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2. Varian Halcyon — სამედიცინო ხაზოვანი ამაჩქარებელი, განკუთვნილი სხივური თერაპიის ჩასატარებლად, ინტეგრირებული ვიზუალიზაციისა და პაციენტის პოზიციონირების სისტემებით.

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TRUEBEAM / VITALBEAM

PRODUCT PLANNING GUIDE



SCAN FOR CURRENT RELEASE

PPG-HT-G JUNE 2025

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EXECUTIVE SUMMARY

Intended Audience

The intended audiences of this PPG are any Varian external customers or their representatives.

Purpose

This document is designed to assist customers and their representatives in understanding the minimum requirements to enable a Varian TrueBeam/VitalBeam to be installed. This document is a reference for the machine and site planning and does not cover specific site conditions that may require additional detailed design or safety solutions.

The information herein will be useful to project managers, architectural and site planners, construction engineers, contractors' trade personnel, and others. Good site preparation and coordination between Varian and the customer's representative are essential for smooth and efficient machine installation.

It is important to finalize the detailed design of the site configuration before construction is started. Once the site is completed, it will be difficult, and costly to make revisions.

Document Structure

This document has four main sections:

Product Overview	- System pictures, identification of deliverables, shielding, and references.
Varian System	- Varian delivered parts, size, weight, and limitations.
Customer Requirements	- Room sizes, utility, and environmental requirements in trade sections.
Project Management	- Contractor tasks, durations, and responsibilities.

Project Planning

Once an order is placed, Varian will assign an Installation Project Manager (PM) to assist the customer and their representatives with the installation of the TrueBeam/VitalBeam system. Refer to 4 Project Management for more information.

Typical Lead-times and Durations

The times below may vary, confirm with Varian PM
Minimum lead-time from Customer order – **~ 8 months** (+ 1-month shipment for non-US orders)
Cable lengths required – **6 weeks** before delivery (+ 1-month shipment for non-US orders)
Third-party products (Power Conditioner, Chiller, Lasers, etc.) – **12 weeks**
BaseFrame installation – **2 days**
Concrete cure time before machine installation – **4 weeks** recommended.
Standard Installation (including rig and acceptance) – **4 - 5 weeks**
SuperFast Installation (including rig and acceptance) – **2 weeks**
Accelerator Commissioning - approximately **6 weeks**, may vary.

Table 4-1 shows the detailed process and responsibilities for each major project milestone.

Site Readiness

The room must be clinically ready, meeting all the requirements within the PPG. All services and utilities must be available with the final finishes completed. The [1] Varian Accelerator Pre-Installation Checklist is used to measure compliance. Any tasks that are NOT completed must be approved by the Varian PM before the machine can be delivered. The Varian engineer must have exclusive possession of the treatment area during machine installation.

REVISION HISTORY

REV	DATE	DESCRIPTION OF CHANGE	AUTHOR
G	June 2025	• Table 3-7, Corrected conduit length for run “E”	DKU
F	June 2025	• Cover page, Added QR Code on Cover Sheet • Page 2, Added QR Code Verification Link • Figure 2-3, Revised BaseFrame drawing • Table 2-2, Revised BaseFrame weight • Table 2-8, Added cable "O" • 2.10.1, Added mounting hole locations • Figure 2-19, Revised Live View Camera post • Figure 3-5, Revised CCTV camera location • Figure 3-5, Added LiveView camera horizontal location • Table 3-2, Revised LiveView camera vertical location • New Figure 3-6, Primary CCTV Camera plan view • 3.2, Revised note for monitor bracket • 3.2.1, Added bullet point for concrete anchors • Figure 3-12, Revised rear wall clearance to 14mm [5 1/2"] • Table 3-3, Revised System Current • Table 3-3, Revised Console Cabinet Current • Table 3-3, Added In-Rush Current • Table 3-3, Removed the Source impedance values • 3.3.3, Added bullet point for ground parity • 3.3.3, Added bullet point for output wirng to the IEC outlet • 3.3.5.1, Revised bullet point for USB Hub power outlet • Figure 3-17, Added conduit "R" • Table 3-7, Added conduits "O" & "R" • Table 3-7, Added * for conduit "D" • 3.3.7.1, Added MainRoom Lights • 3.3.8, Revised Zones "A", “B”, & "C" • Figure 3-18, Revised access zones • New Figure 3-19, Side view access zones • New Figure 3-20, Modulator access zones • 3.3.10.1, Added “consult with customer on regulatory requirements” • 3.4, Revised Notice: Chilled water flow rates • Figure 3-24, Revised flooring void at the Stand • 4.3, Added a task for backfill concrete/grout under BaseFrame • 4.3, Revised metric concrete/grout specification • 4.6, Renamed project title • 4.6, Added customer responsibility to install pull box cover plates • Appendix Table 2, Updated crate weights and sizes	MES

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1 OVERVIEW

The Varian TrueBeam is the only system specifically designed to deliver both radiotherapy and radiosurgery. A sophisticated and highly intelligent technology, this breakthrough system unlocks the ability to do tailored ground-breaking treatments with unprecedented ease, versatility, and speed. The TrueBeam system brings together state-of-the-art, real-time imaging with the ability to deliver higher doses with high precision. Because of this intelligent design, physicians can treat more complex cases and more patients. As sophisticated as it is, the TrueBeam system has been developed for ease of use. Designed with an emphasis on efficiency, the TrueBeam system is easy for a technician or a clinician to learn and operate.

VitalBeam is a new cost-effective technology package for offering high-quality, high-throughput radiation therapy, and for expanding clinical capabilities over time. VitalBeam leverages the best of Varian's technology; incorporating many of the innovations we developed for our popular TrueBeam radiosurgery system to enhance precision, safety, and speed of treatment. It is a flexible and upgradeable system that will affordably meet the clinical needs of today and growth in the future. Each of the five VitalBeam configurations offers up to three photons and four electron energy levels for flexibility in treatment. Customers can choose to start with one configuration and add capabilities over time, at a pace that suits them. It is distinct from our versatile TrueBeam radiotherapy and radiosurgery platform in that VitalBeam is optimized for advanced radiotherapy while TrueBeam systems were designed to handle both.



Figure 1-1 VitalBeam Stand, Gantry, and Couch

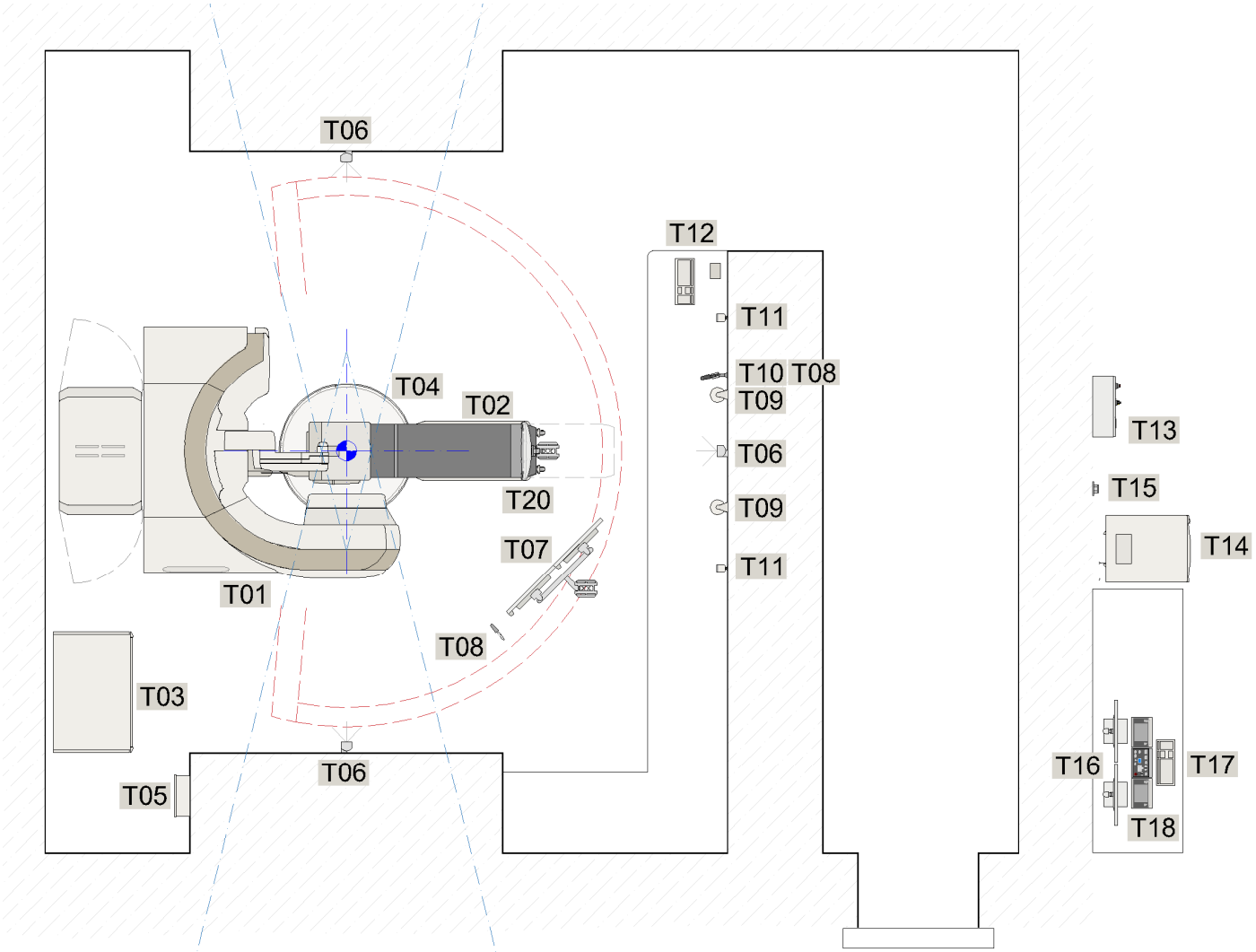


Figure 1-2 TrueBeam/VitalBeam System Components *(sample layout)*

Table 1-1 TrueBeam System Components			
T01	Stand & Gantry	**T11**	Speaker *(x2)*
T02	Treatment Couch	**T12**	USB Hub & Service Keyboard
T03	Modulator Cabinet	**T13**	Main Disconnect Panel *(opt. check SO)*
T04	BaseFrame *(Varian OEM)*	**T14**	Console Cabinet
T05	Relay Junction Box	**T15**	IEC 60309 Power Outlet *(opt. check SO)*
T06	Positioning Laser *(x4, opt. check SO)*	**T16**	System Monitors *(x2, Treat and Image)*
T07	In-Room Monitor Set *(Dual Screen)*	**T17**	Control Console, Keyboard, and Mouse
T08	Patient Microphone	**T18**	CCTV Monitor *(x2)*
T09	CCTV Camera *(x2)*	**T19**	n/a
T10	Live View Camera	**T20**	Optical Imaging Camera *(opt. check SO)*

1.1 SHIELDING



Varian Medical Systems will not have approval or responsibility for any matters related to the adequacy of radiation protection walls, barriers, or safety devices. All radiation shielding designs must comply with codes and regulations of all Authorities Having Jurisdiction (AHJ) and must be approved by the Customer's or Facility's Physicist of Record. The responsibility for these designs lies solely with the Customer/Facility. Factors such as hours of operation, patient workload, accelerator energy, and shielding materials should be considered when calculating shielding requirements. Improper radiation shielding can result in serious injury or death.



The TrueBeam/VitalBeam must be positioned outside the 100 µT (1 Gauss) magnetic field produced by Magnetic Resonance Imaging (MRI) units or any other equipment that generates magnetic fields.

The customer is responsible for verifying that there are no background magnetic fields exceeding this limit in the treatment and control rooms.

1.2 COMPATIBILITY



All finishes and equipment in the treatment room should be suitable for an ionizing radiation environment.

Review the [2] TrueBeam Customer Release Notes for third-party device compatibility.

1.3 REFERENCES

The following reference/support documents are available from Varian Site Planning or the Varian PM.

[1] Varian Accelerator Pre-Installation Checklist

[2] TrueBeam Customer Release Note (CRN)

[3] MICAP Network Configuration Guide

2 VARIAN SYSTEM DIMENSIONS

2.1 STAND, GANTRY, AND COUCH

The Stand, Gantry, and Couch are the main functional components of the machine that the users and patients will have contact with. Isocenter is the primary reference point for Varian equipment in the treatment room.

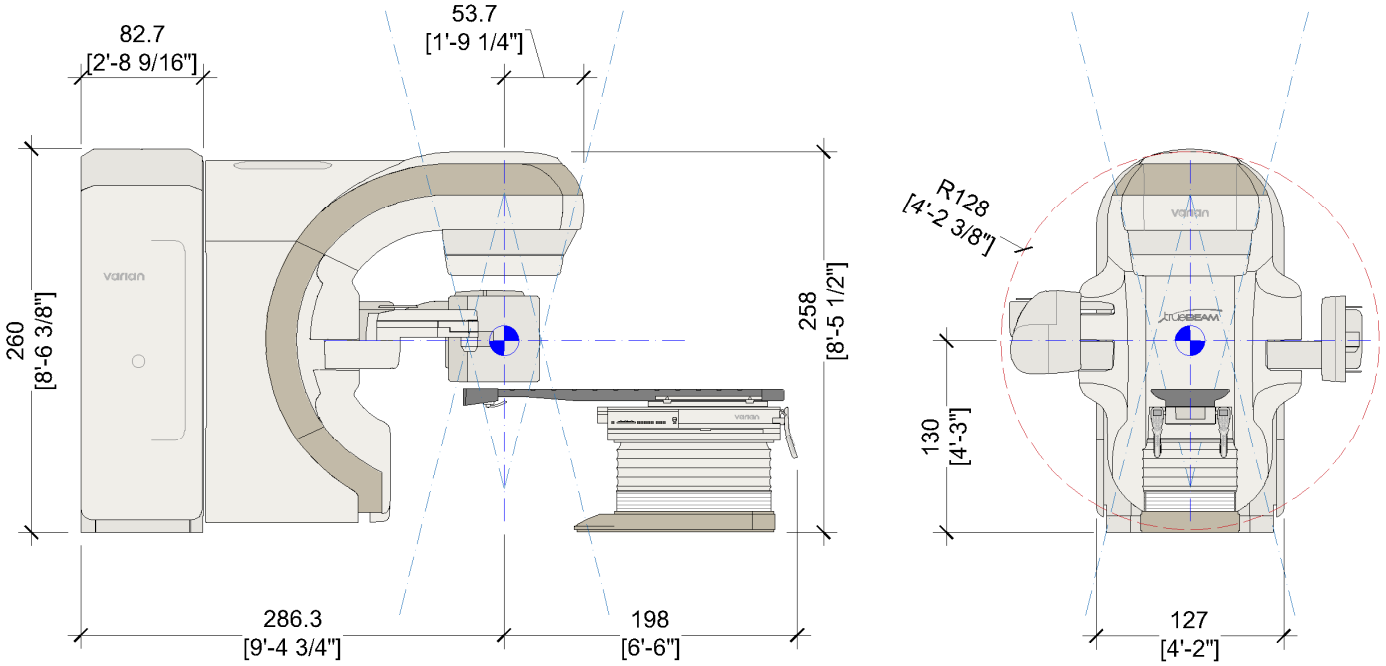


Figure 2-1 TrueBeam/VitalBeam Stand, Gantry, and Couch *(Side and Front View)*

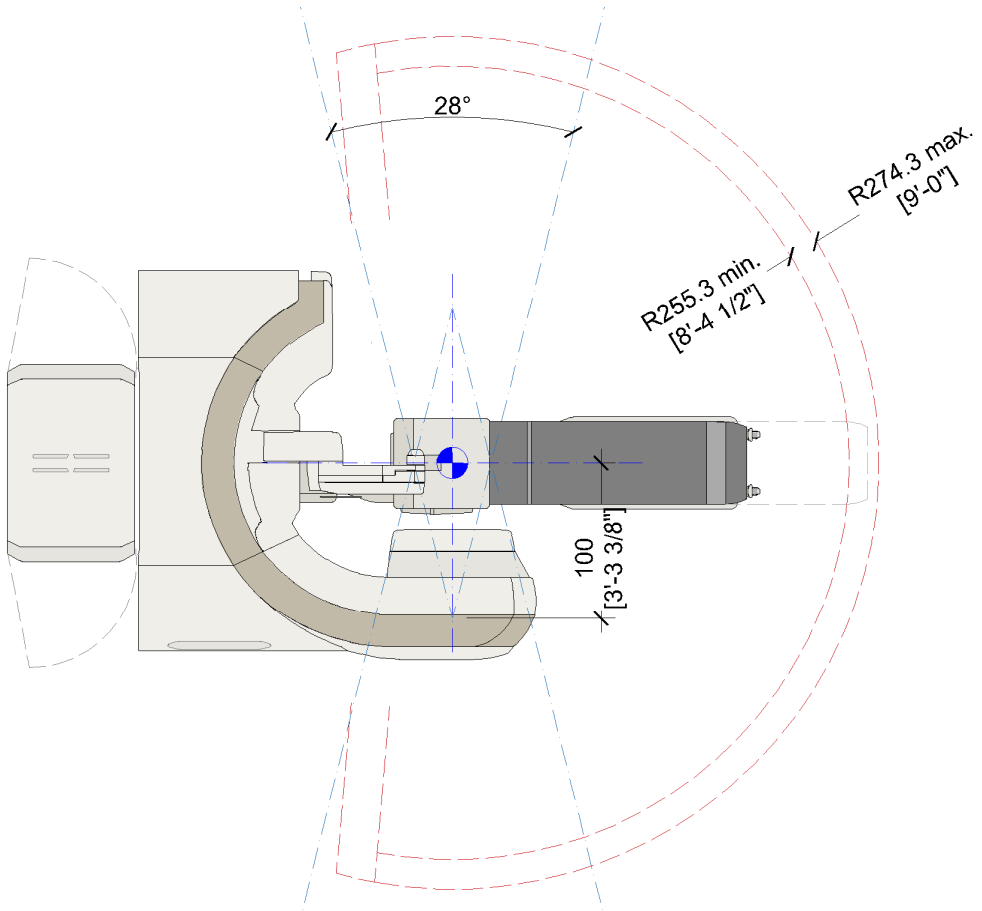


Figure 2-2 Couch Radius, Primary Beam Angle, and Source to Isocenter Distance

Table 2-1 Treatment System Weights		
Description	**Kg**	**Lb**
Stand and Gantry	8507	18754
Couch and Couch Top	627	1382
Turntable Assembly	391	862
Total System *(excluding BaseFrame)*	9525	20998

2.2 BASEFRAME

The BaseFrame is the main structural component of the TrueBeam/VitalBeam accelerator. It is installed into a recessed equipment pit below the finished floor level and is secured to avoid movement during final concrete placement.

Non-seismic anchors are provided and installed at the red dots indicated in the plan view. See 3.1.1 and 4.3 for more information.

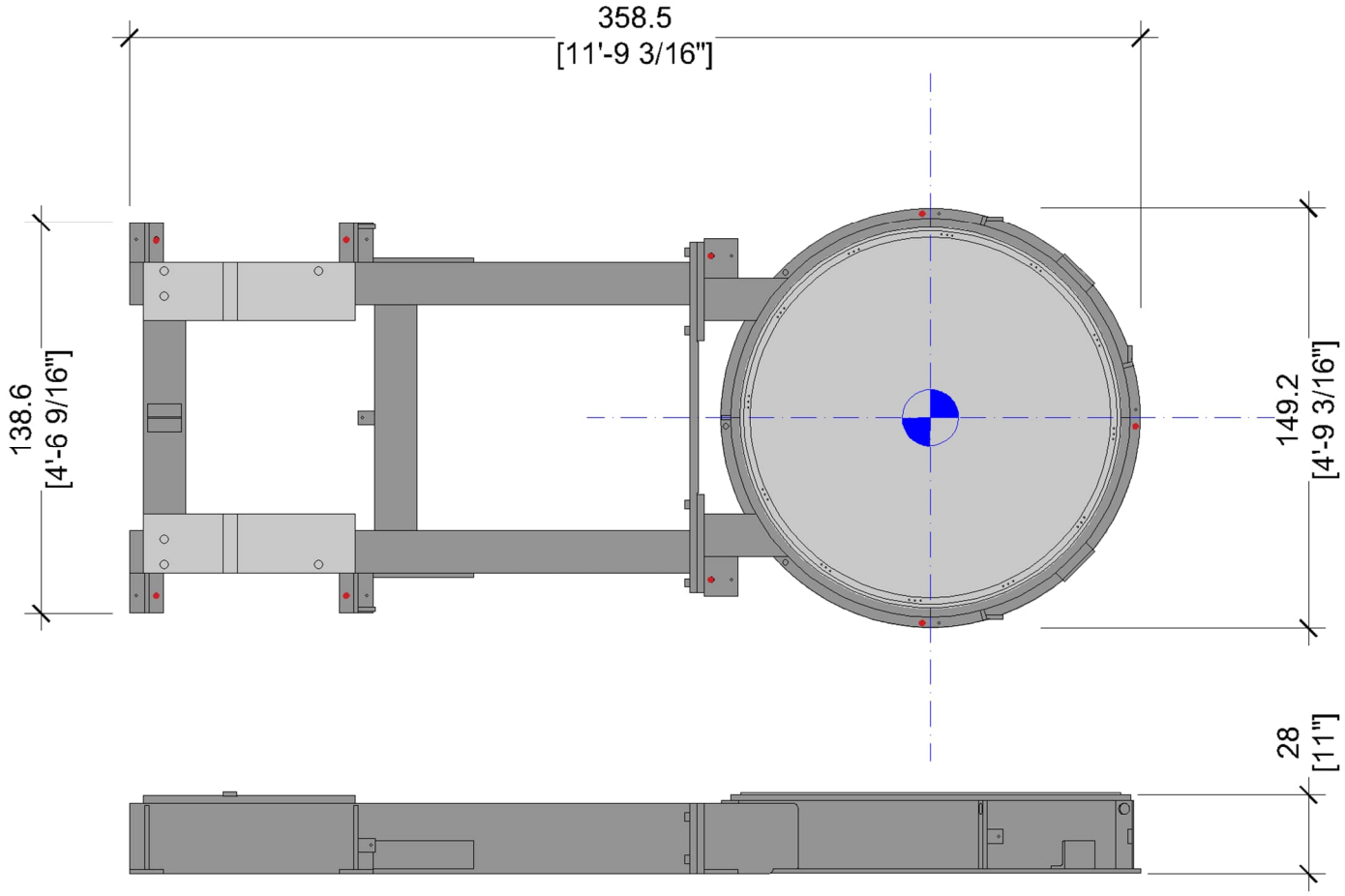


Figure 2-3 BaseFrame *(Plan and Side View)*

For Varian machine replacements, the existing BaseFrame may be able to be reused pending a levelness verification test. During renovation construction, the use of a BaseFrame protection template is recommended. Contact Varian Site Planning or Varian PM for more information.

Table 2-2 BaseFrame Weight		
Description	**Kg**	**Lb**
BaseFrame	657	1448

2.3 MODULATOR

The Modulator is the power supply cabinet to the TrueBeam system. The Modulator cabinet may be located either in the treatment room or remotely. Ventilation, acoustics, service provisions, and cable length must be considered in the final placement. See 3.1.3 for the required clearances.

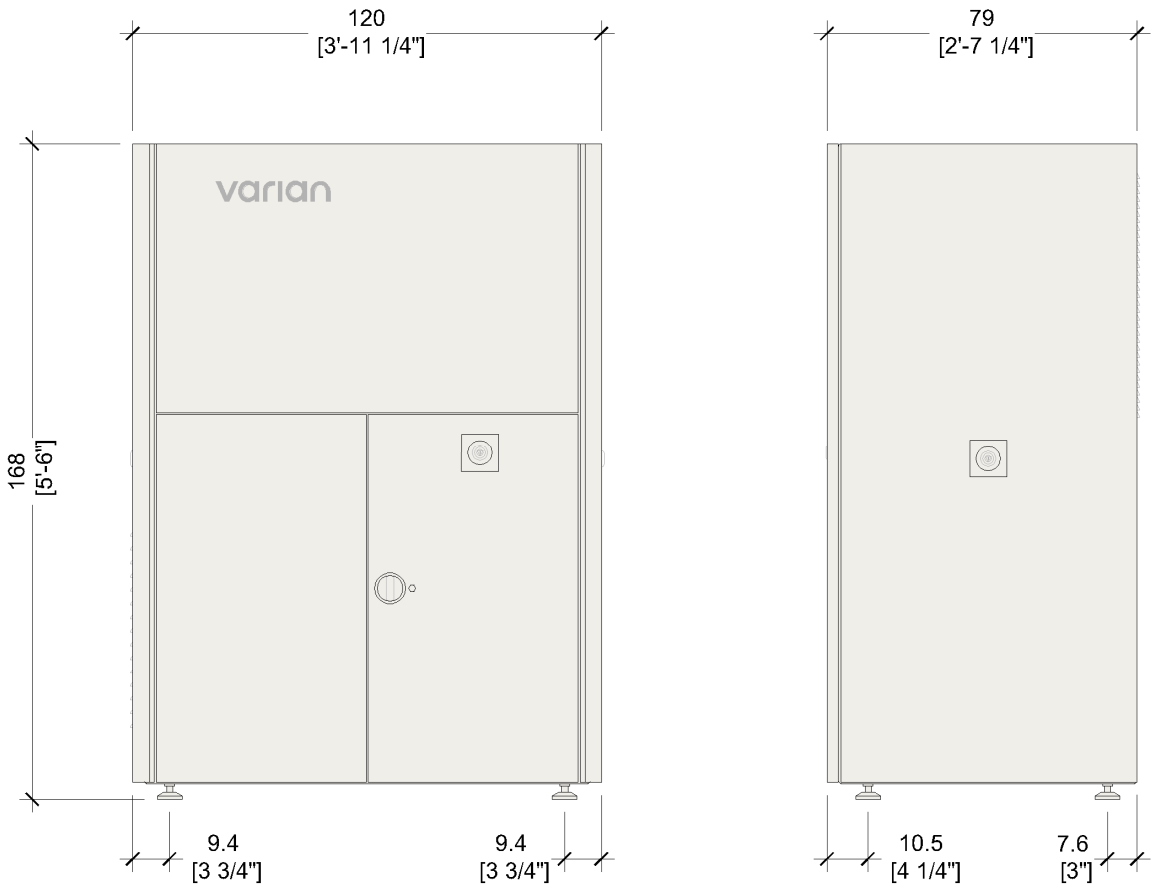


Figure 2-4 Modulator *(Front and Side View)*

Table 2-3 Modulator Weight		
Description	**Kg**	**Lb**
Modulator	900	1985

An optional Moving Modulator Kit is available that permits the Modulator Cabinet to be installed in areas that cannot meet the required service clearance area, as shown in Figure 3-4. This kit positions one side of the Modulator Cabinet closer to the wall during clinical use while allowing it to be rolled away from the wall for service. This kit can be ordered from the Varian PM. There is a requirement for a service pit below the modulator to manage the interconnection power cables. Contact Varian Site Planning or Varian PM for more information.

2.4 IN-ROOM MONITORS (IRM)

Two IRM displays are included as part of the standard TrueBeam/VitalBeam equipment package. See 3.1.5 for location details.

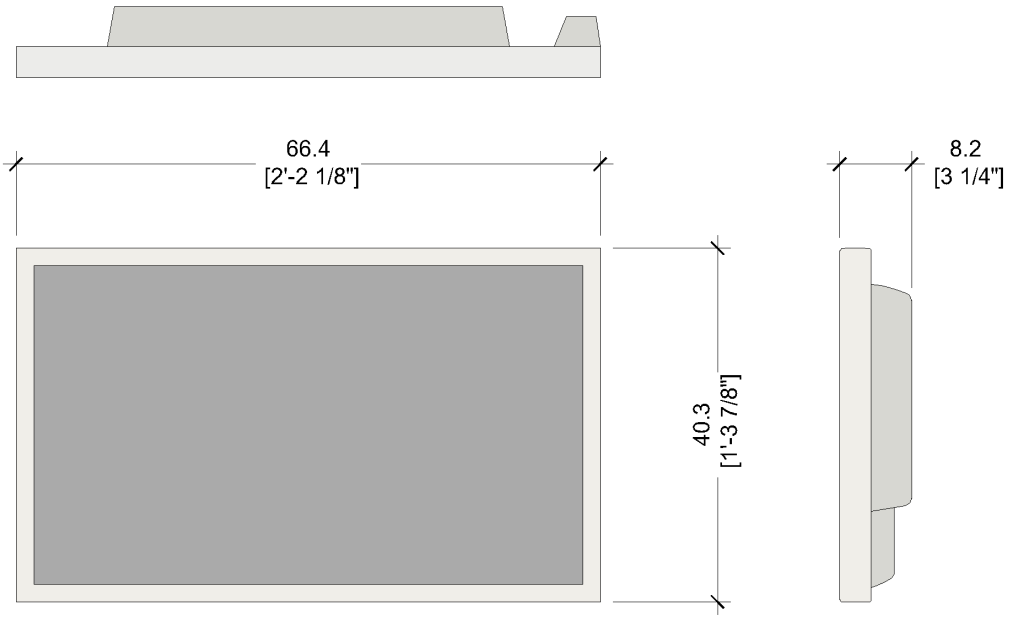


Figure 2-5 In-Room Monitor

Table 2-4 IRM Weight		
Description	**Kg**	**Lb**
IRM	13.6	30

An additional set of IRM displays can be purchased as an option. Verify the quantity on the final sales order or with the Varian PM.

2.5 USB HUB & SERVICE KEYBOARD AND MOUSE

The USB Hub is used to support the wireless service keyboard and mouse and other optional devices in the treatment room.



Figure 2-6 USB Hub



Figure 2-7 Service Keyboard & Mouse

2.6 CONSOLE CABINET

The Console Cabinet houses rack-mounted computers and imaging equipment required to run the system and user interface. It is powered by the Main Disconnect Panel. See Table 3-3 and 3.3.5.2 Control Area for details on the specific electrical requirements for the cabinet.

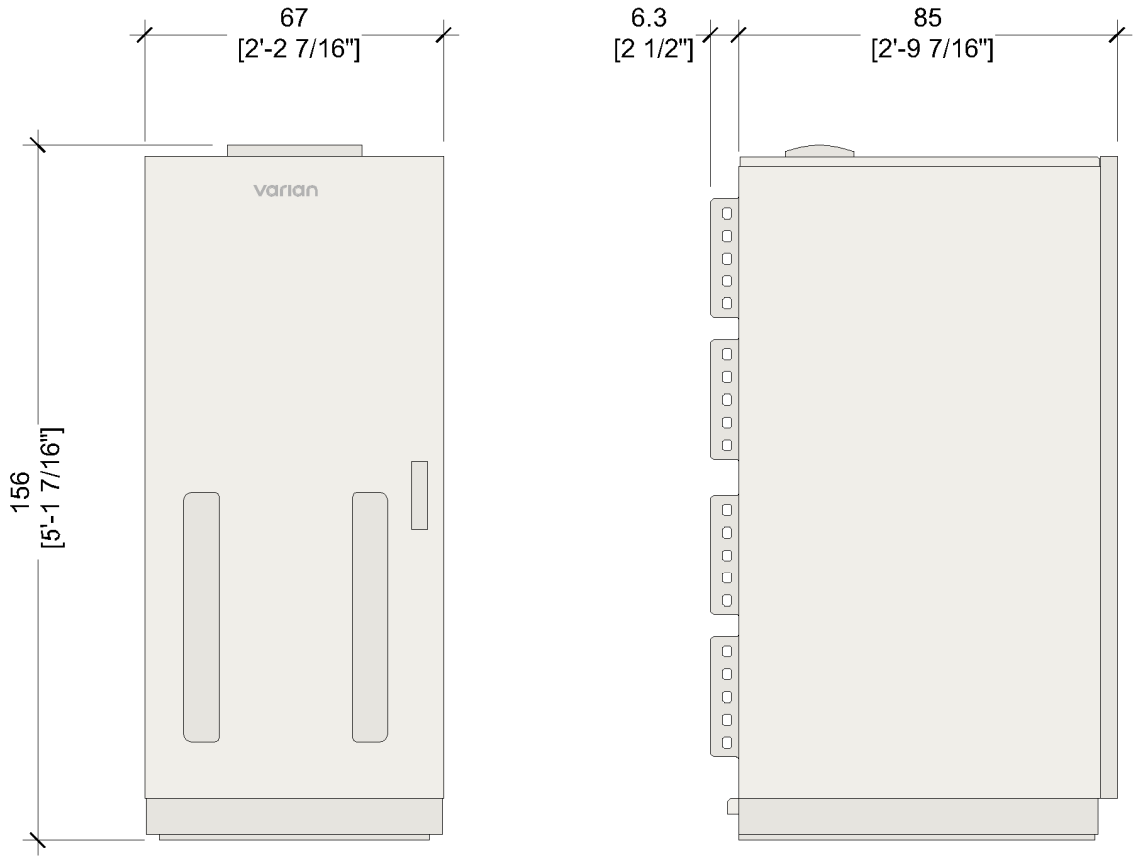


Figure 2-8 Console Cabinet *(Front and Side View)*

Table 2-5 Console Cabinet Weight		
Description	**Kg**	**Lb**
Console Cabinet	290	640

2.7 RESPIRATORY GATING SYSTEM (OPTIONAL)

An optional optical imaging system used to manage patient respiration motion during treatment delivery and imaging may be included with the equipment. There are two types Basic or Advanced, confirm the final equipment with the final sales order.

2.7.1 BASIC RESPIRATORY MOTION MANAGEMENT SYSTEM

Monoscopic Optical Imager – “Single Gating Camera” (SGC)

Table 2-6 SGC Optical Imager Weight		
Description	**Kg**	**Lb**
SGC Optical Imager	1.05	2.3

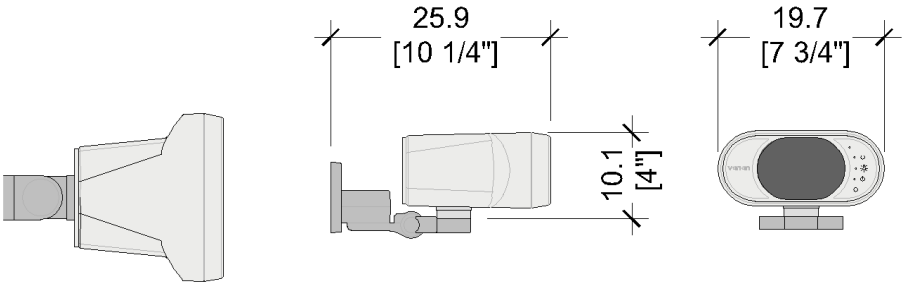


Figure 2-9 SGC Optical Imager *(Plan, Side, & Front View)*

2.7.2 ADVANCED RESPIRATORY MANAGEMENT SYSTEM

Stereoscopic “Dual” Optical Imager – Includes a marker block kit for tracking patient respiration motion.

Table 2-7 Dual Optical Imager Weight		
Description	**Kg**	**Lb**
Dual Optical Imager	1.7	3.75

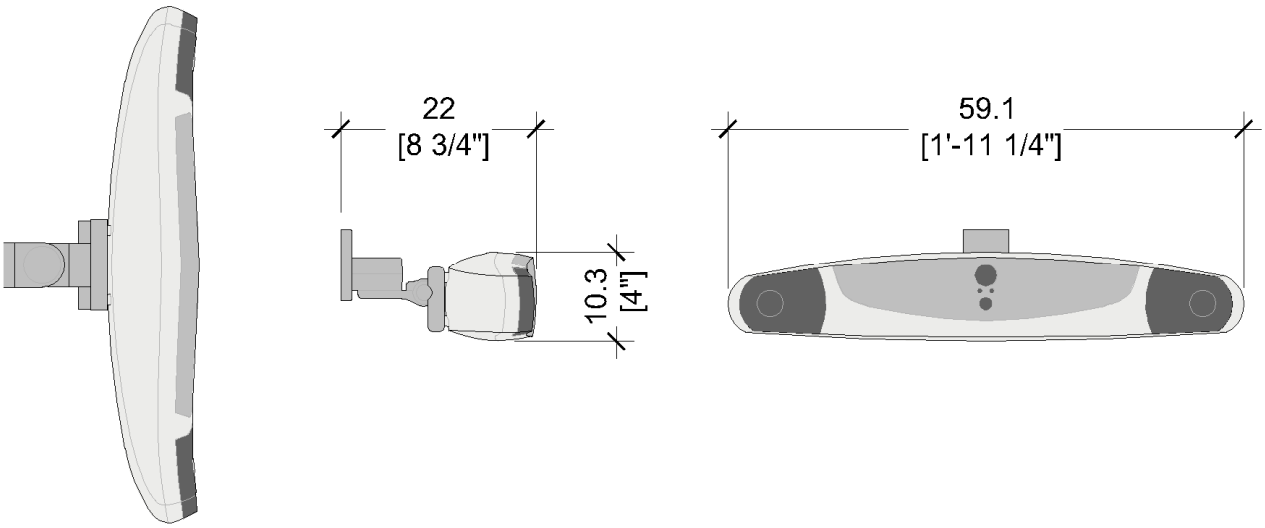


Figure 2-10 Dual Optical Imager *(Plan, Side, & Front View)*



Figure 2-11 Marker Block

2.8 CONTROL CONSOLE

The Control Console is used to operate the TrueBeam/VitalBeam. The components consist of:

- (1) Control Console, commonly referred to as the “Dedicated Keyboard”
- (2) System Monitors *(treat and image)*
- (2) CCTV Monitors
- (1) Standard Keyboard and Mouse *(wired)*

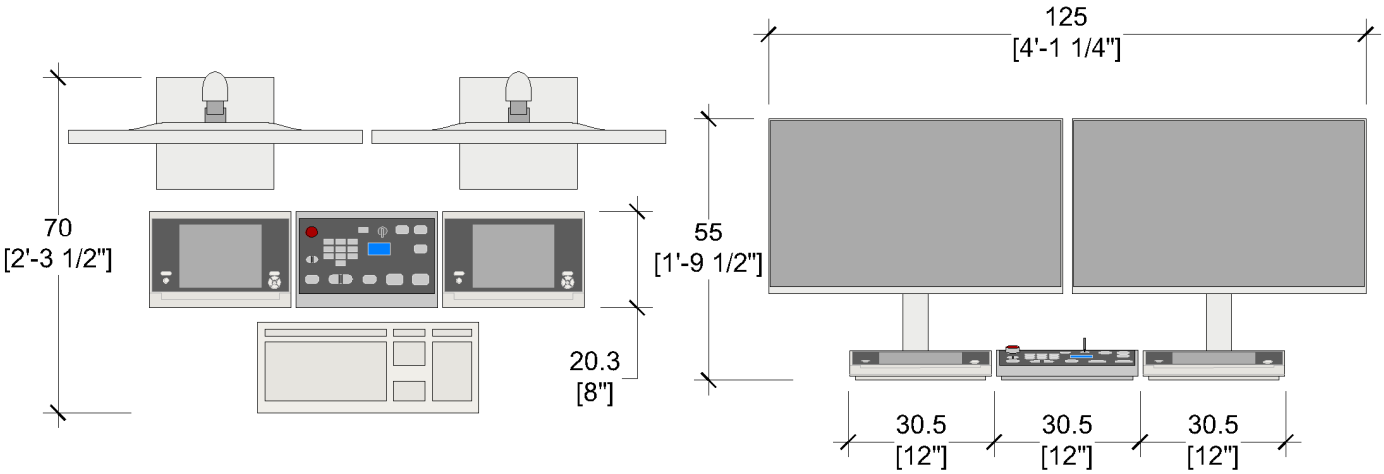


Figure 2-12 Control Console Layout

2.9 CABLES

This section shows you the point-to-point connection and the maximum cable length available for the Varian-supplied system cables. Refer to Table 3-7 for maximum containment lengths.

Table 2-8 TrueBeam/VitalBeam System Cables				
Cable Route	**Maximum Cable Length**	**# of Cables**	**Start**	**Finish**
A	30m [100’]	12	**T01** - Stand	**T03** - Modulator
B	45m [150’]	18		**T14** - Console Cabinet
C	45m [150’]	7		**T17** – Control Console
D	45m [150’]	1	**T14** - Console Cabinet	**T20** - Optical Imaging Camera
E	30m [100’]	2 *(up to x4)*	**T14** - Console Cabinet	**T07** - In-Room Monitor
F_1	15m [50’]	3		**T16** - System Monitors
F_2	15m [50’]	6		**T17** – Control Console
F_3	15m [50’]	2		**T18** - CCTV Monitor
F_4	15m [50’]	1		Network Jack *(by Customer)*
G	15m [50’]	1		**T13** - MDP
H	45m [150’]	1	**T13** - MDP	**T03** - Modulator
I	45m [150’]	2	**T05** - RJB	**T01** - Stand
J	45m [150’]	2	**T08** - Microphone	**T17** - Control Console
K	38m [125’]	1	**T14** - Console Cabinet	**T10** - Live View Camera
L	45m [150’]	2	**T11** - Speaker	**T17** - Control Console
M	45m [150’]	2 *(up to x6)*	**T09** - CCTV Camera	**T18** - CCTV Monitor
N	45m [150’]	1	**T14** - Console Cabinet	**T12** - USB Hub
O	4m [14’]	1		**T15** – IEC Outlet

Table 2-9 Customer Specified Cables				
P	as required	4	**T13** - MDP	**E03** - Modulator
Q	as required	3		**T15** - IEC Outlet

2.10 PRE-INSTALLATION KIT (PIK)

The PIK consists of Varian-provided mounting brackets, plates, posts, and electrical components. This kit is ordered and shipped to the site by the Varian PM for the customer to install before the TrueBeam/VitalBeam delivery. The Varian-supplied components must be installed per local code and regulations using Customer-provided and sized mounting hardware engineered to support a combined maximum load as shown in Table 2-10.

Table 2-10 Pre-Installation Kit Weights

	Bracket Weight		Component Weight	
Component	**Kg**	**Lb**	**Kg**	**Lb**
Floor Positioning Bracket	22	49	See Table 2-5	
Relay Junction Box	N/A		11	24
Laser Mounting Plates	1	2.2	≤ 2.6	≤ 5.7
CCTV Camera Mounts	1	2.2	2	4.5
IRM Ceiling Mounting Post (max.)	12	26.5	27.2	60
Optical Imager Ceiling Mounting Post (max.)	12	26.5	See Table 2-6 or Table 2-7	
Live View Camera Post	0.5	1	3.2	7
Speakers	N/A		0.8	1.75

2.10.1 FLOOR POSITIONING BRACKET

The floor positioning bracket allows for the proper positioning of the Console Cabinet. Refer to 3.2.1 for installation clearance requirements.

- (8) – Pre Drilled 12.7mm [1/2”] diameter mounting holes

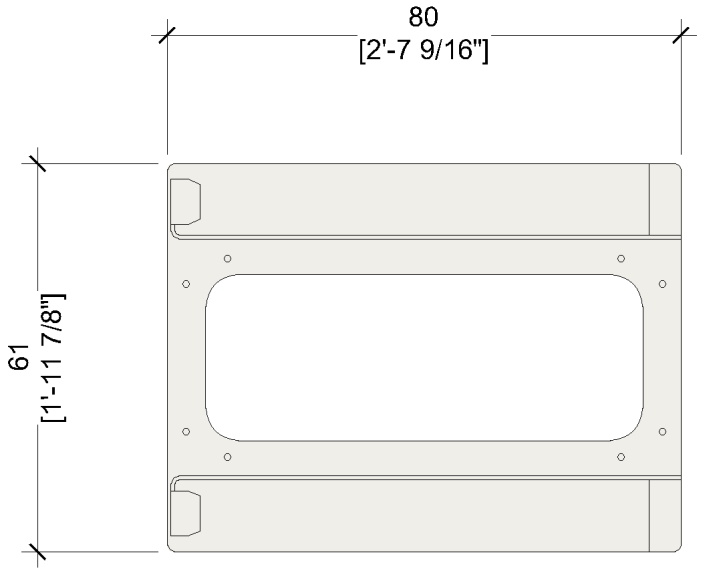


Figure 2-13 Console Cabinet Floor Positioning Bracket

2.10.2 RELAY JUNCTION BOX (RJB)

The RJB is a factory-assembled and tested control panel that provides a central interface connection point between the TrueBeam/VitalBeam Accelerator and the treatment room main room lights, system status warning lights, patient positioning lasers, door interlocks, and remote emergency-off push buttons. Refer to 3.3.4 Relay Junction Box (RJB) for more information.

- The door hinges are on the left side of the RJB.

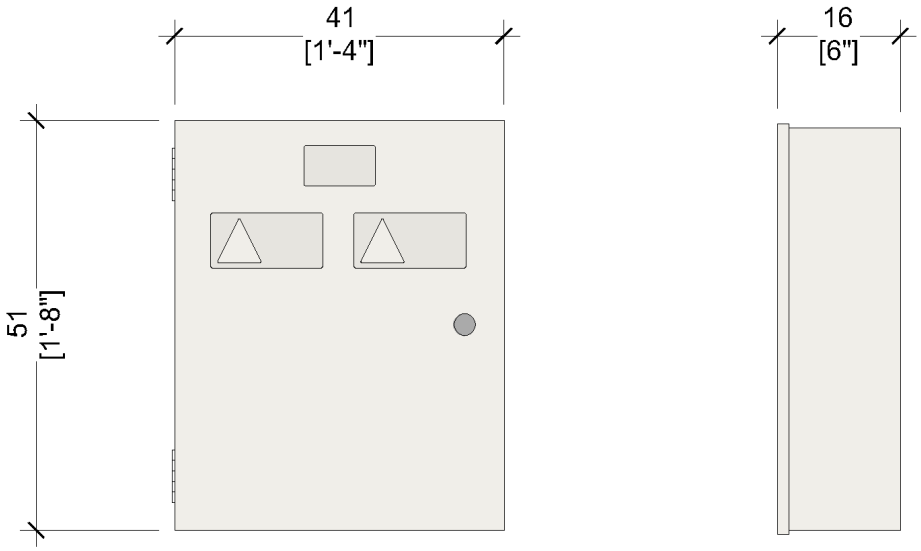


Figure 2-14 Relay Junction Box *(Front and Side View)*

2.10.3 LASER MOUNTING PLATES

The patient is aligned to the accelerator's isocenter with positioning lasers. The lasers are powered and controlled by a common circuit that is connected to the RJB.

- Four steel Laser Mounting Plates are provided, refer to 3.1.4.4 Laser Mounting Plates.

Lasers are not a standard part of the TrueBeam/VitalBeam system but may be supplied by Varian as part of the equipment order. Contact Varian Sales or Varian Site Planning for more information on available options.

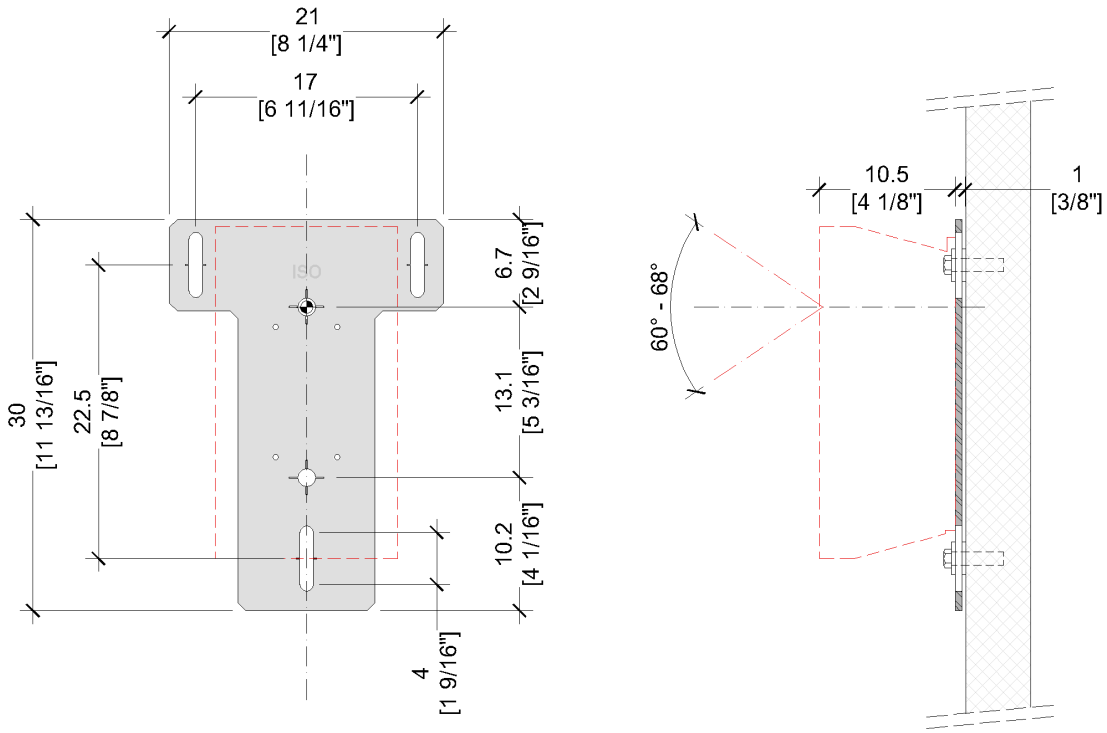


Figure 2-15 Laser Mounting Plate

2.10.4 MOTIONVIEW CCTV CAMERAS

A Closed-Circuit Television (CCTV) system is required for safe operation. It is critical to patient safety that the therapist always maintain visual contact with the patient. Refer to Figure 3-5 and Section 4.5 for more information.

- A two-camera MotionView CCTV camera system is standard with TrueBeam/VitalBeam.
- Additional two-camera MotionView CCTV camera systems may be purchased as an option, up to a maximum of 6 cameras.
- Each CCTV camera has a dedicated monitor in the console area, see 2.8 Control Console
- 18 to 30 VAC, 50/60 Hz (24 VAC, 0.875 A, nominal)

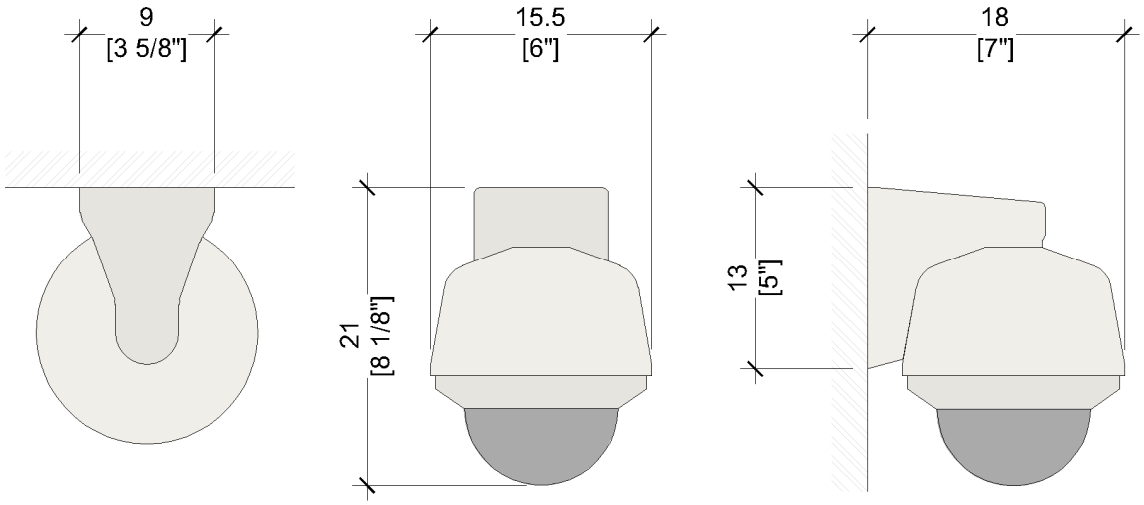


Figure 2-16 CCTV Camera Mounts *(Plan, Front, and Side Views)*

2.10.5 CEILING MOUNTING PLATES & POSTS

Aluminum ceiling mounting plates, configurable posts, and mounting brackets are provided as part of the PIK for installing the In-Room Monitors (IRMs) and the Dual Optical Imager or the SGC Optical Imager. Refer to 3.1.5 for installation locations and heights.

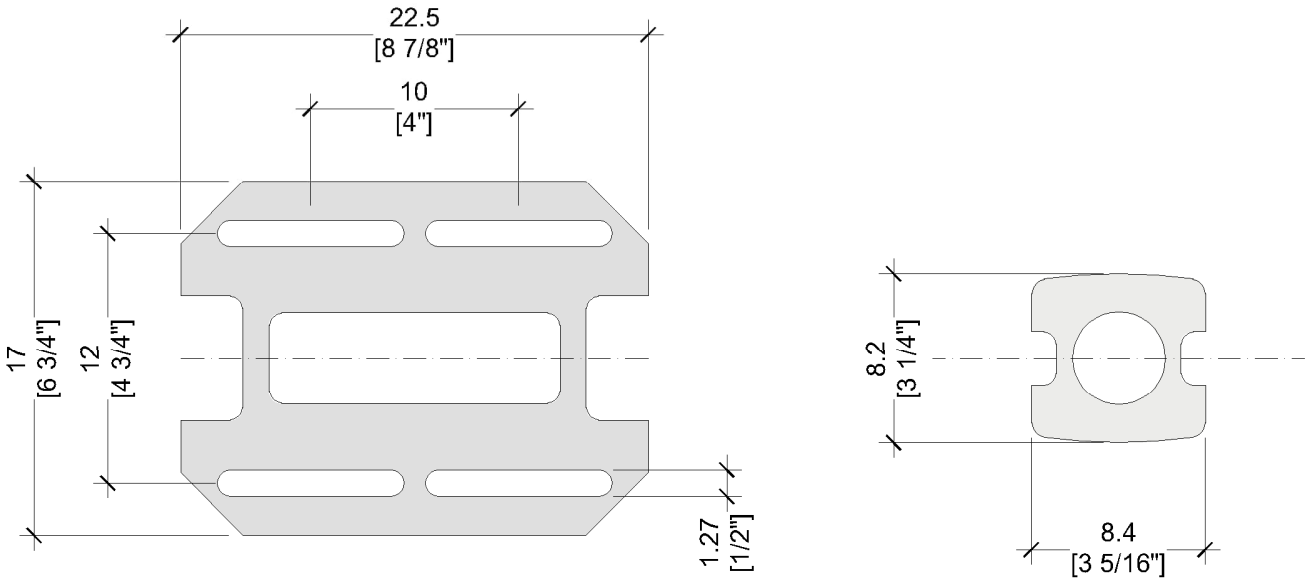


Figure 2-17 Ceiling Mounting Plate and Post Section

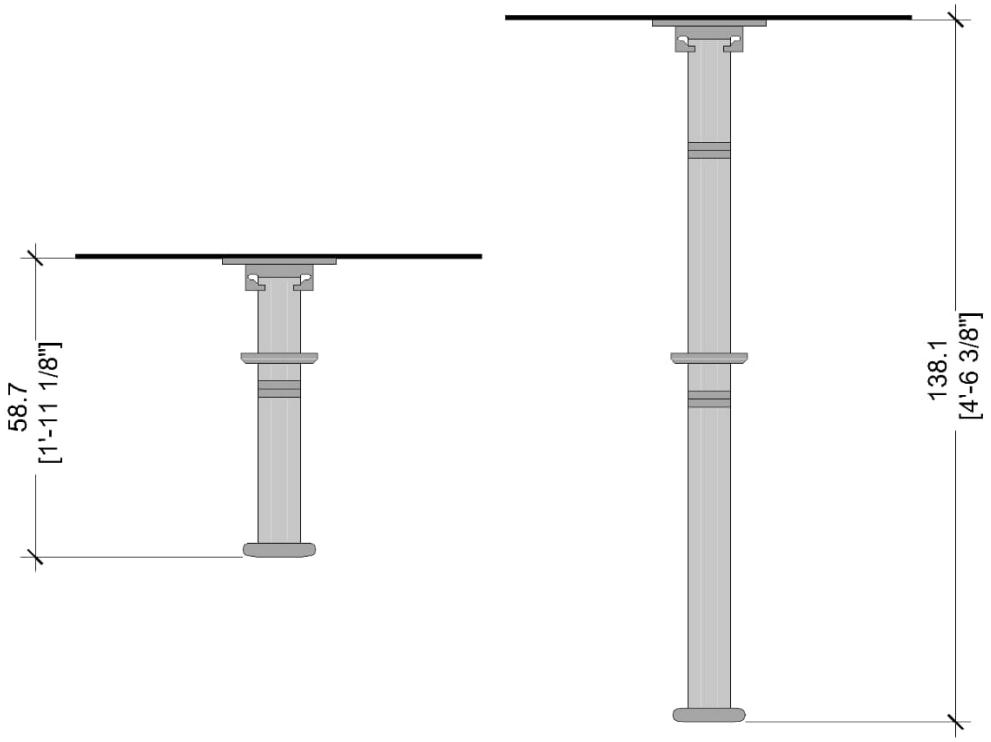


Figure 2-18 Ceiling Mounting Post *(minimum and maximum configuration lengths)*

The posts are configurable in approximately 15cm [6"] increments from the minimum to the maximum shown above. See for installation positioning.

2.10.6 LIVE VIEW CAMERA MOUNT

The Live View (LV) Camera enables monitoring of the TrueBeam/VitalBeam and the patient. The system provides proximity information while the machine is moving to help prevent injury to the patient, refer to Figure 3-5 for the installation location.

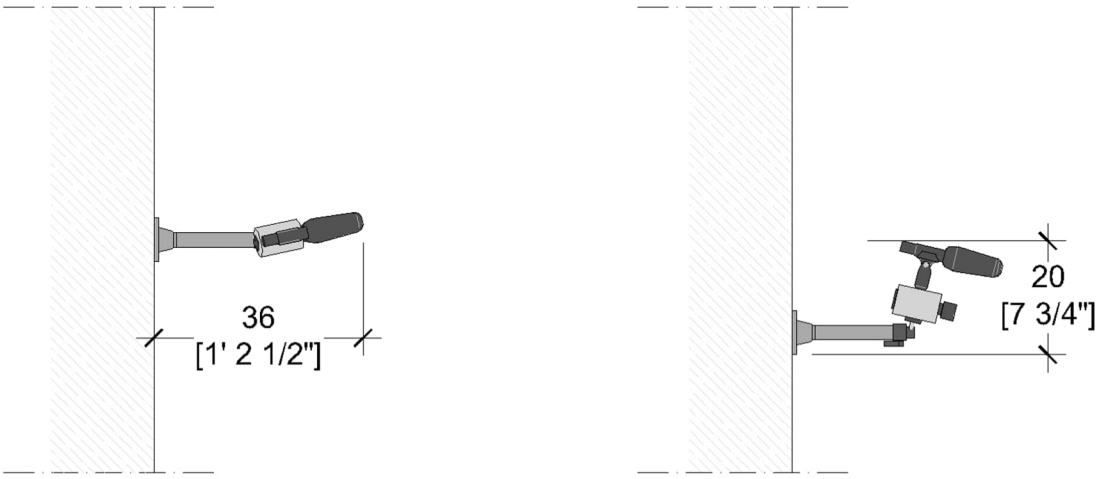


Figure 2-19 Live View Camera Wall Mount *(Plan and Side View)*

2.10.7 SPEAKERS AND MICROPHONE

Two speakers and two microphones are a standard part of the TrueBeam/VitalBeam system that provides intercom and audio services in the treatment room, operated by the Control Console.

- The microphones are Varian-installed
- The speakers are Customer-installed
- Refer to Figure 3-5 for the installation location

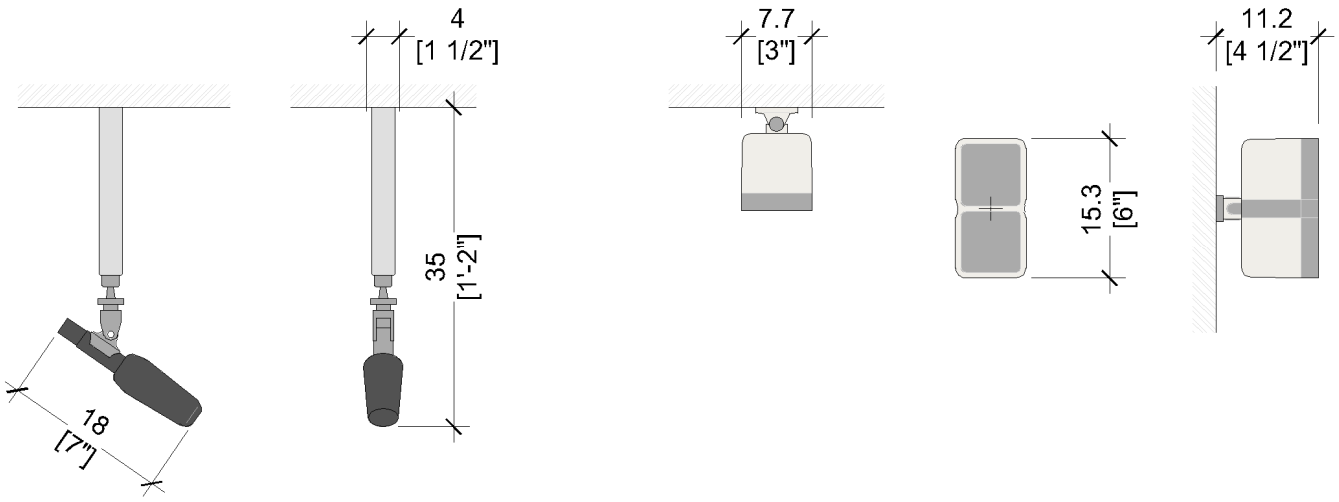


Figure 2-20 Microphone and Speaker *(Side and Front Elevations)*

2.11 MAIN DISCONNECT PANEL (MDP), SALES OPTION

The MDP is the main power distribution point to the TrueBeam/VitalBeam system. The MDP includes safety features to properly control power to the system and depending on the model, may offer additional safety circuits.

- Provides a single point of connection for the site's 3-phase power to the System
- Splits the Mains power into two independent switchable power outputs, refer to 3.3.1 Power Requirements
  - To the Modulator Cabinet
  - To the Control Cabinet, via an IEC 60309 outlet provided with the MDP
- Provides for various system safety features:
  - Overcurrent protection for the outputs
  - Mains Incoming Power Switch (non-emergency)
  - Lock Out/Tag Out capabilities for maintenance safety
  - Emergency Disconnect Button
  - System Start
- Option to provide 24V power for up to 6 CCTV cameras

The MDP and IEC 60309 outlet are not a standard part of the TrueBeam/VitalBeam system but can be supplied by Varian as part of the equipment order.

If the MDP is not part of the equipment sales order, then it can be ordered directly from the manufacturer. Contact Varian Site Planning or Varian PM for more information.

3 CUSTOMER REQUIREMENTS

NOTICE

It is the Customer's responsibility:

To determine the quantity, size, and type of mounting hardware required to adequately and seismically anchor the Varian-provided components to the floor, walls, and ceiling.

To ensure that the site-specific design documents for the Varian system, to be installed, comply with all applicable local, regional, and national codes and regulations.

Compliance must address but is not limited to proper egress, adequate separation of services, and required clearances for equipment with hazardous voltages.

The customer is responsible for the safety of the equipment layout in the Control Area and Treatment Room, particularly with the ceiling and wall-mounted equipment.

3.1 TREATMENT ROOM

3.1.1 BASEFRAME PIT

WARNING

The BaseFrame is supplied with mounting hardware that is NOT suitable for sites subject to seismic activity. It is the responsibility of the customer to provide a qualified structural engineer to determine the quantity, size, and type of mounting hardware required for seismically anchoring the Varian-provided components to the pit floor. Contact Varian Site Planning or Varian PM for more information.

The BaseFrame is the main structural component of the medical device. Any modification, alteration, or damage is strictly prohibited and will result in the BaseFrame having to be replaced at considerable expense and time.

- The pit floor shall be designed by a qualified structural engineer capable of carrying the total weight of the fully assembled accelerator, see Table 2-1 and Table 2-2.
- Structural rebar must be a minimum of 7.5cm [3"] below the pit floor level.
- The BaseFrame pit depth shall not vary more than 6mm [1/4"].
- The concrete finished floor must be level within ±3mm [±1/8"] for a 183cm [6'-0"] radius about the isocenter, see the yellow shaded area shown in Figure 3-1
- All exposed concrete shall be suitably sealed before the BaseFrame Installation.
- The backfill concrete in the pit around the BaseFrame must be leveled to the Outer Ring (**D**) and the Stand Mounting Pads (**F**). This should be performed the same day as the BaseFrame installation so levelness can be verified by Varian and signed off by the Customer.
- Cable and chilled water line access must be considered before backfilling the pit with concrete.
- Refer to 3.4.2 Cooling Line Access for details on the chilled water connection point.
- Contact the Varian PM and refer to 4.3 BaseFrame Installation, for a detailed explanation of the installation procedure.

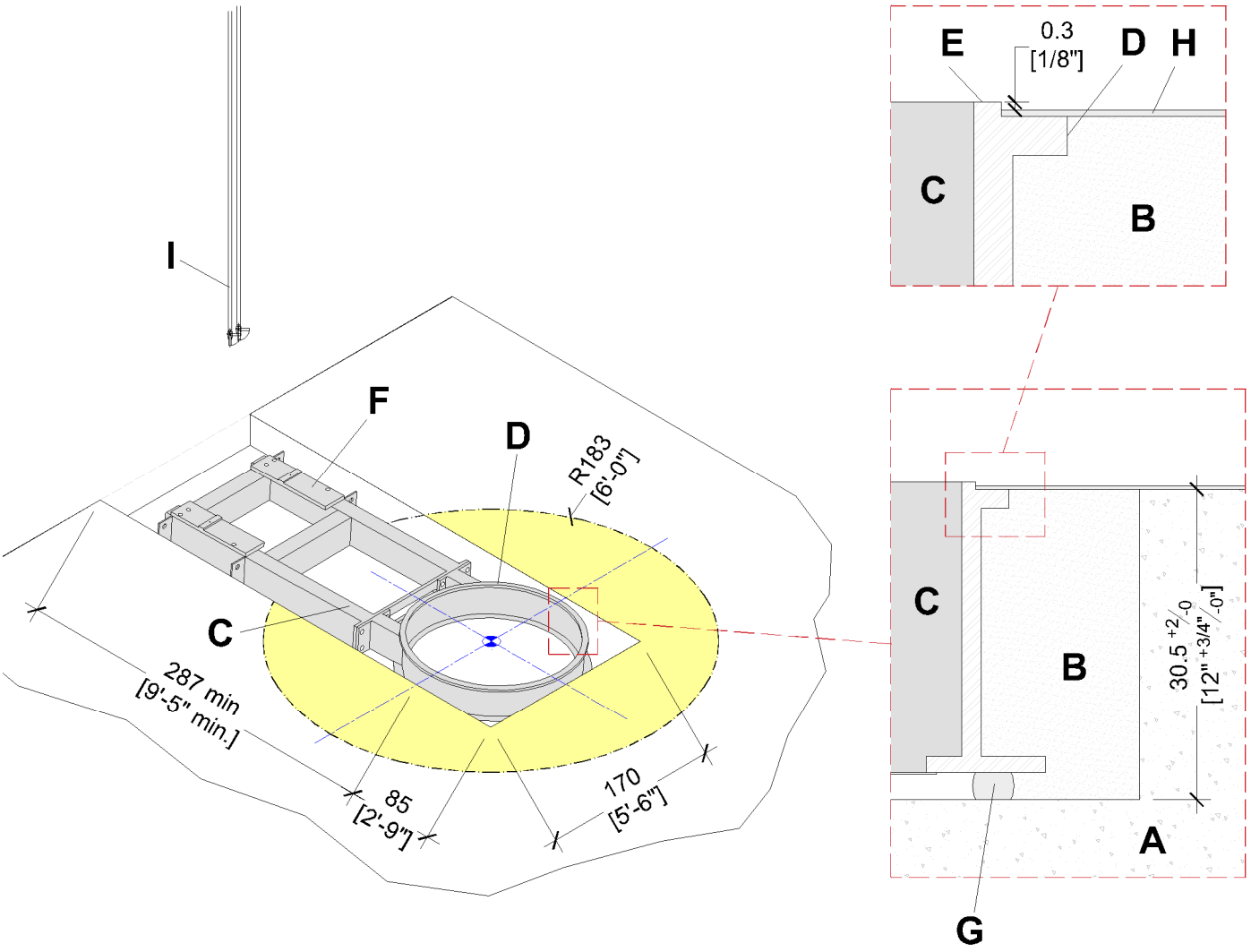


Figure 3-1 Minimum BaseFrame Pit Dimensions

Table 3-1 BaseFrame Pit Key			
A	Structural Concrete (by Customer)	**F**	Stand Mounting Pads, BaseFrame
B	Backfill Concrete (by Customer)	**G**	Foam Backer (by Varian)
C	BaseFrame (by Varian)	**H**	Finished Flooring (by Customer)
D	Outer Ring, BaseFrame	**I**	Chilled Water Supply and Return Isolation Valves (by Customer)
E	Turntable Trim Ring, BaseFrame		

3.1.2 STAND, GANTRY, AND COUCH CLEARANCES

3.1.2.1 MINIMUM FLOOR-LEVEL CLEARANCES

The area highlighted in Figure 3-2 shows the operational and service clearances required for the TrueBeam/VitalBeam Stand, Gantry, and Couch.

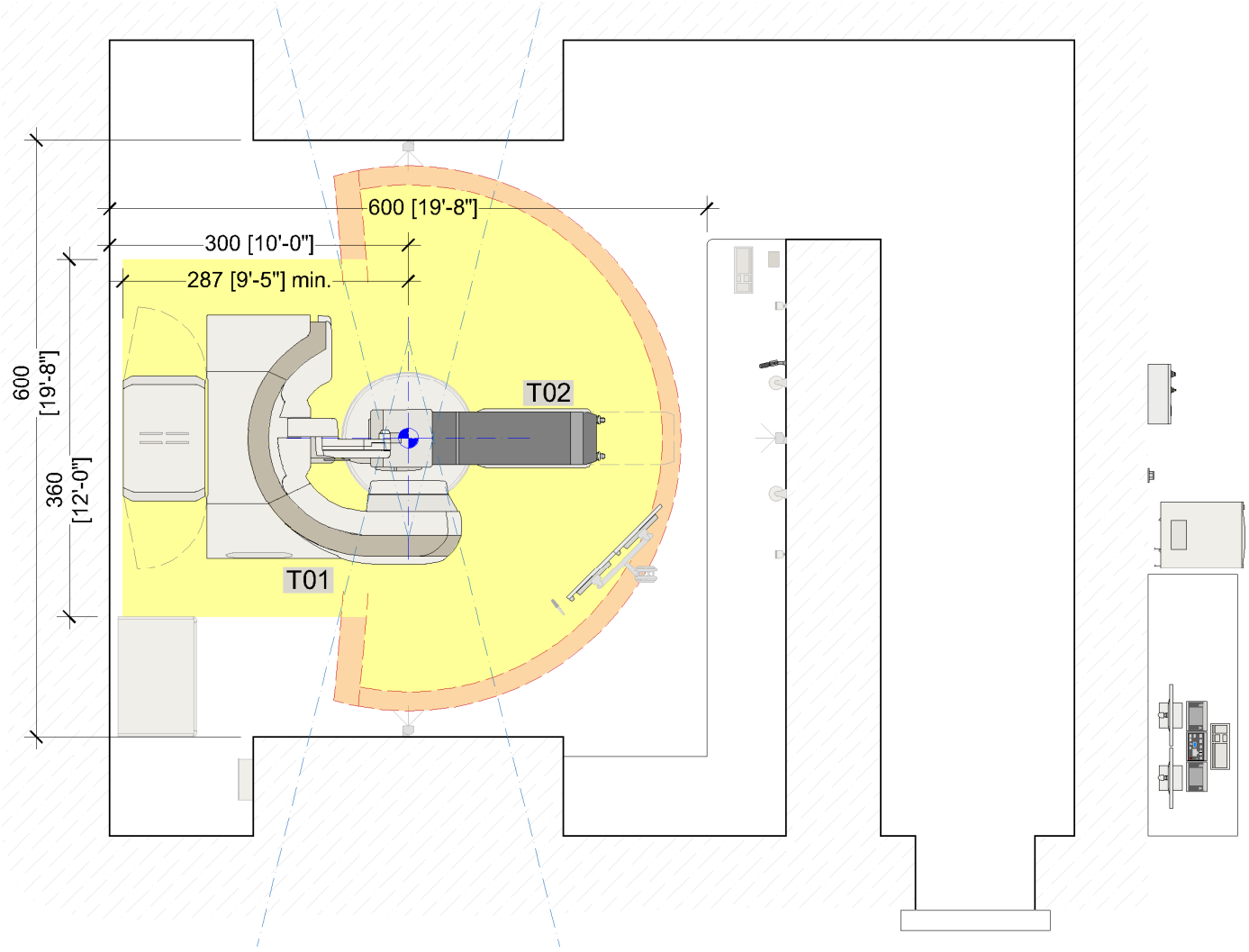


Figure 3-2 Minimum Room Clearances

CAUTION

The maximum couch arc allows complete rotation of the Couch Top at full retraction. Obstructions inside the minimum required couch arc can result in injury to patients and medical personnel as well as equipment damage.

- Refer to Figure 2-2 for the minimum and maximum couch arc radii

Obstructions between the minimum required couch arc and the maximum couch arc may be considered provided they are reviewed and approved by Varian and the Customer. In specific situations, such as dynamic stereotactic treatments, a larger area may be required.

3.1.2.2 OVERHEAD CLEARANCES

The area highlighted in Figure 3-3 shows the overhead installation, operational, and service clearances required for the TrueBeam/VitalBeam Stand, Gantry, and ceiling-mounted components.

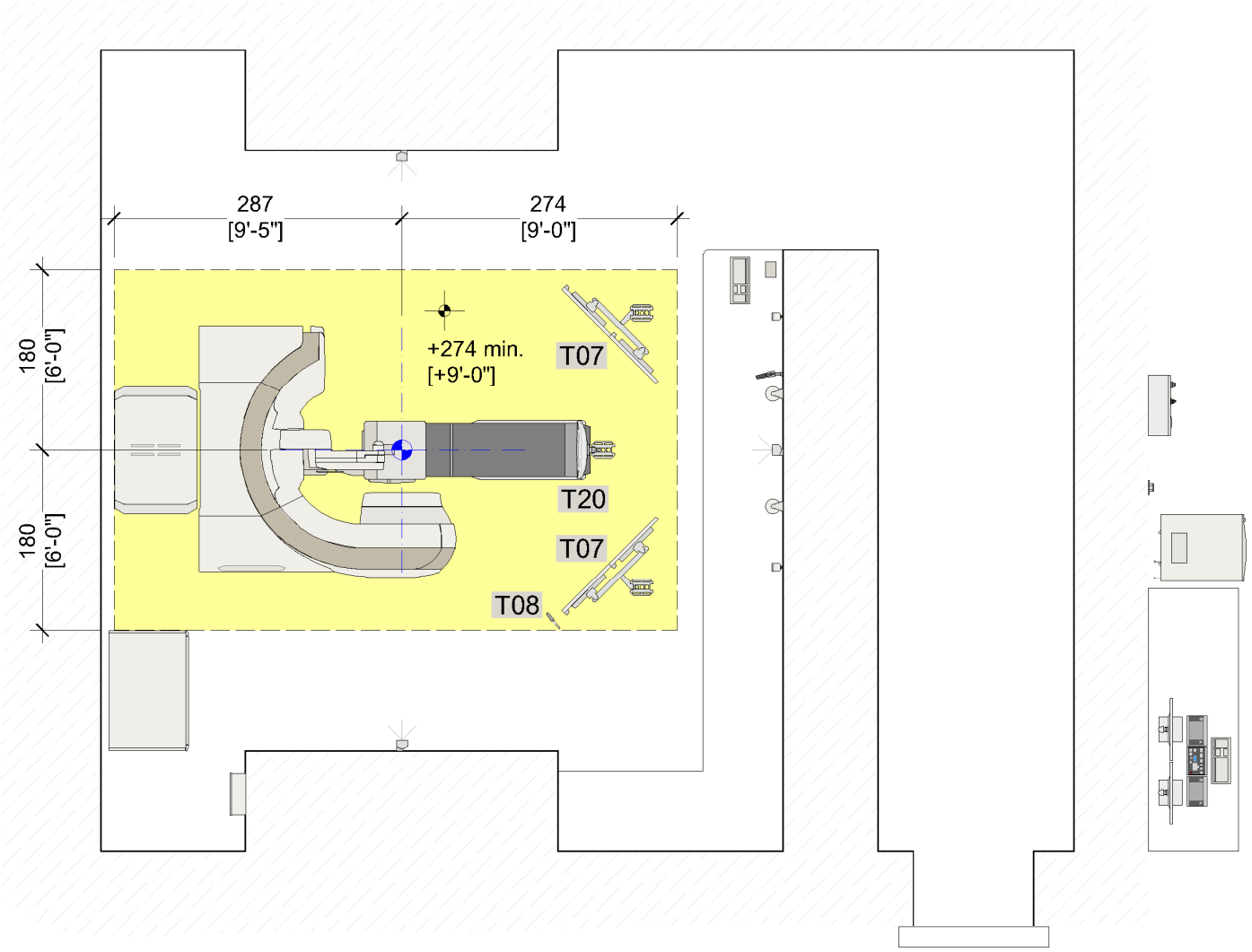


Figure 3-3 Minimum Overhead Clearances

- Provide 274cm [9'-0"] minimum clearance from the finished floor to the finished ceiling.
- Additional clearance height will be required for the ceiling laser that is mounted directly above the isocenter.

3.1.3 MODULATOR CABINET CLEARANCES

The operational, cabling, and minimum service clearances required for the Modulator area are highlighted in Figure 3-4. Refer to 2.3 Modulator and 3.3.8 Cable Access for more information.

NOTICE

Do not locate the Modulator in the accelerator's primary beam path, refer to Figure 2-2.

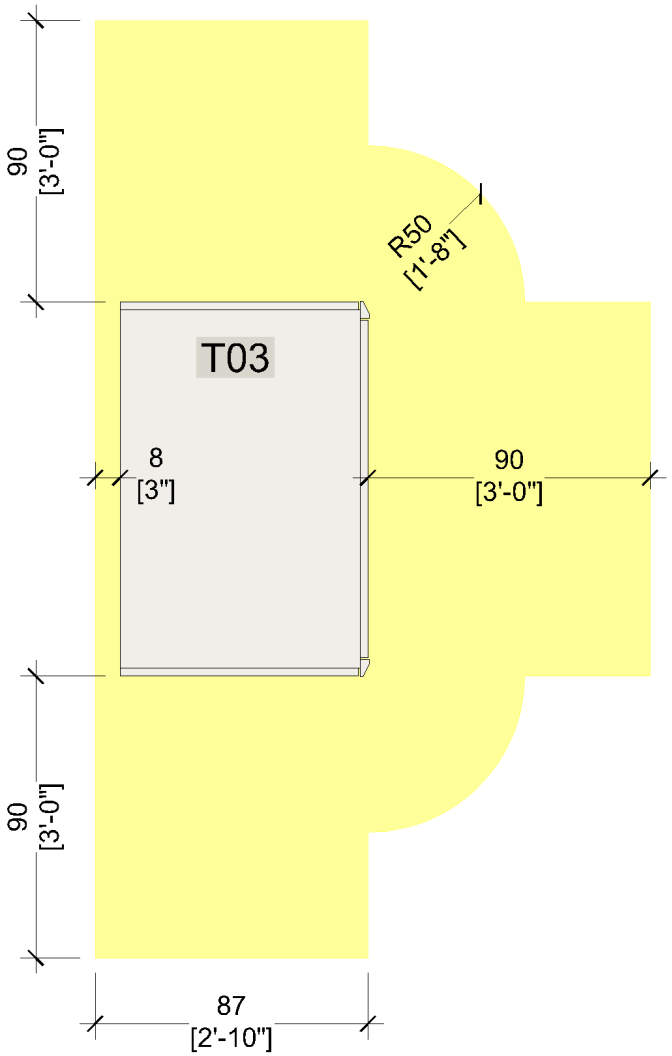


Figure 3-4 Modulator Minimum Service Clearances

WARNING

It is the customer's responsibility to ensure that all electrical safety clearances around the Modulator comply with local, regional, and national codes and regulations.

3.1.4 SAGITTAL WALL COMPONENT LOCATIONS

NOTICE

Provide structural support as required, refer to Table 2-10 for component weights.

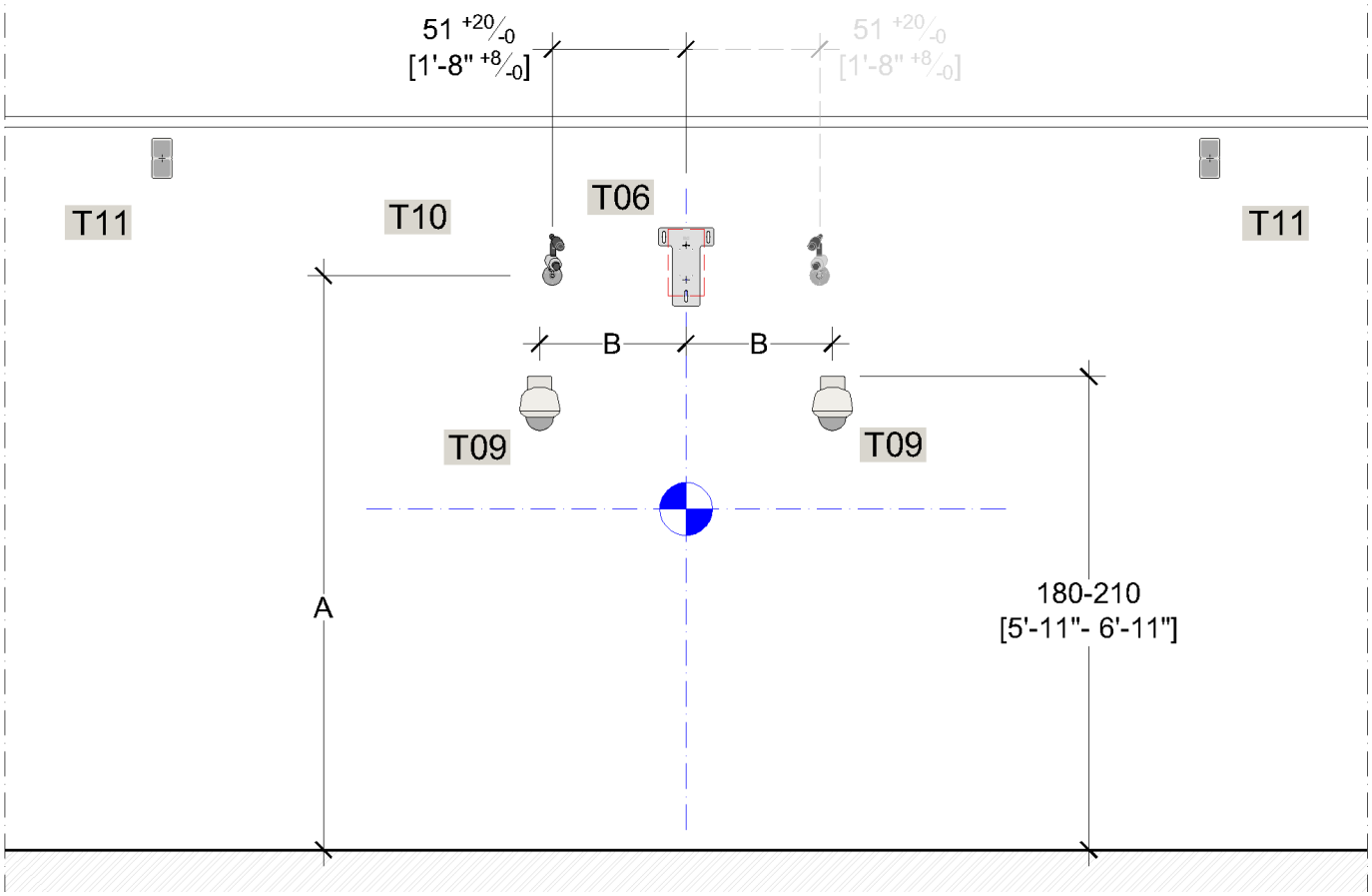


Figure 3-5 Treatment Room Sagittal Wall Elevation

- For dimension "**A**" refer to Table 3-2
- For dimension "**B**" refer to Figure 3-6

3.1.4.1 LIVE VIEW CAMERA

- The LV camera is Varian-installed, refer to 2.10.6 for component details.
- The LV wall mounting post is Customer-installed.
- Wall mount the LV camera post on either side of the isocenter, refer to Figure 3-5 and Table 3-2 for the installation area for the LV camera (**T10**).
- Provide cable access within 15cm [6"] of the LV mounting post.

Table 3-2 Live View Camera Post Installation Area

Distance from Isocenter to Sagittal Wall	Dimension "A" from Finished Floor
260 - 350cm [8'-6" - 11'-6"]	218.5cm ±2.5cm [7'-2" ±1"]
350 - 610cm [11'-6" - 20'-0"]	228cm ±5cm [7'-6" ±2"]

3.1.4.2 MOTIONVIEW CCTV CAMERAS

NOTICE

Do not locate the secondary or CCTV cameras in the accelerator's primary beam path, refer to Figure 2-2.

The MotionView CCTV camera housing is wall-mounted by the customer. The CCTV cameras are Varian-installed, refer to 2.10.4 for component details.

- The primary MotionView CCTV (**T09**) two-camera system location shown in Figure 3-5 and Figure 3-6 is MANDATORY for patient safety.
- If additional CCTV camera systems are purchased, the installation location is Customer preference (not shown).
- Provide cable access for the CCTV camera through the Varian-provided wall-mount housing.

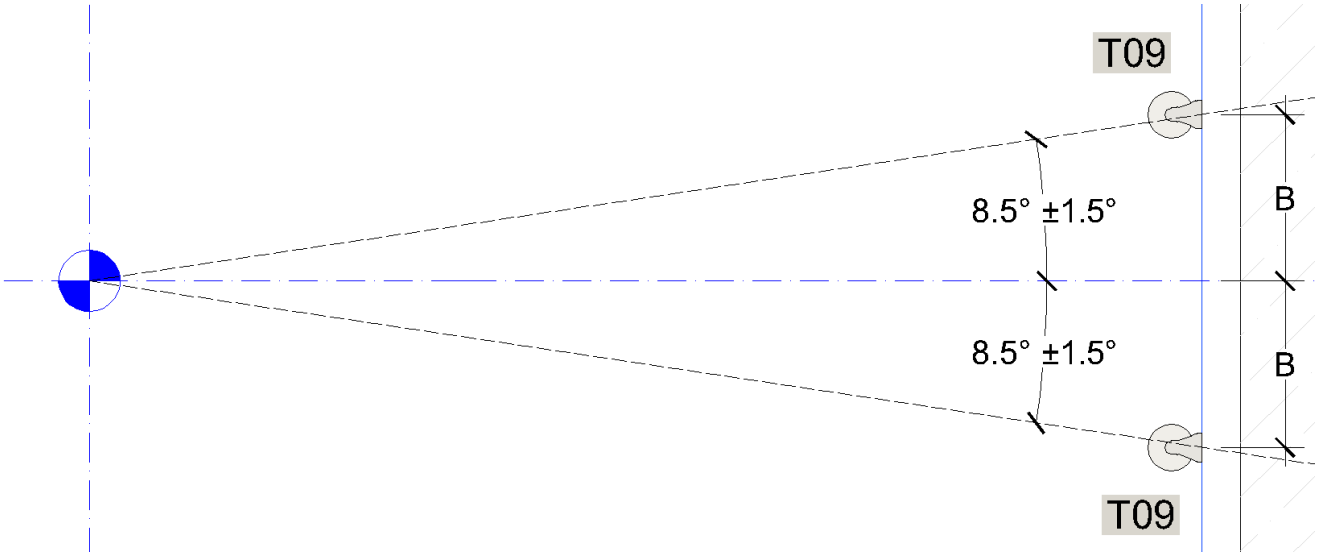


Figure 3-6 Primary MotionView CCTV Camera Sagittal Wall Location *(plan view)*

3.1.4.3 SPEAKERS AND MICROPHONES

- Wall mount the Speakers (**T11**) towards the front of the treatment room outside the primary beam path. The installation location is Customer preference, refer to 2.10.7 for component details.
  - Provide cable access within 15cm [6"] of the Speaker.
- The primary Microphone (**T08**) will be Varian-installed on the LV camera.
  - Refer to 3.1.4.1 for cable access.
- The secondary microphone will be Varian-installed on the false ceiling typically near the ceiling-mounted IRMs using the 25mm [1"] T-bar clip post (not shown), see Figure 2-20.

3.1.4.4 LASER MOUNTING PLATES

NOTICE

The mounting structure must be vibration-free and accessible for service.

DO NOT mount to wood, gypsum board, light gauge steel framing, or suspended ceiling grid.

- Refer to 2.10.3 for component details.
- The sagittal Laser Mounting Plate (**T06**) installation height is variable, 230cm [7'-6"] is the recommended height to avoid any obstructions with the laser alignment beam, see Figure 3-5. Consult with the laser manufacturer and customer on the desired elevation.
- Install the side Laser Mounting Plates at 130cm [4'-3"] above the finished floor (not shown).
- Install the ceiling Laser Mounting Plate directly above the isocenter, the mounting plate may be installed parallel or perpendicular to the sagittal plane.

The Sagittal Laser plate may be installed vertically, as shown in Figure 3-5, or horizontally, depending on the laser model. The mounting plate has two isocenter alignment holes for installation flexibility. Contact the Varian PM or laser manufacturer on installation orientation options.

3.1.5 IRM AND OPTICAL IMAGER

- The IRMs (**T07**) in Figure 3-7, may be located on either side of the isocenter, typically on the opposite side of the maze entrance, refer to 2.10.5 and 4.5 for more information.
- The Optical Imager is located along the longitudinal axis line of the couch.

NOTICE

The mounting structure must be vibration-free and accessible for service.

DO NOT mount to wood, gypsum board, light gauge steel framing, or suspended ceiling grid.

The ceiling mounting plate installation orientation is critical, refer to Figure 2-17, Figure 3-7.

DO NOT locate the IRMs inside or within 60cm [24”] of the primary beam path, refer to Figure 2-2.

WARNING

The customer must maintain a minimum clearance of at least 203cm [6'-8"] between the floor and ceiling-mounted equipment.

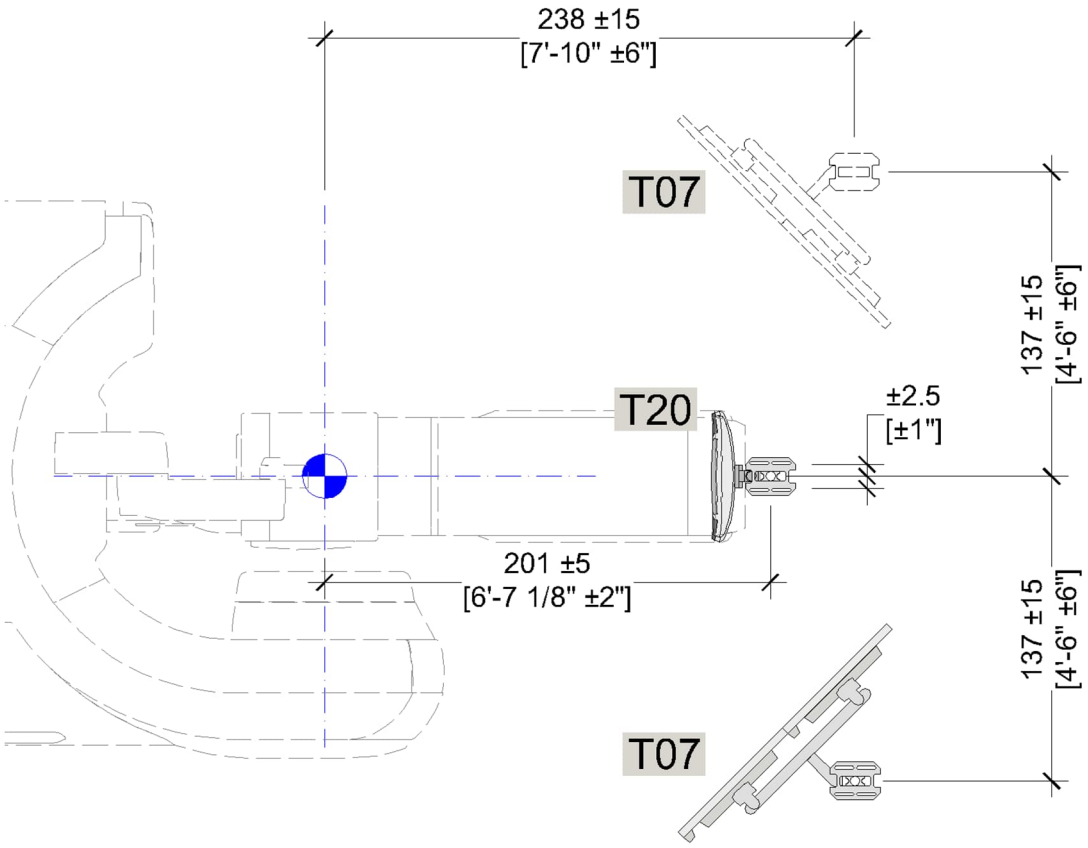


Figure 3-7 Treatment Room Ceiling Mounted Components (Plan)

The IRMs may be mounted on the wall. Contact Varian Site Planning or Varian PM for more information.

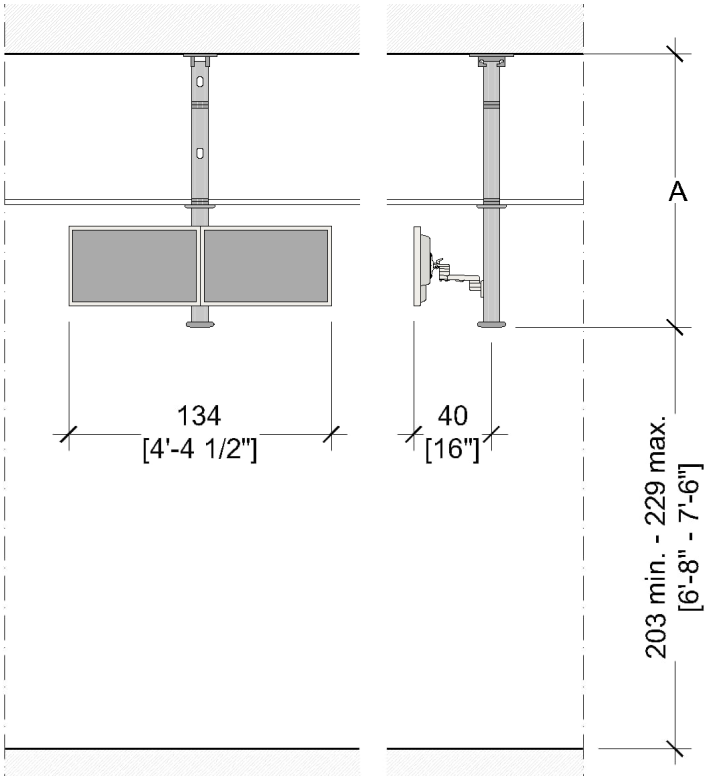


Figure 3-8 IRM Mounting Height

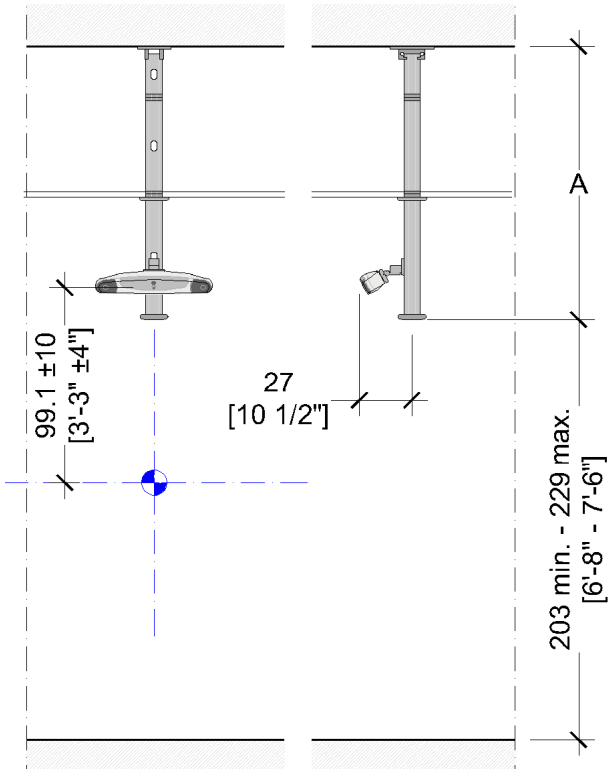


Figure 3-9 "Dual" Optical Imager Mounting Height

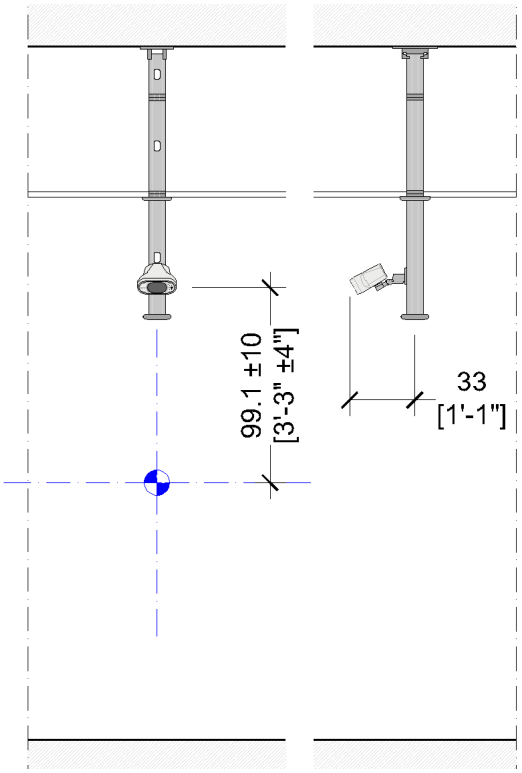


Figure 3-10 "SGC" Optical Imager Mounting Height

- Dimension "**A**" refer to Figure 2-18

213cm [7'-0"] is the recommended mounting height to the bottom of the post.

For installations with IDENTIFY refer to PPG-ID for the post height requirements.

3.2 CONTROL AREA

Figure 3-11 is a generic layout, component positioning may vary per site-specific conditions, consult with the Customer on the desired layout, and if any additional space is required.

- Refer to Table 2-9 for maximum cable lengths from the Console Cabinet to the desktop components.
- The Console Cabinet must be located in a radiation-free environment.

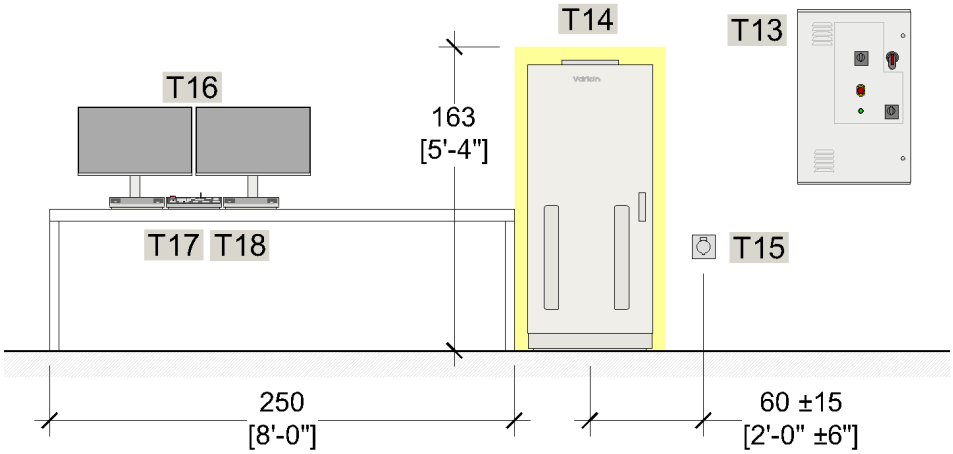


Figure 3-11 Generic Control Console Layout

If additional MotionView CCTV camera systems are on the final sales order, provide additional space at the Control Console for the extra CCTV monitors.

Varian provides a mounting bracket for the monitor power supplies. It may be mounted to the wall below the counter or to the underside of the countertop. The bracket dimensions are 41 x 22 x 4.5 [16 1/8" x 8 3/4" x 1 3/4"].

3.2.1 CONSOLE FLOOR POSITIONING BRACKET

CAUTION

The Floor Positioning Bracket must be installed. Locking pins prevent the Console Cabinet from tipping over or rolling unintentionally.

- The attachment hardware is Customer-provided.
- Install a minimum of one concrete anchor at each corner

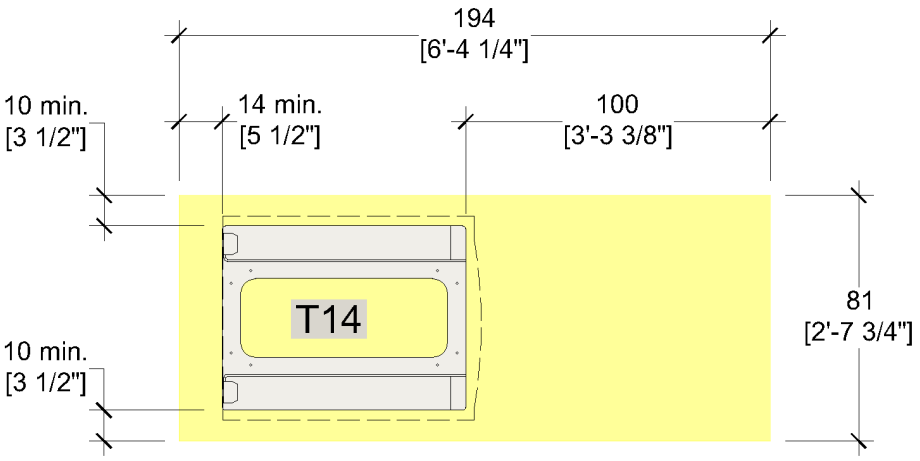


Figure 3-12 Console Cabinet Service Clearances

3.3 ELECTRICAL

3.3.1 POWER REQUIREMENTS

Table 3-3 System Power Requirements	
Input Voltage	200V, **208V**, 240V, 380V, **400V**, 415V, or **480V** *(4 wire, 3-phase and ground)*
System Current	• 91A @ 208V, 60Hz • 48A @ 400V, 50Hz • 45A @ 480V, 60Hz
Console Current	7A @ 230V, 50/60Hz *(1-phase, neutral, and ground)*
Line Voltage Regulation	±5%. This is the maximum allowable steady-state deviation from the nominal value selected. Sinusoidal with less than 5% total harmonic distortion.
Maximum Phase Voltage Imbalance	3% of the nominal value. This is the maximum difference between any 2-phase voltages when operating at full load *(Beam-On)*.
Input Frequency	50 or 60 Hz ±1 Hz
Electrical Loads	3kVA in Stand-By state 45kVA in Beam-On state
Long-Time Load	48kVA *(includes the console, 3kVA)*
In-Rush Current	At power on, and in various operational modes there is a maximum instantaneous peak current of – • 540A @ 208V 60Hz • 340A @ 400V 50Hz • 280A @ 480V 60Hz
Power Factor	Equal to or greater than 90%, inductive load. The line-current waveform is non-sinusoidal.
Source Impedance	2.5% maximum
Mandatory Grounding	See 3.3.6 Dedicated Ground/Protective Earth Requirements

3.3.2 POWER CONDITIONING REQUIREMENTS

The equipment is sensitive to line voltage variations and source impedance. A complete survey of the electrical supply should be conducted before the equipment installation and a copy of this survey should be sent to the Varian PM for the equipment file. Isolation transformers and/or power conditioners are required where the electrical power requirements specified in Table 3-3 cannot be met.



Transients lasting no more than a few cycles will not cause harm if limited to the specified steady-state line voltage regulation. Transient suppression is required where larger, long-lasting, or frequent transients occur as these can cause interruption of operation and/or equipment damage.

For sites that intend to use third-party "Power Conditioning Equipment", contact Varian Site Planning for more information.

3.3.3 MAIN DISCONNECT PANEL (MDP)

NOTICE

The Mains power to the TrueBeam/VitalBeam MDP must be provided from a private branch circuit (for example, sourced from a dedicated transformer). Utilities such as room lighting, receptacles, or other equipment must be powered from a separate source.

- The Customer wiring:
  - Input to the MDP (**T13**) – Line-to-line, 5-wire *(3-phase, neutral, and ground)*
  - Output to the Modulator (**T03**) – Line-to-line, 4-wire *(3-phase and ground)*
  - Ground wires must be equal in size (parity) in respect to the 3-phase input and output wiring refer to 3.3.6 Dedicated Ground/Protective Earth Requirements
  - Output to the IEC 60309 Power Outlet (**T15**) – 3-wire *(line, neutral, and ground)*
- Wall mount the MDP at a standing height from the finished floor.
- The MDP must be visible from and within 3m [10'-0"] of the Console Cabinet.

If the MDP cannot be located near the Console Cabinet contact the Varian Planning Department for more information about using the Remote Emergency Disconnect (R.E.D.) Box kit.

Table 3-4 Generic MDP Components	
A	Main Input Breaker
B	Output Breaker 1
C	3-phase Output Contact
D	Transformer *(optional per A input voltage)*
E	Output Breaker 2
F	1-phase Output Contact
G	Transformer
H	Start Button
I	Emergency Disconnect Button

Customer-provided wiring

Varian-provided cables

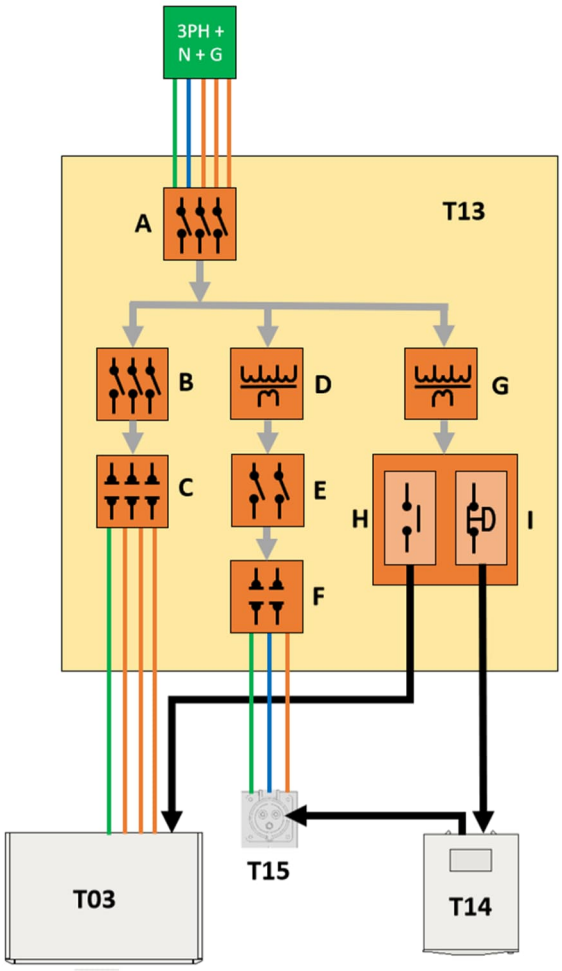


Figure 3-13 Generic MDP Panel Components

3.3.4 RELAY JUNCTION BOX (RJB)

NOTICE **Do not locate the RJB in the primary beam path.**

- Wall mount the RJB in the treatment room at a standing height from the finished floor for service accessibility.
- The RJB may be surface-mounted or semi-recessed, up to a maximum of 12cm [4 3/4”].

3.3.4.1 RJB CUSTOMER CONNECTIONS

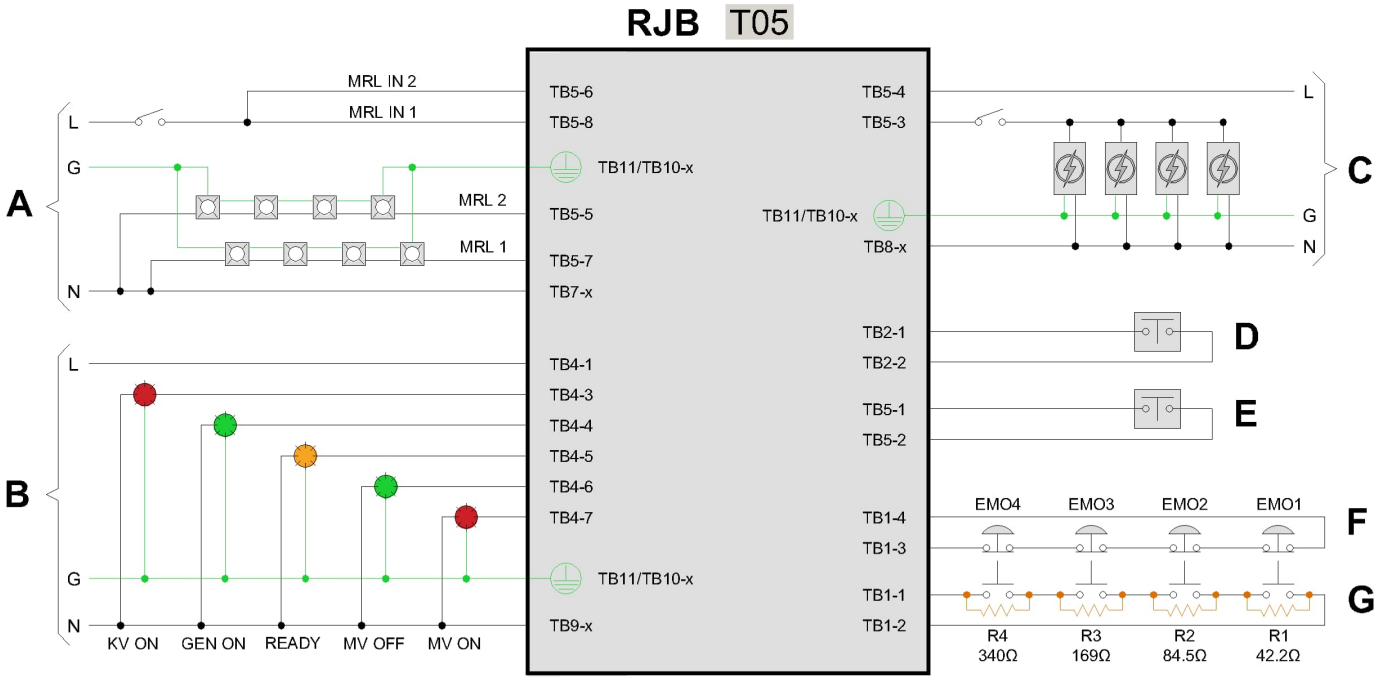


Figure 3-14 RJB Customer Connections

Table 3-5 RJB Connections			
	Device	**Power**	**Notes**
A	Main Room Lights	100 – 277 VAC (50/60Hz), 20A maximum	3.3.9 Room Lighting
B	Warning Lights	100 – 250 VAC (50/60Hz), 10A maximum	3.3.10.1 Warning Lights
C	Lasers Power Outlet	100 – 250 VAC (50/60Hz), 10A maximum	3.3.5.1 Treatment Room
D	DC Door Interlock	24 VDC, provided by the RJB	3.3.10.2 Door Interlock Switches
E	AC Door Interlock	120 VAC, provided by the RJB	
F	EMO, “safety loop”, Normally Closed	24 VDC, provided by the RJB	3.3.10.3 Emergency-Off
G	EMO, “sensor loop”, Normally Open	24 VDC, provided by the RJB	

Table 3-6 RJB Customer Terminal Wire Range		
Description	**Metric**	**Imperial**
Customer Input Terminals	0.75 to 10mm^2	18 to 6 AWG

Additional 24 VDC system interlocks are available in the RJB. Contact Varian Site Planning or Varian PM for more information.

The Customer-supplied neutral wires may be terminated on the RJB neutral bar or by other means as per local electrical codes. The RJB neutral bar is provided for convenience.

3.3.5 POWER OUTLETS

3.3.5.1 TREATMENT ROOM

- (1) Standard power outlet within 92cm [3'-0"] of each Laser (**T06**), wired to the RJB (**T05**)
- (1) Standard power outlet, within 122cm [4'-0"] of each IRM (**T07**)
- (1) Standard power outlet within 30cm [1'-0"] of each CCTV camera (**T09**)
    - Optionally the CCTV cameras can be powered by a Customer-provided 24VAC source
- (1) Standard power outlet within 30cm [1'-0"] of the USB Hub (**T12**)

The 1-phase power to some accessory items can be provided by the MDP, depending on the design and functionality of the MDP. Contact Varian Site Planning or Varian PM for more information.

3.3.5.2 CONTROL AREA

NOTICE

Do not install the IEC outlet directly behind the Console Cabinet. Locate on either side of the Console Cabinet, refer to Figure 3-11.

- (1) IEC 60309 outlet (**T15**) located on either side of the Console Cabinet
    - 2-pole, 3-wire, 6-hour position, blue
    - 30A, 250VAC - North American rated
    - 32A, 220 – 250VAC - European rated

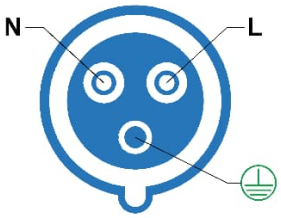


Figure 3-15 IEC 60309 Outlet *(Front View)*

- Provide additional power outlets for convenience as required by the Customer.

*The System Monitors (**T16**) and CCTV Monitors (**T18**) are powered from the Console Cabinet.*

3.3.6 DEDICATED GROUND/PROTECTIVE EARTH REQUIREMENTS

WARNING

The customer-provided G/PE conductor for the Mains power supply must meet or exceed code requirements and be equal in size to the supply/power conductors but, no smaller than 16mm² [6 AWG].

To avoid the risk of electric shock, this equipment must be connected to a supply Mains with protective earth. Do not ground to water supply piping.

The TrueBeam/VitalBeam accelerator requires two Ground/Protective Earth (G/PE) circuits. The first circuit is part of the main power supply and provides grounding for the TrueBeam/VitalBeam Accelerator's major system components. Varian provides and installs the internal grounding cable between the Stand/Gantry, Modulator, Couch, and Console Cabinet. The Customer provides the ground from the MDP (**T13**) to the Modulator (**T03**) in Figure 3-16 as per 3.3.3 Main Disconnect Panel (MDP).

The second G/PE circuit is for the wall- and ceiling-mounted TrueBeam/VitalBeam accessory components that are located at or below 250cm [8'-2 1/2"] from the finished floor.

The Contractor shall install a single G/PE conductor, 4mm² [12 AWG] minimum, from each of the components in Figure 3-16 to the facility's main ground. This grounding system provides compliance with IEC 60101 and -01. This G/PE conductor can be combined with the cable runs outlined in 3.3.7 Cable Containment.

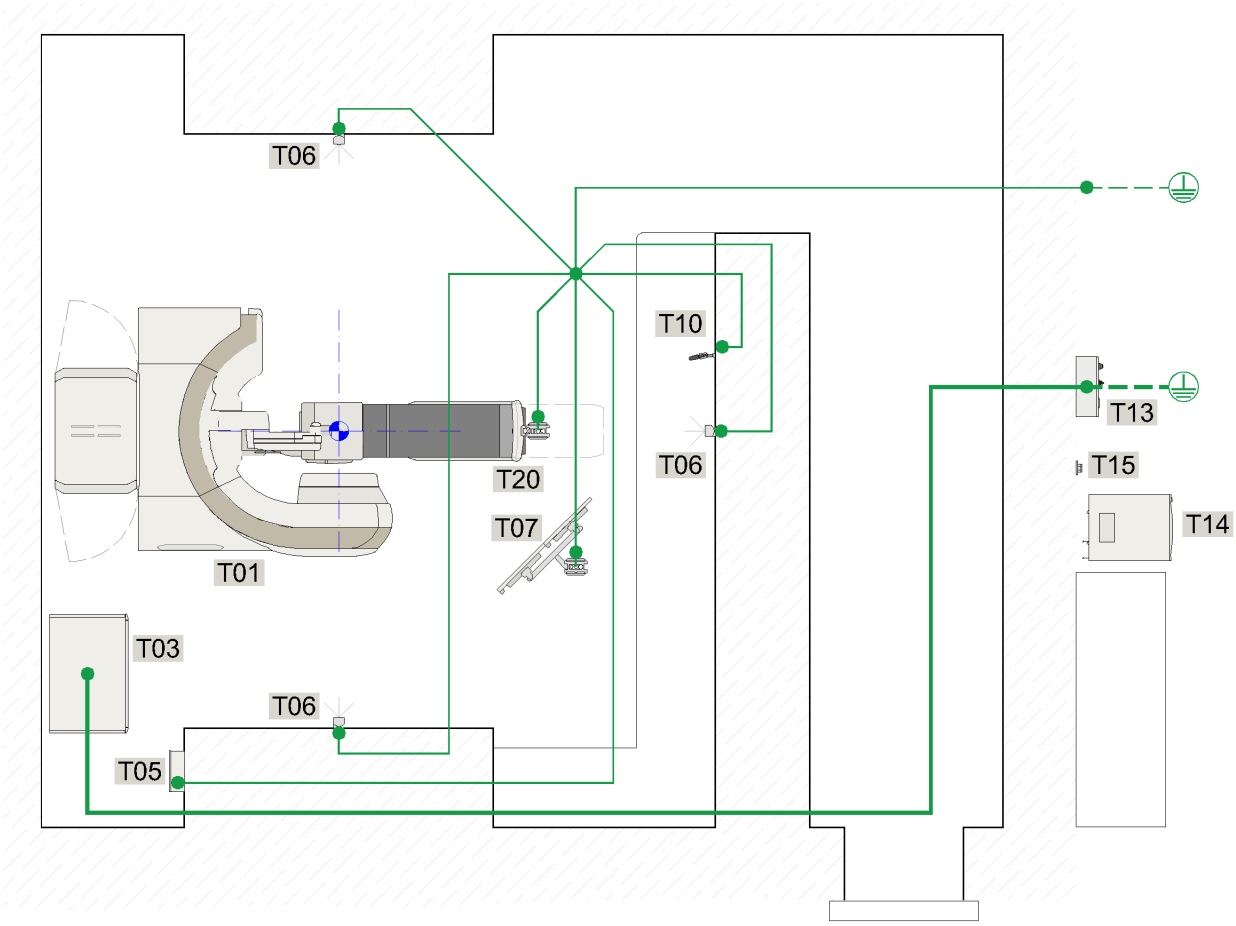


Figure 3-16 Ground/Earthing Conductor Layout

- RJB (**T05**)
- LV Camera and Microphone (**T10**)
- IRM Post (**T07**)
- Optical Imaging Camera Post (**T20**)
- Laser Mounting Plates (**T06**)

3.3.7 CABLE CONTAINMENT

NOTICE

The customer is responsible for ensuring that the cable installation meets applicable local codes and requirements. This might affect the choice of cable routes, number of conduits/ducts, specifications of Mains power and data cables, and the choice of installation locations of system components.

The customer shall provide dedicated conduits or raceway ducts for the Varian system cables.

System cables are not plenum-rated.

System cables shall not be permanently installed through a walking path.

- All conduits shall be smooth-walled.
- All conduits that are routed underground shall be dry and watertight.
- Terminate conduits with insulating bushings or similar means to protect cables from abrasion.
- Conduit bends shall have a radius no less than 6 times the conduit's diameter.
- There shall be no more than three 90-degree bends per conduit (or equivalent).
- Verify all room penetrations with the Physicist of Record.
- Reference Table 2-8 TrueBeam/VitalBeam System Cables for maximum cable lengths.
- The cable route must be shorter than the maximum cable length. Allow for 3m [10'-0"] of excess cable at each end for connection and service, unless otherwise noted.

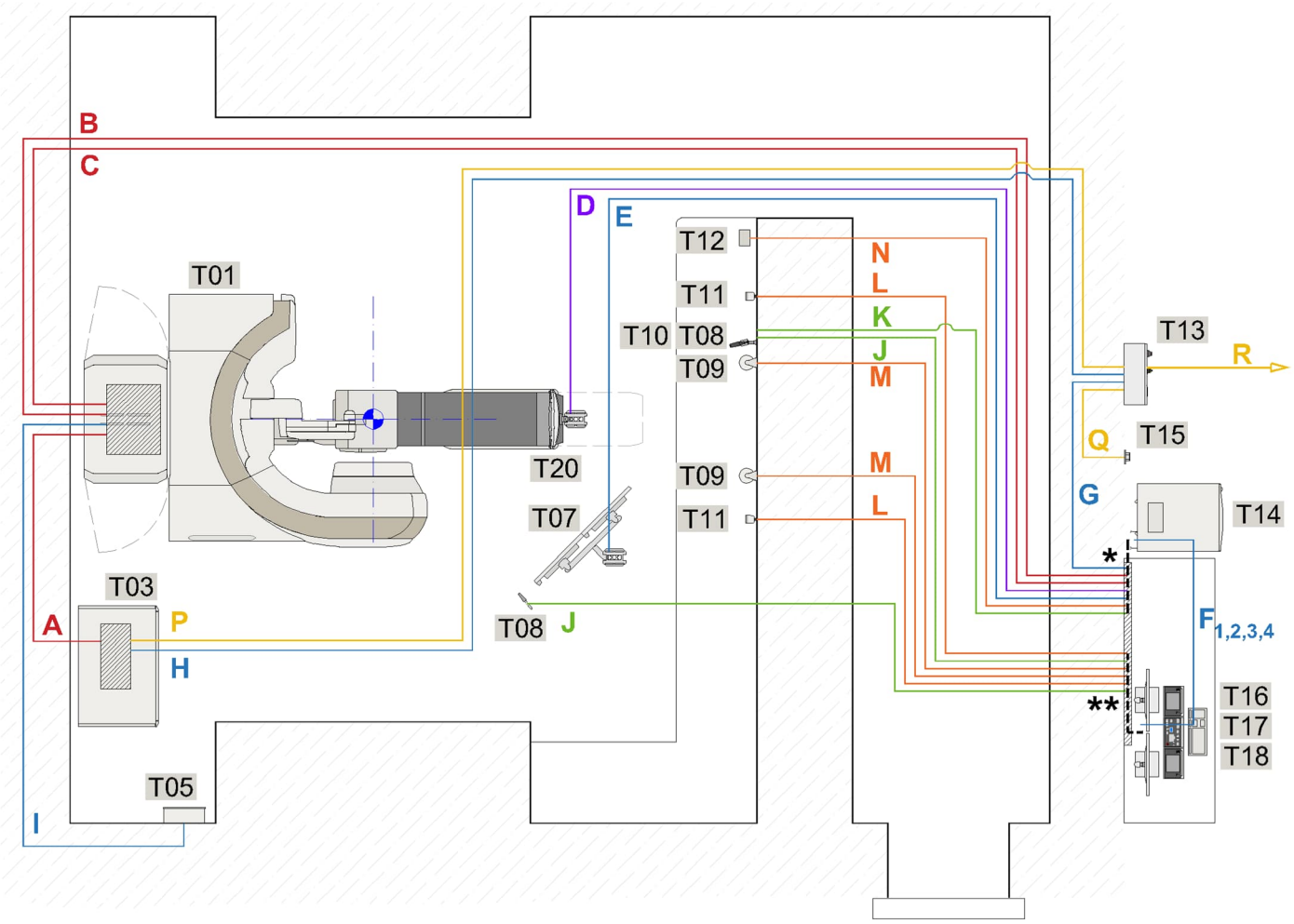


Figure 3-17 Cable Containment Identification

NOTICE

Do not terminate the conduits behind the Console Cabinet (T14).

Include the distance from the conduit termination location to the back of the Console Cabinet or the Desktop components, indicated by the * or ** in Figure 3-17, as part of the total run length.

Table 3-7 TrueBeam/VitalBeam Containment Specifications

Cable Route	Minimum Conduit Size Ø	Conduit Quantity	Maximum Run Length	Start	Finish
A	100mm [4”]	3	24m [80’]	**T01** - Stand	**T03** - Modulator
B		3	39m [130’]		**T14** - Console Cabinet
C		1	39m [130’]		**T17** - Control Console
D *	75mm [3”]	1	39m [130’]	**T14** - Console Cabinet	**T20** - Optical Imaging Camera
E	50mm [2”]	1 *(up to x2)*	24m [80’]	**T14** - Console Cabinet	**T07** - In-Room Monitor
F1	n/a	n/a	12m [40’]		**T16** - System Monitors
F2			12m [40’]		**T17** - Control Console
F3			12m [40’]		**T18** - CCTV Monitor
F4			12m [40’]		Network Jack *(by Customer)*
G	50mm [2”]	1	11m [36’]		**T13** - MDP
H		1	41m [135’]	**T13** - MDP	**T03** - Modulator
I		2	41m [135’]	**T05** - RJB	**T01** - Stand
J	32mm [1.25”]	1	42m [140’]	**T17** - Control Console	**T08** - Microphone
K		1	35m [115’]	**T14** - Console Cabinet	**T10** - Live View Camera
L	25mm [1”]	2	42m [140’]	**T17** - Control Console	**T11** - Speaker
M		2 *(up to x6)*	42m [140’]	**T09** - CCTV Camera	**T18** - CCTV Monitor
N		1	42m [140’]	**T14** - Console Cabinet	**T12** - USB Hub
O	n/a	1	3m [14’]		**T15** – IEC Outlet
P	per code	1	41m [135’]	**T13** - MDP	**T03** - Modulator
Q		1	per site		**T15** - IEC Outlet
R		1	n/a		Hospital MAINS Power
*****	*Shared path for the VCD cable, if included.*				

Larger conduits may be used to group cables to optimize the cable runs between the control area and treatment room before separating them to their final locations. Contact Varian Site Planning for more information on these options.

*Cable Runs **F1**, **F2**, **F3**, and **F4** may be bundled together and run below the countertop. A wire management system is recommended for aesthetics and to provide cable protection.*

3.3.7.1 ADDITIONAL CONTAINMENT REQUIREMENTS

The following Customer-provided components require a containment path to the RJB Figure 3-14, not shown in Figure 3-17.

- Laser Power
- Warning Lights
- Door Interlock Switches
- Main Room Lights
- Emergency-Off Buttons

Consult with the Customer on the requirements for an Experimental Access (Physics Q/A) Port.

3.3.8 CABLE ACCESS

3.3.8.1 BASEFRAME

- Zone **A** is accessible from below the BaseFrame pit slab.
  - 30cm [12”] deep below the finished floor level for bottom access or from Zone **B**.
  - 61cm [24”] deep maximum below the finished floor level for side access.
  - The top of conduits beneath the BaseFrame must be a minimum of 45cm [18”] below the finished floor level to avoid the anchor bolts.
- Zone **B** is centered on the BaseFrame.
  - The minimum width for Zone **B** is shown below and must be coordinated with the chilled water access in Figure 3-23.

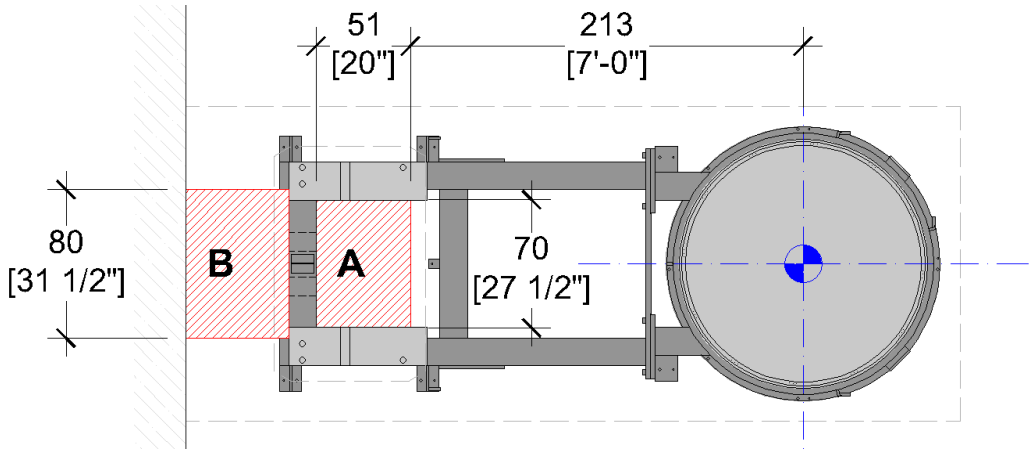


Figure 3-18 BaseFrame Cable Access *(Plan View)*

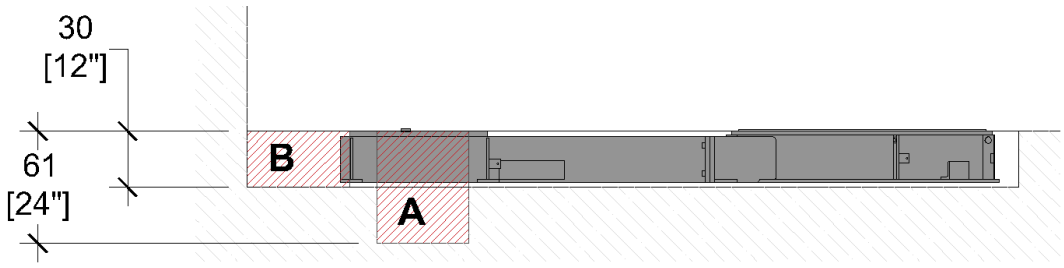


Figure 3-19 BaseFrame Cable Access *(Side View)*

NOTICE

If the isocenter to the rear wall is less than 335cm [11'-0"] contact Varian Site Planning when using Zone B for cable access.

3.3.8.2 MODULATOR

- Zone **C** is accessible from the front, sides, or bottom.

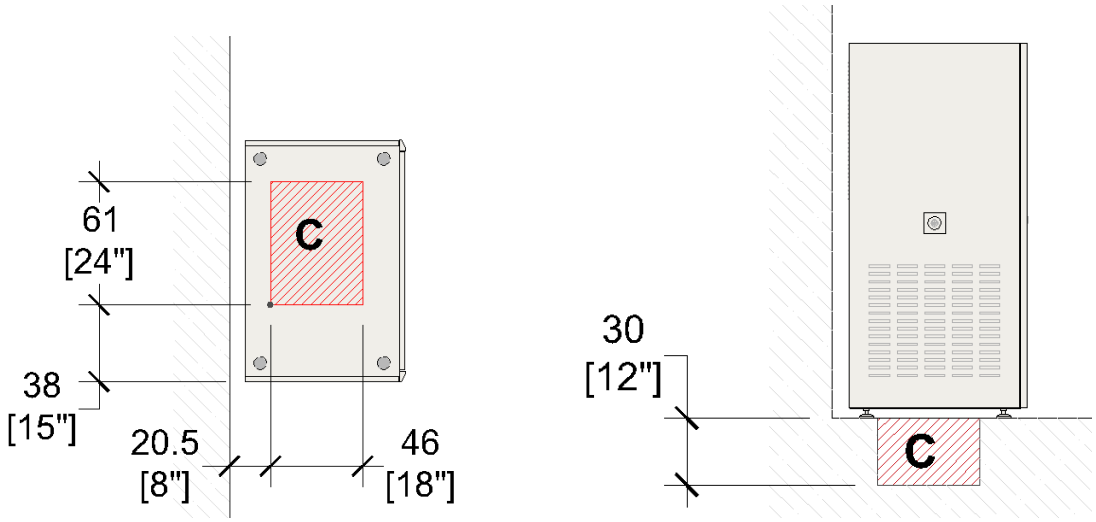


Figure 3-20 Modulator Cable Access *(Plan and Side View)*

For additional cable access options, contact Varian Site Planning.

3.3.9 ROOM LIGHTING

Main room lights are used for general illumination and room maintenance. Typically, the main room lights are controlled (on/off) from the treatment couch during patient setup through voltage-free contacts located in the RJB, refer to Figure 3-14.

Setup lights are normally dimmable fixtures that allow the intensity to be adjusted by the therapists while aligning the patient to the laser lights. The setup lights are typically located above and to either side of the treatment couch. Their control is independent of the equipment.

Room lighting can be configured in multiple ways as defined by the customer's requirements. Contact Varian Site Planning for more information.

3.3.10 EMERGENCY AND SAFETY DEVICES

To meet safety regulations, the following customer-provided safety device systems must be installed per the customer's Radiation Safety Officer and to comply with regional regulatory agency requirements.

3.3.10.1 WARNING LIGHTS

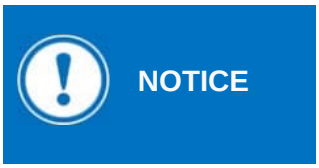
System warning lights are required inside and outside the treatment room to indicate beam-on/beam-off conditions. There are five individual warning light circuits available in the RJB, refer to Figure 3-14. They may be required to blink when the beam is on. Colored (usually red) lights must be placed such that one is visible from any point in the treatment room. Consult with the Customer's Radiation Safety Officer to confirm the regulatory requirements.

- Provide an individual warning light for each circuit.
- Incandescent lamp load, 60W maximum, each circuit.
- 5A maximum, resistive load, including any short-duration switching transients.
- LED fixtures are acceptable, the inrush current for all fixtures must be less than the rating above.
- Fluorescent fixtures are not allowed.
- Combination signs with superimposed lettering are not allowed.



If a greater load is required, these circuits can be used to control separate, customer-provided relays.

Table 3-8 Warning Lights	
Beam READY	Illuminates to show the MV system has no open interlocks and is ready to treat.
Beam ON	Illuminates during MV beam treatment (mandatory).
Beam OFF	Illuminates when the accelerator is not in a radiation-generating state.
Generator ON	Illuminated to show the KV system is ready to image the patient.
X-Ray ON	Illuminates during KV imaging, mandatory for accelerators with On-Board Imaging.



To comply with IEC 60601-2-1: 2009 +A1:2014 aural indicator requirements (Clause # 201.10.1.2.101.10) the customer shall provide and install a suitable aural indicator in parallel with any warning lights connected to the RJB.

3.3.10.2 DOOR INTERLOCK SWITCHES

Door interlock switches are mandatory for all installations to ensure the treatment room door is closed during accelerator operation. Provide two independent safety switches, a primary and a secondary switch. The primary and secondary switches must be in the same state (both open or both closed) within 5 seconds of actuating, refer to Figure 3-14 for connection details to the RJB.

- Primary – 120VAC, 500mA (typical load), normally open contact
- Secondary – 24VDC, 1mA (typical load), normally open contact

For double-entry doors, each door panel requires a set of interlock switches. The primary and the secondary switches on each door panel must be wired in series to the RJB, separate from each other.

For secondary neutron doors, a 24VDC switch should be independently wired to the neutron door inputs in the RJB.

3.3.10.3 EMERGENCY-OFF BUTTONS

The Emergency-Off (EMO) button removes the Mains power from the Accelerator and Modulator while still allowing power to the Console Cabinet UPS. EMO buttons are built into the Accelerator Stand (x2), Couch (x2), Control Console (x1), and Modulator (x3).

Additional Customer-provided EMO buttons are typically required in the treatment room. Consult with the hospital's Radiation Safety Officer to verify the site requirements.

- Two-pole, (1) normally open and (1) normally closed contacts, "dry", manual reset
    - Allen-Bradley 800T-FX6AV or equivalent

Up to four buttons can be identified by sequentially rated resistors (Varian-provided, contractor-installed) across the "sensor loop" contacts, refer to Figure 3-14 and 4.5.

Locate the EMO buttons to avoid unintentional activation.

WARNING **Do not locate the EMO buttons in the primary beam path.**

3.3.10.4 EMERGENCY DISCONNECT BUTTON

An Emergency Disconnect Button must be mounted in the control area. When activated it will remove Mains power from all system components -- Accelerator, Modulator, and the Console Cabinet. This button is integrated as part of the MDP, refer to 3.3.3 Main Disconnect Panel (MDP) for more information.

3.3.10.5 OPTIONAL SAFETY DEVICES

The following optional safety devices are Customer-provided and installed.

- Light Curtain – Optional sensing method to control the AC and DC door interlock circuits.
- Last Person Out (LPO) – A low-voltage timer switch is used with the door interlock system to ensure the treatment room is clear.

3.3.11 NETWORK

- Provide (1) network outlet near the Console Cabinet (**T14**).
  - (3) Additional outlets are *(recommended)*.
- Cat 5e cable *(minimum)*
  - CAT 6 *(recommended)*.
- Bandwidth 100Mbps, full duplex 100BASE-T *(minimum)*
  - 1Gbit/s or higher *(recommended)*.
- The RJ-45 (8P8C) jack must implement wiring pattern T568A as defined in ANSI/TIA-568.
- Varian recommends isolating the Oncology domain from the Enterprise Network.
- The Console Cabinet (**T14**) requires a static IP address.
- The Varian PM will provide the [**3**] MICAP network configuration guide before the final equipment installation.



Wi-Fi is recommended in the control area and treatment room for training, education, and serviceability.

3.4 PLUMBING

Table 3-9 Coolant Requirements and Heat Loads	
Flow Rate *(minimum based on facility water temperature)*	14.0 – 26.5 LPM [3.7 – 7 GPM]
Incoming Coolant Operating Temperature Range	10 – 23.9° C [50 – 75° F]
Glycol Content of Coolant	Not to exceed 50%
Low Power State *(minimum, required 24 hours)*	2 kW [6,830 Btu/hr]
On State *(no energy selected)*	10 kW [34,152 Btu/hr]
Ready/Energy Select State	12.5 kW [42,690 Btu/hr]
Beam-On State *(maximum)*	25 kW [85,379 Btu/hr]
Normal Treatment Cycle	13.3 kW [45,422 Btu/hr]
Inlet Pressure *(maximum)*	6.9 bar [100 PSI]
Pressure Drop *(through the stand's internal cooling system)*	Varies, refer to Figure 3-21

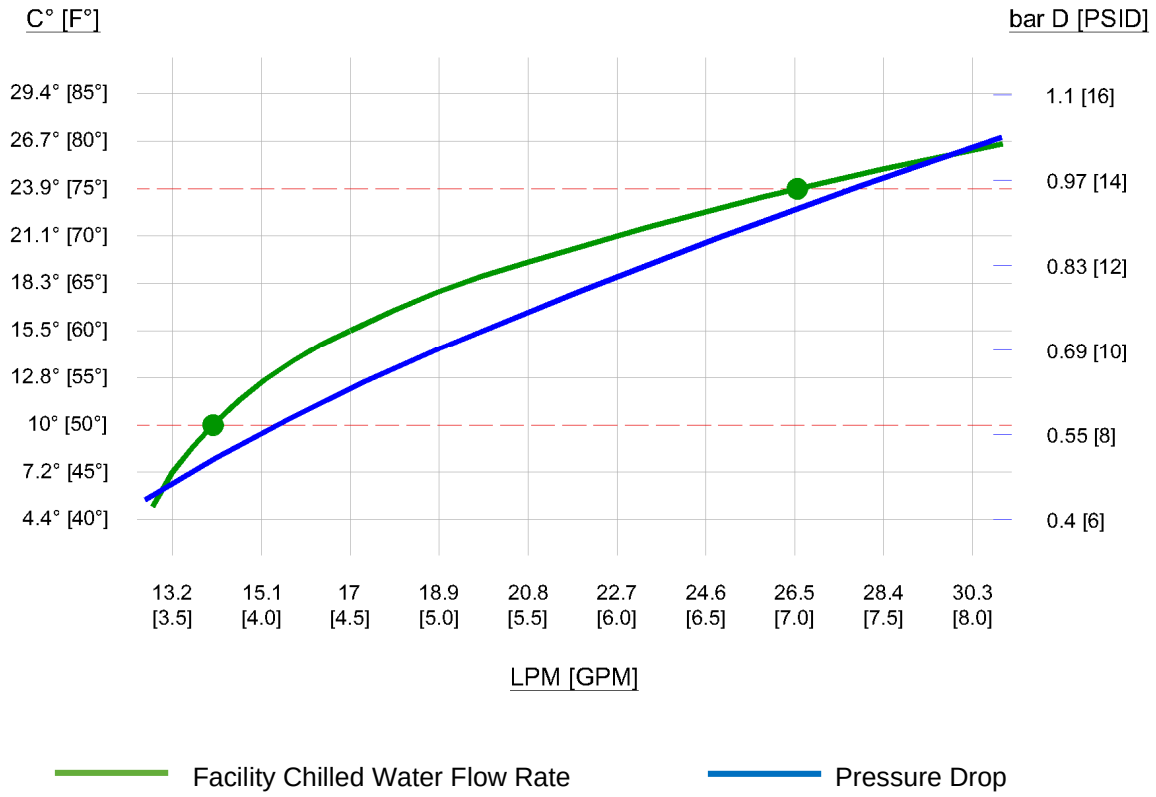


Figure 3-21 Minimum Facility Chilled Water Flow Rate

NOTICE

To prevent equipment damage due to condensation, ensure the incoming coolant temperature lower bound is above the dew point in the facility.

Facility chilled water flow rates above 31.4 LPM [8.3 GPM] may cause excessive erosion and premature component failure.

3.4.1 CHILLED WATER

The cooling water requirement can be satisfied with a Closed-Loop system (Facility Central Plant Chilled Water or a Dedicated Chiller Unit) or a One-Pass system (Domestic "City" Water). The design could also be a combination of methods to provide greater resilience and redundancy. This design detail is the responsibility of the customer's design team and a water quality professional.

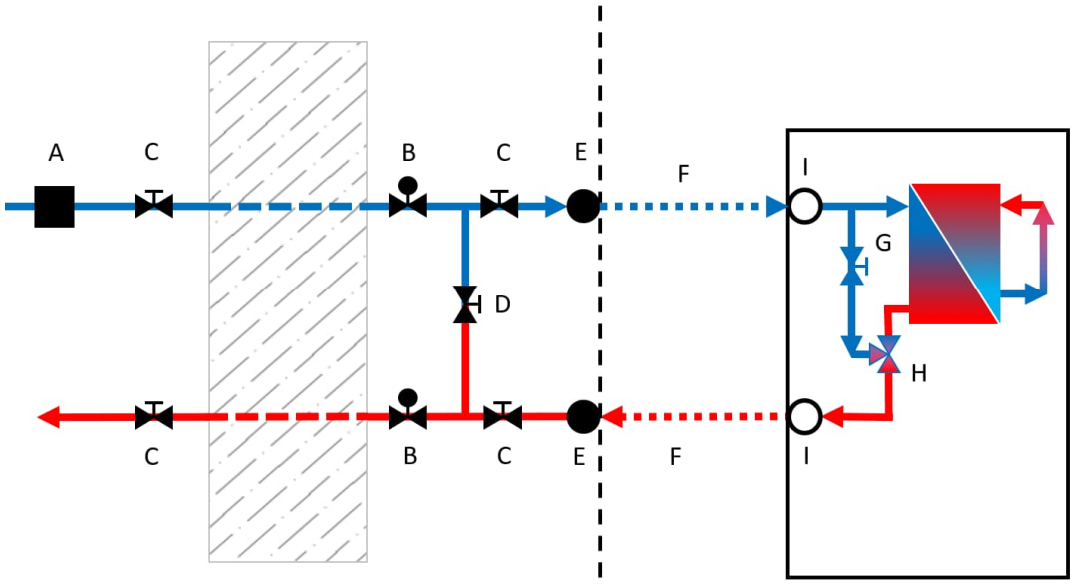


Figure 3-22 Coolant System Schematic

- The chilled water supply must not exceed the maximum inlet pressure shown in Table 3-9, controlled by a pressure regulator (**A**).
- Provide isolation valves (**C**) and terminate with a 25mm [1"] FNPT plug (**E**).
- Provide a bypass valve (**D**) before the isolation valves (**C**) for testing and service.
- Provide a minimum of one flow meter (**B**), which may be installed on the supply or return line.
- Install additional isolation valves (**C**) in an accessible location outside the treatment room.
- Copper piping is recommended, install a filter/strainer for dissimilar metals.
- A Varian-provided, Contractor-installed flexible hose kit (**F**) is used to connect the piping to the accelerator inside the TrueBeam/VitalBeam Stand (**I**).
- A bypass valve (**G**) is located inside the system stand. This valve is open for Closed-Loop systems and closed for One-Pass systems.
- A modulating control valve (**H**) inside the system stand maintains an internal coolant loop temperature of 40°C [104°F].

If a Closed-Loop system is designed with domestic water (One-Pass) emergency backup, it is recommended to provide a means to notify the user that the accelerator bypass valve should be closed in the event the emergency backup system is used.

NOTICE

Do not route water piping directly above the accelerator or modulator. Inadvertent leaks may occur and can seriously damage the accelerator and mechanical systems.

Do not locate floor drains in the treatment room.

3.4.2 COOLING LINE ACCESS

Install isolation valves for the chilled water supply and return lines on the rear wall behind the Stand, refer to Figure 3-22 Coolant System Schematic.

- 290cm [9'-6"] is the maximum distance for the path of the Varian-provided hose (**F**) from the isolation valves (**C**, **E**) to the Stand entry point (**I**).
- The Varian-provided hose must be installed against the BaseFrame at (**I**). There is approximately 5cm [2"] clearance to enter the Stand under the rear cover.

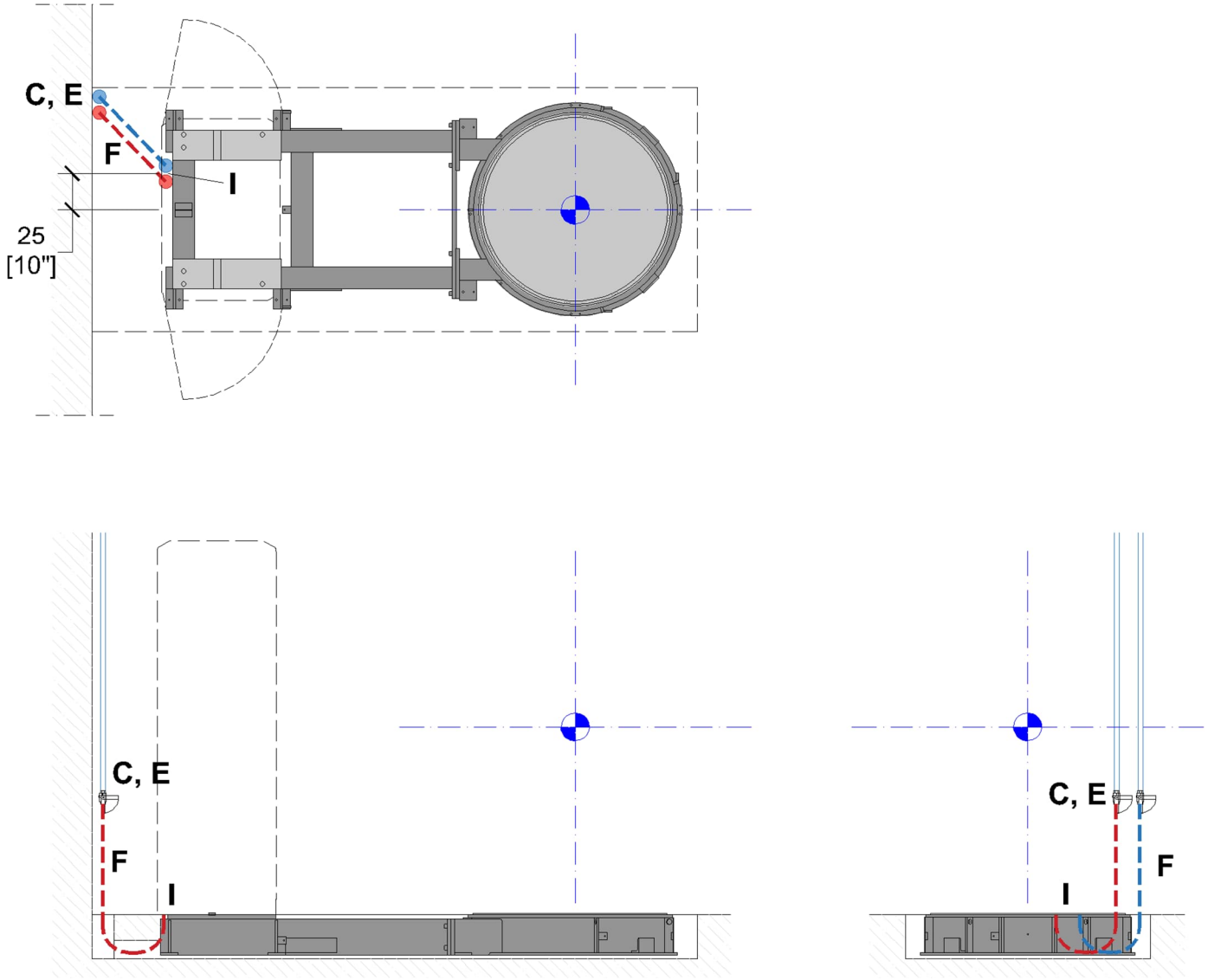


Figure 3-23 Cooling Line Access – Plan, Side, and Front

If the isocenter to rear wall dimension is less than 335cm [11'-0"] the isolation valves must be located to the side of the BaseFrame pit for accessibility.

*The valve location (**C**) must not restrict the Stand door from opening to 90 degrees.*

3.4.3 CHILLED WATER QUALITY

Table 3-10 Minimum Coolant Water Quality	
Quality	**Value**
Appearance	Clean, colorless, non-turbid, and disinfected; closed-loop systems should be treated with a corrosion inhibitor, which may add color.
Heterotrophic Plate Count (HPC) (CFU/ml)	<10,000
pH	7.0 – 10.0
Total Hardness (ppm $CaCO_3$)	>75

Experience has shown that some water supplies have caused excessive corrosion and frequent replacement of the internal heat exchanger. Consult a water treatment professional to design facility water quality specifications to prevent damage to the heat exchanger from corrosion, scale, biofilms, or other common issues. These specifications should include monitoring characteristics (for example pH, conductivity, total dissolved solids, chlorides, and hardness) to maintain values appropriate for the site's corrosion inhibitor and disinfection solutions. Ideal value ranges will vary depending on local conditions.

When glycol is added to external facility water, propylene glycol is preferred (due to its better environmental safety record compared to other glycols) at a strength not to exceed 50% by volume (v/v).

External domestic "city" or hospital "facility" water may require secondary disinfection (in addition to any bleach/chlorine/chloramine reserve present) to avoid biofilm formation in the Accelerator's heat exchanger. Seek advice from a water treatment professional.



The water coolant specification in this section does not apply to the Accelerator's internal coolant water loop. Contact the Varian Help Desk at 1-(888)-Varian5 (827-4265) for information.

3.4.4 OPTIONAL PLUMBING CONSIDERATIONS

- A sink with running hot and cold water is highly recommended in treatment rooms.
- For convenience, a hose spigot is recommended to fill the water phantom.
- A sink drain is recommended to service the TrueBeam/VitalBeam's internal cooling system and drain the water phantom.

3.5 ENVIRONMENTAL SPECIFICATIONS

Table 3-11 Environmental Operating Specifications		
Condition	**Metric**	**Imperial**
Maximum Altitude	2000 m	6562 ft
Ambient Temperature Range	16° to 27° C	60° to 80° F
Relative Humidity	30% to 75%, non-condensing	

3.5.1 VENTILATION

Accelerators will produce detectable levels of ozone under certain conditions.

- Typically, 4 to 6 air changes per hour are required to remove ozone, check with local regulations.
- Fresh air should be used as part of the HVAC design.
- Maintain a minimum ventilation space above the Modulator of 10cm [4”]

Table 3-12 Stand Heat Load		
TrueBeam/VitalBeam Condition	**kW**	**BTU/Hr**
During Ready and Beam-On States	7.25	24,760
During No Mode State	1.5	5,119
During Power Save State	1.0	3,413

Table 3-13 Modulator Heat Load		
Modulator Condition	**kW**	**BTU/Hr**
During Beam-On State	5.25	17,930
During other States	0.5	1,707

Table 3-14 Console Cabinet Heat Load		
Description	**kW**	**BTU/Hr**
Control Console Cabinet	1.1	3,753
Optional ARIA workstation and monitor	0.5	1,707



The customer shall provide a means to remove the heat generated from the components listed in the Tables above.

3.6 VIBRATION

The TrueBeam/VitalBeam is susceptible to vibration, creating self-resonance in the 2 - 10 Hertz range. Most installations are at or below grade, so vibration is normally not an issue. Equipment that should be considered in the overall design are large compressors or generators, elevators, and train lines. Contact Varian Site Planning for more information on assessing site-specific situations.

3.7 FINISHES

3.7.1 FLOORING

The TrueBeam/VitalBeam contains electronic components that are sensitive to electrostatic discharge (ESD). Floor finishes used in the treatment room, maze, and control area should be selected to ensure they have “Anti-Static” properties that meet local and national codes. Carpet is not recommended as it can make gurney movement difficult and present an infection control risk. The floor finish should not have the propensity to create static electricity exceeding 2.0 kV at 20% relative humidity when measured using standard methods.

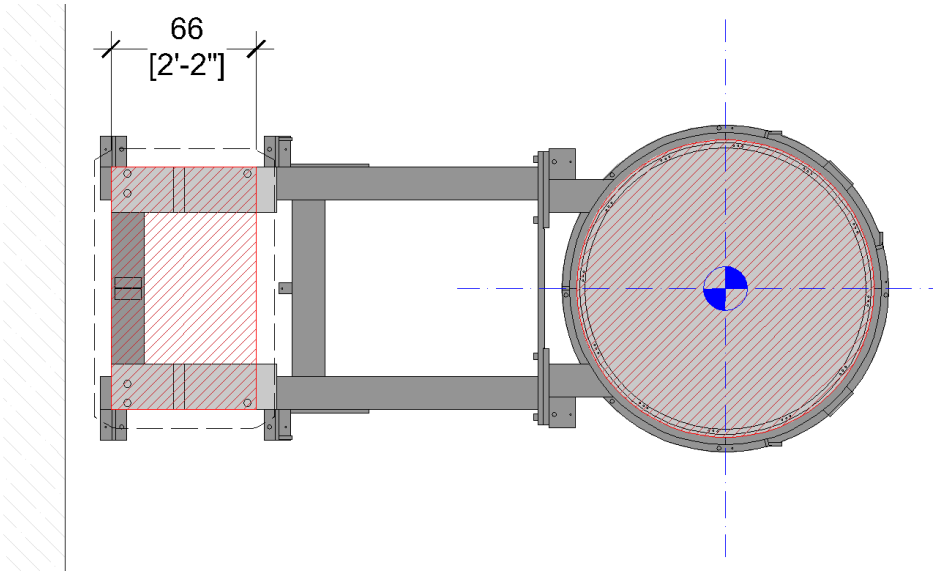


Figure 3-24 Finished Flooring Voids at the BaseFrame

Do not install the final flooring in the hatched area over the Stand mounting pads or inside the turntable trim ring.

It is recommended that the final floor covering be installed before the equipment is delivered, refer to 4.6 Rig and Installation.

3.7.2 CEILING

There is no finished ceiling type specification. However, experience has shown there is a benefit of using a 60cm x 120cm [24” x 48”] or 60cm x 60cm [24” x 24”] lay-in acoustical tile ceiling. Among its benefits are easy access to above-ceiling structures/systems and cables, low repair, acoustic attenuation, and the aesthetic benefits of modern ceiling grids and tiles. The ceiling grid layout must take into consideration the location of the overhead laser and the mounting posts for IRM and ceiling-mounted camera systems. If a solid ceiling is used, an access panel for service is required.

3.7.3 ACCESSORY STORAGE

It's recommended that custom cabinetry be built to store any patient immobilization devices and accessories for the accelerator. Contact Varian Site Planning for more information.

The exact quantity and types of accessories vary with each site. Verify all preferences and storage requirements with the Customer.

3.8 ACOUSTIC

There are no recognized acoustic standards for therapy rooms. The primary sound source on TrueBeam/VitalBeam systems is the Modulator Cabinet. Varian has encountered no acoustic problems when the Modulator is in the treatment room. The patients are in the room for a very short time and observations indicate that some seem reassured by the changing sound levels as the machine goes through its cycles. If noise is a concern, the use of acoustically absorbent materials is recommended. The Modulator Cabinet can be located outside the treatment room. Access for service and safety must be considered along with the cooling requirements and cable length.

TrueBeam/VitalBeam meets the IEC standard for Acoustic Energy

- IEC 60601-1:2005 Clause 9.6.1
- IEC 60601-1:2005 Clause 9.6.2.1

Table 3-15 Acoustic Levels

Equipment	Condition	Location	Sound Pressure Level, dBA*
Stand	Ready / Beam-On	@ isocenter	64
Modulator	Beam-On	@ 1m [3'-3"]	70
Console Cabinet	On	@ 1m [3'-3"]	53
**dBA values are a typical representation, taken under normal conditions, The site-specific design and installation may affect the values.*			

3.9 FIRE PROTECTION

The fire protection system must comply with all local codes and regulations.

NOTICE

Sprinklers inside the treatment room are discouraged. Their discharge or inadvertent leakage into the couch pit or the Stand and Gantry can cause extensive equipment damage and shutdowns.

Consult with a local fire protection specialist so a code-compliant detector/extinguisher solution can be designed for the treatment room.

Heat detectors or photoelectric smoke detectors are preferred over ionization-type detectors due to the potential for false alarms.

If fire sprinklers are required by local authorities, do not locate sprinkler heads above the equipment. A pre-action sprinkler system, controlled by an independent detection system is preferred, however if a wet pipe system is used, recessed high-temperature heads should be considered to reduce the chance of accidental breakage. If a chemical system is used, the safety of nonambulatory patients should be considered.

4 PROJECT MANAGEMENT

4.1 RESPONSIBILITIES

All pre-installation dates for Varian deliverables and milestones are scheduled by the Varian PM, based on an agreement between the customer and the Varian PM and communications with Varian Site Planning and Sales. The Varian PM will communicate regularly with the customer throughout all phases of the project. Also, the Varian PM will perform site inspection visits to help answer questions during construction.

Site visits are commonly held for the Initial Site Meeting/Project Kick-off, the BaseFrame Pre-Installation Inspection (or the BaseFrame installation), and the Pre-Installation Inspection. This final site visit typically occurs 10-14 days before the rig date to verify site readiness is at 100% completion as defined by the [**1**] Varian Accelerator Pre-Installation Checklist.

= Critical STOP/GO Inspections = Varian Install dates per customer schedule = Work by others

Table 4-1 Sample Project Schedule

Task *(week)*	**1**	**...**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**...**
Place Machine Order	X																	
Design & Construction *(varies)*																		
BF Pre-Installation Inspection																		
BaseFrame Installation																		
Concrete Cure Time																		
MDP Installed																		
PIK Delivered & Installed																		
Pre-Installation Inspection																		
Machine Delivery *(weekend)*																		
Machine RIG *(weekend)*																		
System Installation																		
Machine Acceptance																		

4.2 OBJECTIVES

At a minimum, the items listed below must be completed before the Final Inspection can be performed by Varian so the equipment is released for delivery. Varian's installation timeline is based on these items being completed. The complete [**1**] Varian Accelerator Pre-Installation Checklist can be provided by the Varian PM on request.

- The treatment room and control area are finished to a clinical standard and are dust-free with no other construction trades having access.
- The customer has applied for obtained and signed all licenses and approvals required for this installation.
- A load-bearing rig path exists – ensure all clearances from the unloading/staging area to the vault meet the minimum requirements.
- A live hospital network (internet access) with the Record and Verify system is available.
- The MICAP survey has been completed and submitted.
- All electrical requirements are completed including live permanent power, cable containment, wiring, main disconnect panel, power conditioner *(optional)*, and power outlets.
- All safety-related items are installed and connected.
- The chilled water supply at the accelerator is tested and fully operational.
- The treatment and control room HVAC system is tested and fully operational.
- Flooring and casework are installed or prepared as previously agreed.

4.3 BASEFRAME INSTALLATION

Sub Project No.	**1**	The purpose of this section is to provide an overview of the roles and responsibilities of Varian and the Customer's contractors during this phase of the project. It should be coordinated with the TrueBeam/VitalBeam PPG. For clarifications, please contact the Varian PM.
Task Name	**Varian BaseFrame Installation**	
Task Overview	Deliver, level, anchor, shutter/formwork, and pour concrete to complete the installation of the accelerator BaseFrame. The installation must occur a minimum of one month before machine delivery.	
Prerequisites	• BaseFrame pit floor must be cured per the construction document specifications • The treatment room must be watertight • The floor around the isocenter must be level per 3.1.1 BaseFrame Pit • Power and lighting must be available in the room • Isocenter and the Finished Floor Level (FFL) are defined • An approved delivery path must be available • The Customer's subcontractor must be available • Seismic calculations and anchors available *(If required)*	

Responsibilities	**Task**	**Varian**	**Customer**
	Schedule a delivery date	**X**	**X**
	Seismic calculations and anchors *(if required)*		**X**
	Suitability of pit base to support machine		**X**
	Provide a suitable delivery route		**X**
	Inspect delivery route, and pit.	**X**	
	Deliver the BaseFrame to the treatment room	**X**	
	Mark isocenter and FFL project the isocenter lines up the walls 1.5m [5'-0"]		**X**
	Establish the highest point of the floor to FFL		**X**
	Level and install the BaseFrame in the pit	**X**	
	Provide and weld seismic brackets to the BaseFrame *(if required)*		**X**
	Install seismic anchors *(if required)*		**X**
	Build Shutter/formwork before the backfill pour		**X**
	Backfill the pit with concrete/grout, ensure full flow under the BaseFrame except at the turntable pan. **Do not vibrate**.		**X**
	Final BaseFrame level, customer acceptance	**X**	**X**
	Disposal of Varian packing material		**X**

Duration	2 days
Customer Supplied Resources & Materials	Contractor and material for installing shutter/formwork Contractor and concrete/grout for backfill, minimum specification: - • C20, S4 (160 – 175mm) slump with aggregate 10mm ~ 1.2 m^3 • [2000psi, 6-7" slump, 3/8" aggregate ~ 1.6 yds^3] Welding contractor for seismic brackets and anchors *(if required)*
Results	BaseFrame was installed to meet level and alignment specifications with no grout/concrete contamination of the mounting pads, turntable tub, or ducts. All Varian packing material was removed from the site.
Acceptance	Performed by RIG Contractor and returned – **CK-BF-RIG**

4.4 MDP AND RJB

Sub Project No.	**2**	The purpose of this section is to provide an overview of the roles and responsibilities of Varian and the Customer's contractors during this phase of the project. It should be coordinated with the TrueBeam/VitalBeam PPG. For clarifications, please contact the Varian PM.
Task Name	**Main Disconnect Panel (MDP) and Relay Junction Box (RJB)**	
Task Overview	To accept delivery of Varian-provided MDP and IEC outlet (if supplied) and RJB, install them in their final position, and connect the incoming supply and room interface cables. Note - If the customer or contractor wishes to build or use another MDP then this needs to be agreed upon with the Varian PM in advance.	
Prerequisites	• The treatment room must be watertight • The location for the MDP & RJB defined in the construction documents • An isolated power source is available • Mains incoming wire installed • A dedicated earth termination bar installed	

Responsibilities	**Task**	**Varian**	**Customer**
	Schedule delivery date	**X**	**X**
	Unpack RJB and MDP (if supplied)		**X**
	Install the RJB, MDP, and IEC outlet per the SSD		**X**
	Install cable containment		**X**
	Connect to an isolated power source		**X**
	Install power to console cabinet per PPG		**X**
	Wire peripherals to RJB		**X**
	Testing as defined by Varian and local regulations		**X**
	Dispose of Varian packing materials		**X**

Duration	Customer-defined
Customer Supplied Resources & Materials	General contractor to unbox and mount the MDP and RJB, using appropriate mounting hardware Electrical contractor to connect the incoming power and peripherals. Materials for installing cable containment and interconnection. Materials for console power connection per PPG
Results	MDP and RJB installed – incoming power supply connected and the power supply cable ready for connection to Modulator. IEC Outlet is installed near the Console Cabinet and wired to the MDP.
Acceptance	Performed by Varian Installation Project Manager, [**1**] **Varian Accelerator Pre-Installation Checklist**

4.5 PRE-INSTALLATION KIT (PIK)

Sub Project No.	**3**	The purpose of this section is to provide an overview of the roles and responsibilities of Varian and the Customer's contractors during this phase of the project. It should be coordinated with the TrueBeam/VitalBeam PPG. For clarifications, please contact the Varian PM.
Task Name	**Installation of the PIK Items**	
Task Overview	To take delivery of the Varian-provided PIK, assemble components, and install them in their final position.	
Prerequisites	• Scheduled delivery date • BaseFrame installed and accepted • Ceiling height defined • Isocenter lines are marked on the walls for the laser mounting plates • Site-specific plans available for component locations • Cable containment installed	

Responsibilities	**Task**	**Varian**	**Customer**
	Schedule delivery date for PIK	**X**	**X**
	Install Console Cabinet floor bracket		**X**
	Install laser mounting plates to walls and ceiling		**X**
	Install the CCTV housings onto the wall		**X**
	Install the speakers onto the wall		**X**
	Install the optical imager camera plate and post		**X**
	Install the in-room monitor plate and post(s)		**X**
	Install identification resistors into EMO switches		**X**
	Provide cable containment with end-to-end distances and install pull strings.		**X**

Duration	1-2 Days dependent on options
Customer Supplied Resources & Materials	Electrical contractor for running cables. Mounting hardware for Console Cabinet positioning bracket. Mounting hardware for Optical Imager and IRM ceiling mounting plates. Mounting hardware for Laser mounting plates
Results	All Varian-provided mounting plates and brackets are installed. Posts are configured to meet the height requirements.
Acceptance	Performed by Varian Installation Project Manager, [**1**] **Varian Accelerator Pre-Installation Checklist**

4.6 RIG AND INSTALLATION

Sub Project No.	**4**	The purpose of this section is to provide an overview of the roles and responsibilities of Varian and the Customer's contractors during this phase of the project. It should be coordinated with the TrueBeam/VitalBeam PPG. For clarifications, please contact the Varian PM.		
Task Name	**Delivery and RIG**			
Task Overview	Installation of the Machine and Peripherals			
Prerequisites	• Sub-projects 1 – 3 completed • Storage locations for spares and accessories • Power cable (customer supplied) in modulator pull box • Electrical supply available, lockout tag of electrical supply • Active network available			
Responsibilities	**Task**		**Varian**	**Customer**
	Schedule delivery date for the system		**X**	**X**
	Risk assessments and method statements		**X**	
	City Permits (street closures), if required			**X**
	Crane, if required			**X**
	Designated area for the delivery truck			**X**
	Ensure the RIG path is structurally suitable			**X**
	Lay floor protection internally		**X**	**X**
	Unload and unpack the machine and move into the treatment room		**X**	
	Pull Varian system cables		**X**	
	Install the machine		**X**	
	Connect power			**X**
	Connect cooling			**X**
	Commissioning supplied peripherals		**X**	
	Return transportation metalwork		**X**	
	Provide Load test certificates for ceiling hook anchorage points (if required)			**X**
	Install cover plate on conduit pull boxes, as required			**X**
Duration	5 Days			
Customer Supplied Resources & Materials	Access to the site outside of normal working hours Contractors to connect power and water Waste container for Varian package disposal			
Results	Machine delivered and installed			
Acceptance	Performed by RIG Contractor and PM – **CK-HT-RIGEXTND**			

4.7 RADIATION AND SAFETY

Sub Project No.	**5**	The purpose of this section is to provide an overview of the roles and responsibilities of Varian and the Customer's contractors during this phase of the project. It should be coordinated with the TrueBeam/VitalBeam PPG. For clarifications, please contact the Varian PM.
Task Name	**Radiation and Safety Surveys**	
Task Overview	Completion of Radiation and Safety Forms	
Prerequisites	• All facility services are fully operational • Machine installed • Room clinically ready	

Responsibilities	**Task**	**Varian**	**Customer**
	Arrange a date for the IPA	**X**	**X**
	Perform IPA	**X**	**X**
	Critical Exam (safety interlocks etc. Europe).	**X**	
	Failure correction		**X**
	Radiation survey (Room shielding)		**X**
	Magnetic Field room survey (flux density)		**X**

Duration	2 Days
Customer Supplied Resources & Materials	RPA or physicist availability Radiation meter Neutron meter Water tank and CC13 chambers or equivalent Dosimetry equipment and chambers
Results	Passed IPA - passed Radiation Survey and Critical Exam.
Acceptance	Performed by Installer and Customer – **IPA-HT**

APPENDIX A SHIPPING AND RIGGING INFORMATION

1 CRATE WEIGHTS AND SIZES

Appendix Table 1 Environmental Storage Conditions		
Condition	**Metric**	**Imperial**
Ambient Temperature Range	0° to 40° C	32° to 104° F
Relative Humidity	10% to 90%, non-condensing	

Appendix Table 2 System Crate Weights and Sizes				
Kit Description	**Metric**		**Imperial**	
	Weight (kg)	**L x W x H (cm)**	**Weight (lb)**	**L x W x H (in)**
BaseFrame	923	376 x 160 x 56	2035	148 x 63 x 22
Pre-Install Kit	172	122 x 122 x 91	380	48 x 48 x 36
Gantry	5003	325 x 157 x 226	11030	128 x 62 x 89
Stand	1826	163 x 130 x 226	4025	64 x 51 x 89
Counterweight	2695	117 x 114 x 178	5941	46 x 45 x 70
Modulator	1068	155 x 114 x 226	2355	61 x 45 x 89
Couch	626	152 x 76 x 94	1379	60 x 30 x 37
Couch PRS *(optional)*	71	119 x 69 x 38	156	47 x 27 x 15
Turntable	594	149 x 160 x 84	1309	59 x 63 x 33
Couch Top	42	229 x 69 x 38	92	90 x 27 x 15
Console Cabinet	440	127 x 102 x 188	970	50 x 40 x 74
KV Generator	137	119 x 69 x 74	301	47 x 27 x 29
X -Ray Tube	84	81 x 81 x 76	185	32 x 32 x 30
Covers – 1/3	232	196 x 119 x 185	512	77 x 47 x 73
Covers – 2/3	132	127 x 112 x 152	292	50 x 44 x 60
Covers – 3/3	263	259 x 86 x 145	580	102 x 34 x 57
Red Iron Return Crate	4990	264 x 102 x 122	1100	104 x 40 x 48
Box BB *(U.S. only)*	181	122 x 122 x 114	399	48 x 48 x 45
Box CC *(International only)*	171	122 x 122 x 92	378	48 x 48 x 36
Applicator Kit	116	145 x 102 x 64	256	57 x 40 x 25
Mold Kit	60	71 x 71 x 56	132	28 x 28 x 22
Water	154	97 x 66 x 79	339	38 x 26 x 31

2 RIGGING INFORMATION

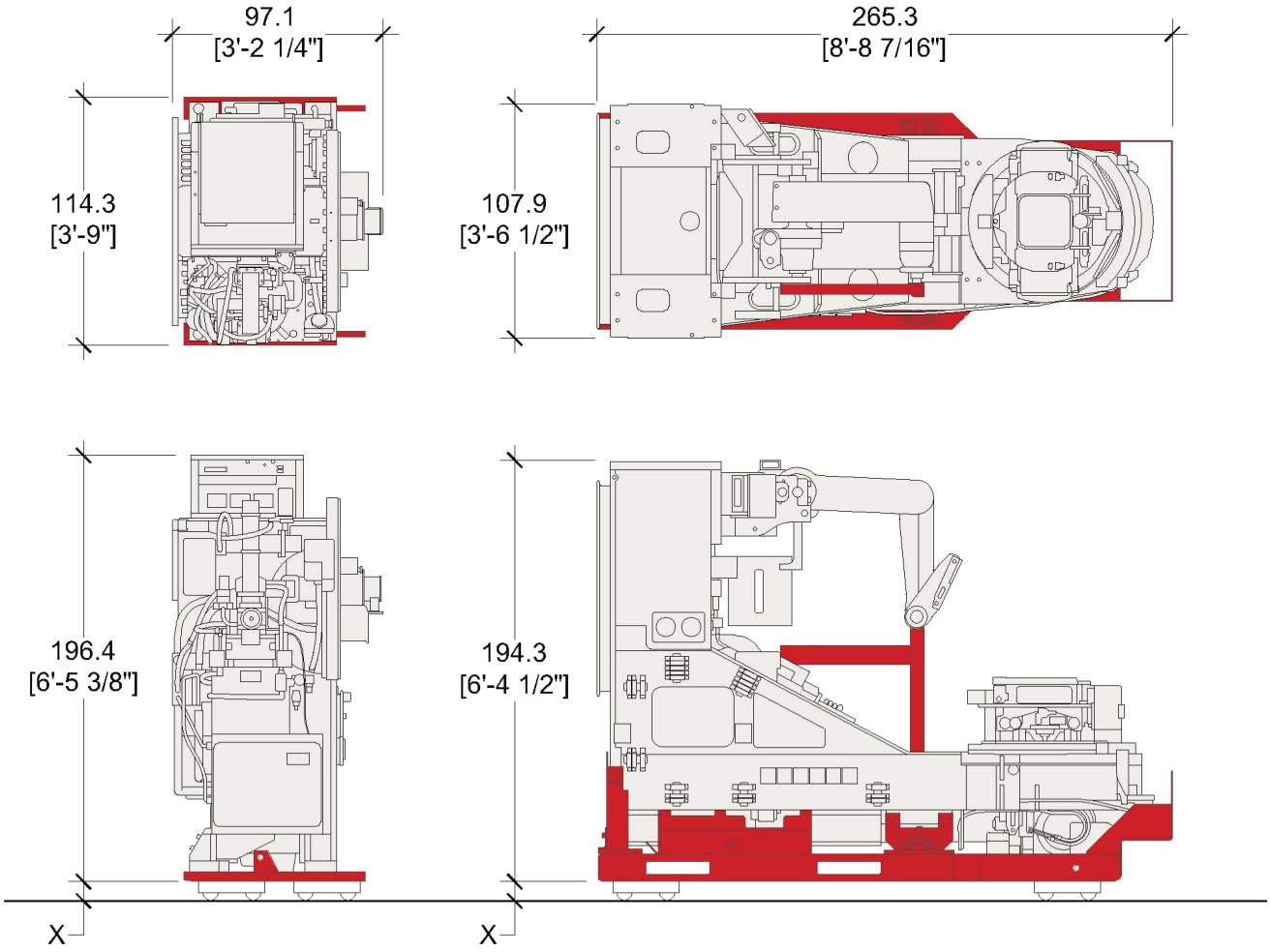
NOTICE

In Appendix Figure 1 the dimension for "X" is variable, dependent on the rigging equipment (skates or dollies).

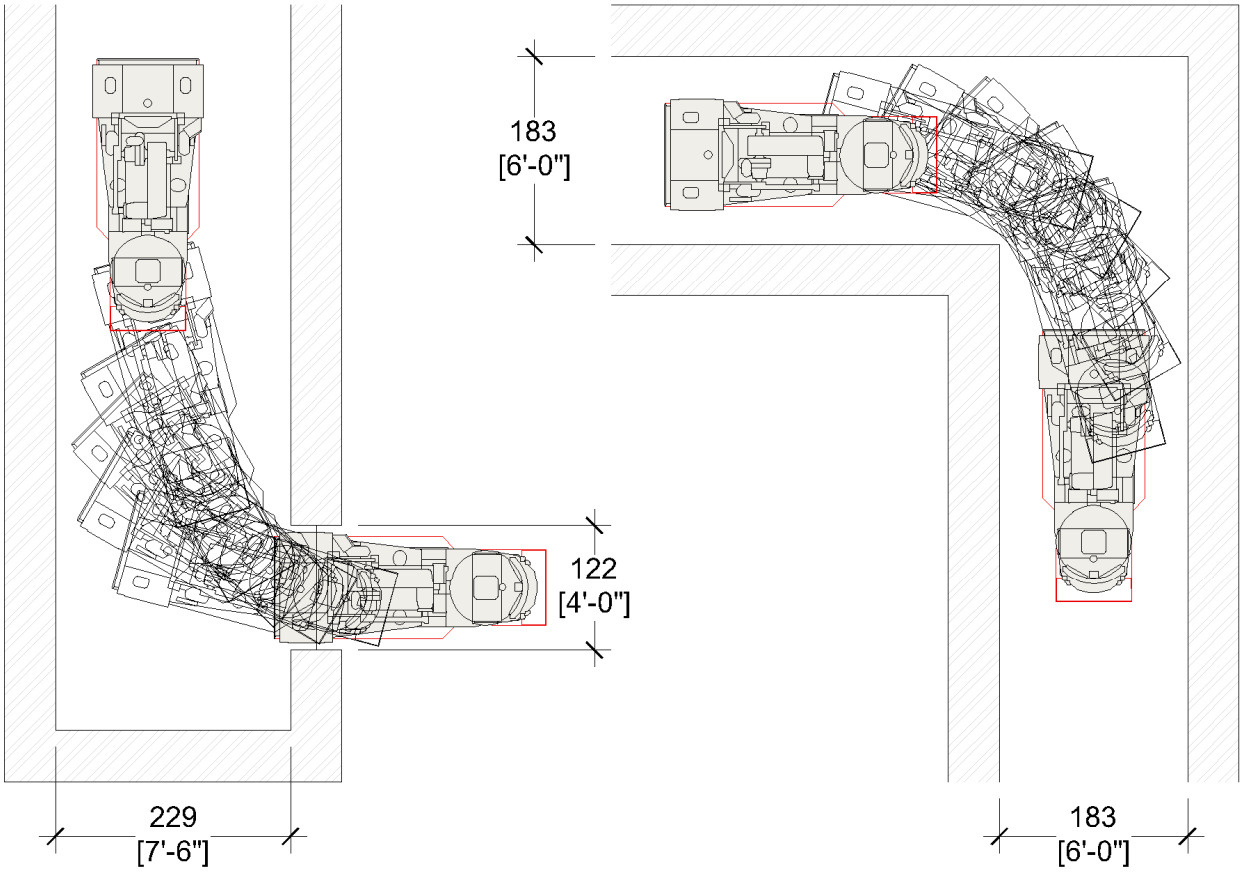
2.1 STANDARD CONFIGURATION

Separated Stand and Gantry (uncrated) with shipping red iron.

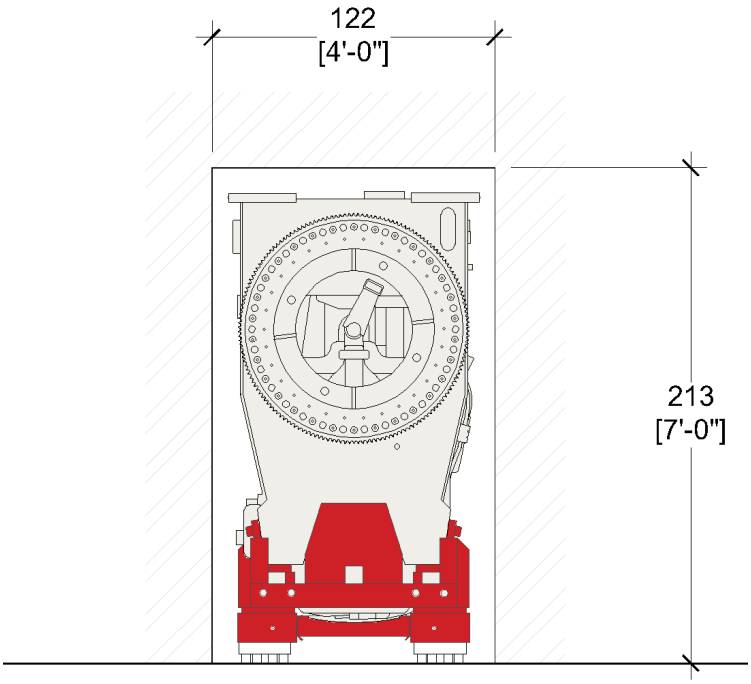
- Gantry Rigging Weight 4225 kg [9,315 lb]
- Stand Rigging Weight 1465 kg [3,230 lb]



Appendix Figure 1 Standard Rigging Configuration (Stand & Gantry)



Appendix Figure 2 Gantry Tracking Route

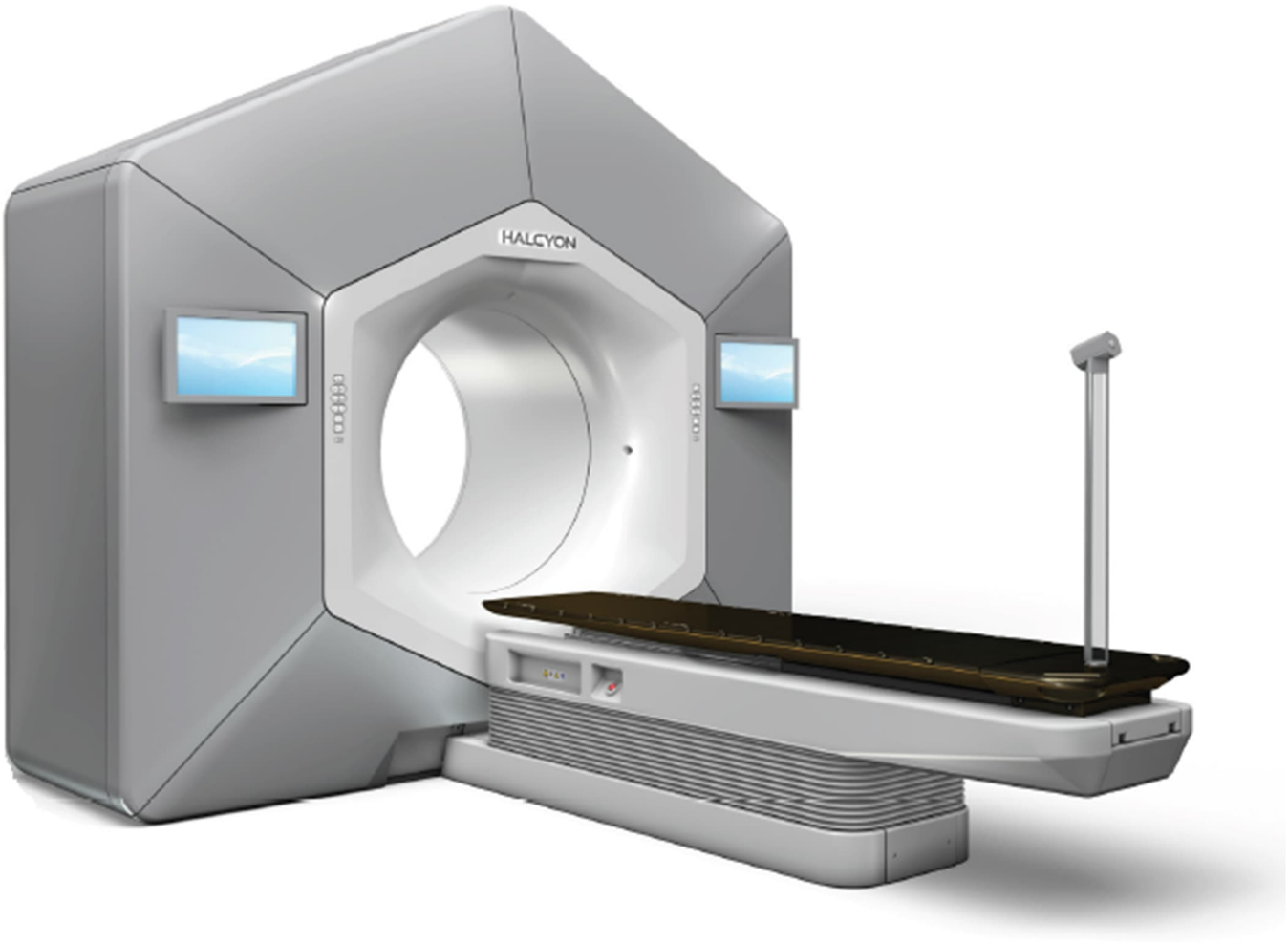


Appendix Figure 3 Minimum Door Opening

varian

HALCYON

PRODUCT PLANNING GUIDE



SCAN FOR CURRENT RELEASE

PPG-AL-I OCTOBER 2025

MANUFACTURER	**Varian Medical Systems** 3100 Hansen Way, Bldg. 4A Palo Alto, CA 94304-1030, U.S.A. https://www.varian.com For more information not included in this publication, contact one of the following Varian Regional Planning Departments: **Central, North, and South America:** planning.ams@varian.com **Asia Pacific, Australia, India, and China:** planning.apac@varian.com **Europe, Middle East, and Africa:** planning.emea@varian.com
AUTHORIZED REPRESENTATIVE IN THE E.U.	**Varian Medical Systems Nederland B.V.** Kokermolen 2 3994 DH Houten The Netherlands
CONVENTIONS	All dimension units are shown as Metric (primary) followed by Imperial (secondary). Metric [Imperial] – The default is cm [inches] unless otherwise noted. Tolerances are given where critical, otherwise, general tolerances from ISO 4463-1: 1989 should be used. The metric to imperial construction dimension conversions may vary due to industry standards. All listed component weights are within a ±5% tolerance, not including system cabling or coolant, if applicable.
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Executive Summary

Intended Audience

The intended audiences for the PPG are any Varian external Customers or their representatives.

Purpose

This document is designed to assist customers and their representatives in understanding the minimum requirements to enable a Varian Halcyon System to be installed. This document is a reference for the Halcyon system to be installed. This document does not cover specific site conditions that may require additional detailed design or safety solutions.

The information herein will be useful to project managers, architectural and site planners, construction engineers, contractors' trade personnel, and others. Good site preparation and coordination between Varian and the Customer's representative is essential for smooth and efficient machine installation.

It is important to finalize the detailed design of the site configuration before construction is started. Once the site is completed, it will be difficult, and costly to make revisions.

Document Structure

This document has four main sections:

Product Overview	- System pictures, identification of deliverables, and references.
Varian System	- System components, size, weight, and limitations.
Customer Requirements	- Room sizes, utility, and environmental requirements in trade sections.
Project Management	- Customer project tasks, durations, and responsibilities.

Project Planning

Once an order is placed, Varian will assign an Installation Project Manager (PM) to assist the Customer and their representatives with the installation of the Halcyon system. Refer to 4 Project Management for more information.

Typical Lead-times and Durations

Min. lead-time from Customer order – **4 months** (may vary, confirm with Varian PM)
Third-party products (Power Conditioner, Chiller, etc.) – **10 weeks**
Standard machine installation and acceptance – **10 days** (Total, not including commissioning)

- Equipment Delivery and Rig-In – **1 day**
- Machine Cabling and Power up – **4 days**
- Initial Beam on and Acceptance Preparation – **2 days**
- SW installation – **1 day**
- Acceptance – **1 day**
- Clean-Up, Finalize Paperwork – **1 day**

Commissioning – **1 to 2 days** (Customer's discretion)

Table 4-1 shows the detailed process and responsibilities for each major project milestone.

Site Readiness

The room must be clinically ready, meeting all the requirements within the PPG. All services and utilities must be available with the final finishes completed. The [1] Varian Accelerator Pre-Installation Checklist is used to measure compliance. Any tasks that are NOT completed must be approved by the Varian PM before the system can be delivered. The Varian installation engineer must have exclusive possession of the treatment area during system installation.

REVISION HISTORY

REV	DATE	DESCRIPTION OF CHANGE	AUTHOR NAME
I	October	• Table 3-2, Revised the Supply Power, 400-480V to the stand PDU • 3.3.1.1, Added KV Imaging electrical load	DKU

H	September 2025	• 1-1, Moved gauss/MRI bullets to a Notice and added customer responsibility
		• Table 3-2:
		  • Corrected the Supply Power
		  • Removed the system current capacity
		  • Removed 342VAC Inrush
		  • Added 400VAC Inrush
		  • Added clarification to Source Impedance
		• 3.3.1.1, Revised the Beam-On electrical load
		• 3.3.1.1, Added duration varies note
			DKU

G	August 2025	• Cover, Added QR code
		• 1-1, Revised note to reference shielding document
		• 1.3, Removed note referencing product compatibility matrix
		• Figure 2-1, Updated System dimensions
		• Table 2-4, Updated Monitor imperial dimensions
		• Figure 2-5, Updated the Monitors
		• 2.5, Added new note on the 380V Step-Up Transformer
		• Figure 2-7, Added mounting hole dimensions to IEC outlet
		• Table 2-7, Removed note on Quart Phantom
		• 3.1.1, Revised the Notice for more clarity
		• Figure 3-2, Revised Treatment Room Floor Pit levelness area
		• Figure 3-6, Revised the chilled water access zone
		• Figure 3-7, Revised drawing
		• 3.2, New Note on mounting bracket for power supplies
		• 3.3.1, Moved Notice to 3.3.3
		• Table 3-2:
		  • Revised the System Current Capacity
		  • Revised the Console Capacity
		  • Moved Electrical Loads to 3.3.1.1
		  • Added In-Rush Current
		  • Moved Power Factor to 3.3.1.1
		  • Revised Source Impedance
		• 3.3.1, New Note, formerly 3.3.2 Step-Up Transformer
		• 3.3.1, Moved existing Note to 3.3.2
		• 3.3.1.1, New Section "Electrical Loads"
		• 3.3.1.2, Revised Source Impedance description
		• 3.3.3.1, Added input "to" and output "from" the MDP
		• Table 3-4, Add note on ground conductor parity
		• Figure 3-10, Revised the "MV ON" and "MV OFF" colors
		• 3.3.4.1, New Note for Customer-provided components
		• 3.3.5.1, Added new outlet requirement for RJB
		• 3.3.5.2, New Figure 3-11 IEC Outlet
		• 3.3.5.2, Revised Notice for IEC receptacle
		• 3.3.6, Revised Grounding description
		• 3.3.6, Converted Caution to Warning, revised text
		• 3.3.7:
		  • Added to Notice, 'do not terminate conduits'
		  • Added link to Table 2-8
			DKU

		• Added to Note, page 32 'include distance'
		• Figure 3-13, Added Conduit K
		• Table 3-8, Added max length for conduit runs F, G, H
		• Table 3-8, Added new conduit K
		• 3.3.9, Revised bullet regarding the RJ 45 wiring pattern
		• Table 3-10:
		  • Revised incoming temperature range
		  • Remove Pressure Differential
		  • Revised Inlet Pressure, 3.5 bar [50 PSI]
		  • Revised the Pressure Drop, varies
		  • Removed average water temperature rise
		• Figure 3-14, Updated and Added pressure drop
		• Figure 3-15, Updated Coolant System Schematic
		• 3.4.1, New Notice regarding water pipe routing and floor drains
		• Figure 3-16, Revised Chilled Water Access Plan
		• Figure 3-17, Removed dimension to isolation valves
		• New Figure 3-18 Chilled Water Access (front view)
		• 3.4.2, New Note regarding location of isolation valves
		• 3.5.1, Removed bullet point regarding positive air pressure
		• 4.3, Revised Task and Acceptance lines
		• 4.4, Added to Customer responsibility to install cover plates
		• Appendix, New Table1 Environmental Storage and Transport Conditions
		• Appendix Table 2, Revised weight(s) and dimension(s) for following:
		  • Box A, Gantry Crate
		  • Box B, Couch Crate
		  • Box C, Console Cabinet Crate
		  • Box D, Utility Crate
		• Appendix Figure 1, Revised Stand and Gantry rigging dimensions	

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1 OVERVIEW

Varian Medical Systems designed the Halcyon linear accelerator so that modern 21st-century radiotherapy treatment techniques could be offered in a way that greatly streamlines the treatment delivery process and clinical operations.

Utilizing advanced technology that was developed and pioneered on this treatment delivery platform, the Halcyon system represents a complete reformulation of the linear accelerator concept around operational efficiency for the clinic with a focus on the patient experience. The clinical operator is guided through the workflow by the user interface so that a given patient can be treated in a reproducible manner during every therapy session.

To effectively treat lesions throughout the entire body with high clinical quality, the foundational treatment capability of the Halcyon system is built upon image-guided intensity-modulated radiotherapy. Thus, the imaging and beam modulation properties of the Halcyon system are differentiated from that of a typical C-arm linear accelerator.

The system is integrated with the Eclipse treatment planning system and ARIA oncology information system software environments to support a range of Halcyon clinical operational roles in a variety of network configurations ranging from a stand-alone multi-purpose linac in a single vault clinic to a dedicated role, such as an image-guided RapidArc specialty machine within a fleet of linacs in a large-hospital network.

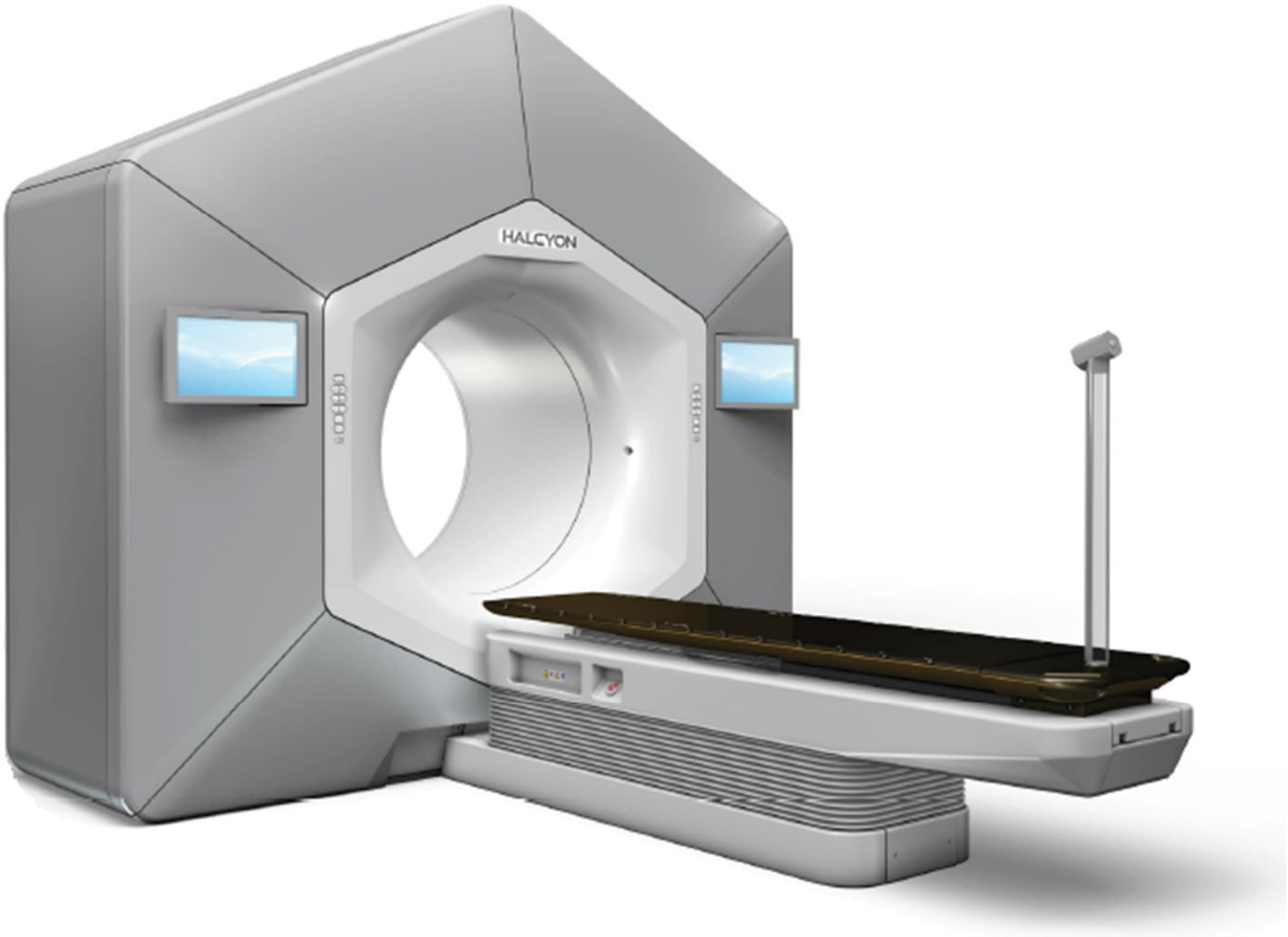


Figure 1-1 Halcyon Gantry and Couch

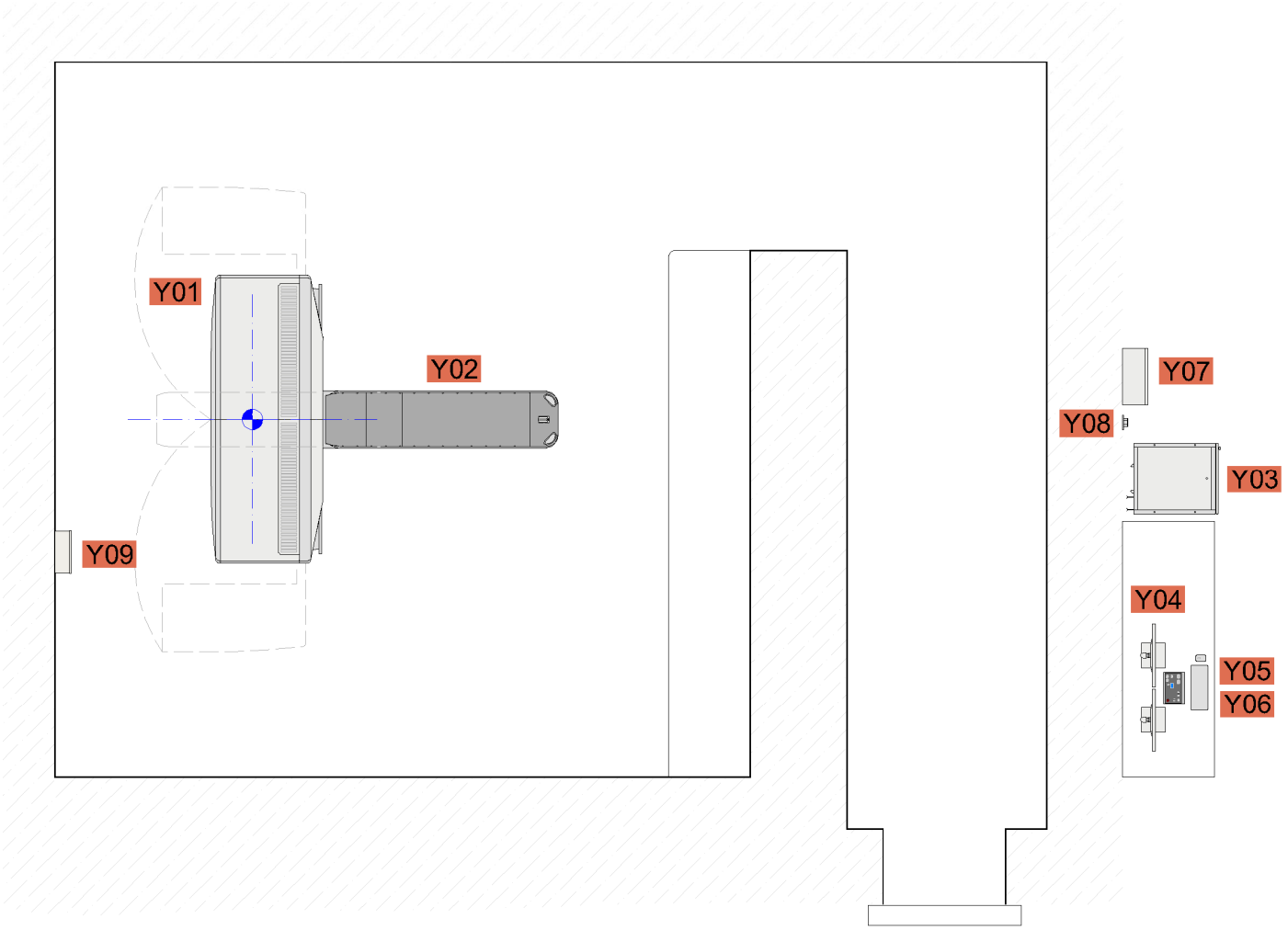


Figure 1-2 Halcyon System Components *(sample room layout)*

Table 1-1 Halcyon System Components			
Y01	Stand & Gantry	**Y03**	Console Cabinet
	In-Room Monitors *(integrated)*	**Y04**	System Monitors *(Image and Data)*
	Positioning Laser *(integrated)*	**Y05**	Control Console
	Speaker *(integrated)*	**Y06**	USB Keyboard and Mouse
	Patient Microphone *(integrated)*	**Y07**	Main Disconnect Panel (MDP)
Y02	Treatment Couch	**Y08**	IEC 60309 Power Outlet
	Live View Camera *(integrated)*	**Y09**	Relay Junction Box (RJB)

The Halcyon system is designed to fit into small rooms with an option for direct entry through a suitably shielded door, or into a room with a maze entry, as shown above. The room layout in Figure 1-2 is for component identification purposes only.

1.1 SHIELDING

WARNING

Varian Medical Systems will not have approval or responsibility for any matters related to the adequacy of radiation protection walls, barriers, or safety devices. All radiation shielding designs must comply with codes and regulations of all Authorities Having Jurisdiction (AHJ) and must be approved by the Customer's or Facility's Physicist of Record. The responsibility for these designs lies solely with the Customer/Facility. Factors such as hours of operation, patient workload, accelerator energy, and shielding materials should be considered when calculating shielding requirements. Improper radiation shielding can result in serious injury or death.



Refer to [1] SD-AL-Shielding for more information on Halcyon's internal shielding.

NOTICE

The Halcyon must be positioned outside the 100 µT (1 Gauss) magnetic field produced by Magnetic Resonance Imaging (MRI) units or any other equipment that generates magnetic fields.

The customer is responsible for verifying that there are no background magnetic fields exceeding this limit in the treatment and control rooms.

1.2 COMPATIBILITY

NOTICE

All treatment room finishes and equipment must be compatible with ionizing radiation.

1.3 REFERENCES

The following reference/support documents are available from Varian Site Planning or the Varian PM.

[1] SD-AL-Shielding

[2] Varian Accelerator Pre-Installation Checklist

[3] Halcyon and Ethos Radiotherapy System Customer Release Note (CRN)

[4] MICAP Network Configuration Guide

[5] SD-Step-Up Transformer (for 380VAC sites)

2 VARIAN SYSTEM

The Halcyon standard system components are listed in Table 1-1 Halcyon System Components.

2.1 GANTRY AND COUCH

The Halcyon system is a self-contained single unit. Patient positioning and user interface devices are integrated into the stand and gantry covers.

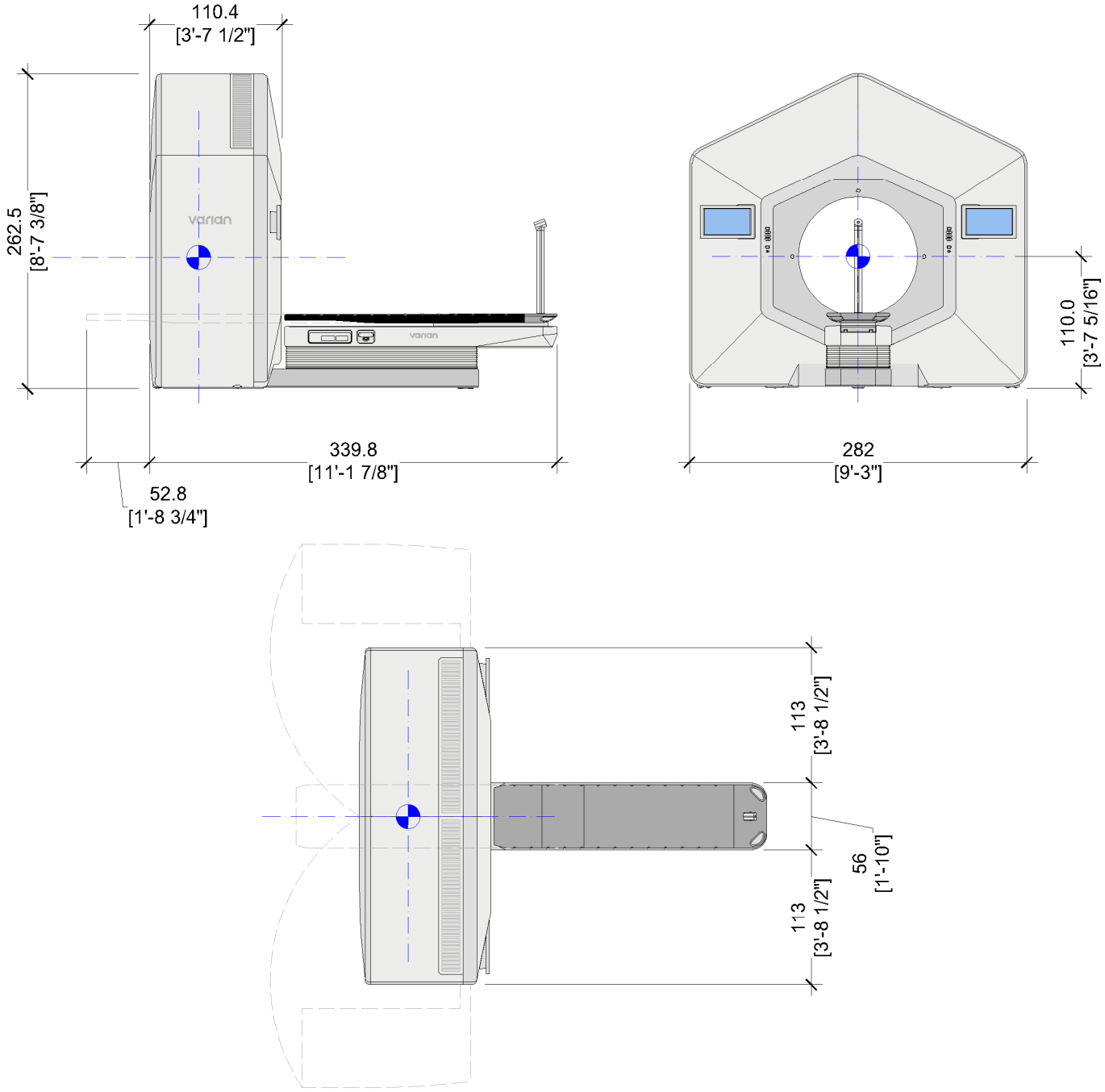


Figure 2-1 Halcyon System Dimensions

Table 2-1 Halcyon System Weights		
Description	**kg**	**lb**
Gantry and Covers	4575	10086
Couch	420	926
Total System *(installed)*	4995	11012

2.1.1 STAND INTEGRATED COMPONENTS

- (2) In-Room Monitors
- Patient Positioning Lasers
- Intercom Speaker and Microphone

2.1.2 COUCH INTEGRATED LIVE VIEW CAMERA

A "Live View" camera is mounted on the treatment couch, enabling the therapist to visually monitor the patient during treatment.

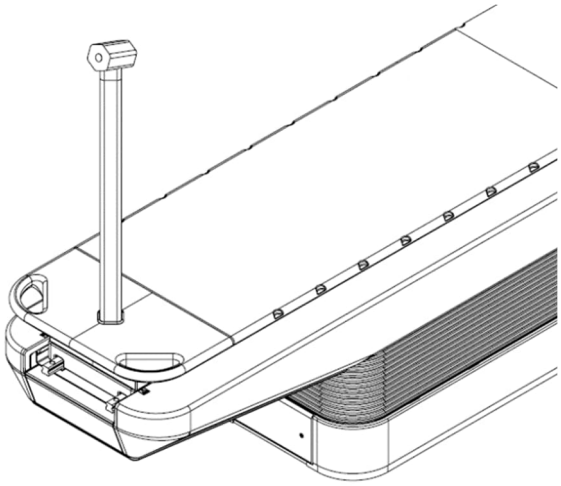


Figure 2-2 Couch Mounted Live View Camera

2.2 CONSOLE CABINET

The Console Cabinet houses rack-mounted computers and imaging equipment required to run the system and user interface. The Console Cabinet is powered by the Main Disconnect Panel. See Table 3-2 for details of the specific requirements and electrical connection required for the cabinet. An optional excess cable storage box is shown installed on top of the cabinet.

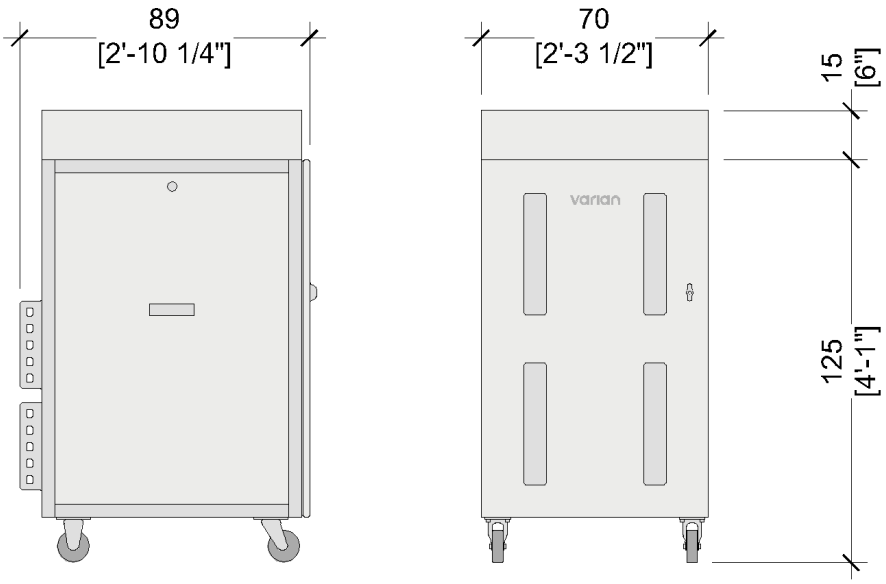


Figure 2-3 Console Cabinet

Table 2-2 Console Cabinet Weight		
Description	**kg**	**lb**
Console Cabinet	310	683

2.3 FLOOR POSITIONING BRACKET

The Floor Positioning Bracket allows for the proper positioning of the Console Cabinet. Refer to 3.2.1 for installation clearance requirements.

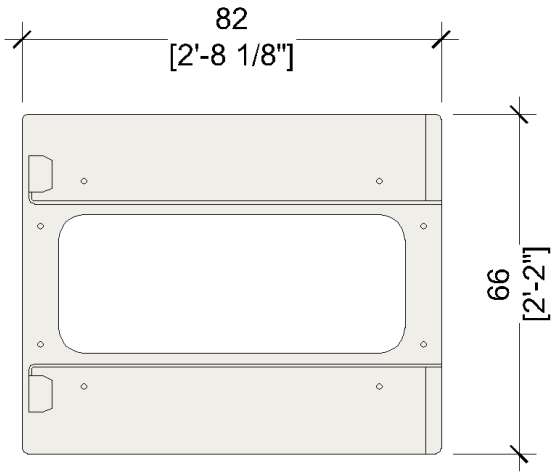


Figure 2-4 Floor Positioning Bracket

Table 2-3 Floor Positioning Bracket Weight		
Description	**kg**	**lb**
Floor Positioning Bracket	23.5	52

2.4 SYSTEM MONITORS AND CONTROL CONSOLE

These are the Halcyon user interface components that are located in the control area.

- (2) 27" Monitors
- Control Console, a.k.a “Dedicated Keyboard”
- Keyboard and Mouse, wired

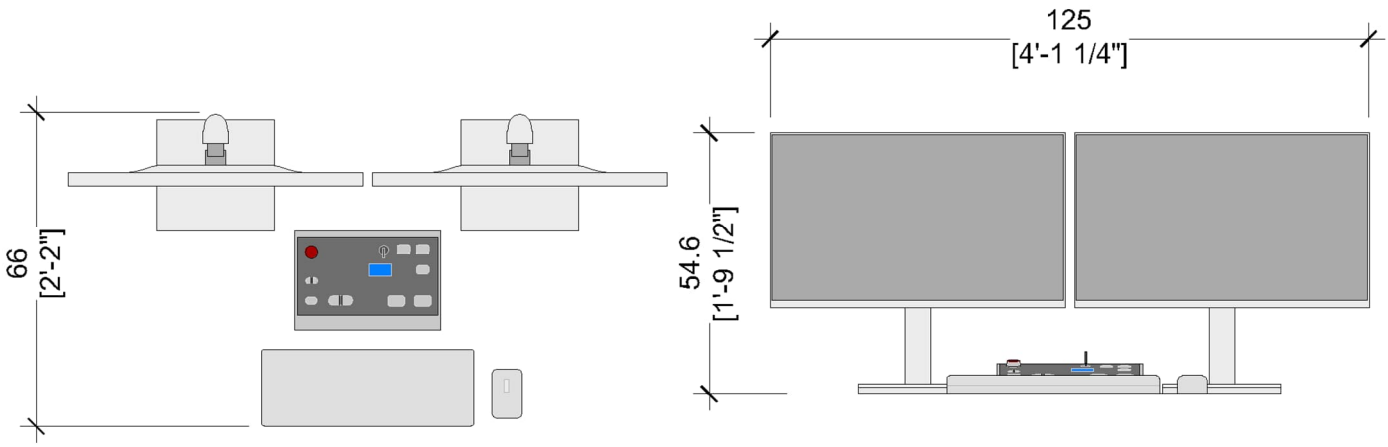


Figure 2-5 Typical Console Layout

Table 2-4 Console Component Weights and Sizes				
Description	**kg**	**W x D x H (cm)**	**lb**	**W x D x H (in)**
Monitor (with stand)	7.5	61.5 x 27.6 x 54.6	16.5	2’-0 1/4” x 10 7/8” x 1’-9 1/2"
Control Console	1.8	29.6 x 20.3 x 7.3	4.0	11 3/4” x 8” x 2 3/4”
Keyboard (wired)	n/a	43 x 12.7 x 2.6	n/a	1’-5” x 5” x 1”
Mouse (wired)	n/a	6.2 x 11.3 x 3.8	n/a	2 3/8” x 4 1/2” x 1 1/2”

2.5 PRE-INSTALLATION KIT (PIK)

The PIK includes a Main Disconnect Panel and Relay Junction Box. These components are delivered to the site by the Varian PM for customer installation prior to the Halcyon delivery. The Varian-supplied components must be installed in compliance with local codes and regulations, using customer-provided and appropriately sized mounting hardware engineered to support the component weights.



In countries where 380VAC is standard, a Step-Up Transformer will be provided by Varian as part of the PIK, refer to 3.3.1.

2.5.1 MAIN DISCONNECT PANEL (MDP)

The MDP serves as the primary distribution point for power to the Halcyon system. It includes safety features to control power to the system.

- Provides a single point of connection for the site’s 3-phase power to the Halcyon System
- Splits the mains power into two independent switchable power outputs
  - Three-phase delta power output to the Halcyon Stand, which matches the incoming 3-phase voltage phase-to-phase, refer to 3.3.1 for more information.
  - Single-phase power output to the Console Cabinet via an IEC60309 outlet that is included with the MDP.
- Provides for various system safety features:
  - Overcurrent protection for the outputs
  - Mains Incoming Power Switch (non-emergency)
  - Emergency Disconnect Button
  - System Start

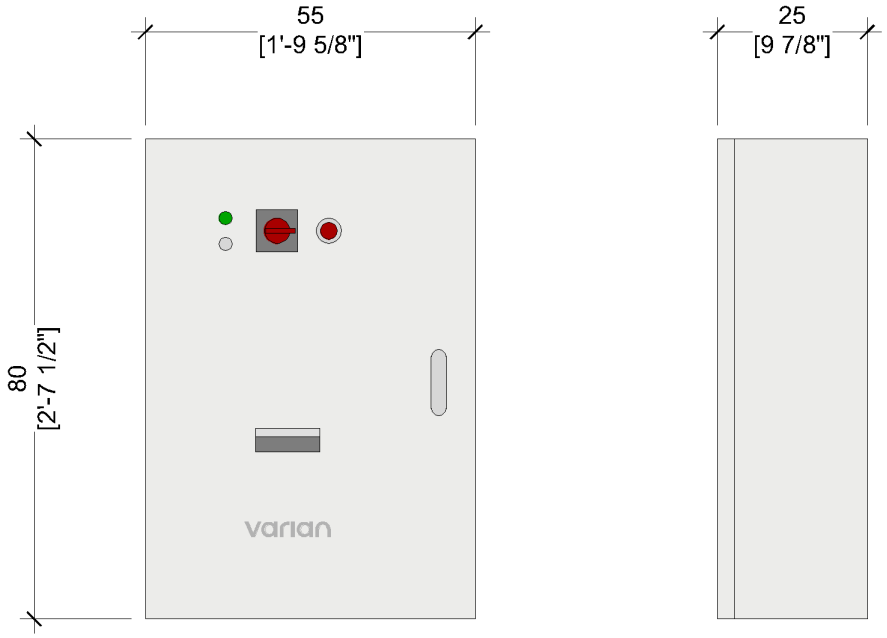


Figure 2-6 Main Disconnect Panel (MDP)

Table 2-5 MDP Weight		
Description	**kg**	**lb**
MDP	47	104

2.5.1.1 IEC 60309 OUTLET

- 2-pole, 3-wire
- Blue, 6-hour position
- 230VAC, 16A, 50/60Hz, refer to 3.3.5.2 for more information.

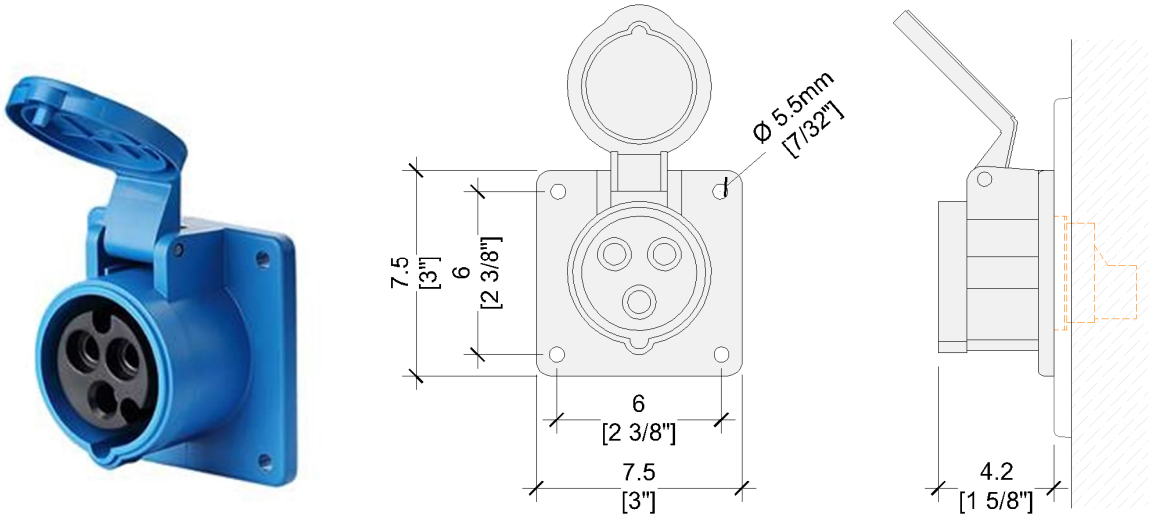


Figure 2-7 Console Cabinet - IEC 60309 Outlet

2.5.2 RELAY JUNCTION BOX (RJB)

The RJB is a factory-assembled and tested control panel that serves as a central interface connection point for Customer-provided system status warning lights, door interlock switches, and remote emergency-off buttons. It features an integrated extender card that offers additional connections for optional Customer-provided safety devices. Refer to 3.3.4 Relay Junction Box (RJB).

- The door hinges are on the left side of the RJB.

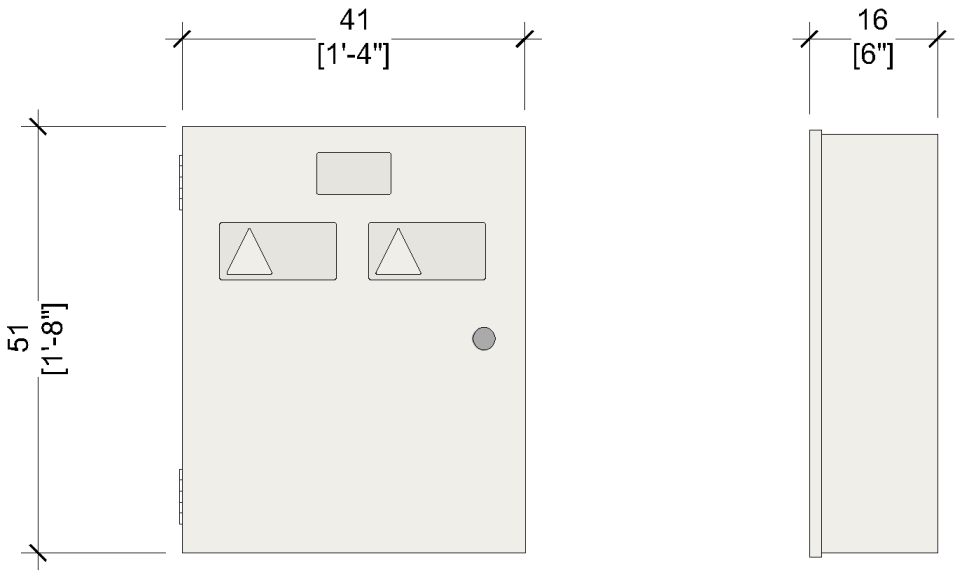


Figure 2-8 Relay Junction Box (Front and Side View)

Table 2-6 RJB Weight		
Description	**kg**	**lb**
RJB	12.5	27.5

2.6 PHANTOMS

The Halcyon system is supplied with a Phantoms Kit for machine performance and physics QA testing.

Table 2-7 Phantom Weights and Sizes				
Description	**kg**	**W x D x H (cm)**	**lb**	**W x D x H (in)**
Drum Phantom	3	55.2 x 33.5 x 24.5	6.6	1’-9 3/4” x 1’-1 1/8” x 9 5/8"
Las Vegas Phantom	1.1	14 x 14 x 2.5	2.4	5 1/2” x 5 1/2” x 1”
Wire Phantom	n/a	10 L	n/a	4” L
Quart Phantom	n/a	16 x 16.2 x 17	n/a	6 5/16” x 6 3/8” x 6 3/4”

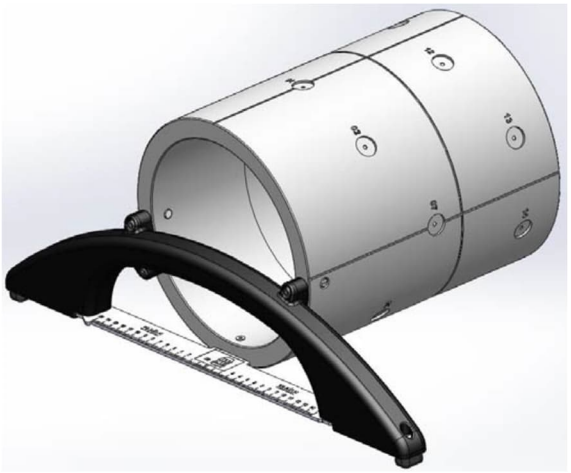


Figure 2-9 Drum Phantom

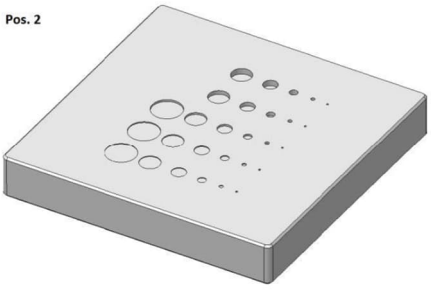


Figure 2-10 Las Vegas Phantom

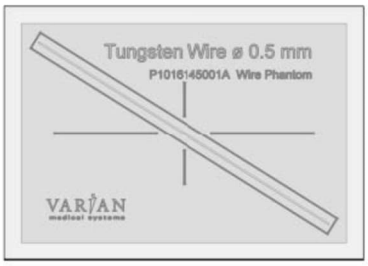


Figure 2-11 Wire Phantom

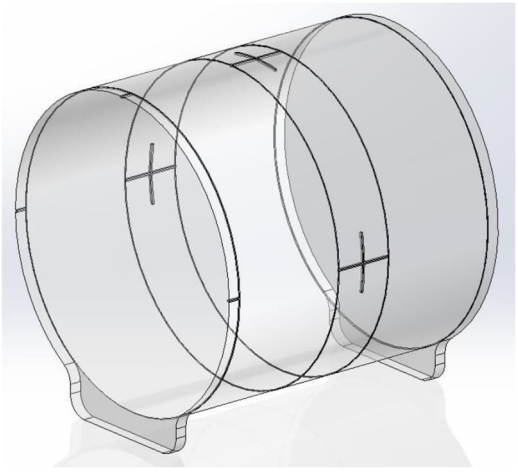


Figure 2-12 Quart Phantom

2.7 CABLES

This section provides the point-to-point connection and the maximum cable length available for the Varian-supplied system cables. Refer to Table 3-8 for maximum containment lengths.

Table 2-8 Halcyon System Cables

Run	Standard Cable Length	Extended Cable Length	Qty	Start *(From)*	Finish *(To)*
A	33m [108’]	46m [150']	17	**Y03** – Console Cabinet	**Y01** – Stand/Gantry
B	33m [108’]	46m [150']	1		
C	15m [49’]	n/a	1		**Y07** – MDP
D	62m [203’]	n/a	1	**Y01** – Stand/Gantry	**Y07** – MDP
E	34m [111’]	46m [150']	2		**Y09** – RJB
F	15m [49’]	n/a	10	**Y03** – Console Cabinet	**Y05** – Control Console
G	3m [10']	n/a	1		**Y08** – IEC Outlet
H	10m [32']	n/a	1		Network Outlet *(by Customer)*

2.8 OPTIONAL SUBSYSTEM COMPONENTS

2.8.1 CLOSED-CIRCUIT TELEVISION (CCTV)

CCTV cameras are not included with the Halcyon system. An independent camera system may be required to comply with local regulations for visual coverage in the treatment room. Consult the Customer about their specific CCTV camera requirements.



Varian offers a two-camera CCTV system as an optional purchase. Contact Varian Sales or Varian Site Planning for more information.

3 CUSTOMER REQUIREMENTS

NOTICE

The Customer is responsible for ensuring that the site-specific design documents for the Varian system, to be installed, comply with all applicable local, regional, and national codes and regulations.

Compliance must address but is not limited to proper egress, adequate separation of services, and required clearances for equipment with hazardous voltages.

3.1 TREATMENT ROOM

The highlighted area below shows the installation, operational, and service clearances required for the Halcyon Stand and Couch.

- A minimum ceiling height clearance of 274 cm [9'-0"] is required above the finished floor.

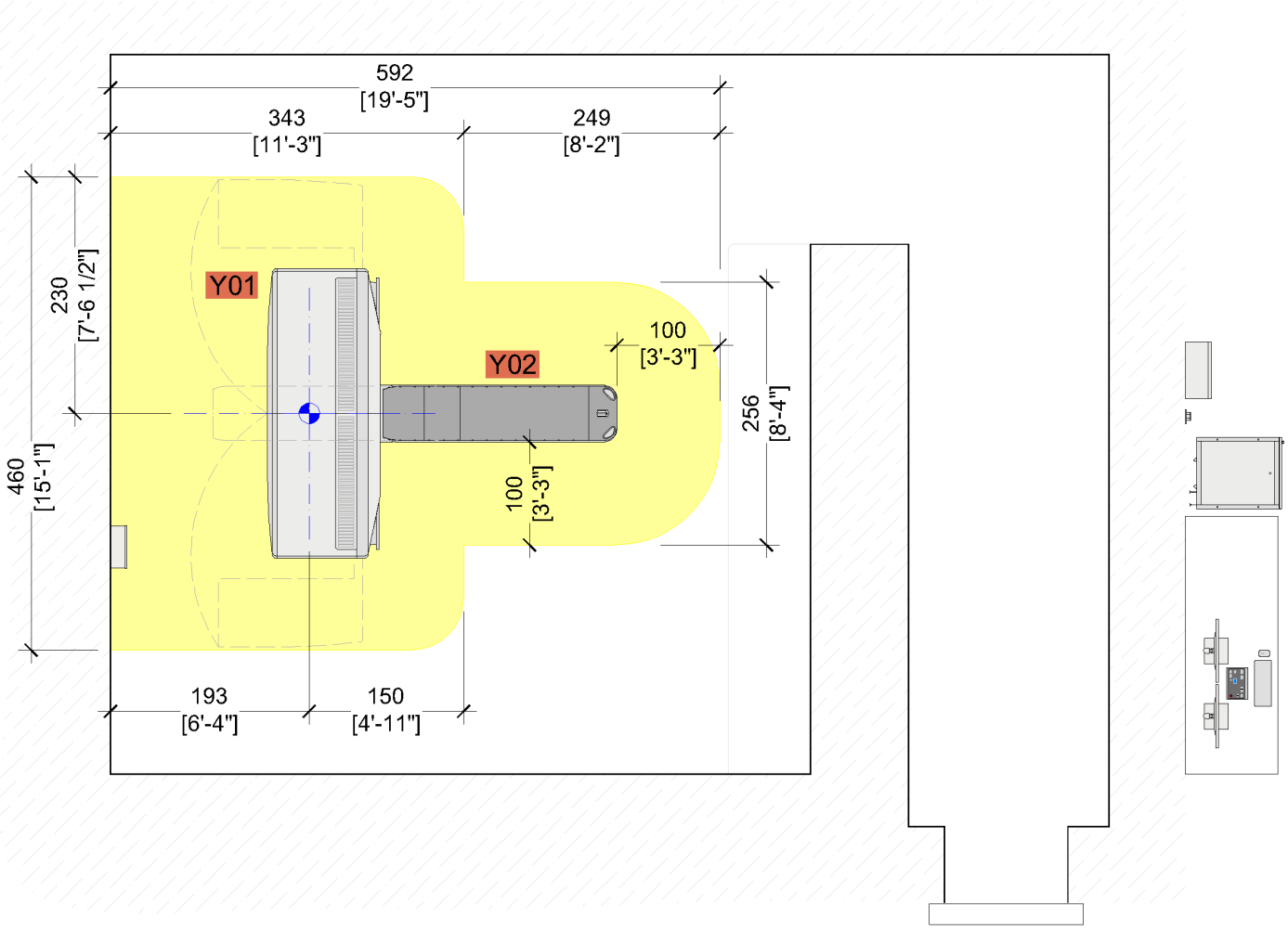


Figure 3-1 Minimum Room Clearances

NOTICE

Failure to maintain the minimum dimension from the isocenter to the rear finished wall may prevent the installation of other Varian products.

Contact Varian Site Planning for options that do not meet the minimum requirements in Figure 3-1.

3.1.1 FLOOR PIT

The Treatment Room Floor Pit provides the required clearance needed for the rotating gantry and is the pathway that allows the electrical cables and chilled water line access to the Halcyon Stand.

- All exposed concrete shall be suitably sealed before the Halcyon Installation.
- Pit depth shall not vary more than 6mm [1/4"].

NOTICE

The concrete finished floor outside of the floor pit must be level.

The boundary of the shaded area must be within ±3mm [1/8”] from the edge of the floor pit, with in a total allowance of 6mm [1/4”] across the shaded area shown in Figure 3-2.

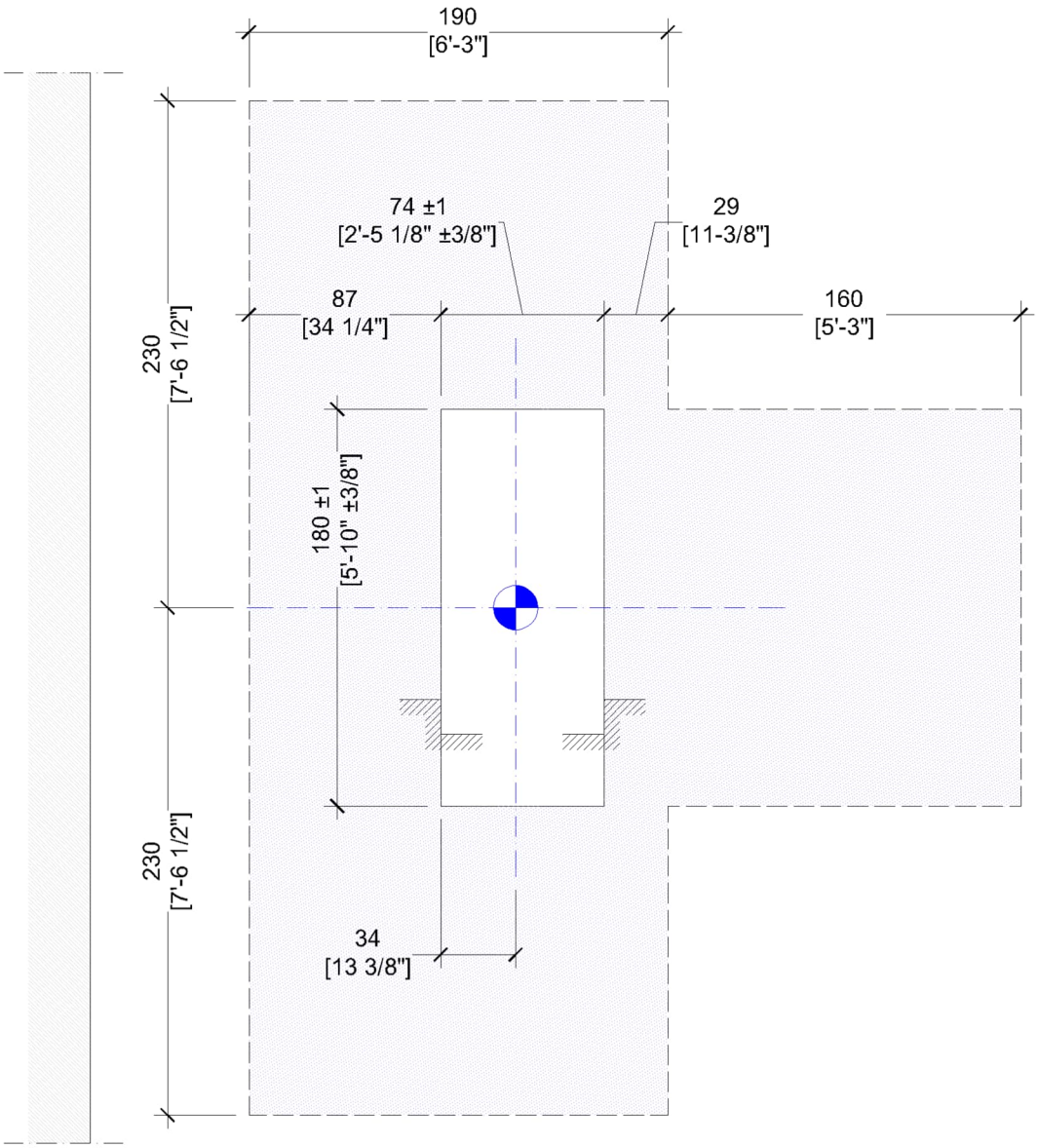


Figure 3-2 Treatment Room Floor Pit – Plan View

When renovating an existing Varian accelerator, it is acceptable to use the existing BaseFrame pit. Contact Varian Site Planning for more information.

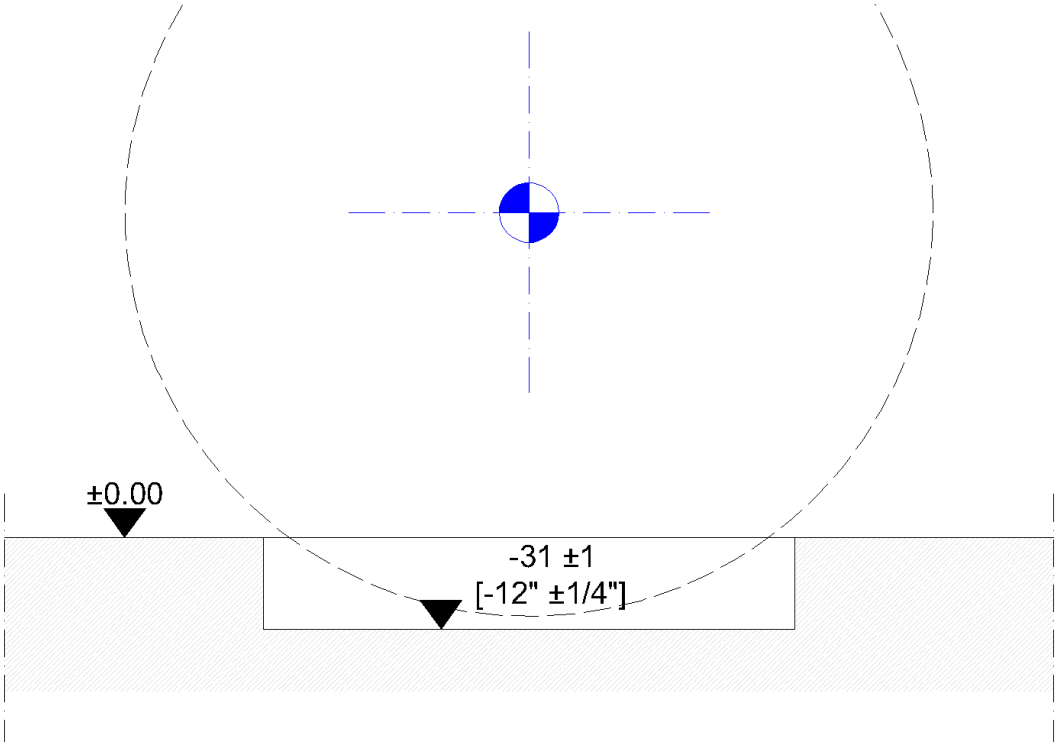


Figure 3-3 Treatment Room Floor Pit – Section with Gantry Rotation

3.1.2 FLOOR LOADS

WARNING

The Halcyon system is supplied with mounting hardware that is not suitable for sites subject to seismic activity. If seismic anchoring is required, it is the Customer's responsibility to provide a qualified structural engineer to determine the quantity, size, and type of mounting hardware required for seismically anchoring the Varian-provided components to the building. Varian Site Planning or Varian PM can provide more information.

The concrete slab below the Stand Base Pad (**B**) and Stand Leveling Foot (**C**) shall be no less than 30cm [12"] thick. In addition, the area below the Stand mounting brackets (**D**) shall be clear of rebar, conduits, water lines, voids, and other sub-floor structures that could interfere with equipment anchorage to a depth of 12cm [5"] at the Stand Bracket (**D**) and 7.5cm [3"] at the Couch Bracket (**E**) for the non-seismic, Varian-provided anchors.

Table 3-1 Stand and Couch Floor Loads

Location	Description	kN	Lbf
A	Couch Foot Pad, (3) Ø2.5cm [1"], *combined*	4.2	945
B	Stand Base Pad, Ø9cm [3 9/16"]	17.1	3845
C	Stand Leveling Foot, Ø6cm [2 3/8"]	7.8	1754
D	Stand Mounting Bracket	n/a	n/a
E	Couch Mounting Bracket	n/a	n/a

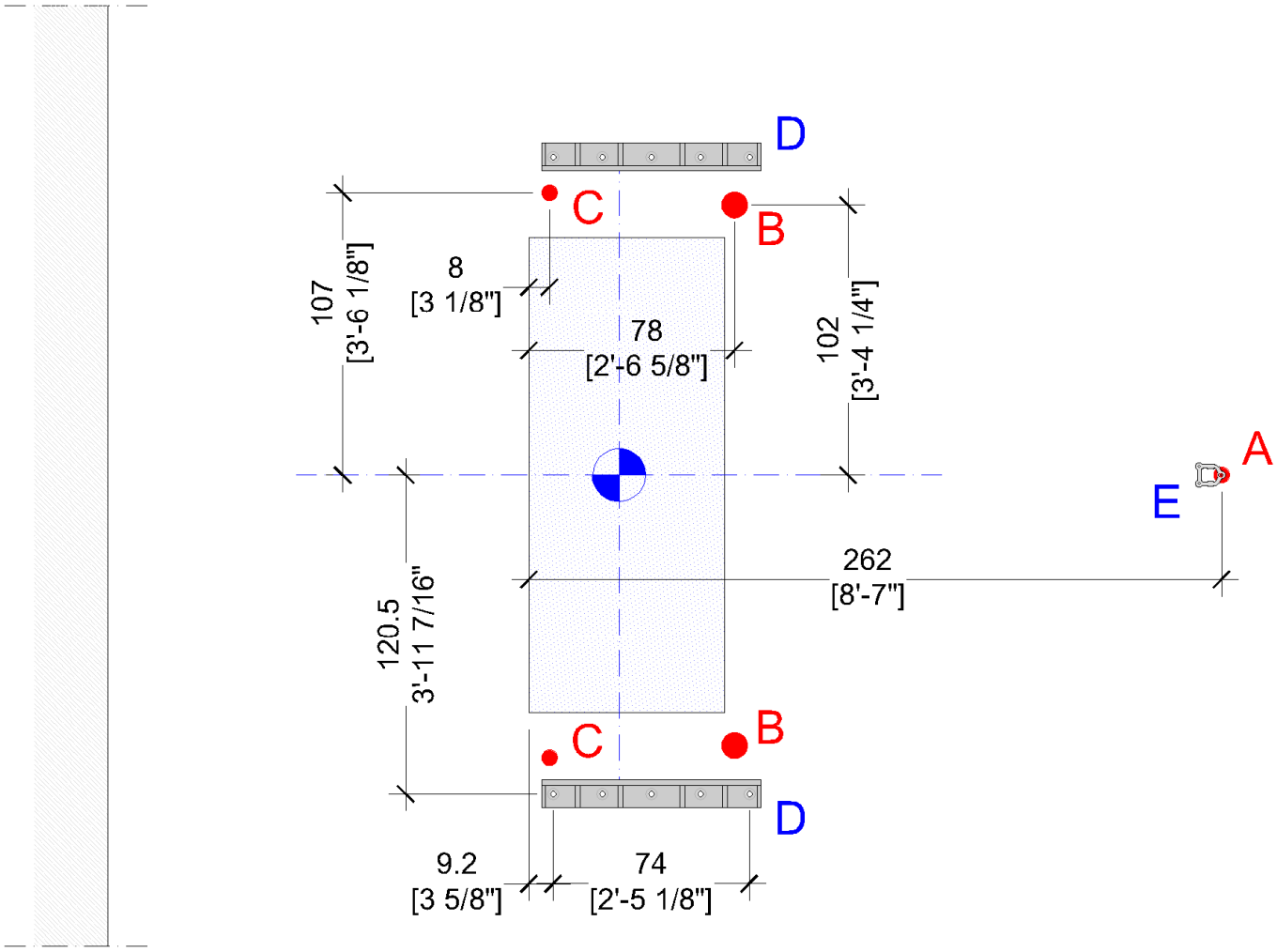


Figure 3-4 Stand and Couch Floor Loads – Plan

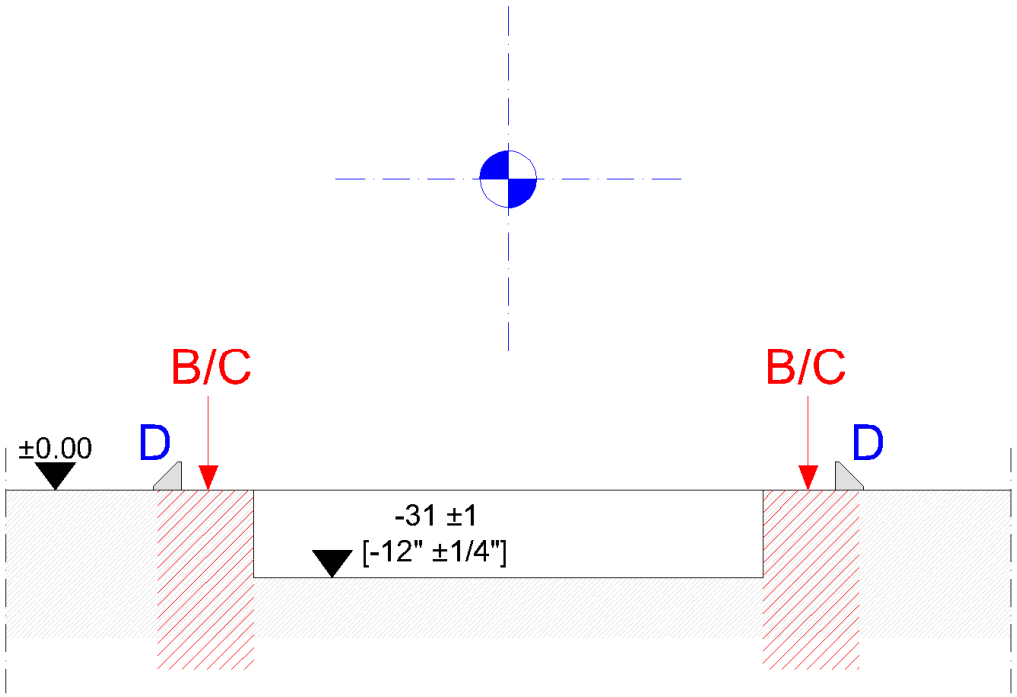


Figure 3-5 Stand and Couch Floor Loads – Section

3.1.3 FLOOR PIT CABLE ACCESS DETAILS

The Halcyon system cables and Customer 3-phase power conductors are required to enter the left front or left rear face of the Floor Pit at location **E**. Additionally, the chilled water supply and return lines must enter the right rear face of the Floor Pit at location **W**. These entries should be within the designated shaded areas to avoid interference with the rotating gantry. Figure 3-6 illustrates the maximum dimensions for the three access areas.

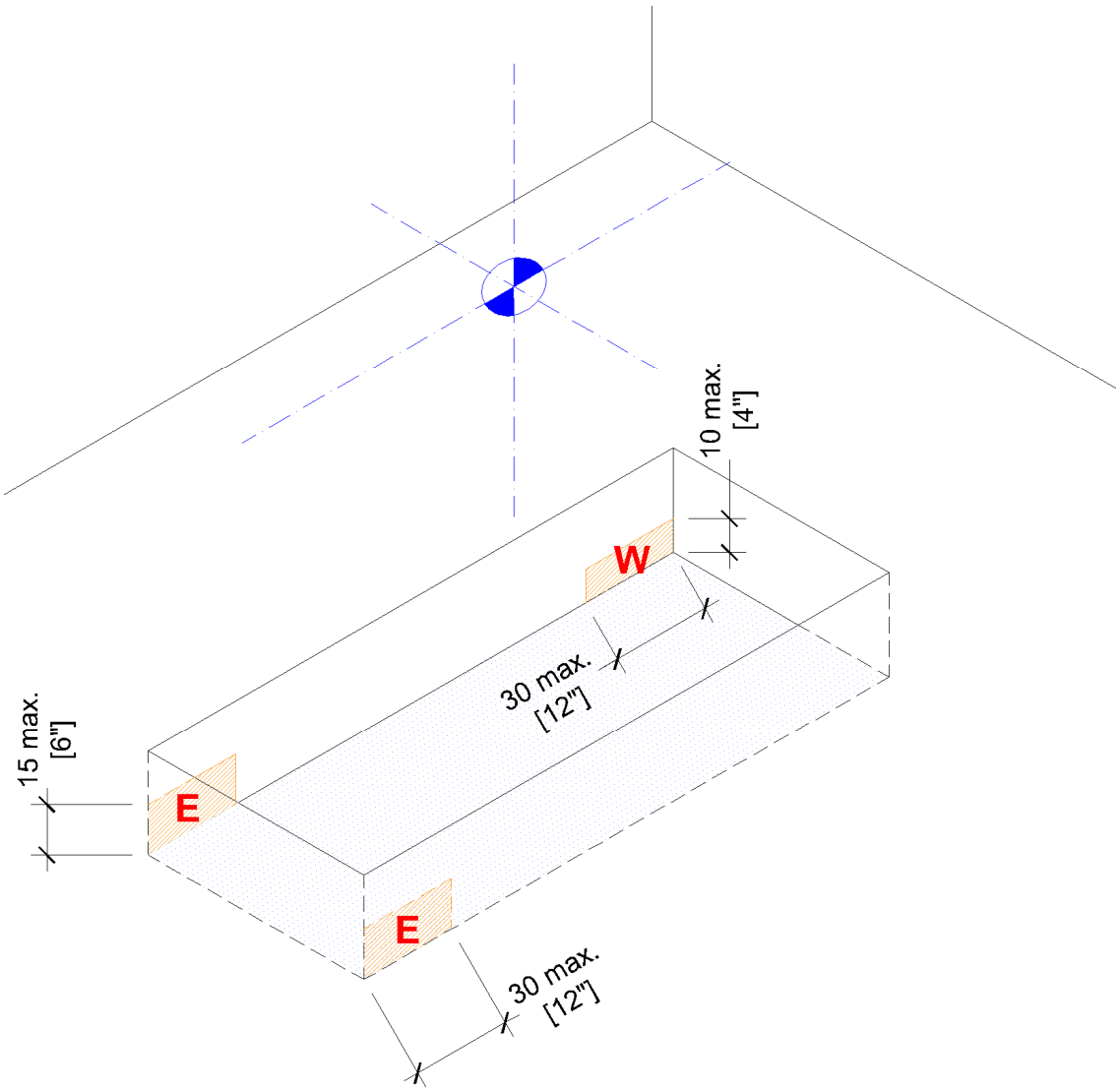


Figure 3-6 Treatment Room Floor Pit Cable Access

3.2 CONTROL AREA

Control area component positioning may vary per site-specific conditions. Consult with the Customer on the desired layout and for any additional cabinetry needs, refer to Figure 2-5.

- The Console Cabinet must be located in a radiation-free environment.

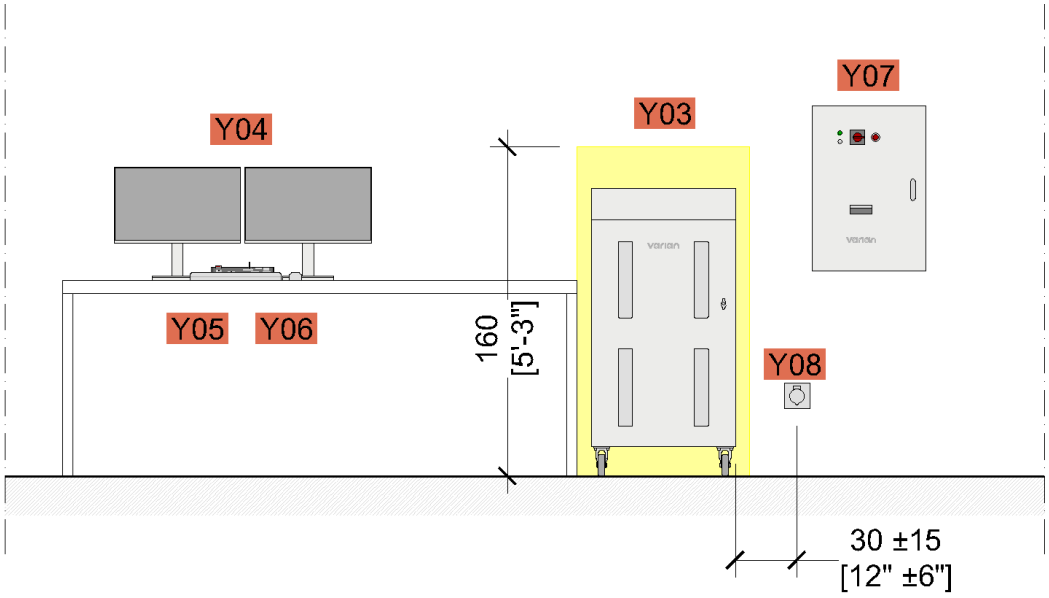


Figure 3-7 Generic Control Console Layout

Varian provides a mounting bracket for the monitor power supplies. The bracket can be installed on the wall below the counter or attached to the underside of the countertop.

The bracket dimensions are 41 x 22 x 4.5 [16 1/8" x 8 3/4" x 1 3/4"]

3.2.1 CONSOLE FLOOR POSITIONING BRACKET

Non-seismic anchors are provided to mount the bracket to the concrete floor to a depth of 7.5cm [3"].

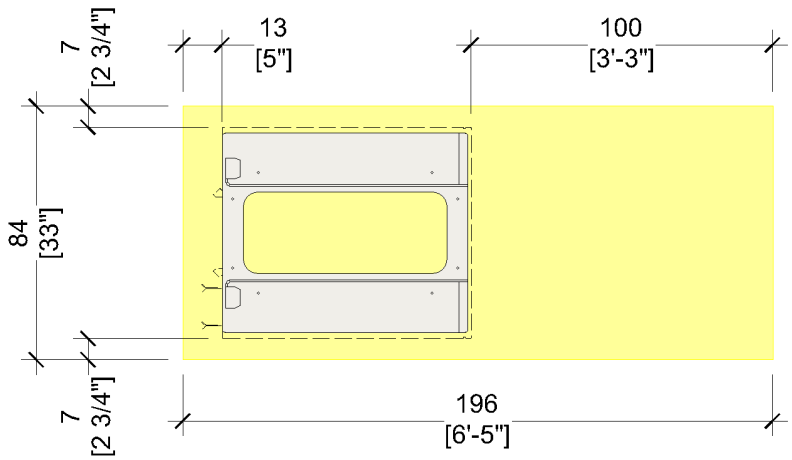


Figure 3-8 Console Cabinet Service Clearances

CAUTION

The Floor Positioning Bracket must be installed. Locking pins prevent the Console Cabinet from tipping over or rolling unintentionally.

3.3 ELECTRICAL

3.3.1 POWER REQUIREMENTS

Table 3-2 System Power Requirements	
Supply Power *(maximum)*	33 kVA • 30 kVA @ 400-480V 50/60Hz *(to the Stand PDU)* • 3 kVA @ 208-230V 50/60Hz *(to the Console Cabinet)*
Input Voltage	400Y/231VAC to 480Y/277VAC, see 3.3.3.1 • 380VAC *(requires a step-up transformer, see note below)*
Line Voltage Range	±10% is the maximum allowable steady-state deviation from the nominal value selected.
Maximum Phase Voltage Imbalance	3% of the nominal value. This is the maximum difference between any 2-phase voltages when operating at full load *(Beam-On)*.
Input Frequency	50 or 60Hz ±3
In-Rush Current	At power on, and in various operational modes there is an instantaneous peak current: • 135A @ 400V 50Hz • 105A @ 480V 60Hz.
Source Impedance	2.5% maximum *(based on the source input voltage)*, see 3.3.1.2
Mandatory Grounding	3.3.6 Grounding Requirements

*In select countries where 380V is the standard voltage, a Step-Up Transformer will be provided with the order. The Step-Up Transformer outputs to 440Y/254V, refer to [**3**] SD Mains Step-Up Transformer (for 380VAC sites) document for specifications.*

3.3.1.1 ELECTRICAL LOADS FOR SYSTEM STATES

Theses are nominal electrical loads for each Halcyon operational states. The duration of each state varies based on the treatment plan.

- 3 kVA in Stand-By
- 5 kVA in Ready
- 10 kVA in MV Beam-On
- 25 kVA in KV Imaging

The minimum power factor is 75%, the line current is non-sinusoidal due to the presence of harmonics.

3.3.1.2 SOURCE IMPEDANCE

The line currents are not symmetrical across the three phases. Contributions from each of the following site-induced sources should be combined, and the total must be less than the maximum impedance defined in Table 3-2.

- A distribution transformer
- The three-phase field-installed wiring input to the MDP
- The three-phase field-installed wiring between the MDP and the Halcyon Stand PDU

3.3.2 POWER CONDITIONING REQUIREMENTS

The equipment is sensitive to line voltage variations and source impedance. An electrical survey should be completed prior to installing the equipment, and a copy of this survey should be provided to the Varian PM for the equipment file. Isolation transformers and/or power conditioners are required if the electrical power requirements listed in Table 3-2 cannot be met.

Transients that last only a few cycles will not cause harm when limited to the specified steady-state line voltage regulation. Where larger, prolonged, or frequent transients are present, transient suppression is necessary to prevent operational interruptions or equipment damage.

For sites that intend to use a third-party "Power Conditioning Equipment", contact Varian Site Planning for more information.

3.3.3 MAINS DISCONNECT PANEL (MDP)

NOTICE

Halcyon MDP mains power must be provided from a private branch circuit, such as a dedicated transformer. Room lighting, receptacles, and other equipment must use a separate power source.

- Wall mount the MDP at a standing height from the finished floor.
- Locate in view and within 3m [10'-0"] of the Console Cabinet.

Table 3-3 MDP Components	
A	Circuit Breaker 1 (CB1), 60A
B	Circuit Breaker 2 (CB2), 50A
C	K1 Contact
D	Transformer
E	Circuit Breaker 3 (CB3), 16A
F	K3 Contact
G	Control Relay
H	Start Button
I	Emergency Disconnect

Customer-provided wiring

Varian-provided cables

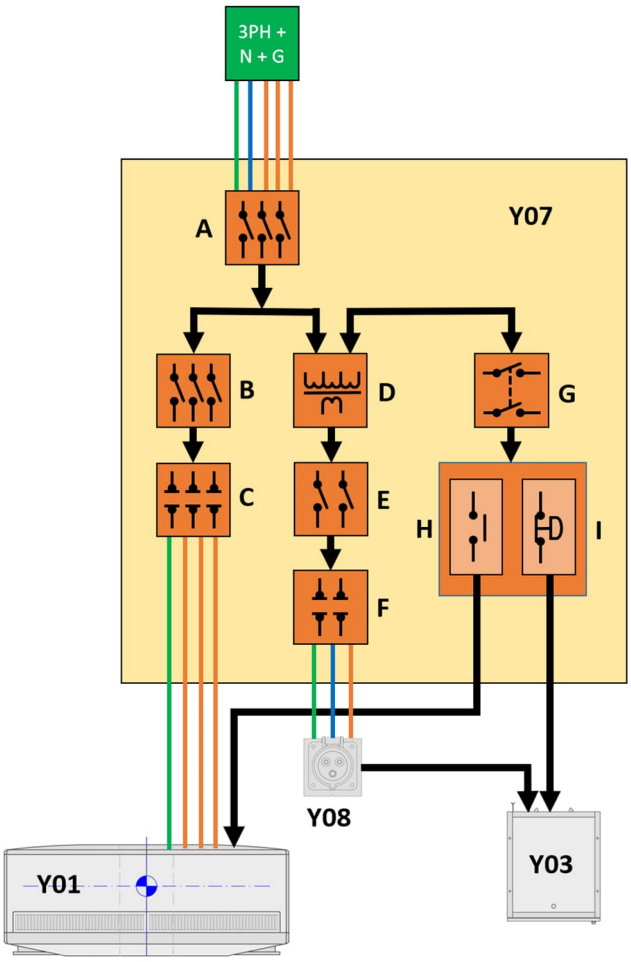


Figure 3-9 Generic MDP Panel Components

If the MDP cannot be placed near the Console Cabinet, contact Varian Site Planning for alternative installation options using the Remote Emergency Disconnect (R.E.D.) Box.

3.3.3.1 MDP CUSTOMER CONNECTIONS

The Customer-provided 3-phase wires must meet the following specifications:

- CB1 input to the MDP (**Y07**), see Table 3-4
- K1 output from the MDP to the Stand (**Y01**), see Table 3-4
- K3 output to the IEC 60309 Power Outlet (**Y08**), see Table 3-4
- Overall maximum source impedance requirements, see Table 3-2
- Use Copper Conductors Only
- Wires routing from the MDP to the Stand must be rated for wet locations and must be routed separately from other wires.
- CB1 and K1 wires must be rated for 600V, with a temperature range of 90°C dry/75°C wet, minimum.
- K3 wires must be rated for 300V minimum, with a minimum temperature rating of 90°C dry.
- Provide a 4m [13'-0"] coil of excess conductors in the treatment room floor pit.

Table 3-4 MDP Wires Size Connection Ranges

Description	Wire	Metric	Imperial
MDP Input Terminals (**CB1**)	3-Phase, N, & G	16 to 50mm^2	6 to 0 AWG
MDP Output Terminals (**K1**)	3-Phase & G	16 to 35mm^2	6 to 2 AWG
MDP Output Terminals (**K3**)	1-Phase, N, & G	3 to 6mm^2	12 to 10 AWG
Note: The ground conductors for **CB1** and **K1** must be equal in size (parity), refer see 3.3.6.			

3.3.4 RELAY JUNCTION BOX (RJB)

- Wall mount the RJB in the treatment room at a standing height from the finished floor for installation and service accessibility.
- The RJB may be surface-mounted or semi-recessed, up to a maximum of 12cm [4 3/4”].

3.3.4.1 RJB CUSTOMER CONNECTIONS

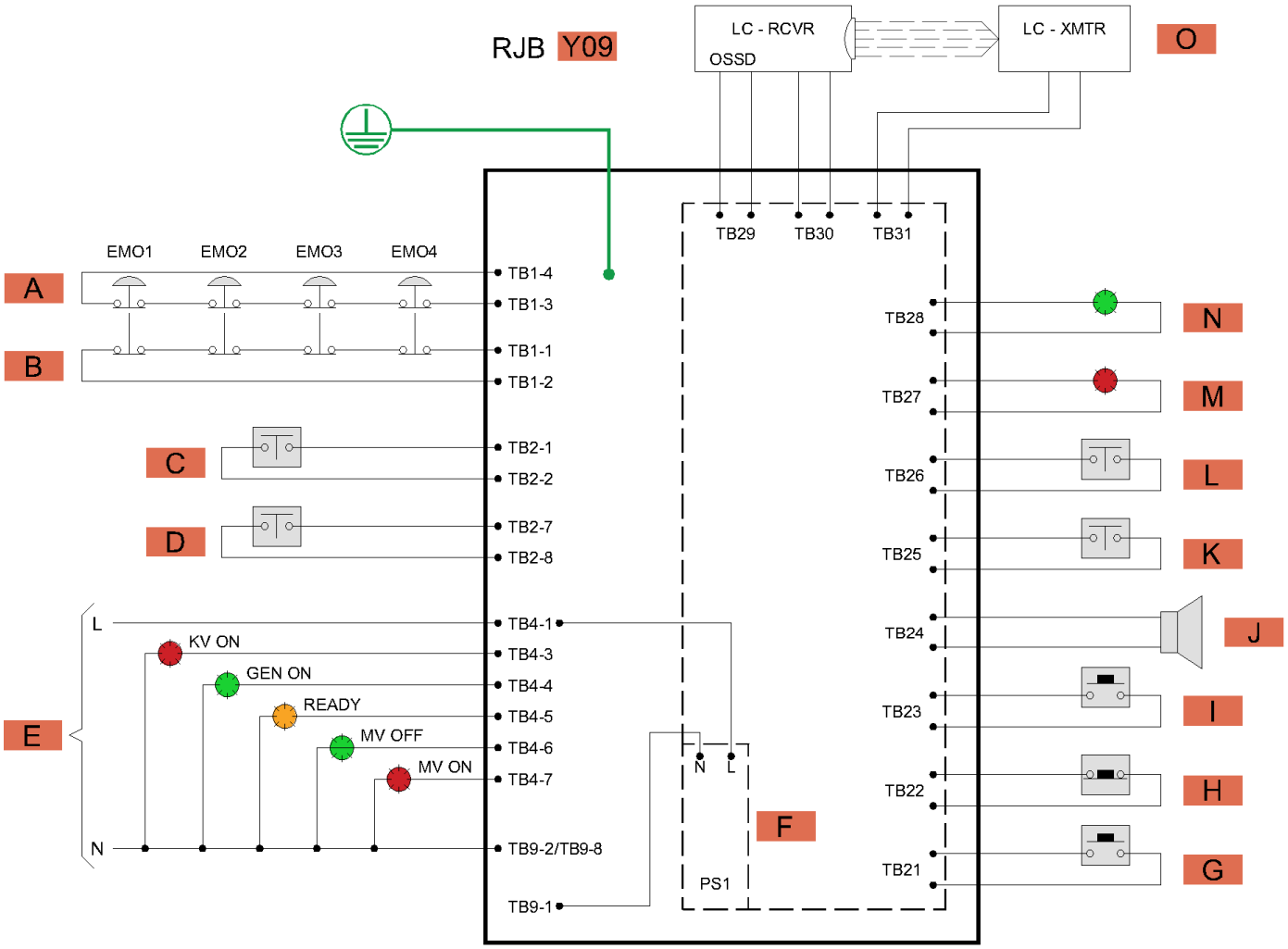


Figure 3-10 RJB Customer Connections

Refer to 3.3.8 for more detailed information on the Customer-provided components.

Table 3-5 RJB Main Customer Connections			
	Device	**Power**	**Notes**
A	EMO Primary Circuit	24VDC *	see 3.3.8.3
B	EMO Secondary Circuit		
C	Secondary Door Switch **	24VDC *	see 3.3.8.2
D	Primary Door Switch **	48VDC *	
E	Warning Lights	100 – 250VAC (50/60Hz)	see 3.3.8.1
*	Power is provided from the RJB		
**	If the RJB Expander is used connect the Door Switches to terminals “K” and “L”.		

Table 3-6 RJB Expander Card Customer Connections *			
	Device	**Power**	**Notes**
F	PS1 (Power Supply) ***	100 – 250VAC (50/60Hz)	n/a
G	Last Person Out (LPO) Button	24VDC **	see 3.3.8.5
H	Cancel Button		
I	Accept Button		
J	LPO Audible Alarm		
K	Primary Door Switch	48VDC **	see 3.3.8.2
L	Secondary Door Switch	24VDC **	
M	Interlock Status Light (Armed)	24VDC **	see 3.3.8.5
N	Interlock Status Light (Not Armed)		
O	Light Curtain (Transmitter/Receiver)		
	Output Signal Switching Device		
*	The use of the RJB Expander is optional. If enabled, the LPO feature is required.		
**	Power is provided from the RJB		
***	Power may be connected to RJB TB4-1 (Warning Light Power IN) or provided from an external source.		

Table 3-7 RJB Wires Size Connection Ranges		
Description	**Metric**	**Imperial**
RJB Main Input Terminals	0.75 to 10mm^2	18 to 6 AWG
TB21 – TB31 Terminals	0.14 to 1.5mm^2	26 to 14 AWG
PS1 Terminals	0.14 to 3mm^2	26 to 12 AWG



The Customer neutral connections may be terminated on the RJB neutral bar or by other means, per local electrical codes. The RJB neutral bar is provided for convenience.

3.3.5 POWER OUTLETS

3.3.5.1 TREATMENT ROOM

- Provide (1) standard power outlet within 1.5m [5’-0”] of the RJB (**Y09**)
- Provide power outlets as required by the Customer

3.3.5.2 CONTROL AREA

- Provide power outlets as required by the Customer
- (1) IEC 60309 outlet (**Y08**) for the Console Cabinet, see 2.5.1.1 and Table 3-4

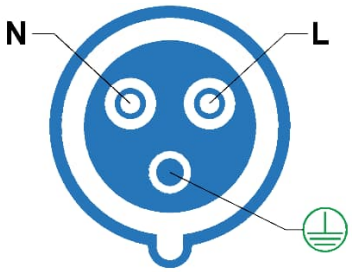


Figure 3-11 IEC Outlet *(Front View)*

NOTICE

Do not install the IEC outlet behind the Console Cabinet. It must be located it on either side of the cabinet as shown in Figure 3-7.

The provided IEC receptacle is for panel mount applications.

3.3.6 GROUNDING REQUIREMENTS

The Halcyon requires Ground/Protective Earth (G/PE) circuits. The primary circuit is part of the main power supply and grounds the Halcyon Stand and Couch as outlined in Section 3.3.3.

Additional G/PE circuits are required for the RJB (**Y09**) and Console Cabinet (**Y03**) to ensure the grounding meets IEC 60101-1. All ground conductors must be connected to the facility's primary grounding point through the Hospital Grid System.

WARNING

The G/PE conductors supplied by the customer for all 3-phase power must meet code standards and be in parity with the corresponding supply conductors, with a minimum cross-sectional area of 16mm² [#6 AWG].

To avoid the risk of electric shock, this equipment must be connected to supply mains with protective earth. Do not ground to water supply piping.

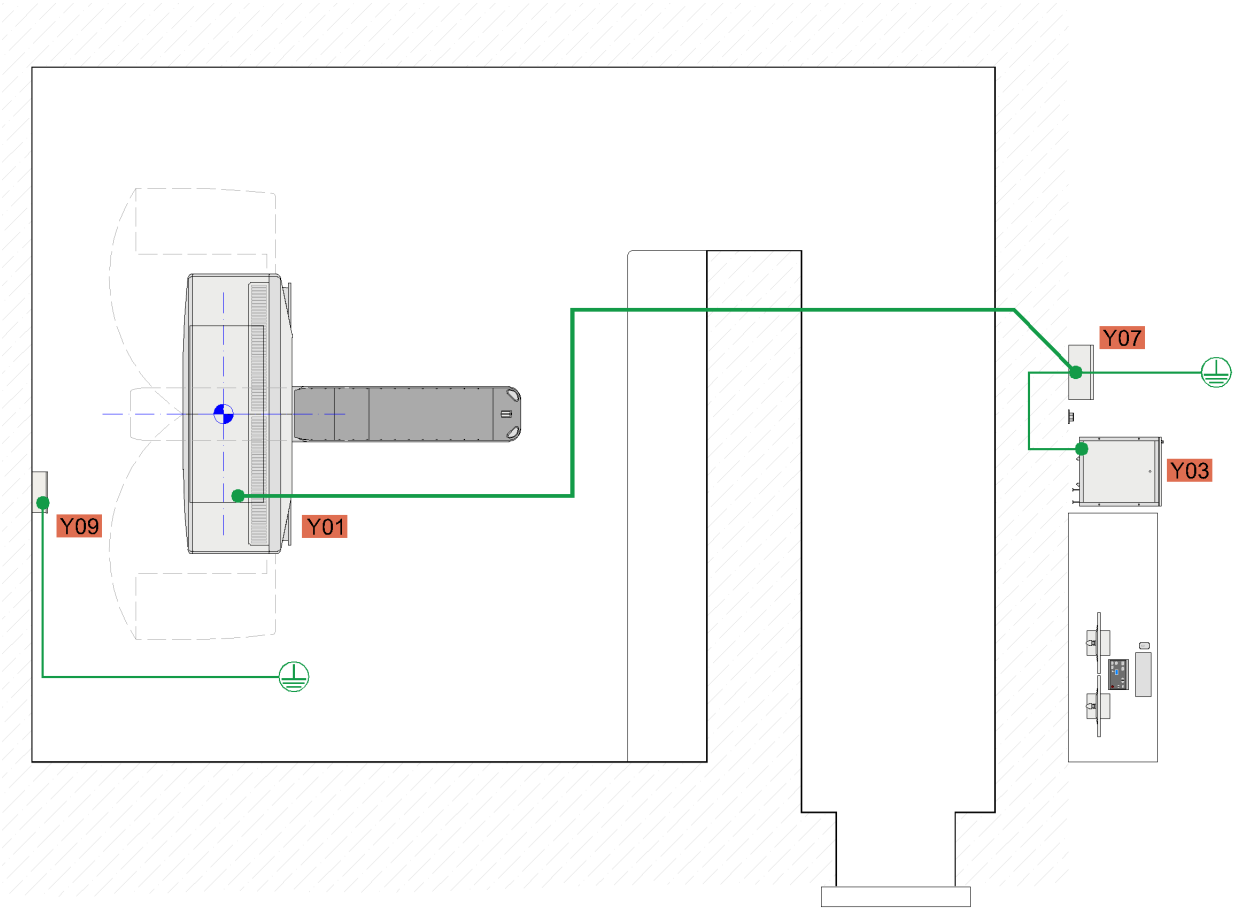


Figure 3-12 Halcyon G/PE Conductor Layout

- (1) G/PE conductor from the MDP (**Y07**) to the Stand (**Y01**) PDU, see 3.3.3.1.
- (1) Dedicated G/PE conductor from the MDP (**Y07**) to the Console Cabinet (**Y03**).
  - 6mm² [10 AWG] or per code, whichever is greater.
  - Terminate with an M6 ring terminal.
  - Provide a 3m [9'-0"] minimum "service loop" at the Console Cabinet (**Y03**).
- (1) Dedicated G/PE conductor to the RJB (**Y09**) sub-panel, see Figure 3-10.
  - 6mm² [10 AWG] or per code, whichever is greater.
  - Terminate with an M6 ring terminal.

3.3.7 CABLE CONTAINMENT

NOTICE

The customer is responsible for ensuring that the cable installation meets applicable local codes and requirements.

This might affect the choice of cable routes, number of conduits/ducts, specifications of mains power and data cables, and the choice of installation locations of system components.

The customer shall provide conduits or raceway ducts for all system cables, as described in this section.

The Varian system cables are not plenum-rated.

Excess cable cannot be stored in the treatment room floor pit.

Refer to Figure 3-6 for the required cable access zones in the treatment room floor pit.

Do not terminate conduits behind the Console Cabinet (Y03).

- All conduits shall be smooth-walled.
- All conduits that are routed underground shall be dry and watertight.
- Terminate conduits with insulating bushings or similar devices to protect cables from abrasion.
- Conduit bends must have a radius at least 6 times the conduit diameter.
- A maximum of three 90-degree bends are permitted per conduit run or a total of 270 degrees.
- All system cable conduits should include a pull string.
- Verify all room penetrations with the Physicist of Record.
- Reference Table 2-8 Halcyon System Cables for maximum cable lengths.
- Cable conduit/duct route must be shorter than the maximum cable length. Allow for 3m [10’-0”] of excess cable at each end for connection and service, unless otherwise noted.

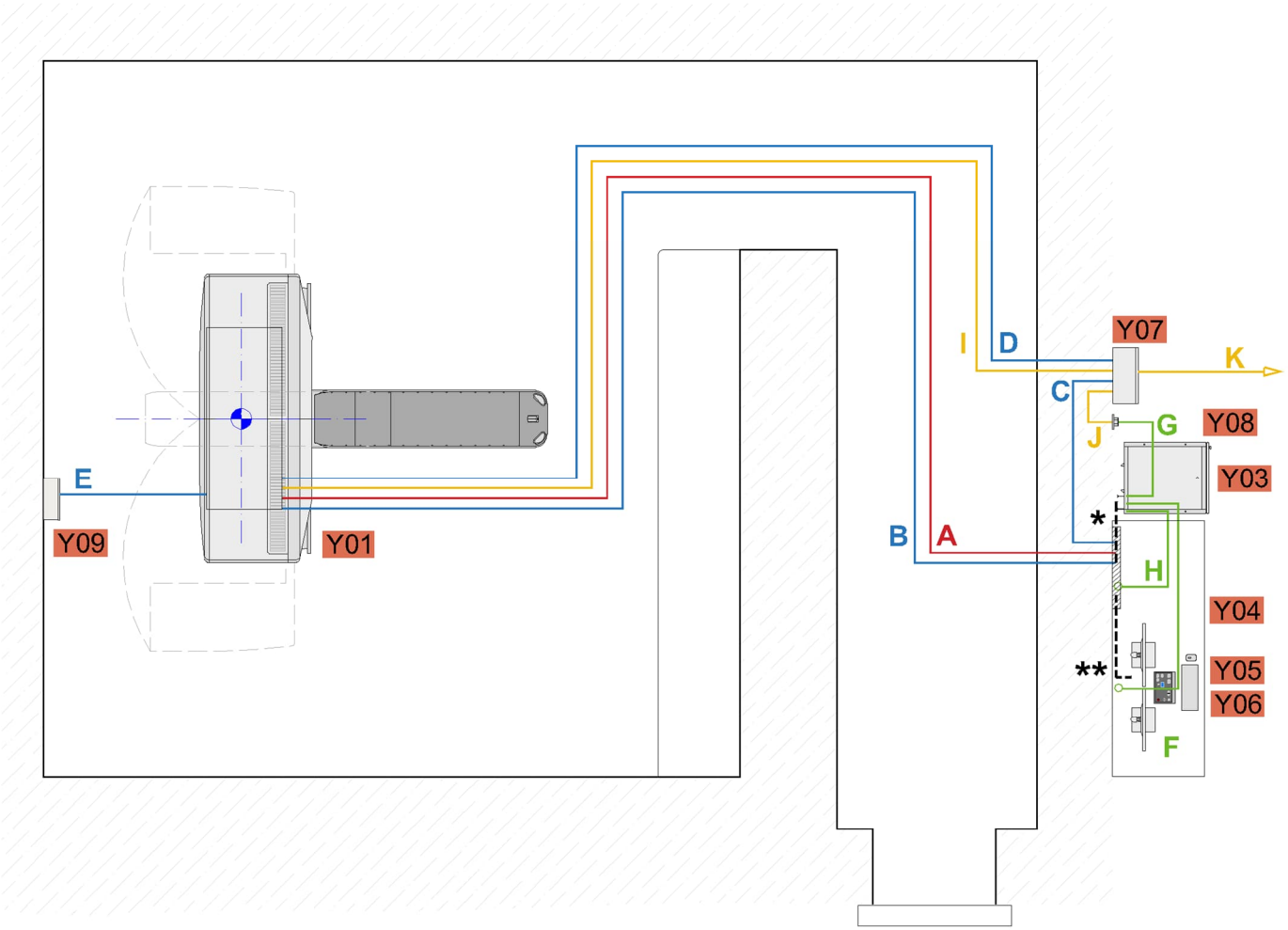


Figure 3-13 Cable Containment Identification

Table 3-8 Halcyon Containment Specifications					
Run	**Minimum Conduit Ø**	**Maximum Length**	**Conduit Quantity**	**Start** *(From)*	**Finish** *(To)*
A	100mm [4”]	38m [125']	1	**Y03** – Console Cabinet	**Y01** – Stand
B	50mm [2”]	38m [125']	1		
C		11m [36']	1		**Y07** – MDP
D		57m [187']	1	**Y01** – Stand	
E		41m [135']	1		**Y09** – RJB
F	n/a	13m [43’]	n/a	**Y03** – Console Cabinet	**Y05** – Control Console
G		1m [3’]			**Y08** – IEC Outlet
H		8m [26’]			Network Outlet *(by Customer)*
I	32mm [1 1/4”]	n/a	1	**Y07** – MDP	**Y01** – Stand
J	per code	n/a	1		**Y08** – IEC Outlet
K	per code	n/a	1		Hospital MAINS Power

Customer-provided wiring, see Table 3-4

*Include the distance from the conduit termination point to the back of the Console Cabinet or Desktop components (shown as ***** or ****** in Figure 3-13) in the total run length.*

*Allowance for mid-run storage of excess cable may be required depending on site conditions. This consideration commonly applies to cable runs "**D**" and "**E**".*

Varian supplies a 32mm diameter, 3m [10'-0"] long Flexible Metal Conduit for routing the 3-phase and ground conductors from the floor pit to the Halcyon Stand Power Distribution Unit, which is to be installed per local code.

3.3.7.1 OTHER CONTAINMENT REQUIREMENTS

The following Customer-provided safety components require a containment path to the RJB, which is not shown in Figure 3-13.

- Warning Lights
- Door Interlock Switch
- Emergency-Off Buttons
- Optional Safety Devices, see 3.3.8.5

Consult with the Customer for Experimental Access (Physics Q/A Port) requirements.

3.3.8 EMERGENCY AND SAFETY DEVICES

The following Customer-provided safety devices must be installed with guidance from the customer's Radiation Safety Officer and in accordance with regulatory requirements.

3.3.8.1 WARNING LIGHTS

System warning lights are required to be installed both inside and outside the treatment room to indicate the beam-status. They may be required to flash when the beam is on. The colored lights must be visible from any location within the treatment room. Five warning light circuits are available in the RJB, refer to Figure 3-10.

- Provide an individual warning light for each circuit.
- Incandescent lamp load, 60W maximum, each circuit.
- 5A maximum, resistive load, including any short duration switching transients.
- LED fixtures are acceptable, the inrush current for all fixtures must be less than the rating above.
- Fluorescent fixtures are not allowed.
- Combination signs with superimposed lettering are not allowed.

If a greater load is required, these circuits can be used to control separate, customer-provided relays.

Table 3-9 Warning Lights	
Beam ON	Illuminates during MV beam treatment ***(mandatory)***.
Beam READY	Illuminates to show the MV system has no open interlocks and is ready to treat.
Beam OFF	Illuminates when the accelerator is not generating radiation.
Generator ON	Illuminates to show the KV system is ready to image the patient.
X-Ray ON	Illuminates during KV imaging, mandatory for accelerators with On-Board Imaging.

NOTICE

To comply with IEC 60601-2-1: 2009 +A1:2014 aural indicator requirements (Clause # 201.10.1.2.101.10) the customer shall provide and install a suitable aural indicator in parallel with any warning lights connected to the RJB.

3.3.8.2 DOOR INTERLOCK SWITCHES

Door interlock switches must be installed on the treatment room door. Two independent safety switches, a primary and a secondary, are required. Both switches must be in the same state (either both open or both closed) within 5 seconds of actuation. For connection details, refer to Figure 3-10.

- Capable of switching 80V, 500mA (maximum)
- Primary – 48VDC, 250mA (nominal), Normally Open, (i.e. Switch open – Door open; Switch closed – Door closed).
- Secondary – 24VDC 1mA (nominal), Normally Open

For rooms with double door entries or a secondary maze door, each door panel requires its own set of interlock switches. Wire the primary switches and the secondary switches in series separately so that both circuits are independent from one another.

3.3.8.3 EMERGENCY-OFF BUTTONS

The Emergency-Off (EMO) button disconnects mains power from the Halcyon system while maintaining power to the Console Cabinet UPS. EMO buttons are integrated into the Halcyon Stand (2), Couch (2), and Control Console (1).

Additional Customer-supplied EMO buttons are typically required in the treatment room. Consult with the site's Radiation Safety Officer to verify the requirements. Each switch must be wired in series across two parallel circuits, refer to Figure 3-10.

- (2) Two-pole, both Normally Closed (NC), "dry type" contacts, manual reset.

Locate the EMO buttons to avoid unintentional activation.

3.3.8.4 EMERGENCY DISCONNECT BUTTON

An Emergency Disconnect Button must be mounted in the control area. When activated, it disconnects mains power from all system components, including the Halcyon Stand and the Console Cabinet. This button is integrated into the MDP panel, refer to 3.3.3 for more information.

3.3.8.5 OPTIONAL SAFETY DEVICES

The following optional safety devices are provided and installed by the customer and connect directly to the RJB Extender Card, refer to Figure 3-10.

- **Last Person Out (LPO)**

  The LPO activates a momentary switch to start a timer relay in the RJB, providing users a configured set time to clear the treatment room and close the door before the door interlock inputs are locked out requiring the process to start over.

  - Momentary, Normally Open, 24VDC, 500mA (minimum)

- **Light Curtain**

  The light curtain serves as an alternative to mechanical door switches for LPO functionality.

  - Output Signal Sensing Device (OSSD) – 24VDC (nominal), 250mA (minimum)
  - Transmitter and Receiver – 24VDC, 250mA each (maximum)



The RJB expander card allows for the use of either a light curtain or door interlock switches, but not both. If the light curtain inputs are used, the system must be configured with an accept button.

- **Accept Button**

  The Accept button is a control located outside the treatment room, which must be activated to complete the door interlock circuit after engaging the door or light curtain interlocks.

  - Momentary, Normally Open, 24VDC, 500mA (minimum)

- **Cancel Button**

  The Cancel button stops the LPO system timer and requires the process to be restarted.

  - Momentary, Normally Closed, 24VDC, 500mA (minimum)

- **LPO Audible Alarm**

  Allows for an audible alarm to be activated during LPO operation.

  - 24VDC, 500mA (maximum)

- **Interlock Status Lights**

  The status indicator outputs visibly show whether the door interlocks are armed (closed) or not armed (open).

  - LED or Incandescent Light, 24VDC, 1000mA (maximum)

3.3.9 NETWORK

The IT NETWORK connection allows the Halcyon system to communicate with hospital or clinic Oncology Information Systems (OIS).

- Provide (1) Network outlet near the Console Cabinet (**Y03**) required
  - (3) additional outlets (recommended).
- Cat 5e cable (minimum), CAT 6 (recommended).
- Bandwidth 100Mbps, full duplex 100BASE-T (minimum), 1Gbit/s or higher (recommended).
- The RJ-45 (8P8C) jack must implement wiring pattern T568A as defined in ANSI/TIA-568.
- Varian recommends isolating the Oncology domain from the Enterprise Network.
- The Console Cabinet (**Y03**) requires a static IP address.
- The Varian PM will provide the [**4**] MICAP network configuration guide before the final equipment installation.



Wi-Fi is recommended in both the control area and treatment room for training, education, and service support.

3.4 PLUMBING

Table 3-10 Chilled Water Requirements and Heat Loads	
Ideal Coolant Temerature & Flow Rate	18° C. at 12 LPM [65° F. at 3.2 GPM]
Incoming Coolant Temperature Range	10 – 23.8° C [50 – 75° F]
Flow Range *(based on incoming coolant temperature)*	7 - 23 LPM [2 - 6 GPM]
Glycol Content of Coolant	Not to exceed 50%
Minimum Heat Load *(required, 24 hours)*	1.0 kW [3,414 Btu/Hr]
Normal Treatment Cycle Heat Load	2.2 kW [7,511 Btu/Hr]
Maximum Heat Load *(Beam-ON)*	7.0 kW [23,900 Btu/Hr]
Inlet Pressure *(maximum)*	3.5 bar [50 PSI]
Pressure Drop *(through the stand's internal cooling system)*	Varies, refer to Figure 3-14



To avoid equipment damage due to condensation, ensure that the minimum temperature of the incoming coolant is above the facility's dew point.

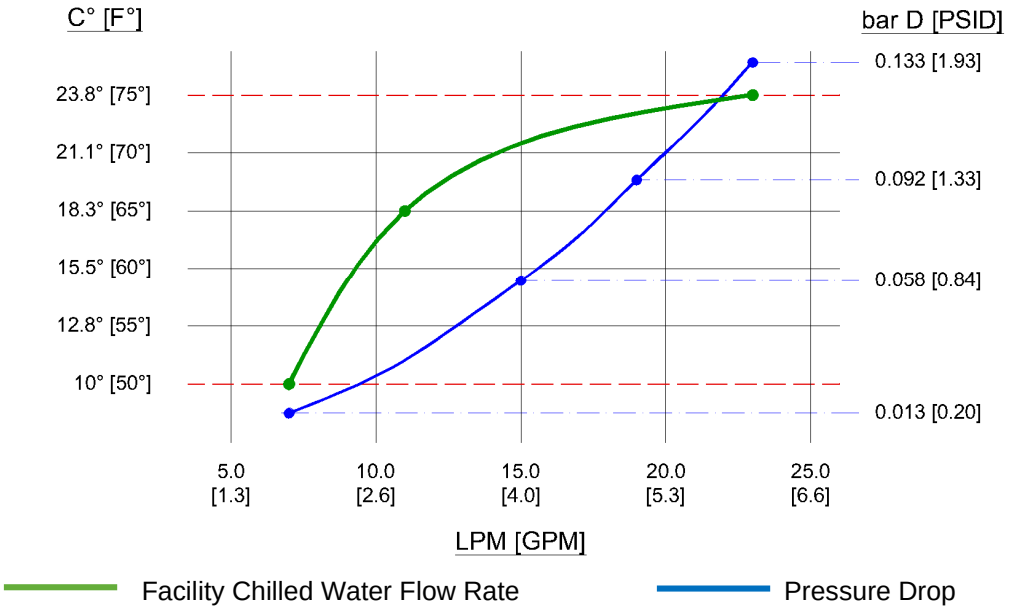
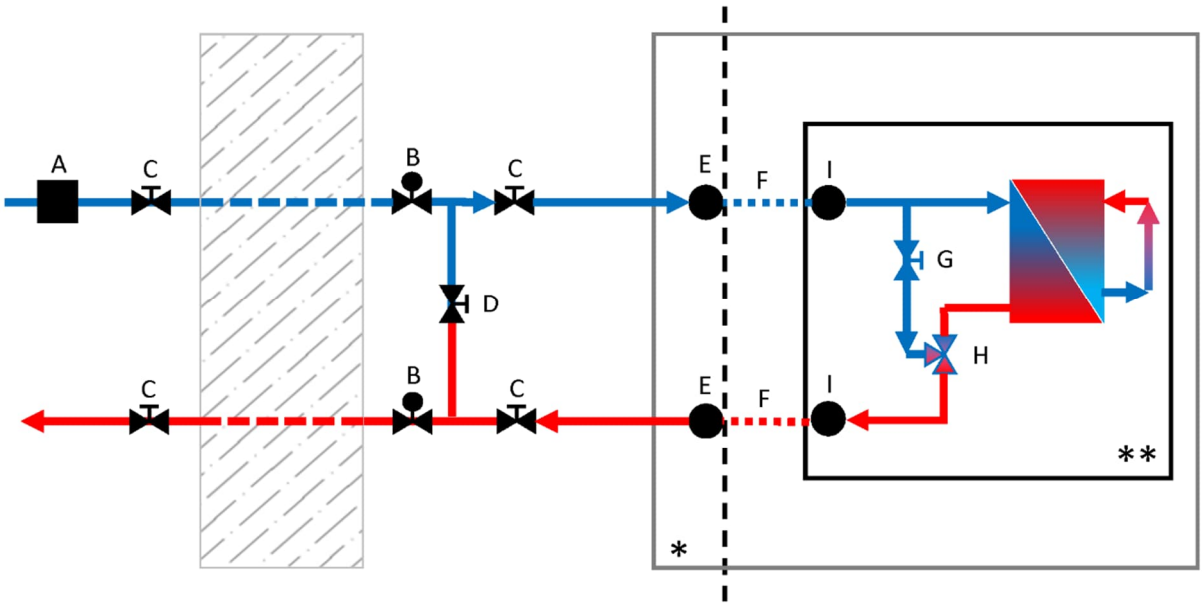


Figure 3-14 Facility Chilled Water Temperature, Flow Rate, and Pressure Drop

3.4.1 CHILLED WATER

The chilled water requirement can be met using a Closed-Loop system (such as Central Plant Chilled Water or a Dedicated Chiller) or a One-Pass system (using Domestic Water). These methods may also be combined to provide resilience and redundancy. The customer's design team and water quality professionals are responsible to determine the most suitable design configuration.



Customer Provided **Varian Provided**

*** Treatment Room Flor Pit** **** Halcyon's Internal Cooling Loop**

Figure 3-15 Coolant System Schematic

- The chilled water supply must not exceed the maximum inlet pressure listed in Table 3-10, controlled by a customer-privided and installed pressure regulator (**A**).
- Provide isolation valves (**C**) and terminate piping with a 25mm [1"] FNPT Plug (**E**).
- Provide a bypass valve (**D**) before the isolation valves (**C**) for testing and service.

- Provide a minimum of one flow meter (**B**) on the supply or return line to monitor the flow rate.
- Install another set of isolation valves (**C**) in an accessible location outside the treatment room.
- Copper piping is recommended, a filter/strainer should be installed for dissimilar metals.
- A Varian-provided, Customer-installed flexible hose kit (**F**) is used to connect the piping to the accelerator in the treatment room floor pit (**I**).
- A bypass valve (**G**) is located inside the system stand.This valve is open for Closed-Loop systems and closed for One-Pass systems.
- The modulating control valve (**H**) located inside the system stand maintains an internal coolant loop temperature of 30°C [86°F]

If a Closed-Loop system includes a One-Pass backup system, it is recommended to provide a way to alert users to close the accelerator's internal bypass valve when the emergency One-Pass backup is activated.

NOTICE

Do not route water piping above the Accelerator, as potential leaks may result in serious damage to the mechanical systems.

Do not locate floor drains in the treatment room.

3.4.2 CHILLED WATER LINE ACCESS AT FLOOR PIT

Extend two 2.5cm [1"] chilled water lines into the Treatment Room Floor Pit and terminate with a 1" FNPT bushing and plug, see Figure 3-16 and Figure 3-6.

Install isolation valves for the chilled water supply and return lines on the rear wall behind the Stand, see Figure 3-17 and Figure 3-18.

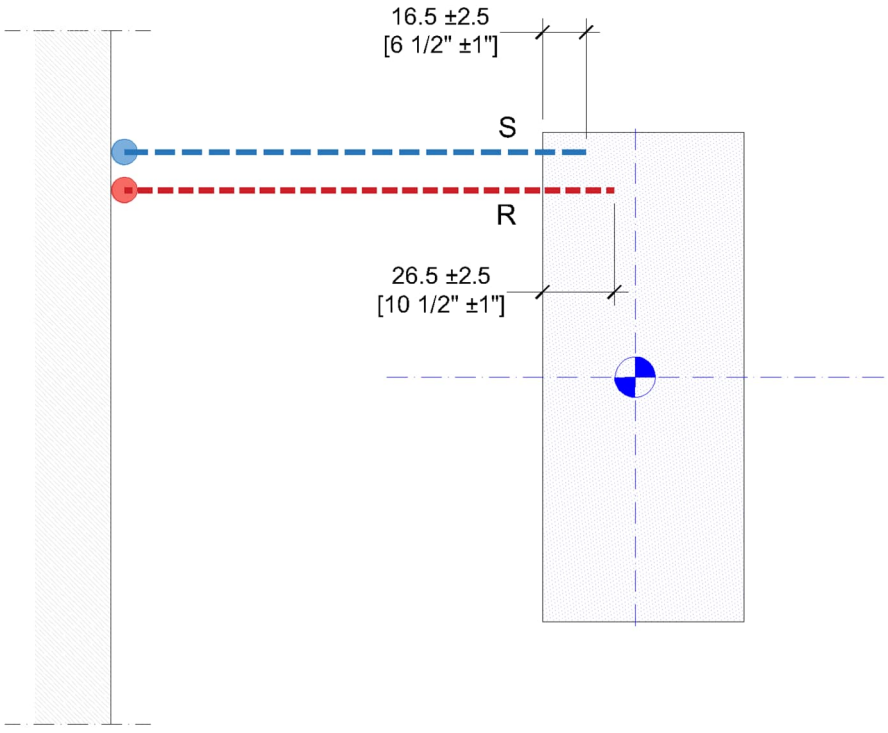


Figure 3-16 Chilled Water Access *(Plan View)*

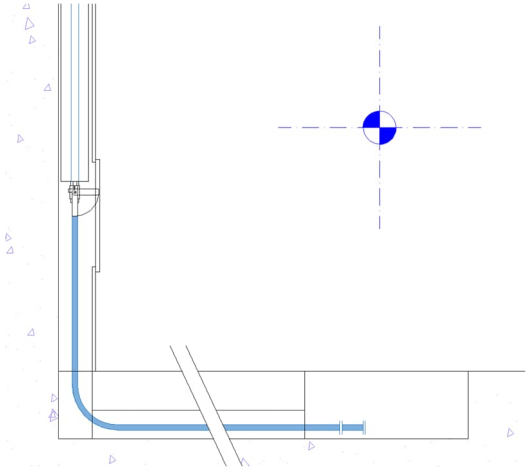


Figure 3-17 Chilled Water Access *(Side View)*

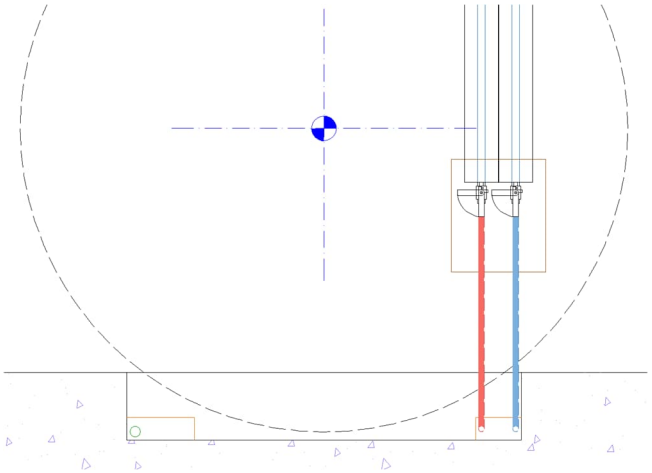


Figure 3-18 Chilled Water Access *(Front View)*

The isolation valves are typically installed in the wall behind the Accelerator. They should be located to ensure easy accessibility.

3.4.3 CHILLED WATER QUALITY

Table 3-11 Minimum Chilled Water Quality	
Quality	**Value**
Appearance	Clean, colorless, non-turbid, and disinfected; closed-loop should be treated with a corrosion inhibitor, which may add color.
Heterotrophic Plate Count (CFU/ml)	<10,000
pH	7.0 – 10.0
Total Hardness (ppm $CaCO_3$)	>75

Experience has shown that some water supplies have caused excessive corrosion and frequent replacement of the internal heat exchanger. Consult a water treatment professional to design facility water quality specifications to prevent damage to the heat exchanger from corrosion, scale, biofilms, or other common issues. These specifications should include monitoring characteristics (for example pH, conductivity, total dissolved solids, chlorides, and hardness) to maintain values appropriate for the site's corrosion inhibitor and disinfection solutions. Ideal value ranges will vary depending on local conditions.

When glycol is added to external facility water, propylene glycol is preferred (due to its better environmental safety record compared to other glycols), not to exceed 50% by volume (v/v).

External domestic "city" or hospital "facility" water may require secondary disinfection (in addition to any bleach/chlorine/chloramine reserve present) to avoid biofilm formation in the Accelerator's heat exchanger. Seek advice from a water treatment professional.

The water coolant specification in this section does not apply to the Accelerator's internal coolant water loop. Contact the Varian Help Desk at 1-(888)-Varian5 (827-4265) for information.

3.5 ENVIRONMENTAL SPECIFICATIONS

Table 3-12 Environmental Specification		
Condition	**Metric**	**Imperial**
Maximum Altitude	2000 m	6562 ft
Ambient Temperature	16° to 27°C	60° to 80°F
Relative Humidity	30% to 75%, Non-condensing	

3.5.1 VENTILATION

Accelerators will produce detectable levels of ozone under certain conditions.

- Typically, 4 to 6 air changes per hour are required to remove ozone, check with your local regulations.
- Fresh air should be used as part of the HVAC design.

Table 3-13 Control Area Heat Loads		
Description	**kW**	**BTU/Hr**
(**Y03**) - Console Cabinet	1.1	3,770
Optional ARIA Workstation and Monitor	0.5	1,707

Table 3-14 Treatment Room Heat Loads		
Description	**kW**	**BTU/Hr**
Halcyon Stand during Beam-On State	6.0	20,487
Halcyon Stand during all other States	1.0	3,413



The Halcyon airflow enters from the top and exits through the bottom of the Stand.

The customer shall provide a means to remove the heat generated by the components listed in the Tables above.

3.6 VIBRATION

The Halcyon system is immune to vibration, but consideration should be given to selected locations where nearby equipment could cause excessive vibration. Most installations are at or below grade so vibration is normally not an issue. The overall design should account for nearby equipment like compressors, generators, elevators, and train lines. The total allowable patient-field position error is specified as 0.1mm (100 microns) zero-to-peak. Contact Varian Site Planning for more information on assessing site-specific situations.

3.7 FINISHES

3.7.1 FLOORING

The Halcyon contains electronic components that are sensitive to electrostatic discharge (ESD). Floor finishes used in the treatment room, maze, and control area should be selected to ensure they have “Anti-Static” properties that meet local and national codes. Carpet is not recommended as it can make gurney movement difficult and present an infection control risk. The floor finish should not have the propensity to create static electricity exceeding 2.0 kV at 20% relative humidity when measured using standard methods.

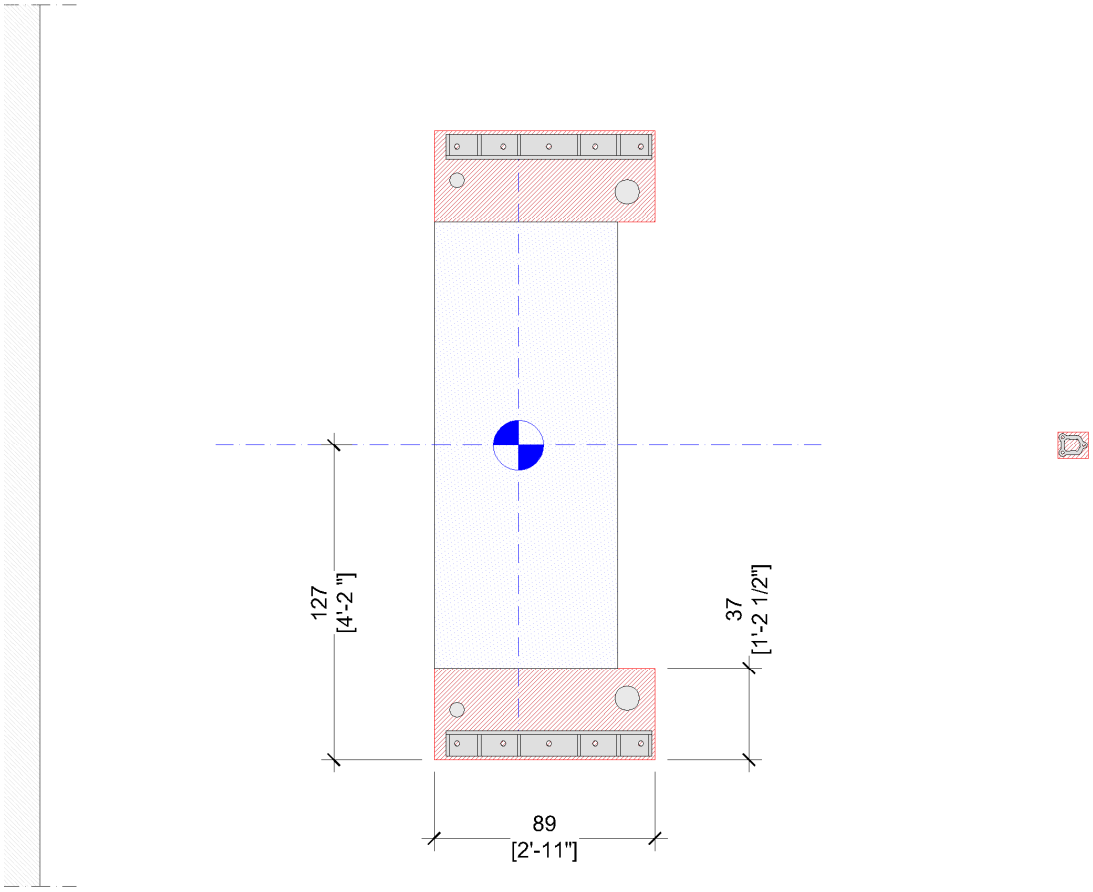


Figure 3-19 Flooring at Floor Pit

NOTICE

DO NOT install flooring in the hatched areas to each side of the floor pit. The Stand base pads, leveling feet, floor brackets, and Couch foot pad must be installed directly on the concrete (non-compressible material).

To ensure precision, the customer will complete the flooring cutout beneath the Couch foot pad during installation.

Refer to Figure 3-2 for floor levelness requirement.

3.7.2 CEILING

There is no requirement for finished ceiling type, but 60 x 120 [24” x 48”] or 60 x 60 [24” x 24”] lay-in acoustical ceiling tiles are recommended. These offer easy access to overhead systems, low repair and modification costs, sound attenuation, and aesthetic flexibility with modern grids and tiles.

3.7.3 ACCESSORIES

It's recommended that custom cabinetry be built to store accessories for the Phantoms, see 2.6. Verify all requirements and storage preferences with the Customer.

3.8 ACOUSTIC

There are no recognized acoustical standards for therapy rooms. Varian has encountered no acoustical problems with the Halcyon in the treatment room. The patients are in the room for a very short time and observations indicate that some seem reassured by the changing sound levels as the machine goes through its cycles.

Halcyon System meets the IEC standard for Acoustic Energy

- IEC 60601-1:2005 Clause 9.6.1
- IEC 60601-1:2005 Clause 9.6.2.1

Table 3-15 Acoustic Levels

Equipment	Condition	Location	Sound Pressure Level, dBA*
(**Y01**) – Halcyon Stand	Ready State	@ Isocenter	46
	Beam-On State		49
(**Y03**) – Console Cabinet	@ 1m [3'-3"]	@ 1m [3'-3"]	53
**dBA values are a typical representation, taken under normal conditions, the site-specific design and installation may affect the values.*			

3.9 FIRE PROTECTION

The fire protection system must comply with all local codes and regulations.

NOTICE

Sprinkler systems inside the treatment room are not recommended, as their activation or leakage may result in significant equipment damage.

Consult a fire protection specialist to design a code-compliant detector or extinguisher system for the treatment room.

Heat detectors or photoelectric smoke detectors are preferred over ionization-type detectors due to the potential for false alarms.

If fire sprinklers are required, avoid placing sprinkler heads directly above the equipment. A pre-action sprinkler system managed by an independent detection system is preferred; however if a wet pipe system is used, recessed high-temperature heads should be considered to minimize the risk of accidental breakage. When employing a chemical system, consider the safety requirements for nonambulatory patients.

4 PROJECT MANAGEMENT

4.1 RESPONSIBILITIES

All pre-installation dates for Varian deliverables and milestones are scheduled by the Varian PM, based on an agreement between the Customer and the Varian PM and communications with Varian Site Planning and Sales. The Varian PM will communicate regularly with the Customer throughout all phases of the project. Also, the Varian PM will perform site inspection visits to help answer questions during the construction progress.

Site visits are commonly held for the Initial Site Meeting/Project Kick-off and the Construction Completion/Pre-Installation Final Inspection. This final visit typically occurs 7 - 10 days before the RIG date to verify site readiness is at 100% completion as defined by the [2] Varian Accelerator Pre-Installation Checklist.

Table 4-1 Sample Project Schedule

Task *(estimated in weeks)*	**1**	**…**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Place Machine Order	X															
Design & Construction *(varies)*																
MDP & RJB *(delivered/installed)*																
Pre-Installation Inspection																
Machine Delivery *(weekend)*																
Machine RIG *(weekend)*																
System Installation																
Machine Acceptance																

= Critical STOP/GO Inspections = Varian Install dates to suit Customer program = Work by others

4.2 OBJECTIVES

The items listed below are required to be completed before the Varian PM conducts the final inspection and releases the equipment for delivery. Varian's installation timeline is dependent on these items being finished. The [2] Varian Accelerator Pre-Installation Checklist is available from the Varian PM upon request.

- The treatment room and control area meet clinical standards, are dust-free, and are restricted from the construction trades.
- The customer has secured and signed all necessary licenses and approvals for this installation.
- A defined, load-bearing rig path is present; all clearances from the unloading or staging area to the vault should meet the specified minimum requirements.
- A live hospital network with internet access with the Record and Verify system available.
- MICAP survey has been completed and submitted.
- All electrical requirements are completed including live permanent power, cable containment, wiring, main disconnect panel, power conditioner *(optional)*, and power outlets.
- All safety-related items are installed and connected.
- The chilled water supply at the accelerator is tested and fully operational.
- The treatment and control room HVAC system is tested and fully operational.
- Flooring and casework are installed or prepared as previously agreed.

4.3 PIK INSTALLATION

Sub Project No.	**1**	The purpose of this section is to provide an overview of the roles and responsibilities of Varian and the Customer's contractors during this phase of the project. It should be coordinated with the Halcyon PPG. For clarifications, please contact the Varian PM.
Task Name	**Main Disconnect Panel (MDP) and Relay Junction Box (RJB)**	
Task Overview	To accept delivery of Varian-provided PIK components, assemble and install them in their final position.	
Prerequisites	• The treatment room must be water-tight • The location of MDP & RJB defined in the construction documents • An isolated power source available • Mains incoming power conductors installed • Dedicated earth termination bar installed	

Responsibilities	**Task**	**Varian**	**Customer**
	Schedule delivery date	**X**	**X**
	Unpack RJB and MDP		**X**
	Install the RJB, MDP, and IEC outlet		**X**
	Install cable containment, provide end-to-end distances, and install pull strings		**X**
	Connect to the isolated incoming source		**X**
	Connect dedicated G/PE to facility bar		**X**
	Connect warning lights to RJB		**X**
	Connect door interlocks to RJB		**X**
	Connect EMO switches to RJB		**X**
	Testing as defined by Varian and local regulations		**X**
	Dispose of Varian packing materials		**X**

Duration	Customer defined
Customer Supplied Resources & Materials	General contractor to unbox and mount the MDP and RJB, using appropriate mounting hardware Electrical contractor to connect the incoming power and peripherals Materials for installing cable containment Materials for console power connection per PPG
Results	MDP and RJB installed – incoming power supply connected, and power supply cable ready for connection to Halcyon. IEC Outlet installed near the Console Cabinet and wired to the MDP.
Acceptance	Performed by Varian Project Manager, **[1] Varian Accelerator Pre-Instalation Checklist**

4.4 RIG AND INSTALLATION

Sub Project No.	**2**	The purpose of this section is to provide an overview of the roles and responsibilities of Varian and the Customer's contractors during this phase of the project. It should be coordinated with the Halcyon PPG. For clarifications, please contact the Varian PM.
Task Name	**RIG and Installation**	
Task Overview	Installation of the Accelerator and Peripherals	
Prerequisites	• Sub-projects 1 – 3 completed • Pull strings in the conduits • Storage locations for spares and accessories • Power cable (customer-supplied) in floor pit • Electrical supply available, lockout tag of electrical supply. • Active network available	

Responsibilities	**Task**	**Varian**	**Customer**
	Schedule delivery date for the system	**X**	**X**
	Risk assessments and method statements	**X**	
	Designated area for the delivery truck		**X**
	City Permits, street closures *(if required)*		**X**
	Crane *(if required)*		**X**
	Ensure the RIG path is structurally suitable		**X**
	Lay floor protection internally	**X**	**X**
	Unload/Unpack system and move into the room	**X**	
	Pull system cables	**X**	
	Install the accelerator	**X**	
	Drill 12mm Ø anchor holes for stand brackets, couch bracket, and floor positioning bracket.		**X**
	Provide **non-seismic** anchors.	**X**	
	Install **non-seismic** anchors for the stand brackets, couch bracket, and floor positioning bracket.		**X**
	Provide and install **seismic** anchors for the stand brackets and floor positioning brackets *(if required).*		**X**
	Torque the stand bolts to the stand brackets	**X**	
	Insert and tighten non-seismic anchors for the stand brackets, couch bracket, and floor positioning bracket to the floor		**X**
	Connect power to the MDP and Halcyon		**X**
	Connect power to the IEC connector		**X**
	Connect warning lights, EMO switches, and interlocks to the RJB		**X**
	Connect chilled water supply and return lines		**X**
	Commissioning supplied peripherals	**X**	
	Install cover plate on conduit pull boxes, as required		**X**

Duration	5 Days
Customer Supplied Resources & Materials	Access to the site outside of normal working hours Contractors to connect power and water Waste container for Varian package disposal
Results	Machine delivered and installed
Acceptance	Performed by RIG contractor and PM – **CK-AL-RIG**

4.5 ACCEPTANCE AND RADIATION SAFETY

Sub Project No.	**3**	The purpose of this section is to provide an overview of the roles and responsibilities of Varian and the Customer's contractors during this phase of the project. It should be coordinated with the Halcyon PPG. For clarifications, please contact the Varian PM.
Task Name	**Acceptance and Radiation Safety**	
Task Overview	Completion of Radiation and Safety Forms	
Prerequisites	• All services fully working and commissioned. • Machine installed and commissioned • Room clinically ready.	

Responsibilities	**Task**	**Varian**	**Customer**
	Arrange a date for IPA	**X**	**X**
	Perform IPA	**X**	**X**
	Critical Exam (safety interlocks etc. Europe).	**X**	
	Failure correction		**X**
	Radiation survey (Room shielding)		**X**
	Magnetic Field room survey (flux density)		**X**

Duration	1 Day
Customer Supplied Resources & Materials	RPA or physicist availability Radiation meter Water tank and CC13 chambers or equivalent Dosimetry equipment and chambers
Results	Passed IPA - Passed Radiation survey and Critical Exam.
Acceptance	Performed by Installer and Customer – **IPA-AL**

APPENDIX A SHIPPING AND RIGGING

1 CRATE SHIPPING WEIGHTS AND SIZES

Appendix Table 1 Environmental Storage and Transport Conditions		
Condition	**Metric**	**Imperial**
Ambient Temerature Range	0° to 40° C	32° to 104° F
Relative Humidity	10% to 90%, non-condensing	

Appendix Table 2 Crate Weights and Sizes						
Box	**P/N**	**Kit Description**	**Metric**		**Imperial**	
			Weight (kg)	**L x W x H (cm)**	**Weight (lb)**	**L x W x H (in)**
A	P1014666	Gantry, Crate	5240	310 x 155 x 244	11552	122 x 61 x 96
B	P1014798	Couch, Crate	719	292 x 97 x 152	1585	115 x 38 x 60
C	P1013839	Console Cabinet, Crate	478	114 x 102 x 157	1054	45 x 40 x 62
D	P1024563	Utility, Crate	340	155 x 86 x 178	750	61 x 34 x 70
E	P1037299	Cover Kit, Crate	530	213 x 213 x 183	1168	84 x 84 x 72
F	P1025054	RJB Crate	31	69 x 61 x 41	68	27 x 24 x 16
G	P1025056	MDP Crate	95	112 x 82 x 59	209	44 x 32 x 23
H	P1025055	Step-Up Transformer *(Opt.)*	230	86 x 71 x 97	507	34 x 28 x 38

2 RIGGING INFORMATION

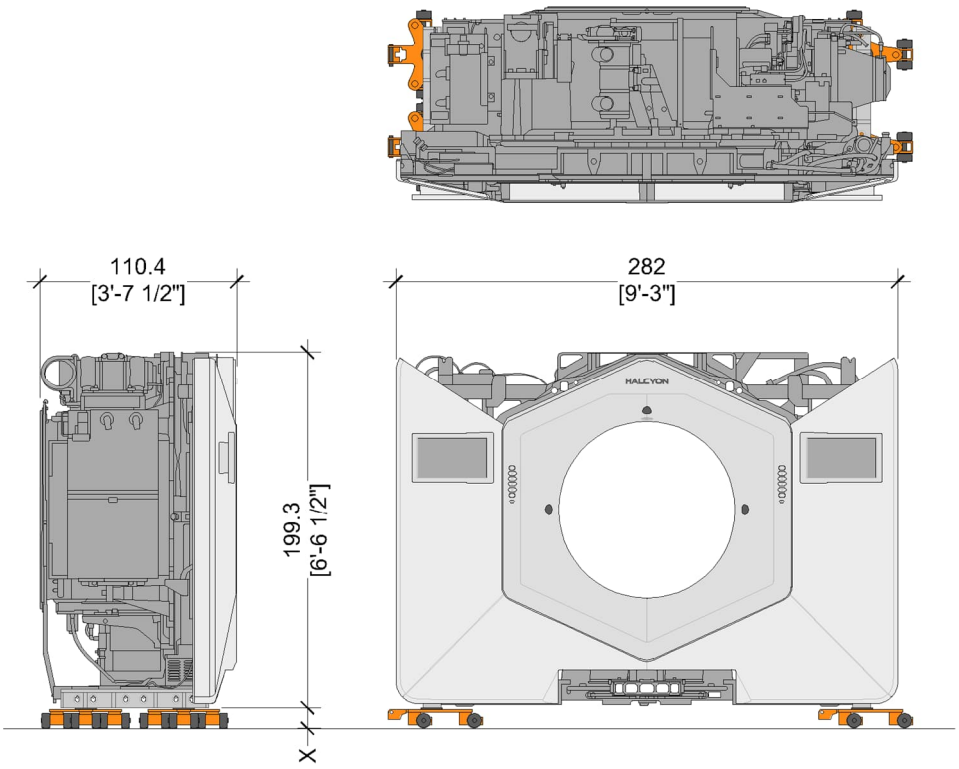
NOTICE

In Appendix Figure 1 the dimension for "X" is variable, dependent on the rigging equipment (skates or dollies) used.

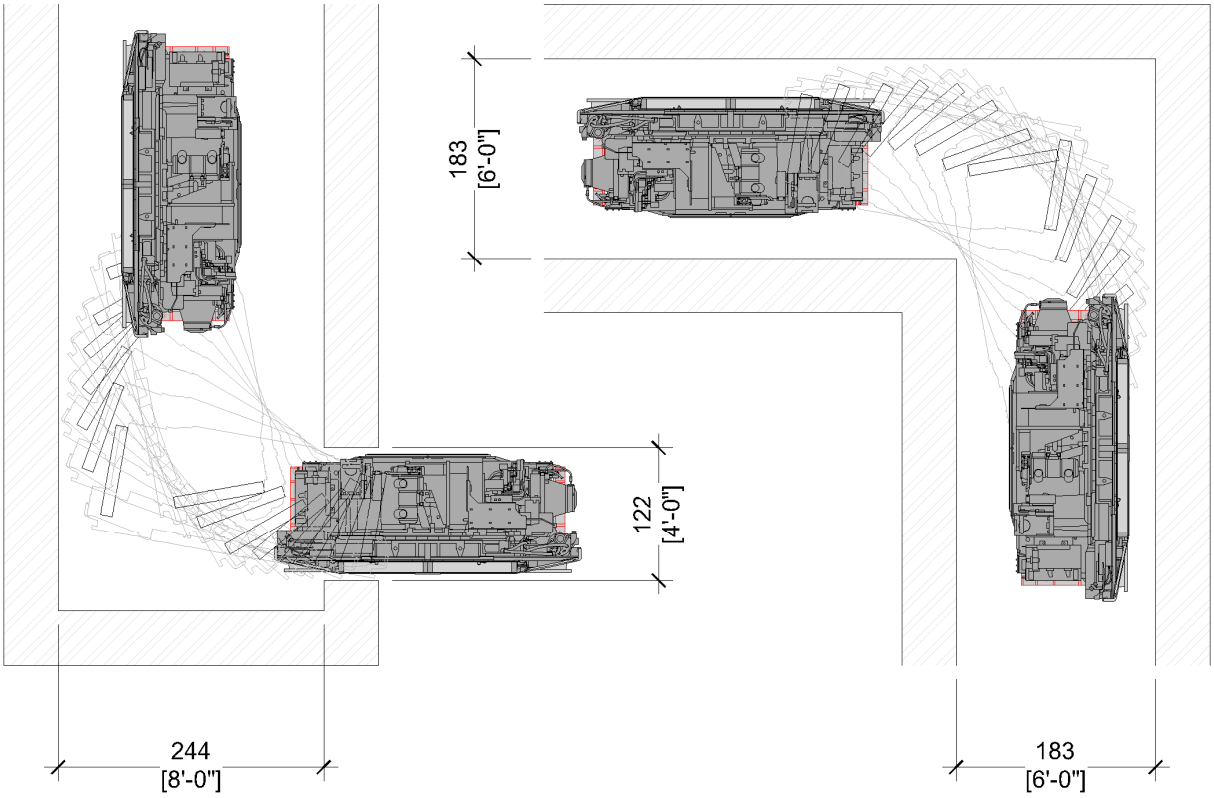
The minimum door clearance height is 213cm [7'-0"].

Provide approximately 10 m^2 [100 ft^2] of secure temporary storage area during installation.

Appendix Table 3 Rigging Weight		
Description	**kg**	**lb**
Halcyon Stand and Gantry	4455	9822



Appendix Figure 1 Stand and Gantry Rigging Dimensions



Appendix Figure 2 Tracking Route – Option "A"

For rigging options that do not meet these minimum requirements, please contact Varian Site Planning.

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Please note:

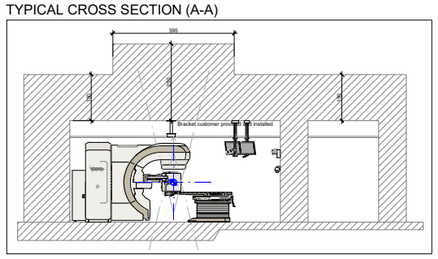
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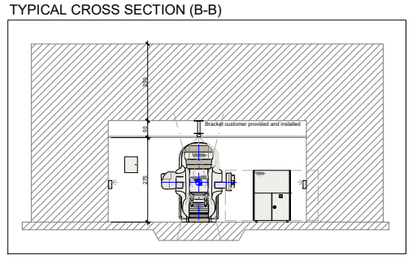
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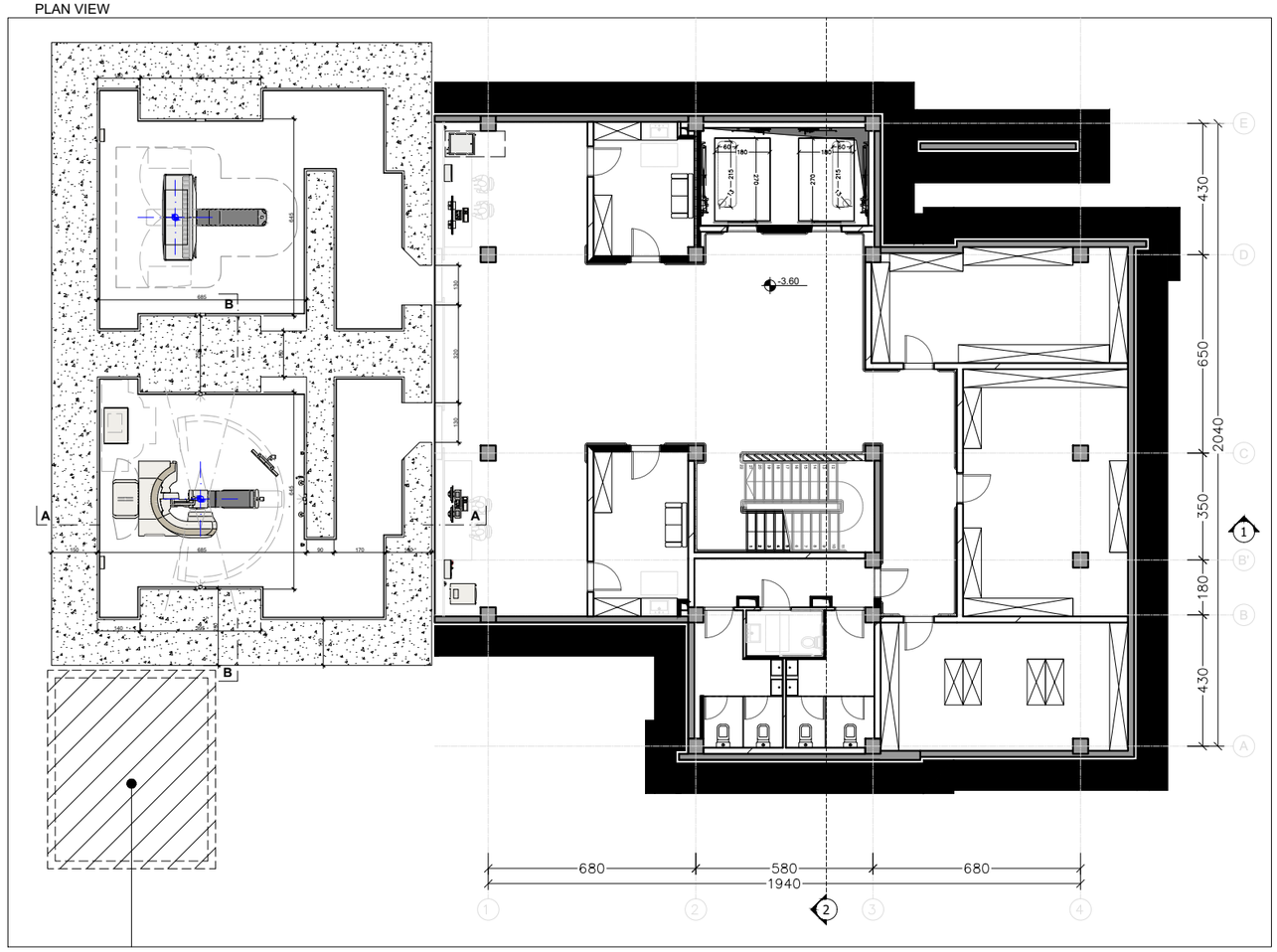
TYPICAL CROSS SECTION (A-A)



TYPICAL CROSS SECTION (B-B)



PLAN VIEW



Todua Clinic
Tbilisi, Georgia

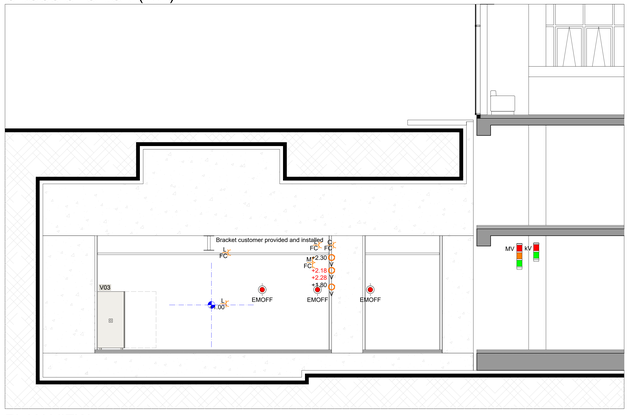
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Scale: 1:200
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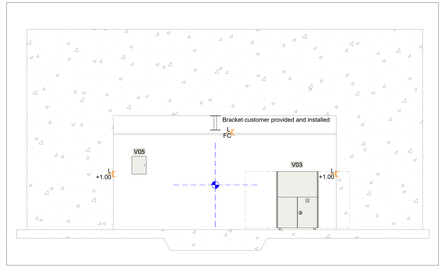
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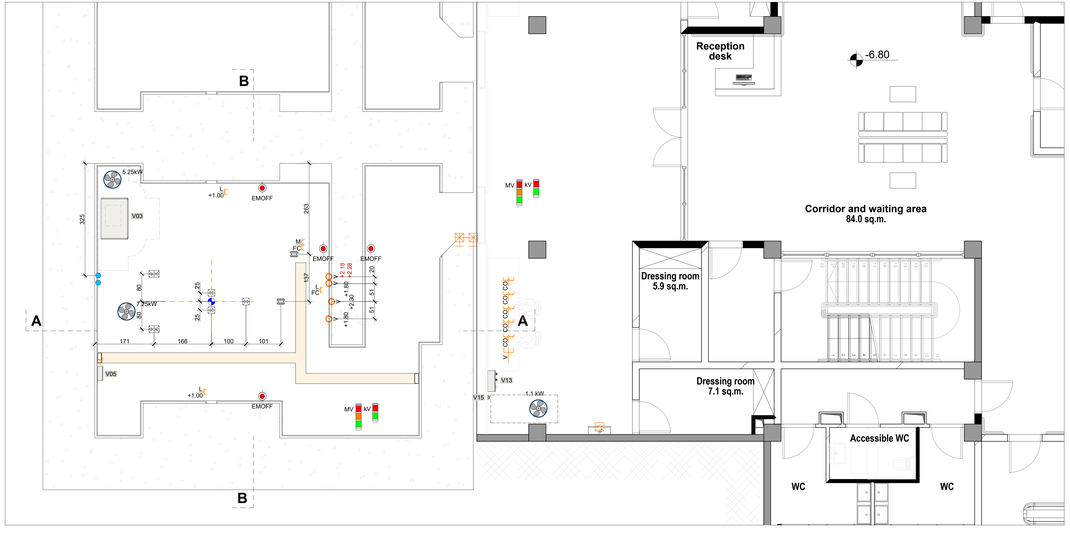
CROSS SECTION (A-A)



TYPICAL CROSS SECTION (B-B)



PLAN VIEW



Brackets & mounting plates

The ceiling brackets with mounting plates are furnished by Varian and shipped in advance of the linear accelerator. The ceiling brackets and mounting plates are customer installed. Maximum load to support Varian equipment is 30kg.

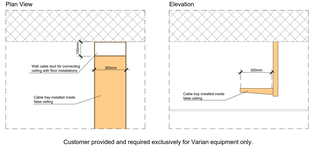
Treatment room lighting

Varian recommends that two separate and independent electrical circuits be used for the treatment room lighting. One circuit can be connected so that the treatment room lights turn off when the lasers are turned on. The second circuit can be configured as desired. Both circuits can be dimmable.

Flooring Requirements

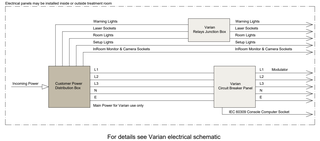
The system contains electronic components that are sensitive to electrostatic discharge (ESD). Floor finishes used in the treatment room, maze, and control area should be selected to ensure they have "Anti-Static" properties that meet local and national codes

Ceiling cable tray detail



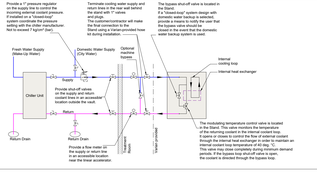
Customer provided and required exclusively for Varian equipment only.

Power Distribution Scheme



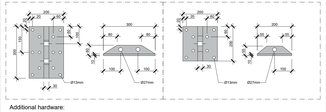
For details see Varian electrical schematic

Chilled Water Connection



Ceiling hooks detail

In facilities where no A-Frame is available it is the customer's responsibility to construct and mount all ceiling hooks to hold 50kN/25kN as shown in this plan. Use of ceiling hooks to rig our machines is associated with severe safety risk. If the use of these for Rigging is considered, and is the only viable option on customer sites, then proof of Load Test and Safe Working Load (SWL) must be provided by the customer before permissible use.



Additional hardware:

- 48 x M12 concrete anchors
- 2 x 5 tons shackles
- 3 x 3 tons shackles

Varian provided, customer installed/connected			
V03	Modulator Cabinet	V13	GEXPRO Main Circuit Breaker Panel
V05	Relay Junction Box	V15	Console IEC Power Receptacle

Electrical & Mechanical Legend

For further details see electrical schematic

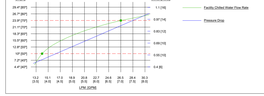
All items are customer provided, installed and are required exclusively for Varian equipment only.
All shown outlets are required exclusively by Varian. No convenience outlets are shown.

LC	Laser receptacle 230V	MV	Warming lights MV
CC	Camera receptacle 230V	kV	Warming lights kV
MC	InRoom monitor receptacle 230V		Door switch
CONC	Console receptacle 230V		Cable conduit M63 / Ø50mm into cable tray
XC	Network receptacle RJ45 (Hospital Network)		Wall cable duct 300x100mm
EMOFF	Emergency off button		Room lighting
LMO	Last man out button	kW	Equipment air heat load
EMO	Emergency disconnect button		Chilled water connection point to equipment (1")
	Power switch	+	Spot height
+2.50	Spot height: distance from finished floor in meters	FC	Spot height: installed inside false ceiling
	Customer power distribution box		Maintenance switch

Technical Requirements Varian VitalBeam

Electrical			
Input voltage	200V, **208V**, 240V, 380V, **400V**, 415V or **480V** (*4 wire, 3-phase and ground*)		
System Current	100 A @ 400V 50 Hz 80 A @ 480V 60Hz		
Console Current	7A @ 230V, 50/60Hz (*P,N,G*)		
Line Voltage Regulation	±5% maximum		
Maximum Phase Voltage Imbalance	3% of the nominal value		
Input Frequency	50 or 60 Hz ±1 Hz		
Electrical Loads (*Long-Time Load*)	48kVA (*includes the console*)		
In-Rush Current	340A @ 400V 50Hz, 280A @ 480V 60Hz		
Source Impedance	2.5% maximum		
Mandatory Grounding	See PPG Grounding Requirements		
Ventilation			
Room temperature	16° - 27° Celsius		
Relative room humidity	30% - 75% (non-condensing)		
Air changes	4 - 6 per hour		
Air handling system	Fresh air		
Equipment air heat load (during beam-on)			
Gantry and stand	7.25 kW		
Modulator cabinet	5.25 kW		
Control console computer	1.1 kW		
Acoustic Levels			
Equipment	Condition	Location	Sound Pressure Level, dBA*
Stand	Ready / Beam-On	@isocenter	64
Modulator	Beam-On	@ 1m [3'-3"]	70
Console Cabinet	On	@ 1m [3'-3"]	53
*dBA values are a typical representation, taken under normal conditions, The site-specific design and installation may affect the values.			
Coolant			
Maximum heat load		25 kW	
Maximum overall input pressure, including normal back pressure		6.9 kg/cm^2 (bar)	
Pressure drop through linear accelerator heat exchanger		See table	
Glycol content of coolant		Not to exceed 50%	

Minimum Facility Chilled Water Flow Rate



Material Legend

	Concrete	2350 kg/m³

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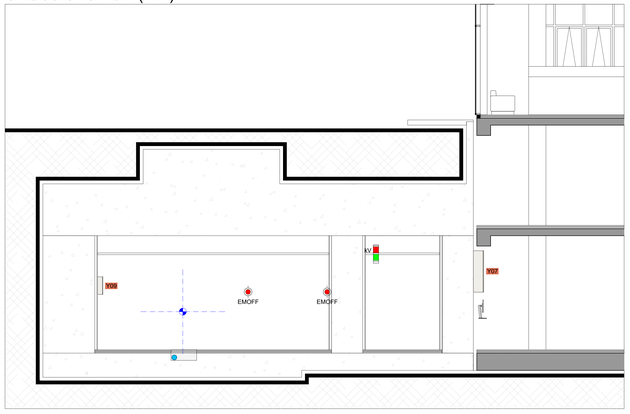
VitalBeam

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Plan Number	ME_VB1	Draw / Date	cf / 24.02.2026
Revision	A	Checked / Date	- / -

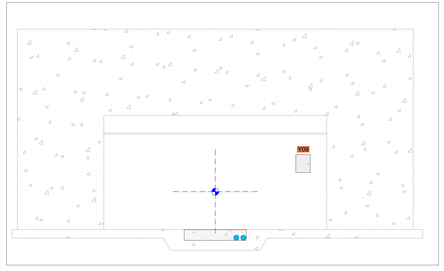
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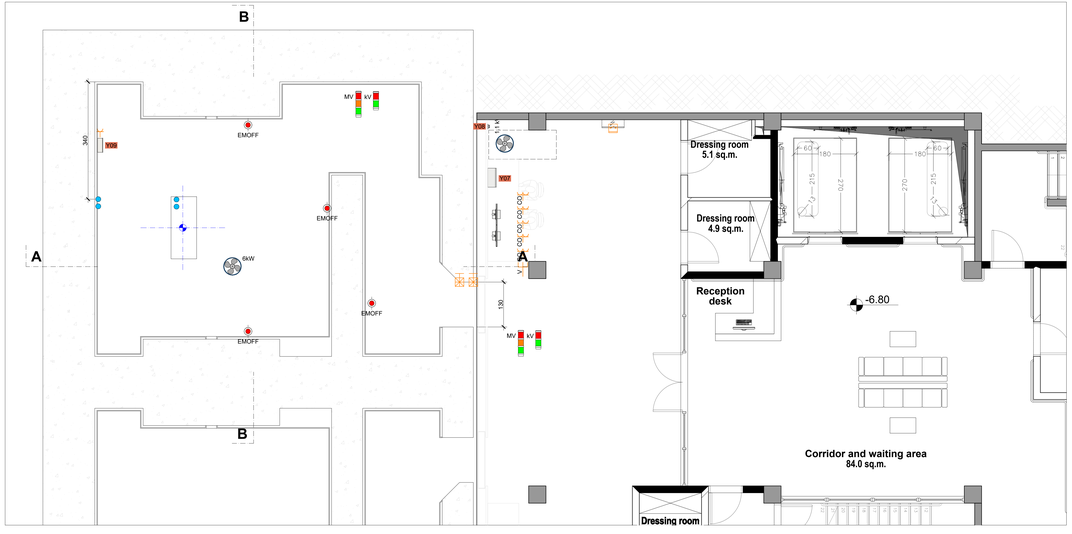
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CROSS SECTION (A-A)



TYPICAL CROSS SECTION (B-B)





Treatment room lighting

Varian recommends that two separate and independent electrical circuits be used for the treatment room lighting.

One circuit, typically used during treatments, is dimmable. The second circuit is typically used for maintenance/service and can also be dimmable.

Flooring Requirements

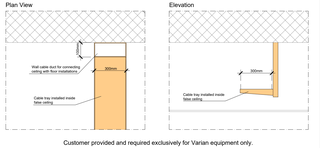
The system contains electronic components that are sensitive to electrostatic discharge (ESD). Floor finishes used in the treatment room, maze, and control area should be selected to ensure they have "Anti-Static" properties that meet local and national codes

Ceiling installations

Routing of any cables or connections to the Varian provided Mains Disconnect Panel and Relay Junction Box are the customer's responsibility. Including cables, cable tray, conduits, etc.

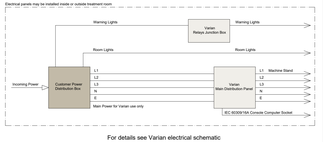
See electrical schematic "SD - AL - Customer Connections"

Ceiling cable tray detail



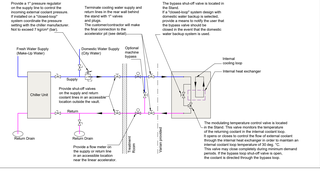
Customer provided and required exclusively for Varian equipment only.

Power Distribution Scheme

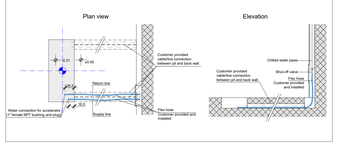


For details see Varian electrical schematic

Chilled Water Connection



Chilled Water Connection



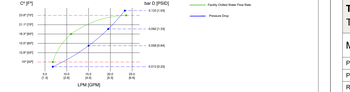
Varian provided, customer installed/connected			
Y07	Mains Disconnect Panel	Y09	Relay Junction Box
Y08	IEC Power Receptacle		

Electrical & Mechanical Legend	For further details see electrical schematic		
All items are customer provided, installed and are required exclusively for Varian equipment only. All shown outlets are required exclusively by Varian. No convenience outlets are shown.			
	Camera receptacle 230V		Warning lights MV
	Console receptacle 230V		Warning lights kV
	Network receptacle RJ45 (Hospital Network)		Door switch
EMOFF	Emergency off button		Cable conduit M63 / Ø50mm into wall cable duct
LMO	Last man out button		Wall cable duct 50x30mm
EMO	Emergency disconnect button		Room lighting
	Power switch	x kW	Equipment air heat load
	Spot height		Chilled water connection point to equipment (1")
+2.50	Spot height: distance from finished floor in meters	FC	Spot height: installed inside false ceiling
	Customer power distribution box		

Technical Requirements Varian Halcyon

Electrical			
Input voltage * *see PPG 3.3.3.1*			400V/231VAC to 480Y/277VAC * 380VAC (requires a step-up transformer)
Supply Power (maximum)			30 kVA @ 200-480V 50/60Hz (Stand PDU) 3 kVA @ 208-230V 50/60Hz (Console Cabinet)
Line Voltage Range			±10% maximum
Maximum Phase Voltage Imbalance			3% of the nominal value
Input Frequency			50Hz ±3 or 60Hz ±3
In-Rush Current			135A @ 400V 50Hz 105A @ 480V 60Hz
Source Impedance			2.5% maximum
Mandatory Grounding			See PPG Grounding Requirements
Environmental Specification			
Room temperature			16° - 27° Celsius
Relative room humidity			30% - 75% (non-condensing)
Air changes			4 - 6 per hour - Check local regulations
Air-handling system			Fresh air
Equipment air heat load (during beam-on)			
Gantry and stand			6.00 kW
Control console computer			1.10 kW
Acoustic Levels			
Equipment	Condition	Location	Sound Pressure Level, dBA*
Stand	Ready State	@isocenter	46
	Beam-On		49
Console Cabinet	@ 1m [3'-3"]	@ 1m [3'-3"]	53
*dBA values are a typical representation, taken under normal conditions, the site-specific design may affect the installed values.			
Coolant			
Maximum heat load			7 kW
Maximum overall input pressure, including normal back pressure			3.5 bar (50PSI)
Pressure drop through linear accelerator heat exchanger			See table
Glycol content of coolant			Not to exceed 50%

Facility Chilled Water Temperature, Flow Rate, and Pressure Drop



Material Legend

	Concrete	2350 kg/m³

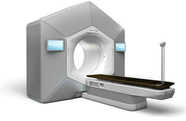
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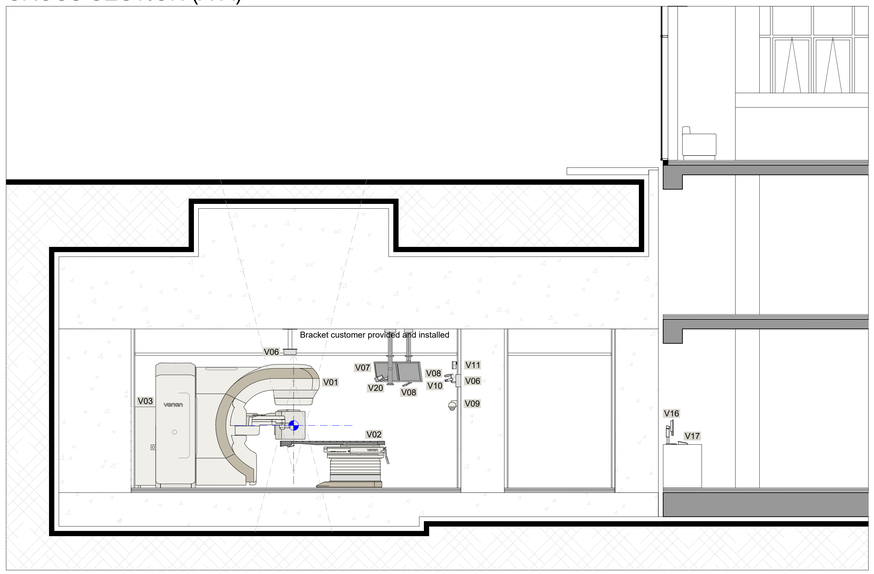
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Tbilisi, Georgia

Mechanical & Electrical — HALCYON

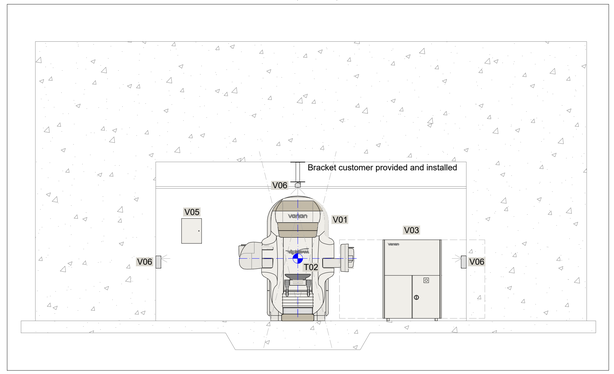
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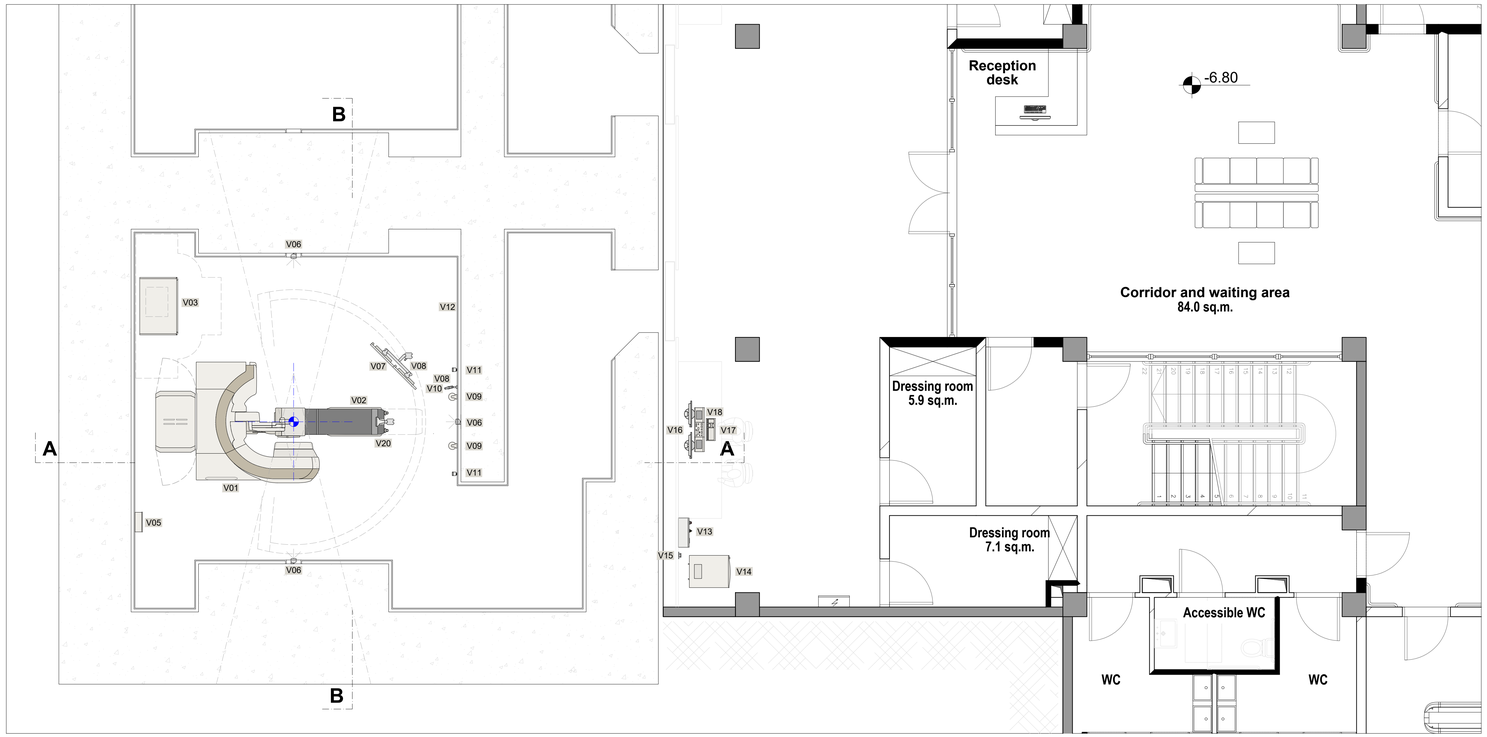
CROSS SECTION (A-A)



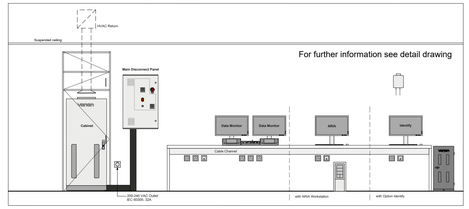
TYPICAL CROSS SECTION (B-B)



PLAN VIEW



Typical Console Layout



Typical Room Storage



The storage drawing shows a suggestion only of possible storage to aid in the design of site specific casework. All casework/storage shall be provided by the Customer.

Bulk and shelf storage are required for Varian accessories and various materials used for therapy.
The Varian-supplied accessories include Electron applicators (cones), wedges, and other field-defining devices.

Many spare parts are shipped with the equipment and an optional spare parts kit can be ordered.
These will require secure storage in or near the treatment room.

See detail drawing: *SD - General Room Storage HE - A*

VitalBeam Equipment Legend (Varian provided)

V01	Stand & Gantry	V10	Live View Camera
V02	Treatment Couch	V11	Speaker
V03	Modulator Cabinet	V12	Treatment Accessories
V04	Base Frame	V13	GEXPRO Main Disconnect Panel
V05	Relay Junction Box	V14	Console Cabinet
V06	Positioning Laser	V15	Console IEC Power Receptacle
V07	In-Room Monitor Set (Dual Screen)	V16	System Monitors (2x) incl. Keyboard & Mouse
V08	Patient Microphone	V17	Dedicated Console Keyboard
V09	CCTV Camera	V18	CCTV Control & Monitors
V20	Optical Imaging Camera (Single Gating SGC)		

Material Legend

	Concrete	2350 kg/m³

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E				
F				

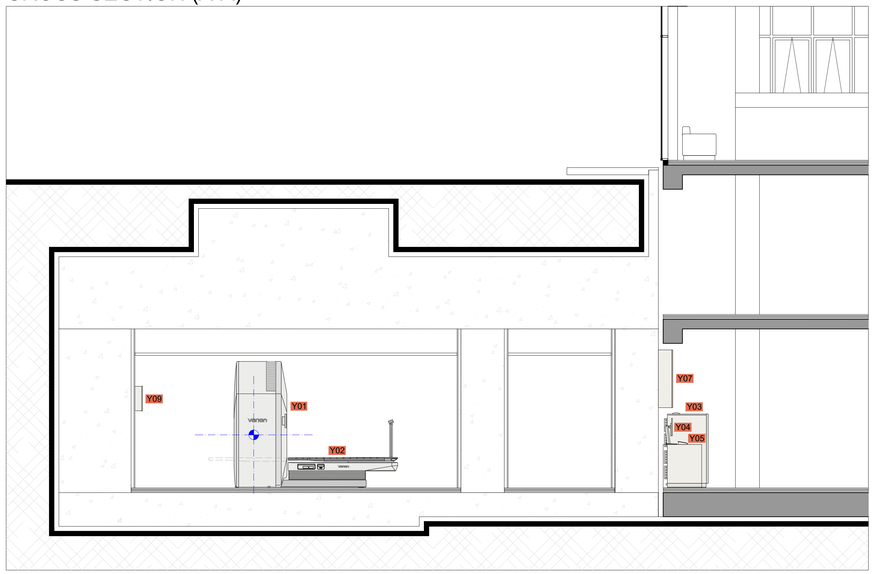
Todua Clinic
Tbilisi, Georgia

Equipment

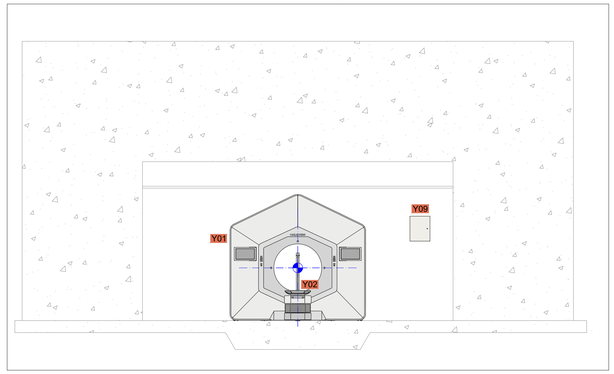
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Plan Number	EQ_VB1	Draw / Date	cf / 24.02.2026
Revision	A	Checked / Date	- / -

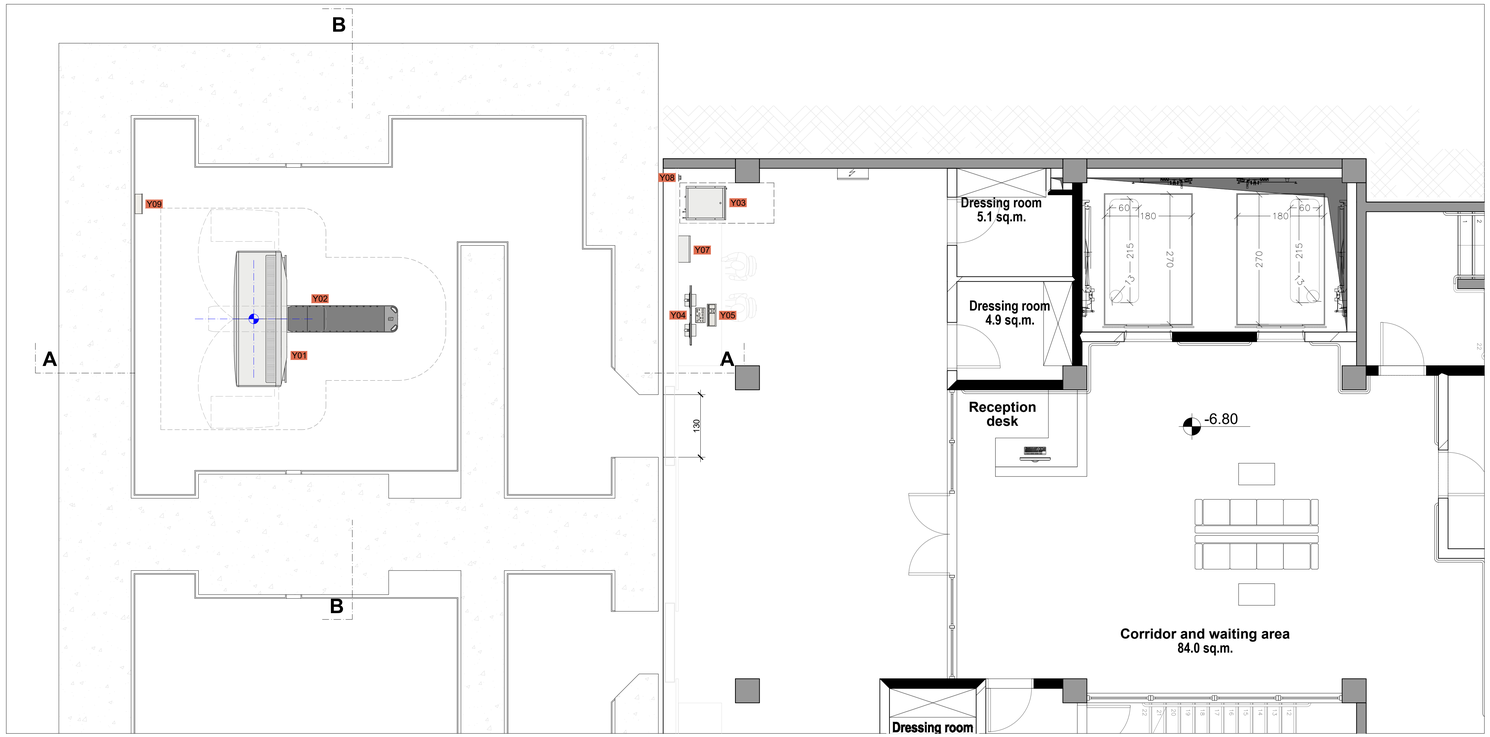
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Hinterbergstrasse 14
CH-6312 Steinhausen
Tel: +41 (0)41 749 88 44
planning.emea@varian.com

CROSS SECTION (A-A)

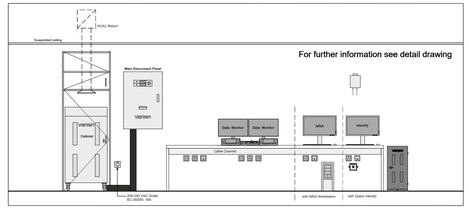


TYPICAL CROSS SECTION (B-B)





Typical Console Layout



Halcyon Equipment Legend (Varian provided)

Y01	Stand & Gantry with integrated:	Y03	Console Cabinet
	Positioning Laser	Y04	System Monitors (2x) incl. Keyboard & Mouse
	Patient Microphone	Y05	Dedicated Console Keyboard
	Speaker	Y06	Floor Anchor Brackets
	In-Room Monitor Set	Y07	Main Disconnect Panel
Y02	Treatment Couch with integrated:	Y08	Console IEC Power Receptacle
	Live View Camera	Y09	Relay Junction Box

Material Legend

	Concrete	2350 kg/m³

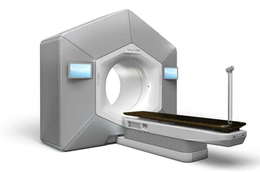
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Revisions

Rev.	Date	Draw	Checked	Revision Text
B				
C				
D				
E				
F				

Todua Clinic
Tbilisi, Georgia

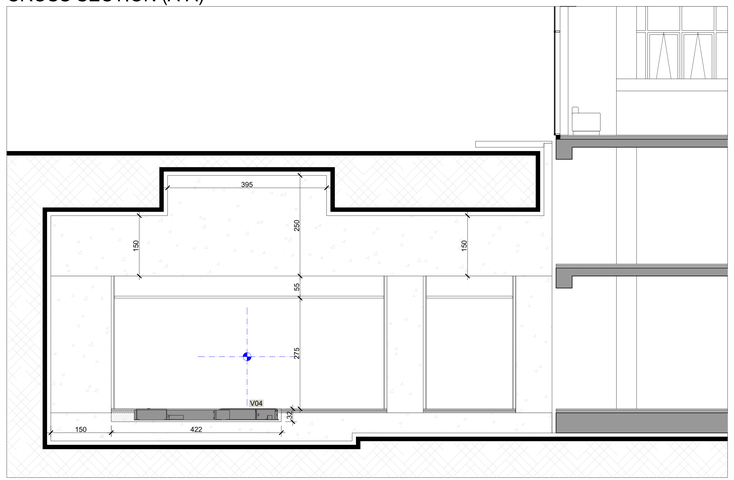
Equipment — HALCYON

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Plan Number	EQ_HL1	Draw / Date	cf / 24.02.2026
Revision	A	Checked / Date	- / -

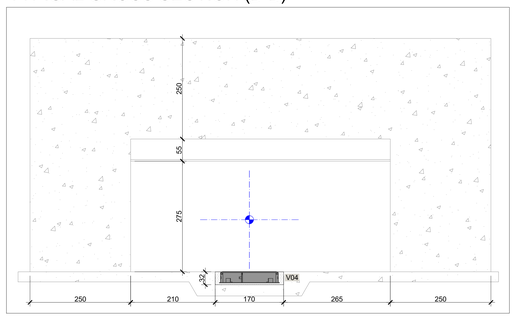
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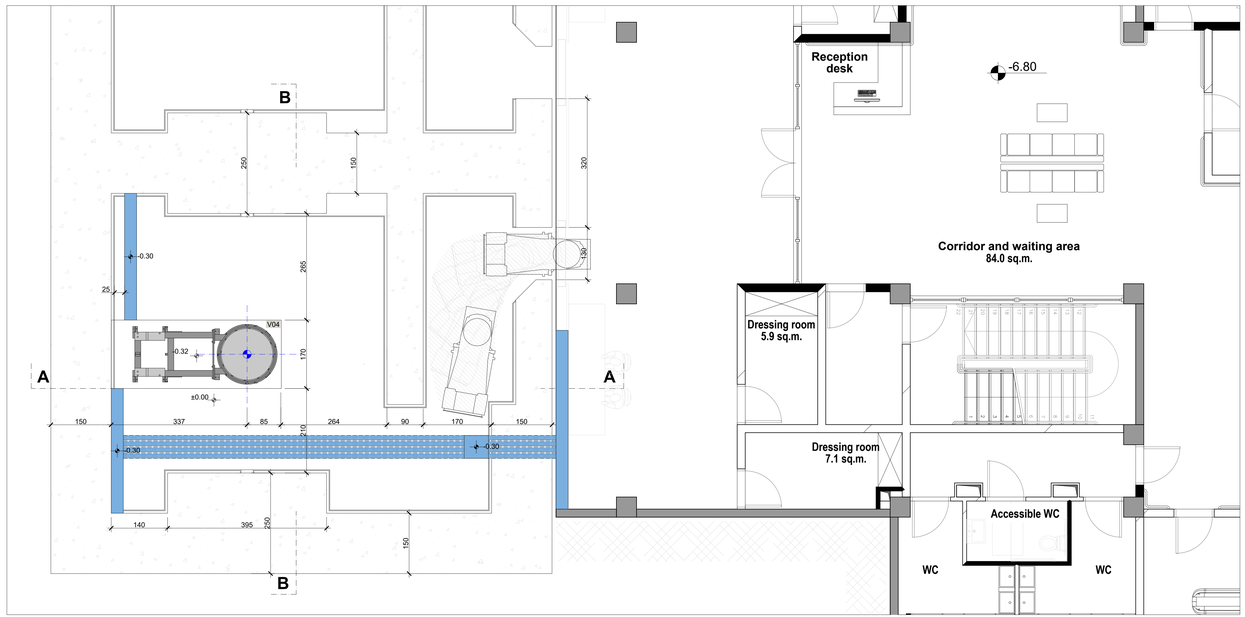
CROSS SECTION (A-A)



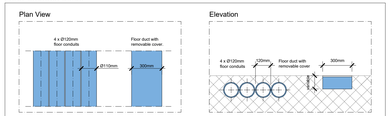
TYPICAL CROSS SECTION (B-B)



PLAN VIEW

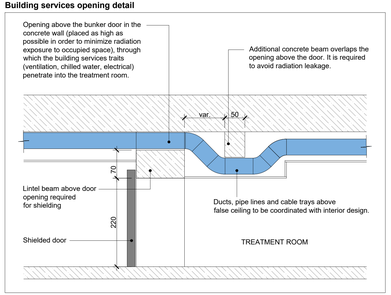


Floor channel detail

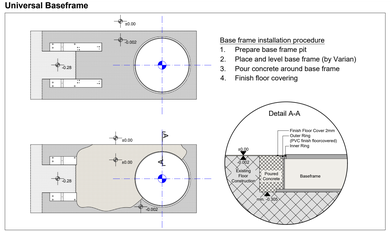


Customer provided and required exclusively for Varian equipment only.

Building services opening detail



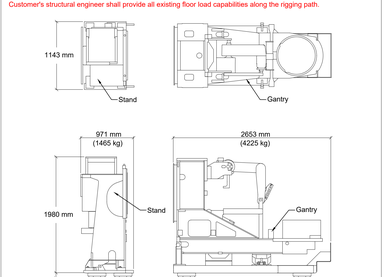
Universal Baseframe



Rigging Information for High Energy Accelerator (4 Piece)

Dimension of largest unit:	1143 mm x 2653 mm x 1980 mm (W x D x H)
Minimum Opening for Rigging: Minimum Opening:	min. 1200 mm x 2000 mm (W x H) min. 1150mm x 2000mm (W x H)
Weight of the biggest unit, unpacked	4658 kg
Transportation load: (with load distribution plates)	800 kg/m²

Customer's structural engineer shall provide all existing floor load capabilities along the rigging path.



General construction advice

It is acceptable to place iron or steel bars as ties through the concrete to maintain wall thickness. Tie sleeves must not be used. The ties must be left in place and cut or broken off after removing the forms. The typical practice of using PVC pipe or other sleeves to allow tie removal is not acceptable, as this will leave a hollow area in the concrete that negatively affects the wall's radiation shielding characteristics.

Varian information regarding the pit design require a thorough review by a qualified structural engineer.

Varian Medical Systems shall deliver, set and level the base frame.
The customer shall grout the base frame with normal concrete with a density approximately 2350 kg/m³ and maximum aggregate size of 10mm.

The grout/concrete for filling the baseframe pit shall be compacted by hand only. A vibrator must not be used for compaction.

Material Legend

	Concrete	2350 kg/m³

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Revisions

Rev.	Date	Draw	Checked	Revision Text
B				
C				
D				
E				
F				

Todua Clinic
Tbilisi, Georgia

Shielding & Structural

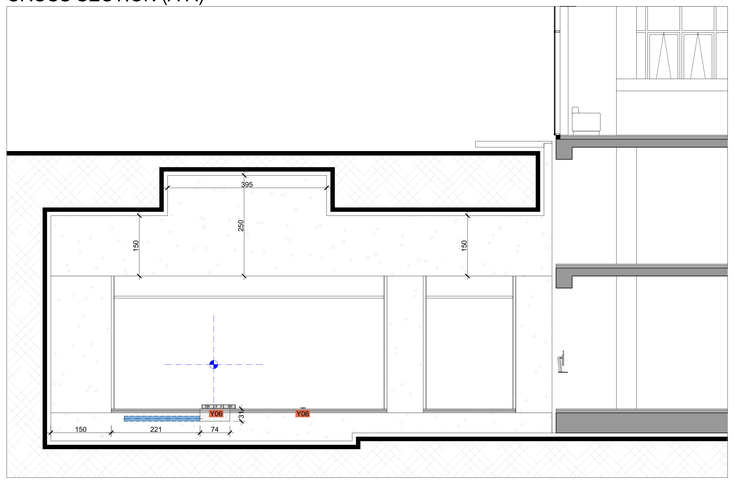
vitalBEAM

Project Number	25-013199	Scale / Size	1:50 / 1260 x 594mm
Plan Number	BF_VB1	Draw / Date	cf / 24.02.2026
Revision	A	Checked / Date	- / -

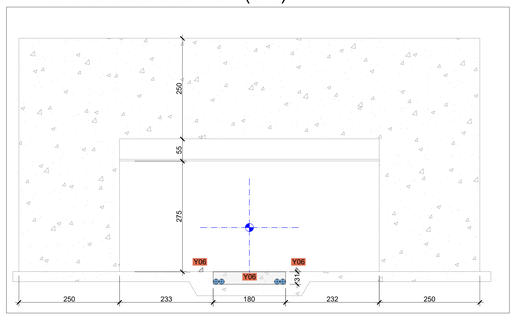
SIEMENS Healthineers

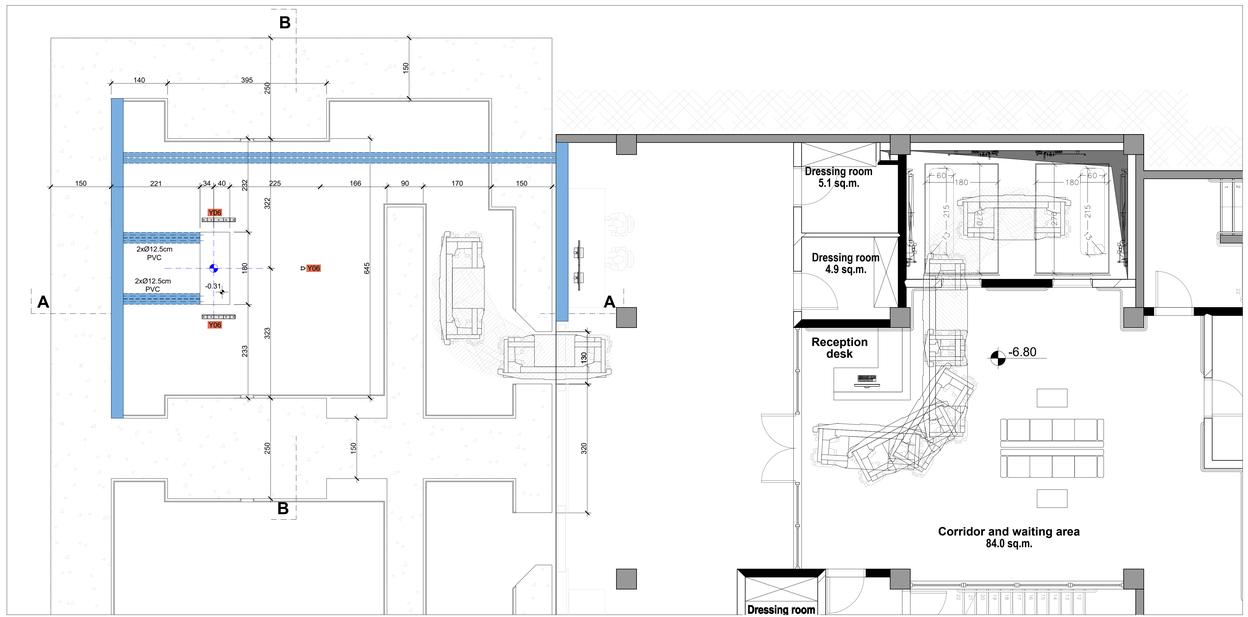
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CROSS SECTION (A-A)



TYPICAL CROSS SECTION (B-B)



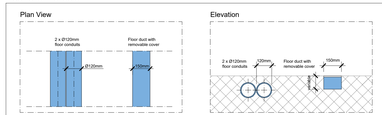


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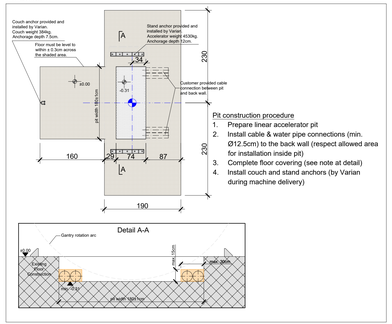
Varian information regarding the pit design require a thorough review by a qualified structural engineer.

Floor channel detail



Customer provided and required exclusively for Varian equipment only.

Pit Detail



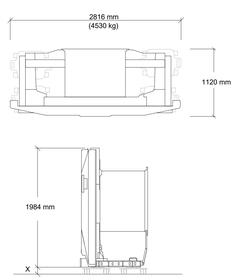
Pit construction procedure

1. Prepare linear accelerator pit
2. Install cable & water pipe connections (min. Ø12.5cm) to the back wall (respect allowed area for installation inside pit)
3. Complete floor covering (see note at detail)
4. Install couch and stand anchors (by Varian during machine delivery)

Rigging Information for Accelerator

Dimension of largest unit:	1120 mm x 2816 mm x 2020 mm (W x D x H)
Clearance for Rigging:	min. 1200 mm x 2100 mm (WxH)
Minimum Opening for Rigging:	min. 1140 mm x 2030 mm (W x H)
Weight of the biggest unit, unpacked	4530 kg
Transportation load: (with load distribution plates)	800 kg/m²

Customer's structural engineer shall provide all existing floor load capabilities along the rigging path.



Material Legend

	Concrete	2350 kg/m³

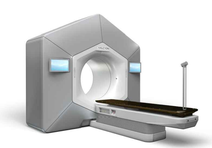
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C				
D				
E				
F				

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Tbilisi, Georgia

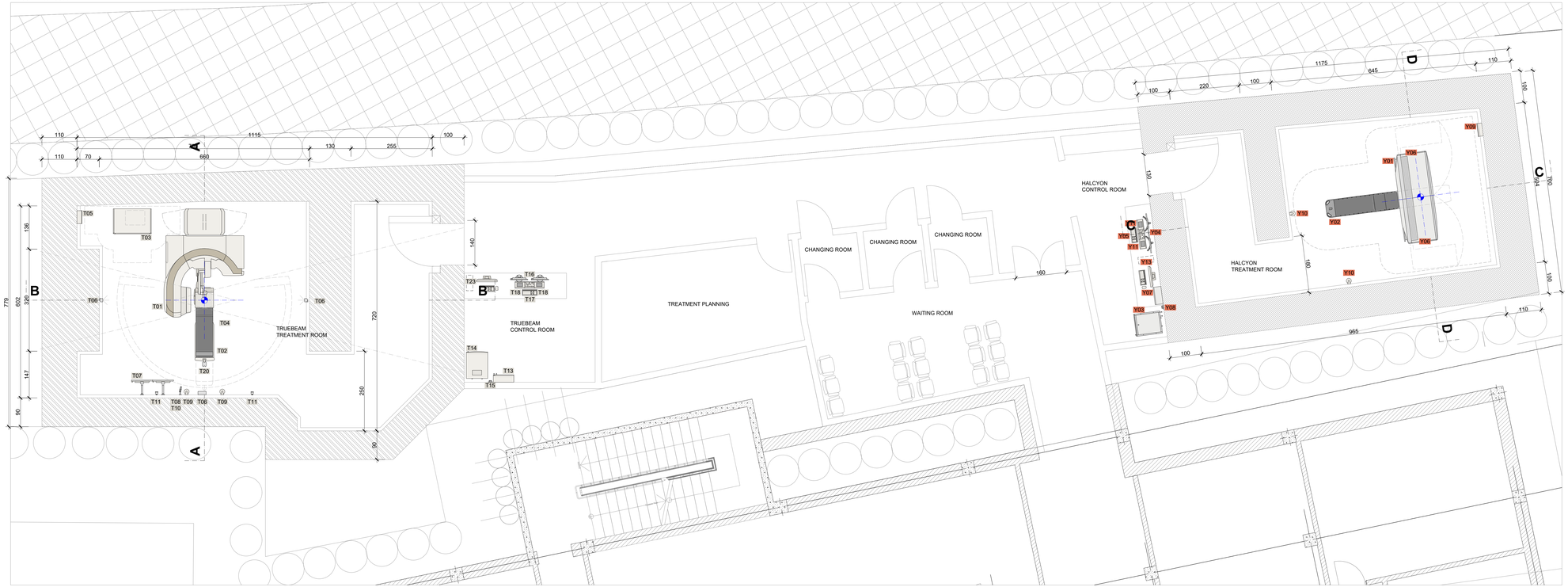
Shielding & Structural — HALCYON

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Plan Number	BF_HL1	Draw / Date	cf / 24.02.2026
Revision	A	Checked / Date	- / -

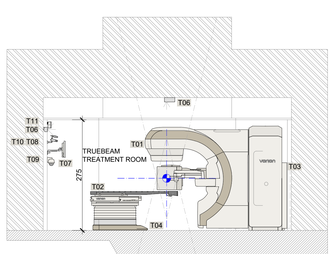
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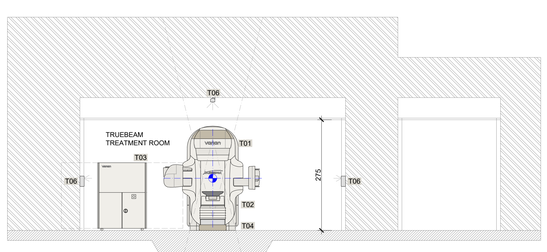
Plan View



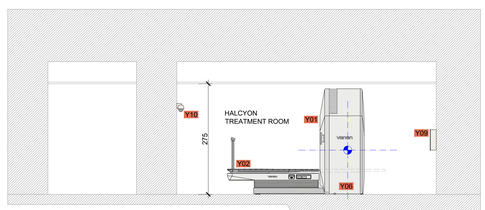
Section A-A



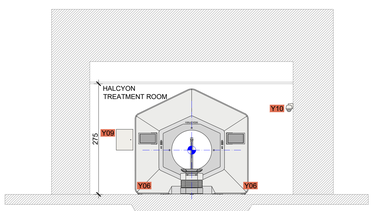
Section B-B



Section C-C



Section D-D



TrueBeam Equipment Legend (Varian provided)			
T01	Stand & Gantry	T11	Speaker
T02	Treatment Couch	T12	Treatment Accessories
T03	Modulator Cabinet	T13	GEXPRO Main Circuit Breaker Panel
T04	Base Frame	T14	Console Cabinet
T05	Relay Junction Box	T15	Console IEC Power Receptacle
T06	Positioning Laser	T16	System Monitors (2x) incl. Keyboard & Mouse
T07	In-Room Monitor Set (Dual Screen)	T17	Dedicated Console Keyboard
T08	Patient Microphone	T18	CCTV Control & Monitors
T09	CCTV Camera	T19	Printer
T10	Live View Camera	T23	Aria Workstation
T20	Optical Imaging Camera (Single Gating SGC)		

Halcyon Equipment Legend (Varian provided)			
Y01	Stand & Gantry with integrated:	Y03	Console Cabinet
	Positioning Laser	Y04	System Monitors (2x) incl. Keyboard & Mouse
	Patient Microphone	Y05	Dedicated Console Keyboard
	Speaker	Y06	Floor Anchor Brackets
	In-Room Monitor Set	Y07	Main Disconnect Panel
Y02	Treatment Couch with integrated:	Y08	Console IEC Power Receptacle
	Live View Camera	Y09	Relay Junction Box
Y10	CCTV Camera	Y11	CCTV Control & Monitors

Material Legend

	Concrete	3200kg/m³
	Concrete	2300 kg/m³

Please note:

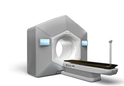
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B				
C				
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E				
F				

Todua Clinic
Tibilisi, Georgia

Equipment TrueBeam HALCYON

Project Number	24-0113	Scale / Size	1:50 / 1050 x 594mm
Plan Number	EQL_TB	Draw / Date	AH / 12.07.2024
Revision	A	Checked / Date	DA / 12.07.2024

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Shielding Calculation

Hospital	Todua Clinic
City	Tbilisi
Country	Georgia
Project Number	25-013199
Date	25 February, 2026
Originator	cf
Calculation Code of Practice	NCRP 151

Machine Parameters

Type		True Beam
Energy	[MV]	High Energy: 18.0 Low Energy: 18.0
Dose rate	[cGy/h]	36000
Field size	[cm^2]	400
Head leakage radiation	[cGy/h]	0.001
Target to Isocenter	[m]	1

Workload

Tx/day	Days	Dose [cGy]	IMRT	IAH	0	90	180	270	High Energy	Pri [cGy/wk]	Sec [cGy/wk]
25.0	5.0	200.0	1.0	1.5	100	25	25	25	☑	25000.0	25000.0
25.0	5.0	200.0	1.0	1.5	100	25	25	25	☐	25000.0	25000.0
25.0	5.0	200.0	3.0	1.5	100	25	25	25	☐	25000.0	75000.0
25.0	5.0	200.0	3.0	1.5	100	25	25	25	☑	25000.0	75000.0

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Siemens Healthineers International AG
Site Solutions
Hinterbergstrasse 14
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Version 1.9.1

Not for regulatory

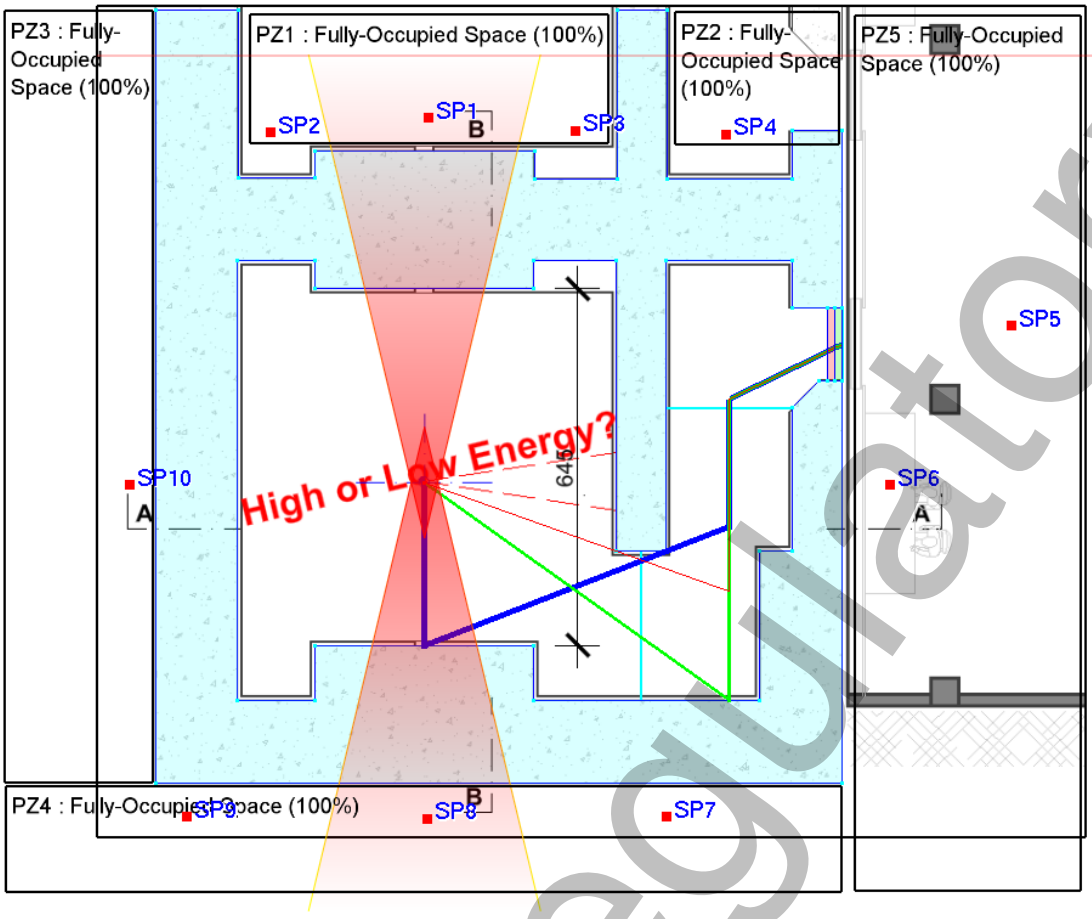


Figure 1: Master Perspective

Not for regulatory

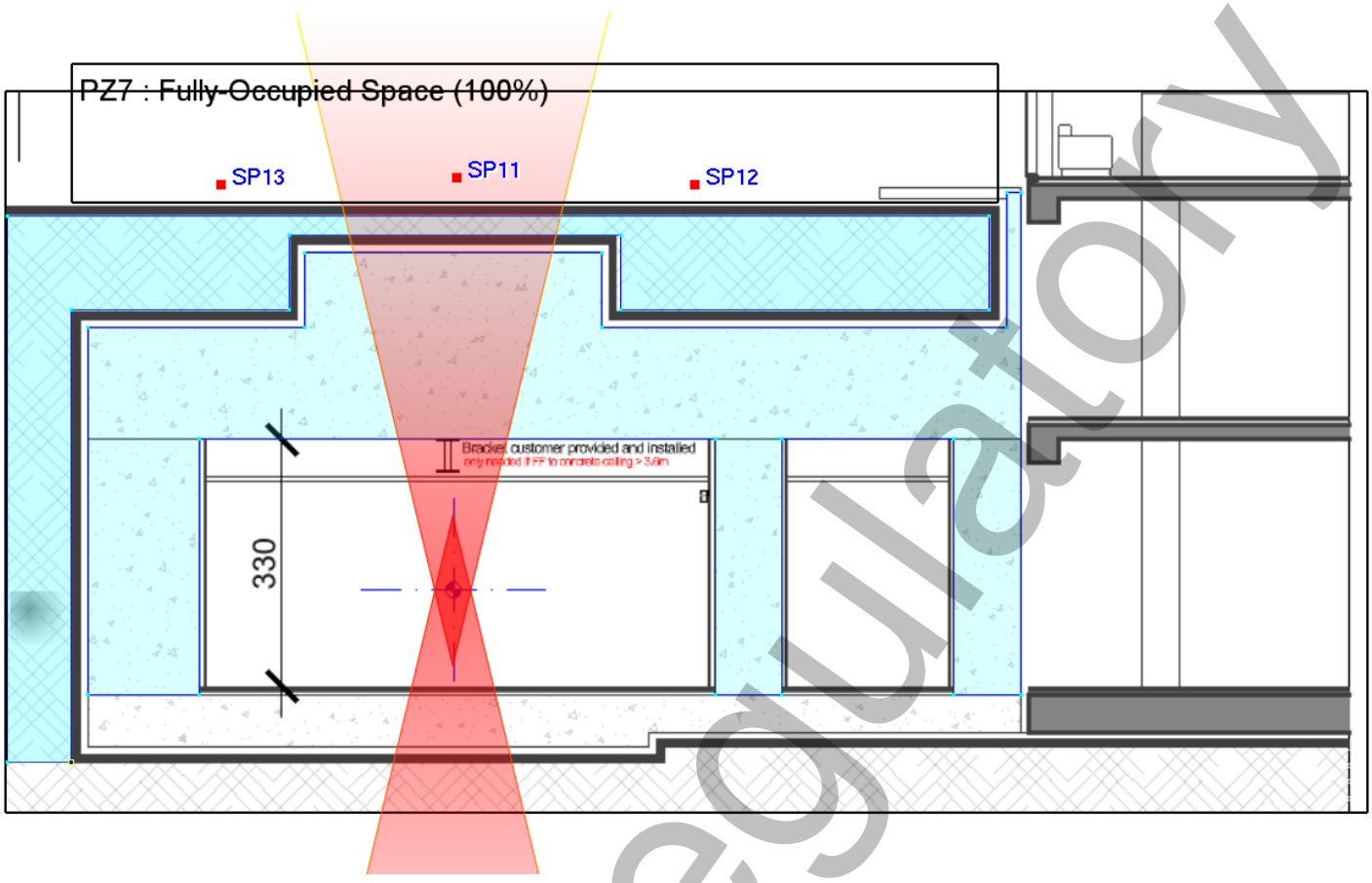


Figure 2: New Perspective

Not for regulatory

Summary Page

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IDR result	[µSv/h]	11.93	✓
TADR limit	[µSv/wk]	20.0	
TADR result	[µSv/wk]	8.29	✓
IAH limit	[µSv/h]	20.0	
IAH result	[µSv/h]	0.1	✓

Survey Point		SP2	
T		1.0	
IDR limit	[µSv/h]	25.0	
IDR result	[µSv/h]	0.48	✓
TADR limit	[µSv/wk]	20.0	
TADR result	[µSv/wk]	2.69	✓
IAH limit	[µSv/h]	20.0	
IAH result	[µSv/h]	0.03	✓

Survey Point		SP3	
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IDR limit	[µSv/h]	25.0	
IDR result	[µSv/h]	0.55	✓
TADR limit	[µSv/wk]	20.0	
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IAH limit	[µSv/h]	20.0	
IAH result	[µSv/h]	0.04	✓

Survey Point		SP4	
T		1.0	
IDR limit	[µSv/h]	25.0	
IDR result	[µSv/h]	0.02	✓
TADR limit	[µSv/wk]	20.0	
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IAH limit	[µSv/h]	20.0	
IAH result	[µSv/h]	1.29E-3	✓

Survey Point		SP5	
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TADR limit	[µSv/wk]	20.0	
TADR result	[µSv/wk]	4.23	✓
IAH limit	[µSv/h]	20.0	
IAH result	[µSv/h]	0.05	✓

Survey Point		SP12	
T		1.0	
IDR limit	[µSv/h]	25.0	
IDR result	[µSv/h]	2.89E-4	✓
TADR limit	[µSv/wk]	20.0	
TADR result	[µSv/wk]	1.61E-3	✓
IAH limit	[µSv/h]	20.0	
IAH result	[µSv/h]	1.93E-5	✓

Not for regulatory

Siemens Healthineers shall have no approval or other responsibility for this calculation. This calculation is not for regulatory or construction.

Survey Point		SP13	
T		1.0	
IDR limit	[µSv/h]	25.0	
IDR result	[µSv/h]	0.04	✓
TADR limit	[µSv/wk]	20.0	
TADR result	[µSv/wk]	0.22	✓
IAH limit	[µSv/h]	20.0	
IAH result	[µSv/h]	2.6E-3	✓

Survey Point		Door	
T		1.0	
IDR limit	[µSv/h]	25.0	
IDR result	[µSv/h]	3.35	✓
TADR limit	[µSv/wk]	20.0	
TADR result	[µSv/wk]	18.59	✓
IAH limit	[µSv/h]	20.0	
IAH result	[µSv/h]	0.22	✓

Not for regulatory

Siemens Healthineers shall have no approval or other responsibility for this calculation. This calculation is not for regulatory or construction.

Survey Point

Survey Point		SP1
Protection Zone		PZ1
Primary Leakage		True
Use Factor	U	0.25
Occupancy	T	1.0
Distance	d	7.57766
Scatter Angle	θ	0.0

Shielding Layer

Concrete	S_1	248.299	[cm]

Dose Calculation

IDR_{dose} (HL)	[µSv/h]	11.73
IDR_{dose} (PS)	[µSv/h]	0.2
IDR_{dose} (NL)	[µSv/h]	1.88E-8
IDR_{total}	**[µSv/h]**	**11.93**
IDR_{limit}	[µSv/h]	25.0
		✓

$TADR_{dose}$ (HL)	[µSv/wk]	8.15
$TADR_{dose}$ (PS)	[µSv/wk]	0.14
$TADR_{dose}$ (NL)	[µSv/wk]	5.23E-8
$TADR_{total}$	**[µSv/wk]**	**8.29**
$TADR_{limit}$	[µSv/wk]	20.0
		✓

IAH_{dose} (HL)	[µSv/h]	0.1
IAH_{dose} (PS)	[µSv/h]	1.69E-3
IAH_{dose} (NL)	[µSv/h]	6.27E-10
IAH_{total}	**[µSv/h]**	**0.1**
IAH_{limit}	[µSv/h]	20.0
		✓

Survey Point		SP2
Protection Zone		PZ1
Primary Leakage		False
Use Factor	U	1.0
Occupancy	T	1.0
Distance	d	6.89882
Scatter Angle	θ	23.0

Shielding Layer

Concrete	S_1	216.873	[cm]

Dose Calculation

IDR_{dose} (HL)	[µSv/h]	3.62E-3
IDR_{dose} (PS)	[µSv/h]	0.48
IDR_{dose} (NL)	[µSv/h]	7.12E-7
IDR_{total}	**[µSv/h]**	**0.48**
IDR_{limit}	[µSv/h]	25.0
		✓

$TADR_{dose}$ (HL)	[µSv/wk]	0.02
$TADR_{dose}$ (PS)	[µSv/wk]	2.67
$TADR_{dose}$ (NL)	[µSv/wk]	3.96E-6
$TADR_{total}$	**[µSv/wk]**	**2.69**
$TADR_{limit}$	[µSv/wk]	20.0
		✓

IAH_{dose} (HL)	[µSv/h]	2.41E-4
IAH_{dose} (PS)	[µSv/h]	0.03
IAH_{dose} (NL)	[µSv/h]	4.75E-8
IAH_{total}	**[µSv/h]**	**0.03**
IAH_{limit}	[µSv/h]	20.0
		✓

Not for regulatory

Siemens Healthineers shall have no approval or other responsibility for this calculation. This calculation is not for regulatory or construction.

Survey Point		SP3
Protection Zone		PZ1
Primary Leakage		False
Use Factor	U	1.0
Occupancy	T	1.0
Distance	d	6.90171
Scatter Angle	θ	23.0

Shielding Layer

Concrete	S_1	214.330	[cm]

Dose Calculation

IDR_{dose} (HL)	[µSv/h]	4.3E-3
IDR_{dose} (PS)	[µSv/h]	0.55
IDR_{dose} (NL)	[µSv/h]	9.4E-7
IDR_{total}	**[µSv/h]**	**0.55**
IDR_{limit}	[µSv/h]	25.0
		✓

$TADR_{dose}$ (HL)	[µSv/wk]	0.02
$TADR_{dose}$ (PS)	[µSv/wk]	3.04
$TADR_{dose}$ (NL)	[µSv/wk]	5.22E-6
$TADR_{total}$	**[µSv/wk]**	**3.07**
$TADR_{limit}$	[µSv/wk]	20.0
		✓

IAH_{dose} (HL)	[µSv/h]	2.87E-4
IAH_{dose} (PS)	[µSv/h]	0.04
IAH_{dose} (NL)	[µSv/h]	6.27E-8
IAH_{total}	**[µSv/h]**	**0.04**
IAH_{limit}	[µSv/h]	20.0
		✓

Survey Point		SP4
Protection Zone		PZ2
Primary Leakage		False
Use Factor	U	1.0
Occupancy	T	1.0
Distance	d	8.31849
Scatter Angle	θ	40.0

Shielding Layer

Concrete	S_1	196.561	[cm]

Dose Calculation

IDR_{dose} (HL)	[µSv/h]	9.86E-3
IDR_{dose} (PS)	[µSv/h]	9.48E-3
IDR_{dose} (NL)	[µSv/h]	4.54E-6
IDR_{total}	**[µSv/h]**	**0.02**
IDR_{limit}	[µSv/h]	25.0
		✓

$TADR_{dose}$ (HL)	[µSv/wk]	0.05
$TADR_{dose}$ (PS)	[µSv/wk]	0.05
$TADR_{dose}$ (NL)	[µSv/wk]	2.52E-5
$TADR_{total}$	**[µSv/wk]**	**0.11**
$TADR_{limit}$	[µSv/wk]	20.0
		✓

IAH_{dose} (HL)	[µSv/h]	6.57E-4
IAH_{dose} (PS)	[µSv/h]	6.32E-4
IAH_{dose} (NL)	[µSv/h]	3.03E-7
IAH_{total}	**[µSv/h]**	**1.29E-3**
IAH_{limit}	[µSv/h]	20.0
		✓

Not for regulatory

Siemens Healthineers shall have no approval or other responsibility for this calculation. This calculation is not for regulatory or construction.

Survey Point		**SP5**
Protection Zone		PZ5
Primary Leakage		False
Use Factor	U	1.0
Occupancy	T	1.0
Distance	d	10.96191
Scatter Angle	θ	75.0

Shielding Layer

Concrete	S_1	92.876	[cm]
Steel		0.518	[cm]
Borated PE (5%)		11.903	[cm]
Lead		13.973	[cm]
Steel		0.518	[cm]

Dose Calculation

IDR_{dose} (HL)	[µSv/h]	0.02
IDR_{dose} (PS)	[µSv/h]	3.52E-6
IDR_{dose} (NL)	[µSv/h]	9.01E-3
IDR_{total}	**[µSv/h]**	**0.03**
IDR_{limit}	[µSv/h]	25.0
		✓

$TADR_{dose}$ (HL)	[µSv/wk]	0.1
$TADR_{dose}$ (PS)	[µSv/wk]	1.96E-5
$TADR_{dose}$ (NL)	[µSv/wk]	0.05
$TADR_{total}$	**[µSv/wk]**	**0.15**
$TADR_{limit}$	[µSv/wk]	20.0
		✓

IAH_{dose} (HL)	[µSv/h]	1.14E-3
IAH_{dose} (PS)	[µSv/h]	2.35E-7
IAH_{dose} (NL)	[µSv/h]	6E-4
IAH_{total}	**[µSv/h]**	**1.74E-3**
IAH_{limit}	[µSv/h]	20.0
		✓

Survey Point		**SP6**
Protection Zone		PZ5
Primary Leakage		False
Use Factor	U	1.0
Occupancy	T	1.0
Distance	d	8.41144
Scatter Angle	θ	89.0

Shielding Layer

Concrete	S_1	89.732	[cm]
Concrete		89.732	[cm]

Dose Calculation

IDR_{dose} (HL)	[µSv/h]	0.03
IDR_{dose} (PS)	[µSv/h]	3.4E-5
IDR_{dose} (NL)	[µSv/h]	2.9E-5
IDR_{total}	**[µSv/h]**	**0.03**
IDR_{limit}	[µSv/h]	25.0
		✓

$TADR_{dose}$ (HL)	[µSv/wk]	0.17
$TADR_{dose}$ (PS)	[µSv/wk]	1.89E-4
$TADR_{dose}$ (NL)	[µSv/wk]	1.61E-4
$TADR_{total}$	**[µSv/wk]**	**0.17**
$TADR_{limit}$	[µSv/wk]	20.0
		✓

IAH_{dose} (HL)	[µSv/h]	2.05E-3
IAH_{dose} (PS)	[µSv/h]	2.26E-6
IAH_{dose} (NL)	[µSv/h]	1.93E-6
IAH_{total}	**[µSv/h]**	**2.05E-3**
IAH_{limit}	[µSv/h]	20.0
		✓

Not for regulatory

Siemens Healthineers shall have no approval or other responsibility for this calculation. This calculation is not for regulatory or construction.

Survey Point		SP7
Protection Zone		PZ4
Primary Leakage		False
Use Factor	U	1.0
Occupancy	T	1.0
Distance	d	7.45131
Scatter Angle	θ	35.0

Shielding Layer

Concrete	S_1	185.157	[cm]

Dose Calculation

IDR_{dose} (HL)	[µSv/h]	0.03
IDR_{dose} (PS)	[µSv/h]	0.03
IDR_{dose} (NL)	[µSv/h]	1.98E-5
IDR_{total}	**[µSv/h]**	**0.05**
IDR_{limit}	[µSv/h]	25.0
		✓

$TADR_{dose}$ (HL)	[µSv/wk]	0.15
$TADR_{dose}$ (PS)	[µSv/wk]	0.15
$TADR_{dose}$ (NL)	[µSv/wk]	1.1E-4
$TADR_{total}$	**[µSv/wk]**	**0.3**
$TADR_{limit}$	[µSv/wk]	20.0
		✓

IAH_{dose} (HL)	[µSv/h]	1.77E-3
IAH_{dose} (PS)	[µSv/h]	1.79E-3
IAH_{dose} (NL)	[µSv/h]	1.32E-6
IAH_{total}	**[µSv/h]**	**3.56E-3**
IAH_{limit}	[µSv/h]	20.0
		✓

Survey Point		SP8
Protection Zone		PZ4
Primary Leakage		True
Use Factor	U	0.25
Occupancy	T	1.0
Distance	d	7.06284
Scatter Angle	θ	0.0

Shielding Layer

Concrete	S_1	248.185	[cm]

Dose Calculation

IDR_{dose} (HL)	[µSv/h]	13.59
IDR_{dose} (PS)	[µSv/h]	0.23
IDR_{dose} (NL)	[µSv/h]	2.19E-8
IDR_{total}	**[µSv/h]**	**13.82**
IDR_{limit}	[µSv/h]	25.0
		✓

$TADR_{dose}$ (HL)	[µSv/wk]	9.44
$TADR_{dose}$ (PS)	[µSv/wk]	0.16
$TADR_{dose}$ (NL)	[µSv/wk]	6.09E-8
$TADR_{total}$	**[µSv/wk]**	**9.6**
$TADR_{limit}$	[µSv/wk]	20.0
		✓

IAH_{dose} (HL)	[µSv/h]	0.11
IAH_{dose} (PS)	[µSv/h]	1.95E-3
IAH_{dose} (NL)	[µSv/h]	7.31E-10
IAH_{total}	**[µSv/h]**	**0.12**
IAH_{limit}	[µSv/h]	20.0
		✓

Not for regulatory

Siemens Healthineers shall have no approval or other responsibility for this calculation. This calculation is not for regulatory or construction.

Survey Point		SP9
Protection Zone		PZ4
Primary Leakage		False
Use Factor	U	1.0
Occupancy	T	1.0
Distance	d	7.40143
Scatter Angle	θ	35.0

Shielding Layer

Concrete	S_1	183.918	[cm]

Dose Calculation

IDR_{dose} (HL)	[µSv/h]	0.03
IDR_{dose} (PS)	[µSv/h]	0.03
IDR_{dose} (NL)	[µSv/h]	2.29E-5
IDR_{total}	**[µSv/h]**	**0.06**
IDR_{limit}	[µSv/h]	25.0
		✓

$TADR_{dose}$ (HL)	[µSv/wk]	0.16
$TADR_{dose}$ (PS)	[µSv/wk]	0.17
$TADR_{dose}$ (NL)	[µSv/wk]	1.27E-4
$TADR_{total}$	**[µSv/wk]**	**0.33**
$TADR_{limit}$	[µSv/wk]	20.0
		✓

IAH_{dose} (HL)	[µSv/h]	1.95E-3
IAH_{dose} (PS)	[µSv/h]	1.98E-3
IAH_{dose} (NL)	[µSv/h]	1.53E-6
IAH_{total}	**[µSv/h]**	**3.94E-3**
IAH_{limit}	[µSv/h]	20.0
		✓

Survey Point		SP10
Protection Zone		PZ3
Primary Leakage		False
Use Factor	U	1.0
Occupancy	T	1.0
Distance	d	5.33305
Scatter Angle	θ	89.0

Shielding Layer

Concrete	S_1	147.801	[cm]

Dose Calculation

IDR_{dose} (HL)	[µSv/h]	0.65
IDR_{dose} (PS)	[µSv/h]	2.01E-3
IDR_{dose} (NL)	[µSv/h]	2.32E-3
IDR_{total}	**[µSv/h]**	**0.66**
IDR_{limit}	[µSv/h]	25.0
		✓

$TADR_{dose}$ (HL)	[µSv/wk]	3.62
$TADR_{dose}$ (PS)	[µSv/wk]	0.01
$TADR_{dose}$ (NL)	[µSv/wk]	0.01
$TADR_{total}$	**[µSv/wk]**	**3.64**
$TADR_{limit}$	[µSv/wk]	20.0
		✓

IAH_{dose} (HL)	[µSv/h]	0.04
IAH_{dose} (PS)	[µSv/h]	1.34E-4
IAH_{dose} (NL)	[µSv/h]	1.55E-4
IAH_{total}	**[µSv/h]**	**0.04**
IAH_{limit}	[µSv/h]	20.0
		✓

Not for regulatory

Siemens Healthineers shall have no approval or other responsibility for this calculation. This calculation is not for regulatory or construction.

Survey Point		SP11
Protection Zone		PZ7
Primary Leakage		True
Use Factor	U	0.25
Occupancy	T	1.0
Distance	d	6.52490
Scatter Angle	θ	0.0

Shielding Layer

Concrete	S_1	250.026	[cm]
Earth (1.5g/cm3)		26.615	[cm]

Dose Calculation

IDR_{dose} (HL)	[µSv/h]	5.98
IDR_{dose} (PS)	[µSv/h]	0.1
IDR_{dose} (NL)	[µSv/h]	1.13E-9
IDR_{total}	**[µSv/h]**	**6.08**
IDR_{limit}	[µSv/h]	25.0
		✓

$TADR_{dose}$ (HL)	[µSv/wk]	4.15
$TADR_{dose}$ (PS)	[µSv/wk]	0.07
$TADR_{dose}$ (NL)	[µSv/wk]	3.15E-9
$TADR_{total}$	**[µSv/wk]**	**4.23**
$TADR_{limit}$	[µSv/wk]	20.0
		✓

IAH_{dose} (HL)	[µSv/h]	0.05
IAH_{dose} (PS)	[µSv/h]	8.51E-4
IAH_{dose} (NL)	[µSv/h]	3.78E-11
IAH_{total}	**[µSv/h]**	**0.05**
IAH_{limit}	[µSv/h]	20.0
		✓

Survey Point		SP12
Protection Zone		PZ7
Primary Leakage		False
Use Factor	U	1.0
Occupancy	T	1.0
Distance	d	6.32498
Scatter Angle	θ	30.0

Shielding Layer

Concrete	S_1	173.600	[cm]
Earth (1.5g/cm3)		142.850	[cm]

Dose Calculation

IDR_{dose} (HL)	[µSv/h]	1.78E-4
IDR_{dose} (PS)	[µSv/h]	1.11E-4
IDR_{dose} (NL)	[µSv/h]	1.54E-11
IDR_{total}	**[µSv/h]**	**2.89E-4**
IDR_{limit}	[µSv/h]	25.0
		✓

$TADR_{dose}$ (HL)	[µSv/wk]	9.9E-4
$TADR_{dose}$ (PS)	[µSv/wk]	6.18E-4
$TADR_{dose}$ (NL)	[µSv/wk]	8.53E-11
$TADR_{total}$	**[µSv/wk]**	**1.61E-3**
$TADR_{limit}$	[µSv/wk]	20.0
		✓

IAH_{dose} (HL)	[µSv/h]	1.19E-5
IAH_{dose} (PS)	[µSv/h]	7.42E-6
IAH_{dose} (NL)	[µSv/h]	1.02E-12
IAH_{total}	**[µSv/h]**	**1.93E-5**
IAH_{limit}	[µSv/h]	20.0
		✓

Not for regulatory

Siemens Healthineers shall have no approval or other responsibility for this calculation. This calculation is not for regulatory or construction.

Survey Point		**SP13**
Protection Zone		PZ7
Primary Leakage		False
Use Factor	U	1.0
Occupancy	T	1.0
Distance	d	6.25355
Scatter Angle	θ	29.0

Shielding Layer

Concrete	S_1	171.639	[cm]
Earth (1.5g/cm3)		135.898	[cm]

Dose Calculation

IDR_{dose} (HL)	[µSv/h]	2.82E-4
IDR_{dose} (PS)	[µSv/h]	0.04
IDR_{dose} (NL)	[µSv/h]	4.17E-11
IDR_{total}	**[µSv/h]**	**0.04**
IDR_{limit}	[µSv/h]	25.0
		✓

$TADR_{dose}$ (HL)	[µSv/wk]	1.57E-3
$TADR_{dose}$ (PS)	[µSv/wk]	0.21
$TADR_{dose}$ (NL)	[µSv/wk]	2.32E-10
$TADR_{total}$	**[µSv/wk]**	**0.22**
$TADR_{limit}$	[µSv/wk]	20.0
		✓

IAH_{dose} (HL)	[µSv/h]	1.88E-5
IAH_{dose} (PS)	[µSv/h]	2.58E-3
IAH_{dose} (NL)	[µSv/h]	2.78E-12
IAH_{total}	**[µSv/h]**	**2.6E-3**
IAH_{limit}	[µSv/h]	20.0
		✓

Not for regulatory

Siemens Healthineers shall have no approval or other responsibility for this calculation. This calculation is not for regulatory or construction.

Survey Point		Door
Protection Zone		PZ Fully-Occupied Space
Primary Leakage		False
Use Factor	U	1.0
Occupancy	T	1.0
Distance	d	7.94195
Scatter Angle	θ	71.0

Maze Wall

Concrete	S_1	94.515	[cm]

Door Materials

Steel	S_1	[cm]	0.5000 cm
Borated PE (5%)	S_2	[cm]	11.5000 cm
Lead	S_3	[cm]	13.5000 cm
Steel	S_4	[cm]	0.5000 cm

Dose Calculation

IDR_{dose} Photon	[µSv/h]	0.63
IDR_{dose} Neutron	[µSv/h]	2.71
IDR_{total}	[µSv/h]	3.35
IDR_{limit}	[µSv/h]	25
		✓

$TADR_{dose}$ Photon	[µSv/wk]	3.52
$TADR_{dose}$ Neutron	[µSv/wk]	15.07
$TADR_{total}$	[µSv/wk]	18.59
$TADR_{limit}$	[µSv/wk]	20
		✓

IAH_{dose} Photon	[µSv/h]	0.04
IAH_{dose} Neutron	[µSv/h]	0.18
IAH_{total}	[µSv/h]	0.22
IAH_{limit}	[µSv/h]	20
		✓

Not for regulatory

Siemens Healthineers shall have no approval or other responsibility for this calculation. This calculation is not for regulatory or construction.