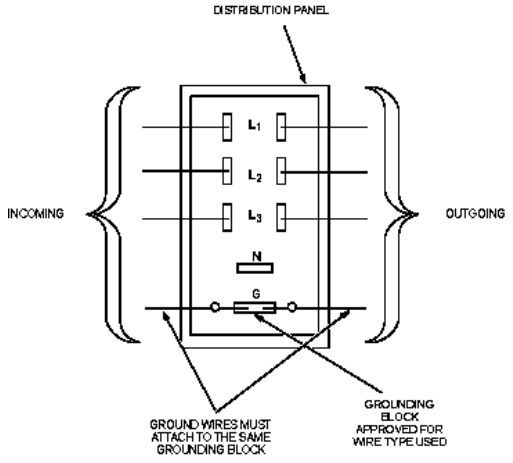
6-3-5 Final Checks, Before System Installation Can Begin

The customer must provide GE Medical Systems or its representative (installation specialist) evidence that grounds and electrical power meet GE Medical Systems' specifications.
Prior to product installation, a local service or installation specialist, to be determined by GEMS, will do a physical walk-through of the exam suite to ensure the following.

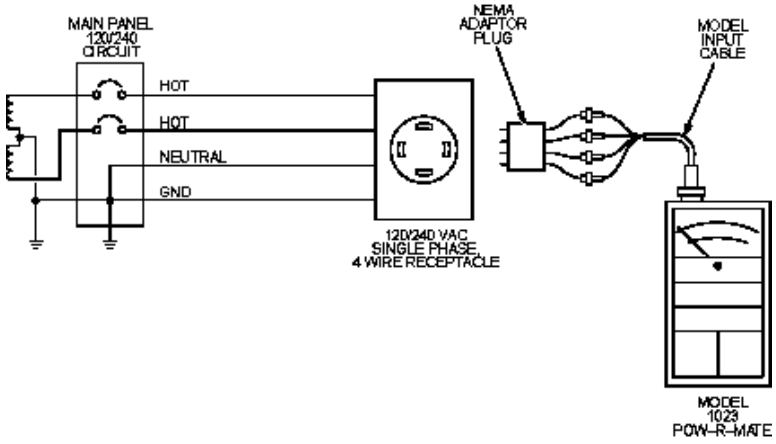
1) Ground wires are of the same size as the power feeder or AWG 1/0, whichever is larger.
2) Grounds at junction points are connected properly and securely to an approved ground bus
3) Grounds within an enclosure are tied together by copper wire or to an appropriate buss bar (i.e., separate buss bars within an enclosure must be tied together with copper wire of appropriate size.
4) Grounds originate at the power source (i.e. transformer or entrance panel into facility).
5) Ground wires measure less than 2 ohms to earth.

You may use the following form to record the results of that inspection.

GROUND IMPEDANCE MEASURED TO BE _____ OHMS
Inspector's Name and Date:_____
Customer's Name and Date:_____



Ground Connection at Distribution Panel



Wire Impedance Test

7 Planning Aids and delivery information

7-1 Door Size Requirements

The minimum door size requirement depends on how the equipment is transported into the exam room. If delivered on pallets on a pallet jack minimum requirements are according table 3, though the critical width is 85 cm since pallet 1 and 2 can be split into 2.

Doors less than 30.5 in (85 cm) wide, based on a straight approach, will require additional intervention (removing door frame, knocking out a partition wall, etc.)

If delivered on dollies the requirements are according to chapter 7-1-2.

Note: Installation wheels TOOL0268 are not delivered with the system.

Remember the equipment must travel from outside the building to the designated room so hallways, doorways, and elevators needed for delivery must have sufficient clearance.

7-1-1 Transportation on pallets

Table 3 MINIMUM DOOR SIZES

Pallet	Width	Length	Height	Weight
Pallet 1 Base unit with main arm Table top Side arm Cable guide Standard accessories	41.73 in (106cm)	107.46 in (273 cm)	72.83 in (185cm)	2870 lbs (1300 kg.)
Pallet 2 Positioner LCD monitor Generator touch screen Isolation transformer for the image system Image intensifier Generator Digital image computer Positioner control panels Remote touch panel	41.73 in (106cm)	107.46 in (273 cm)	**72.83 in (185cm)**	1300 lbs (590 kg.)
Pallet 3 C-arc Tube suspension Heat exchanger (optional on RF systems)	32.67 in (83cm)	91.73 (233 cm)	**61.41 in (156cm)**	993 lbs (450 kg.)

7-1-2 Transportation dollies

Large parts of the equipment (C-arc and positioner Base Unit) can be transported from the unpacking area using transportation dollies as shown in the pictures below.

Picture 1

Picture 2

Picture 3

Dimentions for C-arc and Positioner Base Unit with transportation dollies attached

C arm
L = 66.9 in (170 cm)
H = 39.4 in (100 cm)
W = 51.6 in (131 cm)

NOTE! The width given is referring to the recommended transportation position as shown in picture 1 and 2. If dollies are mounted as shown in picture 3 the width can be reduced to 85cm.

Positioner
L = 98.4 in (250 cm)
H = 68.9 in (175 cm)
W = 30.3 in (77 cm)

7-2 Materials and Tools

7-2-1 Tools and Materials Needed But Not Shipped with the Product

The following tools and material are needed ton install the product

- Anchor bolts for generator and positioner gantry. See chapter 9 for anchoring details.
- Wall anchors for Collimator Control Module See chapter 9 for anchoring details.
- Power feed for generator
- Main cable for positioner
- Transportation dollies (not supplied with the system)

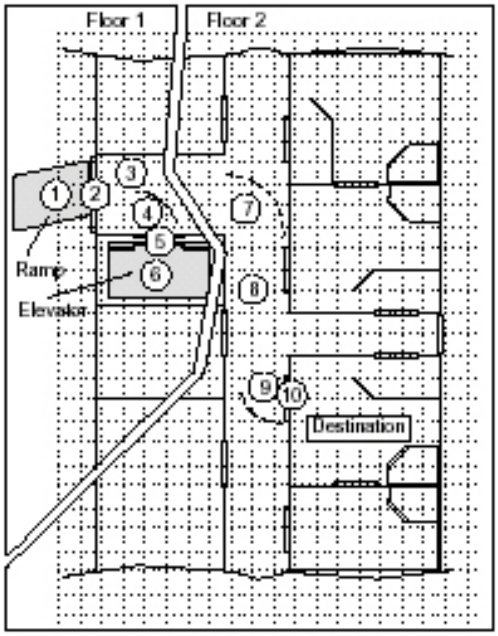
7-2-2 Materials Provided with Product

The following items are provided with the product (as part of the pre-install kit):

- Transformer oil and high voltage insulating grease
- Touch-up paint

7-3 Preparing the Delivery Route

1) Step One – Sketch out the Route
Begin preparing the Route Survey by sketching the area of the hospital or clinic, which will receive the equipment. Include all areas on the delivery route from outside of building to destination. See sample sketch below.



2) Step Two – Survey the Route
Record all loading capacities, corridor widths, door openings, turning radii, flooring materials, elevator sizes, obstructions, and so on for reference.

3) Step Three – Check the Route
Verify equipment can actually be transported via the route determined in step 1.

7-4 Pre-Installation Checklist

Delivery Date: _____ Sales Person: _____
Customer: _____ FDO No.: _____ Room # _____
Equipment: _____

Physical Requirements of Site	**Completed**
1.) Room size adequate for intended equipment configuration?	☐
2.) Floor and ceiling is strong enough for intended equipment and mounting methods approved – seismic regulatory codes considered?	☐
3.) Delivery route accommodates all intended equipment?	☐
4.) Radiation physicist consulted?	☐
5.) Necessary alterations made to circumvent obstructions?	☐
6.) Modifications to room finished?	☐
7.) Supports, platforms, suspensions, ceiling materials been provided?	☐
8.) Support structures installed for floor, ceiling, and wall mounted equipment?	☐
9.) Ceiling supports leveled?	☐
10.) Has floor been modified for cable ducts?	☐
11.) If drop-in ceiling is not used, is access panel provided (3 x 2 ft. minimum)?	☐
12.) Electrical service in place – at the ratings specified in pre-installation documentation?	☐
13.) Power available to operate power tools?	☐
14.) All non-electrical lines (air, water, oxygen, vacuum) installed?	☐

Interconnections	**Completed**
1.) Signal cable, power and grounding plans produced?	☐
2.) Necessary interconnection hardware, such as junction boxes, conduit or raceways, and fittings provided?	☐
3.) Interconnection hardware installed?	☐
4.) Flexible, stranded wire provided for System input power connection?	☐
5.) System "feeder" power cables pulled and sufficient length available at disconnect box for connections?	☐
6.) Interconnecting cables continuity checked, and labeled?	☐

Interconnections	Completed
7.) All high voltage cable lengths verified?	☐
8.) Interface information available for equipment?	☐

General	Completed
1.) Ceiling, walls, and floor clear of all obstructions?	☐
2.) Walls finished?	☐
3.) Finished floor installed?	☐
4.) Room lights installed?	☐
5.) Dust-creating work completed?	☐
6.) Old equipment within room removed?	☐
7.) Component positions clearly marked on floor?	☐
8.) Space available to store equipment?	☐
9.) Lock on door, or locked room available?	☐
10.) Room IP Addresses for DICOM and Broadband identified?	☐
11.) Dedicated inbound "dialup" phone line provided for InSite connection?	☐
12.) Optional media converter power supplies obtained (for UK or continental Europe)? *Media Converter - The power adaptor currently supplied with the Allied Telesyn media converter (AT-FS202) is rated for 120VAC operation only. For UK and continental European sites requiring 240 VAC input, the adaptor must be customer supplied. Contact Allied Telesyn ((see contact information supplied in Allied Telesyn installation guide, or find equivalent 240VAC to 12VDC/0.5A adapter.*	☐

Comments: _____

_____

_____

_____

_____

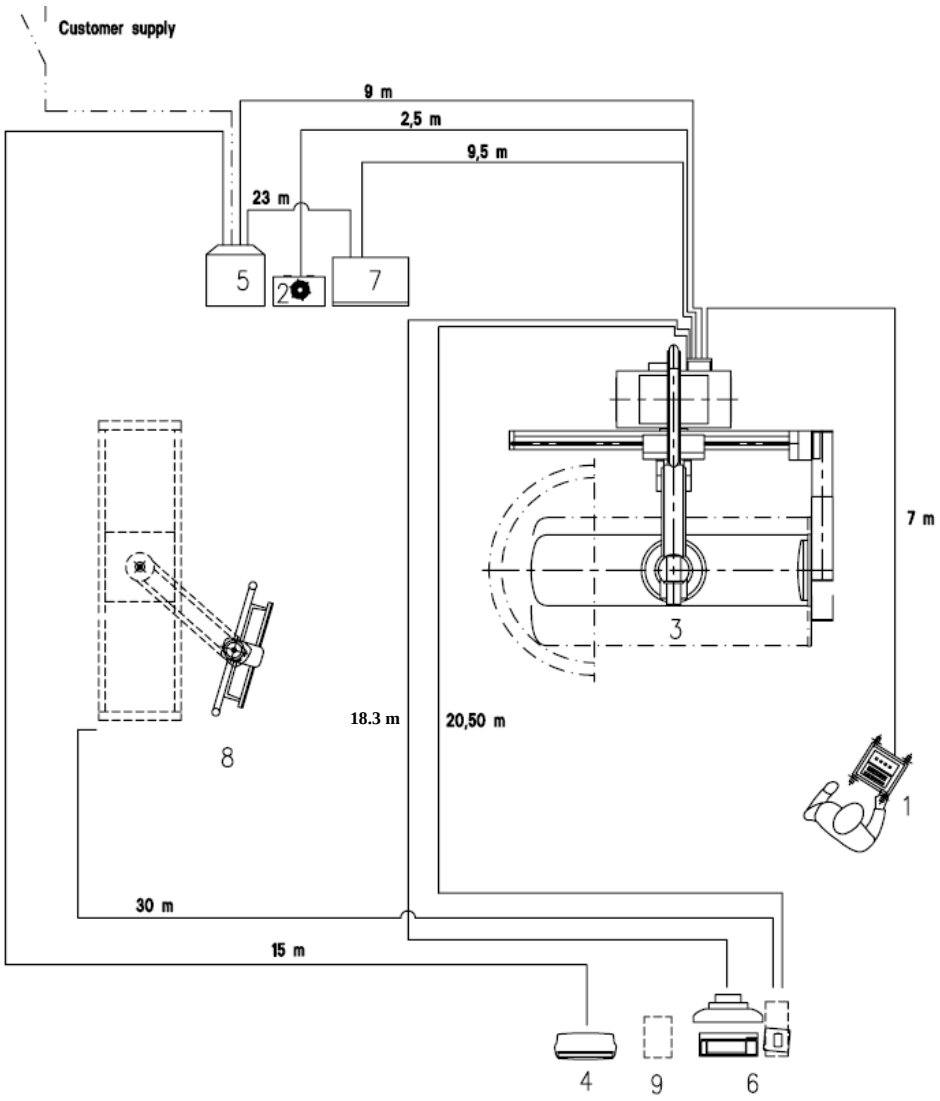
Inspection Date(s): _____

8 System Cable Information

The following tables contain information you may need to plan your installation. Use the information to plan cable routing. In Section 8-2 lengths and characteristics by cable run number (run #) are described. Make sure you have the proper length cables before you begin the installation. Termination characteristics are also described. They allow you to determine whether the cable routes you plan can accommodate the cable dimensions. Remember, cables must always be routed and connected in accordance to all governing laws and regulations that apply to your site.

8-1 Cable length overview

See next page for cable length overview.



8-1 Cable lengths overview

1. Exam Room Positioner Control Panel
2. Heat Exchanger
3. Precision MPI with Positioner Cabinet
4. Control Room Touch screen
5. Generator
6. Control Room Monitors + Platinium PC
7. Collimator Control Cabinet
8. LCD Monitors suspension
9. Isolation Transformer

Cable #	Useable Length		Cable Desc.	UL Style	Cable Class	Volt Rate	Actual Volt	Temp Rate[ºC]	Diameter			Plugs Type and dimensions [mm]	
	Feet	Meter							Inch	mm	UL Style		
MIS RUN 1 X-ray Room Positioner Control Panel to Positioner Cabinet													
X6/X110	29.52	9.0	Positioner Control Panel COM	2560	AWM	30	0-5	60	0.49	12.5	2560	Sub-D 37 16 x 72	Sub-D 37 16 x 72
X8/X111	29.52	9.0	Positioner Control Panel COM	2560	AWM	30	0-5	60	0.49	12.5	2560	Sub-D 37 16 x 72	Sub-D 37 16 x 72
X52/X112	29.52	9.0	Positioner Control Panel COM	2560	AWM	30	0-5	60	0.49	12.5	2560	Sub-D 37 16 x 72	Sub-D 37 16 x 72
X120	49.20	15	Ground Cable	1015	MTW	600	0	105	0.20	5		No plug	No plug
X60/X130	22.96	7.0	RTP COM	2464	AWM	300	0-5	80	0.28	7	2464	D-Sub 9F 15 x 32	D-Sub 9F 15 x 32
X61/X131	22.96	7.0	RTP COM	2464	AWM	300	0-5	80	0.28	7	2464	D-Sub 9F 15 x 32	D-Sub 9F 15 x 32
X62/X132	22.96	7.0	RTP Power		AWM	600	20	90	0.26	6.5		Diameter 10 mm	Diameter 10 mm

Cable #	Useable Length		Cable Desc.	UL Style	Cable Class	Volt Rate	Actual Volt	Temp Rate[° C]	Diameter			Plugs Type and dimensions [mm]	
	Feet	Meter							Inch	mm	UL Style		
MIS RUN 2 Heat Exchanger to Positioner cabinet													
X274/X301	8.20	2.5	Heat Exchanger Oil Hose						0.75	19		Diameter: 31 mm	Diameter: 31 mm
X275/X302	8.20	2.5	Heat Exchanger Oil Hose						0.75	19		Diameter: 31 mm	Diameter: 31 mm
X66/X300	29.52	9.0	Heat Exchanger Power			600	120	105		12		Diameter 28 mm	Diameter 28 mm
MIS RUN 3 Positioner Cabinet to Collimator Control Cabinet													
X260/X373	32.80	10.0	Collimator Control COM						0.51	13		1 x UMNL 28 x 42	5 x UMNL 28 x 42
X261/X372	32.80	10.0	Collimator Control COM						0.51	13		1 x UMNL 28 x 42	5 x UMNL 28 x 42
X49/X371 (02979303)	31.16	9.5	Collimator Control MAG-Mode	2560	AWM	30	0-5	60	0.49	12.5	2560	D-Sub37 16 x 72	1 x UMNL 28 x 42

Cable #	Useable Length		Cable Desc.	UL Style	Cable Class	Volt Rate	Actual Volt	Temp Rate[ºC]	Diameter			Plugs Type and dimensions [mm]	
	Feet	Meter							Inch	mm	UL Style		
X0/X370 (02979383)	39.36	12.0	Collimator Control Power		AWM	600	120	90	0.28	7		No plug	Splits up into 2 IEC power plugs
MIS RUN 4 Positioner Cabinet to Generator													
X61/X350 (02979363)	39.36	12.0	RTP COM	2464	AWM	300	0-5	80	0.28	7	2464	D-sub9F	D-Sub9F
X74/X320 (02979683)	0.00		Injector						0.00				
X64/X321	31.16	9.5	CPU COM	2560	AWM	30	0-5	60	0.20	5		D-sub9	D-sub9
X60/X323 (02979353)	39.36	12.0	CPI Touch Screen COM	2464	AWM	300	0-5	80	0.28	7	2464	D-Sub 9 15 x 32	No plug
X63/X320 (02979323)	31.16	9.5	Generator COM MAG-Mode	2571	AWM	300	0-5	80	0.49	12.5	2571	D-Sub25F 15 x 54	No plug
X0/X316 (02979244)	36.08	11.0	Generator COM Flow switch		AWM	600	24	90	0.31	8		D-Sub 9 15 x 32	No plug
X200 (02979084)	0.00		Ground Cable	1015	MTW	600	0	105	0.20	5		No plug	No plug

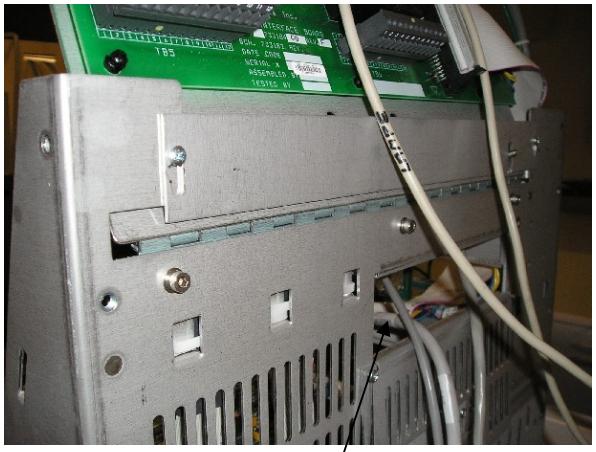
Cable #	Useable Length		Cable Desc.	UL Style	Cable Class	Volt Rate	Actual Volt	Temp Rate[ºC]	Diameter			Plugs Type and dimensions [mm]	
	Feet	Meter							Inch	mm	UL Style		
X210/X317 (02979093)	36.08	11.0	Generator COM AEC	2571	AWM	300	0-5	80	0.16	4	2571	RJ45 12 x 13	No plug
X250/X312	29.52	9.0	DAP Signal						0.20	5		Diameter: 11.5 mm	D-Sub 9 15 x 32
X272/X311	31.16	9.5	HV.Cable Cathode			75000	0-75000	75000	0.63	16		Federal Standard Diameter 40	Federal Standard Diameter 40
X273/X310	31.16	9.5	HV.Cable Anode			75000	0-75000	75000	0.63	16		Federal Standard Diameter 40	Federal Standard Diameter 40
X240/X327 (02979214)	0.00		Ground Cable	1015	MTW	600	0	105	0.20	5		No plug	No plug
X271/X319	32.80	10.0	Stator Cable	E67179	AWM	600	0-600	105	0.55	14		Diameter: 26 mm	No plug
X230/X313 (02979113)	36.08	11.0	PSU/MAG		AWM	600	24	90	0.35	9		PLTX15 13 x 40	No plug
MIS RUN 5 Positioner Cabinet to Control Room													
X5/X456	45.92	18.3	Control Panel COM	2560	AWM	30	0-5	60	0.49	12.5	2560	D-Sub37 16 x 72	D-Sub37 16 x 72
X7/X457	45.92	18.3	Control Panel COM	2560	AWM	30	0-5	60	0.49	12.5	2560	D-Sub37 16 x 72	D-Sub37 16 x 72
X51/X458	45.92	18.3	Control Panel COM	2560	AWM	30	0-5	60	0.49	12.5	2560	D-Sub37 16 x 72	D-Sub37 16 x 72

Cable #	Useable Length		Cable Desc.	UL Style	Cable Class	Volt Rate	Actual Volt	Temp Rate[° C]	Diameter			Plugs Type and dimensions [mm]	
	Feet	Meter							Inch	mm	UL Style		
X461	49.20	15	Ground Cable	1015	MTW	600	0	105	0.20	5		No plug	No plug
MIS RUN 6 Generator to Collimator Control Cabinet													
X329/X374 (02979394)	75.44	23.0	Relay Signal	2464		300	24	80	0.24	6	2464	No plug	No plug
MIS RUN 7 Positioner Cabinet to Control Room													
X220/X434 (39860001)	67.24	20.5	Camera COM	48621	CMG	300	24	75	0.39	10		D-Sub50 8 x 40	D-Sub50 13 x 53
MIS RUN 8 Generator to Control Room													
X351/X435 (39860008)	98.40	30.0	GIM-PC COM	E 142890	CMG	30	0-5	75	0.28	7		RJ45	RJ45
X330/X480 (02979463)	49.20	15.0	Foot Switch Signal	2464		300	0-24	80	0.24	6	2464	No plug	Diameter 18 mm
X331/X481 (02979453)	49.20	15	Hand Switch Signal	2464	AWM	300	0-24	80	0.24	6		No plug	D-sub 9 15x32
X314/X470 (39860009)	49.20	15.0	CPI Touch Screen COM	E 129985	AWG	600	0-5	105	0.39	10		No plug	D-sub 9 15x32
X315/X471	49.20	15.0	CPI Touch Screen Power			600	120	105	0.47	12		No plug	IEC power plug
X328/X472	49.20	15	Ground Cable	1015	MTW	600	0	105	0.20	5		No plug	No plug

Cable #	Useable Length		Cable Desc.	UL Style	Cable Class	Volt Rate	Actual Volt	Temp Rate[ºC]	Diameter			Plugs Type and dimensions [mm]	
	Feet	Meter							Inch	mm	UL Style		
MIS RUN 9 X-ray Room Image Monitor to Control Room													
X101/X404 (39842011)	98.40	30.0	VGA Cable	2919	AWM	30	0-5	80	0.39	10		High Density DB15 plug	High Density DB15 plug
X103/X417 (39842011)	98.40	30.0	VGA Cable	2919	AWM	30	0-5	80	0.39	10		High Density DB15 plug	High Density DB15 plug

8-3 Cable entrances

8-3-1 Generator



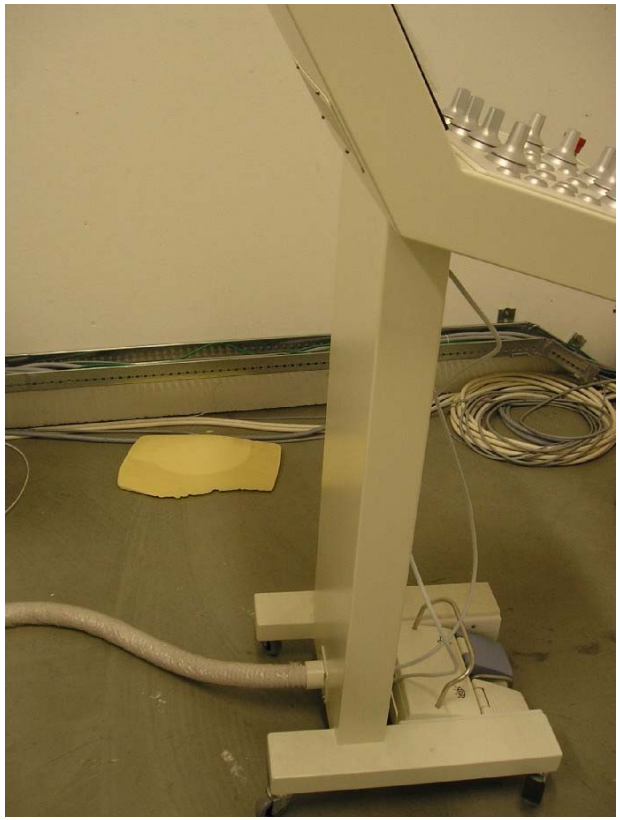
Other signal Cables
1090mm from the floor

HV + Stator Cables
600mm from the floor

Main Power from
PDB

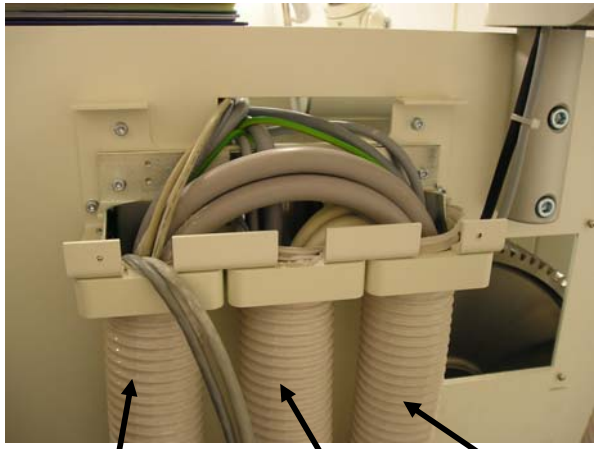
8-3-2 Mobile control panel & heat exchanger

X-ray Room Positioner Control Panel



Heat Exchanger

8-3-3 Positioner cabinet



Top of the positioner cabinet (hose connection

Collimator Control Cab + Heat Exchanger cables

C arc cables

Generator cables

Control Room + X ray Room control Panel cables

8-3-4 Isolation Transformer

Isolation Transformer outputs

Isolation Transformer in the control room (to supply PC + control room monitors)

Isolation Transformer intputs (from PDB)

8-3-4 Collimator control cabinet

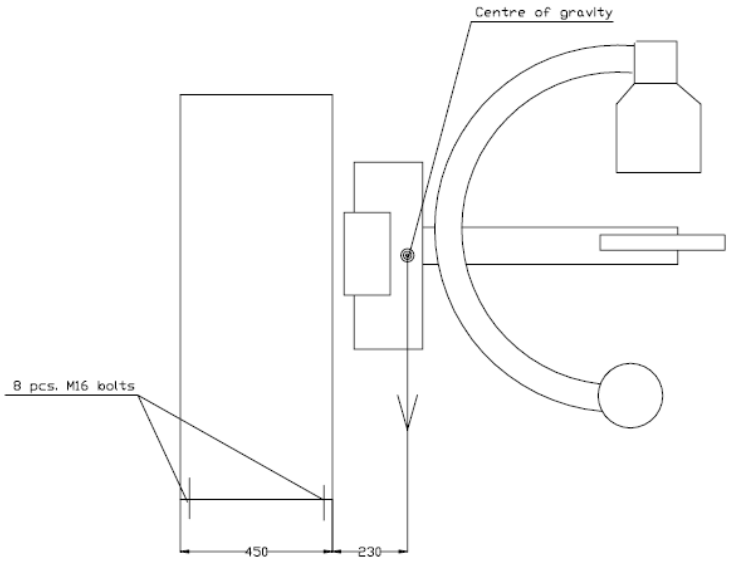
Collimator Control Cabinet
cable entrance at the bottom

Back of the
Collimator Control

9 Anchoring requirements and seismic drawings

9-2 Non-seismic areas

9-2-1 Precision MPi, Positioner



Maximum load including patient $L = 1859kg \quad (4099Lbs)$

Pull force for the 4 bolts in the back row of the cabinet $$F = \frac{1859kg \bullet 10\frac{m}{s^2} \bullet 0.230m}{0.450m} = 9501.5N$$

Pull force for each bolt in the row $$F_1 = \frac{F}{4} = \frac{9501.5}{4} \approx 2375N$$

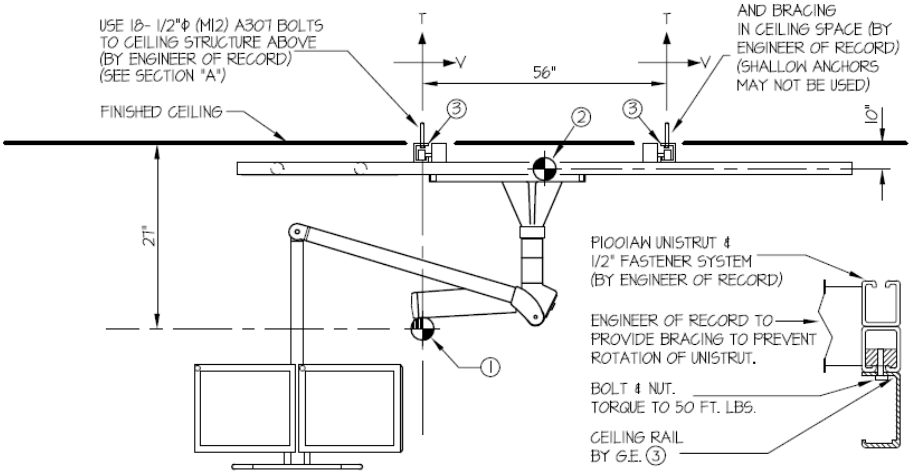
By using a safety factor of 4, the required pull force for each bolt will be $$F_s = 2375 \bullet 4 = 9500N$$

9-3 Seismic areas

EASE EQUIPMENT ANCHORAGE & SEISMIC ENGINEERING

GEHC PIM 2404435	DES. R. LA BRIE	SHEET 1
Precision MP/i LCD Monitor Suspension	JOB NO. 12-0603	
	DATE 3/3/06	OF 2 SHEETS

SEISMIC ANCHORAGE CALCULATION



DESCRIPTION	WEIGHT
① MONITORS & SUSPENSION	165 LBS
② BRIDGE & DOLLY	140 LBS
③ LONGITUDINAL RAIL	5.8 LB/FT.

ELEVATION

T_{MAX} = 445 LBS/BOLT
V_{MAX} = 174 LBS/BOLT

NOTE:
STEEL CHANNEL MAY BE PARALLEL TO CEILING RAIL AS SHOWN OR PERPENDICULAR.

SECTION "A"

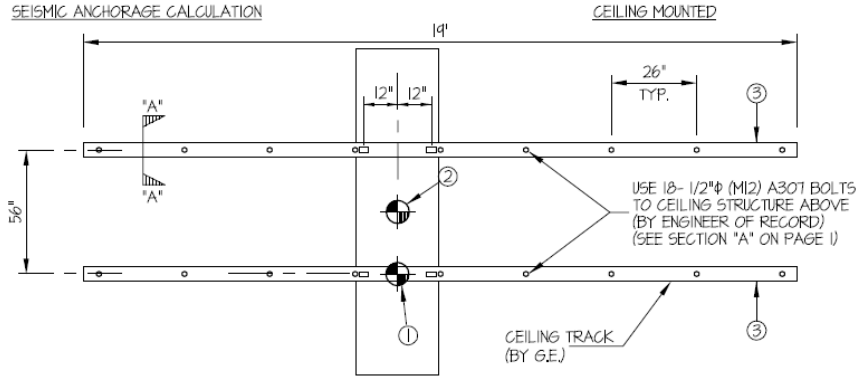
NOTES:

1. FORCES ARE DETERMINED PER 2001 CALIFORNIA BUILDING CODE - SECTION 1632A AND HAVE BEEN FACTORED TO REPRESENT WORKING DESIGN LOADS, NOT ULTIMATE.
   HORIZONTAL FORCE (V_H) = 1.4IW (C_a = .66, a_p = 1.5, I_p = 1.5, R_p = 3.0)
   VERTICAL FORCE (V_V) = 0.33(V_H)
2. CENTER OF GRAVITY (C.G.) WEIGHT IS A MAXIMUM. THIS CALCULATION ENCOMPASSES ALL WEIGHTS UP TO THE MAXIMUM WEIGHT SHOWN.
3. ARCHITECT OR STRUCTURAL ENGINEER OF RECORD SHALL PROVIDE SUPPORT STRUCTURE TO SUPPORT WEIGHTS AND FORCES SHOWN IN ADDITION TO ALL OTHER LOADS.

EASE EQUIPMENT ANCHORAGE & SEISMIC ENGINEERING

GEHC PIM 2404435	DES. R. LA BRIE	SHEET 2
Precision MP/i LCD Monitor Suspension	JOB NO. 12-0603	
	DATE 3/3/06	OF 2 SHEETS

SEISMIC ANCHORAGE CALCULATION — CEILING MOUNTED



PLAN AT CEILING

LOADS:

① MONITORS & SUSPENSION
WEIGHT = 165 LBS
HORIZ. FORCE (V_H) = 233 LBS
VERT. FORCE (V_V) = 78 LBS

② BRIDGE & DOLLY
WEIGHT = 140 LBS
HORIZ. FORCE (V_H) = 197 LBS
VERT. FORCE (V_V) = 66 LBS

③ RAILS
WEIGHT = 5.8 LB/FT.
HORIZ. FORCE (V_H) = 8.2 LB/FT.
VERT. FORCE (V_V) = 2.7 LB/FT.

BOLT FORCES:

TENSION (T)

$$T_1 = \frac{(165\# + 78\#)}{2 \text{ BOLTS}} + \frac{233\#(27")}{24"} = 384 \text{ LBS}$$

$$T_2 = \frac{(140\# + 66\#)}{4 \text{ BOLTS}} + \frac{197\#(10")}{2 \text{ BOLTS } (24")} = 93 \text{ LBS}$$

$$T_3 = \frac{(5.8\#/FT + 2.7\#/FT)(26")}{12"/\text{ FT.}} = 18 \text{ LBS}$$

$$T_{MAX} = 384\# + 93\# + 18\# = 495 \text{ LBS/BOLT (MAX)}$$

SHEAR (V)

$$V = \frac{233\#}{2 \text{ BOLTS}} + \frac{197\#}{4 \text{ BOLTS}} + \frac{8.2\#}{1 \text{ BOLT}}$$

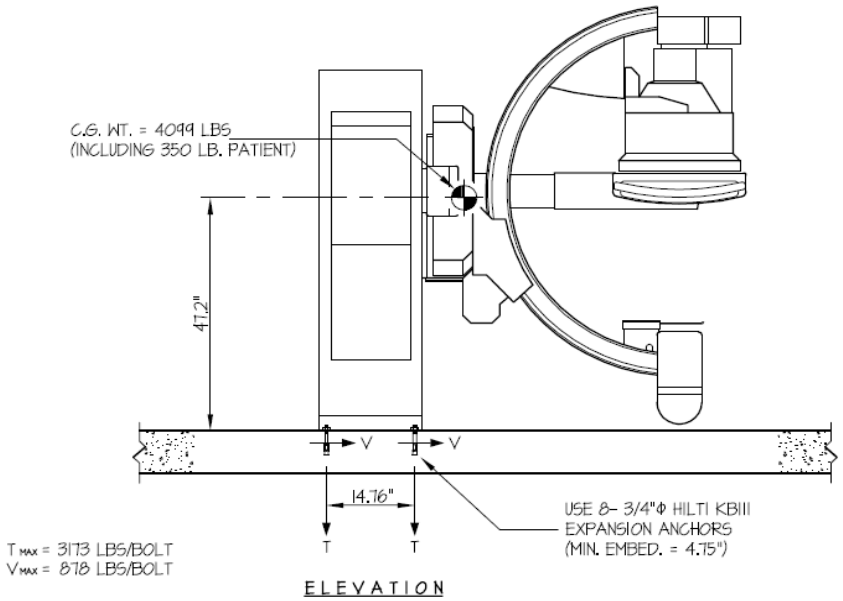
$$V_{MAX} = 174 \text{ LBS/BOLT (MAX)}$$

EASE EQUIPMENT ANCHORAGE & SEISMIC ENGINEERING

GEHC PIM 2404435	DES. R. LA BRIE	SHEET 1
	JOB NO. 12-0603	
Precision MP/i Positioner Gantry	DATE 3/3/06	OF 2 SHEETS

SEISMIC ANCHORAGE CALCULATION

SLAB ON GRADE



ELEVATION

NOTES:

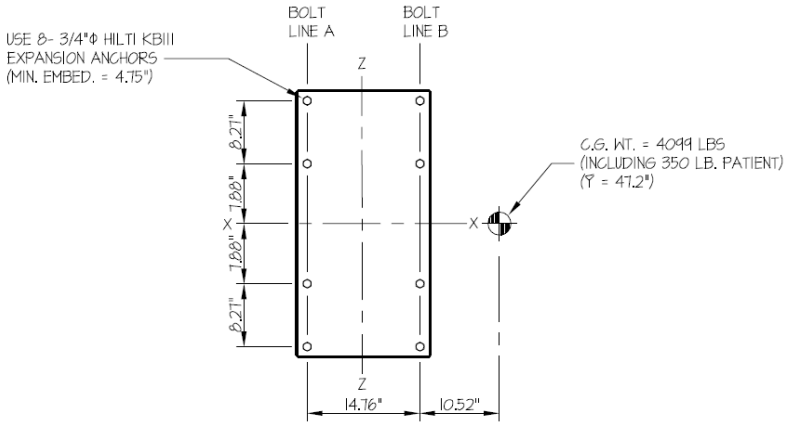
1. FORCES ARE DETERMINED PER 2001 CALIFORNIA BUILDING CODE - SECTION 1632A AND HAVE BEEN FACTORED TO REPRESENT WORKING DESIGN LOADS, NOT ULTIMATE.
   HORIZONTAL FORCE (V_H) = 0.50W (C_a = .66, a_p = 1.0, I_p = 1.5, R_p = 1.5)
   VERTICAL FORCE (V_V) = 0.33(V_H)
2. CENTER OF GRAVITY (C.G.) WEIGHT IS A MAXIMUM. THIS CALCULATION ENCOMPASSES ALL WEIGHTS UP TO THE MAXIMUM WEIGHT SHOWN.
3. ARCHITECT OR STRUCTURAL ENGINEER OF RECORD SHALL PROVIDE SUPPORT STRUCTURE TO SUPPORT WEIGHTS AND FORCES SHOWN.

EASE EQUIPMENT ANCHORAGE & SEISMIC ENGINEERING

GEHC PIM 2404435	DES. R. LA BRIE	SHEET 2
	JOB NO. 12-0603	
Precision MP/i Positioner Gantry	DATE 3/3/06	OF 2 SHEETS

SEISMIC ANCHORAGE CALCULATION

SLAB ON GRADE



PLAN AT BASE

LOADS:
WEIGHT = 4099 LBS
HORIZONTAL FORCE (V_H) = 2050 LBS
VERTICAL FORCE (V_V) = 683 LBS

MOMENTS: (FROM VERTICAL LOADS)
M_{ZZ} = (4099# - 683#)17.9" = 61,146"#

BOLT GROUP PROPERTIES:
$I_{X\text{-}X}$ = 646 in.^{4} (EACH BOLT LINE)
$I_{Z\text{-}Z}$ = 436 in.^{4}
$I_{Y\text{-}Y}$ = 1728 in.^{4}

MOMENTS: (FROM LATERAL LOADS)
M_{XX} line A = 2050"#(47.2")(10.52"/14.76") = 68964"#
M_{XX} line B = 2050"#(47.2")(25.28"/14.76") = 165724"#
M_{ZZ} = 2050"#(47.2") = 96,760"#
M_{YY} = 2050#(17.9") = 36,695"#

BOLT FORCES:

TENSION (T)

$$T = \left[\frac{96760"\#(7.38") \times 0.3}{436}\right] + \left[\frac{165724"\#(16.15")}{646}\right] - \left[\frac{61146"\#(7.38")}{436}\right] - \left[\frac{4099\# - 683\#}{8 \text{ BOLTS}}\right] = 3173 \text{ LBS/BOLT (MAX)}$$

$\frac{M_{XX\text{-}LAT}(C)}{I}$ $\frac{M_{ZZ\text{-}LAT}(C)}{I}$ $\frac{M_{ZZ\text{-}VERT}(C)}{I}$ $\frac{P}{A}$

SHEAR (V)

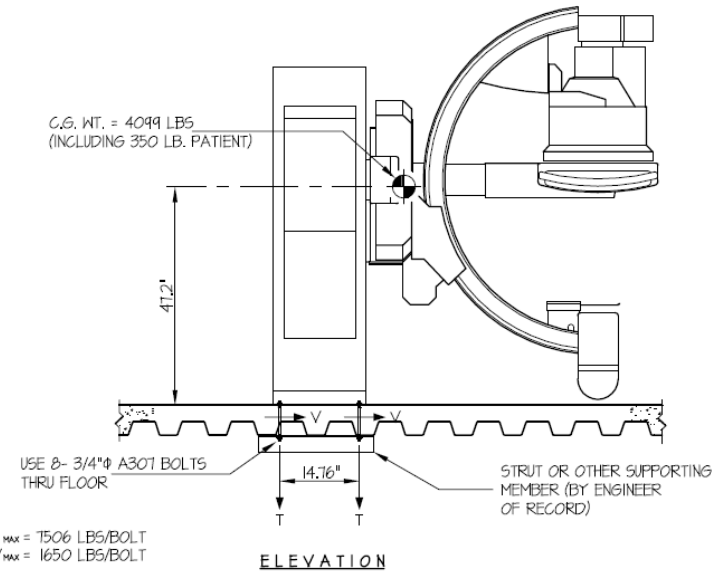
$$V = \frac{2050"\#(25.28")}{4 \text{ BOLTS } (14.76")} = 878 \text{ LBS/BOLT (MAX)}$$

EASE EQUIPMENT ANCHORAGE & SEISMIC ENGINEERING

GEHC PIM 2404435	DES. R. LA BRIE	SHEET 1
	JOB NO. 12-0603	
Precision MP/i Positioner Gantry	DATE 3/3/06	OF 2 SHEETS

SEISMIC ANCHORAGE CALCULATION

UPPER FLOOR



T_{max} = 7506 LBS/BOLT
V_{max} = 1650 LBS/BOLT

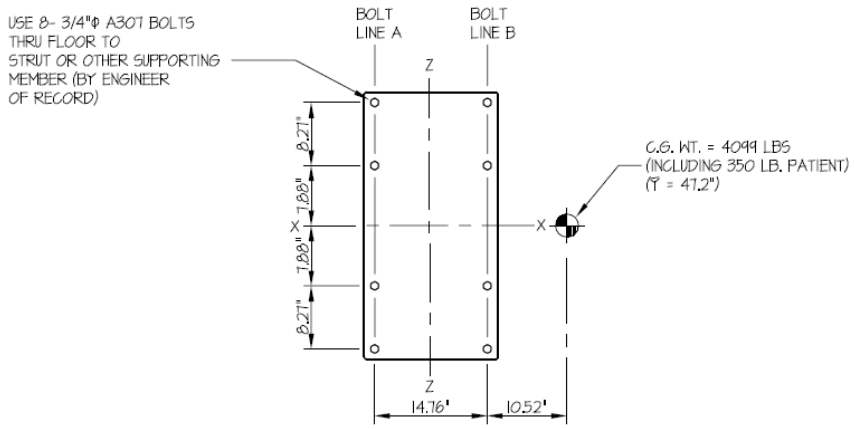
ELEVATION

NOTES:

1. FORCES ARE DETERMINED PER 2001 CALIFORNIA BUILDING CODE - SECTION 1632A AND HAVE BEEN FACTORED TO REPRESENT WORKING DESIGN LOADS, NOT ULTIMATE.
   HORIZONTAL FORCE (V_H) = 0.94W (C_a = .66, a_p = 1.0, I_p = 1.5, R_p = 3.0)
   VERTICAL FORCE (V_V) = 0.33(V_H)
2. CENTER OF GRAVITY (C.G.) WEIGHT IS A MAXIMUM. THIS CALCULATION ENCOMPASSES ALL WEIGHTS UP TO THE MAXIMUM WEIGHT SHOWN.
3. ARCHITECT OR STRUCTURAL ENGINEER OF RECORD SHALL PROVIDE SUPPORT STRUCTURE TO SUPPORT WEIGHTS AND FORCES SHOWN.

EASE EQUIPMENT ANCHORAGE & SEISMIC ENGINEERING		
GEHC PIM 2404435	DES. R. LA BRIE	SHEET 2
	JOB NO. 12-0603	
Precision MP/i Positioner Gantry	DATE 3/3/06	OF 2 SHEETS

SEISMIC ANCHORAGE CALCULATION — UPPER FLOOR



PLAN AT BASE

LOADS:
WEIGHT = 4099 LBS
HORIZONTAL FORCE (V_H) = 3853 LBS
VERTICAL FORCE (V_V) = 1284 LBS

MOMENTS: (FROM VERTICAL LOADS)
M_{ZZ} = (4099# - 1284#)17.9" = 50,389"#

BOLT GROUP PROPERTIES:
I_{X-X} = 646 in.^{4} (EACH BOLT LINE)
I_{Z-Z} = 436 in.^{4}
I_{Y-Y} = 1728 in.^{4}

MOMENTS: (FROM LATERAL LOADS)
M_{XX} line A = 3853"#(47.2")(10.52"/14.76") = 129,620"#
M_{XX} line B = 3853"#(47.2")(25.28"/14.76") = 311,481"#
M_{ZZ} = 3853"#(47.2") = 181,862"#
M_{YY} = 3853#(17.9") = 68,969"#

BOLT FORCES:

TENSION (T)

$$T = \left[\frac{181862"\#(7.38") \times 0.3}{436}\right] + \left[\frac{311481"\#(16.15")}{646}\right] - \left[\frac{50389"\#(7.38")}{436}\right] - \left[\frac{4099\# - 1284\#}{8 \text{ BOLTS}}\right] = 7506 \text{ LBS/BOLT (MAX)}$$

$$\frac{M_{XX\text{-LAT}}(C)}{I} \qquad \frac{M_{ZZ\text{-LAT}}(C)}{I} \qquad \frac{M_{ZZ\text{-VERT}}(C)}{I} \qquad \frac{P}{A}$$

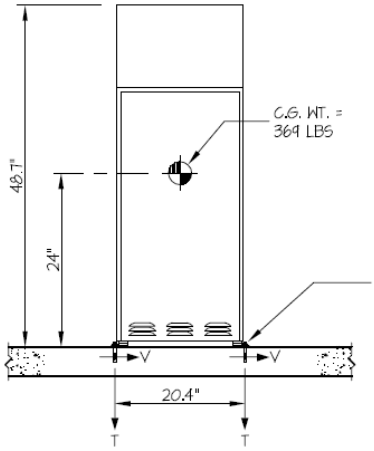
SHEAR (V)

$$V = \frac{3853"\#(25.28")}{4 \text{ BOLTS } (14.76")} = 1650 \text{ LBS/BOLT (MAX)}$$

EASE EQUIPMENT ANCHORAGE & SEISMIC ENGINEERING

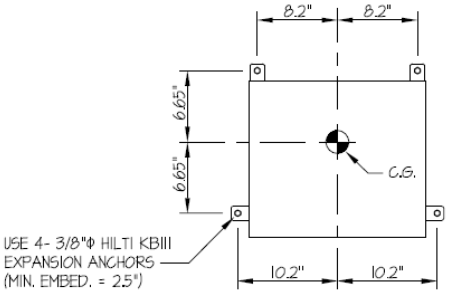
GEHC PIM 2404435	DES. R. LA BRIE	SHEET 1
	JOB NO. 12-0603	
Precision MP/i Generator Cabinet	DATE 3/3/06	OF 1 SHEET

SEISMIC ANCHORAGE CALCULATION



FRONT ELEVATION

SLAB ON GRADE



PLAN AT BASE

T_{MAX} = 131 LBS/BOLT
V_{MAX} = 46 LBS/BOLT

LOADS: PER 2001 CALIFORNIA BUILDING CODE - SECTION 1632A (WORKING LOADS, NOT ULTIMATE)
WEIGHT = 369 LBS
HORIZONTAL FORCE (V_H) = 0.50W = 185 LBS
VERTICAL FORCE (V_V) = 0.33(V_H) = 62 LBS

BOLT FORCES:

TENSION (T)

$$T_{MAXIMUM} = \left[\frac{185\#(24")}{2\ BOLTS\ (16.4")} \times (0.3)\right] + \frac{185\#(24")}{2\ BOLTS\ (13.3")} - \frac{369\# - 62\#}{4\ BOLTS} = 131\ LBS/BOLT\ (MAX)$$

(HORIZ - SIDE TO SIDE) (HORIZ - FRONT TO BACK) (WEIGHT - V_V)

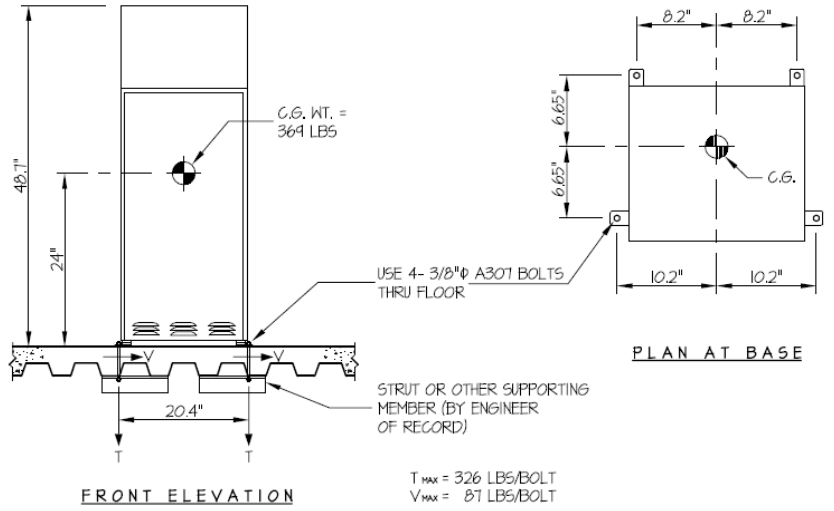
SHEAR (V)

$$V = \frac{185\#}{4\ BOLTS} = 46\ LBS/BOLT\ (MAX)$$

NOTE:
ARCHITECT OR STRUCTURAL ENGINEER OF RECORD SHALL PROVIDE SUPPORT STRUCTURE TO SUPPORT WEIGHTS AND FORCES SHOWN.

EASE EQUIPMENT ANCHORAGE & SEISMIC ENGINEERING		
GEHC PIM 2404435	DES. R. LA BRIE	SHEET 1
	JOB NO. 12-0603	
Precision MP/i Generator Cabinet	DATE 3/3/06	OF 1 SHEET

SEISMIC ANCHORAGE CALCULATION



FRONT ELEVATION

T_{MAX} = 326 LBS/BOLT
V_{MAX} = 87 LBS/BOLT

UPPER FLOOR

PLAN AT BASE

LOADS: PER 2001 CALIFORNIA BUILDING CODE - SECTION 1632A (WORKING LOADS, NOT ULTIMATE)
WEIGHT = 369 LBS
HORIZONTAL FORCE (V_H) = 0.94W = 347 LBS
VERTICAL FORCE (V_V) = 0.33(V_H) = 116 LBS

BOLT FORCES:

TENSION (T)

$$T_{MAXIMUM} = \left[\frac{347\#(24")}{2\ \text{BOLTS}\ (16.4")} \times (0.3)\right] + \frac{347\#(24")}{2\ \text{BOLTS}\ (13.3")} - \frac{369\# - 116\#}{4\ \text{BOLTS}} = 326\ \text{LBS/BOLT (MAX)}$$

(HORIZ. - SIDE TO SIDE) (HORIZ. - FRONT TO BACK) (WEIGHT - V_V)

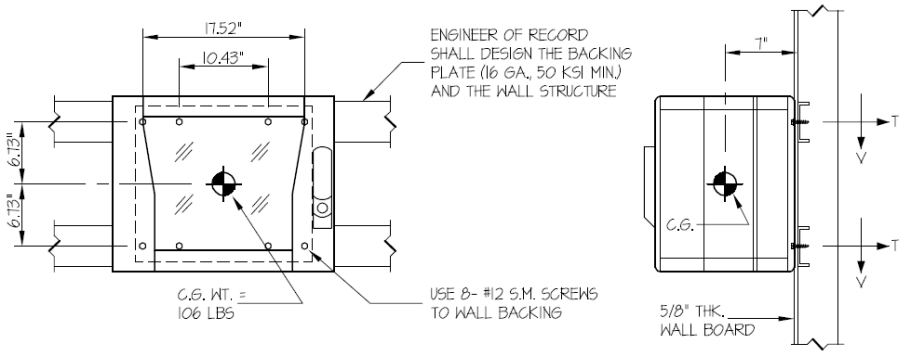
SHEAR (V)

$$V = \frac{347\#}{4\ \text{BOLTS}} = 87\ \text{LBS/BOLT (MAX)}$$

NOTE:
ARCHITECT OR STRUCTURAL ENGINEER OF RECORD SHALL PROVIDE SUPPORT STRUCTURE TO SUPPORT WEIGHTS AND FORCES SHOWN.

EASE EQUIPMENT ANCHORAGE & SEISMIC ENGINEERING		
GEHC PIM 2404435	DES. R. LA BRIE	SHEET 1
	JOB NO. 12-0603	
Precision MP/i Collimator Control Module	DATE 3/3/06	OF 1 SHEET

SEISMIC ANCHORAGE CALCULATION WALL MOUNTED



FRONT ELEVATION SIDE ELEVATION

T_{MAX} = 36 LBS/SCREW
V_{MAX} = 30 LBS/SCREW

LOADS: PER 2001 CALIFORNIA BUILDING CODE - SECTION 1632A (WORKING LOADS, NOT ULTIMATE)

WEIGHT = 106 LBS
HORIZONTAL FORCE (V_H) = 0.94W = 100 LBS
VERTICAL FORCE (V_V) = 0.33(V_H) = 33 LBS

TENSION (T)

$$T_{VERTICAL} = \frac{(106\# + 33\#)7''}{4 \text{ SCREWS } (13.46'')} = 18 \text{ LBS}$$

$$T_{PARALLEL} = \frac{100\#(7'')}{4 \text{ SCREWS } (13.98'')} = 13 \text{ LBS}$$

$$T_{PERP.} = \frac{100\#}{8 \text{ SCREWS}} = 13 \text{ LBS}$$

$$T_{MAX} = 18\# + \sqrt{13^2 + 13^2} = 36 \text{ LBS/SCREW (MAX)}$$

SHEAR (V)

$$V_{MAX} = \frac{106\# + 33\# + 100\#}{8 \text{ SCREWS}} = 30 \text{ LBS/SCREW (MAX)}$$

#12 SM SCREWS TO 16 GAGE, 50 KSI
$T_{ALLOW.}$ = 225 LBS
$V_{ALLOW.}$ = 570 LBS

NOTE:
ARCHITECT OR STRUCTURAL ENGINEER OF RECORD SHALL PROVIDE SUPPORT STRUCTURE TO SUPPORT WEIGHTS AND FORCES SHOWN.