



Designers' Desk Reference

TrueBeam STx Edition

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VOL. 13, No. 4

THIS EDITION IS VALID FOR
PLANNING PURPOSES OR FOR
CONSTRUCTION STARTS BETWEEN
1 JULY AND 18 OCTOBER 2013

Introduction to the Varian Designers' Desk Reference (DDR)

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Designers' Desk Reference, TrueBeam STx Edition

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Version	Issue Date	eSign Workflow #
Vol. 10, No. 1	N/A	
Vol. 10, No. 2	N/A	
Vol. 10, No. 3	N/A	
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Vol. 11, No. 1	N/A	
Vol. 11, No. 2	January 1, 2011	Manual
Vol. 11, No. 3	May 26, 2011	Manual
Vol. 11, No. 4	July 2, 2011	Manual
Vol. 12, No. 1	October 17, 2011	Manual
Vol. 12, No. 2	January 3, 2012	Manual
Vol. 12, No. 3	April 2, 2012	Manual
Vol. 12, No. 4	July 2, 2012	Manual
Vol. 13, No. 1	October 1, 2012	Manual
Vol. 13, No. 2	January 2, 2013	#23933048
Vol. 13, No. 3	April 1, 2013	#26942910

List of Revisions

For revisions prior to those listed below, please contact your Varian Planning Manager.

Item #	Version	Section	Page #	Revision	Remarks
176	Vol. 13, No. 1	2.1	2-1	Added shielding warning note	All radiation shielding designs must meet codes and regulations of all Authorities Having Jurisdiction and must be approved by the Customer's or Facility's Physicist of Record and shall be the sole responsibility of the Customer/Facility

List of Revisions

Item #	Version	Section	Page #	Revision	Remarks
177	Vol. 13, No. 1	3	3-1	Figure 3-1: Updated Treatment Room Overview, Sample Set-up	Revised drawing to reflect new ExacTrac 6.0 requirements, (2) ETX Generator Cabinets and new conduit requirements
178	Vol. 13, No. 1	3.2	3-5	Figure 3-2: Updated Typical TrueBeam STx Conduit Diagram (Plan View)	Revised drawing to show ceiling mount microphone (recommended location)
179	Vol. 13, No. 1	3.2	3-5	Figure 3-2: Added "optional" to the PAVS system	The PAVS system is an option and not standard equipment included with the TrueBeam
180	Vol. 13, No. 1	3.2	3-5	Figure 3-2: Removed "CCTV" from the Live View (Radiation Hardened) camera	
181	Vol. 13, No. 1	3.2	3-7	Figure 3-3: Added "optional" to the PAVS system	The PAVS system is an option and not standard equipment included with the TrueBeam
182	Vol. 13, No. 1	3.2	3-7	Figure 3-3: Removed "CCTV" from the Live View (Radiation Hardened) camera	
183	Vol. 13, No. 1	3.2	3-7	Figure 3-3: Added a note that the 2" (50) conduit from the Accessory pull box to the In-Room Monitor mounting bracket will contain the secondary microphone cable.	
184	Vol. 13, No. 1	3.2	3-7	Figure 3-3: Revised note about the Experimental (Physics) conduit	Revised from conduit termination's to conduit termination location.
185	Vol. 13, No. 1	3.2	3-9	Figure 3-4: Updated Typical ExacTrac Conduit Diagram (Plan View)	Revised drawing to reflect new ExacTrac 6.0 requirements, (2) ETX Generator Cabinets and new conduit requirements
186	Vol. 13, No. 1	3.2	3-11	Figure 3-5: Updated Typical ExacTrac Conduit Diagram (Section View)	Revised drawing to reflect new ExacTrac 6.0 requirements, (2) ETX Generator Cabinets and new conduit requirements
187	Vol. 13, No. 1	3.2	3-13	Figure 3-6: Updated Typical Composite TrueBeam STx Conduit Diagram (Section View)	Revised drawing to reflect new ExacTrac 6.0 requirements, (2) ETX Generator Cabinets and new conduit requirements
188	Vol. 13, No. 1	3.4	3-17	Figure 3-9: Updated Dual X-Ray Generator Cabinets	Added new photo of the ETX Generator Cabinets

Item #	Version	Section	Page #	Revision	Remarks
189	Vol. 13, No. 1	3.4	3-17	Table 3-1: Revised the general requirements of the ETX Generator Cabinets	The recommended maximum distance between the two Generator Cabinets is 16'-0" (5m) but can be up to 65'-0" (20m) with Brainlab approval. Main power and control data input only connects to Generator Cabinet 1 (X-ray tube 1 connects to generator 1, X-ray tube 2 connects to generator 2).
190	Vol. 13, No. 1	3.4	3-17	Table 3-1: Added new overall dimensions to the Dual Generator Cabinets	Each Cabinet is: 21 3/4" x 21 3/4" x 59 1/2" (550 x 550 x 1510)
191	Vol. 13, No. 1	3.4	3-17	Table 3-1: clarified the service and cable access areas for the Dual Generator Cabinets	
192	Vol. 13, No. 1	3.4	3-17	Table 3-1: Updated the configuration weights for the Dual Generator Cabinets	Dual Generator without pre-transformer 706 lbs. (320 kg), Dual Generator with pre-transformer 208V-400V 860 lbs. (390 kg), Dual Generator with pre-transformer 420/440/480V-400V 816 lbs. (370 kg), Dual Generator with pre-transformer Delta 200/210/220208V-Star 400V 1,014 lbs. (460 kg), Single Cabinet without pre-transformer 353 lbs. (160 kg)
193	Vol. 13, No. 1	3.4	3-17	Table 3-1: Added note for fixation of rear panel to wall	Use wall anchors according to wall conditions and per local regulations (Contractor provided).
194	Vol. 13, No. 1	3.7	3-31	Figure 3-19: Updated the Interior Elevation - Component Location drawing	New layout reflects mounting locations the primary and secondary microphones
195	Vol. 13, No. 1	3.7	3-31	Figure 3-19: Added "optional" to the PAVS system	The PAVS system is an option and not standard equipment included with the TrueBeam
196	Vol. 13, No. 1	3.7	3-31	Figure 3-19: Removed "CCTV" from the Live View (Radiation Hardened) camera	
197	Vol. 13, No. 1	3.7.2.1	3-33	Figure 3-21: Updated the Typical CCTV System Diagram drawing	Removed power cables from the console cabinet to the CCTV displays and added the dedicated keyboard
198	Vol. 13, No. 1	3.7.2.1	3-33	Revised the note for mounting location when using a system with only two CCTV cameras	Changed the note to make it Mandatory to locate the cameras in the Primary position as shown in Figure 3-22
199	Vol. 13, No. 1	3.7.3	3-35	Figure 3-23: Updated the Treatment Room, Speaker, Microphone and Live View Camera drawing	New layout reflects mounting locations the primary and secondary microphones

Item #	Version	Section	Page #	Revision	Remarks
200	Vol. 13, No. 1	3.7.3	3-35	Removed "CCTV" from the Live View (Radiation Hardened) camera	
201	Vol. 13, No. 1	3.7.3.1	3-35	Added Dedicated Ground Wire note for Microphone when mounted below 8'-2 1/2" (2500)	Provide one 18 AWG (1.0mm ²) ground or earthing wire from the Microphone signal pull box to the accessory pull box
202	Vol. 13, No. 1	3.8.4.1	3-40	Revised the ETX System X-Ray Generator ventilation requirement in standby mode	Changed from "0.17 kW (587 Btu/hr)" to "0.25 kW (853 Btu/hr)"
203	Vol. 13, No. 1	3.9.2	3-43	Added shielding warning note	All radiation shielding designs must meet codes and regulations of all Authorities Having Jurisdiction and must be approved by the Customer's or Facility's Physicist of Record and shall be the sole responsibility of the Customer/Facility
204	Vol. 13, No. 1	3.12.1	3-52	Figure 3-33: Added requirement that the recess surface of the floor box must be level	
205	Vol. 13, No. 1	3.12.2	3-53	Figure 3-34: Updated Recommended Position of Recess layout	Added a horizontal dimension from Isocenter to the center back of the floor box (53 3/4" +1/2" [1366 +14])
206	Vol. 13, No. 1	3.12.3	3-54	Figure 3-36: Updated External Dimensions for 12" Floor Box, Back View	Revised the height dimension of the floor box changed from "12" (305)" to "11 7/8" (301)"
207	Vol. 13, No. 1	3.12.4	3-55	Figure 3-37: Added note to 3D Overview of ExacTrac 12" Floor Box with Cable Outlet	Added - The Floor Boxes are delivered with leveling feet for fine adjustment
208	Vol. 13, No. 1	3.12.5	3-56	Figure 3-38: Updated Positioning of Floor Boxes layout	Added notes for the outline of the concrete recess and the floor box
209	Vol. 13, No. 1	3.13.1	3-58	Table 3-5: Revised weight and safety factor requirements for the Infrared Camera and Flat Panel Detector Systems	Changed the weight from "55 lbs. (25 kg)" to "110 lbs. (50 kg)" and changed the safety factor from "220 lbs. (100 kg)" to "440 lbs. (200 kg)"
210	Vol. 13, No. 1	3.13.1.1	3-59	Figure 3-39: Revised Recommended Maximum Ceiling Heights layout	Changed the mounting height of Monitor Arm from "13' - 7 3/8" (4150)" to "13'-11" (4250) max." and changed the Suspended Ceiling height from "9' - 10 1/2" (3015)" to "10'-1" (3095) max."
211	Vol. 13, No. 1	3.13.2.1	3-66	Figure 3-44: Updated the Force and Moment Diagram (for Structural Analysis) layout	No Changes

Item #	Version	Section	Page #	Revision	Remarks
212	Vol. 13, No. 1	3.13.2.1	3-67	Figure 3-45: Updated the Dimensions of Ceiling and Interface Plate layout	No Changes
213	Vol. 13, No. 1	3.14.3	3-76	Revised the ETX Warning Lights System to include two options	Option “A” is the current system with (2) Brainlab provided ETX warning lights. Option “B” is an alternative system with customer provided warning lights
214	Vol. 13, No. 1	3.14.4	3-78	Removed entire section on optional Video Feedback System for Gating	
215	Vol. 13, No. 1	3.14.4.1	3-79	Clarified the mounting location for the External Bluetooth Module	Added that the Bluetooth Module can be mounted to the wall at 8'-10" (2700)
216	Vol. 13, No. 1	3.14.4.1	3-79	Added the main power requirement and size and weight specifications for the External Bluetooth Module	100Vac to 240Vac/ 47-63Hz @ 10W minimum; Size and weight: 3 1/2" x 1 3/4" x 1 1/4" (90 x 45 x 32), 0.25 lbs. (0.1kg)
217	Vol. 13, No. 1	3.14.4.1	3-79	Changed the type of connection cable for the External Bluetooth Module	Changed from 'serial extension cable and a 6'-6" (2000) Null-Modem cable' to “crossover cable”
218	Vol. 13, No. 1	3.14.4.1	3-79	Changed the maximum distance the battery charger for the External Bluetooth Module can be located from the treatment couch	Changed from “9'-8" (3000)” to “19'-0" (6000)”
219	Vol. 13, No. 1	3.14.4.1	3-79	Removed note calling for standard duplex receptacle 12" (306) from the External Bluetooth Module	
220	Vol. 13, No. 1	3.14.5	3-80	Figure 3-58: Replaced Control Room Workspace photo	
221	Vol. 13, No. 1	3.14.5	3-80	Table 3-14: Reduced the required space for the Control Room Workspace	Changed from “40" (1000)' to '28" (700)”
222	Vol. 13, No. 1	3.14.5	3-80	Table 3-14: Added a row recommending the location for the Control Room Workspace	The ExacTrac Workspace and the TrueBeam workspace should be as close as possible in the Control Area to allow smooth integrated workflows for the operators
223	Vol. 13, No. 1	4.1.4	4-5	Figure 4-1: Updated Grounding/Earthing Conductor Diagram layout	Revised drawing to show ceiling mount microphone (recommended location)
224	Vol. 13, No. 1	4.1.4	4-5	Figure 4-1: Revised Section reference for Microphone grounding	Changed from “see Figure 3-19 and Section 3.5.3 for details” to “see Figure 3-19, Figure 3-23, and Section 3.7.3.1 for details”

Item #	Version	Section	Page #	Revision	Remarks
225	Vol. 13, No. 1	4.3	4-14	Table 4-3: Revised the Input Voltage requirements for the ExacTrac X-Ray Generator Power	The HFe Generator without pre-transformer can be directly connected to: [400 V AC star TN] - The TN star network provides all five required lines L1, L2, L3, N, PE that must be connected (400V phase to phase and 230V neutral to phase). IT and TT power systems do not provide the solid Neutral line and will cause generator damage. Brainlab provides two pre-transformers if a TN network is present, but the voltage differs from 400V: [208V AC star TN], [420V/440V/460V AC star TN] and one pre-transformer for a special delta power network: [208V AC delta (for Japan mainly)]
226	Vol. 13, No. 1	4.3	4-14	Table 4-3: Changed the Slow Blow Fuse amperage for the ExacTrac X-Ray Generator Power	Changed from “420V/440V/480V @ 70A” to “420V/440V/480V @ 50A”
227	Vol. 13, No. 1	4.3	4-14	Table 4-3: Removed the 380 V maximum line regulation requirement for the ExacTrac X-Ray Generator Power	
228	Vol. 13, No. 1	4.3	4-14	Table 4-3: Revised the Standby power consumption for the ExacTrac X-Ray Generator Power	Changed from “0.05 VA” to “0.15 kVA”
229	Vol. 13, No. 1	4.4	4-16	Changed Section Title	Changed from “Computer Cabinet Subsystem” to “ExacTrac Computer Cabinet Subsystem”
230	Vol. 13, No. 1	4.4.4	4-17	Replaced System Emergency Power Off with new Section for ExacTrac System Interlocks	
231	Vol. 13, No. 1	4.4.4.1	4-18	Added new Section for ExacTrac Emergency-Off Interlock Inputs	
232	Vol. 13, No. 1	4.4.4.2	4-19	Added new Section for External Universal Emergency-Off Interlock Input (Emergency-Stop)	
233	Vol. 13, No. 1	4.4.4.3	4-20	Added new Section for Varian Emergency-Off Interlock Input (Emergency-Stop)	
234	Vol. 13, No. 1	4.4.4.4	4-21	Added new Section for System Power Emergency-Off Installation (Emergency-Off)	

Item #	Version	Section	Page #	Revision	Remarks
235	Vol. 13, No. 1	4.4.4.5	4-21	Added new Section for ExacTrac System Door Contact Interlock	
236	Vol. 13, No. 1	4.5.1	4-23	Figure 4-4: Updated PEQ Schematic ETX/NB System layout	Revised drawing to reflect new ExacTrac 6.0 grounding requirements
237	Vol. 13, No. 1	5.1	5-1	Figure 5-1: Added note for Dedicated Keyboard	
238	Vol. 13, No. 1	5.1	5-3	Figure 5-2: Revised note for Dedicated Keyboard	Changed from “Control Console” to “Dedicated Keyboard”
239	Vol. 13, No. 1	5.1	5-5	Figure 5-3: Revised note for Dedicated Keyboard	Changed from “Control Console” to “Dedicated Keyboard”
240	Vol. 13, No. 2	1.1	1-1	Changed “non-Flattening Filter Free (FFF) Mode” to “High Intensity Mode (HIM)”	
241	Vol. 13, No. 2	1.1	1-1	Changed “FFF Mode” to “HIM”	
242	Vol. 13, No. 2	3.8.4.1	3-40	Revised the air heat load for the ExacTrac System X-Ray On	Changed from “0.1 kW (341 Btu/hr) at X-ray Generator during X-ray On” to “0.4 kW (1365 Btu/hr) at X-ray Generator during X-ray On”
243	Vol. 13, No. 2	3.8.4.1	3-40	Revised the air heat load for the ExacTrac System Computer Cabinet	Changed from “0.41 kW (1386 Btu/hr) at Computer Cabinet during all States” to “0.5 kW (1706 Btu/hr) Computer Cabinet and IR System Components in all States”
244	Vol. 13, No. 2	3.8.4.1	3-40	Removed the air heat load for the ExacTrac System X-Ray Tube during X-Ray On	
245	Vol. 13, No. 2	3.9.2	3-43	Changed “Flattening Filter Free (FFF) Mode” to “High Intensity Mode (HIM)”	
246	Vol. 13, No. 2	3.9.2	3-43	Changed “FFF Mode” to “HIM”	
247	Vol. 13, No. 2	3.9.2	3-43	Changed “1500 rads/min for the 6MV” to “1400 rads/min for the 6MV”	
248	Vol. 13, No. 2	3.9.2	3-43	Changed “3000 rads/min for the 10MV” to “2400 rads/min for the 10MV”	
249	Vol. 13, No. 2	3.14.4.1	3-79	Added “crossover cable” text	
250	Vol. 13, No. 2	4.4.4.3	4-20	Changed “J55” to J15”	
251	Vol. 13, No. 3	Back of Cover		Removed download link for AutoCAD DWG files	

List of Revisions

Item #	Version	Section	Page #	Revision	Remarks
252	Vol. 13, No. 3	Back of Cover		Updated the Planning Department Contact Web site link	
253	Vol. 13, No. 3	1.2	1-3	Updated the Planning Department Contact Web site link	
254	Vol. 13, No. 3	2.4	2-11	Figure 2-4: Corrected the dimension from isocenter to target	Changed from “3’-3” (991)” to “3’-3 3/8” (1000)”
255	Vol. 13, No. 3	3.2	3-13	Figure 3-6: Changed from “(4)-4” (100) C” to “(3)-4” (100) C”	
256	Vol. 13, No. 3	3.7.3	3-35	Corrected section reference number	Changed from “See “Dedicated Ground Wire – Microphone(s)” on page 3-35 for details.” to “Section 3.7.3.1”
257	Vol. 13, No. 3	3.15.1	3-82	Figure 3-61: Revised the furring note	Changed to “Wall furring shall not overlap steel plate. Steel plate minimum dimensions exceed laser dimensions to allow for adjustment during installation.”
258	Vol. 13, No. 3	3.15.1	3-82	Figure 3-61: Removed note “Each laser consumes 25W”	Replaced with “See Figure 4-5”
259	Vol. 13, No. 3	3.15.1	3-83	Figure 3-62: Corrected figure reference number	Changed from “Figure 3-30” to “Figure 3- 61”
260	Vol. 13, No. 3	3.15.1	3-83	Figure 3-62: Removed note “Each laser consumes 25W”	Replaced with “See Figure 4-5”
261	Vol. 13, No. 3	3.15.1	3-83	Figure 3-62: Revised decorative cover note	Changed to “Decorative/protective laser recess cover (by Customer) must allow full access to recess. Do not allow the cover to contact the laser when closed. Locate and drill laser beam hole in cover after laser has been installed.”
262	Vol. 13, No. 3	3.15.1	3-84	Figure 3-63: changed “expansion shields” to “expansion anchors” and from “anchor” to “secure”	
263	Vol. 13, No. 3	3.15.1	3-84	Figure 3-63: Removed note “Laser output”	
264	Vol. 13, No. 3	3.15.1	3-84	Figure 3-63: Revised decorative cover note.	Changed to “Decorative/protective laser recess cover (by Customer) must allow full access to recess. Do not allow the cover to contact the laser when closed. Locate and drill laser beam hole in cover after laser has been installed.”
265	Vol. 13, No. 3	3.15.1	3-84	Figure 3-63: Removed note “Each laser consumes 25W”	Replaced with “See Figure 4-5”
266	Vol. 13, No. 3	3.15.2	3-85	Figure 3-64: Corrected figure reference number	Changed from “Figure 3-30” to “Figure 3- 61”

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267	Vol. 13, No. 3	3.15.2	3-85	Figure 3-64: Removed note "Each laser consumes 25W"	Replaced with "See Figure 4-5"
268	Vol. 13, No. 3	3.15.3	3-86	Figure 3-65: Removed note "Each laser consumes 25W"	Replaced with "See Figure 4-5"
269	Vol. 13, No. 3	3.15.3	3-86	Figure 3-65: Revised the furring note	Changed to "Wall furring shall not overlap steel plate. Steel plate minimum dimensions exceed laser dimensions to allow for adjustment during installation."
270	Vol. 13, No. 3	3.15.3	3-86	Figure 3-65: Corrected figure reference numbers	Changed from "Figure 3-31 and Figure 3- 32" to "Figure 3-62 and Figure 3-63"
271	Vol. 13, No. 3	4.6.2	4-27	Revised laser power consumption	Changed from "Each laser consumes 25W" to "(see Figure 4-5). Each laser can consume up to 25W, varies per manufacturer."
272	Vol. 13, No. 3	5.1	5-7	Figure 5-4: Updated ARIA Treatment Workstation Elevation	Removed uninterruptible power supply
273	Vol. 13, No. 3	5.6	5-15	Figure 5-10: Changed from "see section 3.4" to "see section 3.6" and from "see section 3.10" to "see section 3.15"	
274	Vol. 13, No. 3	5.6	5-15	Figure 5-10: Updated Typical Reflected Ceiling Plan	Changed from "11'-6" (3505)" to "To Rear Wall"
275	Vol. 13, No. 4	Back of Cover		Added Trademark and Copyright text	TrueBeam, Clinac, Calypso, Acuity, and ARIA are trademarks or registered trademarks of Varian Medical Systems, Inc. These and/or other Varian Medical Systems Inc.'s products referenced herein are either registered trademarks or trademarks of Varian Medical Systems in the U.S. and/or other countries. The names of other companies and products mentioned herein may be the trademarks of their respective owners. Any rights not expressly granted herein are reserved. © 1999-2013 Varian Medical Systems, Inc. All rights reserved. Reproduction of any of the material contained herein in any format or media without the express written permission of Varian Medical Systems is prohibited.
276	Vol. 13, No. 4	2.1	2-1	Moved shielding warning note to beginning of section	
277	Vol. 13, No. 4	Multiple		Removed "Optional Facade Panels" from the TrueBeam STx Stand and Gantry in all layouts	Updated the following Figures: 2-1, 2-2, 2-4, 2-5, 2-6, 3-1, 3-2, 3-3, 3-5, 3-6, 3-29,

List of Revisions

Item #	Version	Section	Page #	Revision	Remarks
278	Vol. 13, No. 4	2.3	2-5	Figure 2-2: Revised the Figure reference for the speakers	Changed from “shown in Figure 3-18” to “shown in Figure 3-19”
279	Vol. 13, No. 4	2.3	2-5	Figure 2-2: Revised the installation reference for the CCTV and Live View Cameras	Changed to “see section 3.7”
280	Vol. 13, No. 4	2.3	2-5	Figure 2-2: Removed duplicate note about the two side lasers positioning lights being located at isocenter height.	
281	Vol. 13, No. 4	3.9	3-42	Moved shielding warning note to beginning of section	
282	Vol. 13, No. 4	3.9.2	3-43	Reversed the order of units for allowed radiation dose	Changed from “2 mrem/week (20 μ Sv/week)” to “20 μ Sv/week (2 mrem/week)”
283	Vol. 13, No. 4	3.9.3	3-44	Added equivalent Tesla unit to Gauss magnetic field limit	Changed to “linear accelerators and simulators should be located outside of the 100 μ T (1 Gauss) magnetic field created by the MRI.”
284	Vol. 13, No. 4	3.15.1	3-82	Figure 3-61: Updated the Side Laser Mounting Details (Recessed in Wall) - Elevation View layout	No Changes
285	Vol. 13, No. 4	3.15.3	3-86	Figure 3-65: Updated the Sagittal Laser Mounting Details (Recessed in Wall) - Elevation View layout	No Changes
286	Vol. 13, No. 4	4.2.2.1	4-11	Revised the TrueBeam Main Disconnect Panel. VWB Series specifications	Changed the weight from “155 pounds (70.3 kg)” to “179 lbs. (81.1 kg)” and removed the Main lug wires #3/0 max. note
287	Vol. 13, No. 4	4.2.2.5	4-13	Revised the GEXPRO contact phone number and hours	Changed to “Available from GEXPRO, Indianapolis, Indiana at (800) 279-7925, 7:30 a.m. to 5:00 p.m. U.S. Central Standard Time (Monday - Friday).”
288	Vol. 13, No. 4	4.6	4-25	Figure 4-5: Revised the Interconnection Wiring Diagram In-Room safety devices emergency-off and contacts	Changed EM01, EM02, EM03, and EM04 contacts from displayed as normally open to normally closed
289	Vol. 13, No. 4	4.6	4-25	Figure 4-5: Revised the Interconnection Wiring Diagram In-Room safety devices resistor ratings	Changed the Resistor #1-#4 values to 42.2 Ω , 84.5 Ω , 169 Ω , and 340 Ω
290	Vol. 13, No. 4	4.6.4.7	4-29	Added note to see Figure 4-5	
291	Vol. 13, No. 4	5.1	5-1	Figure 5-1: Corrected section reference number	Changed from “Section 4.1.5” to “Section 4.1.6”

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292	Vol. 13, No. 4	5.1	5-3	Figure 5-2: Corrected section reference number	Changed from “Section 4.1.5” to “Section 4.1.6”
293	Vol. 13, No. 4	5.1	5-5	Figure 5-3: Corrected section reference number	Changed from “Section 4.1.5” to “Section 4.1.6”
294	Vol. 13, No. 4	5.1	5-7	Figure 5-4: Corrected section reference number	Changed from “Section 4.1.5” to “Section 4.1.6”
295	Vol. 13, No. 4	5.6	5-15	Figure 5-10: Updated the Typical Reflected Ceiling Plan layout	Added BL ExacTrac ceiling mounted components (touch screen monitor and flat panel detectors)

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The dual energy TrueBeam STx™ is a high-end accelerator product that includes a combination of Varian and Brainlab products and options. It offers a fully configurable accelerator positioned for the stereotactic radiosurgery (SRS) and Stereotactic Body Radiotherapy (SBRT) markets.

Novalis Radiosurgery components are manufactured by Brainlab and are a standard option available on the TrueBeam STx Linear Accelerator. ExacTrac X-ray (ExacTrac) provides room-based image-guided targeting capability. Two kV X-ray tubes recessed into the floor and two ceiling-mounted amorphous silicon flat panel detectors enable imaging of internal structures or implanted markers in order to calculate and correct pitch and roll deviations between the current and planned target position.

1.1 Technical Key Features

TrueBeam STx Accelerator

- Multiple Full Field (40 x 40) Photon Energy Accelerator @ 600 MU/min in High Intensity Mode (HIM).
- High Intensity Mode Beams 6MV @ 1400 MU/min in HIM and 10MV @ 2400MU/min in HIM with HD MLC.
- Full range of Photon and Electron Energy options.
- Standard or High Definition 120 Leaf MLC.
 - Standard Definition 120 leaf MLC with 5mm leaves for the central 20cm and 10mm leaves for the external 10cm on each side. Maximum field size of 40 x 40 for fixed field and 32 x 40 for IMRT.
 - Optional High Definition 120 leaf MLC with 2.5 mm leaves for the central 8cm and 5mm leaves for the external 7cm on each side. Maximum field size of 22 x 40 for fixed field and 22 x 32 for IMRT.
- Integrated MV Portal Imaging system with 1024 x 768 resolution.
- Fine Beam .5mm radius Isocenter (Gantry/Collimator), .75mm radius Isocenter (Gantry/Collimator/Couch).
- Exact Couch.
- 4D Integrated Treatment Console.
- Klystron Driven system.
- Triode Electron gun enabling advanced capabilities such as gating of radiation beam during delivery.

Note: Additional items may be required to perform this capability.



Integrated Imaging

- Gantry mounted Oil cooled kV X-ray tube and Amorphous Silicon Imaging panel.
- Robotic arms allowing both in room and console area control for retracting imaging system and moving into position.
- Radiographic Mode: Allowing Stereoscopic Imaging including Marker matching mode.
- Cone Beam CT: 3D Imaging with full 3D Volumetric Matching Capabilities.
- Allowing sub-cGy volumetric Cone Beam CT acquisition in both full (360 degrees) and half rotation (200 degrees) modes.
- Fluoroscopic Mode: Allowing Pre-treatment Fluoro verification of treatment field.

ExacTrac X-ray System (ETX)

- Two X-ray Tubes recessed into the Linac room floor.
- Two ceiling-mounted amorphous silicon Flat Panel detectors.
- Ceiling-mounted Infrared and Video Camera System.
- Ceiling-mounted Touch Screen Monitor for convenient handling (optional).
- Control room workspace with X-ray control console.
- 65kW X-ray Generator with integrated transformer unit.
- Compact-sized Computer Cabinet for computer, power supplies, electrical safety devices, control electronics and excess cables.
- Interface box for automatic couch movement attached to the couch.
- Linac Interface Box to allow communication with Linac for synchronized Beam On/Beam Off with patient breathing motion (optional).
- Patient Video Feedback Tool for gated treatment (optional).
- Tilt alignments of targeting volume possible via ExacTrac Robotics (optional).

This document provides essential information and detailed descriptions about the TrueBeam STx's installation requirements.



Note: Varian highly recommends you read this document prior to the baseframe and pre-installation kit delivery. To ensure a simple and timely system installation, several pre-working/pre-assembly steps must be accomplished. It is also very important to inform Varian of all information regarding the hospital's electrical and spatial conditions.

Appendix A, "TrueBeam STx Pre-Installation Checklist" includes a checklist that you can use to ensure that all listed requirements are completed and finalized.

1.2 Supported Accelerator Models

This Designer's Desk Reference (DDR) TrueBeam STx Edition describes equipment facility requirements for the TrueBeam STx High Energy medical linear accelerator:



Note: This DDR does not apply to Clinac 2100C/D, Clinac 2300C/D, Clinac 21EX, Clinac 23EX, Clinac iX, Silhouette, Novalis Tx, Novalis Tx Silhouette, or Trilogy.

For unsupported accelerators, as described above, please contact your Regional Planning Manager or Varian's Global Planning Department for the appropriate planning documents at:

Varian Medical Systems
Planning Group, Site Solutions – Services
660 N. McCarthy Blvd., Milpitas, CA 95035
Phone: (800) 278-2747
Direct: (408) 232-4231
Fax: (408) 232-4230
Email: planning@varian.com
www.varian.com/us/oncology/services_and_support/architectural_planning/contact.html

1.3 TrueBeam STx Installation Timeline Description

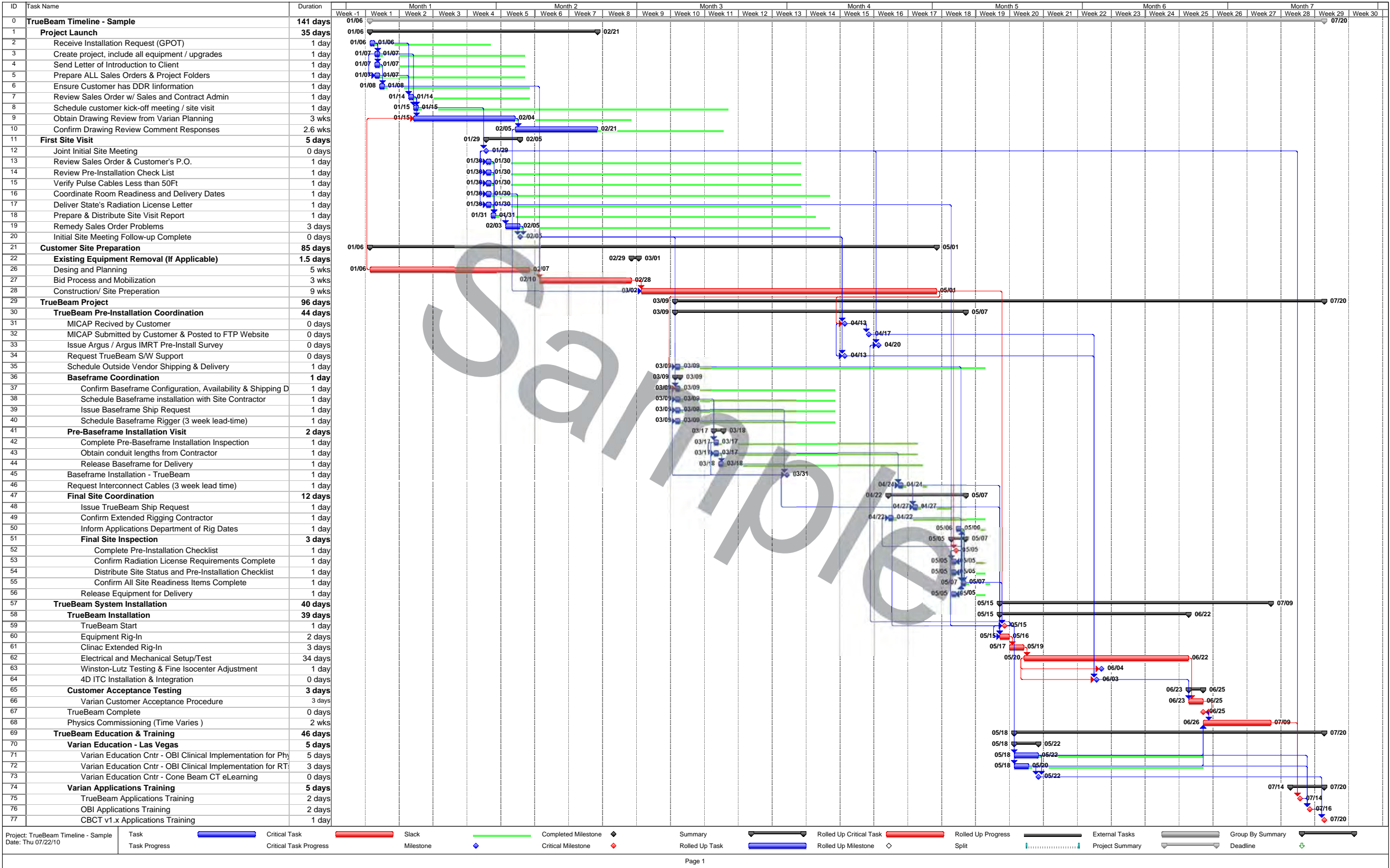
While the TrueBeam STx includes subsystems from separate companies, Varian Medical Systems and Brainlab teams work together, in close synchronization, to deliver and install the TrueBeam STx accelerator with the Novalis Radiosurgery components. The TrueBeam STx installation currently takes 6 weeks from Delivery and Rig-In through completion of the Accelerator, the SRS, and, if included, the ExacTrac Customer Acceptance Procedures. The installation process **cannot** be split based on its subsystems.

The Installation Product Acceptance (IPA) for the TrueBeam STx will begin no later than the 5th week, barring unforeseen conditions, and will require full-time services of the site physicist.

The Sample timeline is based on the following assumptions and is in a *perfect world* scenario.

- The Design and Planning, Contract Bid and Mobilization, and Construction processes shall take 5 weeks, 3 weeks, and 9 weeks, respectively, after the placement of the TrueBeam STx accelerator order. Activities prior to order placement are not considered in this timeline.
- The accelerator rig date shall be no earlier than 120 days after the order initiation date. This is Varian's standard manufacturing lead time.
- The Baseframe shall be installed ~30 days prior to the accelerator rig date.

All pre-installation dates and considerations are individually scheduled by the Varian Project Manager, based on mutual agreement between the customer and project manager and communications with Varian Planning and Sales. The District Sales Manager will coordinate with the customer and the Varian Project Manager for a Configuration Confirmation Meeting or conference call. The Project Manager will engage the customer with regular communications throughout all phases of the project. In addition, the Project Manager typically performs site visits to help answer questions and observe construction progress. Site visits are commonly held for the Initial Site Meeting/Project Kickoff, the Baseframe Pre-Installation Inspection or the Baseframe installation, and the Construction Completion/Pre-Installation Final Inspection. This final visit typically occurs 10-14 days prior to the rig date to verify 100% completion as defined by the TrueBeam STx Final Checklist.



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Chapter 2 General System Information

2.1 Typical Room Shielding Tables

The shielding values found in these tables were based on the assumptions shown in “[Radiation Shielding Details](#)” on page 3-42. For more information on shielding, also see “[Other Shielding Information](#)” on page 3-44.



WARNING: Varian Medical Systems shall have no approval or other responsibility for any matter affecting or related to the adequacy of the radiation protection walls and barriers or related safety devices. All radiation shielding designs must meet codes & regulations of all Authorities Having Jurisdiction (AHJ) and must be approved by the Customer's or Facility's Physicist of Record and shall be the sole responsibility of the Customer/Facility. The hours of operation, patient workload, accelerator energy, and the shielding materials should all be taken in to consideration when calculating shielding requirements.

Table 2-1 Typical Shielding for Standard Procedures

Primary Barrier	4MV	6MV	8MV	10 MV	15 MV	18 MV	20 MV
At 100% occupancy	66 (1676)	75 (1905)	84 (2134)	86 (2184)	91 (2311)	93 (2362)	96 (2438)
At 10% occupancy	53 (1346)	62 (1575)	70 (1778)	72 (1829)	75 (1905)	78 (1981)	80 (2032)
Secondary Barrier							
At 100% occupancy	30 (762)	33 (838)	39 (991)	40 (1016)	43 (1092)	43 (1092)	44 (1118)
At 10% occupancy	21 (533)	22 (559)	27 (686)	28 (711)	30 (762)	31 (787)	32 (813)
Note: Inches (mm) of 147 lbs./cu. ft. (2355 kg/cu. M) Concrete.							

Table 2-2 Typical Shielding for Standard Procedures with 50% IMRT of a Factor F=3

Secondary Barrier	4MV	6MV	8MV	10 MV	15 MV	18 MV	20 MV
At 100% occupancy	34 (864)	37 (940)	42 (1067)	43 (1092)	47 (1194)	47 (1194)	48 (1219)
At 10% occupancy	24 (610)	26 (660)	31 (787)	32 (813)	34 (864)	35 (889)	36 (914)
Note: Inches (mm) of 147 lbs./cu. ft. (2355 kg/cu. M) Concrete.							

Table 2-3 Typical Shielding for SRS Procedures with 20% IMRT of a Factor F=3

Primary Barrier		6MV	10 MV
At 100% occupancy		81 (2057)	92 (2337)
At 10% occupancy		68 (1727)	77 (1956)
Secondary Barrier			
At 100% occupancy		40 (1016)	46 (1168)
At 10% occupancy		29 (737)	35 (889)
Note: Inches (mm) of 147 lbs./cu. ft. (2355 kg/cu. M) Concrete.			

Table 2-4 Concrete to Lead and Steel Ratios

		4 MV	6 MV	8MV	10 MV	15 MV	18 MV	20 MV
Steel	Primary Barrier	3.5	3.7	3.8	4.0	4.0	4.1	4.2
	Secondary Barrier	3.2	3.5	3.6	3.6	3.8	3.8	3.9
Lead	Primary Barrier	6.1	6.5	7.0	7.2	7.7	7.9	8.1
	Secondary Barrier	5.4	6.2	6.3	6.6	7.0	7.0	7.0
Note: Inches (mm) of 147 lbs./cu. ft. (2355 kg/cu. M) Concrete Equal to Inches (mm) of Lead/Steel.								

Table 2-5 Tenth Value Layer (TVL) for Concrete vs. X-Ray Energy

	4 MV	6 MV	8 MV	10 MV	15 MV	18 MV	20 MV
Primary Beam X-Rays	11.4 (290)	13.5 (343)	14.3 (363)	15.3 (389)	17.0 (432)	17.5 (455)	18.0 (457)
Leakage X-Rays (90°)	10.0 (254)	11.0 (279)	11.5 (292)	12.0 (305)	13.0 (330)	13.0 (330)	13.5 (343)
Note: Inches (mm) of 147 lbs./cu. ft. (2355 kg/cu. M) Concrete.							

Table 2-6 Typical Minimum TrueBeam STx Room Door Shielding

	4 MV	6 MV	8 MV	10 MV	15 MV	18 MV	20 MV
Lead	1/8 (3)	1/8 (3)	1/4 (6)	1/4 (6)	n/a	n/a	n/a
Wood	2 (51)	2 (51)	3 (76)	3 (76)	n/a	n/a	n/a
Lead	n/a	n/a	n/a	n/a	1/4 (6)	3/4 (19)	3/4 (19)
5% Borated Polyethylene	n/a	n/a	n/a	n/a	3 (76)	4 (102)	5 (127)
Steel-Both Sides	n/a	n/a	n/a	n/a	1/4 (6)	1/4 (6)	1/4 (6)
Note: Thickness in Inches (mm).							

Table 2-7 Quality of X-Ray Beams (BJR 11 vs. BJR 17 Values)

X-Ray Energy (MV)							
BJR 11 Value	4	6	8	10	15	18	20
BJR 17 Value	4	6	8	10	16	23	25
Note: % of Primary X-Ray Dose at Isocenter.							

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2.2 Typical Room Isometric View

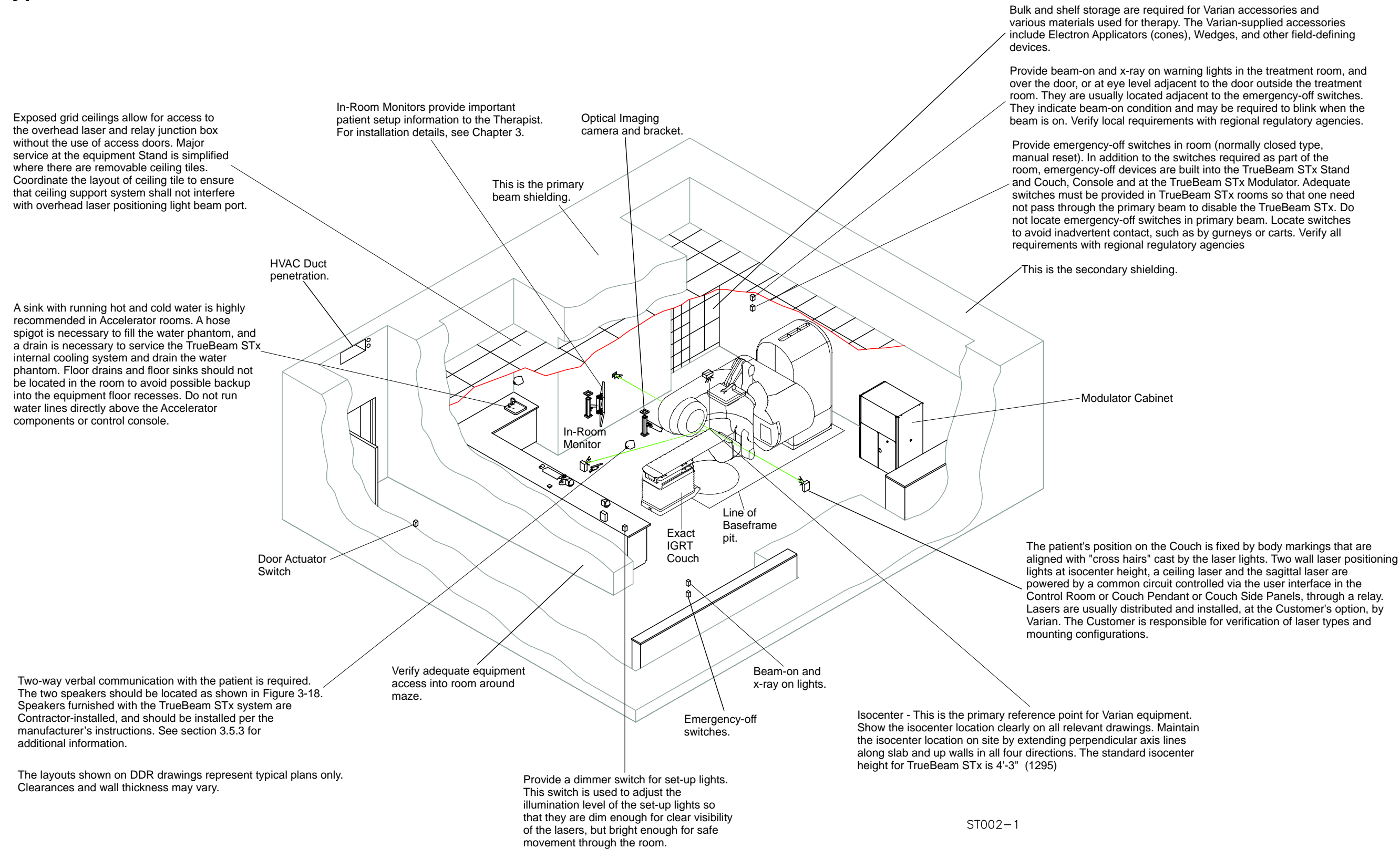


Figure 2-1 Typical Room Isometric View

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2.3 Typical Room Configuration

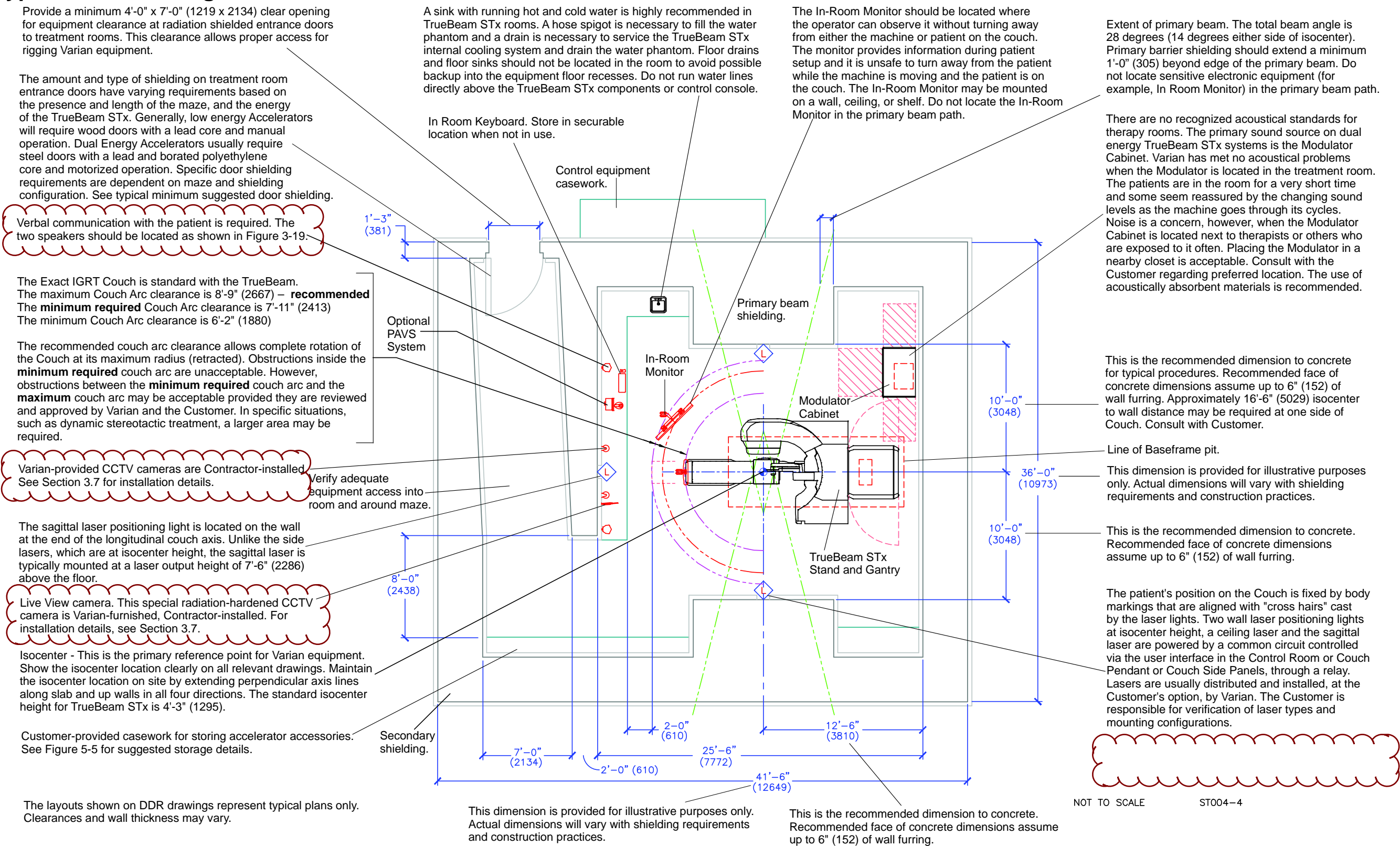
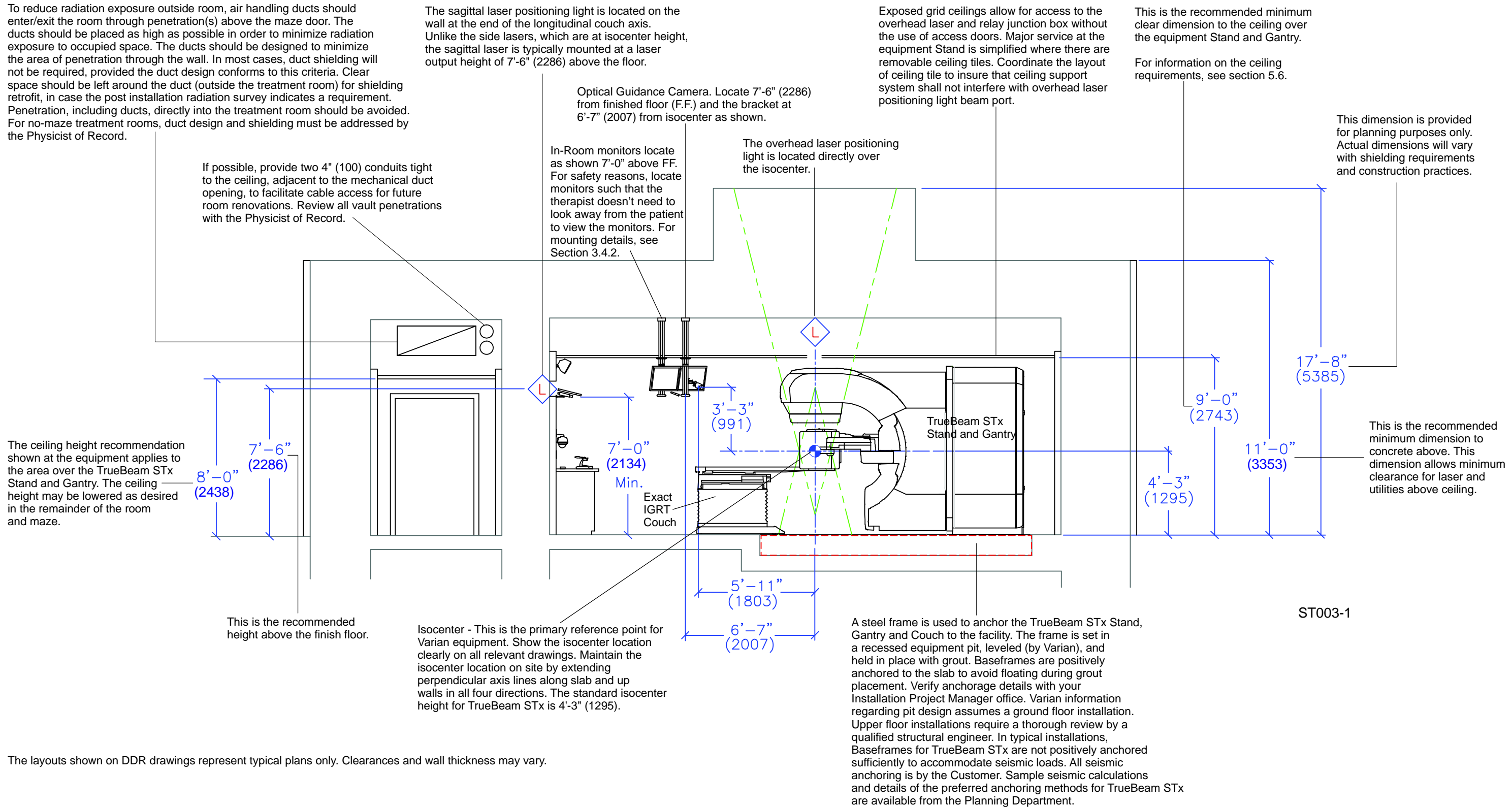


Figure 2-2 Typical Room Plan View

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The layouts shown on DDR drawings represent typical plans only. Clearances and wall thickness may vary.

Figure 2-3 Typical Room Section

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2.4 Detail – Plan View

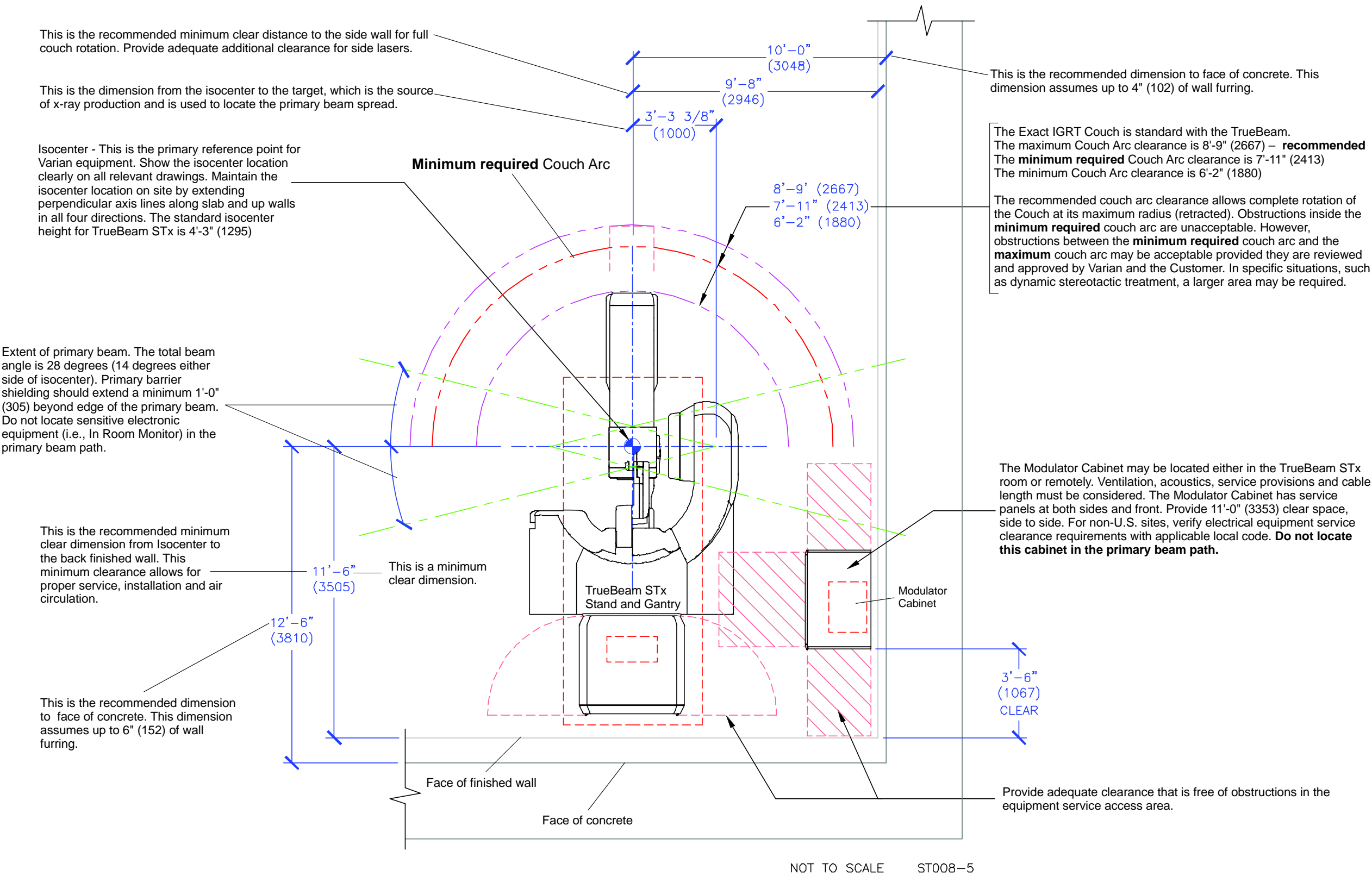


Figure 2-4 Plan View

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2.5 Detail – Elevations

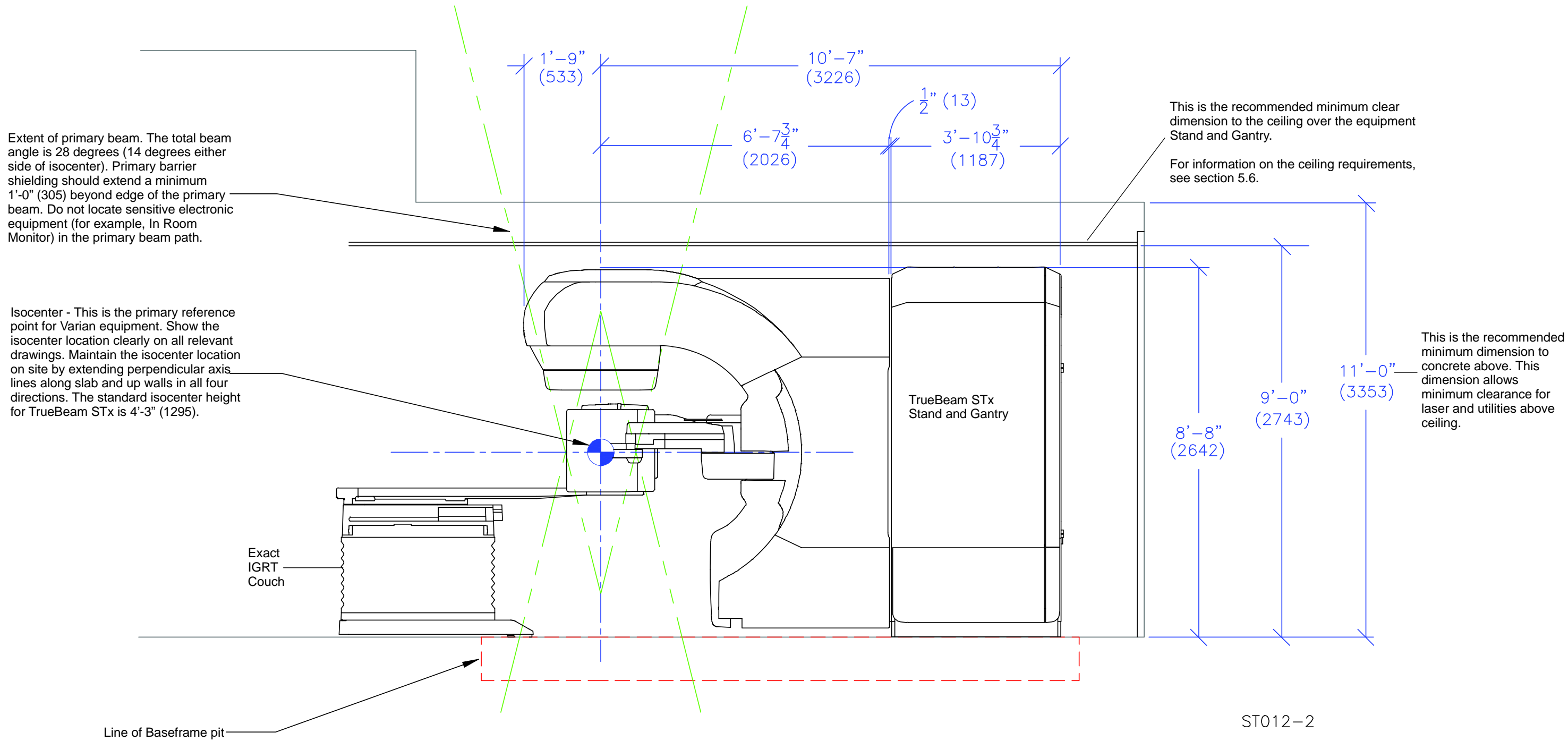


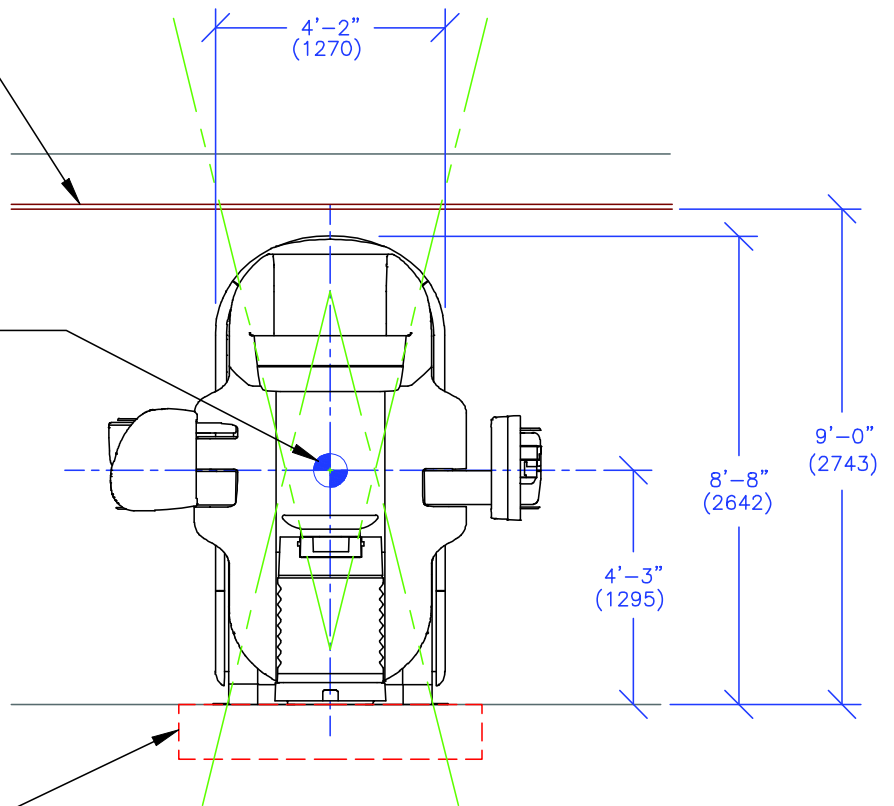
Figure 2-5 Side Elevation

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Exposed grid ceilings allow for access to the overhead laser and relay junction box without the use of access doors. Major service at the equipment Stand is simplified where there are removable ceiling tiles. Coordinate the layout of ceiling tile to insure that ceiling support system shall not interfere with overhead laser positioning light beam port.

Isocenter - This is the primary reference point for Varian equipment. Show the isocenter location clearly on all relevant drawings. Maintain the isocenter location on site by extending perpendicular axis lines along slab and up walls in all four directions. The standard isocenter height for the TrueBeam STx is 4'-3" (1295).

Line of Baseframe pit.



DO NOT SCALE

ST011-2

Figure 2-6 Front Elevation

2.6 Shipping/Rigging Dimension Clearances

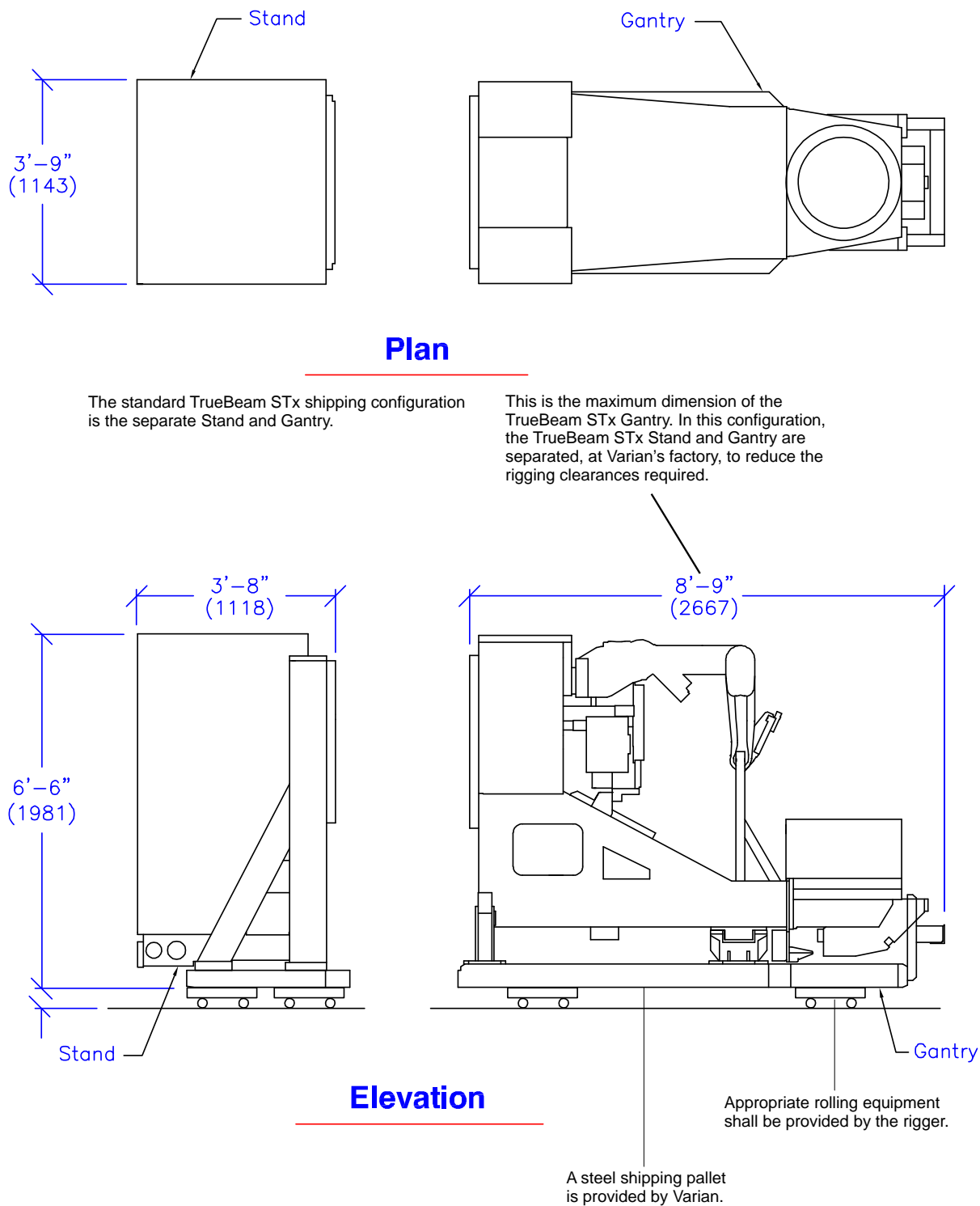
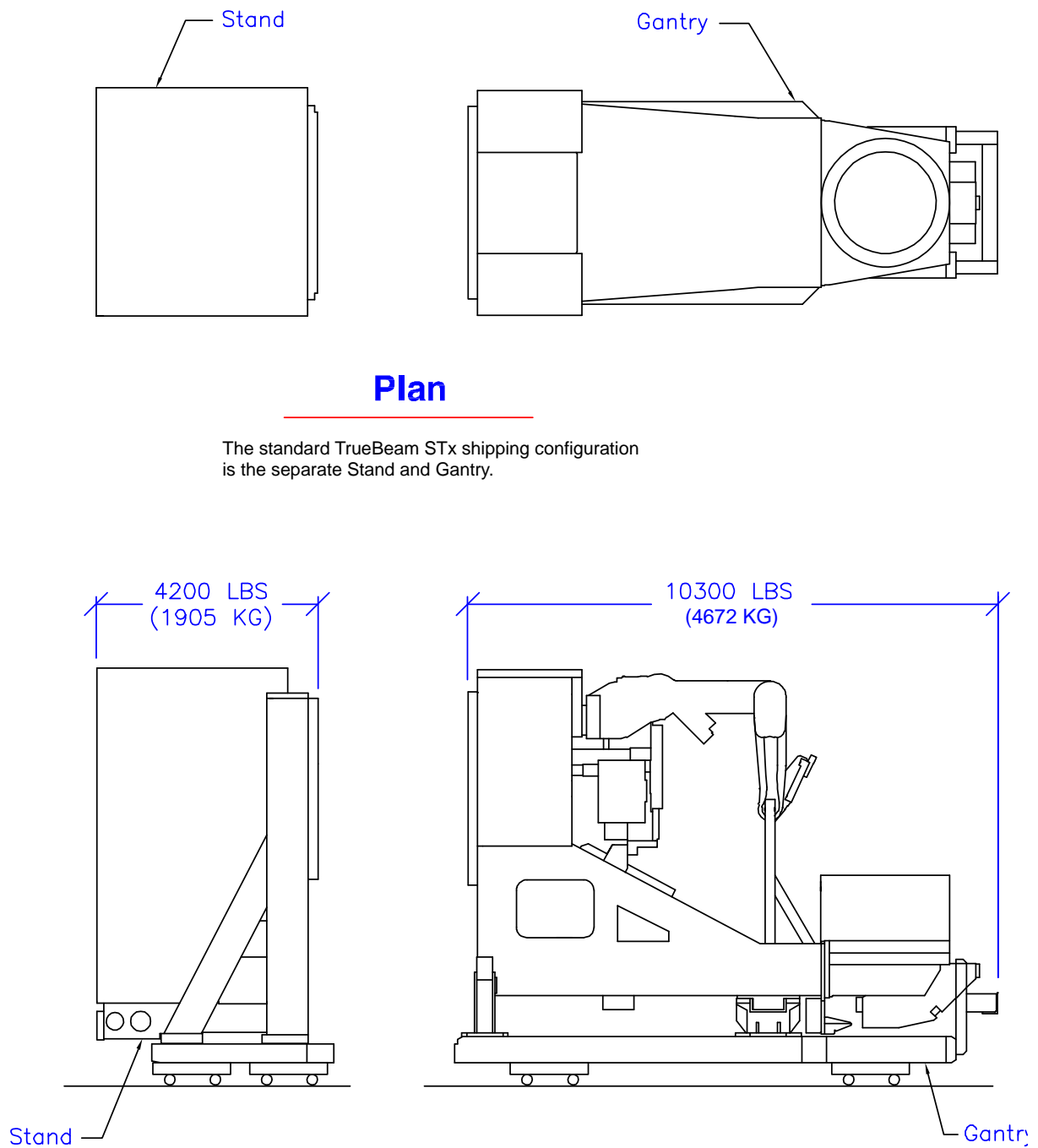


Figure 2-7 Shipping Configuration — Dimensions

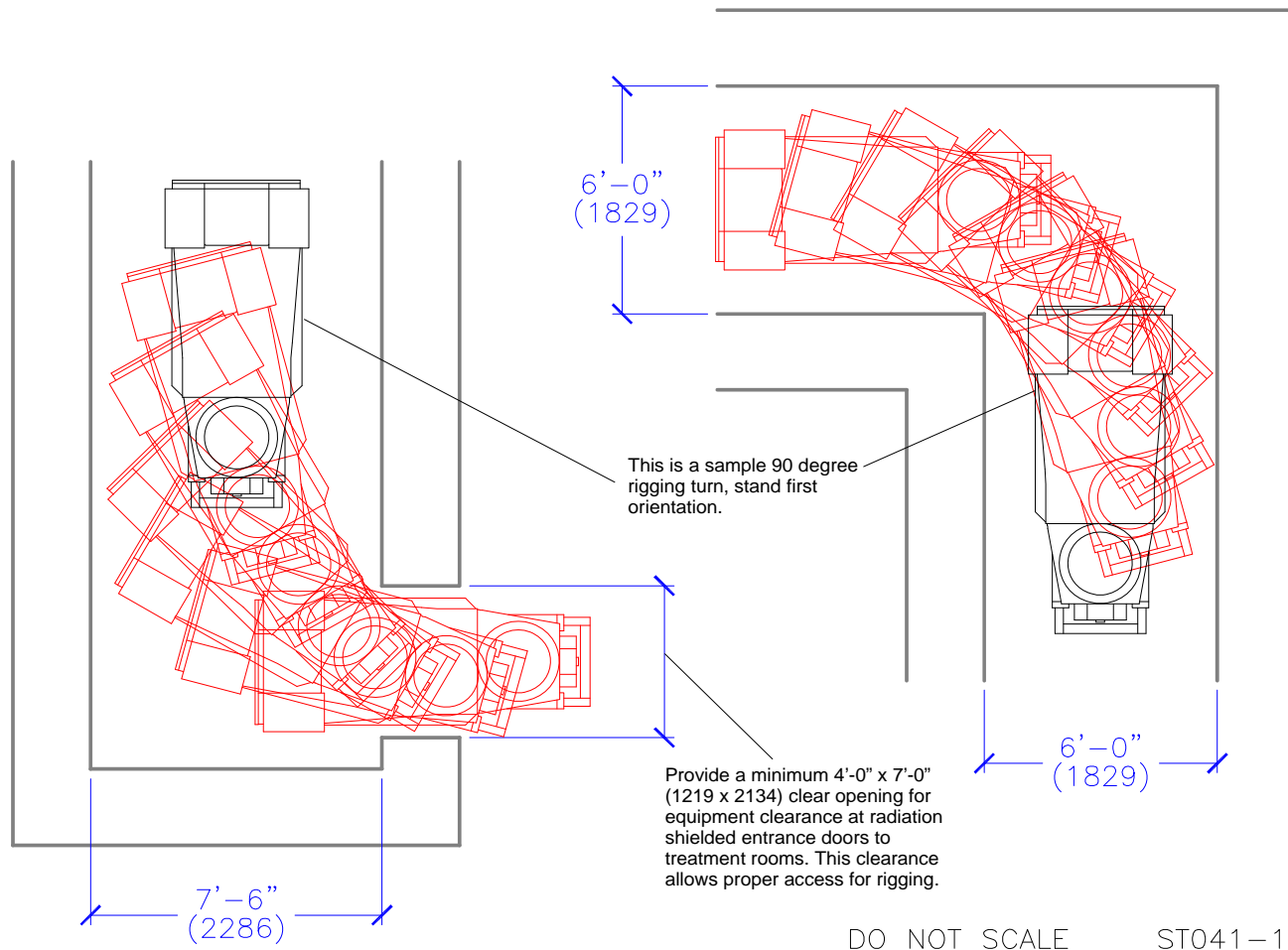


During installation, TrueBeam STx components must be stored in a secure area of about 250 square feet (23 square meters).

DO NOT SCALE

ST006-2

Figure 2-8 Shipping Configuration — Weights



Create an overlay sheet to simulate the Gantry rig clearances during the project planning stage. Use the DWG file to print the Gantry (in plan-view) onto a clear sheet of acetate to ensure scale accuracy.

Verify adequate equipment access into room and around maze.

The dimensions shown on the rig route details are to face of finish and represent minimum configurations only. Verify adequate rigging clearances for specific site using the Shipping Configuration drawing to create an overlay. If the templates cannot be easily rotated through the maze without wall obstruction, review by a qualified Rigger will be required. Varian will review the installation route upon request. Coordinate all rigging with the Installation Project Manager. Final confirmation of rig route clearances and review of adequate structural support along the route is the responsibility of the Customer and the Structural Engineer of Record.

Rigging is defined as the positioning of the Baseframe and Linear Accelerator components into the treatment room. The Baseframe is rigged prior to the rest of the equipment and delivery must be scheduled by the construction Contractor with the Installation Project Manager. As designated in the final Varian/Customer Terms and Conditions of Sale, a rigging company is hired by the Customer or Varian to off-load these items from the truck and to move them through the facility and into the treatment room. The Customer's architect and structural engineers shall review the entire rig route for adequate clearance and structural support. The work can include temporary demolition and shoring. Final equipment positioning is part of the rigging contract.

Figure 2-9 Minimum Rigging Clearances, Standard Factory Breakdown

Chapter 3 Facilities Requirements

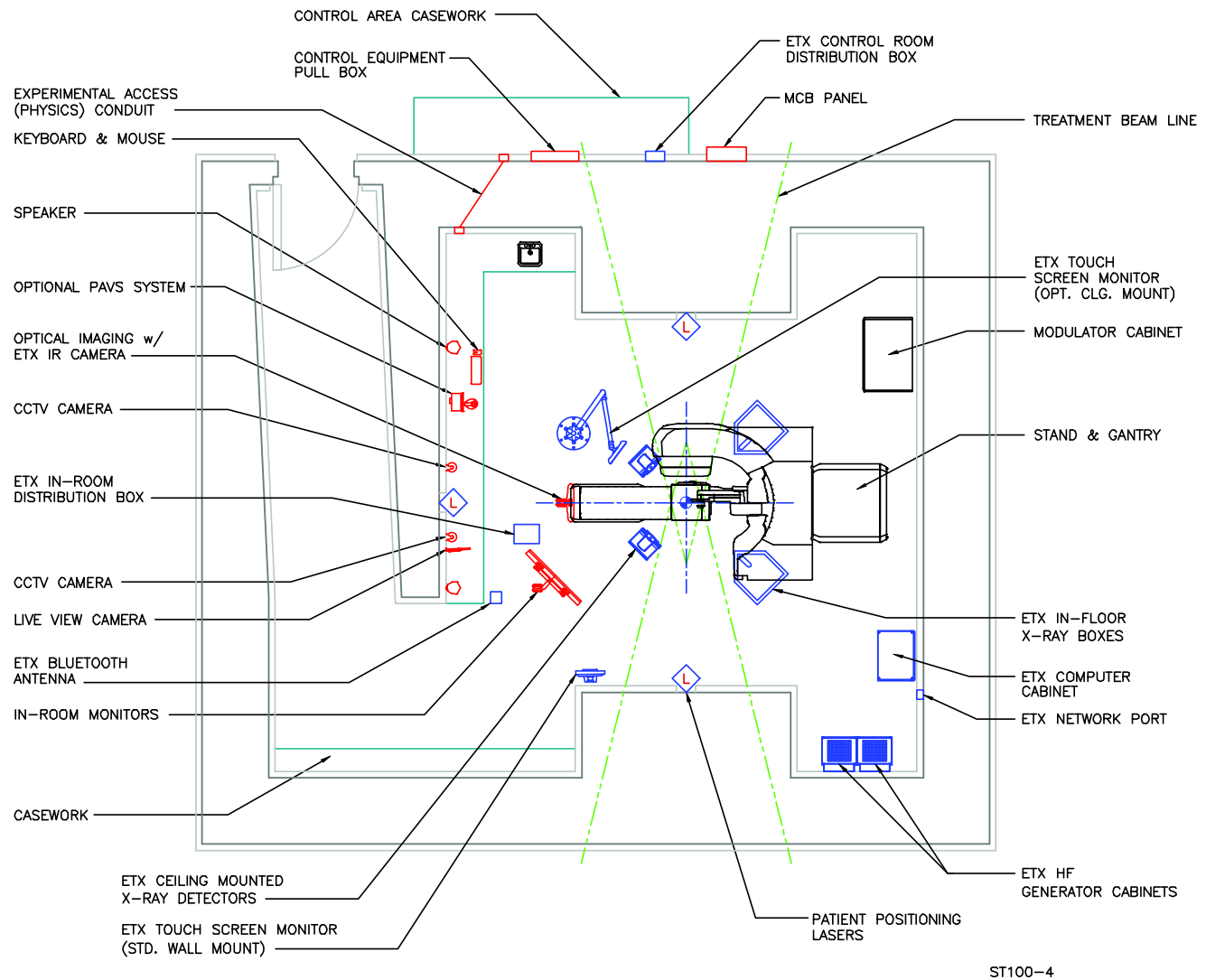


Figure 3-1 Treatment Room Overview, Sample Set-up

3.1 Cable Conduit/Ducts



CAUTION: The customer is responsible for permissibility of the installation at site with respect to applicable local or regional standards.

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

The customer must be aware that fire protection engineering aspects (plenum rating) may be affected when installing cables and system components.

- Ensure all components are placed so that the shortest cable length is sufficient.
- TrueBeam STx conduit runs must not exceed 75 feet (22,860), start to finish.
- All conduits run underground shall be dry and watertight. Therefore, all PVC pipes must be glued together, and metal conduits must be properly sealed.
- All conduits must be terminated with insulating bushings or similar means to protect cables from abrasion.

3.1.1 Pull/Junction Boxes

3.1.1.1 Control Equipment Pull Box

The Control Equipment pull box shall have a minimum size of 30" x 12" x 6" (750 x 300 x 150). This pull box may be wall mounted or accessed similar to details in [“Baseframe Cable Access Details” on page 3-49](#). Locate this pull box so that the free ends of cables are protected from physical damage and located within 5'-0" (1524) of the TrueBeam STx Electronics Cabinet.

3.1.1.2 Modulator Pull Box

The Modulator pull box is recessed into the floor slab and shall be 18" x 24" x 10" deep (450 x 600 x 250). As no connections are made at this location, many regulatory agencies allow a pull box to be formed within the concrete floor in lieu of requiring a metallic pull box. The size and location of the Modulator Pull Box is very specific, in order to ensure proper placement of the Modulator and Interconnect Cable access. See [“Major System Components – Modulator Cabinet” on page 3-15](#) for further details

3.1.1.3 Baseframe Pull Box

Conduit termination/cable access to the Baseframe (BF) is accomplished one of 3 methods:

1. Standard, recessed pull box below the BF pit
2. Alternative, surface-mounted pull box
3. Alternative, trough-accessible, grout-free junction area at the rear of the BF pit.

In methods 1 and 2 above, the BF pull box shall have a size of 12" x 24" x 10" deep (300 x 600 x 250). As no connections are made at this location, many regulatory agencies allow a pull box to be formed within the concrete BF pit floor in lieu of a metallic pull box. See [“Baseframe Cable Access Details” on page 3-49](#) for further details.

3.1.1.4 In-Room Monitor

Provide a signal pull box for the In-Room Monitor. This is a standard computer signal cable outlet. If the signal cables are to be recessed, provide a signal outlet and conduits from the in-room monitor to the Accessory Junction Box.

3.1.1.5 Accessory Pull Box

Provide a 24" x 18" x 6" (600 x 450 x 150) Junction Box. Locate above the finished ceiling space near the foot of the couch. Vertical-mounting, on a wall or suspended from the concrete ceiling, is recommended. This pull box serves as a collection/distribution point for the cable conduits between the control console and all ancillary accelerator subsystems, such as In-Room Monitor, Optical Imaging, Live View Camera, CCTV, Audio components, and so on. Consequently, excess cable will be coiled and stored at this location.

The Accessory Pull Box shall incorporate a #6-32 x 1" (M3.5 -0.7 x 25mm) screw stud, with lock washer and nut, to accommodate dedicated Ground or Earthing wires from multiple TrueBeam Subsystems. See [“Dedicated Grounding Requirements” on page 4-2](#) for additional details.

3.1.1.6 Relay Junction Box

The Relay Junction Box (RJB) is provided by Varian and is 20" x 16" x 6" (508 x 406 x 152). Wall mount this junction box above the acoustical tile ceiling. Service access to the RJB must be maintained so DO NOT locate the RJB directly above the TrueBeam Stand, Modulator Cabinet, or treatment room casework. See [Figure 3-2, Typical TrueBeam STx Conduit Diagram \(Plan View\)](#) for further details. Locate this junction box within 68'-0" (2076) of the Baseframe Pull Box.



WARNING: To prevent injury during installation and service, DO NOT locate the RJB directly above the TrueBeam Stand, Modulator Cabinet, or casework.

3.1.1.7 ExacTrac X-ray Computer Cabinet Pull Box (Optional)

The recommended size of the pull box for the Computer Cabinet is 16" x 16" x 12" (400 x 400 x 300). This item should be situated directly beneath the intended cabinet location.

3.1.1.8 ExacTrac X-ray Generator Pull Box (Optional)

The recommended size of the pull box for the X-ray Generator is 16" x 16" x 12" (400 x 400 x 300). This item should be situated directly beneath the intended cabinet location.

3.1.1.9 ExacTrac X-ray Tube Floor Box (Optional)

When the optional ExacTrac X-ray system is incorporated in the Novalis Tx, the use of two Varian-supplied X-ray Tube Floor Boxes is required. The preparation for and installation of the boxes must very precise, in order to ensure proper operation of the ExacTrac system. See [“Floor Boxes for ExacTrac X-ray Tubes”](#) on page 3-52 and consult with the Brainlab Project Manager for further details.

3.2 Cable Access Diagrams

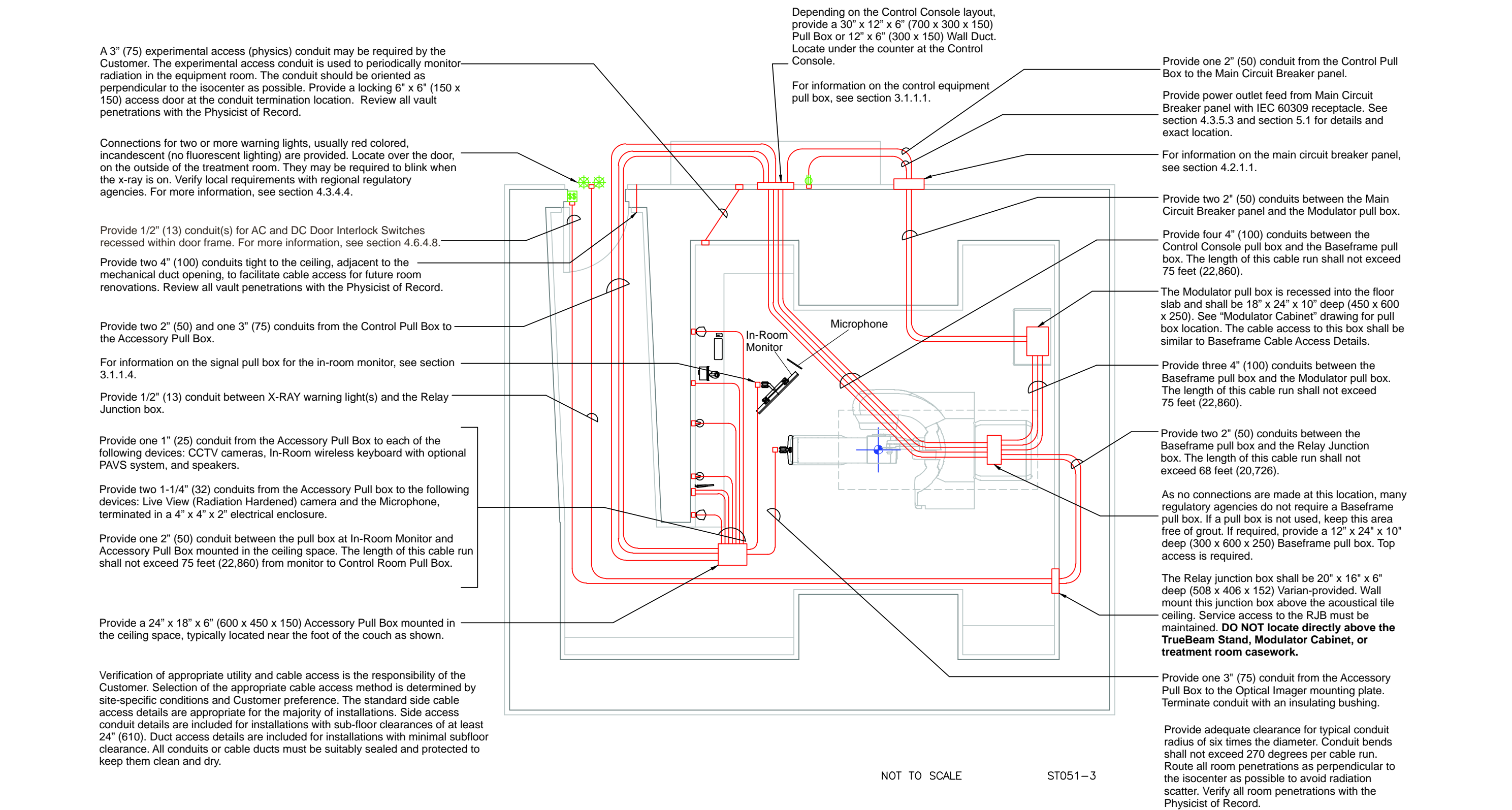


Figure 3-2 Typical TrueBeam STx Conduit Diagram (Plan View)

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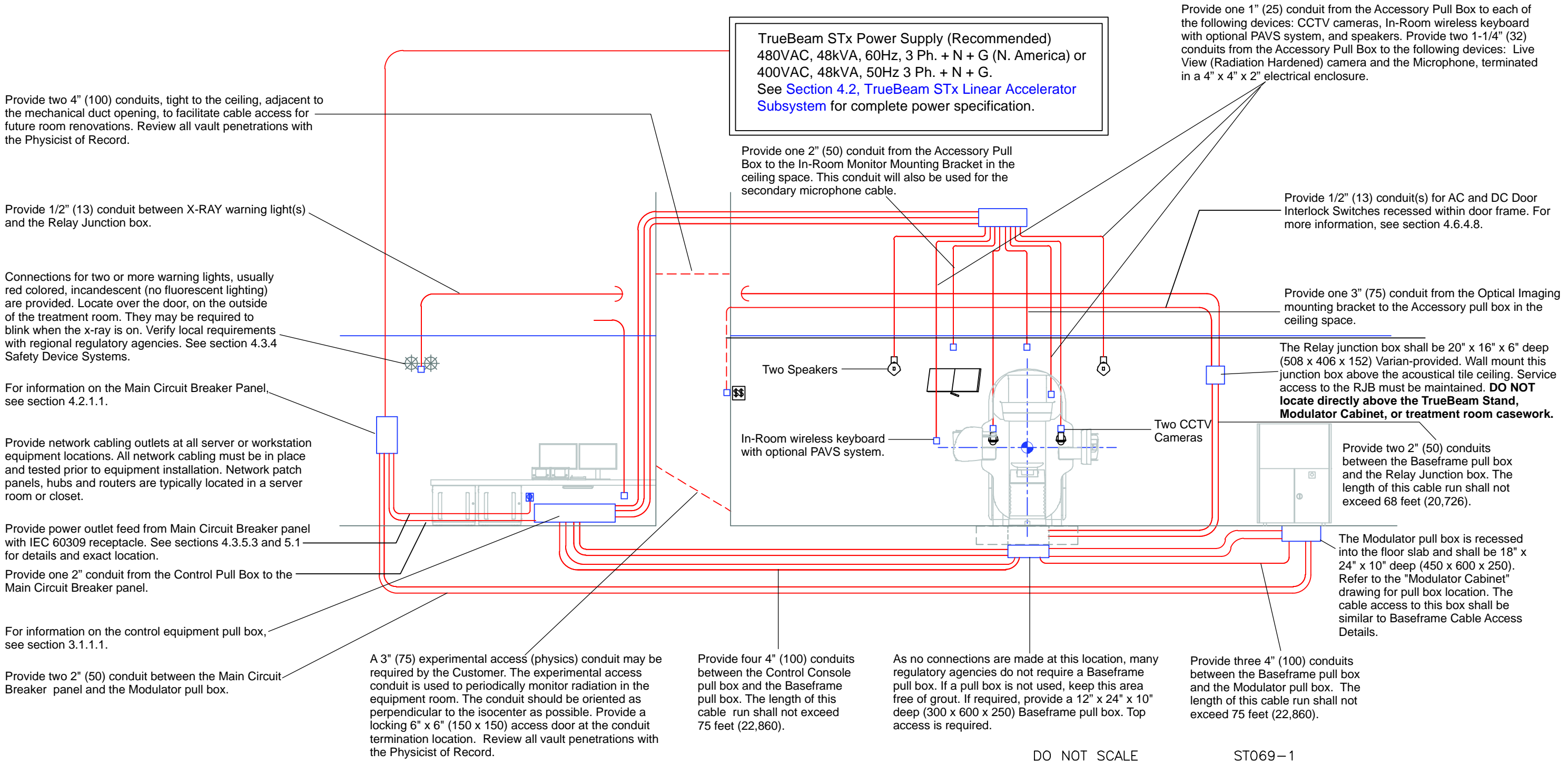


Figure 3-3 Typical TrueBeam STx Conduit Diagram (Section View) without ExacTrac

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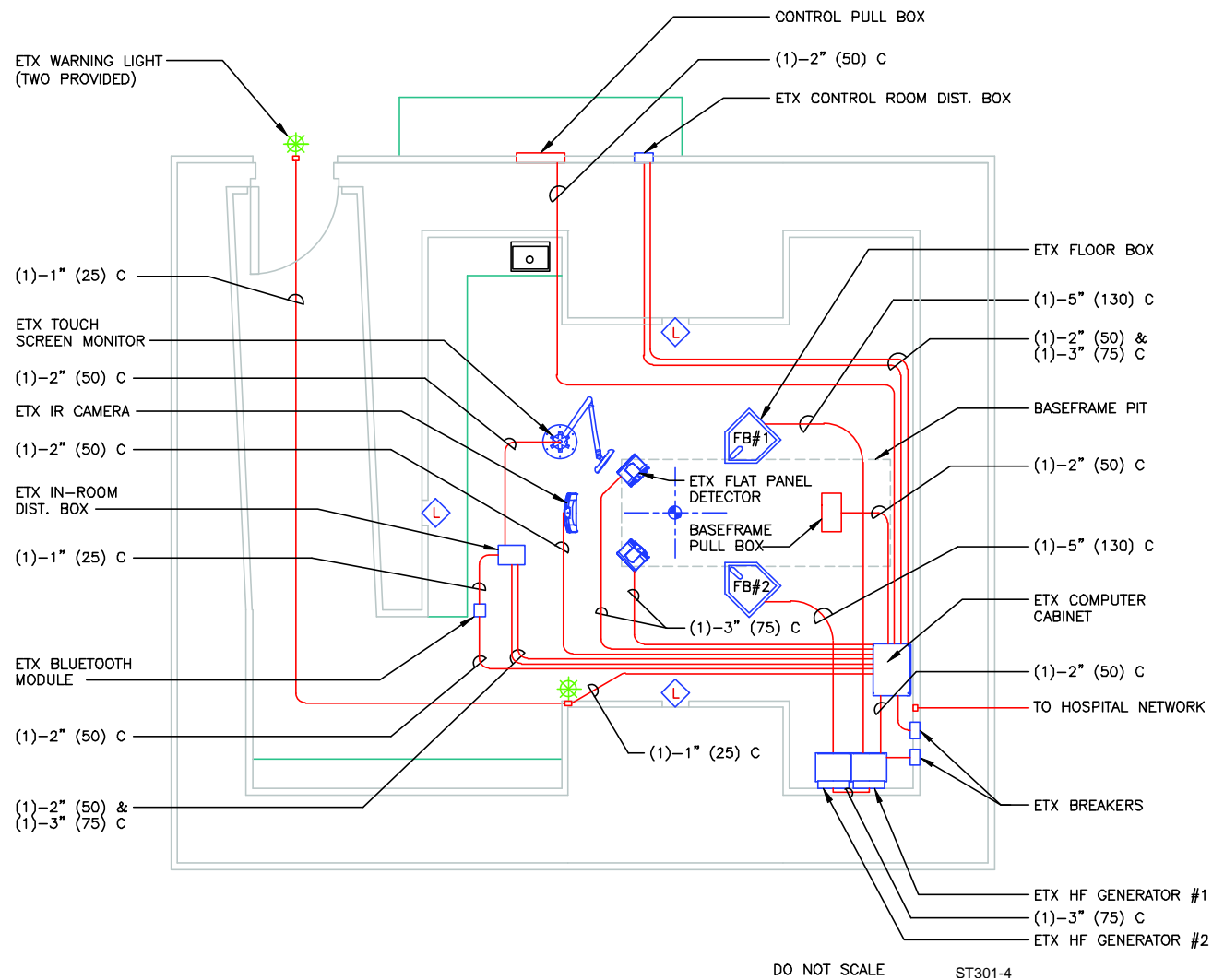
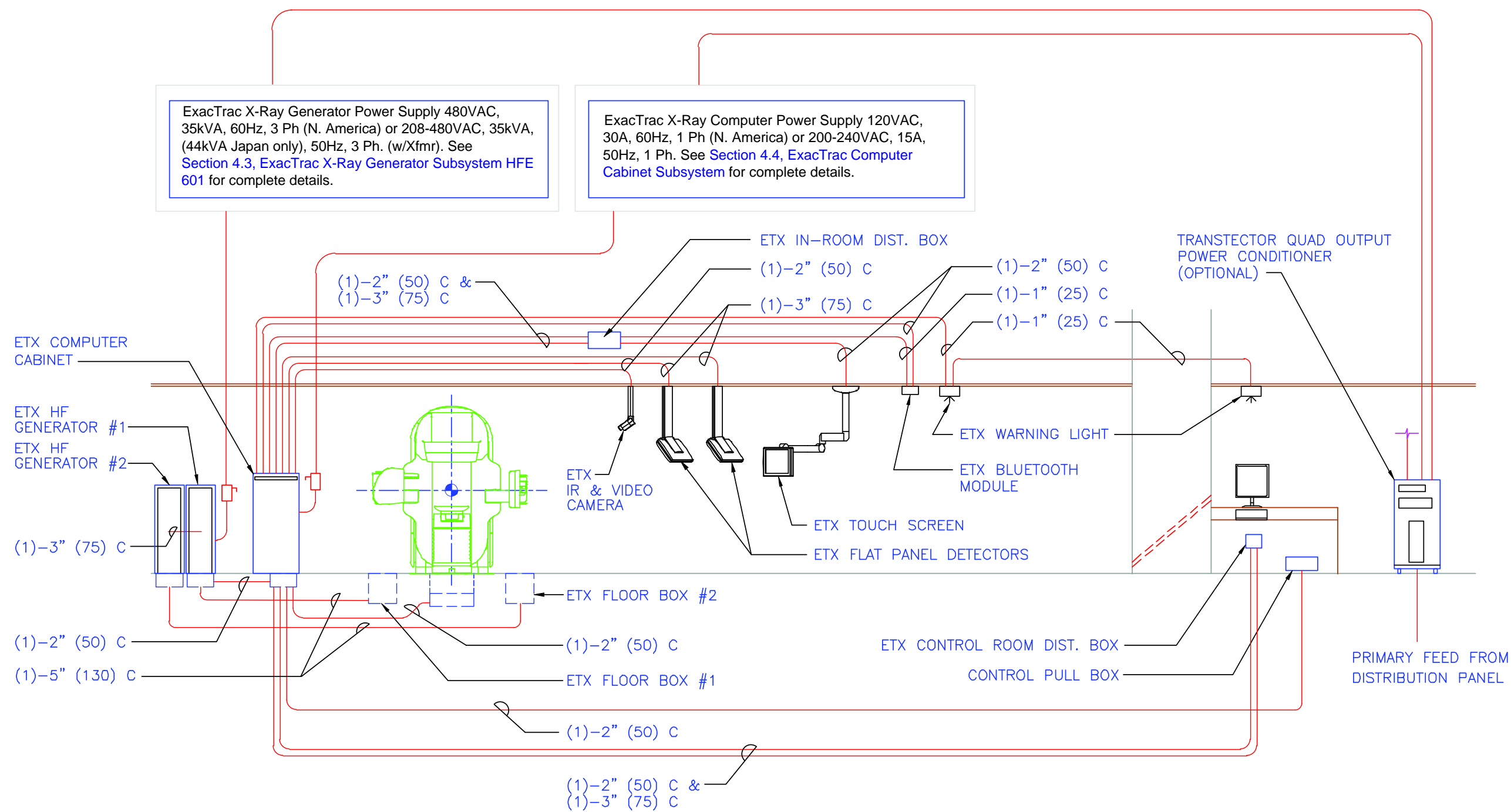


Figure 3-4 Typical ExacTrac Conduit Diagram (Plan View)

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ST302-4

NOTE:
ALL ITEMS LISTED WITH A "ETX" ARE A COMPONENT OF THE OPTIONAL EXACTRAC X-RAY POSITIONING SYSTEM.
ETX COMPONENTS ARE EXPANDED FOR CLARITY

Figure 3-5 Typical ExacTrac Conduit Diagram (Section View)

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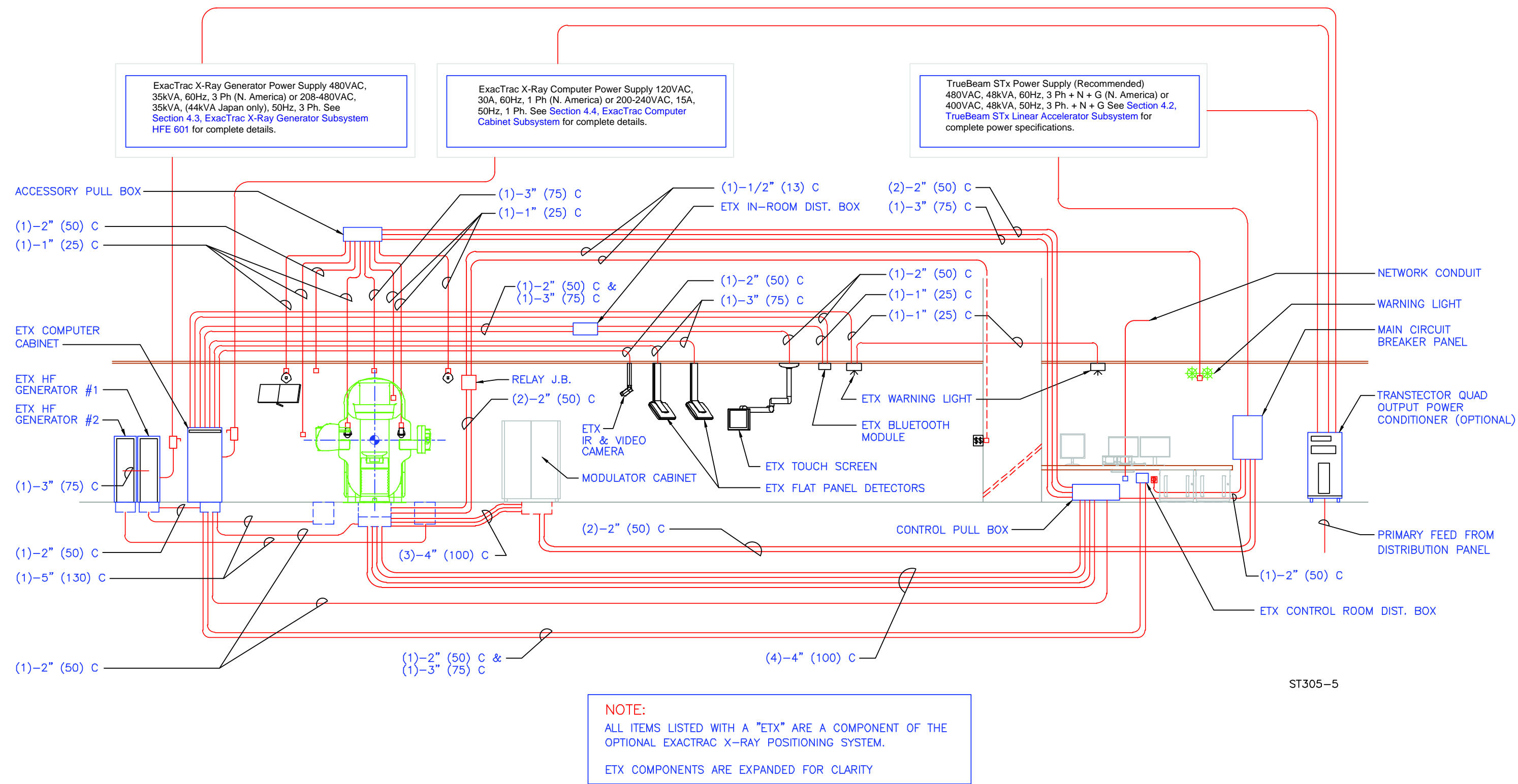
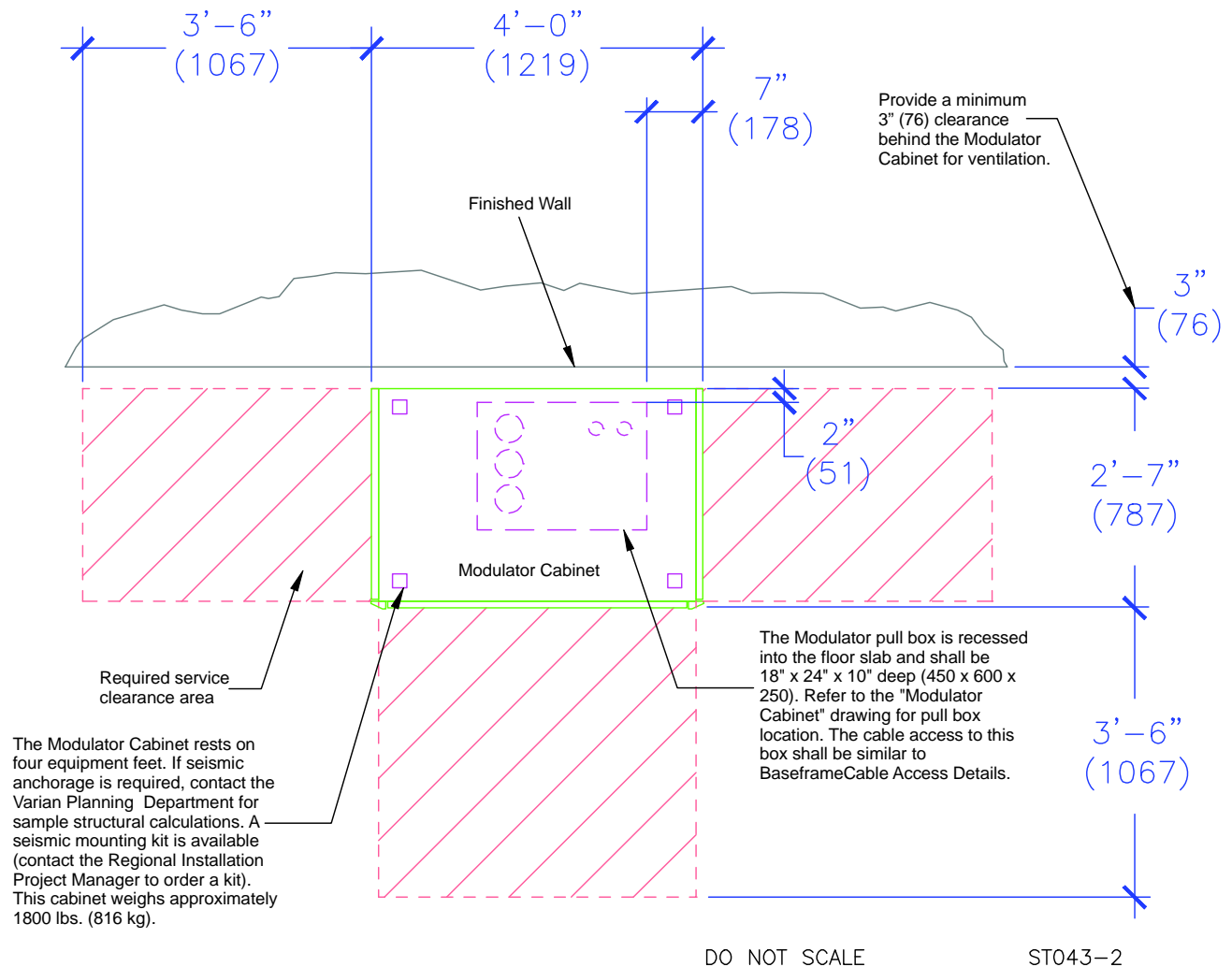


Figure 3-6 Typical Composite TrueBeam STx Conduit Diagram (Section View)

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3.3 Major System Components – Modulator Cabinet



The Modulator Cabinet may be located either in the TrueBeam STx room or remotely. Ventilation, acoustics, service provisions and cable length must be considered. The Modulator Cabinet has service panels at both sides and front. Provide 11'-0" (3353) clear space, side to side. For non-U.S. sites, verify electrical equipment service clearances with applicable local code. **Do not locate this cabinet in the primary beam path.**

Figure 3-7 Modulator Cabinet, Plan View

The Modulator Cabinet may be located either in the TrueBeam STx room or remotely. Ventilation, acoustics, service provisions, and cable length must be considered. The Modulator Cabinet has service panels at both sides and front. Provide 11'-0" (3353) clear space, side to side. For non-U.S. sites, verify electrical equipment service clearance requirements with applicable local code. **Do not locate this cabinet in the primary beam path.**

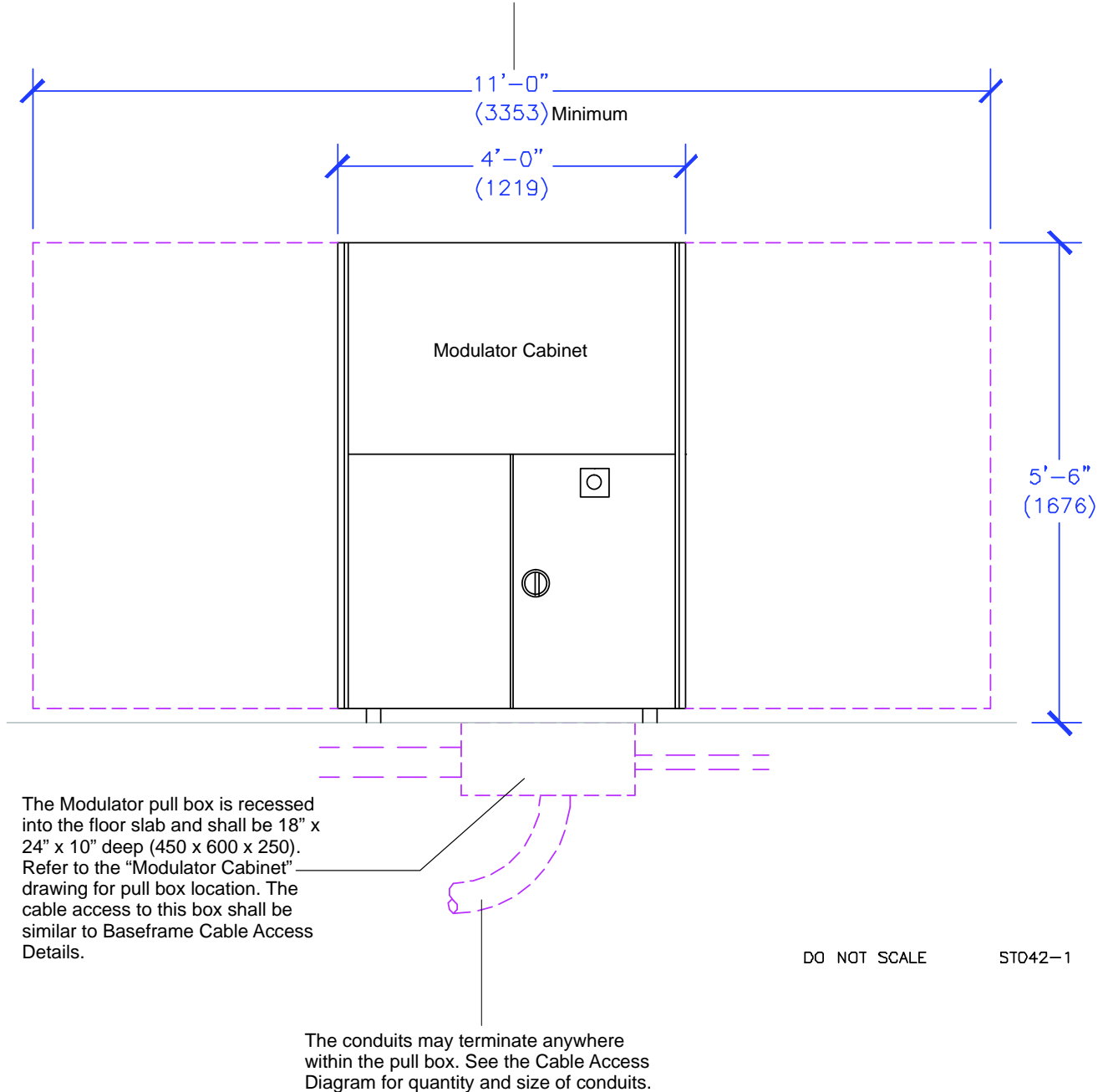


Figure 3-8 Modulator Cabinet, Elevation View

3.4 Dual X-Ray Generator Cabinets



Figure 3-9 Dual X-Ray Generator Cabinet (HFE 601)

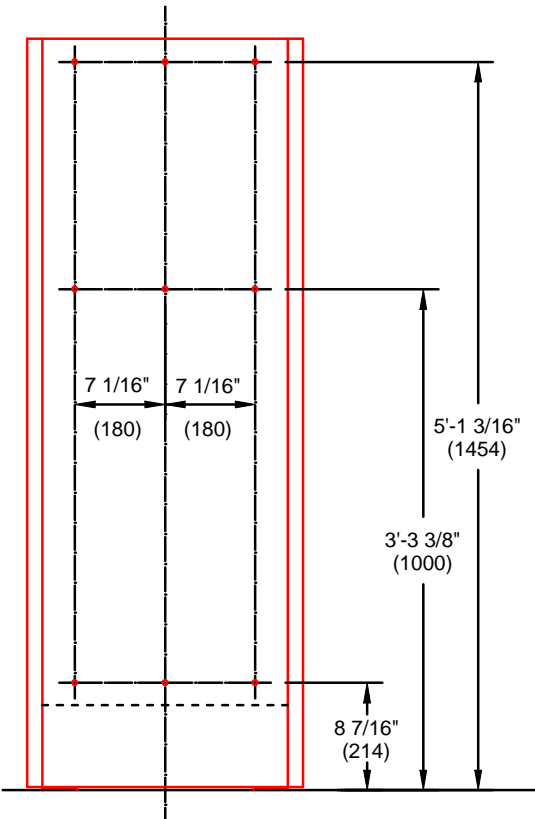

Table 3-1 Dual X-Ray Generator Cabinets

General Information	<p>To be specified by the customer:</p> <p>Possible cable lengths between generator and x-ray tubes: 36'-0" (11m), 49'-0" (15m), or 59'-0" (18m).</p> <p>Use same cable length for both tubes.</p> <p>Recommended maximum distance between the two Generator Cabinets: 16'-0" (5m). In special cases, the maximum distance between the Generator Cabinets can be up to 65'-0" (20m) with Brainlab approval.</p> <p>External interfaces: Main power and control data input only connect to Generator Cabinet 1.</p> <p>X-ray tube 1 is connected to generator 1</p> <p>X-ray tube 2 is connected to generator 2</p>
---------------------	--

Table 3-1 Dual X-Ray Generator Cabinets (continued)

Dimensions	<p>Dual Generator Each Cabinet is: 21 3/4" x 21 3/4" x 59 1/2" (550 x 550 x 1510).</p>
Service and Cable Access Areas	

Table 3-1 Dual X-Ray Generator Cabinets (continued)

Weight	Configuration		Weight
	Dual Generator without pre-transformer		706 lbs. (320 kg)
	Dual Generator with pre-transformer 208V-400V		860 lbs. (390 kg)
	Dual Generator with pre-transformer 420/440/480V-400V		816 lbs. (370 kg)
	Dual Generator with pre-transformer Delta 200/210/220208V-Star 400V		1014 lbs (460 kg)
	Single Cabinet without pre-transformer		353 lbs. (160 kg)
	Cabinet is supplied with wheels.		
Wall fixation of rear panel	<p>The back panel of the X-ray Generator Cabinet must be fixated to the wall. Its weight is max. 55 lbs. (25 kg), depending on the configuration.</p>  <p>Use wall anchors according to wall conditions and per local regulations (Contractor-provided).</p>		
Location	 CAUTION: Do not place the cabinet in the primary beam of the Linac.		

3.5 Major System Components – ExacTrac Computer Cabinet

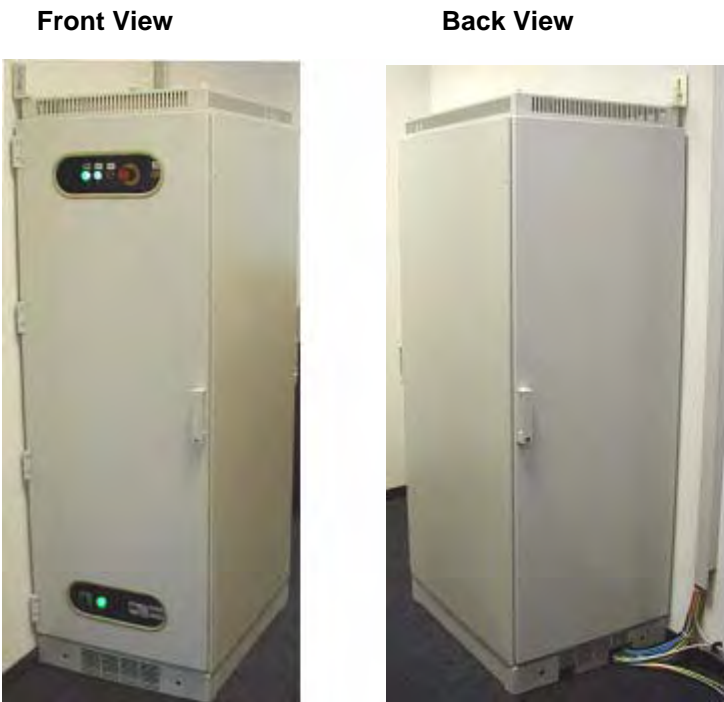


Figure 3-10 Two-way Accessible Cabinet for Computer, Power Supplies, Electrical Safety Devices, Control Electronics, and Excess Cables

Table 3-2 ExacTrac Computer Cabinet

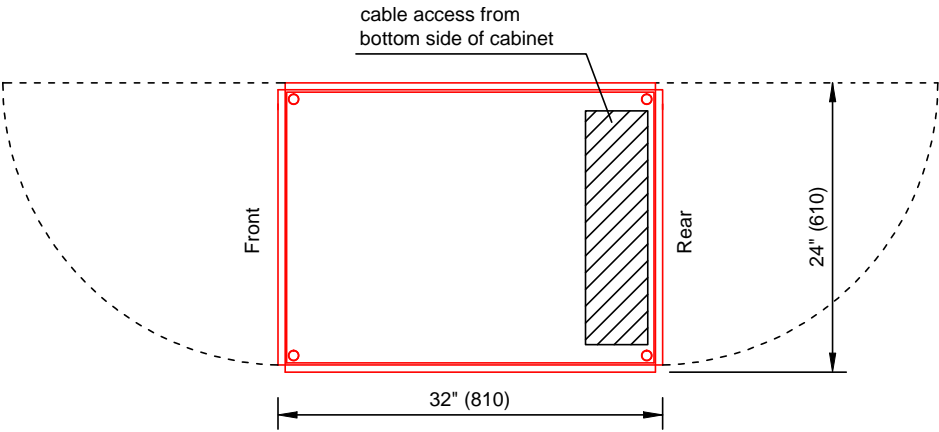

General Information	Two-way accessible cabinet for workstation, power supplies, electrical safety devices, Interface Electronics, and excess cables.
Cabinet Dimensions	<div><p>Only Cabinet: 32" x 24" x 70" (810 x 610 x 1780)</p><p>With door handles: 35" x 26" x 70" (880 x 650 x 1780)</p></div>

Table 3-2 ExacTrac Computer Cabinet *(continued)*

Weight	551 pounds (250 kg)
Heat Dissipation	Approximately 406W (1386 Btu/hr)
Location	<p>The cabinet can be placed with either long side towards the wall. The direction of door opening can be switched.</p>  <hr/> <p>WARNING: The computer cabinet may not be located in the primary beam of the Linac.</p> <hr/>
Network Connection	Cat 5E Patch Cable 13'-0" (4m)

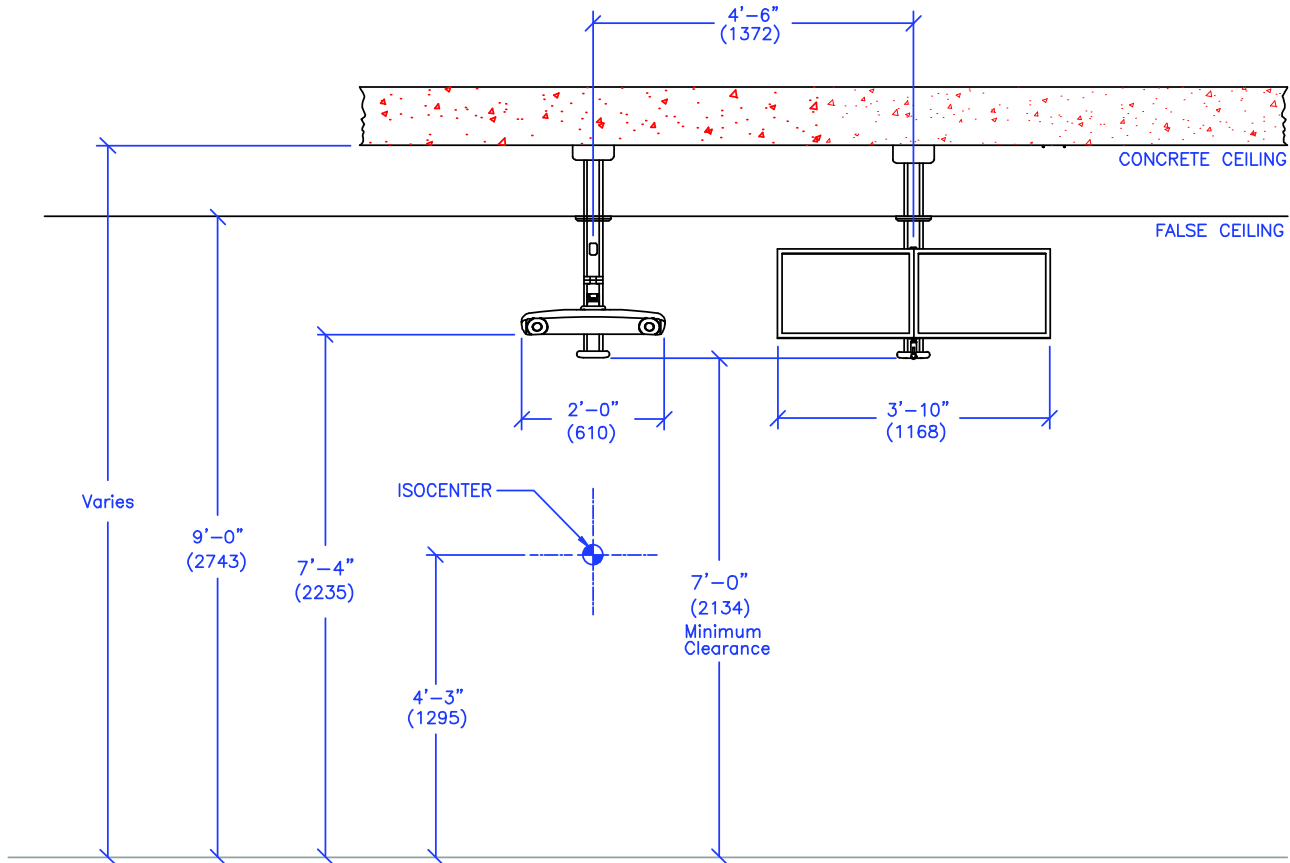


Note: Ensure sufficient spatial clearance for rig-in of the computer cabinet.

For limited space, the cabinet may be positioned with the rear service door side next to a wall (4 inches [100] clearance) after all cabling is done. The door can be removed for service access by releasing the door hinges.

3.6 Major System Components – Optical Imaging with IRM

The TrueBeam STx includes a ceiling-mounted Optical Imaging camera system and ceiling-mounted Dual In-Room Monitor (IRM) displays. While shown on one side of the Isocenter/Longitudinal Axis, the IRM can be mounted on either side of Isocenter. Verify placement side with owner.



ST110-0

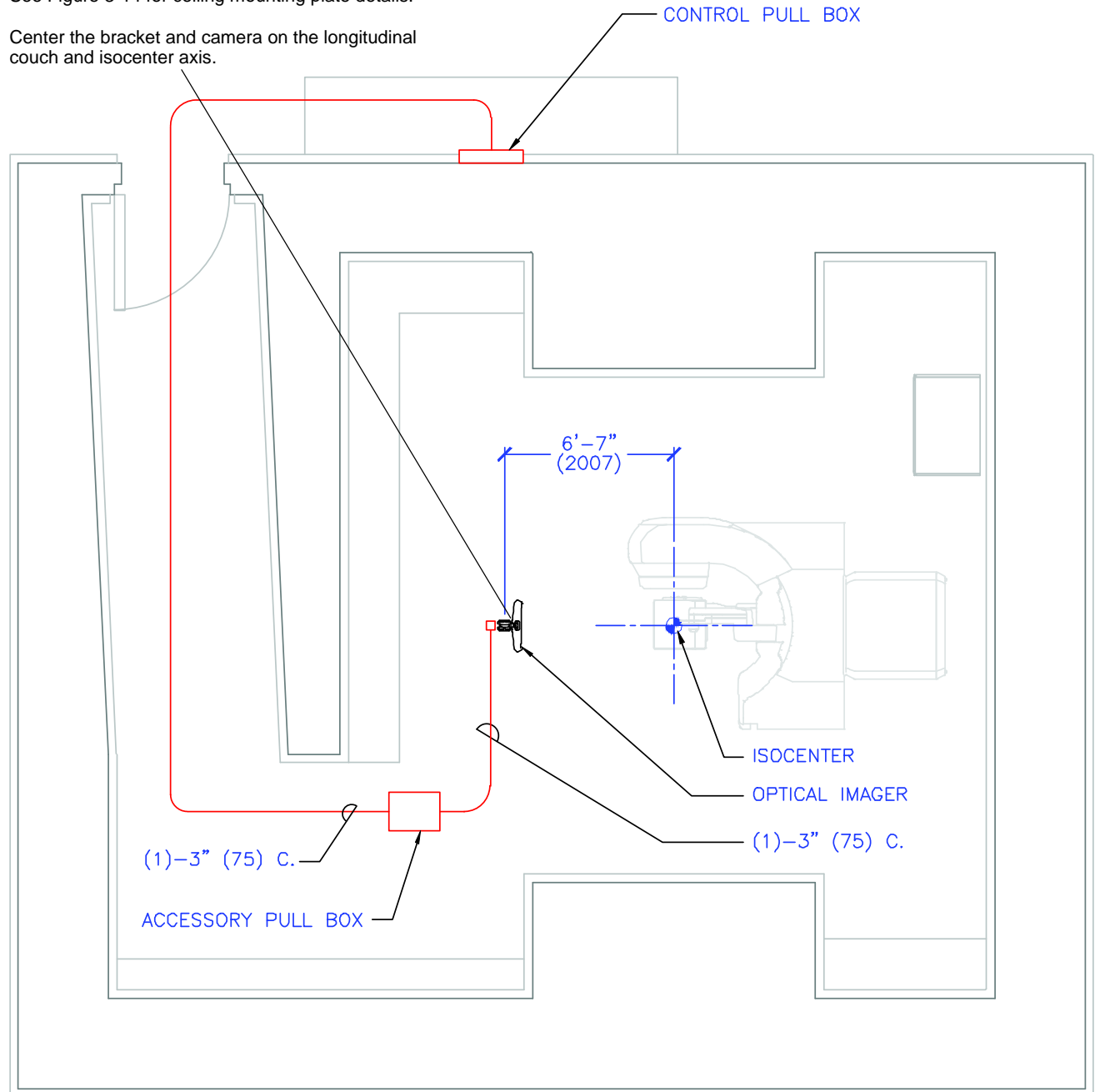
Figure 3-11 Optical Imaging and In-Room Monitor (Typical) – Front Elevation

3.6.1 TrueBeam STx Optical Imaging Subsystem

3.6.1.1 Mounting Location

See Figure 3-14 for ceiling mounting plate details.

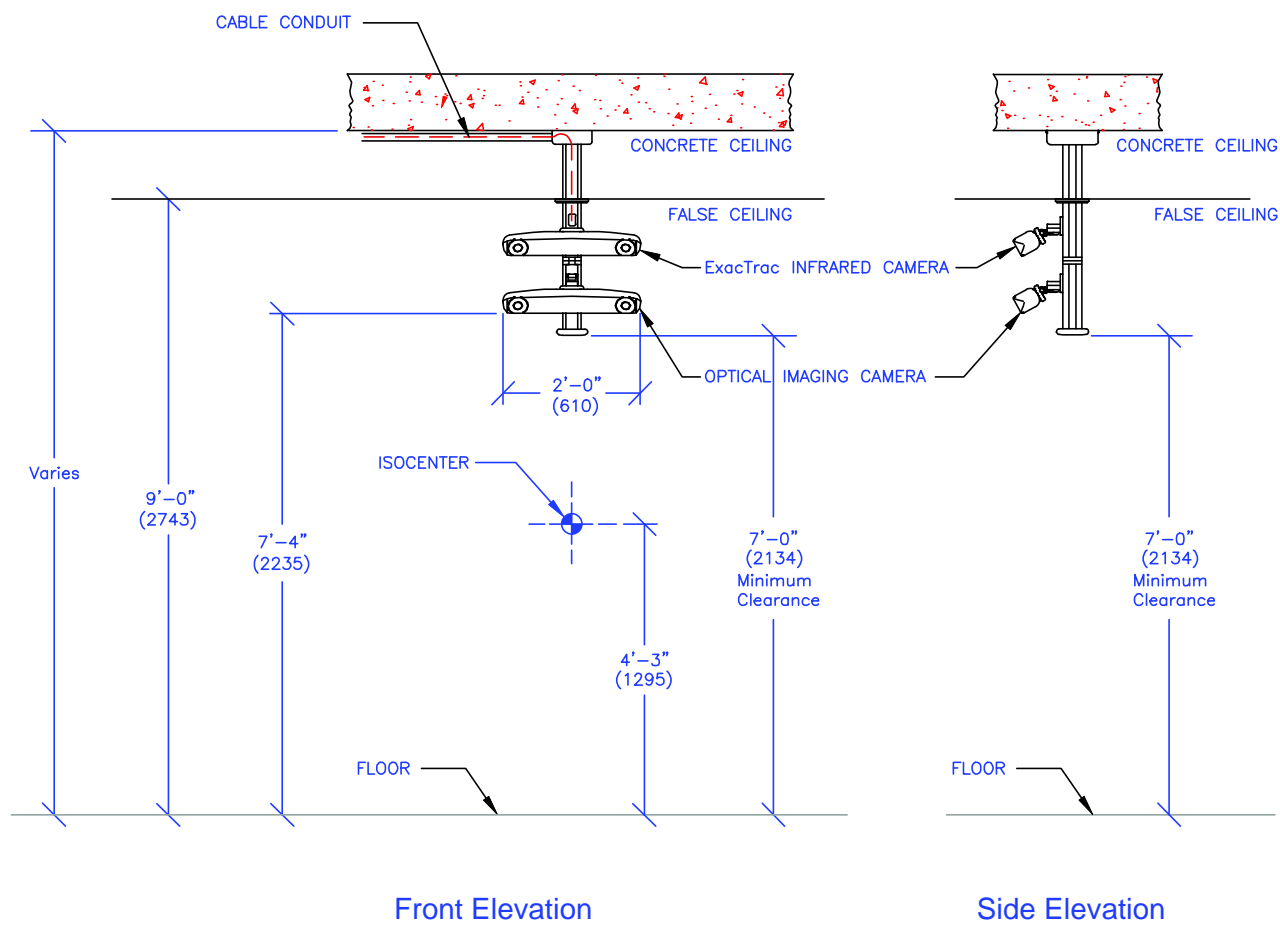
Center the bracket and camera on the longitudinal couch and isocenter axis.



NOT TO SCALE

ST201-2

Figure 3-12 TrueBeam STx Optical Imaging Mount – Plan View

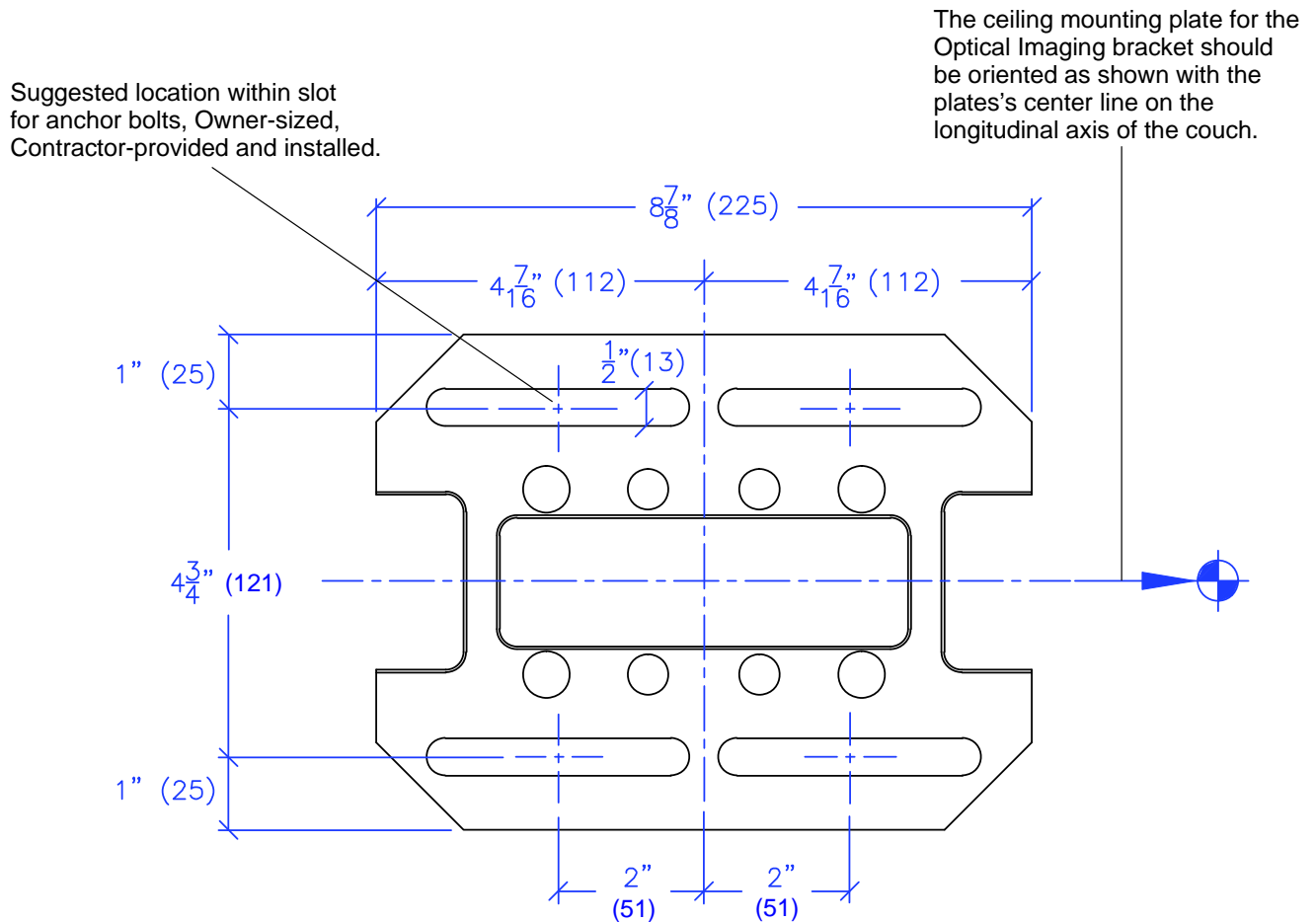


ST103-1

Figure 3-13 TrueBeam STx Optical Imaging Mount – Elevation Views

3.6.1.2 Mounting Method

The ceiling mount of the Optical Imaging subsystem is standard with the TrueBeam STx. The Ceiling Mount Monitor Bracket with Ceiling Mounting Plate is furnished by Varian and shipped in advance of the TrueBeam STx system. The ceiling mount support bracket is Contractor-installed. Mount Ceiling Plate in accordance with local code/regulations using appropriately-sized anchors engineered to support a combined maximum load of 30 lb. (13.6 kg.).



Ceiling mounting plate comes with the Varian-furnished, Contractor-installed Monitor bracket.

NOT TO SCALE

ST106-1

For location details with respect to Isocenter, see [Figure 3-12](#) and [Figure 3-13](#).

Figure 3-14 Ceiling Mounting Plate – Optical Imaging Camera

3.6.1.3 Dedicated Ground Wire – TrueBeam Optical Imaging

The Contractor shall install one (1) 18 AWG (1.0 mm²) Ground or Earthing wire from the Optical Imaging Ceiling Mount to the Accessory Pull Box using the existing 3" (75) conduit. The wire color shall be green with yellow stripe. Each wire shall be terminated with #6 (M3.5) ring terminals, one end of which shall be affixed to the Accessory Pull Box ground stud. The contractor shall leave excess wire at the Ceiling Mount Bracket to reach a point 7'-0" (2134) above finished floor.

3.6.2 TrueBeam STx Dual In-Room Monitor (IRM)

3.6.2.1 Standard Mounting Location – TrueBeam STx IRM

The In-Room Monitor should be located as shown in the plan and hung from the ceiling. For ceiling mount details, see [Figure 3-15 on page 3-27](#) and [Figure 3-16 on page 3-28](#). The monitor provides information during patient setup and it is unsafe to turn away from the patient while the machine is moving and the patient is on the couch. Alternatively, the In-Room Monitor may be mounted on a wall (see [Figure 3-18 on page 3-30](#) for mounting details).

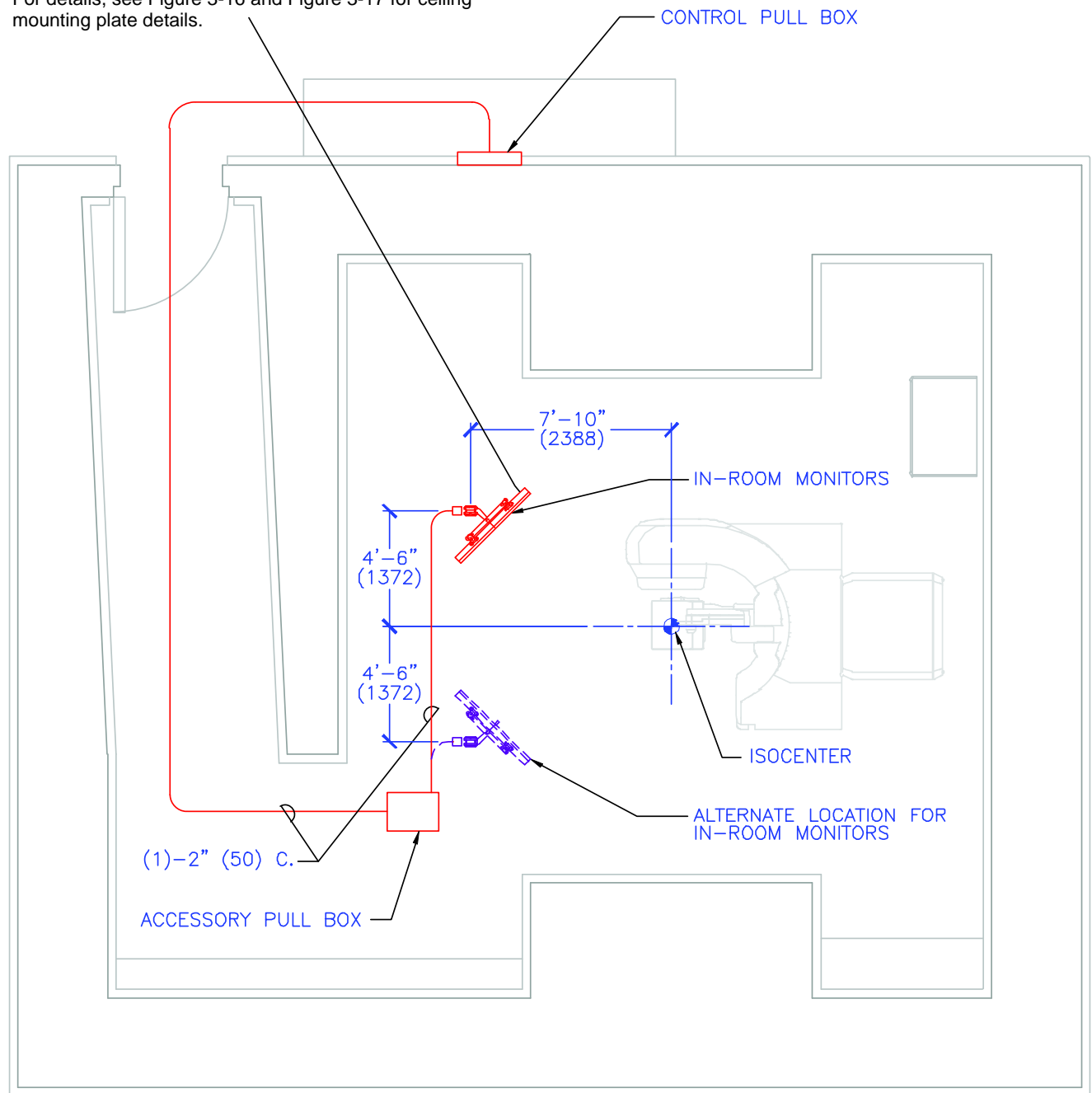


CAUTION: Do not locate the In-Room Monitor inside or within 2'-0" (610) of the Primary Beam Path.

The ceiling mount In-Room Monitor is standard with the TrueBeam STx. The ceiling mount monitor bracket is furnished by Varian and shipped with the system, and the ceiling mount support bracket is Contractor-installed.

3.6.2.2 Mounting Method

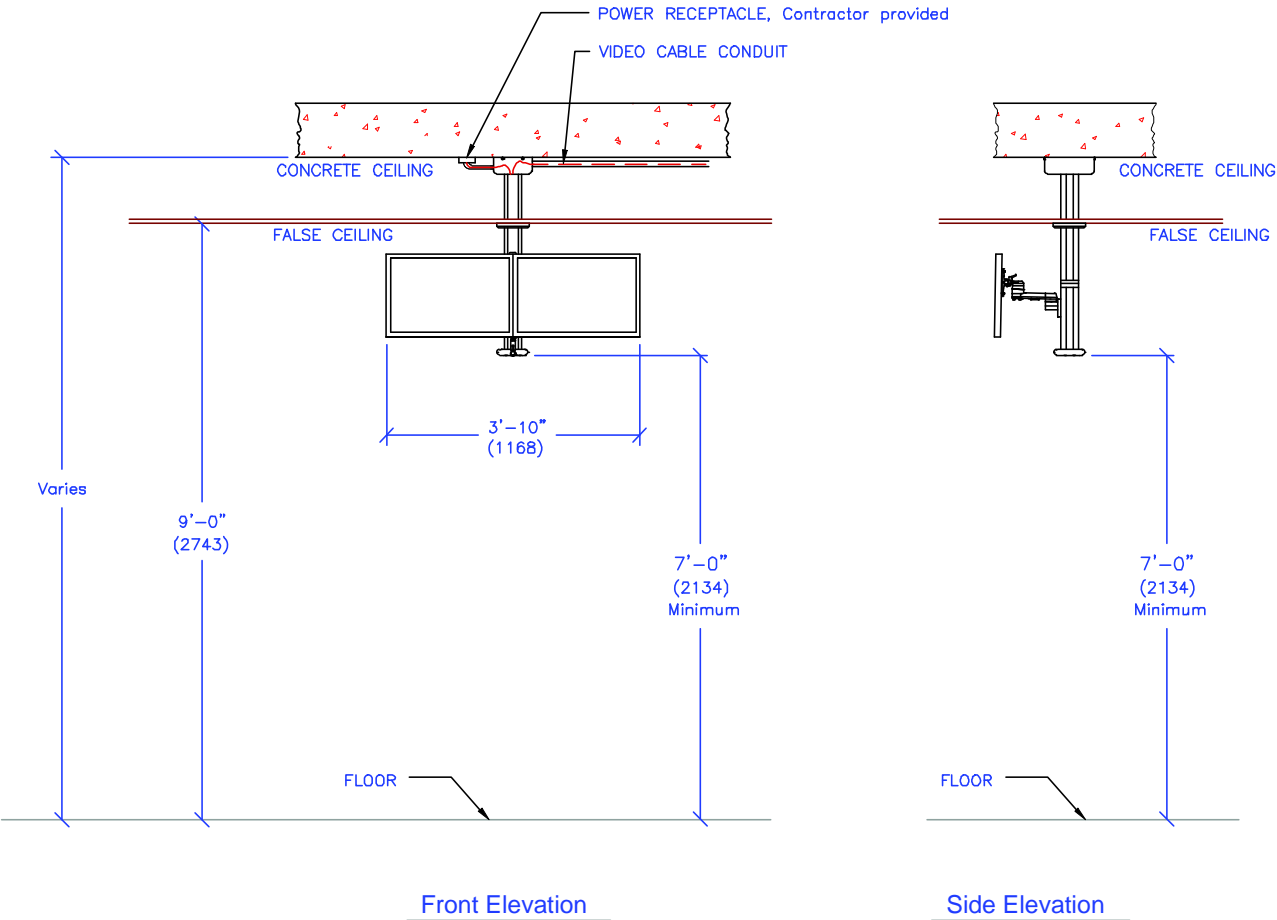
In-Room Monitors, Varian-furnished, Contractor-installed.
For details, see Figure 3-16 and Figure 3-17 for ceiling mounting plate details.



NOT TO SCALE

ST105-2

Figure 3-15 Dual In-Room Monitor Mount – Plan View

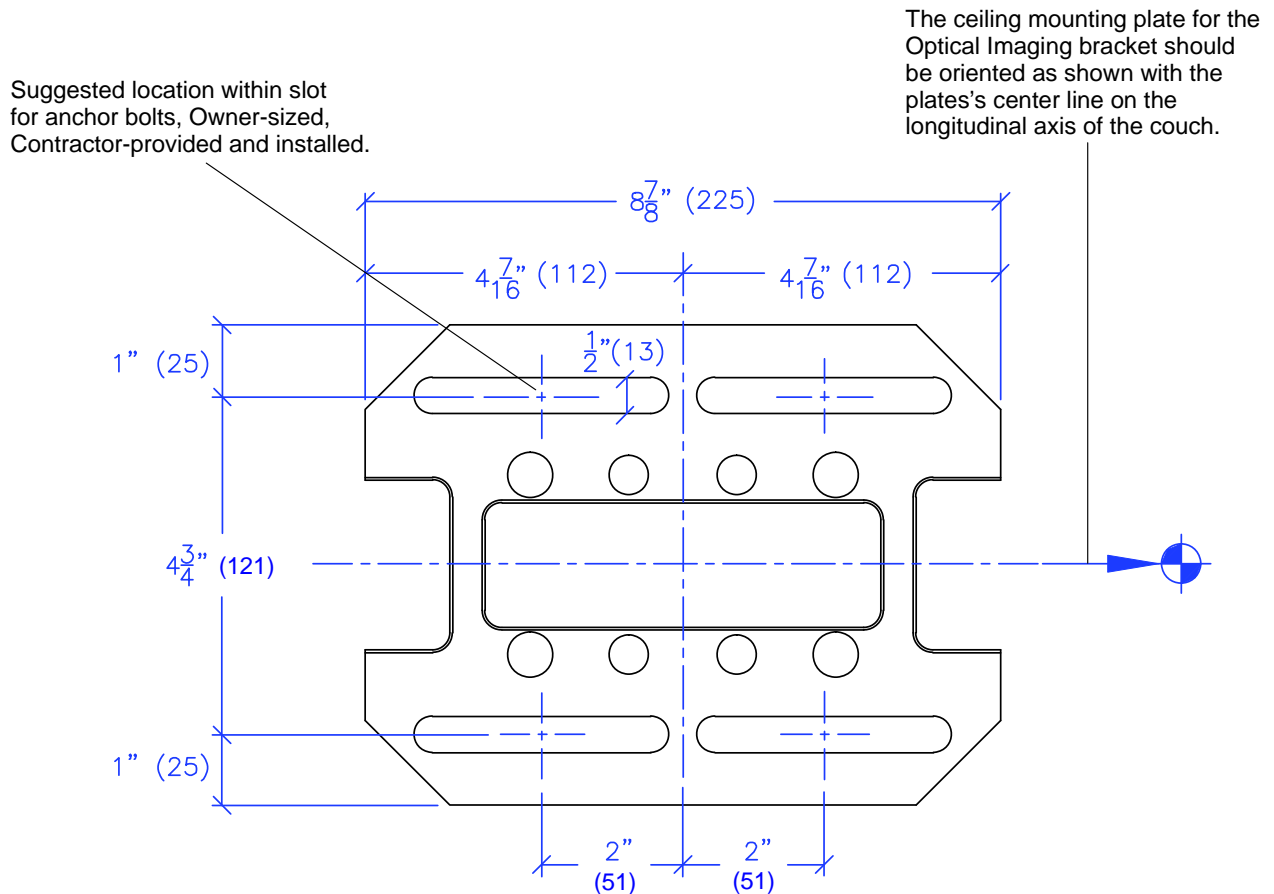


NOT TO SCALE ST104-2

Figure 3-16 Dual In-Room Monitor Mount – Elevation View

3.6.2.3 Mounting Method

The ceiling mount of the Dual In-Room Monitor subsystem is standard with the TrueBeam STx. The Ceiling Mount Monitor Bracket with Ceiling Mounting Plate is furnished by Varian and shipped in advance of the TrueBeam STx system. The ceiling mount support bracket is Contractor-installed. Mount Ceiling Plate in accordance with local code/regulations using appropriately-sized anchors engineered to support a combined maximum load of 70 lb. (31.8 kg.).



Ceiling mounting plate comes with the Varian-furnished, Contractor-installed Monitor bracket.

NOT TO SCALE

ST106-1

For location details with respect to Isocenter, see [Figure 3-15](#).

Figure 3-17 Ceiling Mounting Plate – In-Room Monitor Bracket

3.6.2.4 Dedicated Ground Wires – TrueBeam IRM

The Contractor shall install two (2) 18 AWG (1.0 mm²) Ground or Earthing wires from the In Room Monitor signal box to the Accessory Pull Box using the existing 2" (50) conduit. The wire color shall be green with yellow stripe. Each wire shall be terminated with #6 (M3.5) ring terminals, one end of which shall be affixed to the Accessory Pull Box ground stud. The contractor shall leave excess wire at the In Room Monitor signal box to reach a point 7'-0" (2134) above finished floor.

3.6.2.5 Alternate Wall-Mounting Location – TrueBeam STx IRM

If equipment is to be anchored to a wall or ceiling, provide structural backing and support (by Customer/Contractor). Install per bracket manufacturer's instructions. Verify mounting height with local codes. A ceiling mounting bracket is furnished by Varian, Customer/Contractor installed.

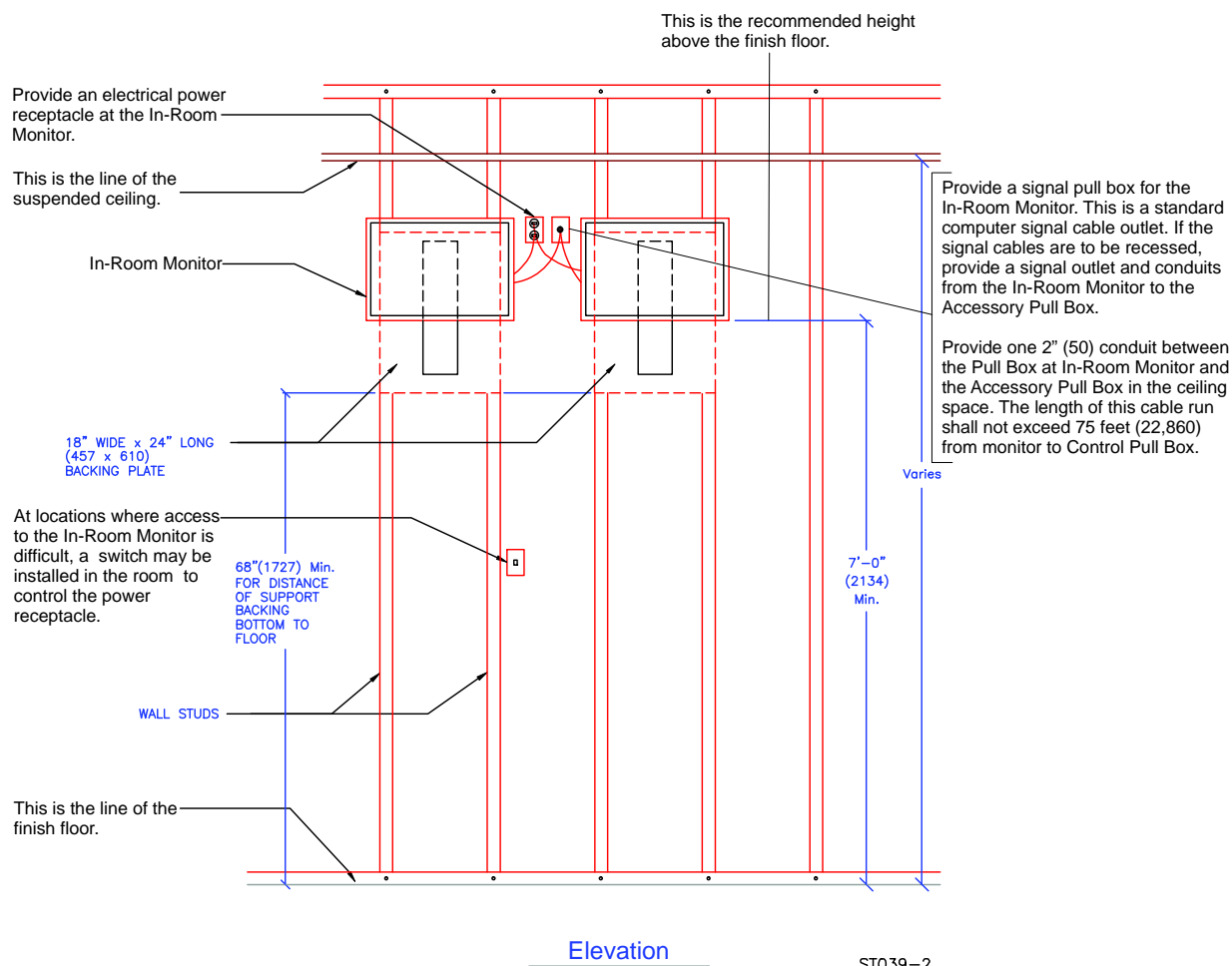


Figure 3-18 Alternate Wall-Mount Dual In-Room Monitor Installation

3.7 Minor System Components – Live View Camera, CCTV, PAVS, and Intercom Subsystems

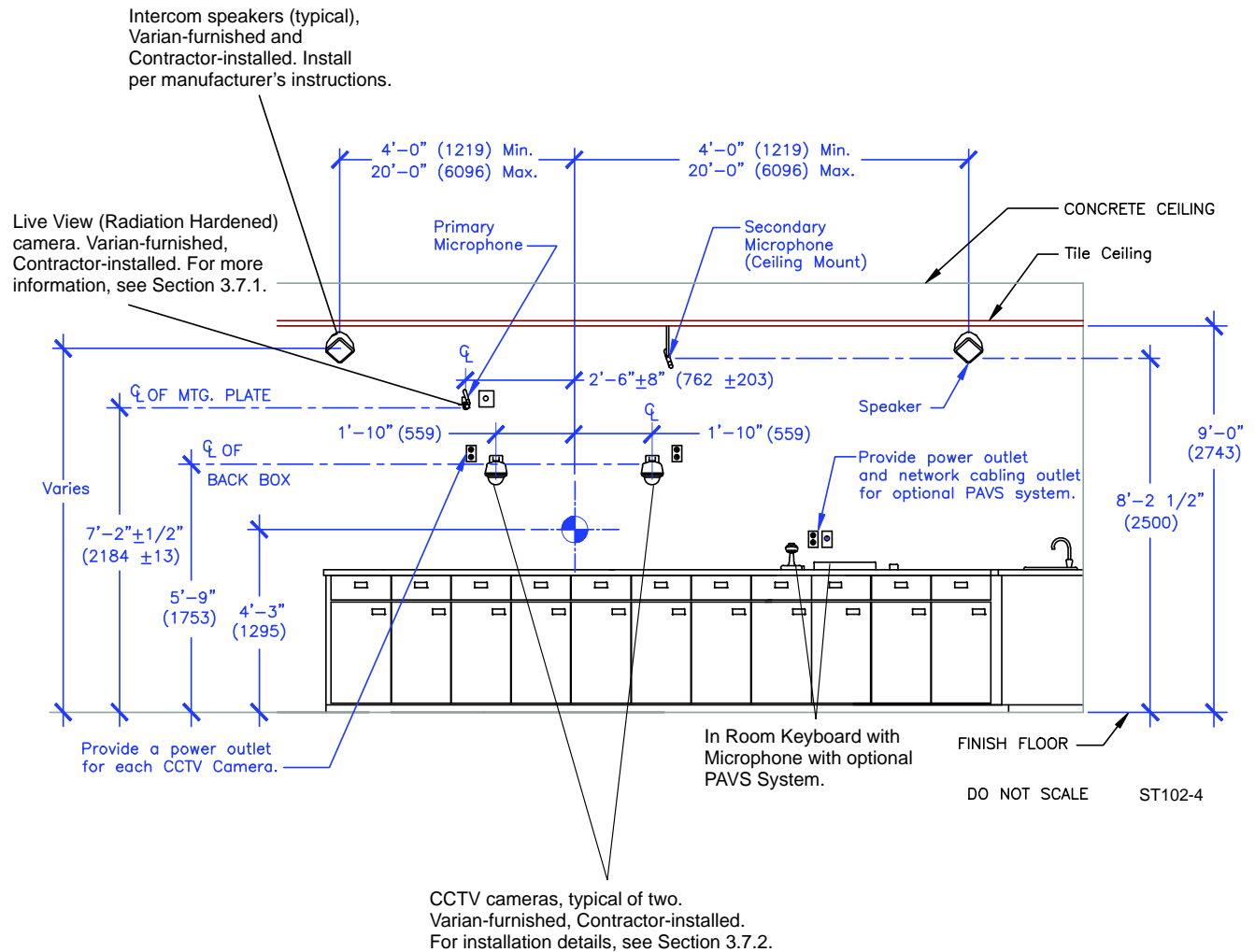


Figure 3-19 Interior Elevation – Component Location

3.7.1 Live View Camera Subsystem

3.7.1.1 Live View Mounting Locations and Method

The Live View (LV) Camera is a radiation-hardened system that enables monitoring of the TrueBeam STx and the patient at all times. The system provides proximity information while the machine is moving to help prevent injury to the patient.

Mount the LV Camera to the wall. Provide structural backing and support for a maximum 10 lb. (4.5 kg) load. Install per bracket manufacturer's instructions. Alternately, a ceiling-mount is acceptable.

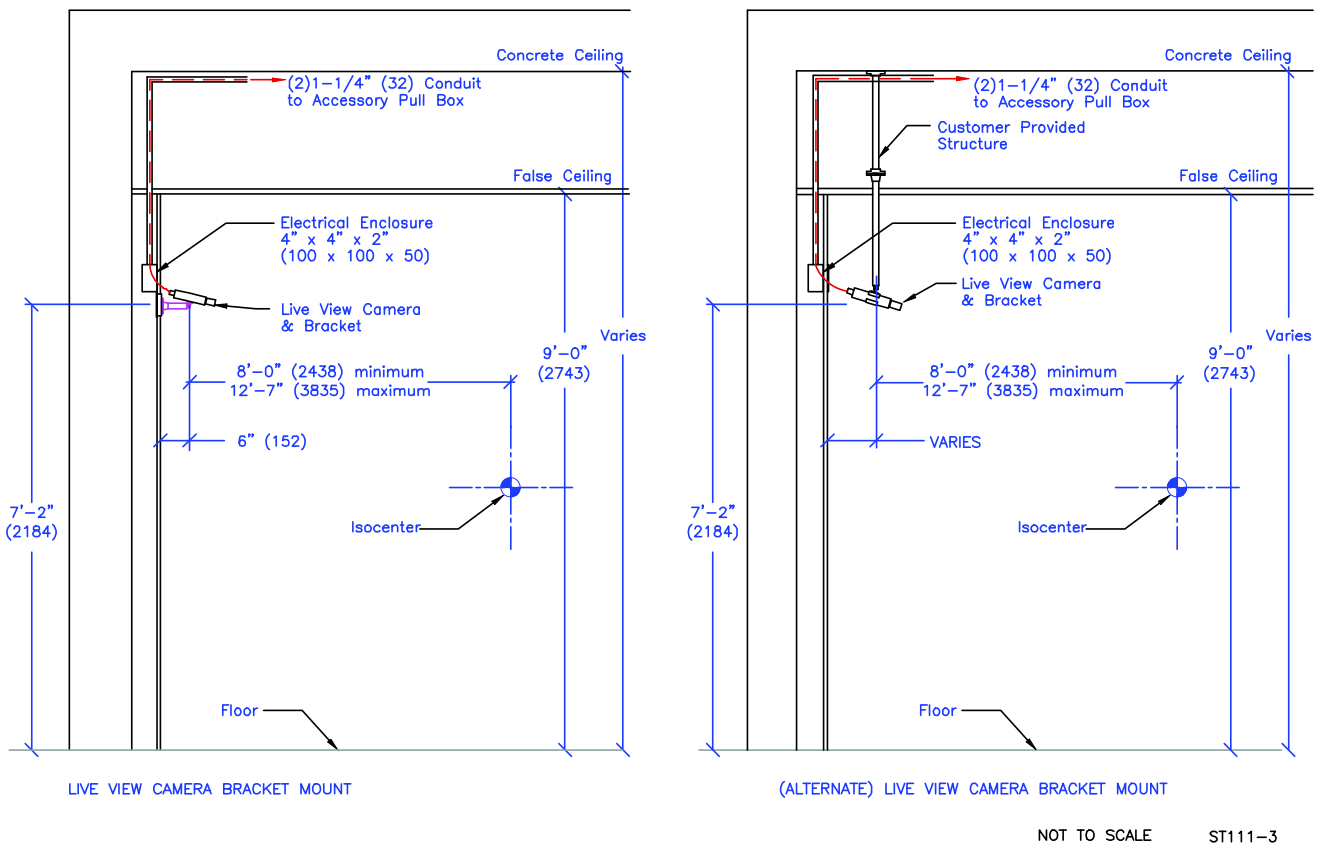


Figure 3-20 Live View Camera – Wall Mount (Section View)

3.7.1.2 Dedicated Ground Wire – Live View Camera

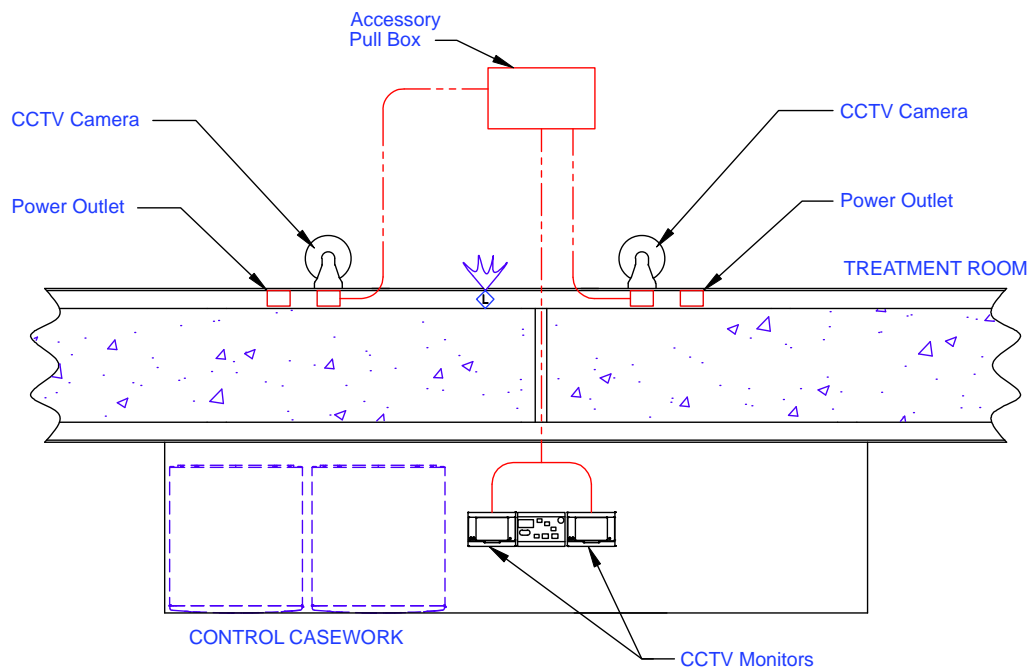
The Contractor shall install one (1) 18 AWG (1.0 mm²) Ground or Earthing wire from the Live View Camera signal box to the Accessory Pull Box using one of the existing 1 1/4" (32) conduit. The wire color shall be green with yellow stripe. The wire shall be terminated with #6 (M3.5) ring terminals, one end of which shall be affixed to the Accessory Pull Box ground stud. The contractor shall leave excess wire at the Live View Camera signal box to reach a point 7'-0" (2134) above finished floor

3.7.2 Closed Circuit TV (Motion View) Subsystem

There are no windows in an accelerator treatment room. However, it is critical to patient safety that the therapist maintain visual contact with the patient at all times.

- A Closed-Circuit Television system is required for TrueBeam STx operation. The CCTV System Diagram (see [Figure 3-21](#)) represents a typical installation only. The CCTV System components and cabling is furnished by Varian, the power receptacles and conduit shall be supplied and installed by the Customer.
- The CCTV Cameras are located in the room with the accelerator. They are typically Varian-furnished, Contractor-installed in a 2-Camera, 4-Camera, or 6-Camera configuration. Provide a standard power outlet directly adjacent to the camera.
- CCTV monitors must be located as close as possible to the TrueBeam STx display monitors at the control counter, and must be visible during treatment. The CCTV monitors must be located with patient privacy in mind. Small, high-resolution monitors may be more exposed as the image is not clear from a distance. Refer to [Figure 3-21](#) and the CCTV System manufacturer's literature for conduit, mounting, and installation requirements. A non-interruptible power source may be required by regulatory code.

3.7.2.1 Mounting Locations



ST037-1

The typical Varian-furnished, Contractor-installed CCTV System includes the following:

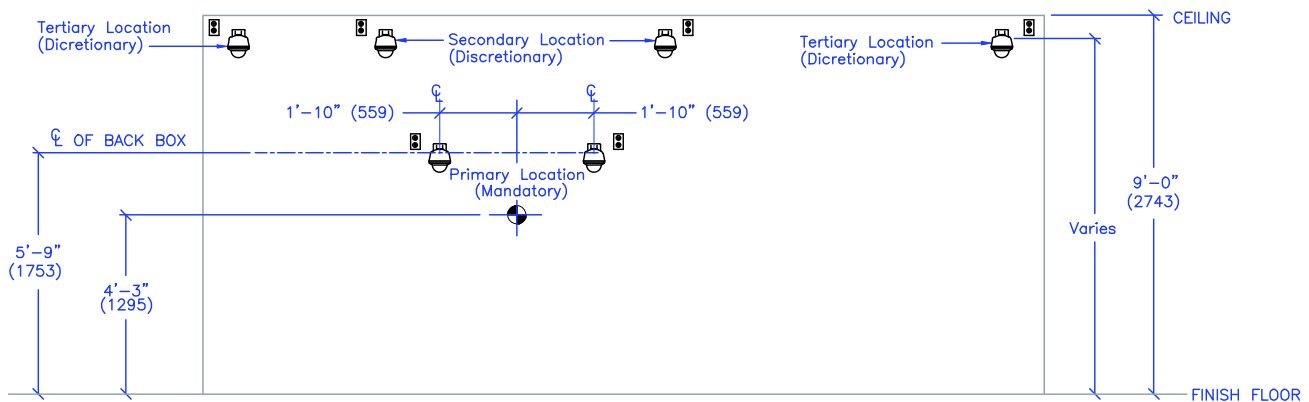
Camera, Mount, Display Assembly, and Cables - CCTV System is supplied in pairs.

1. Dome Camera housing with P/T Mechanism and Zoom Lens.
2. Mounting Bracket.
3. Associated Cables and Power Transformer.
4. Monitor Assembly with integrated Pan/Tilt/Zoom Control.

Figure 3-21 Typical CCTV System Diagram

As an option, up to three sets of CCTV cameras can be furnished with the TrueBeam STx.

- When using a system with only two cameras, it is mandatory to position the cameras in the Primary Location as shown in [Figure 3-22](#).
- When using a system with four cameras, locate two of the cameras in the primary position. The location shown for the second set of cameras is recommended as shown in [Figure 3-22](#), but is at the customer's discretion.
- When using a system with six cameras, locate two of the cameras in the primary position. The second set of cameras should be located in the recommended secondary position, and the third set shall be located at the customer's complete discretion.
- Never locate a CCTV camera in the Primary Beam path.

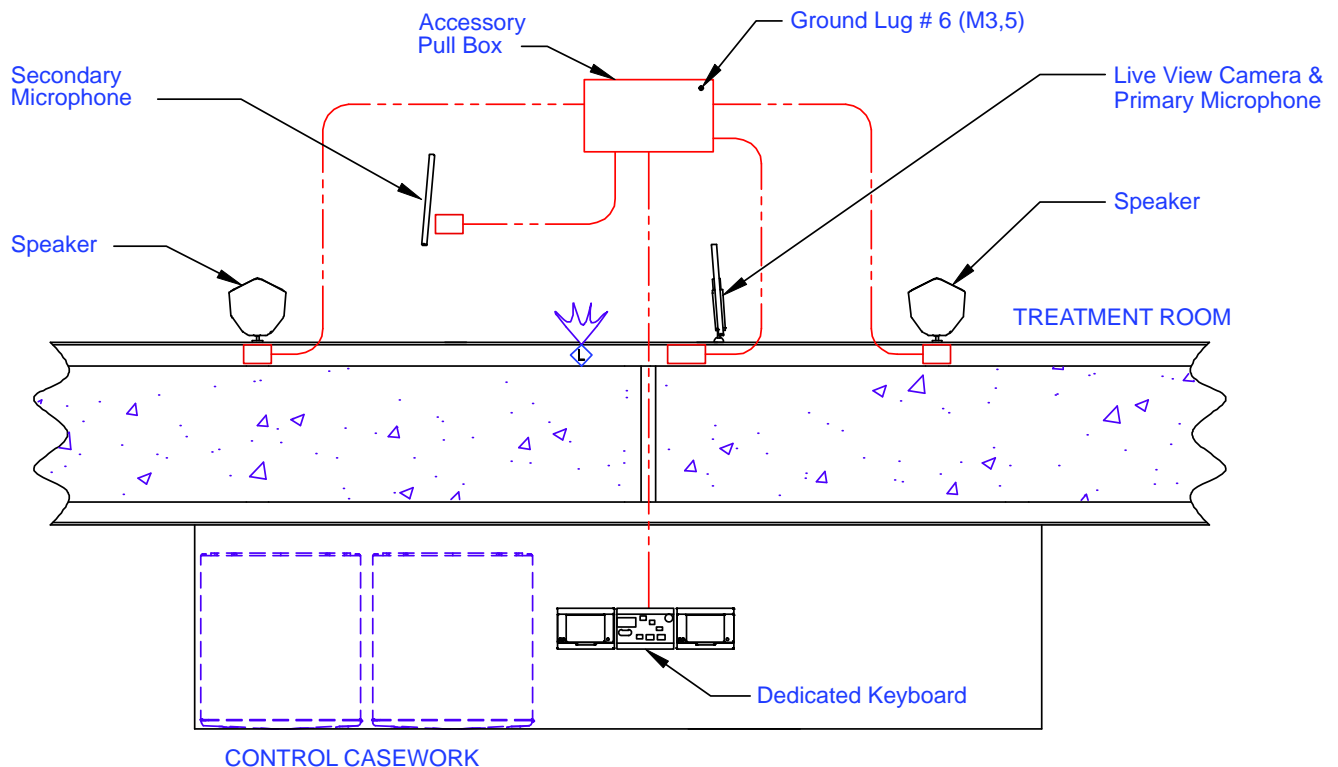


ST112-1

Figure 3-22 Multiple CCTV Camera Locations – Elevation

3.7.3 Audio Subsystem – Microphone(s) and Speakers

- The Accelerator system is shipped with two wall-mounted speakers, two microphones, and a special Live View (Radiation Hardened) camera.
- The microphones should be mounted above 8'-2 1/2" (2500) above finished floor (AFF). It is recommended that the microphones be mounted to the ceiling using Varian-supplied hard-surface or ceiling-grid brackets.
- If the microphone is mounted below 8'-2 1/2" (2500), the microphone body will have to be grounded using a customer-supplied ground. See [Section 3.7.3.1](#) for details.
- No details are provided for mounting the speakers on the wall. Install per manufacturer's recommendations.



ST052-2

Figure 3-23 Treatment Room Speaker, Microphone, and Live View Camera Layout: Top View

3.7.3.1 Dedicated Ground Wire – Microphone(s)

If the Microphone is mounted below 8'-2 1/2" (2500), the Contractor shall install one (1) 18 AWG (1.0 mm²) Ground or Earthing wire from the Microphone signal box to the Accessory Pull Box using one of the existing 1-1/4" (32) conduit. The wire color shall be green with yellow stripe. The wire shall be terminated with #6 (M3.5) ring terminals, one end of which shall be affixed to the Accessory Pull Box ground stud. The contractor shall leave excess wire at the Microphone signal box to reach a point 7'-0" (2134) above finished floor.

3.8 HVAC and Plumbing Requirements

[Table 3-3](#) includes the ideal mechanical specifications. Individual site conditions may vary. For complete specifications, see the specific subsections within [HVAC and Plumbing Requirements](#).

Table 3-3 Ideal Mechanical Specifications

Coolant flow	65°F. at 4 GPM (18°C. at 15 LPM).
Glycol content of coolant	Not to exceed 50%.
Compressed air	Not required for TrueBeam installations.
Room humidity	50% Relative Humidity, Non-condensing.
Room temperature	70°F (21°C).
Maximum coolant heat load	25 kW (85,379 Btu/hr).
Nominal coolant load during normal treatment cycles (TrueBeam STx Operational States)	13.3 kW (45,422 Btu/hr).

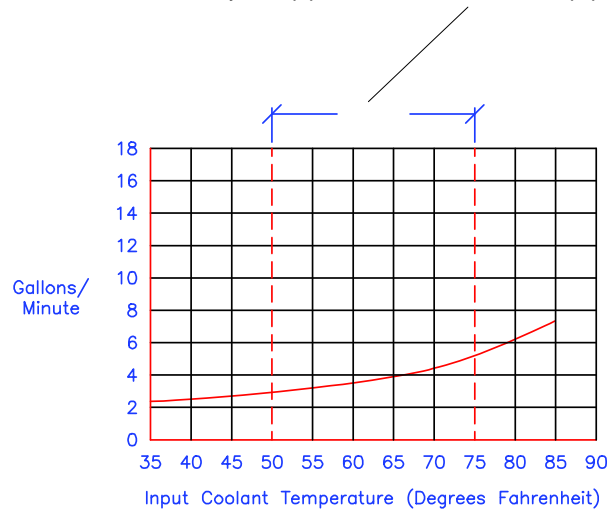
3.8.1 Operational States

Use the following description of the TrueBeam STx operational states to determine the estimated utility load based on normal treatment cycles:

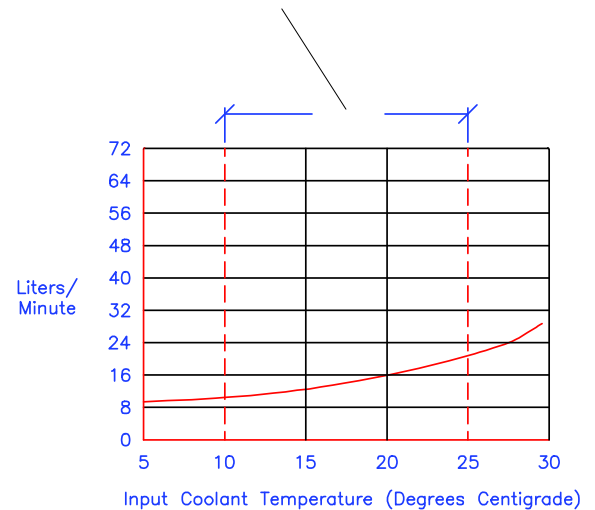
- **Low Power** – A condition usually in effect on weekends and overnight with only DC power to the control systems and Vac-Ion power supplies and AC power only to the TrueBeam STx Imager Detection Unit (DU) and the Multi-Leaf Collimator.
- **On** – A condition with no energy selected, all magnet and steering power supplies off, but with the klystron solenoid power supplies operative. Approximately 42 minutes per hour.
- **Ready/Energy Select** – A condition with the machine ready to Beam-On. Approximately 6 minutes per hour.
- **Beam-On** – The full-duty condition in which all primary heat sources operate at their maximum levels. Approximately 12 minutes per hour. The Beam-On State is maintained continuously for one hour or more during physics and calibration use.
- The estimated number of minutes per hour of each state is based on an average of six patients treated per hour.
- Heat loads for each of these states can be found in [Section 3.8.2.1, TrueBeam STx Coolant Requirements](#).

3.8.2 TrueBeam STx Coolant System

The typical incoming coolant temperature range is 50 deg. F. to 75 deg. F. (10 Deg. C. to 25 deg. C.). The coolant system must be designed to eliminate the possible formation of condensation. If lower temperature coolant is used, a psychrometric chart must be consulted to determine the dew point in the facility. If the inlet coolant temperature is at or below this dew point, condensation will form on the coolant system pipes which could result in equipment damage.



U.S. Systems - Imperial



SI Systems - Metric

ST060-0

Figure 3-24 Minimum Coolant Flow Requirements

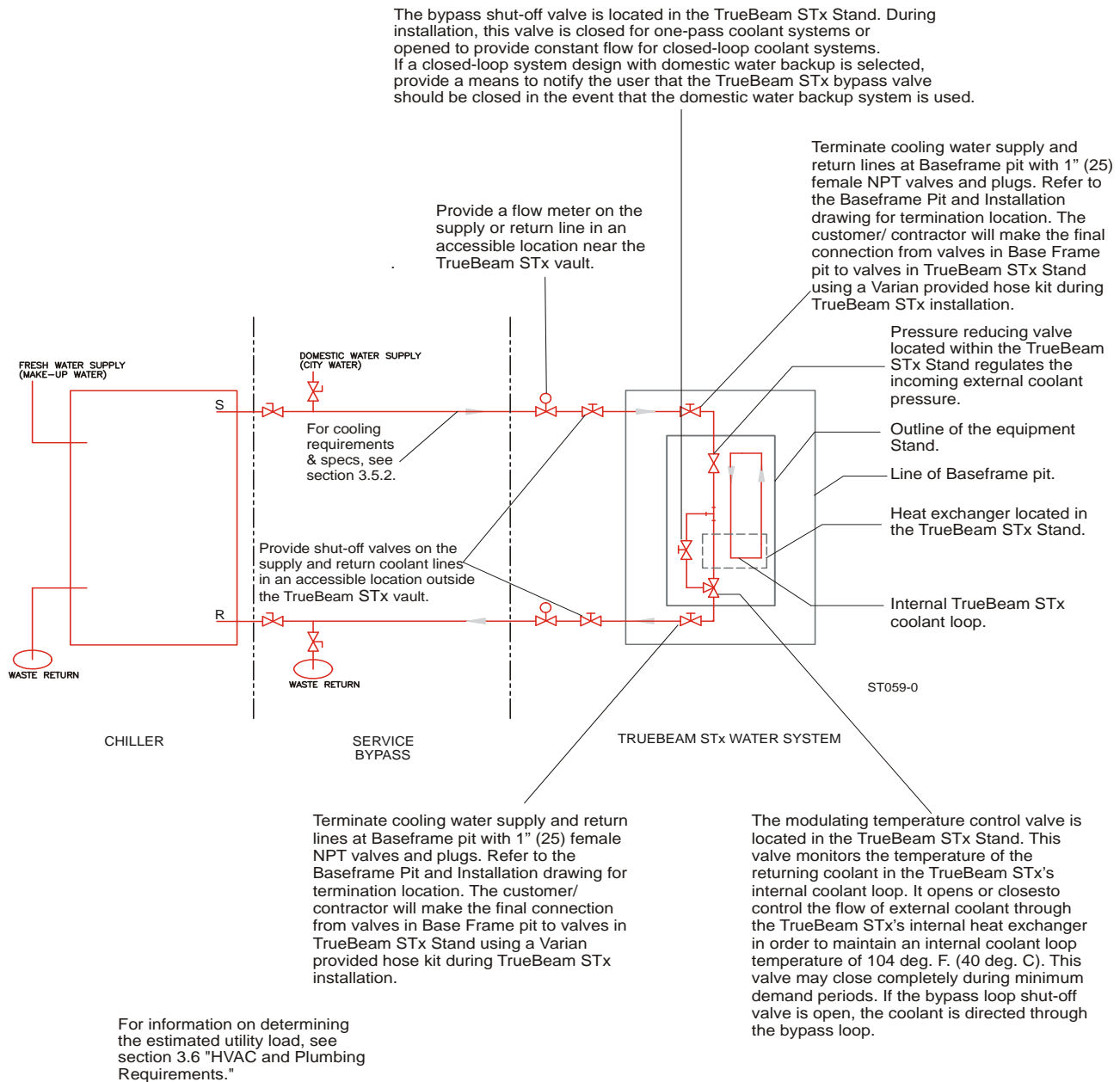


Figure 3-25 TrueBeam STx Coolant System Diagram

3.8.2.1 TrueBeam STx Coolant Requirements

The TrueBeam STx coolant heat load varies with the Operational State as outlined in [Table 3-4](#).

Table 3-4 TrueBeam STx Coolant Requirements

Low Power (Power Save) State coolant heat load.	2 kW (6,830 Btu/hr)
On (No Mode) State coolant heat load.	10 kW (34,152 Btu/hr)
Ready/Energy Select State coolant heat load.	12.5 kW (42,690 Btu/hr)
Beam-On State coolant heat load.	25 kW (85,379 Btu/hr)
Normal treatment cycles (see “Operational States” on page 3-36).	Requires heat dissipation into cooling water of 13.3 kW (45,422 Btu/hr)
Minimum operational heat load.	2 kW (6,830 Btu/hr) – 24 hour cooling required.
Maximum heat load (during Beam-On).	25 kW (85,379 Btu/hr)
Maximum overall input pressure, including normal back pressure.	100 PSIG (7 kg/cm ²)
The pressure differential between the inlet and outlet fittings at the TrueBeam STx Stand.	Adjusted to between 10 PSI (0.7 kg/cm ²) and 24 PSI (1.7 kg/cm ²) @ 3.0 – 5.0 GPM (11.4 – 18.9 LPM), respectively (while in the Ready State).
Actual pressure drop through the TrueBeam STx.	24 PSI (1.7 kg/cm ²) (under maximum heat load conditions).
Periodic cooling water flow through the TrueBeam STx.	0 GPM (with the internal bypass valve closed only).
Average water temperature rise during Beam-On, Standby, and Ready States (w/closed bypass valve).	27 deg. F. (15 deg. C.)

3.8.2.2 Coolant Specifications

- The cooling water requirement can be satisfied with a one-pass system (domestic supply and waste return) or a closed-loop system. Although most water and sanitary districts restrict the use of one-pass cooling, it can generally be used for backup. If a closed-loop system is used, provide a domestic back-up system.
- The TrueBeam STx does not contaminate the coolant.
- Experience has shown that some local potable water supplies have caused excessive corrosion and frequent replacement of the internal TrueBeam STx heat exchanger. Under the following conditions, professional advice should be obtained to recommend appropriate water treatment:
 - When the total dissolved solids are greater than 300 mg/L and the pH (actual) is less than 6.5 or greater than 9.6.
 - When the total dissolved solids are between 100 mg/L and 300 mg/L and the pH (actual) is less than 8.2 or greater than 11.2.
 - When the total dissolved solids are less than 100 mg/L and the pH (actual) is less than 10.0 or greater than 13.0.
 - When the chloride or sulfate content is high.
- Maximum glycol content of coolant – 50%.

3.8.3 Compressed Air System

Compressed air is not required for the TrueBeam STx. If an existing system is available from a previously-installed Varian Clinac, it is recommended that the compressed air system remain in place for TrueBeam STx servicing.

3.8.4 Environmental Specifications

- Humidity range – 15% to 80% Relative Humidity, Non-condensing.
- Room temperature range – 60° to 80°F (16° to 27°C).
- Maximum allowable temperature shift of Imager from time of calibration to time of treatment – $\pm 2.0^{\circ}\text{C}$ ($\pm 3.6^{\circ}\text{F}$). Applies to the Stereotactic Optical Imager only.

3.8.4.1 Ventilation

TrueBeam STx will produce detectable levels of ozone under certain conditions. Four to six air changes per hour are normally required to maintain undetectable levels, depending on the size of the vault and air circulation efficiency. Ventilation required to remove the heat dissipated to the vault air normally accomplishes this. The ventilation system should use *fresh-air* as part of its design. Treatments should not be performed if the ventilation system is not in operation. Long irradiation's at high dose rates, such as those performed for physics measurements, should be followed by *airing out* the vault. It is important to provide positive air pressure in the TrueBeam STx vault to *hold* swing-type doors closed.

Provide ventilation sufficient for removal of equipment air heat load as follows:

- TrueBeam STx Vault
 - 7.0 kW (23,891 Btu/hr) at TrueBeam STx Stand/Gantry during Ready and Beam-On States.
 - 1.5 kW (5,119 Btu/hr) at TrueBeam STx Stand/Gantry during No Mode State.
 - 1.0 kW (3,413 Btu/hr) at TrueBeam STx Stand/Gantry during Power Save State.
 - 5.0 kW (17,065 Btu/hr) at Modulator Cabinet during Beam-On State.
 - 0.5 kW (1,707 Btu/hr) at Modulator Cabinet during other States.
 - 0.2 kW (683 Btu/hr) at ExacTrac X-ray tube during X-ray On.
- TrueBeam STx Control Console Area
 - 1.5 kW (5,118 Btu/hr) at the Control Console Cabinet.
 - 1.5 kW (5,118 Btu/hr) at the Control Console Imaging Cabinet.
 - 0.5 kW (1,707 Btu/hr) at optional ARIA Workstation.
- ExacTrac System (location of ExacTrac components at customers' discretion).
 - 0.25 kW (853 Btu/hr) at X-ray Generator during Standby.
 - 0.4 kW (1365 Btu/hr) at X-ray Generator during X-ray On.
 - 0.5 kW (1706 Btu/hr) at Computer Cabinet and IR System Components in all States.

3.8.5 Plumbing

A sink with running hot and cold water is highly recommended in TrueBeam STx vaults. Appropriate codes should be followed regarding paddle or foot controls and type of faucet. A hose spigot is necessary to fill the water phantom and a drain is necessary to service the TrueBeam STx's internal cooling system and drain the water phantom. Floor drains and floor sinks should not be located in the vault to avoid possible backup into the equipment floor recesses. Do not run water lines directly above the TrueBeam STx components or control console.

3.8.6 Fire Protection

Sprinklers inside the treatment room are discouraged. Their discharge or inadvertent leakage into the Couch pit or into the Stand generate expensive repairs with extended shut-downs. Some jurisdictions allow substitution of Type I construction for fire protection. Detectors are strongly recommended and normally adequate if a type "C" fire extinguisher is available in the treatment room. Heat detectors or photo-electric smoke detectors are preferred because ionization-type detectors can, under certain circumstances, give false alarms. If fire sprinklers are required by local authorities, sprinkler heads should not be located above the equipment. A system valved and controlled by the smoke detector (dry pre-action) can be incorporated so that sprinklers are *wet* only upon specific need. Semi- or fully recessed, high temperature heads are recommended in *wet* systems. The safety of non-ambulatory patients should be reviewed if a chemical system is considered. Verify all regional regulatory code requirements.

3.9 Shielding

For detailed information on shielding data, see “[Typical Room Shielding Tables](#)” on page 2-1.



WARNING: Varian Medical Systems shall have no approval or other responsibility for any matter affecting or related to the adequacy of the radiation protection walls and barriers or related safety devices. All radiation shielding designs must meet codes and regulations of all Authorities Having Jurisdiction (AHJ) and must be approved by the Customer's or Facility's Physicist of Record and shall be the sole responsibility of the Customer/Facility. The hours of operation, patient workload, accelerator energy, and the shielding materials should all be taken in to consideration when calculating shielding requirements. Serious injury or Death can result from improper radiation shielding

3.9.1 Radiation Shielding Details

- Treatment room shielding is required for the protection of therapists and others while the Linear Accelerator has the beam on. Linear Accelerator shielding is provided by either poured-in-place concrete alone (low or dual x-ray energy), lead/steel plates alone (low x-ray energy only), or a prescribed combination of both (low or dual x-ray energy).
- The amount and type of shielding on treatment room entrance doors have varying requirements based on the presence and length of the maze, and the energy of the Linear Accelerator. Generally, low energy accelerators will require wood doors with a lead core and manual operation. High Energy accelerators usually require steel doors with a lead and borated polyethylene core and motorized operation. Exact accelerator door shielding requirements are dependent on maze and shielding configuration. See typical minimum suggested door shielding. Accelerator neutron leakage calculations down the maze follow the general guidelines of NCRP Report 79. A Varian monograph titled: “Neutron Doors for High Energy Accelerators,” is available on request. As these doors do not have latching mechanisms, room air pressure must be positive relative to the department. Typically, shielded doors must be “exempted” where fire code labeling is required.
- To reduce radiation exposure outside room, air handling ducts should enter/exit the room through penetration(s) above the maze door. The ducts should be placed as high as possible in order to minimize radiation exposure to occupied space. The ducts should be designed to minimize the area of penetration through the wall. In most cases, duct shielding will not be required, provided the duct design conforms to this criteria. Clear space should be left around the duct (outside the treatment room) for shielding retrofit, in case the post installation radiation survey indicates a requirement. Penetration, including ducts, directly into the treatment room should be avoided. For no-maze treatment rooms, duct design and shielding must be addressed by the Physicist of Record.
- Provide adequate radiation shielding (usually lead or steel with a 1" (25) margin) behind all junction and pull boxes recessed in concrete walls. Verify thickness and location with the Physicist of Record.

- Steel or lead shielding at Linear Accelerator rooms may be embedded in or mounted on the inside surface of concrete walls and ceiling. Additional structural reinforcement may be required. Neutron shielding must be carefully analyzed by the Physicist of Record when lead or steel is to be located on primary or secondary barriers on installations with photon energies higher than 10 MV.
- Linear Accelerator shielding calculations follow the general guidelines of NCRP Reports 49 and 51. The TVL of leakage x-rays have been modified based on the report of W.R. Nelson and P.D. LaRiviere: "Primary and leakage Radiation Calculations at 6, 10 and 25 MeV," Health Physics, 38811 (1984). Copies are available on request.
- The shielding table suggestions are based on calculations using NCRP report 151 methodology and measured data. Distances of point of interest from isocenter are taken from Varian's Typical Room Configuration (see [Figure 2-2](#) on [page 2-7](#)). The room dimensions are based on machine clearance. This would translate into a distance of 10 feet from the isocenter to the nearest inner wall surface of the primary barrier.

3.9.2 Radiation Shielding Calculation Assumptions

- The primary beam use factor is defined as 25%.
- The occupancy is defined as either 100% or 10%.
- The weekly dose limit is defined as $20\mu\text{Sv/week}$ (2 mrem/week).

The workload for standard procedures is defined as 75000 rads/week with 0% IMRT procedures when using the system for 10 hours per day, five days per week, five patients treated per hour at 250 rads per session.

- $W = 75,000$ rads per week for primary walls.
- $W = 75,000$ rads per week for secondary walls.

The workload for standard procedures with 50% IMRT procedures and a modulation factor of $F=3$.

- $W = 75,000$ rads per week for primary walls.
- $W = 150,000$ rads per week for secondary walls.

The workload for SRS procedures in utilizing the High Intensity Mode (HIM) (dose rates > 1000 MU/min) is defined as 200,000 rads/week with 20% IMRT procedures and a modulation factor of $F=3$. The assumed system usage is 10 hours per day, five days per week, two treatments per hour at 2000 rads per treatment, average six sessions per day.

- $W = 200,000$ rads per week for the primary walls.
- $W = 280,000$ rads per week for the secondary walls.

The dose output in the HIM is assumed to be 1400 rads/min for the 6MV and 2400 rads/min for 10MV.

- Except where specifically noted, radiation leakage in non-controlled areas shall not exceed 20 μ Sv/week (2 mrem/week), assuming 100% occupancy beyond the shielding barriers (per NCRP Report 91 “Recommendations of Limits for Exposure to Ionizing Radiation”).
- Most treatment rooms are entered through a maze. This hallway is designed to reduce radiation levels at the entrance door. The length of the maze and the occupancy outside the entrance door affects the amount of shielding required in the door. “No-maze” doors are available from several shielding manufacturers. The use of these doors must be reviewed by the Physicist of Record early in the design process.
- Supplement No. 11 (1972) and Supplement No. 17 (1983) of the “British Journal of Radiology” describes two different conventions for referencing the quality of an x-ray radiotherapy beam. The convention presented in Supplement No. 11 has been adopted for this sheet.
- The typical room shielding tables information is provided to assist early treatment room design. The Physicist of Record for the project should become involved with the treatment room design as early as possible. With regard to facility shielding, the Physicist of Record is responsible for designing the treatment room radiation shield barriers and confirming they meet applicable regulatory requirements. The facility design is based on regulatory requirements of the regulatory body tasked with oversight of Radiation Producing Devices in the Region, and recommendations of the national Council of Radiation Protection and Measurement (NCRP).

3.9.3 Other Shielding Information

During Schematic Development for a TrueBeam STx and associated video monitors, consideration should be taken of the proximity to Magnetic Resonance Imaging (MRI) units or other magnetic field generating equipment. According to MRI manufacturers, linear accelerators and simulators should be located outside of the 100 μ T (1 Gauss) magnetic field created by the MRI. A map of the magnetic field emanating from the particular MRI unit can be obtained from the manufacturer of the MRI unit.

3.10 Baseframe Pit and Installation

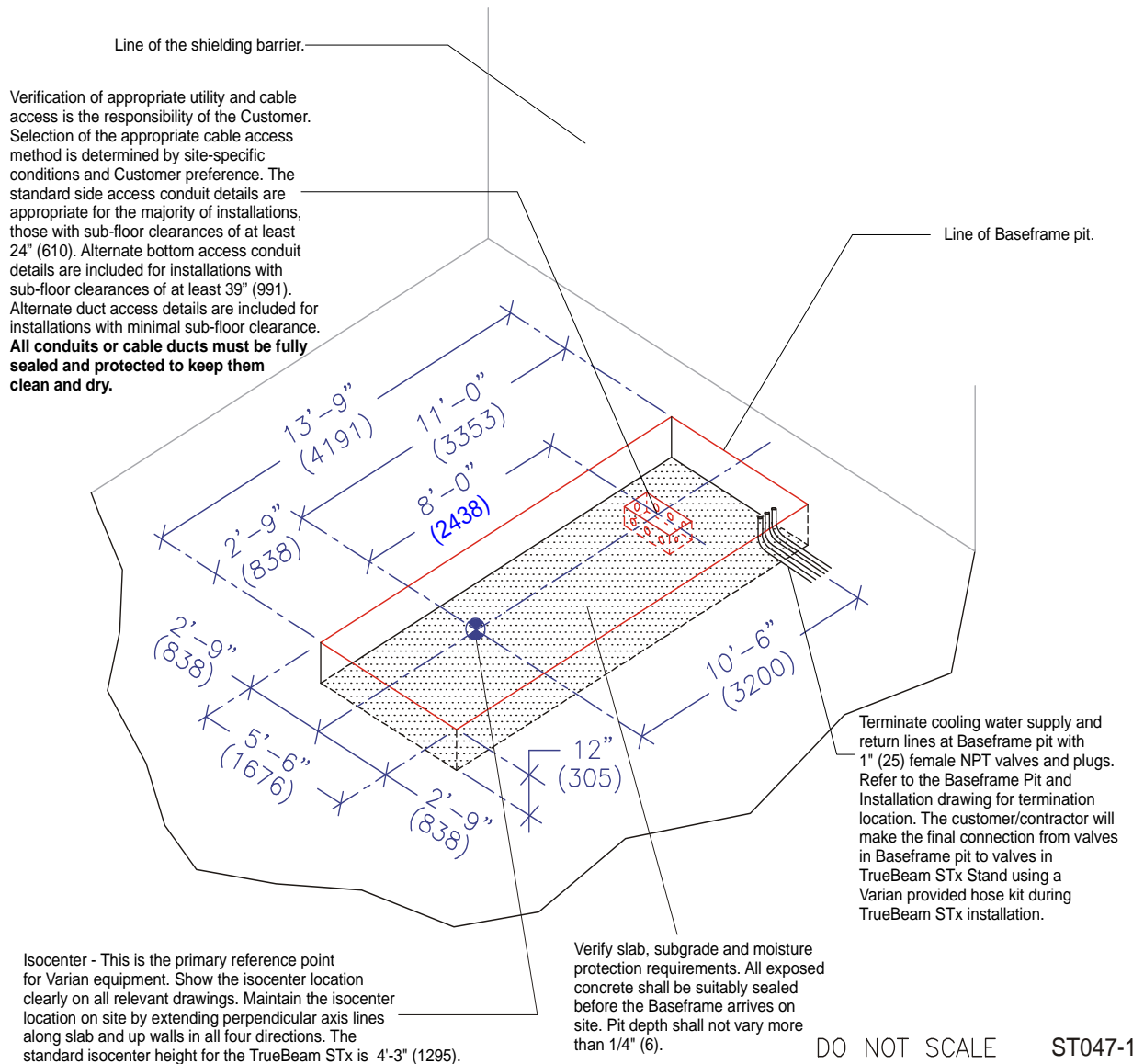


Figure 3-26 TrueBeam STx Baseframe Pit Dimensions



Note: The installed weight of the High Energy Accelerator is approx. 26,530 lbs. (12,034 kg)

- Baseframe ≈ 2,260 lb. (1,025 kg.)
- Treatment Couch ≈ 1,600 lb. (726 kg.)
- Combined Stand/Gantry ≈ 22,670 lb. (10,283 kg.)

The design of the Baseframe Pit for this load should be reviewed by a Structural Engineer.



WARNING: In all seismically active locations, the design of the Baseframe Pit for this load, and its anchorage, should be approved by a licensed Structural Engineer. During a seismic event, serious injury or loss of life may result from a substandard design.

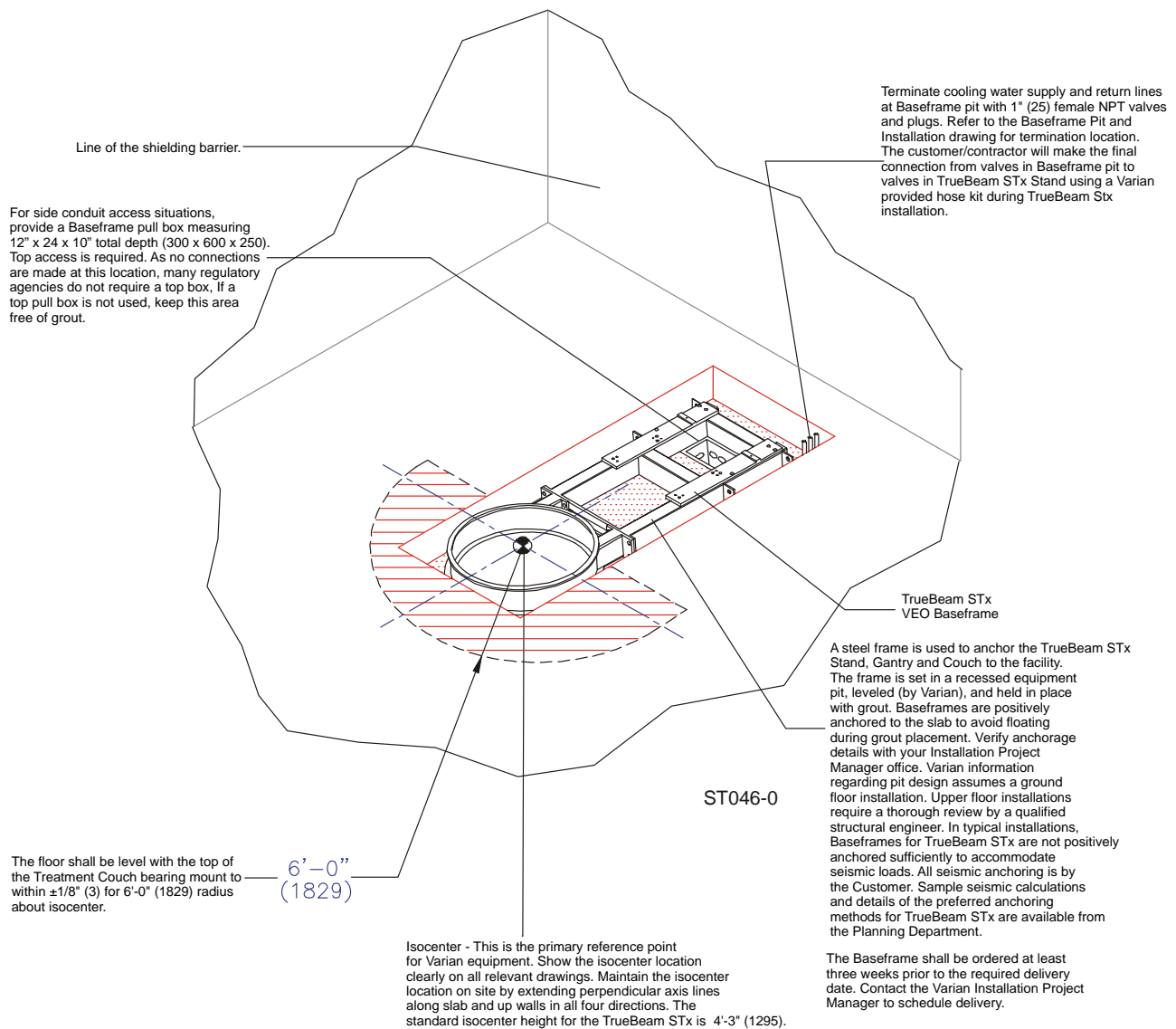


Figure 3-27 TrueBeam STx Baseframe Installed

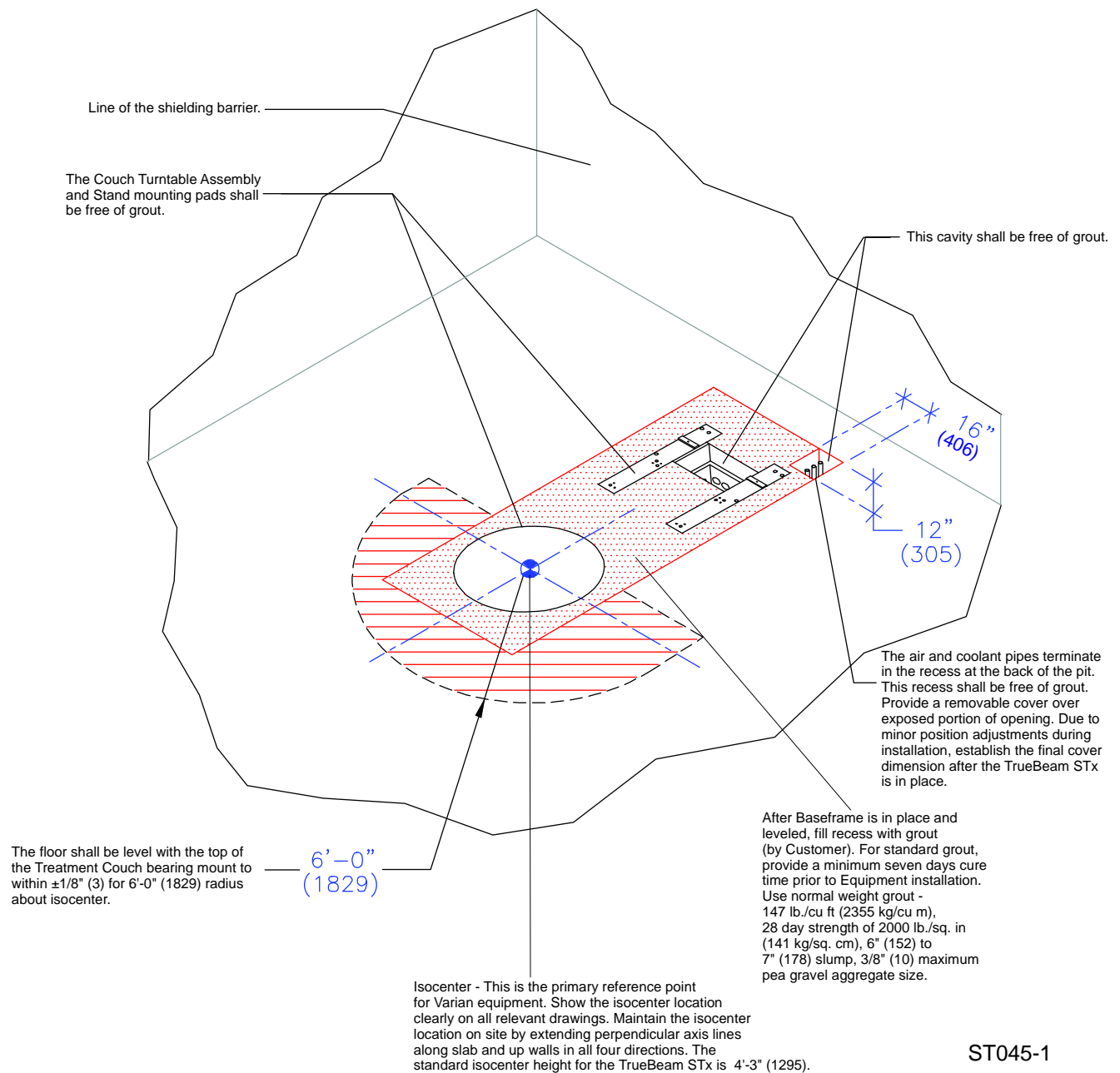
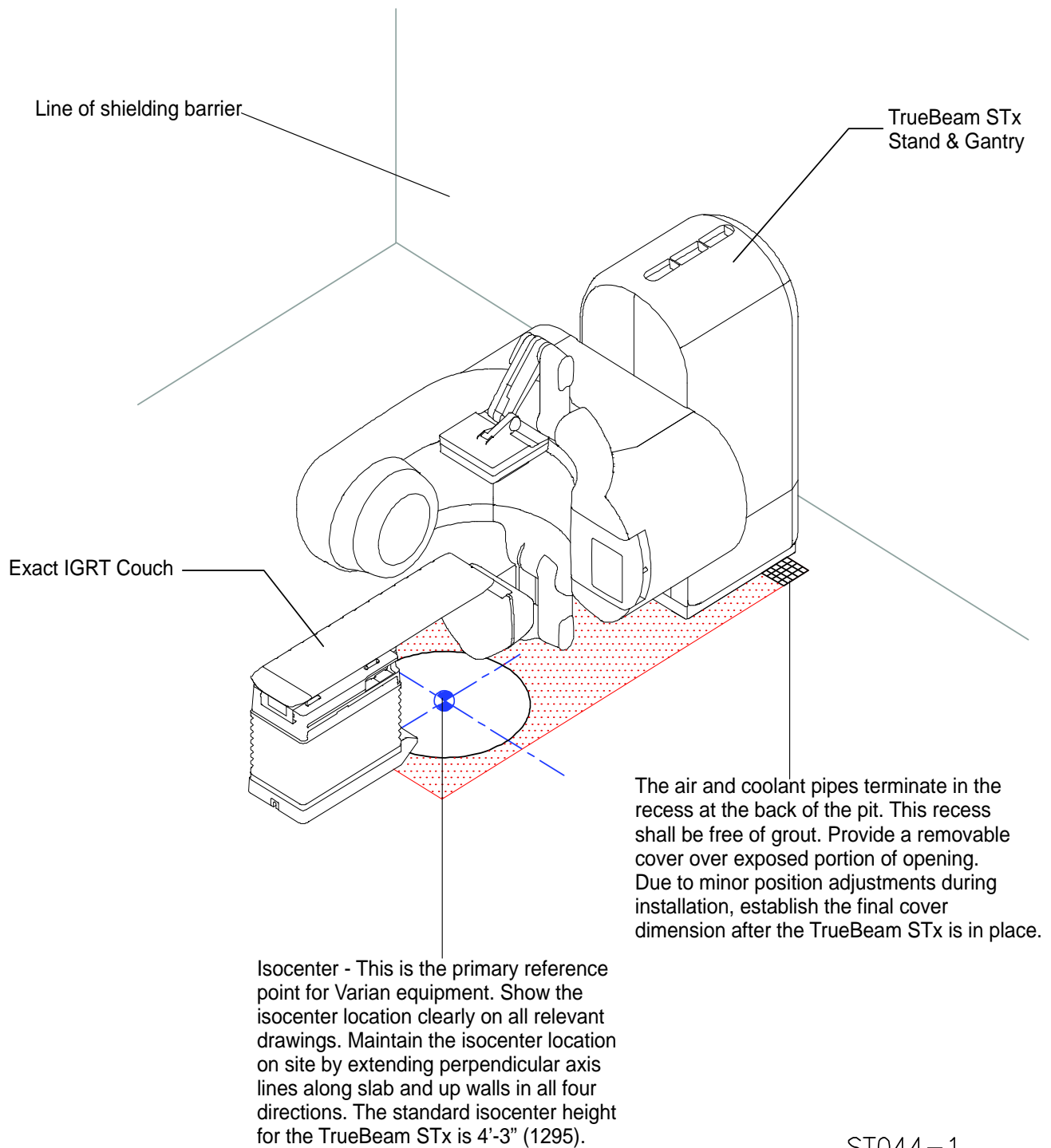


Figure 3-28 Grout After Baseframe Installation



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For information on flooring requirements, see section 5.4 "Carpeting and Flooring Requirements."

Figure 3-29 TrueBeam STx Installed on Baseframe

3.11 Baseframe Cable Access Details

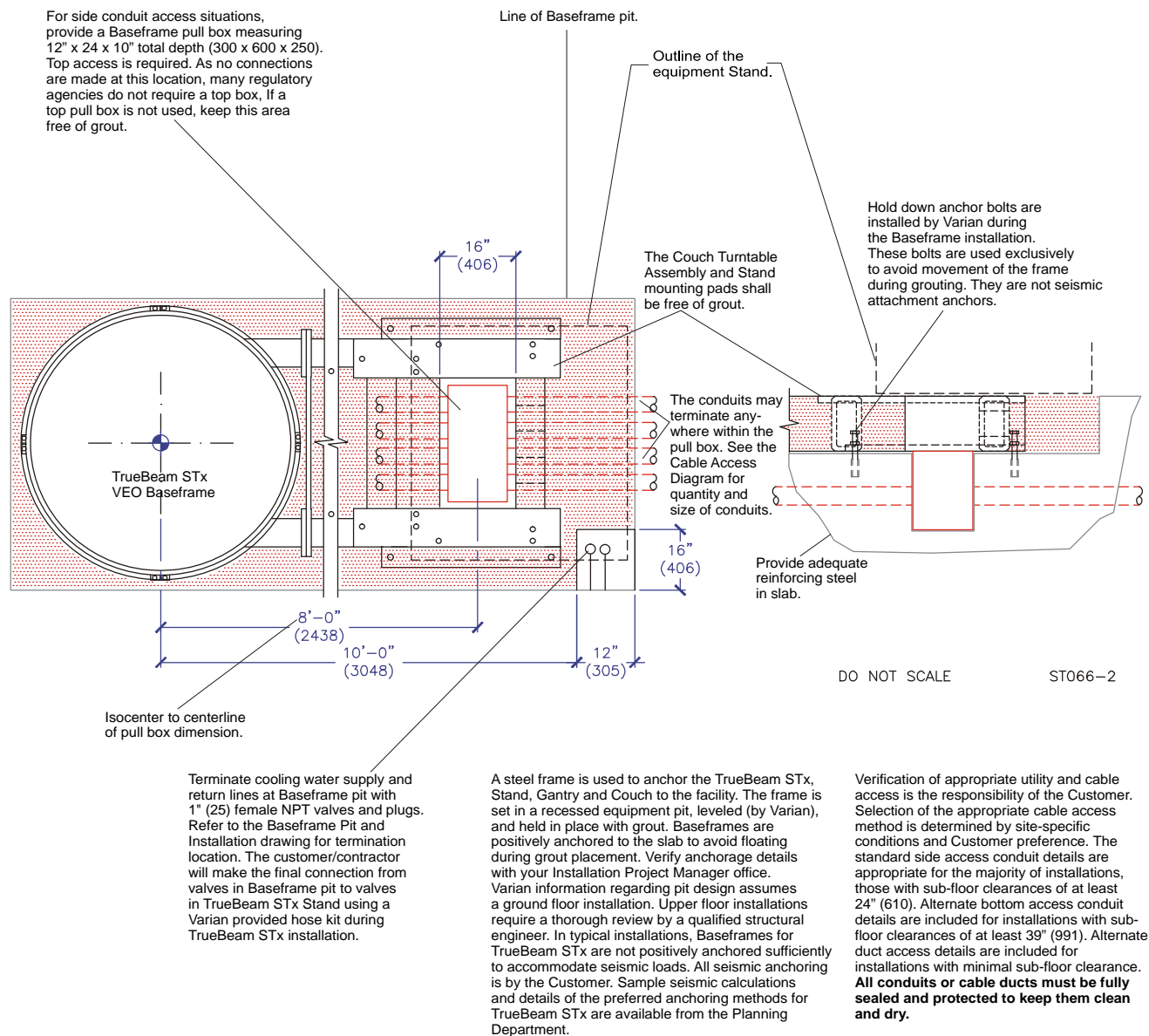


Figure 3-30 Standard Side Cable Access Plan and Section at Pull Box

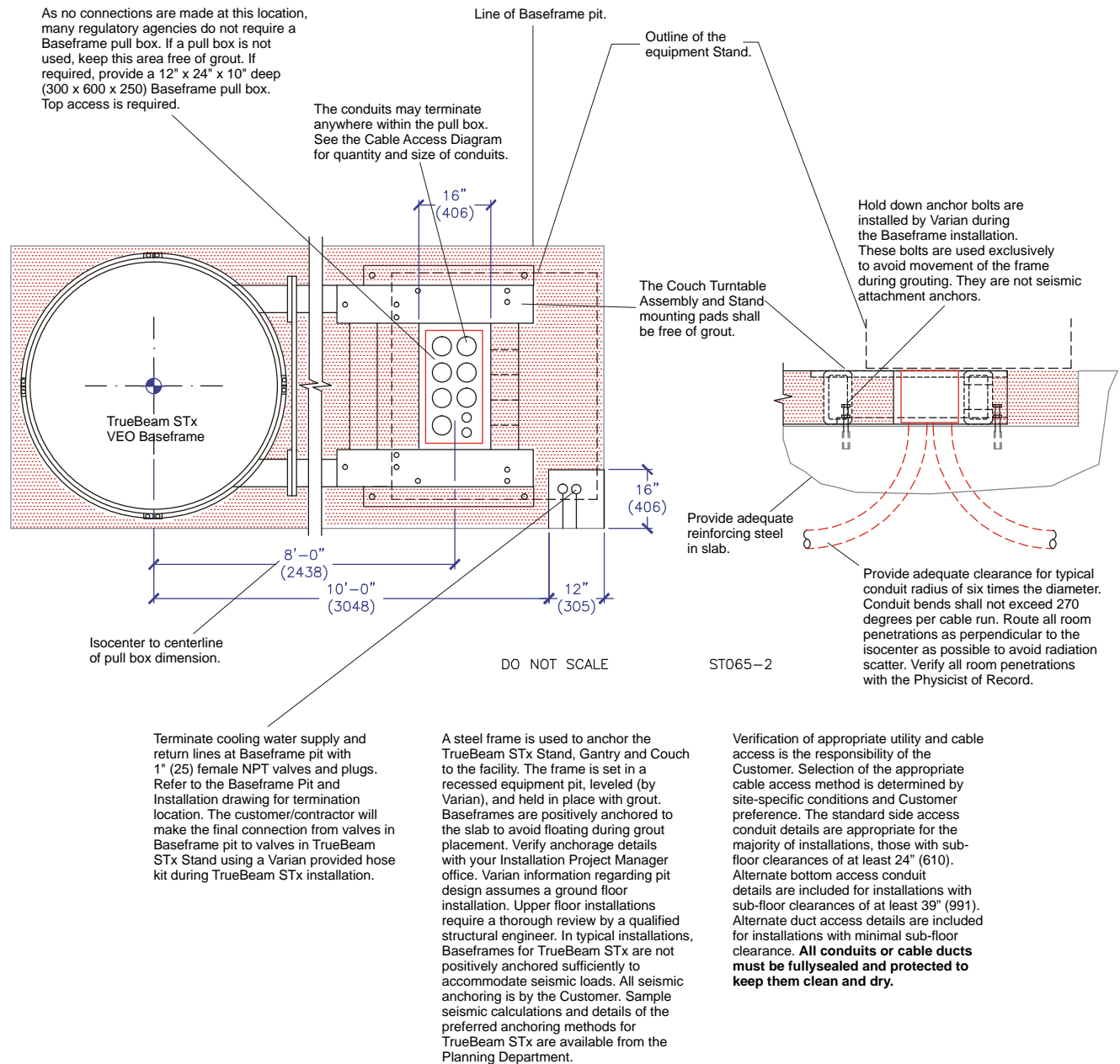


Figure 3-31 Alternate Bottom Cable Access Plan and Section at Pull Box

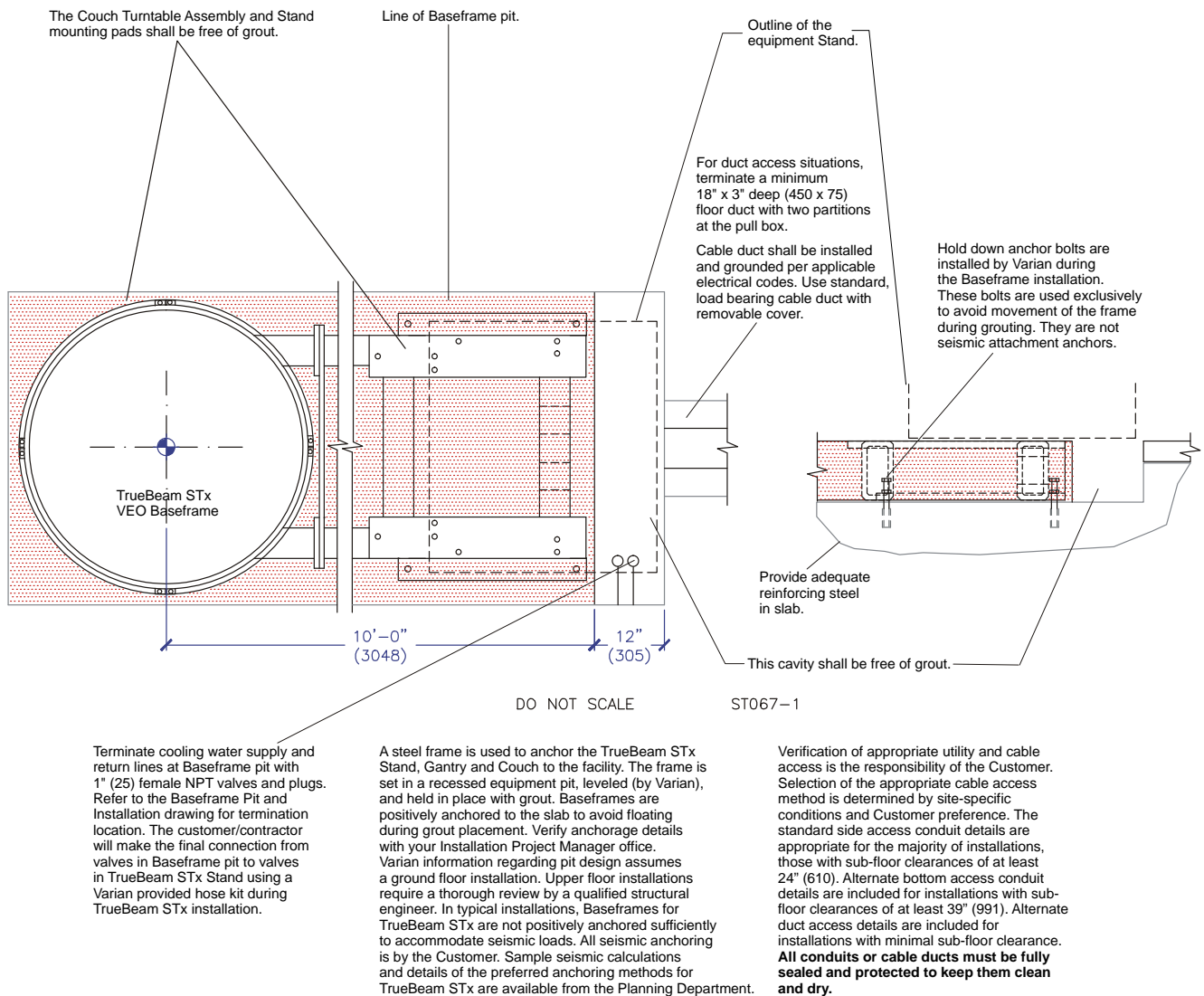
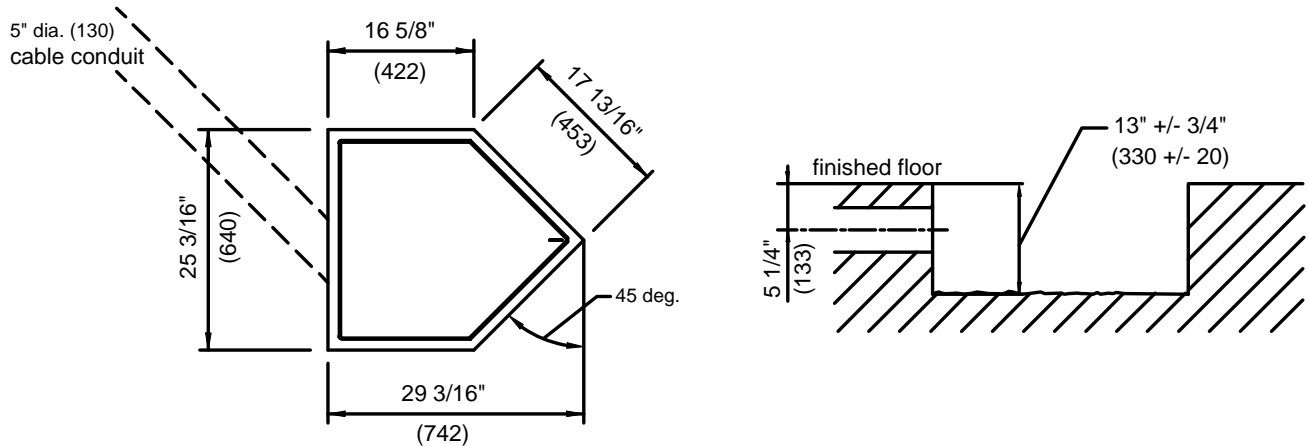


Figure 3-32 Alternate Conduit/Duct Cable Access Plan and Section at Pull Box

3.12 Floor Boxes for ExacTrac X-ray Tubes

3.12.1 Recess Dimensions for ExacTrac 12" Floor Box



- The dimension of the recess may be increased to a margin of $1 \frac{15}{16}$ " (50) on each side. This requires that concrete is poured after placement of the box to ensure that the aluminum cover rests all around with minimum $\frac{3}{8}$ " (10) on concrete floor.
- The absolute minimum depth of the Floor Box Recess over the whole surface is $12 \frac{1}{4}$ " (310).
- The recess surface must be level for fine adjustment of floor boxes.

Figure 3-33 Recommended Dimension for Recess to Fit 12" Floor Box



WARNING: The cutting of floor box recesses is a severe interference into the building statics. A stress analyst approval/clearance is mandatory.

As long as the floor box is not already installed in the pit, the pit has to be marked with warning signs or covered.

The aluminum cover should fit within $\frac{3}{8}$ " (10) of finished concrete floor.

3.12.2 Position of ExacTrac 12" Floor Box Recess

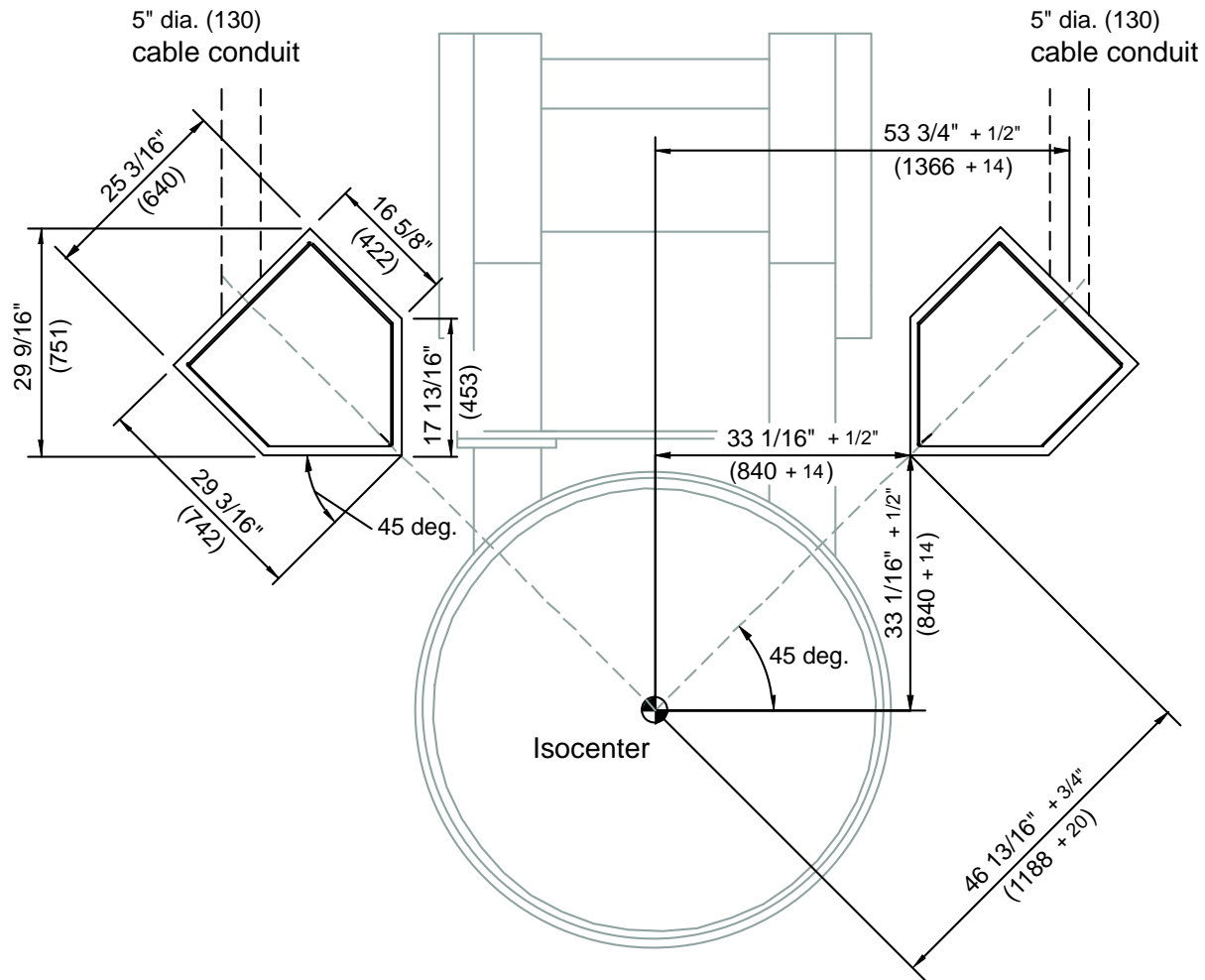


Figure 3-34 Recommended Position of Recess



Note: The position of the recess tolerance is high because the tube itself may be moved back and forward to adjust. See [“Maximum Deviation”](#) on page 3-56.

3.12.3 External Dimensions for ExacTrac 12" Floor Box

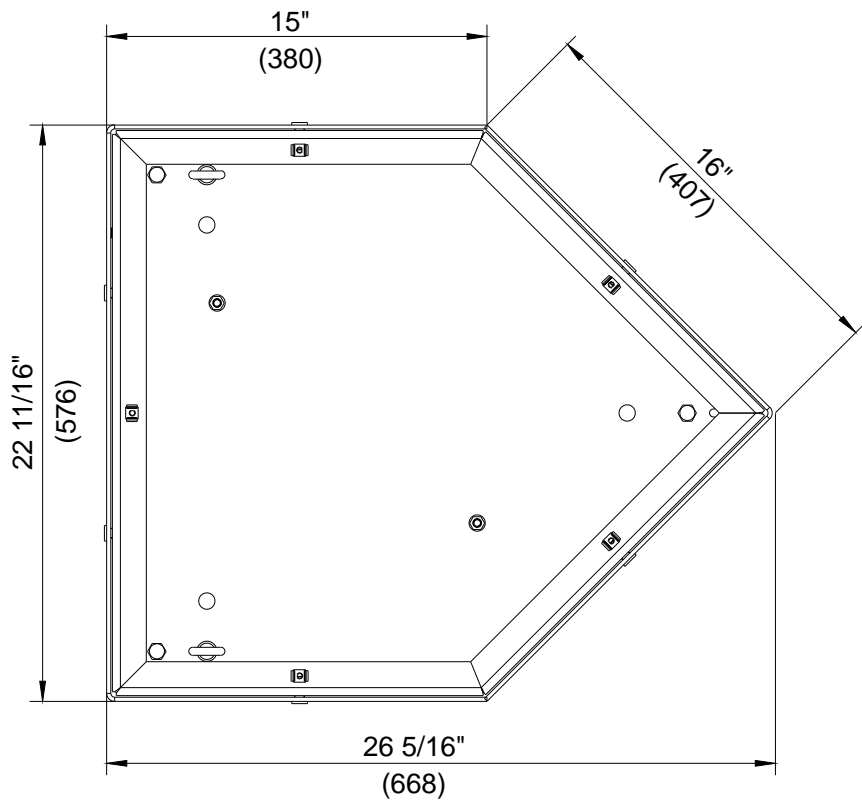


Figure 3-35 External Dimensions for 12" Floor Box, Top View

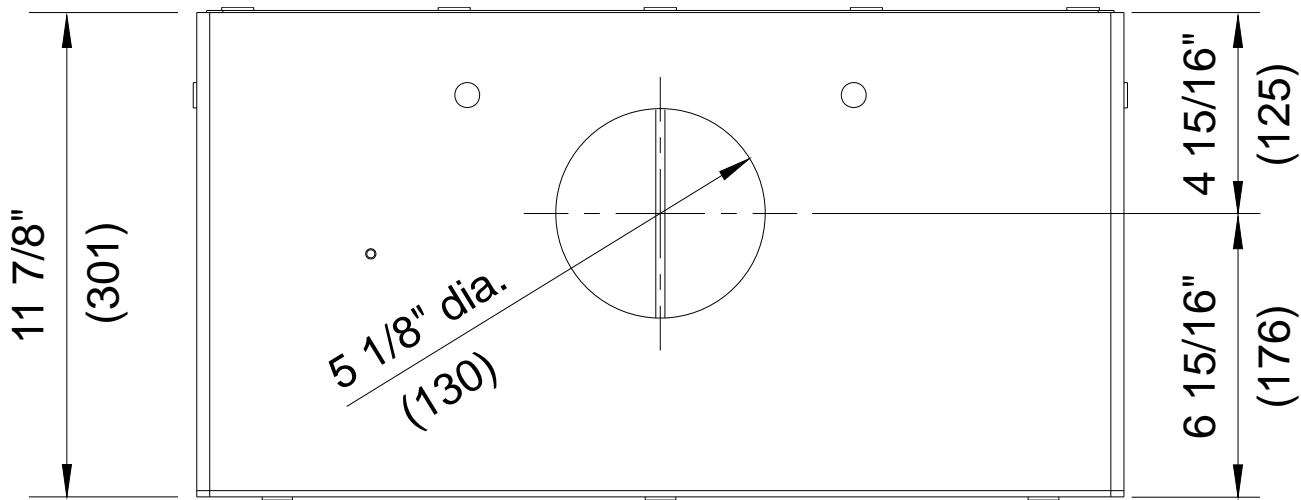
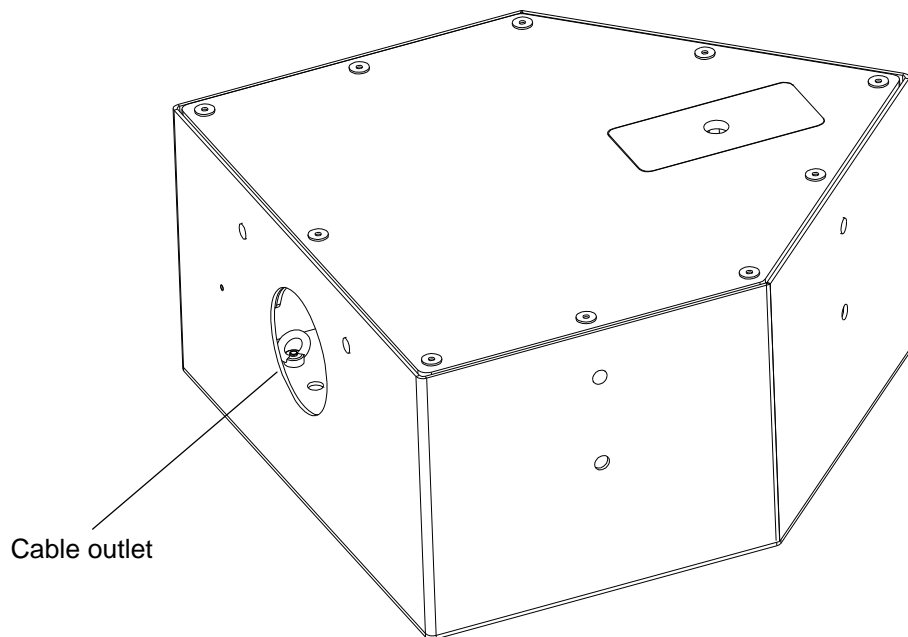


Figure 3-36 External Dimensions for 12" Floor Box, Back View (Height without Leveling Feet)

3.12.4 ExacTrac 12" Floor Box Cable Outlet



- Both floor boxes are identical.
- The Floor Boxes are delivered with leveling feet for fine adjustment.
- Only the provided cable outlet may be used. For exact position, see [Figure 3-36](#).

Figure 3-37 3D Overview of ExacTrac 12" Floor Box with Cable Outlet

3.12.5 Horizontal Position and Tolerance of ExacTrac 12" Floor Box

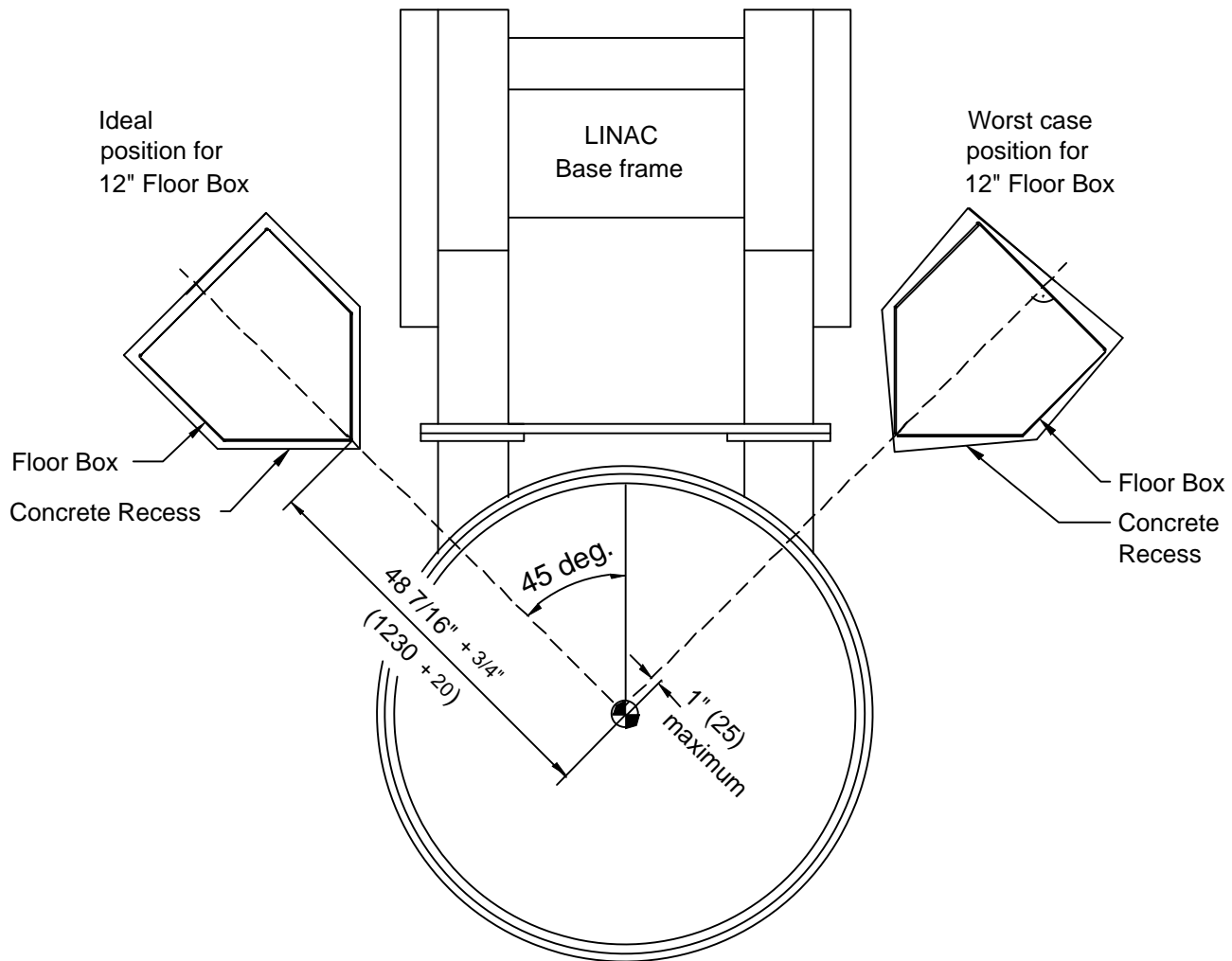


Figure 3-38 Positioning of Floor Boxes

3.12.5.1 Maximum Deviation

Due to an incorrect recess setup, the floor box must be rotated within the recess into a correct position, which can be very limiting. The maximum deviation of the line “floor box tip to midpoint rear wall of box” at the isocenter is 25mm (one inch).



Note: The only (and determining) measurement is the exact distance between isocenter and floor box tip at 45°.

3.13 ExacTrac Ceiling Mounts



CAUTION: All ceiling and wall mounts should be installed by the hospital or its subcontractor. The customer is responsible for installing in accordance to the local work safety regulations.

All hardware parts are provided by Brainlab, except bolts for the concrete ceiling, as local conditions and building construction vary.

The customer or contractor has to provide appropriate fixation with bolts and anchors according to local regulations and assure the correct installation by signing a compliance statement during acceptance procedure.

List of ExacTrac (ETX) Ceiling Mounted components:

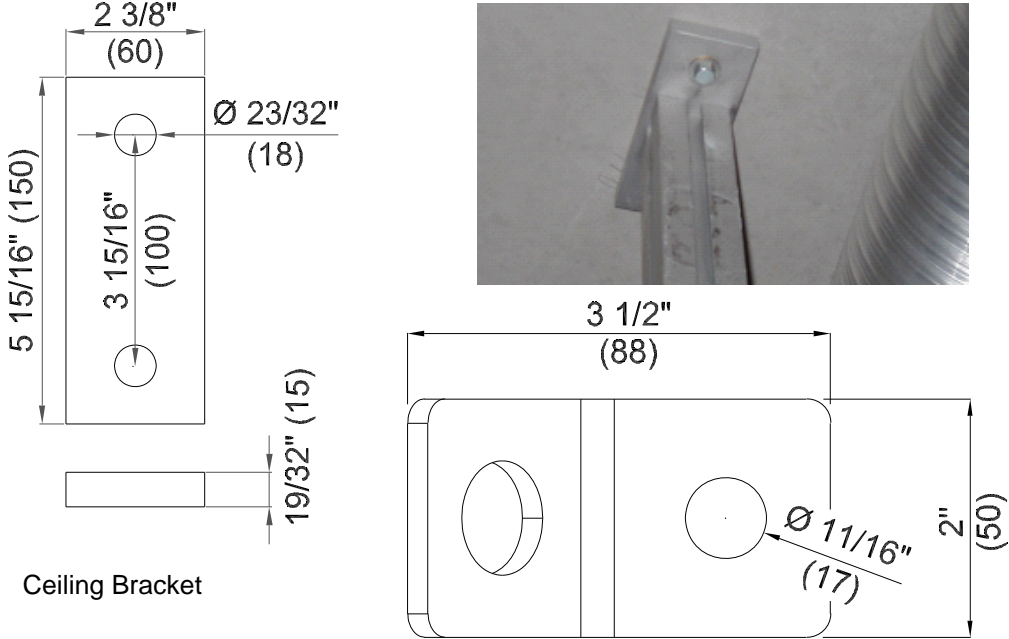
- Two Flat Panel ceiling mounts (ceiling mounts for Flat Panels and Camera System are identical)
- ExacTrac Infrared Camera is installed on the Optical Imaging Mount. See [Figure 3-13](#).
- Ceiling Frame for [ExacTrac In-Room Touch Screen Monitor \(Optional\)](#)
- One [Ceiling Mounted In-Room Distribution Box](#)



CAUTION: In case the mounting positions are obstructed from objects that cannot be moved, the customer is allowed to provide interfaces to BL equipment. Please refer to the corresponding section for further details.

3.13.1 Flat Panel and Camera System Ceiling Mount Installation

Table 3-5 Flat Panel and Camera System Ceiling Mount Installation

	Ceiling Mount for Infrared Camera System/Flat Panel Detector System
Weight	110 lbs. (50 kg)
Safety Factor	4 Construction must carry 440 lbs. (200 kg)
Bolts Required	<p>6 2 for the ceiling bracket, 4 for support cables</p>  <p>Ceiling Bracket</p> <p>Rope Ceiling Angle</p> <p>Use the 11/16" (17) borehole to attach the angle to ceiling.</p>
Mounting Accuracy Infrared Camera System	<p>15/32" (12)</p> <p>If there are pipes, HVAC, med gas, or other fixed objects obstructing the mounting position, the Ceiling Mount may not be moved closer to the isocenter but can be adjusted at a maximum of 5'-11" (1800) away from isocenter.</p> <p>The Interface Plate has the same orientation as the vertical profile bar. The slots are parallel to the center line.</p>
Mounting Accuracy Flat Panel Detector System	<p>15/32" (12)</p> <p>If there are pipes, HVAC, med gas, or other fixed objects obstructing the mounting position, the whole Ceiling Mount may not be moved closer to isocenter but can be adjusted at a maximum of 1 3/16" (30) further away from isocenter. Furthermore, the brackets (ceiling plate) may be rotated for 90°. Otherwise, items that impede the installation of the flat panel ceiling brackets must be re-routed or moved.</p> <p>The Interface Plate must be attached to the profile in 45° rotation. The slots of the plate are perpendicular to the line towards the isocenter (see Figure 3-39).</p>

3.13.1.1 Height Limitation

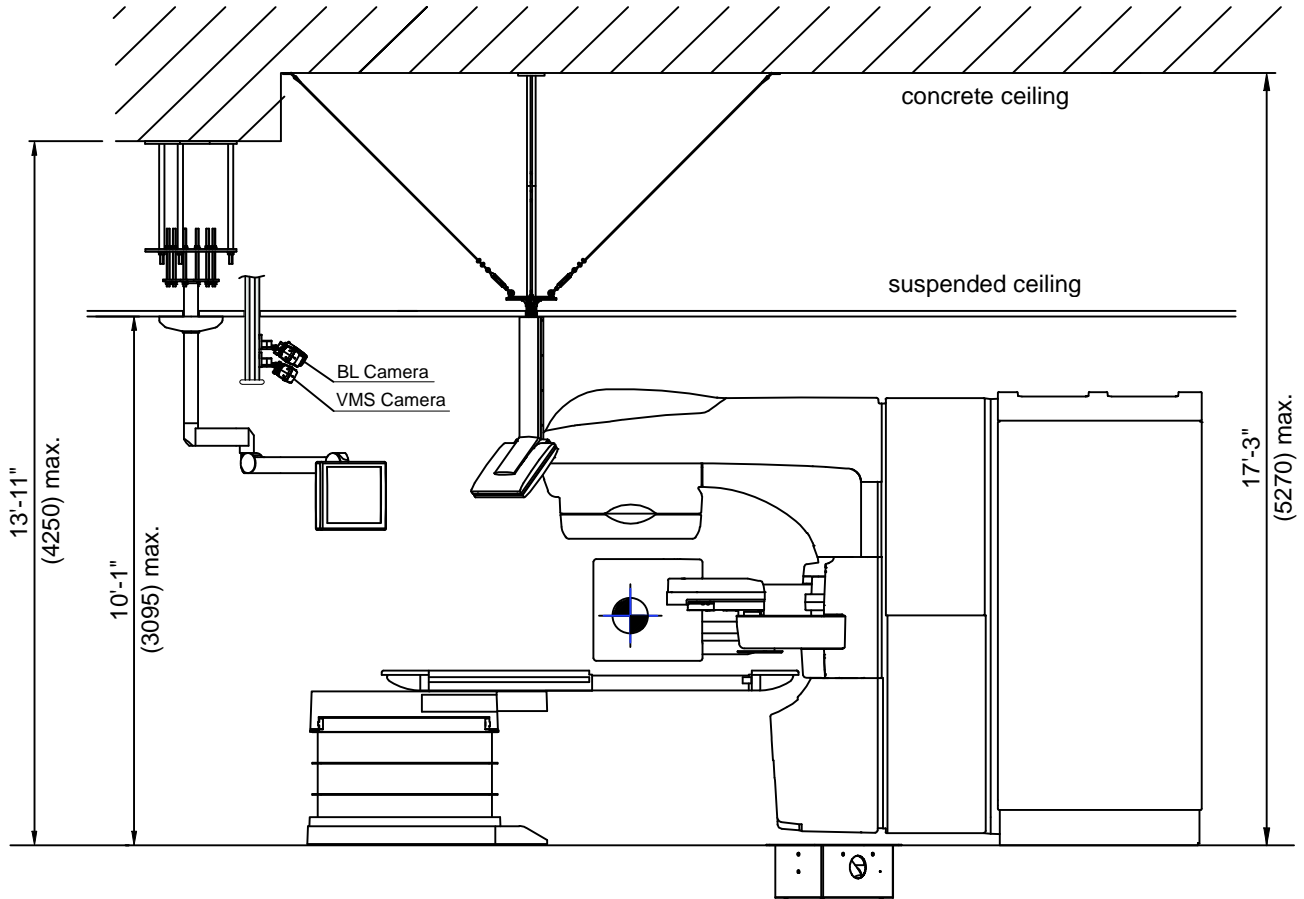


Figure 3-39 Recommended Maximum Ceiling Heights (not to scale)

In case of very high concrete ceilings, additional custom-made construction is necessary in order to maintain the maximum mounting heights (from finished floor).

- Ceiling Mount for Monitor Arm: 13'-11" (4250) max.
- Ceiling Mount for Flat Panels: 17'-3" (5270) max.
- Suspended Ceiling Height: 10'-1" (3095) max.
- Ceiling Mount for Camera System: ExacTrac Infrared Camera is installed on the Optical Imaging Mount. See [Figure 3-13](#).



CAUTION: For suspended ceilings higher than the recommended maximum height, the customer is responsible for covering all visible parts of the ceiling mounts.

3.13.1.2 Position of Ceiling Brackets

a. Ceiling Mount, Top View

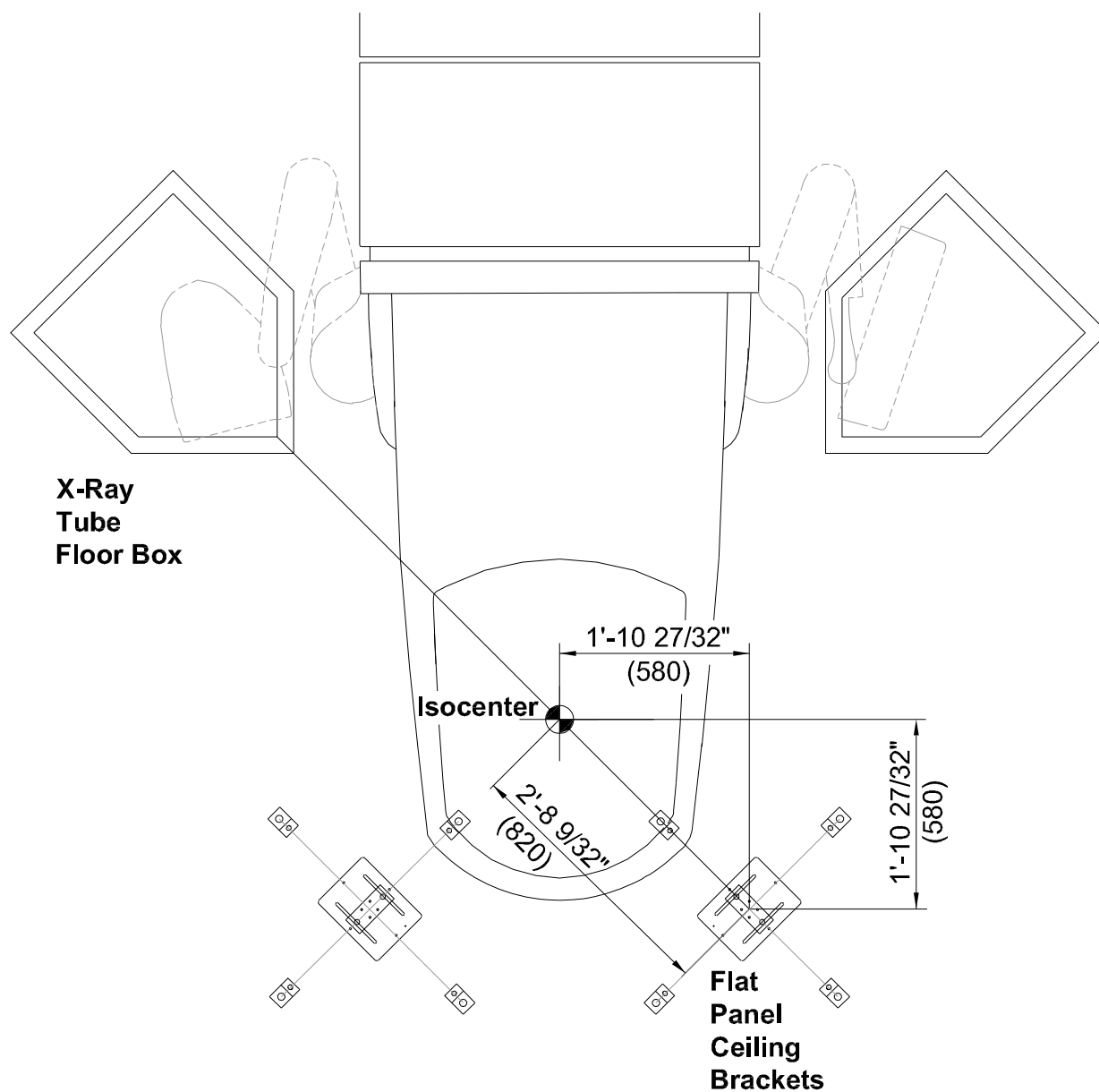
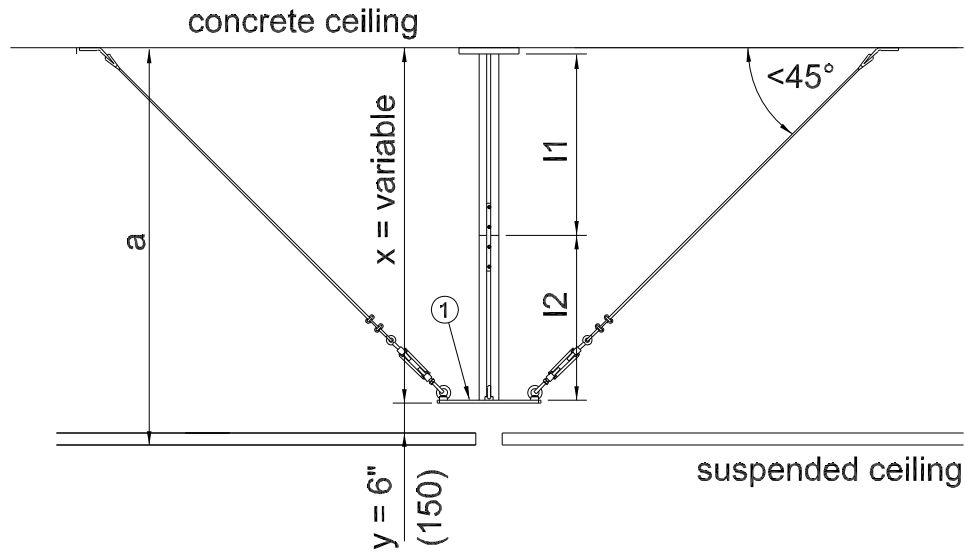
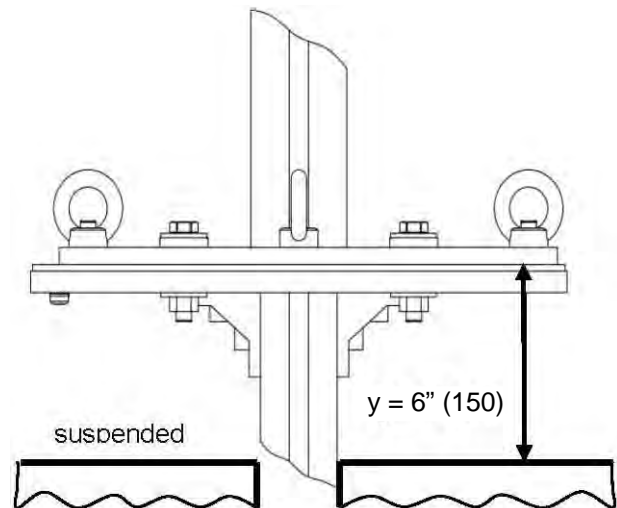


Figure 3-40 Position Ceiling Brackets for Camera and Flat Panel Suspension

- All measurements are made from isocenter.
- Define mounting spot on floor first.
- Use a Plumb Bob/Laser Pointer to project it to the concrete ceiling.

b. Ceiling Mount, Side View**Figure 3-41 Ceiling Mount for Camera and Flat Panel**

The clearance of $y = 6''$ (150) between the lower edge of the interface plate of the ET Ceiling Mount (1) and the upper edge of the suspended ceiling must be reserved for the installation and adjustment of the Brainlab devices

**Figure 3-42 Ceiling Mount Clearance**

CAUTION: The maximum distance between interface plate and isocenter is 7'-4 3/4" (1950). The maximum height of the interface plate above the finished floor is 11'-7 3/4" (3245).

Table 3-6 Flat Panel and Camera System Ceiling Mount Configurations Dimensions

Configuration	a	l1	l2	l = l1+l2	Bars	Ropes	Rope Ceiling Angle
XS	< 8 5/8" (220)	2" (50)	—	2" (50)	1	1	2
S	8 5/8" to 9 7/8" (220 to 250)	2 3/4" (70)	—	2 3/4" (70)	1	1	2
M	9 7/8" to 1'-5 3/4" (250 to 450)	a - 6 5/8" (170)	—	a - 6 5/8" (170)	1	4	4
L	1'-5 3/4" to 7'-1 7/16" (450 to 2170)	(a - 6 5/8" [170])/2	(a - 6 5/8" [170])/2	a - 6 5/8" (170)	2	4	4
XL	7'-1 7/16" (2170)	3'-3 3/8" (1000)	3'-3 3/8" (1000)	6'-6 3/4" (2000)	2	4	4

See [Table 3-7](#) for additional details.

Rope tighteners are used to apply proper tension to the ropes if long vertical bars are used for Ceiling Mount Installation (Configurations M, L, and XL).



Table 3-7 Flat Panel and Camera System Ceiling Mount Configuration Details


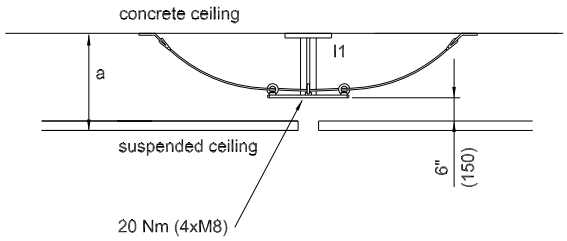
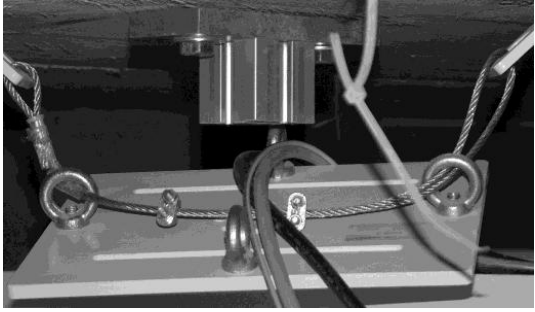

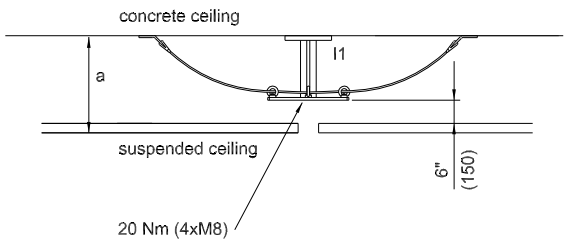
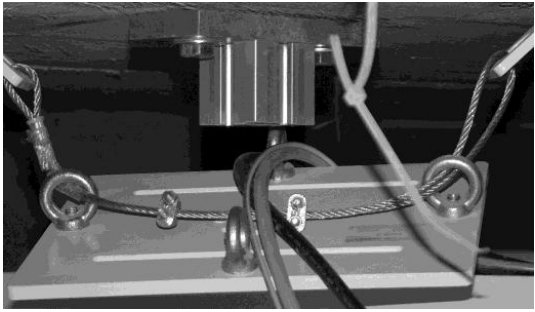

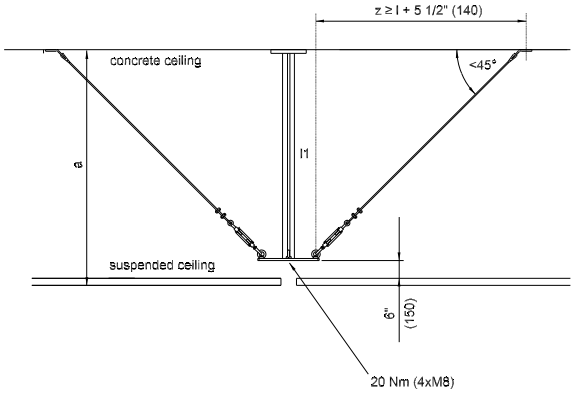

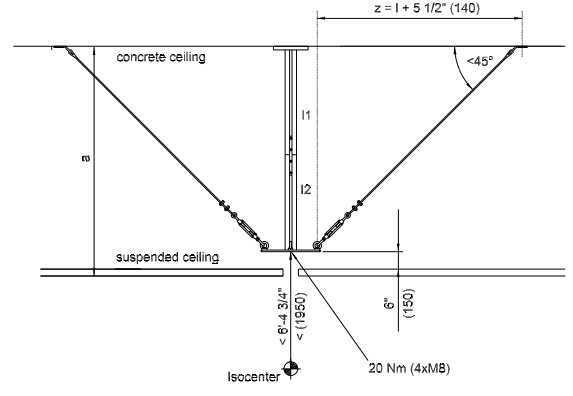

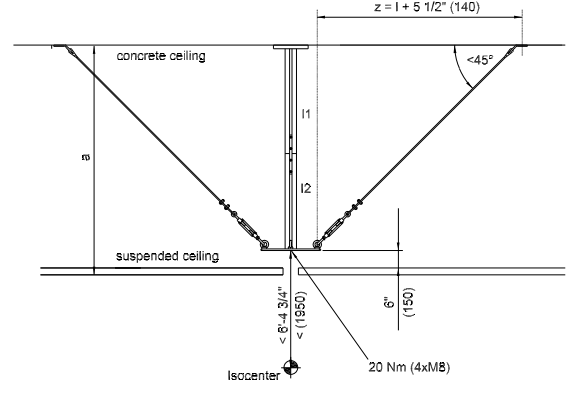
<p>Configuration XS</p> <p>Use only the upper vertical bar.</p> <ul style="list-style-type: none"> ■ Cut the bar as straight as possible. ■ Cut four M8 threads into the bar and mount the interface plate. ■ Tighten the screws with specified torque. <p>It is possible to leave out the tension ropes.</p> <ul style="list-style-type: none"> ■ Install oppositely positioned ropes as additional mechanical protective device. <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p> CAUTION: Do not use the rope tensioners, do not apply tension to this safety rope. Fix the rope loop with at least three rope clamps.</p> </div> <p>If the distance between the suspended and concrete ceiling is less than 6" (150) the mounting bracket could be visible, contact the project site coordinator.</p>	 
<p>Configuration S</p> <p>Use only the upper vertical bar.</p> <ul style="list-style-type: none"> ■ Cut the bar as straight as possible. ■ Cut four M8 threads into the bar and mount the interface plate. ■ Tighten the screws with specified torque. <p>It is possible to leave out the tension ropes.</p> <ul style="list-style-type: none"> ■ Install oppositely positioned ropes as additional mechanical protective device. <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p> CAUTION: Do not use the rope tensioners, do not apply tension to this safety rope. Fix the rope loop with at least three rope clamps.</p> </div>	 

Table 3-7 Flat Panel and Camera System Ceiling Mount Configuration Details (*continued*)

<p>Configuration M</p> <p>Use only the upper vertical bar.</p> <ul style="list-style-type: none"> ■ Cut the bar as straight as possible. ■ Cut four M8 threads into the bar and mount the interface plate. ■ Mount the Rope Ceiling Angels according to the drawing. ■ Tighten the screws with specified torque. <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p> CAUTION: Fix the rope loop with at least three rope clamps. Fix the rope tensioners after having applied proper tension.</p> </div>	
<p>Configuration L</p> <p>Use both vertical bars.</p> <ul style="list-style-type: none"> ■ Cut each vertical profile bar accordingly at half-length of the distance interface plate–concrete ceiling. ■ Mount the Rope Ceiling Angels according to the drawing. ■ Bars have to be assembled with four connection plates. Each connection plate is fixed with four strongly tightened screws. ■ Tighten the screws with specified torque. <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p> CAUTION: Fix the rope loop with at least three rope clamps. Fix the rope tensioners after having applied proper tension.</p> </div>	
<p>Configuration XL</p> <p>Use both vertical bars.</p> <ul style="list-style-type: none"> ■ Mount the Rope Ceiling Angels according to the drawing. ■ Bars have to be assembled with four connection plates. Each connection plate is fixed with four strongly tightened screws. ■ Tighten the screws with specified torque. <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p> CAUTION: Fix the rope loop with at least three rope clamps. Fix the rope tensioners after having applied proper tension.</p> </div>	

3.13.2 ExacTrac In-Room Touch Screen Monitor (Optional)



Note: If you have *not* ordered the Ceiling Mounted version, you will get the Wall Mount for the In-Room Touch Screen Monitor by default (see [“ExacTrac Wall Mounts”](#) on page 3-74).



Figure 3-43 Ceiling Mounted In-Room Touch Screen Monitor

Table 3-8 Ceiling Arm with In-Room Touch Screen Monitor

General Information	A 17" In-Room Touch Screen Monitor is mounted to the ceiling left or right to the couch area. The area of movement is given by the max. arm extension of 6'-3" (1910). The rotation can be limited by one stopper. The movement range is 330°.
Weight	218 lbs. (99 kg)
Safety Factor	Must be defined according to the local safety requirements by hospitals stress analyst in written form.
Bolts	4 Supplied by the customer. According to ceiling attachment load requirements.
Location	None of the In-Room components mentioned above may be located in the primary beam of the Linac.
Power Supply Data Connection	In-Room Distribution Box
Clearance Height	The distance between spring arm and finished floor is minimum 6'-6 3/4" (2000) and must not exceed 7'-2 1/2" (2200). A clearance between 6'-10 5/8" (2100) and 7'-2 1/2" (2200) requires consultation and agreement with customer.

3.13.2.1 Ceiling Mount Dimension and Weight

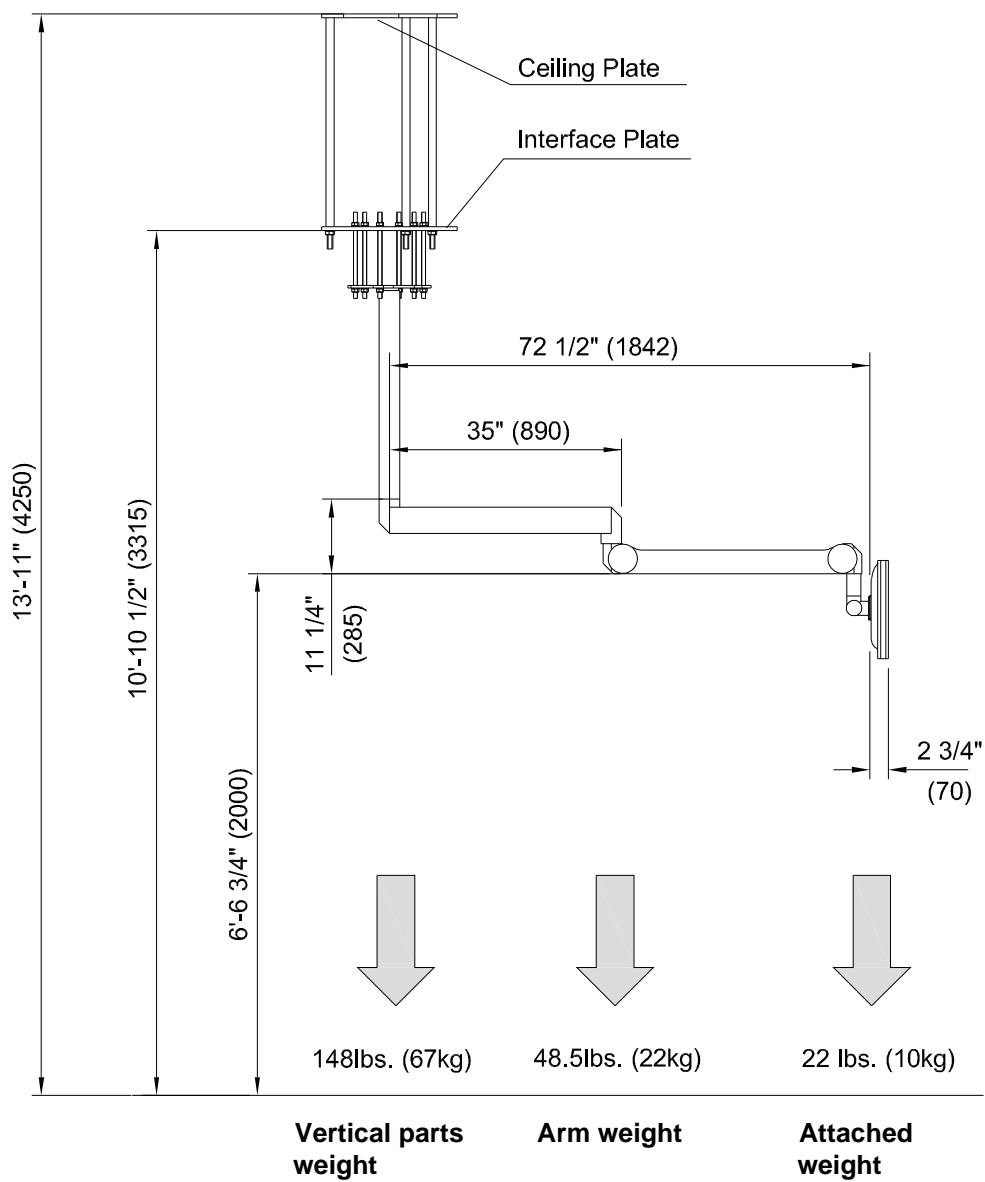


Figure 3-44 Force and Moment Diagram (for Structural Analysis)



Note: Ceiling plate and upper tubes are only applicable for concrete ceiling height greater than 11'-2" (3400). For height limitations, see [Figure 3-39](#).

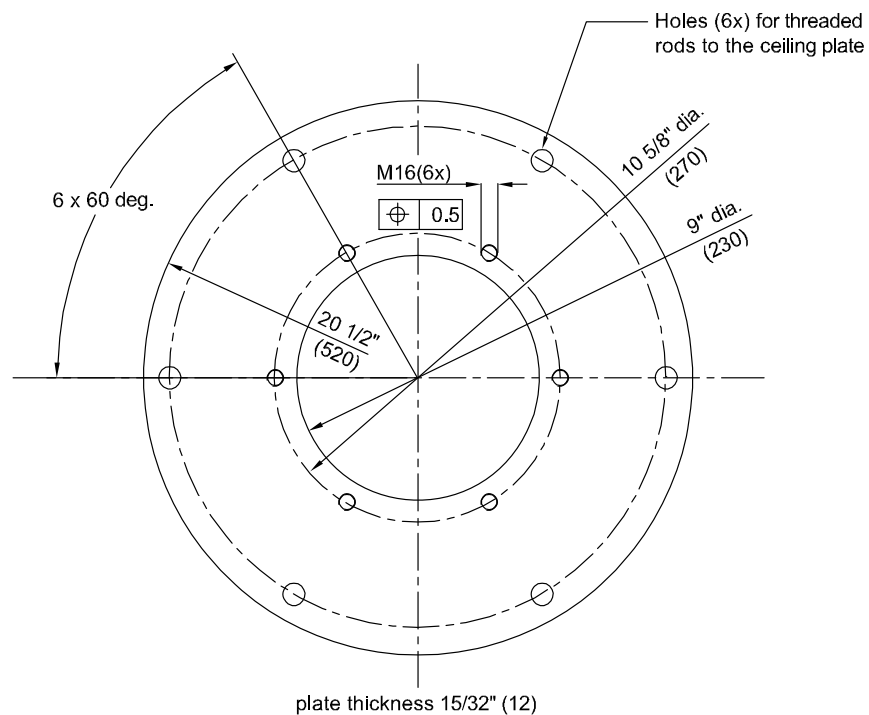
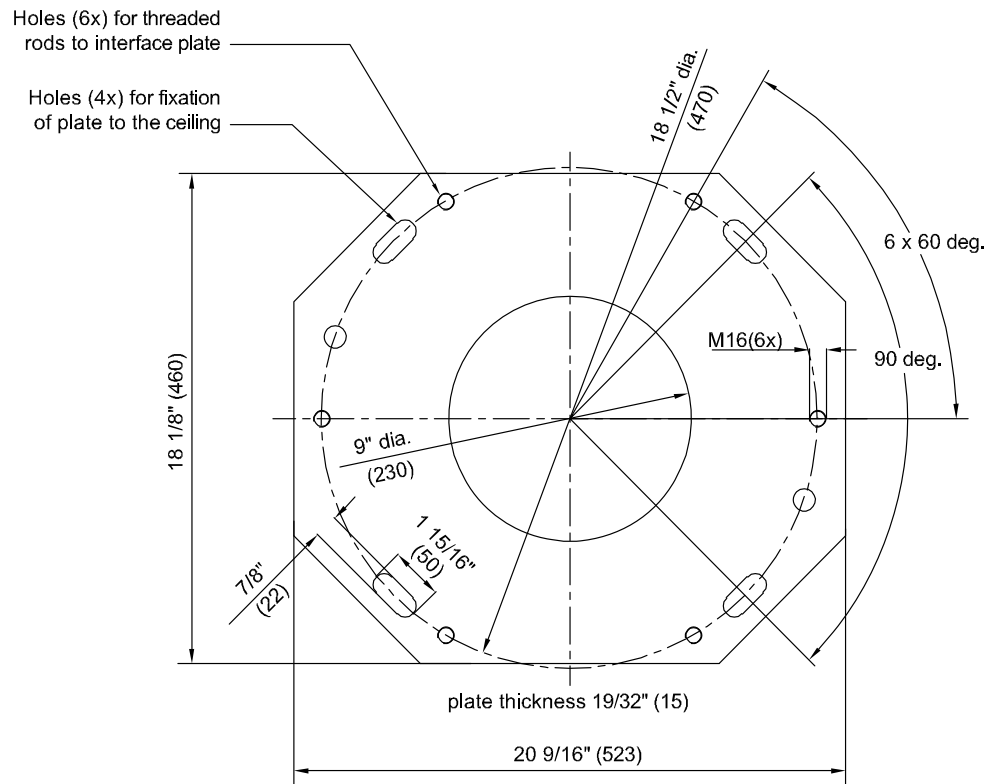


Figure 3-45 Dimensions of Ceiling Plate (Top) and Interface Plate (Bottom)

3.13.2.2 Mounting Height of Interface Plate

In order to have a clearance height of 6'-6 3/4" (2000), the installed height of the interface plate has to be considered as the determining factor.

Table 3-9 Mounting Height of Interface Plate

Concrete Ceiling Height	Interface Plate Installation Height [h]	Vertical Tube Type	Comments
8'-0 1/2" (2450)	Attach directly to ceiling	11 3/4" (300)	The clearance height is below 6'-2 3/4" (1900). The vertical tube has to be cut to 11 3/4" (300).
8'-0 1/2" to 8'-2 1/4" (2450 to 2750)	Attach directly to ceiling	11 3/4" to 1'-7 1/2" (300 to 500)	The vertical tube has to be cut accordingly.
8'-2 1/4" to 10'-2" (2750 - 3100)	Attach directly to ceiling	1'-7 1/2" (500)	
10'-2" to 11'-2" (2750 to 3100)	Attach directly to ceiling	2'-7 1/2" (800)	
11'-2" to 13'-7" (3100 to 4150)	10' - 11 1/2" \pm 3/8" (3315 \pm 10)	2'-7 1/2" (800)	Cut the tubes and threaded bolts of the ceiling frame to match this measure. Cut the threaded bolts 4" (100) longer than the tubes.
13'-7" to 14'-0" (4150 to 4250)	>10'-11 3/4" (3320)	2'-7 1/2" (800)	Clearance height 6'-6 3/4" to 6'-10 5/8" (2000 to 2100)
> 14'-0" (4250)	10'-11 1/2" \pm 3/8" (3315 \pm 10)	2'-7 1/2" (800)	An additional custom made construction is necessary to fulfill the required interface plate height or clearance height > 6'-10 5/8" (2100). Has to be agreed by customer.

3.13.2.3 Recommended Position of Ceiling Arm



Note: For height limitations, see [Figure 3-39](#).

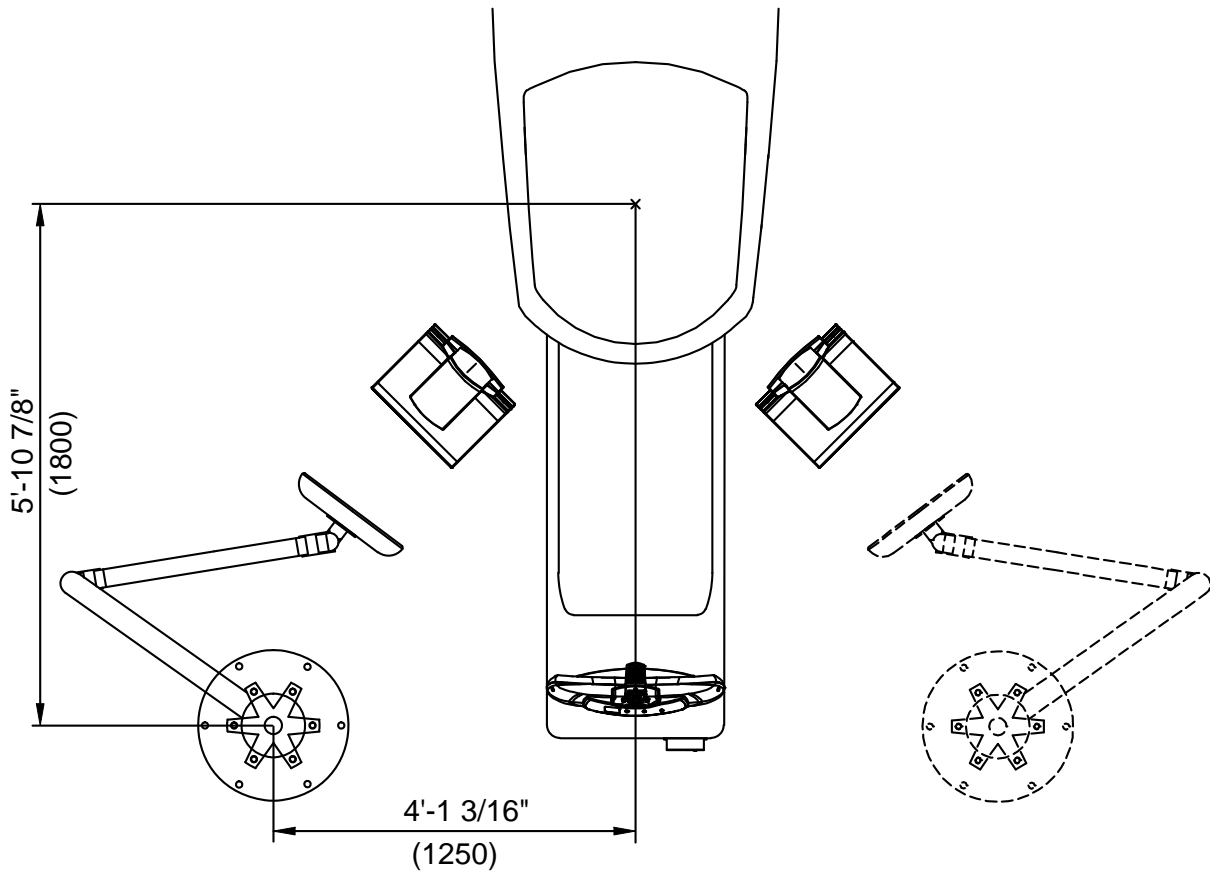


Figure 3-46 Position of Ceiling Mounted Monitor (and Alternate Location)

The position of the Ceiling Mounted Monitor is **recommended** at a longitudinal distance of 5'-10 7/8" +20"/-12" (1800 +500/-300) and lateral distance of 4'-1 3/16" +20"/-10" (1250 +500/-250) from isocenter. The position depends also on other existing ceiling mounted objects.

There are few issues to be considered:

- Risk of collision with gantry is still possible but not critical, as the spring arm will give way. Nevertheless, the longitudinal distance should not drop below 4'-11" (1500).
- The Monitor will reach the primary beam area, the personal has to be instructed to park the monitor in safe position.
- Maximum distance from in-room distribution box is 9'-10" (3000) because of limited cable length.
- Horizontal arm must not collide with the camera! If the arm is installed closer than 4'-1 3/16" (1250) to the isocenter, a collision can be possible if the camera and the arm are installed at the same height.

3.13.2.4 Installation of Ceiling Frame



Note: Only applicable for concrete ceiling heights > 11'-2" (3400).



Package content:

- 1 Ceiling Plate (red), 57.3 lbs. (26 kg)
- 3 Threaded bolts M16
- 3 Tubes outer Ø 1 7/8" (48)
- 6 Fixing disks
- 6 Spring washers
- 6 Hexagon nuts M16
- Washers
- 1 Interface plate (black)

Figure 3-47 Ceiling Frame Parts



CAUTION: The Ceiling/Interface plate must be installed by experts in drilling and sawing concrete. The selection of fasteners/anchors, and the safe execution of the fastening work, is the responsibility of the hospital/customer.



1. Install the ceiling plate (in case of low ceiling heights: the interface plate) to the concrete ceiling. Drill four holes with the drill pattern of the plate (for example, made of package material). Use four heavy-load anchors. Secure the plate using four fasteners defined by the hospital's stress analyst. Tighten fasteners according to their specifications.
2. Calculate length of the tubes and threaded bolts, add 4" (100), and cut to size in accordance with plane-parallel and angular requirements.
3. Screw the hexagon nut approximately 1" (25) onto the threaded bolt and install the spring washer, then screw on the upper fixing disk.

Figure 3-48 Ceiling Plate Installed



WARNING: If the threaded bolts are not screwed in completely, the ceiling arm system can fall down.



Figure 3-49 Ceiling Plate with Installed Threaded Bolts

4. Screw the threaded bolts into the ceiling plate all the way to the stop, tighten the upper fixing disk flush with the ceiling plate, and tighten the hexagon nuts to 100 Nm. Confirm using a calibrated torque wrench with 24mm socket.



Figure 3-50 Ceiling Plate with Installed Tubes

5. Slide the tube onto the bolt and screw the lower fixing disk onto the tube all the way to the stop.



WARNING: As the lower fixing disk does not provide safe fixing of the tube; unless the interface plate is installed; do not allow anyone to stay below the tubes during installation.



6. Secure the interface plate to the ceiling plate using the washer, spring washer, and hexagon nut. Tighten the hexagon nuts to 100 Nm. Confirm using a calibrated torque wrench with 24m socket.

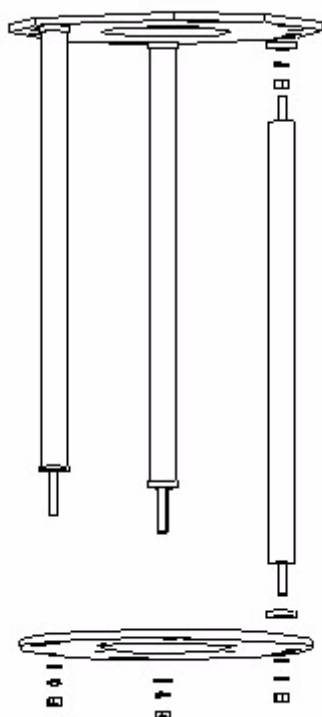


Figure 3-51 Assembled Ceiling Frame

For detailed installation description, refer to the included installation manual delivered with the package.

3.13.3 Ceiling Mounted In-Room Distribution Box

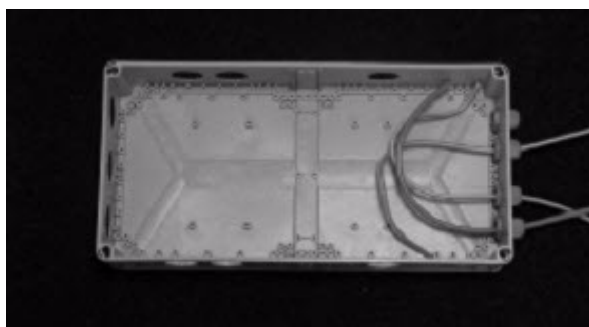



Figure 3-52 In-Room Distribution Box

Table 3-10 In-Room Distribution Box

Dimensions	24" x 12" x 7" deep (600 x 300 x 170)
Weight	18 lbs. (8 kg) fully equipped
Safety Factor	4 (refer to local regulations)
Material Fire Resistance	UL94 V-2
Bolts needed	4 – Supplied by customer, according to ceiling attachment load requirements.
Location	<p>The in-room distribution box should be in the area of the Touch Screen Ceiling Arm and the camera system and attached to the ceiling within a radius of 9'-8" (3000) to both devices.</p> <div>  <p>CAUTION: Do not place the distribution box in the primary beam of Linac.</p> </div>

3.14 ExacTrac Wall Mounts

3.14.1 Control Room Distribution Box

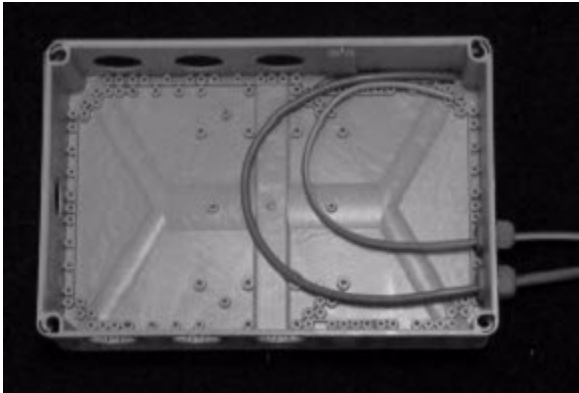


Figure 3-53 Control Room Distribution Box

Table 3-11 Control Room Distribution Box

Dimensions	18" x 12" x 7" deep (450 x 300 x 170)
Weight	13 lbs. (6 kg) fully equipped
Safety Factor	(Refer to local regulations)
Material Fire Resistance	UL94 V-2
Bolts needed	4 – Supplied by customer, according to ceiling attachment load requirements.
Location	The control room distribution box should be in the area of the Control Console. The cable length from power box to the workspace is 16'-4" (5000) maximum.

3.14.2 In-Room Touch Screen Monitor Wall Mount (Standard Version)

The ETX Wall Mount is part of the order by default if the ETX Ceiling Arm is not explicitly ordered.



The wall track can be attached directly onto drywall by using appropriate drywall anchors and screws (4x) for mounting.



Attach the 100mm VESA adapter plate to the arm.



Close the cable channel with supplied covers (cut to fit).

Figure 3-54 In-Room Touch Screen Monitor Wall Mount

3.14.3 ETX Warning Lights (Applicable for X-ray Systems)

The ETX Warning Lights warn the user with flashing light that x-ray exposure is enabled when the user presses the trigger or exposure button of the ExacTrac X-Ray Console.



Figure 3-55 Wall Mounted ETX Warning Light

Table 3-12 ETX Warning Lights



Option A – The pre-installation shipment contains two ETX Warning Lights.	
Dimensions	5 1/2" x 7" x 4" deep (135 x 170 x 100)
Weight	1.5 lbs. (0.7 kg) fully equipped
Safety Factor	According to local regulations.
Bolts needed	4 (each) screws and plastic wall anchors. Provided with the warning lights.
Cabling	<p>Cable length: 2x - 98'-0" (30m)</p> <p>The Warning Lights are electrically installed in parallel. The In-Room Warning Light can be used as distribution point for the Control-Room Warning Light.</p>
Interface on ExacTrac system computer cabinet	ExacTrac DXR Insert, Connector "XR Warning light" (if the dual generator is present).
Location	<ul style="list-style-type: none"> ■ Warning Light 1: The In-room warning light has to be installed in the treatment room with clear visibility for all users. ■ Warning Light 2: The control room warning light has to be installed in the control room, above the treatment room entrance. <div style="text-align: center;">  </div> <hr/> <p>WARNING: Do not place the warning light in the primary beam of the Linac.</p> <hr/>

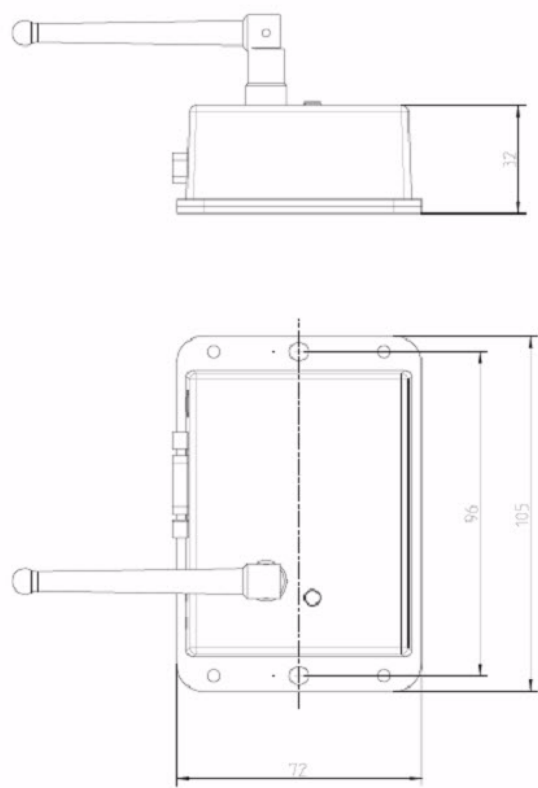
Table 3-13 Non-ETX Warning Lights

Option B – The customer provides own warning lights for installation.		
Safety Factor	According to local regulations.	
Cabling	The customer integrates the warning light cabling into the building installation. A control cable must be provided by the customer to the ExacTrac cabinet for contacting the EXT ILK connector on the ILK Insert panel.	
Warning Light Requirements	<p>The customer is responsible for all local regulatory requirements for the warning light installation.</p> <p>If the warning light is expected to be flashing, an electric circuit must be provided to generate periodic phases. (The ExacTrac x-ray warning output is a permanent signal during active status.)</p>	
Interface on ETX System Computer Cabinet	Location	ExacTrac ILK Insert, connector EXT ILK.
	Signalization Logic	<ul style="list-style-type: none"> ■ The interface provides an isolated switch with two contacts that are closed static in case of activated warning. ■ On request Brainlab can modify the signal into an active 12V DC output, depending on the local installation requirements.
	Electric Max. values	<ul style="list-style-type: none"> ■ If used as passive switch: Current: 500mA Voltage 24 V AC / DC ■ If used as active output 12V DC: Current: 100mA (ILK Insert provides an internal melting fuse that can only be changed by Brainlab service.)
	Pin Out	<ul style="list-style-type: none"> ■ Terminal 1 - switch contact 1 (first upper position) ■ Terminal 2 - switch contact 2 ■ Terminal 7 - GND isolated ■ Terminal 8 - 12 V DC isolated
	Connector Type	Plugged screw terminals w/strain relief for single wires (Phoenix Contact Article: MC 1.5/8-STF-3.81: for single wires 0.14 - 1.5 mm ² = AWG28 - AWG16)
	Galvanic Separation	The EXT ILK Interface on Brainlab side is separated according to IEC 60601-1 for S.F.C: 250V AC (El. safety of medical devices)

Table 3-13 Non-ETX Warning Lights (continued)

Location		<ul style="list-style-type: none">■ Warning Light 1: The in-room warning light must be installed in the treatment room with clear visibility for all users.■ Warning Light 2: The control room warning light must be installed in the control room, above the treatment room entrance.
		WARNING: Do not place the warning light in the primary beam of the Linac.

3.14.4 External Bluetooth Module



The External Bluetooth Module weighs approximately 1.1 lbs. (0.5 kg).

Figure 3-56 External Bluetooth Module

3.14.4.1 Installation Requirements

- ExacTrac Robotics, including the Brainlab imaging couch top (not shown) will be attached permanently to the treatment couch pedestal.
- External Bluetooth Module is installed at about 8'-6" (2600) behind isocenter to false ceiling or wall at about 8'-10" (2700) height.
- Metal parts between External Bluetooth Module and Bluetooth Antenna (receiving data) on the foot end of the ETX Robotics should be avoided.
- The maximum distance from the External Bluetooth Module to the foot end of ETX Robotics should be 16'-4" (5000).
- The power supply of the External Bluetooth Module will be installed in the In-Room Distribution Box. The cable length is 16'-0" (5000). Provide cable conduits. (Nom. mains power requirements: 100Vac to 240Vac/ 47-63Hz @ 10W min; mech. dimensions 3 1/2" x 1 3/4" x 1 1/4" (90 x 45 x 32); 0.25 lbs. (0.1kg).
- The External Bluetooth Module will be connected to the ETX Computer Cabinet using a 98'-0" (30m) crossover cable.
- ETX Robotics is powered by batteries, which should be re-charged every night. Provide a standard power plug (country specific – protection class II [ungrounded]) for the battery charger at a maximum distance of 19'-0" (6000) from the treatment couch.

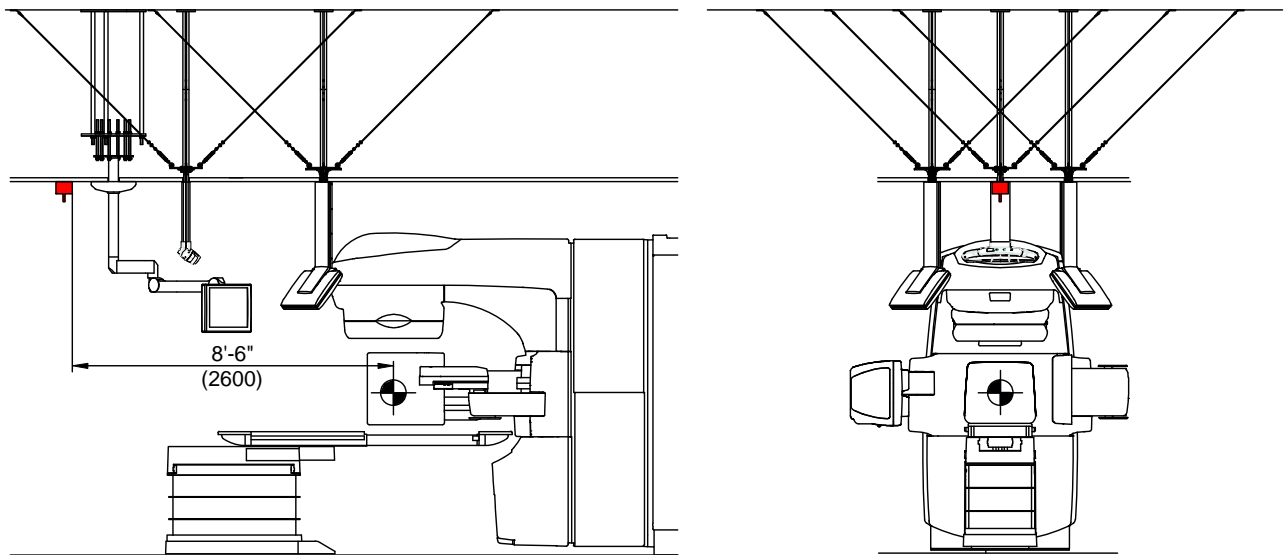


Figure 3-57 External Bluetooth Monitor Installed

3.14.5 Control Room Workspace



Figure 3-58 Control Room Workspace

Table 3-14 Control Room Workspace

Equipment	Keyboard, Mouse, 19" Flat-Screen Monitor. X-ray Control Console Keyboard 17 3/8" x 9 5/8" x 2 1/2" (440 x 345 x 65).
Location	We recommend that you have the ExacTrac Workspace and the TrueBeam workspace as close as possible in the Control Area. This will allow smoother integrated workflows for the operators.
Required Space	Approximately 28" (700) as shown in Figure 3-58 .
Power Supply	ExacTrac X-Ray Generator via the Control Room Distribution Box.
Data Connections	X-ray Console is connected to the X-ray Generator.

3.15 Patient Positioning Lasers

The patient's position on the couch is fixed by body markings that are aligned with *cross hairs* cast by the laser lights. Two wall laser positioning lights at isocenter height, a ceiling laser, and the sagittal laser are powered by a common circuit controlled by the user interface in the Control Room or Couch Pendant or Couch Side Panels, through a relay. Lasers are usually distributed and installed, at the Customer's option, by Varian. The Customer is responsible for verification of laser types and mounting configurations.

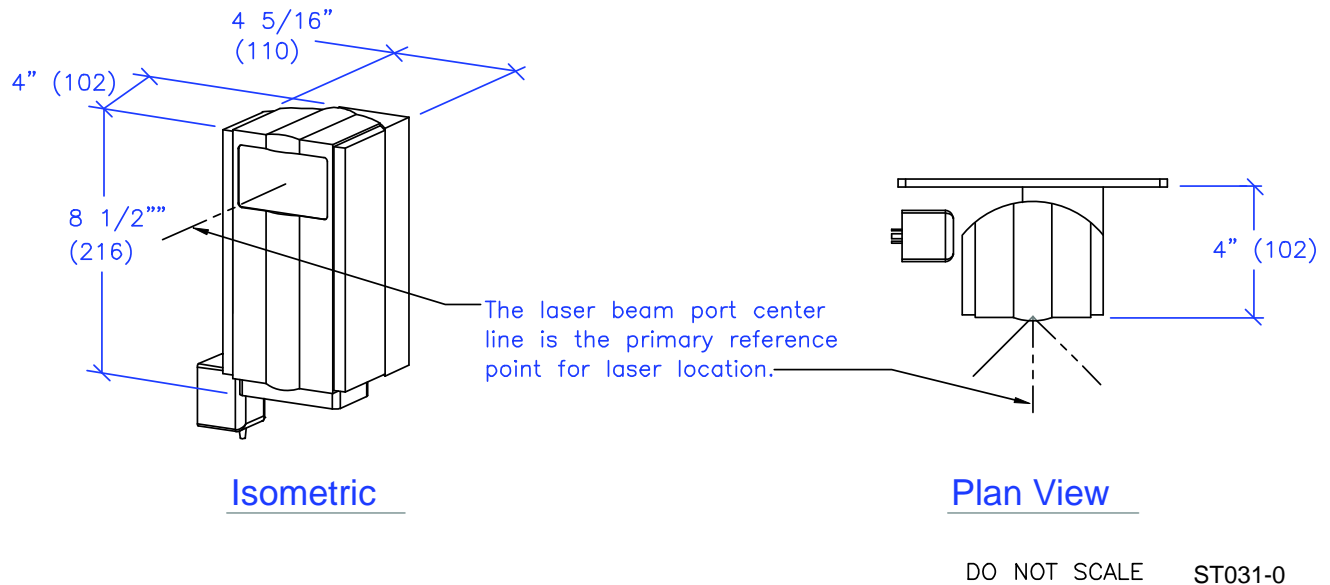


Figure 3-59 Laser Positioning Light – Isometric and Plan Views

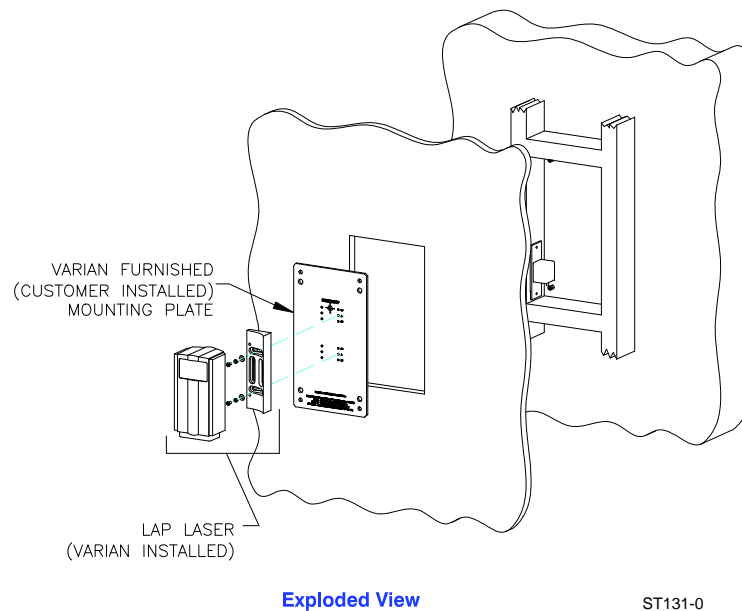


Figure 3-60 Laser and Mounting Plate (Typical) – Exploded View

3.15.1 Side Laser Mounting Detail

Do not mount lasers on sheet rock, drywall, or suspended ceilings. Secure directly to rigid structure. Varian furnishes the steel plate for installation onto concrete walls. Without rigidly mounted steel plate backing for lasers, stable isocenter positioning cannot be guaranteed. The differential movement between the laser location and the isocenter shall not exceed 1mm. Do not mount lasers until isocenter has been established. Lasers may be installed "upside down" (with the beam port nearest the bottom of laser) or "sideways" at locations with obstructions below laser. If the lasers are provided by Varian, the laser mounting will be done by Varian. Otherwise, the laser mounting is to be done by the Customer.

Isocenter - This is the primary reference point for Varian equipment. Show the isocenter location clearly on all relevant drawings. Maintain the isocenter location onsite by extending perpendicular axis lines along slab and up walls in all four directions.

The two side laser plates are located on the side walls centered on the lateral axis with the 'Isocenter Target Hole' centered at the isocenter height of 4'-3" (1295).

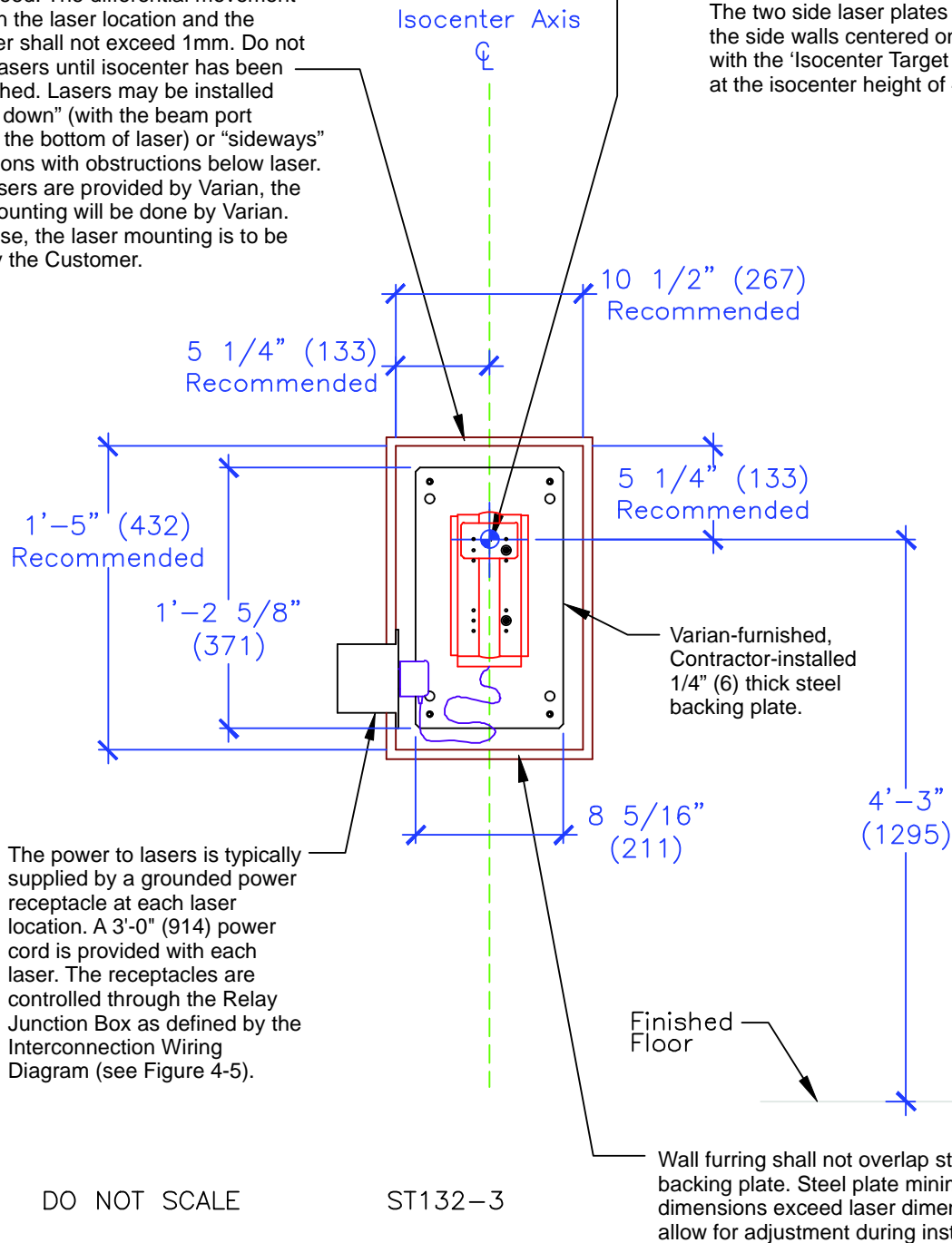
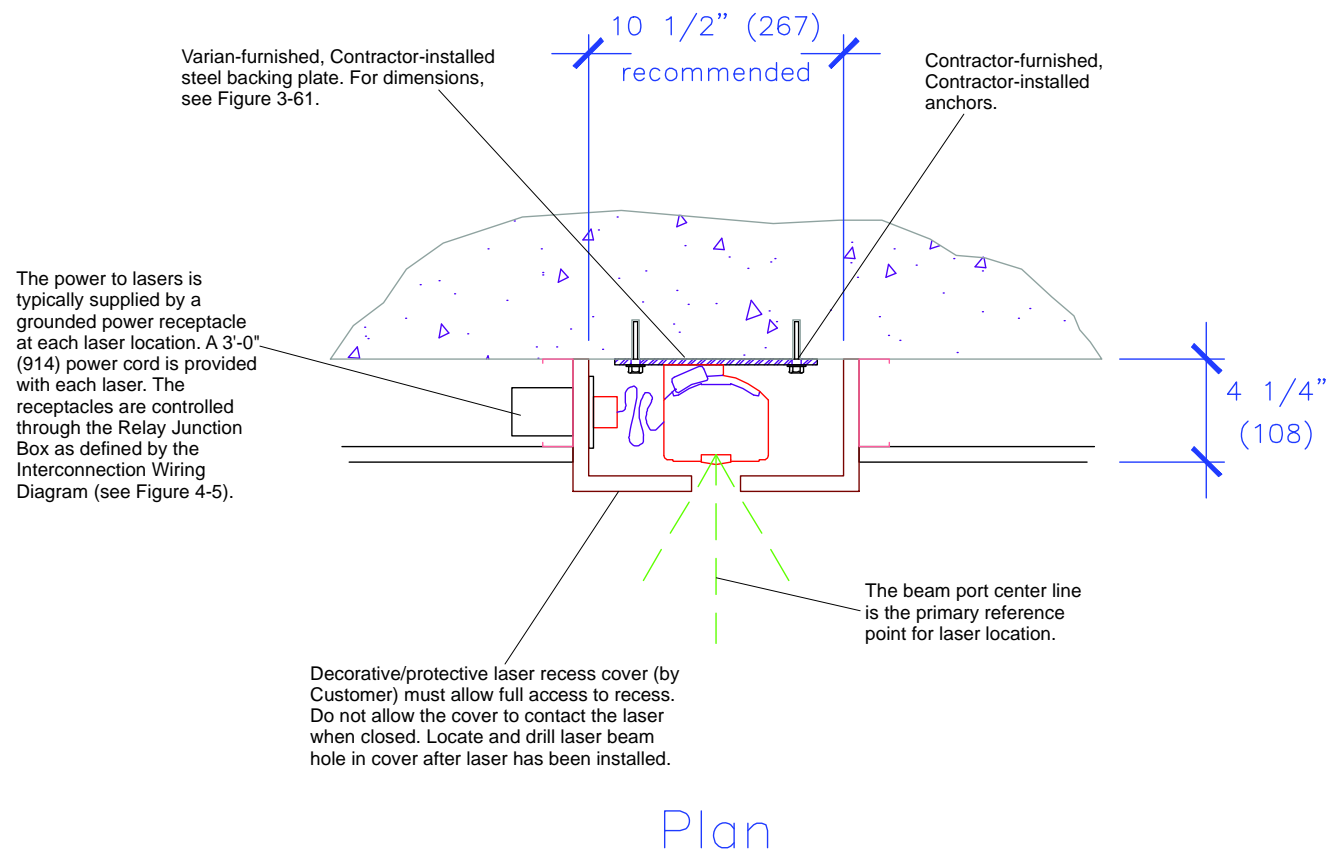


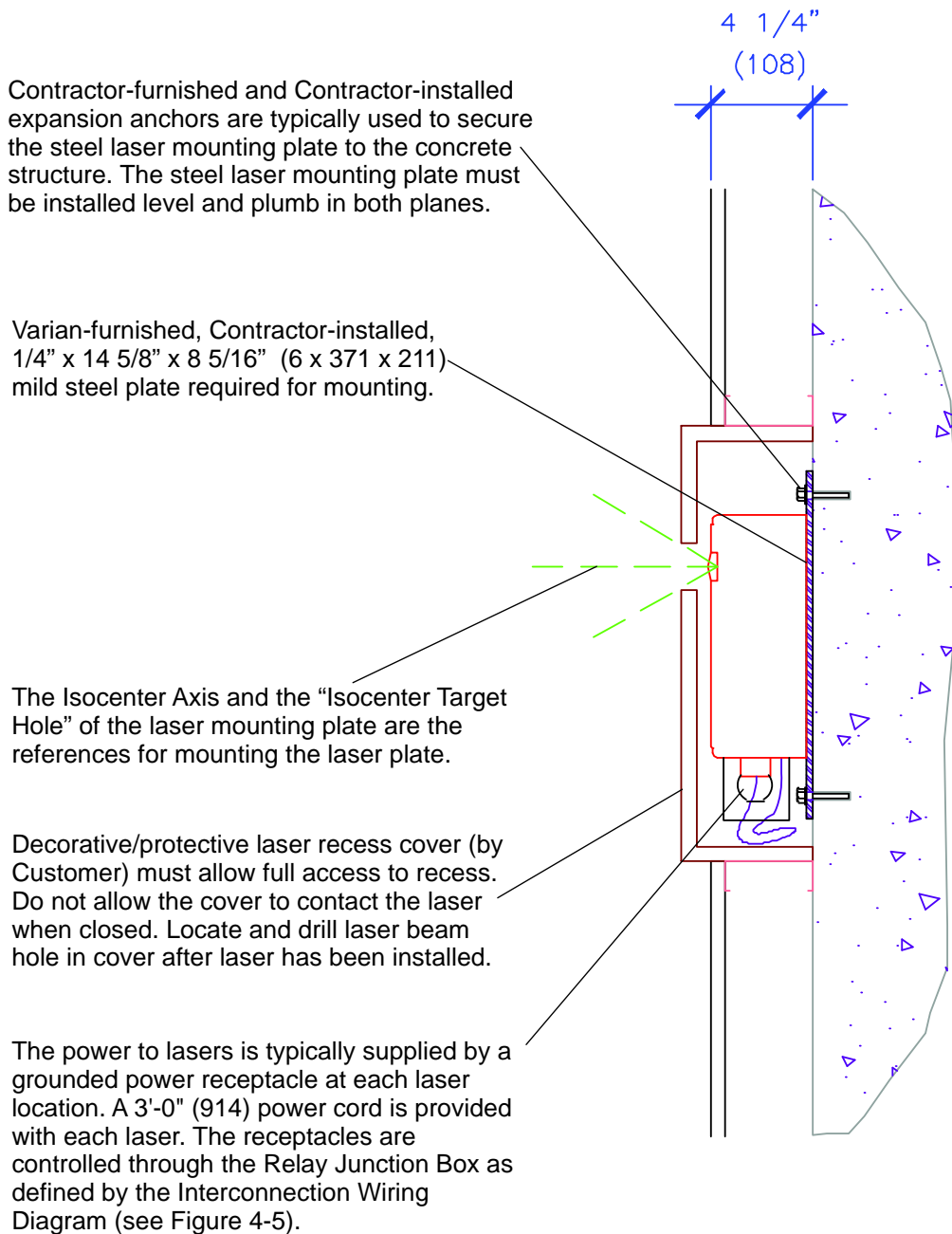
Figure 3-61 Side Laser Mounting Details (Recessed in Wall) – Elevation View



DO NOT SCALE

ST134-1

Figure 3-62 Side Laser Mounting Details (Recessed in Wall) – Plan View

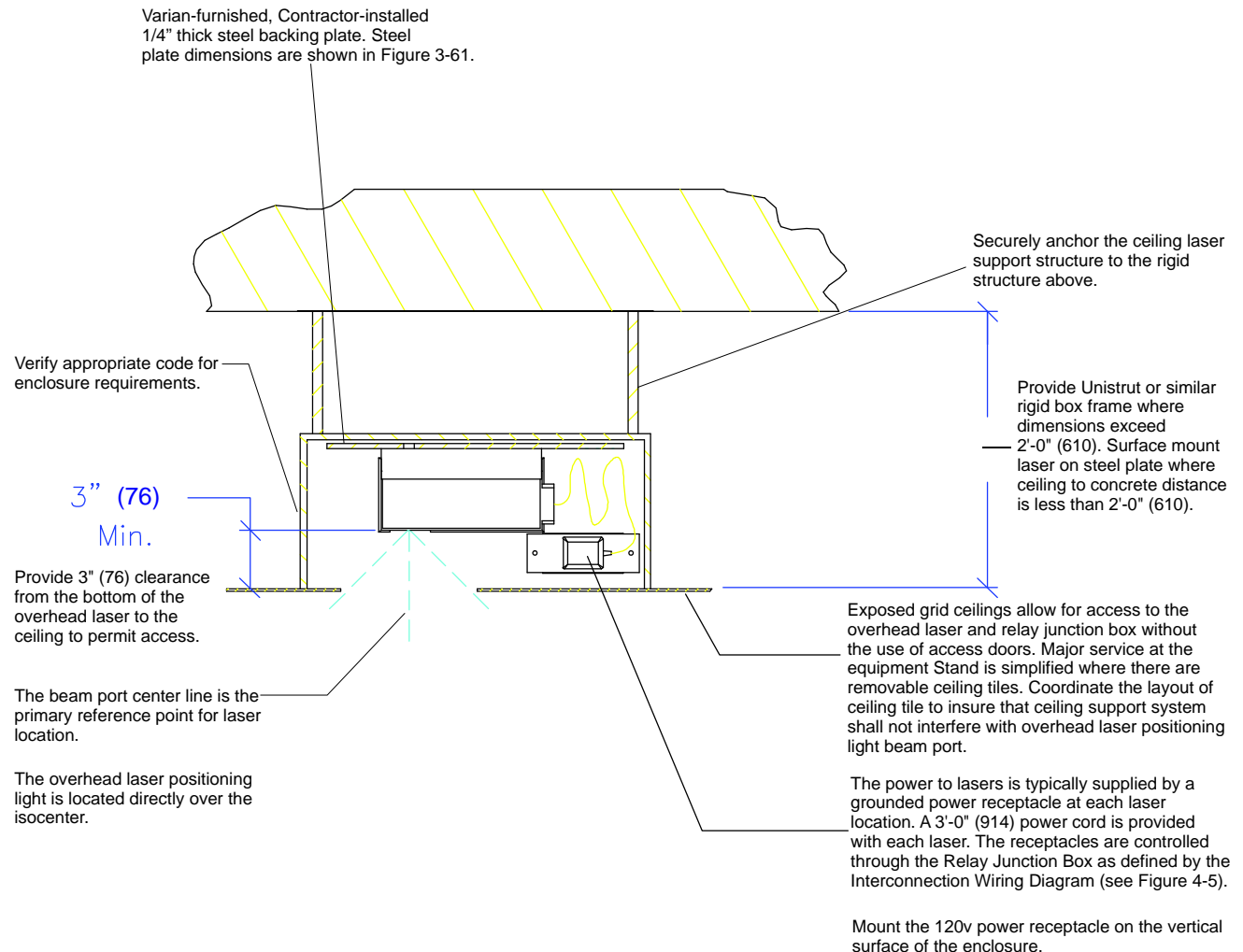


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Figure 3-63 Side Laser Mounting Details (Recessed in Wall) – Section View

3.15.2 Ceiling Laser Mounting Detail



DO NOT SCALE

ST029-1

Figure 3-64 Ceiling Laser Mounting Detail – Side View

3.15.3 Sagittal Laser Mounting Detail – Recessed

Do not mount lasers on sheet rock, drywall, or suspended ceilings. Secure directly to rigid structure. Varian furnishes the steel plate for installation onto concrete walls. Without rigidly mounted steel plate backing for lasers, stable isocenter positioning cannot be guaranteed. The differential movement between the laser location and the isocenter shall not exceed 1mm. Do not mount lasers until isocenter has been established. Lasers may be installed "upside down" (with the beam port nearest the bottom of laser) or "horizontal" at locations with obstructions below laser. If the lasers are provided by Varian, the laser mounting will be done by Varian. Otherwise, the laser mounting is to be done by the Customer.

Isocenter - This is the primary reference point for Varian equipment. Show the isocenter location clearly on all relevant drawings. Maintain the isocenter location onsite by extending perpendicular axis lines along slab and up walls in all four directions.

The sagittal laser plate is located on the wall at the end of the longitudinal couch axis. Unlike the side lasers, which are at isocenter height, the sagittal laser is typically mounted in a vertical configuration with the "Isocenter Target Hole" centered on the longitudinal axis and at a height of 7'-6" (2286) above the floor.

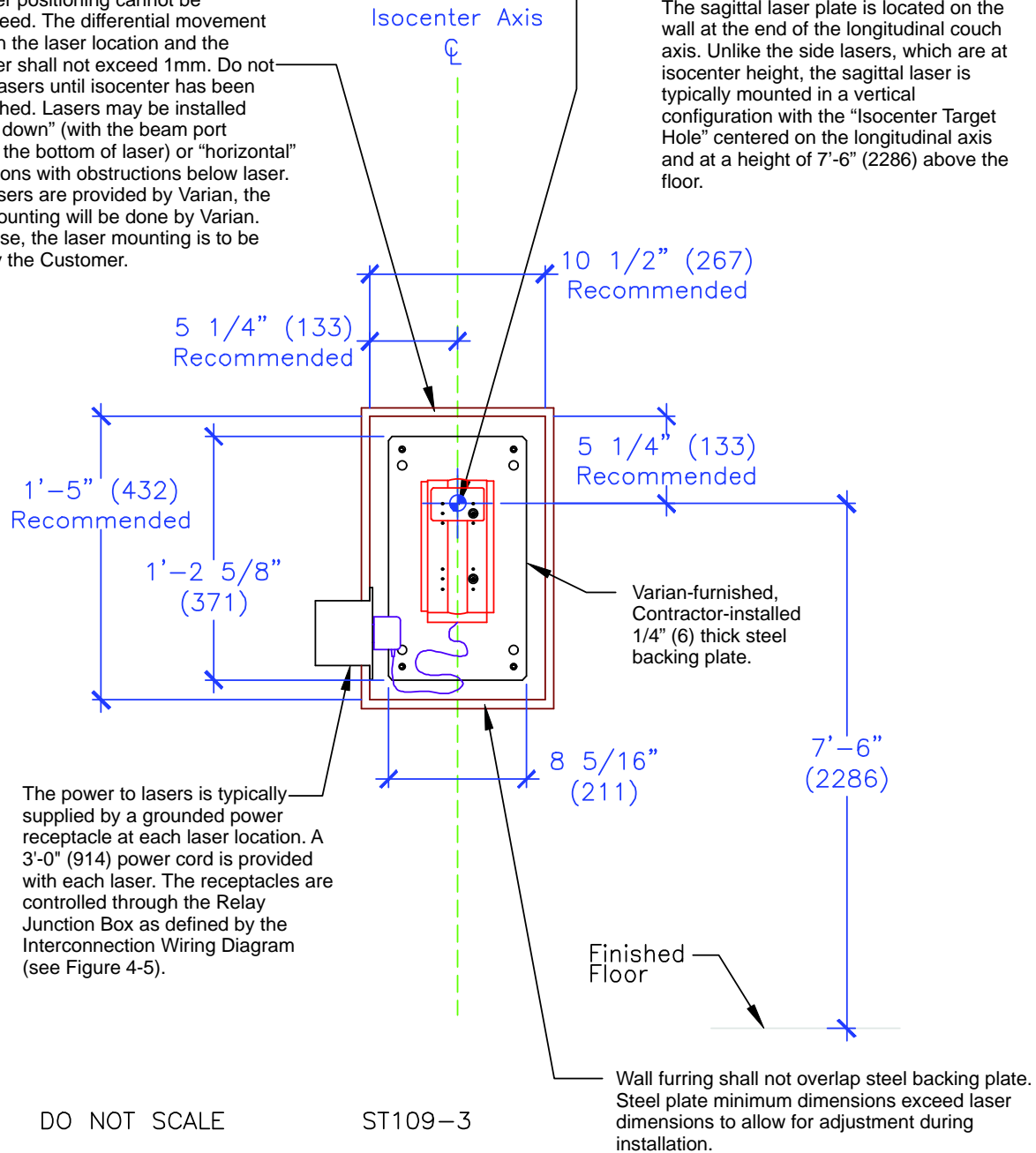


Figure 3-65 Sagittal Laser Mounting Details (Recessed in Wall) – Elevation View

Chapter 4 Electrical Requirements

Table 4-1 Recommended Power Specification Summary

Component		Voltage	Amperage	Phase
^a TrueBeam STx	60 Hz	480V	80A	3-phase + Neutral + Ground (Parity-Sized)
	50 Hz	400V	100A	3-phase + Neutral + Ground (Parity-Sized)
^a Console	60 Hz	208V	20A	Included in TrueBeam STx source 1-phase + Ground (Parity-Sized)
	50 Hz	230V	10A	
ExacTrac X-Ray Generator	60 Hz	480V	70A	3-phase + Neutral + Ground (Supplied)
	50 Hz	400V	50A	3-phase + Neutral + Ground (Supplied)
ExacTrac Computer Cabinet	60 Hz	120V	30A	1-phase + Ground (Supplied)
	50 Hz	230V	16A	1-phase + Ground (Supplied)

a. These feeds can be supplied simultaneously by a GE TrueBeam STx MCB Panel.



CAUTION: Ground conductors must be equal in size (Parity-Sized) to the supply/power conductors, but no smaller than #6 AWG (16mm²).

4.1 General Electrical Specifications

4.1.1 Wiring and Components

The dashed lines indicate wiring provided by Varian. The Customer shall provide the wiring shown as solid lines as well as the Main Circuit Breaker panel on the left side of the reference lines in [Figure 4-5, Interconnection Wiring Diagram](#). The Relay Junction Box is Varian-furnished, Contractor-installed.

The main power and ground conductors as well as the room interconnection with the Relay Junction Box are sized, pulled, and terminated by the Contractor. The Varian-provided control interconnect cables are not shown in [Figure 4-5, Interconnection Wiring Diagram](#).

4.1.2 Lighting and Accessories Circuits

Provide 120 VAC (typical 60Hz) or 240 VAC (typical 50Hz) 20 amps maximum power for lighting, laser positioning lights, and warning lights to the Relay Junction Box, as discussed in [Section 4.1.1, Wiring and Components](#). 277 VAC lighting is acceptable but will require that the remaining items be on a separate circuit. Lighting, lasers, and warning lights may each be on separate circuits.

4.1.3 Electrical Connections

The Customer shall (under Varian supervision):

- Route all system power from an isolated power source through the Main Circuit Breaker Panel.
- Ensure that rough-in for conductors for listed items includes 12'-0" (3658) left coiled in pull box.
- Supply and connect phase, neutral, and ground power supply wires.
- Supply and connect wiring at the Relay Junction Box for Under Voltage Relay, Beam-On Lights, Door Interlocks, Emergency-Off Switches, Positioning Laser Relay and Room Lights Relay.
- Make all power and wiring harness connections to the Modulator, ExacTrac Computer Cabinet, or ExacTrac X-Ray Generator per [Figure 4-5, Interconnection Wiring Diagram](#).
- Connect wiring harness from the MCB panel to the Control Console Cabinet.
- Review connections and equipment function with the Varian Installer.
- Bundle all wiring in conduits shared by Varian cables.
- Pull Varian-supplied TrueBeam STx control cables and/or ExacTrac cables as specified by the Varian and/or Brainlab Project Managers.

4.1.4 Dedicated Grounding Requirements

The TrueBeam STx accelerator requires two Ground or Earthing circuits, as shown in [Figure 4-5, Interconnection Wiring Diagram](#). The first circuit is part of the main power supply and provides grounding for the TrueBeam STx Accelerator's major system components: the Gantry/Stand, the Modulator, and the Console Cabinets. The minimum size of the copper wire ground conductor shall be equal in size (Parity-Sized) with the supply conductors. Ground conductors shall be installed from the Modulator to the TrueBeam STx Main Disconnect Panel (MDP) and from the MDP to the facility's main ground through the Hospital Grid System. The equipment is sensitive to electrolysis from water pipe grounding. Do not use water supply piping for ground.



CAUTION: Ground/Earthing conductor must be equal in size (Parity-Sized) to the supply/power conductors, but no smaller than #6 AWG (16mm²).

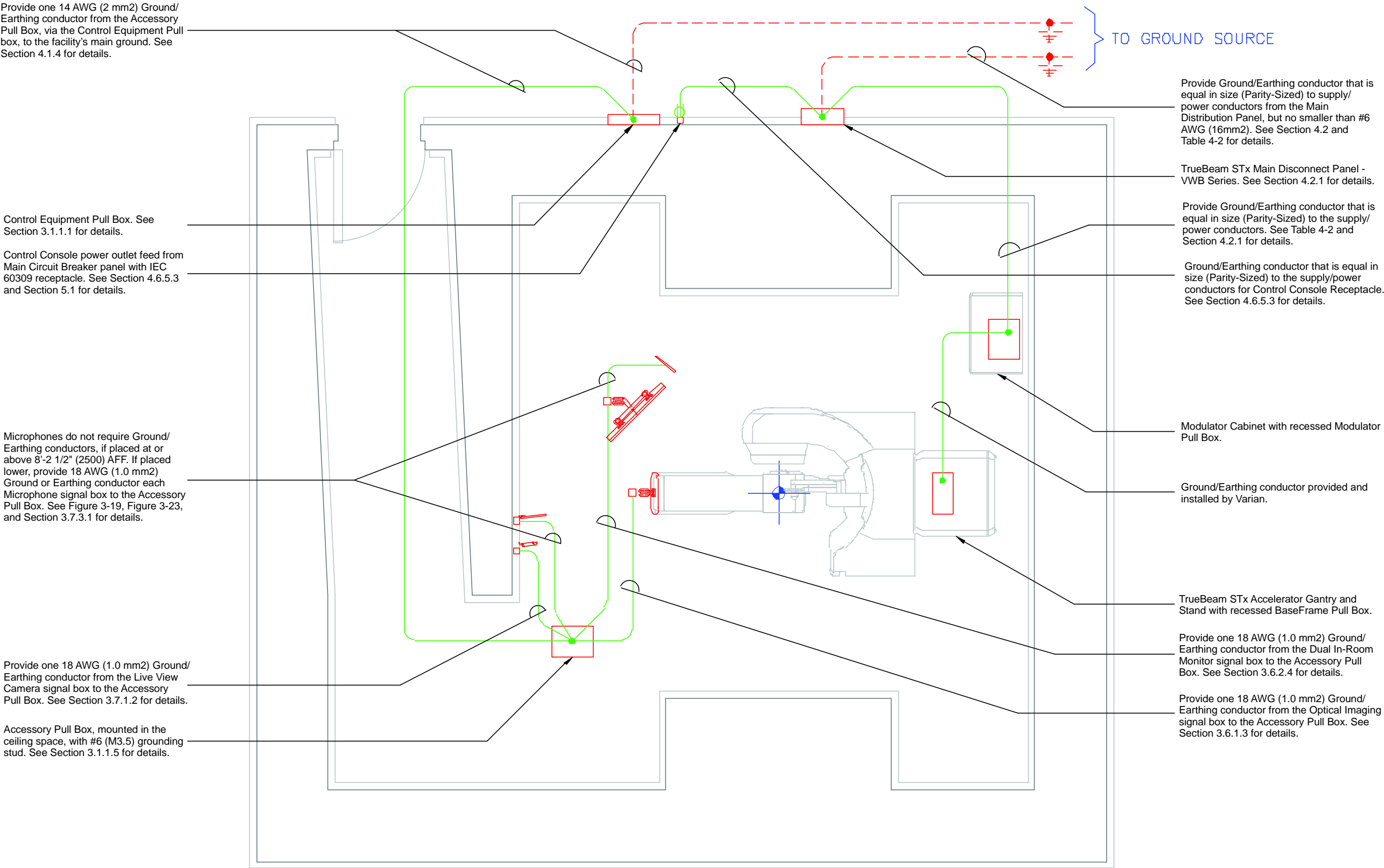
The second grounding circuit is for wall- and ceiling-mounted TrueBeam STx Accelerator's subsystems located at or below 8'-2 1/2" (2500) above finished floor (AFF). The Contractor shall install a Ground or Earthing wire from each of the subsystems listed below to the Grounding Stud in the Accessory Pull Box and from there to the facility's main ground, as noted above. Please see [Figure 4-1, Grounding/Earthing Conductor Diagram](#).

See the following for additional details.

- Accessory Pull Box – See also [Section 3.1.1.5, Accessory Pull Box](#).
- Optical Imaging Subsystem – See also [Section 3.6.1.3, Dedicated Ground Wire – TrueBeam Optical Imaging](#).
- Dual In-Room Monitor Subsystem – See also [Section 3.6.2.4, Dedicated Ground Wires – TrueBeam IRM](#).
- Live View Camera Subsystem – See also [Section 3.7.1.2, Dedicated Ground Wire – Live View Camera](#).

This grounding system provides compliance with IEC 60101 and -01.

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ST115-4

Figure 4-1 Grounding/Earthing Conductor Diagram

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4.1.5 Power Conditioning Requirements

The equipment is sensitive to line voltage variations and source impedance. A complete survey of the electrical supply should be conducted prior to the equipment installation and a copy of this survey should be sent to the regional Installation Project Manager for the equipment file. Isolation transformers and/or power conditioners are required where the electrical power requirements specified herein cannot be met.

Caution should be taken when powering the TrueBeam STx from the same distribution source as elevators, HVAC equipment, and other phase-controlled loads, because of potential adverse affects on the operation of the x-ray equipment. The supply voltage waveform should be practically sinusoidal with less than 5% total harmonic distortion. Signals from devices that use the power line as a means of distribution can be the source of problems. Efforts should be taken to minimize such effects.

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, longer lasting or frequent transients occur as these can cause interruption of operation and/or equipment damage.

4.1.6 Network Cabling and Termination

4.1.6.1 Cabling

Network cabling must be minimum Category 5e with a minimum bandwidth of 100 Mbps full duplex (100BaseT). The cable run must be a single segment of less than 100 meters (328 feet) from the wall plate to the network switch or router, located within the telecommunications closet. The RJ-45 connector will be labeled as a DATA connection with a unique identifier that delineates the termination point at the Patch Panel, Switch, or Router.



Note: The network data drops must be active at the time of installation with a live connection to the network switch or router.

4.1.6.2 Termination

The Control Console requires a minimum of one (1) network cable outlet (RJ-45) located within three (3) feet of the Control Console. Although the Control Console requires a single network drop, Varian Medical Systems recommends three (3) additional drops for customer-supplied computers and/or a network printer. Varian Medical Systems recommends the use of a modular wall plate that meets TIA/EIA and NEC standards and codes for data communications. The RJ-45 jack must meet TIA/EIA-568-A wiring pattern. Orientation of the RJ-45 wall jack should be at a 45-degree down angle.



Note: The customer may require additional workstations and printers in the vicinity of the Control Console to run customer required applications. Therefore, Varian Medical Systems recommends that the customer pulls three (3) additional Cat 5 cables and terminates each connection into a four-plex modular wall plate. Thus bringing the total number of network drops to the Control Console to four (4).

4.1.6.3 TCP/IP Protocol

The Control Console makes use of the TCP/IP protocol suite. Varian Medical Systems recommends that the customer eliminate all unnecessary protocols. Varian Medical Systems requires subnets for the TCP/IP protocol in order to reduce the number of broadcast messages that must be processed by the Control Console to the Radiation Oncology network. The subnet of the Radiation Oncology Department should be kept as small as possible. Large, flat TCP/IP networks running broadcast intensive software will adversely impact the performance of the radiation delivery system. Varian Medical System recommends isolating the Radiation Oncology broadcast domain from the Enterprise Network.



Note: The Control Console requires a static Internet Protocol (IP) address at the time of installation. Varian Medical Systems requires that the network drop provided for the Control Console is “hot” with a live connection to the network switch or router.

4.2 TrueBeam STx Linear Accelerator Subsystem

Table 4-2 TrueBeam STx Linear Accelerator Power Requirements

Input voltage	200VAC, 208VAC, 240VAC, 380VAC, 400VAC , 415VAC, or 480VAC (nominal), line-to-line, 5-wire (3-phase, neutral, and ground [Parity-Sized]).
Line voltage regulation	±5%. This is the maximum allowable steady-state deviation from nominal value selected.
Maximum phase voltage imbalance	3% of the nominal value. This is the maximum difference between any two phase voltages when operating at full load (Beam-On).
Input frequency	50 or 60 Hz ±1 Hz.
Electrical loads (with Console)	7kVA in Stand-By state, 48kVA in Beam-On state. (4kVA & 45 kVA Accelerator loads only, respectively.)
Long-Time Load (with Console)	48kVA (45kVA Accelerator Only). This is the maximum load that the source is expected to sustain during normal (Beam-On) operation; that is, during treatment. It must also be capable of sustaining this load occasionally for much longer periods of test and calibration.
Power factor	Estimated to be 90% or more. Most of the load is inductive. The line-current waveform is non-sinusoidal.
Source impedance	2.5% maximum. This maximum recommendation is based on the minimum required source capacity; namely, 48kVA. At 208 VAC, this corresponds to 133A full load current. The recommended maximum impedance is therefore 24mOhm. At 400 VAC, the full load current is 69A and the recommended maximum impedance is 89mOhm. No minimum is specified, however, the fault current available shall not exceed 10,000A.
Mandatory grounding conductor	The minimum size of the copper wire ground conductor shall be in equal in size (Parity-Sized) to the supply/power conductors, but no smaller than #6 AWG (16mm ²). Ground equipment through the “Hospital Grid System.” The equipment is sensitive to electrolysis from water pipe grounding. Do not use water supply piping for ground.



CAUTION: Ground/Earthing conductor must be equal in size (Parity-Sized) to the supply/power conductors, but no smaller than #6 AWG (16mm²).

4.2.1 Circuit Breaker

4.2.1.1 TrueBeam STx Main Circuit Breaker Panel

Varian Medical Systems strongly recommends the use of the GE Main Circuit Breaker Panel specifically designed for the unique requirements of the TrueBeam STx accelerator. This custom panel provides a single-input, dual output design and incorporates/supports Emergency Off and Console UPS circuitry.



Note: The TrueBeam STx Main Circuit Breaker Panel must be located within sight of and within 10 feet (3048) of TrueBeam STx Control Equipment. The Main Circuit Breaker should be conspicuously identified as “Main Disconnect for Accelerator” per NEC. This statement may vary per country/region. Please consult the appropriate governing body.

For additional information, see [Section 4.2.2, TrueBeam STx Main Disconnect Panel – VWB Series](#).

If the GE MCB panel cannot be obtained, this panel must be replicated in full functionality. Please contact your Regional Planning Manager for additional specifications.

4.2.2 TrueBeam STx Main Disconnect Panel – VWB Series

4.2.2.1 Application

The VWB Series of Main Disconnect Panels are custom panels that serve as the main power disconnect between the Varian TrueBeam STx system and the facility power source. These panels provide overcurrent protection and a panel mounted Emergency System Disconnect push-button providing immediate shut down of the entire system, complying with the NEC disconnect requirements. The standardized designs provide the customer, specifier, and installer several advantages by combining a variety of individual components into a single, pre-engineered, factory tested panel. Each panel is UL, and cUL Listed for compliance with approvals required by the NEC Articles 100 and 110-3. All panels are also CE marked for the many countries that require CE marking. The VWB panel may be surface or semi-flush mounted.

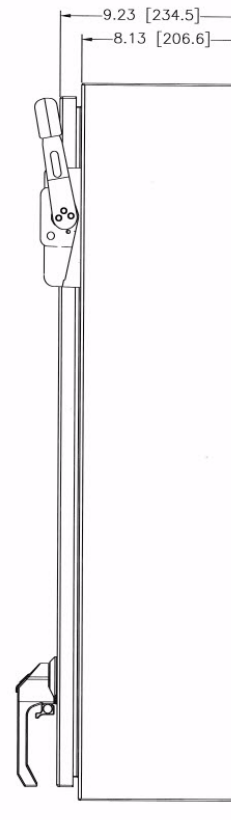
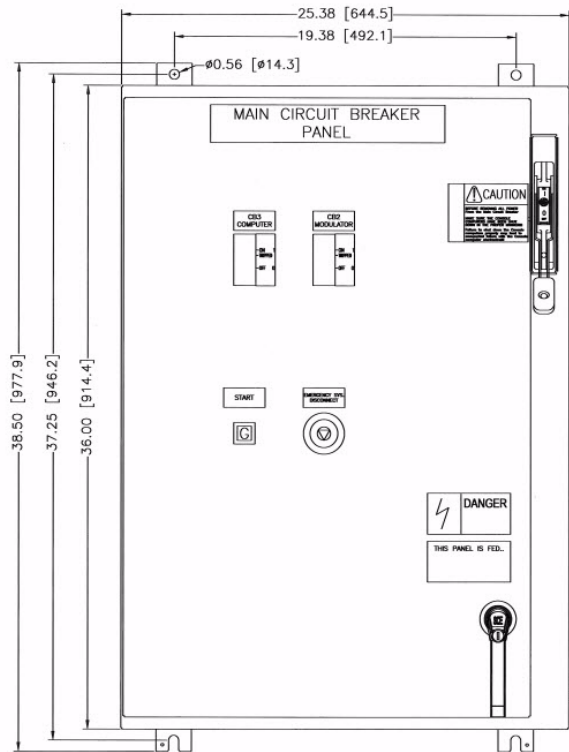
Designed for use with the following Varian Medical Systems:

- TrueBeam STx.

Physical Specifications

- Height: 36 inches (914.4 mm).
- Width: 25.38 inches (644.5 mm).
- Depth: 9 in. (approximately) (152.4 mm).
- Weight: 179 pounds (81.1 kg).

8" of enclosure may be recessed in wall for semi-flush installations.



- **Mounting:** Via keyhole slots: width is 19.38 inches (492.3mm) on centers. Height is 37.25 inches (946.2 mm) on centers (see diagram).
- **Conduit Access:** Conduits may enter or exit from top, bottom, or sides. Preferred location is incoming near top and outgoing at the bottom. Rear conduits not possible. Exact location must be field verified.

There are several configurations of the VWB panel to accommodate domestic and international power requirements.

Catalog Number	Ampere Rating	Voltage Rating	Short Circuit Current Rating
VWB175A208V	175 Amps	200, 208Y	25,000 Amps RMS
VWB150A240V	150 Amps	240	25,000 Amps RMS
VWB100A400V	100 Amps	380Y, 400Y, 415Y	25,000 Amps RMS
VWB80A480V	80 Amps	480Y	25,000 Amps RMS

4.2.2.2 Features

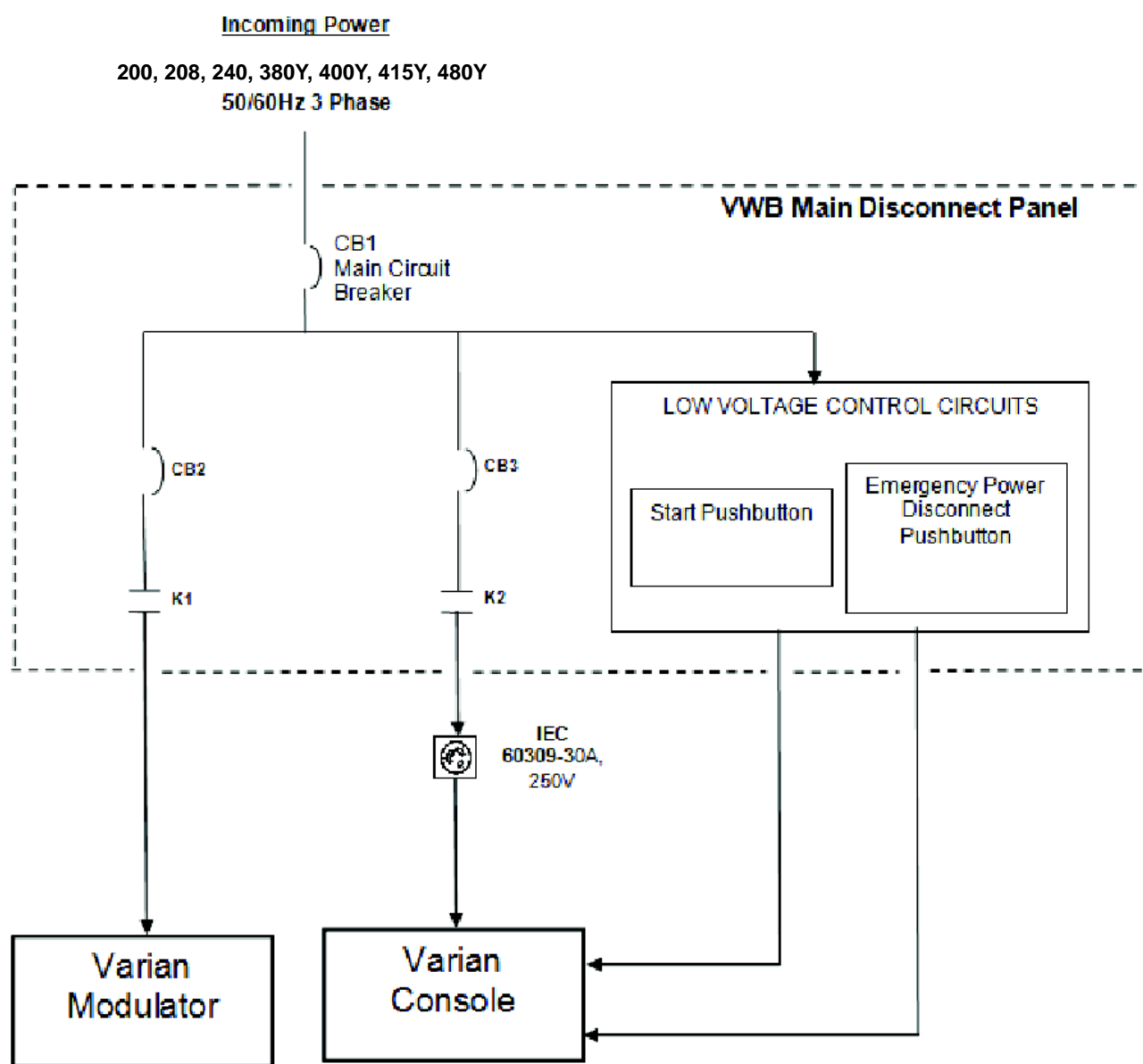
- Single Incoming Power Source with Main Circuit Breaker/Disconnect.
- Configurable Auto Restart Feature.
- Pre-Terminated Interface Cables.
- Surge suppression for each relay coil.
- Single panel completely assembled and tested.
- Custom tailored for Varian Systems.

4.2.2.3 General Features

- Developed specifically for Varian Medical Systems.
- Off white exterior paint finish.
- May be surface or semi-flush mounted.
- UL and cUL Listed and CE marked.

4.2.2.4 Benefits

- Provides local Lock Out/Tag Out capability. Coordinated with Modulator and Console, and control circuits.
- If enabled, re-applies power to the Modulator after a power outage. If disabled, pressing the START push-button is required to start the Modulator.
- Facilitates system installation and troubleshooting.
- Provides protection for the sensitive electronic equipment.
- A pre-engineered panel with a permanent wiring diagram.
- Standardized design and testing assures high product quality and reliability.



4.2.2.5 Ordering Information

Available from GEXPRO, Indianapolis, Indiana at (800) 279-7925, 7:30 a.m. to 5:00 p.m.
U.S. Central Standard Time (Monday-Friday).

4.3 ExacTrac X-Ray Generator Subsystem HFE 601

Table 4-3 ExacTrac X-Ray Generator Power

Generator	HFe 601 Generator								
Maximum output rating	65 kW								
Input voltage	<p>The HFe Generator without pre-transformer can be directly connected to:</p> <ul style="list-style-type: none"> ■ 400 V AC star TN <p>The TN star network provides all five required lines L1, L2, L3, N, PE that must be connected (400V phase to phase and 230V neutral to phase). IT and TT power systems do not provide the solid Neutral line and will cause generator damage.</p> <p>Brainlab provides two pre-transformers if a TN network is present, but the voltage differs from 400V:</p> <ul style="list-style-type: none"> ■ 208V AC star TN ■ 420V / 440V / 460V AC star TN <p>and one pre-transformer for a special delta power network:</p> <ul style="list-style-type: none"> ■ 208V AC delta (for Japan mainly) <p>Customer must specify the provided nominal voltage and grid type (star or delta).</p> <p>If none of the provided pre-transformers is appropriate, customer is responsible for providing the star 400V TN network.</p>								
Connection	<p>5 Lines: three phases, neutral (N), ground (PE) max. 35 mm² fine wire and cable end sleeves recommended TN mains required</p>								
Mains fuses in building installation	<table> <tr> <th>Mains Supply</th><th>Slow Blow Fuse</th></tr> <tr> <td>400V</td><td>50 A</td></tr> <tr> <td>420V/440V/480V</td><td>50 A</td></tr> <tr> <td>208V</td><td>100A</td></tr> </table>	Mains Supply	Slow Blow Fuse	400V	50 A	420V/440V/480V	50 A	208V	100A
Mains Supply	Slow Blow Fuse								
400V	50 A								
420V/440V/480V	50 A								
208V	100A								
Frequency	50/60 Hz \pm 1 Hz								
Maximum line regulation	+5%, -10% @ 400 V								
Maximum allowable mains resistance per phase	0.2 Ω								
Power consumption:									
■ Stand By	0.15 kVA								
■ Nominal power consumption (Provider)	35 kVA								
■ Exposure (max)	75 kVA								
Power factors (cos ϕ)	0.9								
Input current at full output rating per phase for 0.2 sec	112 A								

4.3.1 Generator Power Supply (Distribution Box)

A distribution box is not mandatory for the operation of the generator and patient positioning system. However, for electrical safety reasons, applicable local regulations, and work convenience, a distribution box is recommended. Typically, an appropriately sized circuit breaker, installed within six feet of the x-ray generator, will serve this purpose.



Note: If a distribution box is provided, the customer must bring the power supply (5 lines: L1, L2, L3, N, PE) to the generator. The cable should reach to the bottom of the generator plus 9'-8" (3000) for slack, and the cross section should not exceed 25mm² (4 AWG).

Figure 4-2 displays an example of a distribution box according to German regulations. The design of this distribution box can be modified to accommodate local regulations.

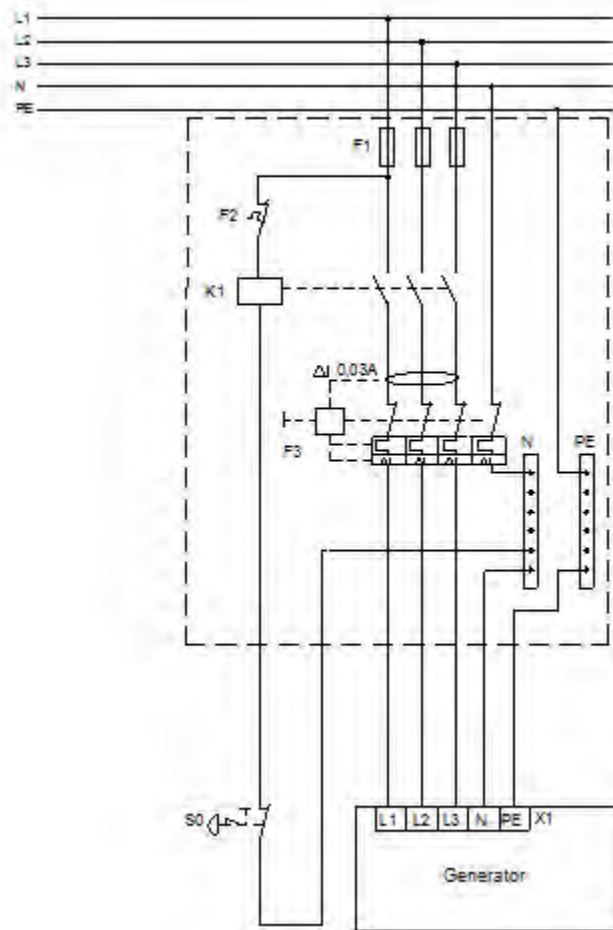


Figure 4-2 German Example of Wiring Plan for X-ray Distribution Box

4.4 ExacTrac Computer Cabinet Subsystem

The Customer has to provide main connection to the Computer Cabinet: L1, N, PE. Use cable-diameter according estimated maximum nominal input current I_N as defined in [Table 4-4](#).

Connection of the Isolation Transformer Unit (inside the Computer Cabinet) occurs via cable clamps. Input-clamps accept cable-wiring diameters from #14 AWG (2.5mm²) to #6 AWG (16mm²). No cable end sleeves are required. Slack: 9'-8" (3000).

Table 4-4 Computer Cabinet Power Supply

Supported input voltage $U_{(N)}$		Max. input current $I_{(N)}$	Recommended Wire-Diameter
100, 110, 115, 120V	60 Hz	30 - 32A	\geq #7 AWG (10mm ²)
200, 220, 230, 240V (each $\pm 5\%$)	50 Hz	13 - 16A	\geq #14 AWG (2.5mm ²)
Nominal power consumption: approx. 500W.			



CAUTION: The protective earth potential of the PE-conductor derived from the mains power input must carry the same PE-potential as the Linac to avoid potential equalization currents between the Linac and ExacTrac system

4.4.1 Computer Cabinet Power Input Main Switch

For service and maintenance of the ExacTrac system (Computer Cabinet) a power input main switch with two switching contacts for the simultaneous interruption of both lines (L & N) is mandatory. The contact opening gap must be at least 3mm. Major load on mains is the ET Isolation Transformer Unit. The main switch therefore must be of that type to manage high inrush currents at power on, as it is required for intended inductive loads, for example, transformers and electro motors. This switch is not provided by Brainlab.

Maximum inrush current is $8 \times I_N$.



CAUTION: Fusing: The customer must protect the mains input of the ExacTrac system (Computer Cabinet) with adequate fusing according to mains power input ratings (I_N/U_N) and the above-mentioned specs.

4.4.2 Computer Cabinet Power Input Lightning Arrester

For an additional surge/rush current protection, a lightning arrester CB (for example, IEC 61643-1 Class II) must be installed within the mains input power line (usually within the main room distribution box), if not already provided by the hospital main power supply or the use of the optional Transtector TrueBeam STx Power Conditioning Unit (see [Figure 4-3](#)).



Figure 4-3 Lightning Arrester

4.4.3 Computer Cabinet Network Connection

A standard 100Mb/s LAN connection is required for the connection of ETX to the hospital network. Supply a network wall jack near to the computer cabinet. The provided patch cable is 13'-0" (4000).

4.4.4 ExacTrac System Interlocks

The ExacTrac system can be installed in different Emergency-Off configurations, depending on local regulatory requirements and the purchased product features. Contact your Brainlab Project Manager for additional information.

Within the ExacTrac system the term "Emergency-Off" ("EMO") is used and the system uses an EMO Interlock line for the internal hardware treatment. This interlock is located in the electronics rack and inhibits all operational risks arising from ExacTrac output without shutting down the system power.

When differing between emergency OFF and STOP, the ExacTrac system cabinet provides and requires the Emergency-"STOP" functionality only. If a total system shut down "OFF" is required by local regulations, this has to be done separately by an additional external circuit (contractor provided). The ExacTrac system will then receive a fast EMO signal via the dedicated "STOP" interfaces inside the ExacTrac cabinet and in addition will be switched "OFF" completely after some delay due to stored electrical energy in the supplies of the ExacTrac system.

The ExacTrac system construction follows a fail-safe design, that no additional risks need to be handled by emergency interactions of the operator in case of a single device failure in the ExacTrac system. Regular inspection of the system will keep the system safe.

4.4.4.1 ExacTrac Emergency-Off Interlock Inputs

In general, all operational risks of one room installation shall be cut-off by the same Emergency-Off button chain; therefore, ExacTrac 6 does not provide a separate button or direct user interface for emergency off, but it has some interfaces to connect to different centralized emergency off circuits.

Table 4-5 Emergency-Off Interlock Inputs

ExacTrac EMO Input Interface	Connected EMO Source	Emergency-Off Effect	ExacTrac Mandatory	ExacTrac Optional	Remarks
EXT ILK	Low voltage EMO signal from building installation	Inhibits all risk outputs of ExacTrac, no effect on the ExacTrac system power	YES - One of the inputs "EXT ILK" or "Varian" must be used	NO	Fulfills timing requirements for RTM2
Varian	Dedicated EMO interlock from Varian Linac				
ExacTrac Cabinet and/or Dual Generator power cut-off	Building installation contactor controlled by external EMO signal	Complete ExacTrac system shutdown inhibits all risk outputs, but with a shutdown delay	NO	YES - that is, required due to local regulation	Does not fulfill the timing requirements for RTM2



WARNING: Emergency-Off either using the External universal Emergency-Off interlock input or using Varian Emergency-Off interlock input is mandatory. The Emergency-Off circuit using System Power only is not sufficient.

4.4.4.2 External Universal Emergency-Off Interlock Input (Emergency-Stop)

The Universal Emergency-Off Interlock connects the ExacTrac system to any low voltage type treatment room emergency off loop, if a Varian Linac with ExacTrac Interlock interface is not present

Table 4-6 Universal Emergency-Off Interlock Input

EXT ILK Universal Low Voltage Emergency-Off Interface Connector		
Cabling	The customer provides a complete emergency-off button loop installation. A control cable must be provided by the customer to connect the EXT ILK to the ILK panel in the ExacTrac computer cabinet.	
Emergency Off Requirements	<p>The customer is responsible for fulfilling local regulatory requirements with the emergency-off installation.</p> <p>All emergency-off buttons within the room need to have the same function and reach all required system of the room. The switch-off delay for motion stop should not exceed 15 ms for compliance of the breaking distances of RTM2 (robotics).</p>	
Interface on ExacTrac System Cabinet	Location	ExacTrac ILK Insert, connector EXT ILK.
	Signalization Logic	The interface provides an opto isolated input with two contacts (anode and cathode) that are de-energized in case of emergency-off. Brainlab provides an isolated 12V DC output that a simple NO contact can be used for signalizing. On request the input can be modified that an external 12V DC source can drive the signal.
	Electric Max. Values	<p>If used for a passive switch:</p> <ul style="list-style-type: none"> ■ Current through switch: 20 mA max. ■ ExacTrac-Voltage used: 12V DC.
		<p>If used for an active external voltage: (modification)</p> <ul style="list-style-type: none"> ■ Nominal required voltage: 12V DC. ■ Current: 20mA. <p>(ILK Insert provides an internal melting fuse that can only be changed by Brainlab service.)</p>
	Pin Out	<ul style="list-style-type: none"> ■ Terminal 5 – cathode (1 = first upper position). ■ Terminal 6 – anode. ■ Terminal 7 – GND isolated. ■ Terminal 8 – 12 V DC isolated.
	Connector Type	Plugged screw terminals with strain relief for single wires (Phoenix Contact Article: MC 1.5/8-STF-3.81: for single wires $0.14 - 1.5 \text{ mm}^2 = \#28 \text{ AWG} - \#16 \text{ AWG}$).
	Galvanic Separation	The EXT ILK Interface on Brainlab side is separated according to IEC 60601-1 for S.F.C: 250V AC (electrical safety of medical devices).

4.4.4.3 Varian Emergency-Off Interlock Input (Emergency-Stop)

Connect the ExacTrac system to a Varian Linac with a dedicated ExacTrac Interlock interface (J15) in the TrueBeam stand.



Note: If this interface is not present, install the first option as described above (EXT ILK).

Table 4-7 Varian Emergency-Off Interlock Input

Varian ILK Universal Low Voltage Emergency-Off Interface Connector		
Cabling	A shielded 9pole SUB-D extension cable, maximum 30m (BL article 49025) is needed from the Linac stand to the ExacTrac cabinet. Depending on the Varian Linac type, a short adapter inside the ExacTrac Computer Cabinet selects the used interlocks dependent on the system configuration.	
Emergency Off Requirements	<p>The customer is responsible for fulfilling local regulatory requirements with the emergency-off installation.</p> <p>The timing requirements for motion stop are met with this installation.</p>	
Interface on ExacTrac System Cabinet	Location	ExacTrac ILK Insert, connector Varian ILK.
	Signalization Logic	In case of emergency-off, the Varian Linac de-energizes the signal within the cable. This is detected by the ExacTrac system.
	Connector Type	9pol SUBD Standard components.
	Galvanic Separation	The Varian ILK Interface on Brainlab side is separated according to IEC 60601-1 for S.F.C: 250V AC (electrical safety of medical devices).
	Pin Out	<ul style="list-style-type: none"> ■ Terminal 5 – cathode (1 = first upper position). ■ Terminal 6 – anode. ■ Terminal 7 – GND isolated. ■ Terminal 8 – 12 V DC isolated.
	Additional interlocks within the same interface connector	<p>Depending on the system configuration (TrueBeam or Linac with Exact couch), two more interlocks can be used by the ExacTrac system.</p> <ul style="list-style-type: none"> ■ NO_COLLISION ■ MEL_HW <p>Brainlab will select the appropriate adapter inside the cabinet to select the right interlocks (no customer decision required – see motion interlock description).</p>

4.4.4.4 System Power Emergency-Off Installation (Emergency-Off)

This Emergency-Off method shall be installed if a total system shutdown is required to comply with local regulations, in spite of the Emergency-Stop behavior that is recommended only for normal ExacTrac operation by Brainlab.

It ensures that in case of Emergency-Off, not only are the motion and x-ray related risks stopped, the system is completely separated from main voltage.

The entire power supply of the ExacTrac System (Computer Cabinet and X-Ray Generator Cabinet) shall be connected to the Emergency-Off circuit. This means the ExacTrac System will be immediately powered down whenever the emergency button is pushed/active.

The customer/contractor will be responsible for designing and providing the Emergency-Off circuit and button.

4.4.4.5 System Door Contact Interlock

Table 4-8 ExacTrac Door Contact Interlock

Door Interlock Interface Description		
Safety Factor	According to local regulations	
Cabling	The customer integrates the door interlock switch and circuits into the building installation. At least there must be provided a control cable by the customer to the ExacTrac cabinet for contacting the EXT ILK connector on the ILK Insert panel.	
Door Contact Requirements	The customer is responsible for fulfilling local regulatory requirements with the door contact installation. The circuit shall be designed functional fail safe.	
Interface on ExacTrac System Cabinet	ExacTrac ILK Insert, connector EXT ILK Properties.	
	Signalization Logic	The interface provides an isolated opto input with two contacts anode and cathode. If the input is energized, for example, by a simple door contact switch that is closed if the door is closed as well, the ExacTrac system detects this and enables the system for further operation (for example, x-ray). On request Brainlab can modify the signal depending on the local installation requirements.
	Electric Max. Values	If used for a passive switch: <ul style="list-style-type: none"> ■ Current through switch: 20 mA max. ■ ExacTrac-Voltage used: 12V DC
	Pin Out	<ul style="list-style-type: none"> ■ Terminal 3 – cathode (1 = first upper position). ■ Terminal 4 – anode. ■ Terminal 7 – GND isolated. ■ Terminal 8 – 12 V DC isolated.
	Connector Type	Plugged screw terminals with strain relief for single wires (Phoenix Contact Article: MC 1.5/8-STF-3.81: for single wires 0.14 - 1.5 mm ² = #28 AWG – #16 AWG).
	Galvanic Separation	The EXT ILK Interface on Brainlab side is separated according to IEC 60601-1 for S.F.C: 250V AC (electrical safety of medical devices)

4.5 ExacTrac System Mains Power and Potential Equalization Cabling

Mains Power/Potential Equalization (PEQ) cabling material supplied with the ExacTrac system (Brainlab supplied) complies with worldwide harmonized certification “HAR” and dedicated certifications for the North American / Canadian market. In cases where the provided certifications are not sufficient for installation (for example, regional regulatory or local installation aspects), the customer is responsible for providing adequate cabling material. See your Brainlab Project Manager for additional information.

4.5.1 Electrical Safety/Equipotential Grounding

The customer has to install power and PEQ cables between the computer cabinet, power boxes and equipotential grounding spot. For details, see [Table 4-9](#) and [Figure 4-4](#).

Table 4-9 Main Power and PEQ Cabling Plan

Cable Type	Destination Start	Destination End	Length (max.)	Cable Diameter	Plug Diameter
Mains power	Computer Cabinet	In-Room Distr. Box	98'-0" (30,000)	0.38" (9.6)	N/A
PEQ	“	“	98'-0" (30,000)	0.35" (8.9)	N/A
Mains power	Computer Cabinet	Control Room Distr. Box	98'-0" (30,000)	0.38" (9.6)	N/A
PEQ	“	“	98'-0" (30,000)	0.35" (8.9)	N/A
PEQ	In-Room Distr. Box or Computer Cabinet	Equipotential Grounding (Treatment Room)	98'-0" (30,000)	0.35" (8.9)	N/A



Note: Run cable with 12" (300) slack within both power boxes.



CAUTION: The customer is responsible for permissibility of the installation at site with respect to applicable local or regional standards.

This might affect the choice of cable routes, specifications of mains power- and data cables, connection to potential equalization and the choice of installation locations of system components.

The customer must be aware that fire protection engineering aspects (plenum rating) may be affected when installing cables and system components.

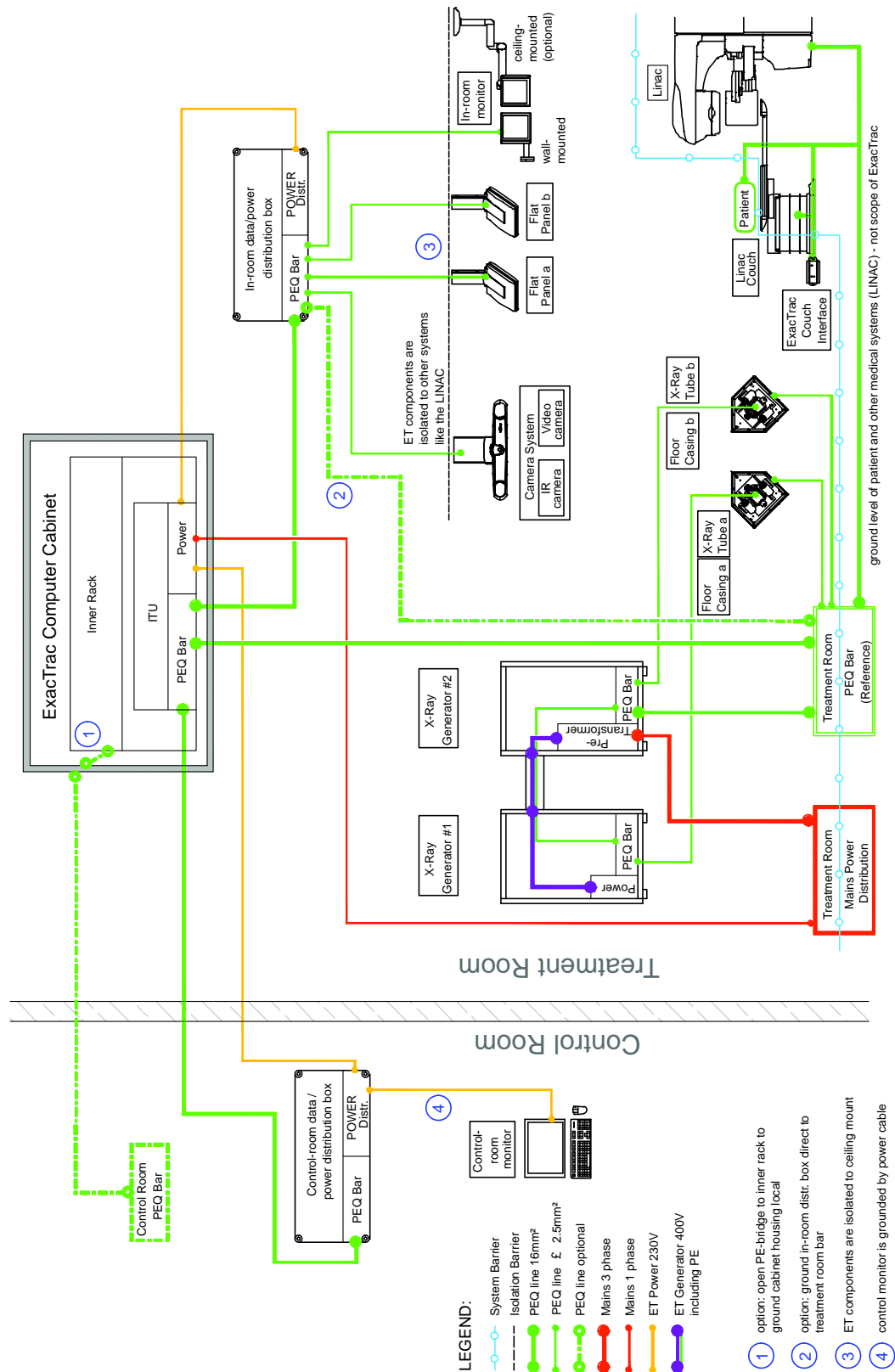


Figure 4-4 PEQ Schematic ETX/NB System

Additional PEQ cables have to be installed between each system component (supplied by Brainlab).

- One cable #6 AWG (16mm²) between:
 - Generator – Treatment room equipotential grounding spot
- and six cables #14 AWG (2.5mm²) between:
 - Both flat panel-ceiling mounts – In-room distr. box
 - Touch screen ceiling frame – In-room distr. box
 - Camera ceiling mount – In-room distr. Box
 - Both floor boxes – Treatment room equipotential grounding spot



Note: Pull cable length with sufficient slack.

If the generator and/or the computer cabinet are located in a room, or rooms, other than the treatment room, all of these rooms must be brought to the same equalization level.

Correct PEQ grounding of Linac and couch is presumed. The PEQ grounding is usually defined with the Linac electrical cabling diagrams or was defined by hospital electrician.

4.6 Interconnection Wiring Diagram

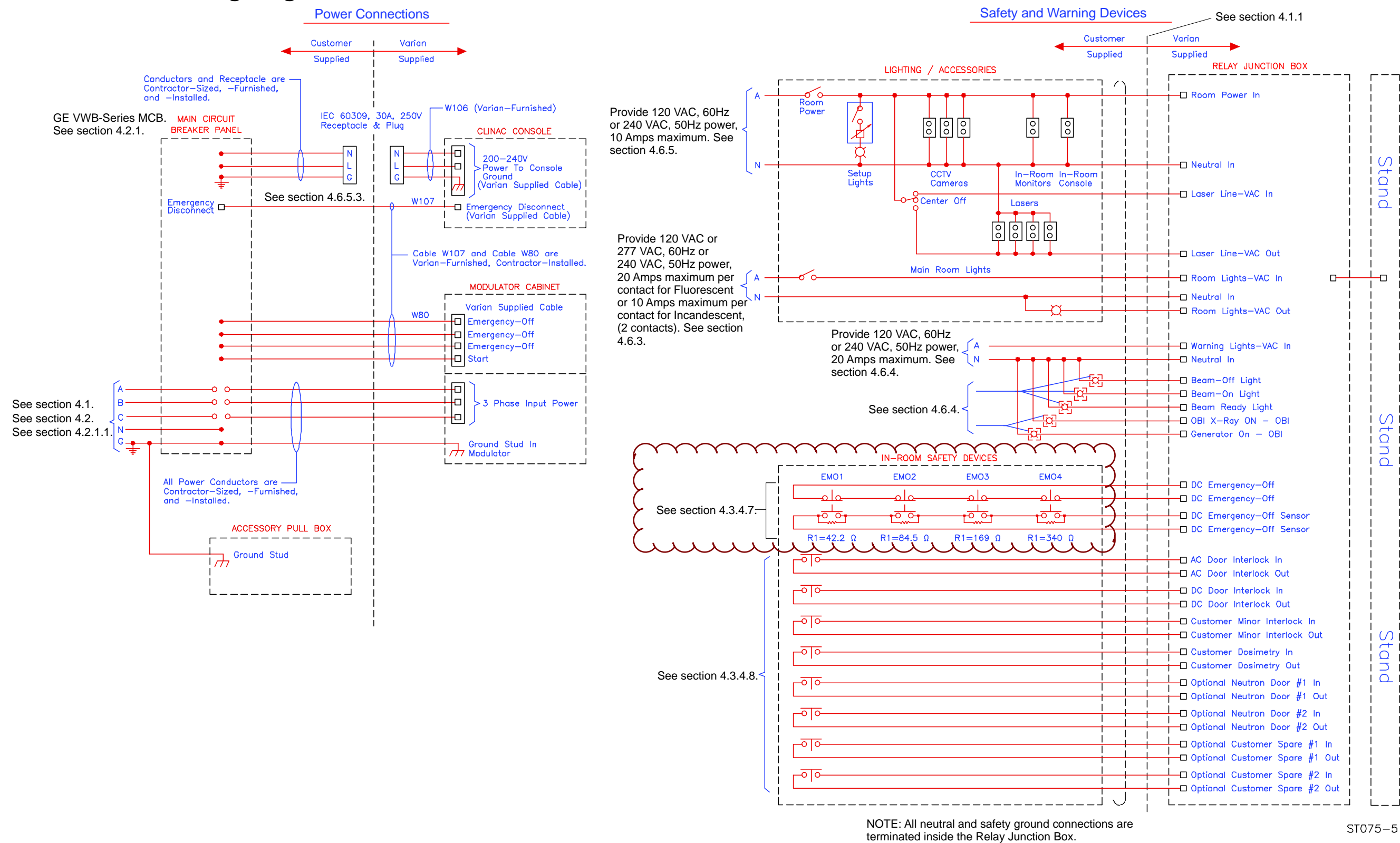


Figure 4-5 Interconnection Wiring Diagram

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4.6.1 General Notes

Use the following description of the TrueBeam STx operational states to determine the estimated utility load based on normal treatment cycles:

- **Low Power** – A condition usually in effect on weekends and overnight with only DC power to the control systems and vacuum power supplies and AC power only to the DU and MLC.
- **On** – A condition with no energy selected, all magnet and steering power supplies off, but with the klystron solenoid power supplies operative. Approximately 42 minutes per hour.
- **Ready/Energy Select** – A condition with the ready to Beam-On. Approximately 6 minutes per hour.
- **Beam-On** – The full-duty condition in which all primary heat sources operate at their maximum levels. Approximately 12 minutes per hour. The Beam-On State is maintained continuously for one hour or more during physics and calibration use.
- The estimated number of minutes per hour of each state is based on an average of six patients treated per hour.
- Heat loads for each of these states can be found in [Section 3.8.2.1, TrueBeam STx Coolant Requirements](#).

4.6.2 Laser Positioning Lights and Optional Bypass/Override Switch

The power to the lasers is typically supplied by a grounded power receptacle at each laser location. A 3'-0" (914) power cord is provided with each laser. The receptacles are controlled through the Relay Junction Box (RJB) as defined by the Interconnection Wiring Diagram (see [Figure 4-5](#)). Each laser can consume up to 25W, which varies per manufacturer.

For Q/A or maintenance purposes, a bypass/override switch can be installed to independently illuminate the laser positioning lights. These laser positioning lights are normally controlled through the hand pendant on the couch simultaneously dimming the room lights. This switch will allow the positioning lights to come on without dimming the room lights. If desired, a Single-Pole, Triple-Throw (SPTT) or a Single-Pole, Center Off (SPCO) wall switch should be installed, as shown in [Figure 4-5](#). As an alternative, a Single-Pole, Double-Throw (SPDT) wall switch can be installed; however, the SPDT switch does not incorporate the *center off* functionality, which terminates power before reaching the RJB.

4.6.3 Room Lighting

4.6.3.1 Room Lights, Setup Lights, Laser Positioning Lights, and CCTV

The room lights, setup lights, laser positioning lights, In-Room Monitor, and Closed Circuit Television System (CCTV) can be controlled by a single room master switch, often outside the room and including a pilot light. The room lights can be on a separate circuit. Laser positioning lights control is automatically subordinated to room lights control on TrueBeam STx and Acuity. A warning that lasers are on is implied when the room lights are off (lasers are turned off when room lights

are on). The room lights and laser positioning lights may have wall switches inside the room, but this is not necessary when they are connected to the Relay Junction Box. Three-way switching is not recommended.

4.6.3.2 Setup Lights

Setup lights are normally dimmable incandescent fixtures, that allow the intensity to be adjusted by the therapists, while aligning the patient to the laser lights. The setup lights are usually located above and to either side of the longitudinal axis. The range of illumination for the setup lights is usually 25 to 40 foot-candles (269 to 431 meter-candles). Their operation is independent of the Pendant and Couch controls.

4.6.3.3 Main Room Lights

Main room lights are used for general illumination, while the patient is moving into and out of the room and for machine and room maintenance. Typically, fluorescent fixtures are used. The range of illumination for this activity is 75 to 100 foot-candles (807 to 1076 meter-candles) at the working level, approximately 3'-0" (914) above the floor. The fixtures are operated from the TrueBeam STx Couch and the Couch Pendant through a relay. If skylights and atria are used for general illumination, their contribution to the light level must be coordinated with the requirements during patient setup.

4.6.4 Safety Device Systems

System warning lights are customer-provided fixtures that are required in the treatment room, and/or over the door, and/or at eye level adjacent to the door outside the treatment room to indicate beam-on/beam-off conditions. 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 a TrueBeam STx room. They are usually located adjacent to the emergency-off switches. Verify local requirements with regional regulatory agencies.

Each of the five Warning Light circuits has a maximum incandescent lamp load of 60 watts. If a greater load is required, these circuits can be used to control separate, customer-provided relays. Alternately, LED fixtures can be substituted. Fluorescent fixtures are not approved.

4.6.4.1 Beam-On Warning Lights

The *BEAM ON* warning light illuminates when treatment radiation (MV) is being produced by the accelerator and is mandatory. Provide no less than one *Beam On* warning light located over the door, on the outside of the treatment room. Verify additional requirements with regional regulatory agencies.

4.6.4.2 Beam Ready Warning Light

The *BEAM READY* warning light illuminates when all interlock conditions have been cleared and the accelerator is in a *ready* state to generate treatment radiation (MV). A Beam Ready warning light in the room and/or over the door may be required. Verify local requirements with regional regulatory agencies.

4.6.4.3 Beam-Off Light

The *BEAM OFF* warning light illuminates when the accelerator is not in a radiation-generating state. Most sites do not use this feature. Verify local requirements with regional regulatory agencies.

4.6.4.4 X-RAY ON (Integrated Imaging) Warning Light

The *X-RAY ON* warning light illuminates when imaging radiation (KV) is being produced by the Integrated Imaging and is mandatory. Provide no less than one *X-RAY ON* warning light, located over the door, on the outside of the treatment room. This light is commonly red-colored and may be required to blink when the Integrated Imaging X-Ray is on. Verify additional requirements with regional regulatory agencies.

4.6.4.5 Generator ON (Integrated Imaging) Warning Light

The *GENERATOR ON* warning light illuminates when the Integrated Imaging is in a *ready* state to generate imaging radiation (KV). A Generator On warning light warning light in the room and/or over the door may be required. This light is commonly white-colored and may be required to blink when the Integrated Imaging X-Ray is on. Verify local requirements with regional regulatory agencies.

4.6.4.6 ExacTrac Warning Lights

Provide locations for two ExacTrac warning lights. Locate one inside the treatment room and the other over the door, on the outside of the treatment room.

4.6.4.7 Emergency-Off Switches

Provide Emergency-Off (E-Off) switches in treatment room. The TrueBeam STx E-Off switch shall be Allen-Bradley 800T-FX6AV or equivalent, two pole, dry contact type with manual reset. Each switch shall be wired in series to two separate parallel circuits. The first contact shall be normally closed (NC) and make up the “safety loop.” The second contact shall be normally open (NO) and include the “sensor loop.” Each E-Off switch shall incorporate a Varian-provided, contractor-installed resistor across the Sensor Loop pole (see [Figure 4-5](#)). Specific directions for installing the Sensor Loop Resistors will be provided by the Varian Project Manager in advance of and in preparation for his Pre-Installation Inspection Site Visit.

In addition to the switches required as part of the room, Emergency-Off devices are built into the TrueBeam STx Stand and Couch, Console, and at the TrueBeam STx Modulator. Therefore, an adequate quantity of switches must be provided in Accelerator rooms so that one need not pass

through the primary beam to disable the TrueBeam STx. Do not locate Emergency-Off switches in primary beam. Locate switches to avoid inadvertent contact, such as by gurneys or carts. Verify all requirements with regional regulatory agencies.

4.6.4.8 Safety Door Interlock Switches

Safety door interlock switches are required for all installations. Provide door switches for both 24VDC (1 mA typical load) and 120 VAC (500 mA typical load) door interlocks. They are normally open type switches and are used to ensure the room doors are closed during TrueBeam STx operation. Verify with the door manufacturer the type of switches supplied with the door or provide compatible type. Neutron door switches should be connected to the Neutron door inputs on the RJB.



Note: Second door interlock switches are shown for paired entry doors. Both interlock switches must be provided at each entry door.

The TrueBeam STx system allows for several additional interlocks to be used at the customer's discretion for ancillary purposes such as roof hatches, in-vault storage room doors, radiation dosimeter interlock, and so on. Contact your Regional Planning Manager for additional details.

4.6.5 Power Receptacles/Switches

4.6.5.1 Setup Lights

Provide a dimmer switch for setup lights. This switch is used to adjust the illumination level of the set-up lights so that they are dim enough for clear visibility of the lasers, but bright enough for safe movement through the room.

4.6.5.2 CCTV Camera

Provide a power receptacle at each CCTV Camera.

4.6.5.3 TrueBeam STx Control and Imaging Cabinets

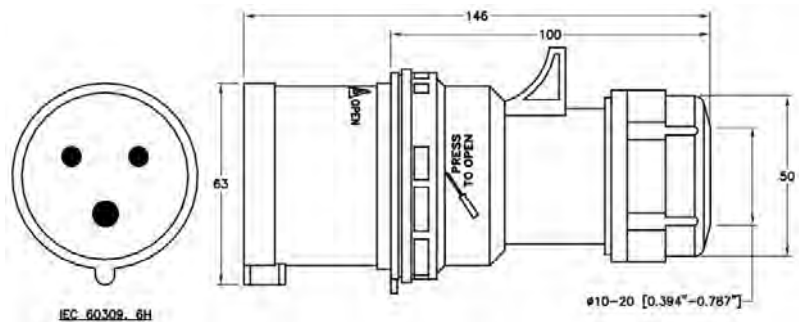
Provide one 200VAC-240VAC power receptacle with an IEC60309, Blue, 30A, 250V (UL/CSA) or 32A, 220/240V (European) 50/60HZ, 2 Pole, 3Wire, Grounding receptacle (available from GEXPRO 1-800-200-9760).

This receptacle shall be powered by the GE VWB-Series MCB, located below the counter, and 2' (610) to either side of the TrueBeam STx Control Cabinet. Do not place this receptacle directly behind either control cabinet. See [Section 5.1, Typical Control Equipment Casework](#) for details.



Contractor-furnished IEC60309 Receptacle

The Contractor furnished receptacle provides power to the TrueBeam STx Control Cabinet through the Varian supplied W106 Cable with IEC60309 power plug.



Varian-furnished Cable (W106) with IEC60309 Plug

The electrical loads for the Varian control console equipment are:

- TrueBeam STx Control Cabinet – Receives power from GE MCB-fed wall receptacle via Varian-furnished W106 cable.
- TrueBeam STx Imaging Cabinet – Receives power from TrueBeam STx Control Cabinet.
- Control Console and CCTV Monitors – Receive power from TrueBeam STx Control Cabinet.
- Log Printer – 120VAC - 1A.

Provide one grounded 4-plex electrical power receptacle for the Log Printer. Locate below the counter.

In addition, optional duplex or 4-plex electrical power receptacles should be provided above and/or below the counter for operators' convenience.

4.6.5.4 ARIA Workstation Components (Optional)

Provide a grounded 4 plex electrical power receptacle for any optional workstation.

4.6.5.5 ExacTrac Control Console Components

If selected, provide a grounded 4 plex electrical power receptacle for ExacTrac components. Locate adjacent to the underside of the counter to provide maximum power cable extension.

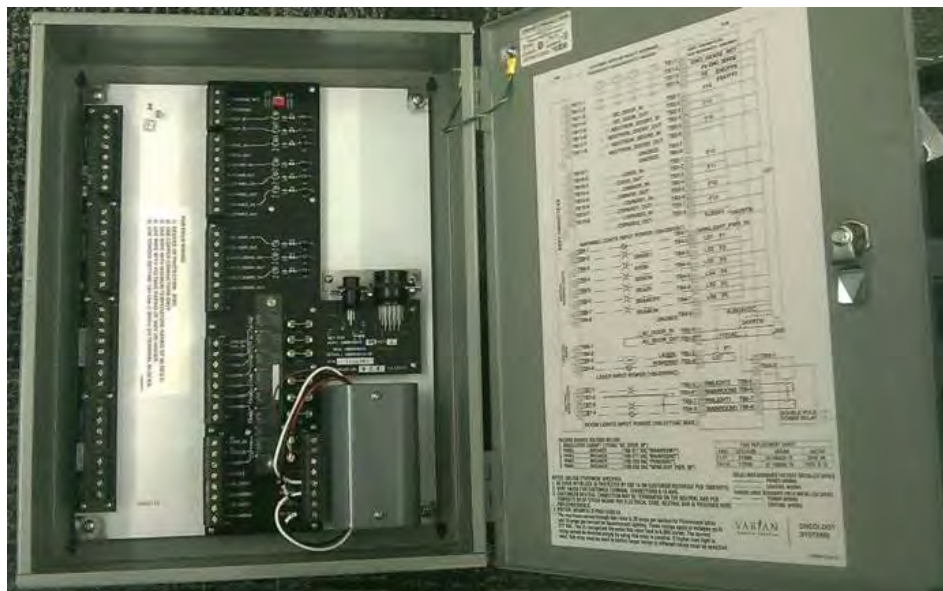
4.6.6 Varian Relay Junction Box

4.6.6.1 Application

The Varian-provided Relay Junction Box provides an interface with the TrueBeam Accelerator via a factory assembled and tested control panel designed to provide a convenient, organized, labor saving central connection point for the Laser positioning system status warning lights, room lighting, and door interlocks and remote emergency off push buttons. The panel includes wiring diagrams to enable it to be used as a radial junction and control point simplifying the connection of the various systems. Multiple terminals are dedicated for connecting these devices. The Relay Junction Box is designed for wall mounting.

Designed for use with the following Varian Medical Systems:

- TrueBeam
- TrueBeam STx



4.6.6.2 Features

- Dedicated terminals and multiple ground terminal bars are clearly marked with Varian drawing reference numbers.
- Provided by Varian Medical Systems.
- Polarity protection diode installed for each relay coil.
- All DC switches input and relay output signals are protected with fuses and transient voltage suppressors, except room light relay.
- Isolated contacts accommodate different lighting circuit voltages.
- Easy mounting wall mounted enclosure utilizing (4) holes for ¼ mounting screws.
- Hinged door provides easy access.
- Finish is gray powder coat inside and out.
- All components selected for high reliability and long life.
- Provides a standardized platform for future applications or upgrading.

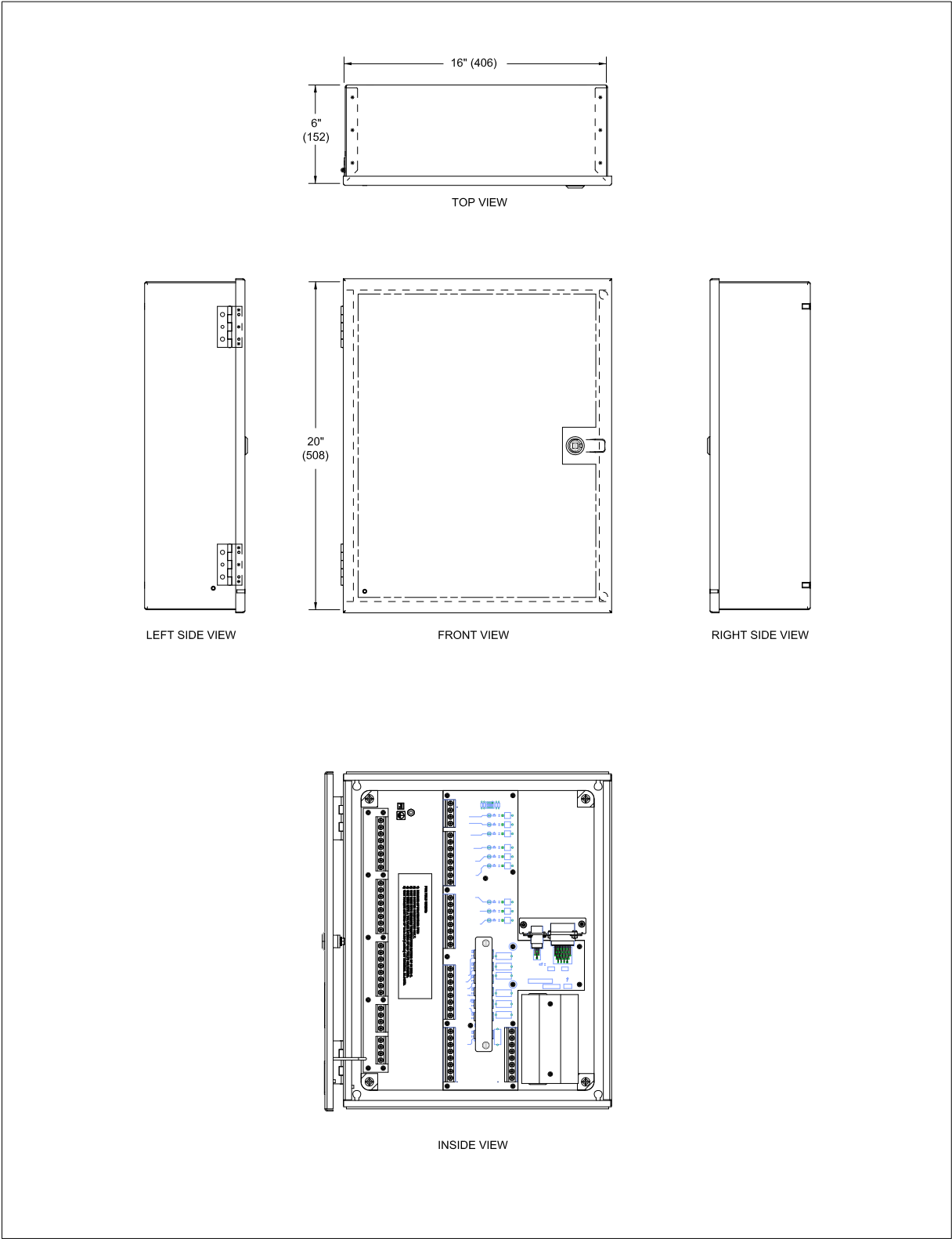


Figure 4-6 Varian Relay Junction Box

5.1 Typical Control Equipment Casework

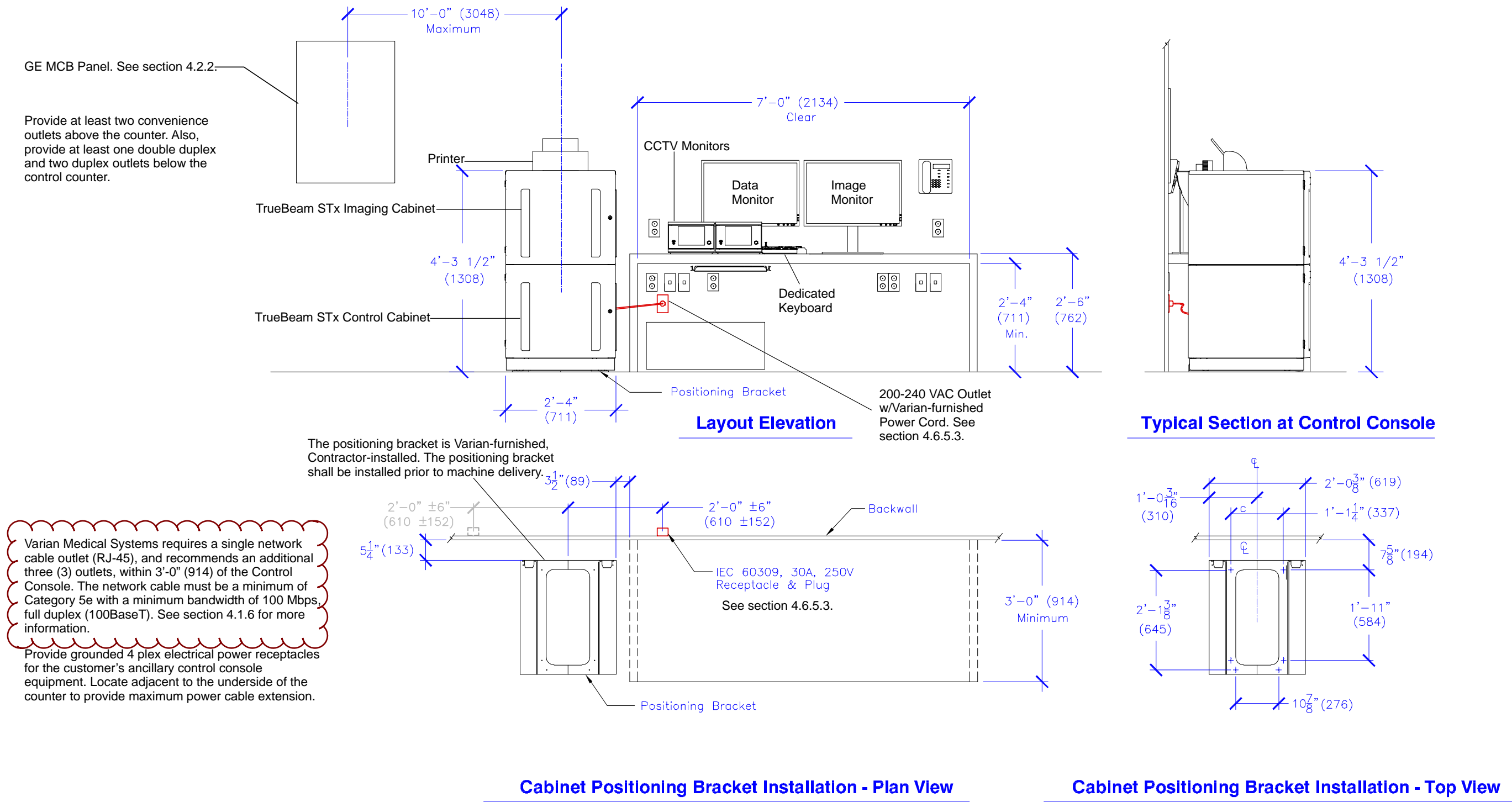


Figure 5-1 Control Equipment Layout, Stacked

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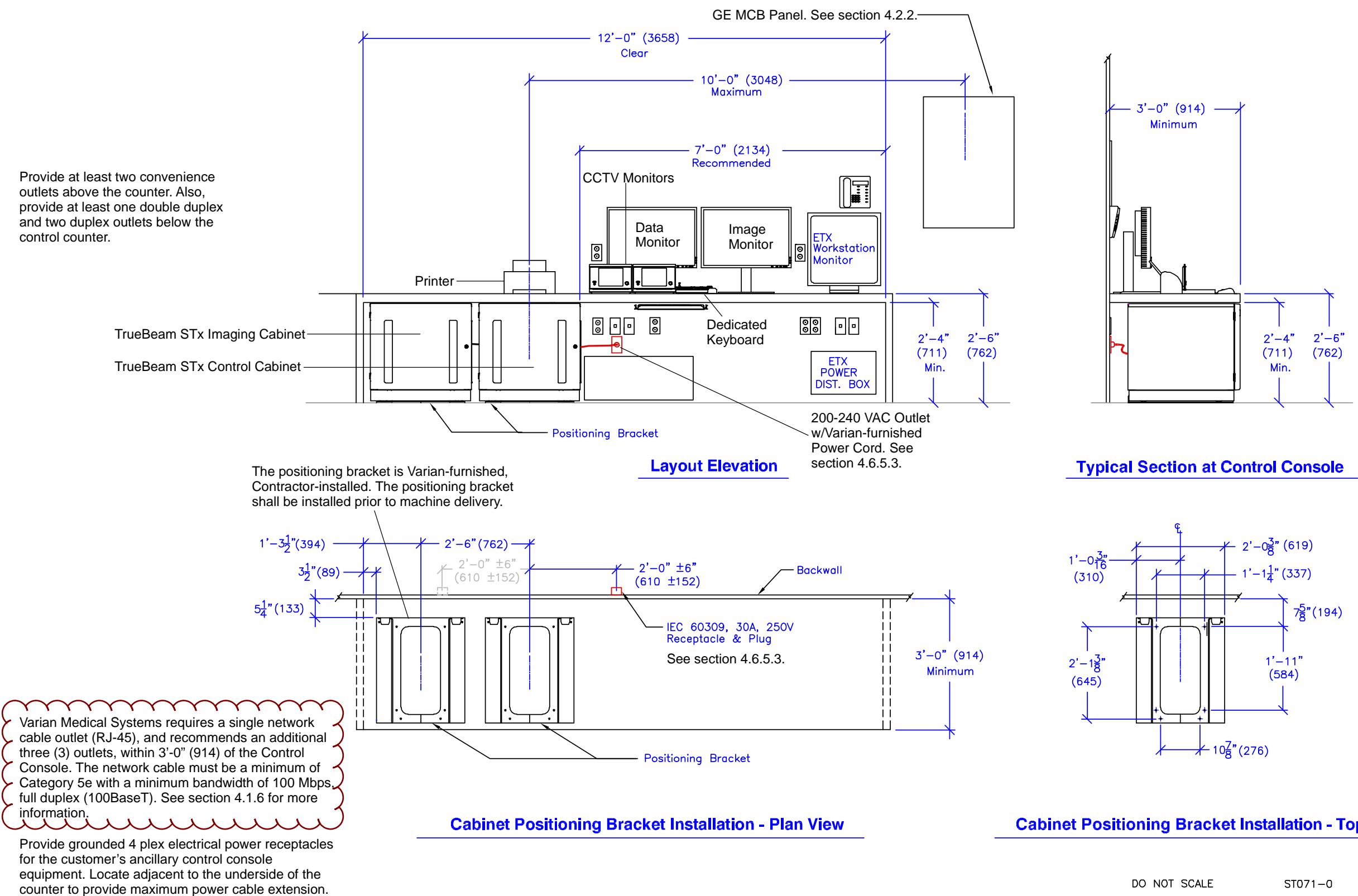


Figure 5-2 TrueBeam STx Electronics Cabinet Elevation

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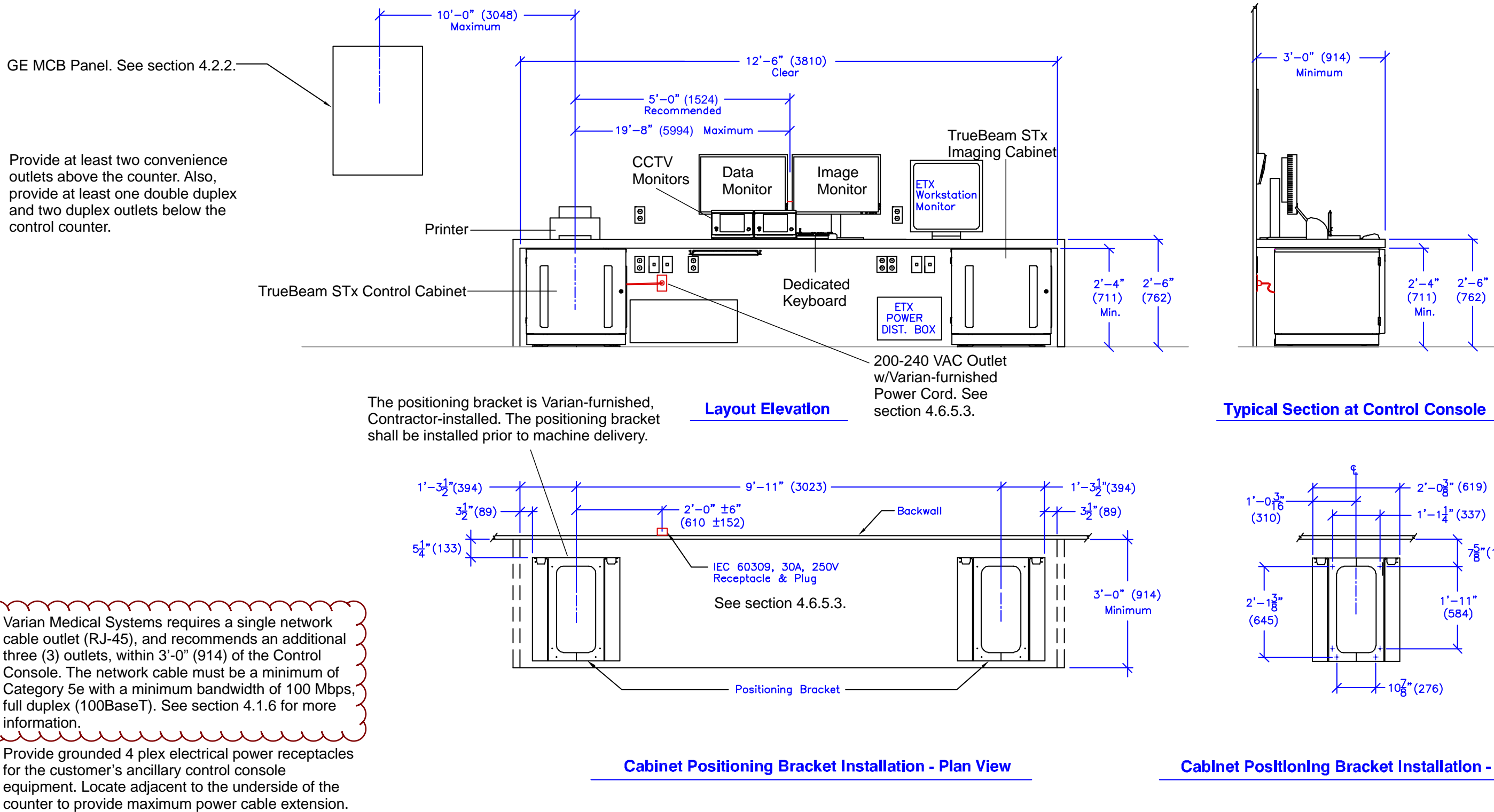
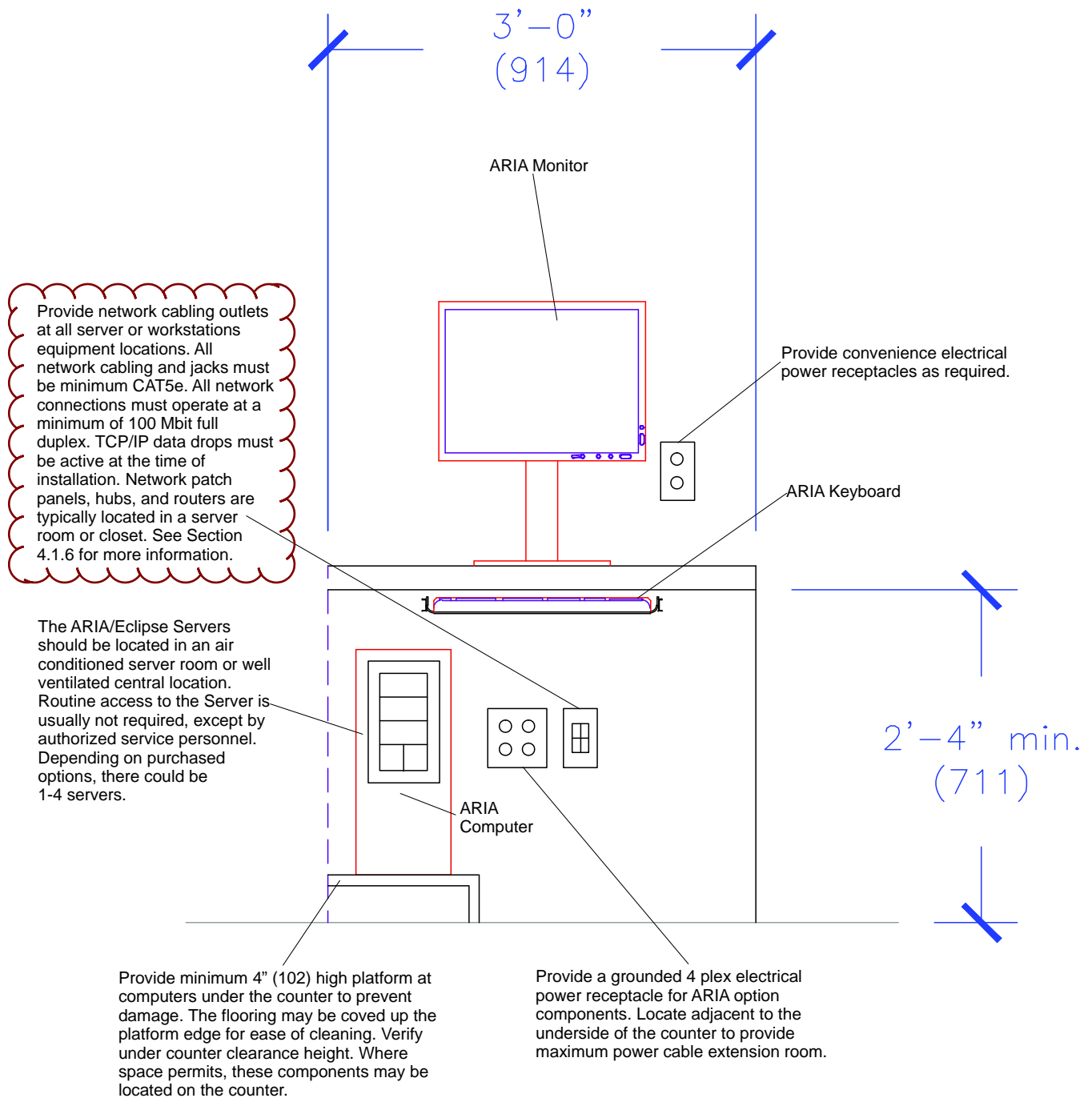


Figure 5-3 Typical Section at TrueBeam STx Electronics Cabinet

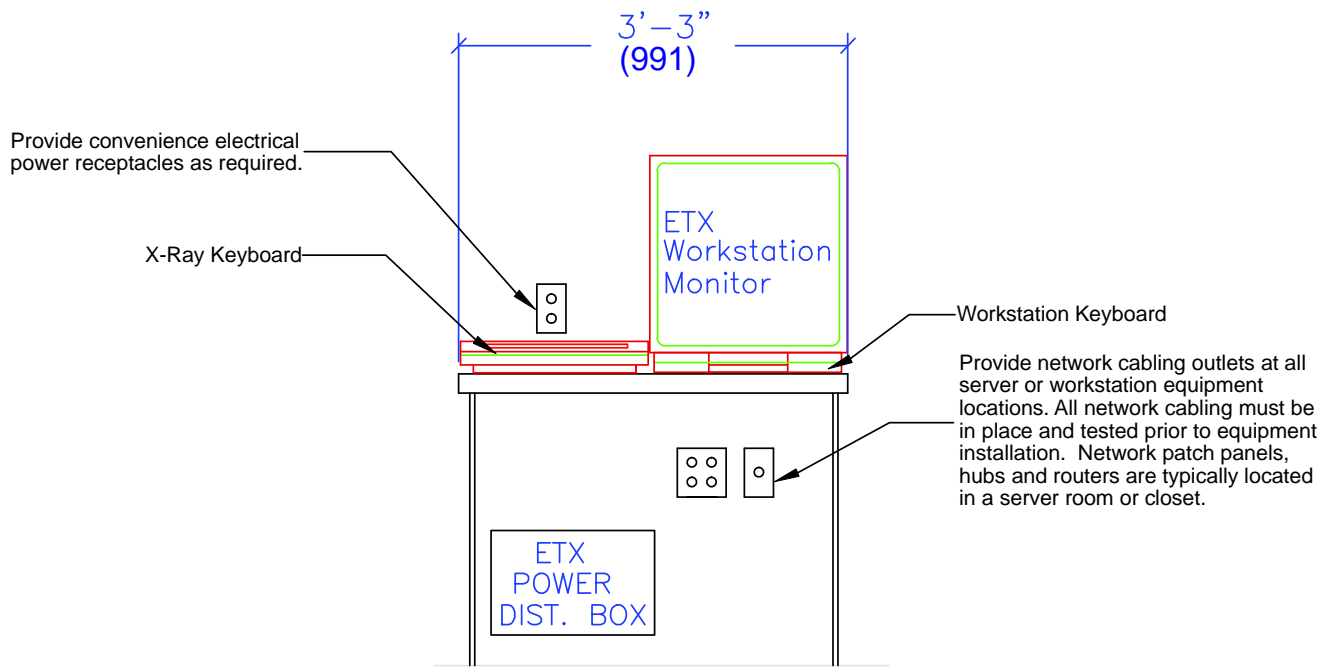
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ST024-1

Figure 5-4 ARIA Treatment Workstation (Optional)

See section 3.12.5 "Control Room Workspace" for more information.



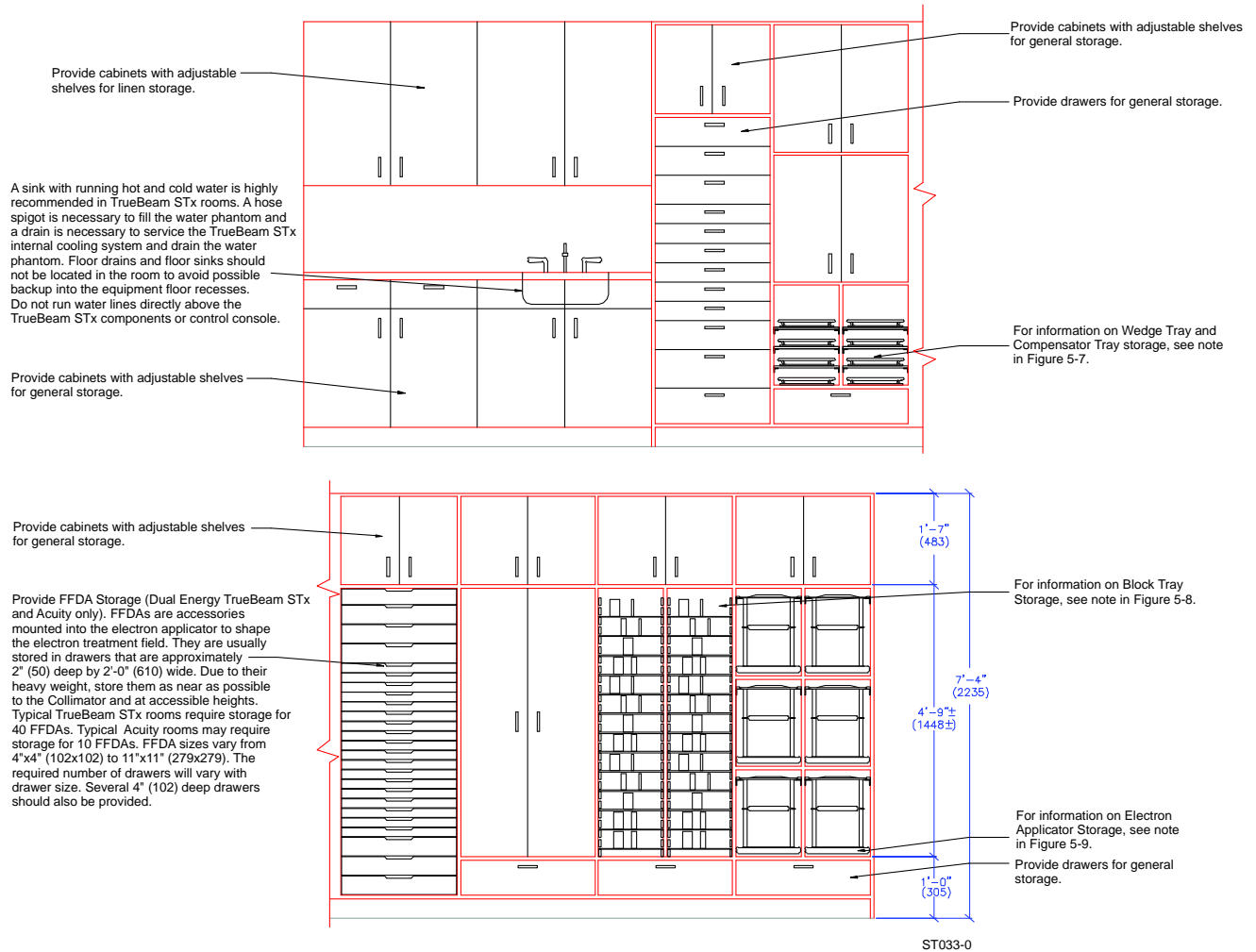
ST025-1

Figure 5-5 Optional ExacTrac Workstation

5.2 General Room Storage Requirements



Note: The type and quantity of storage is at the customer's discretion.



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. Storage space in the treatment room should be planned to reduce travel required for patient set-up. Patient block tray storage should be located on the entrance side of the Treatment Couch. Linen storage in the treatment room and storage space for many patient positioning pads and devices is desirable.

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.

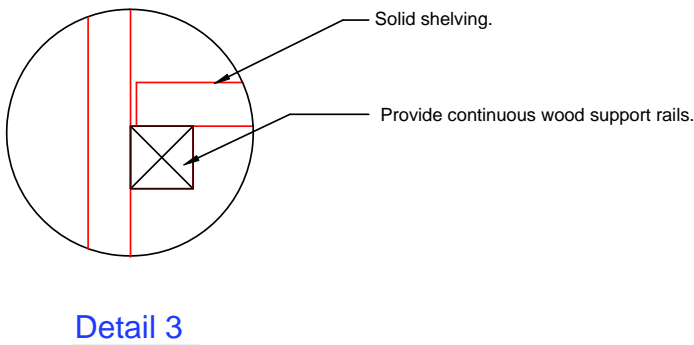
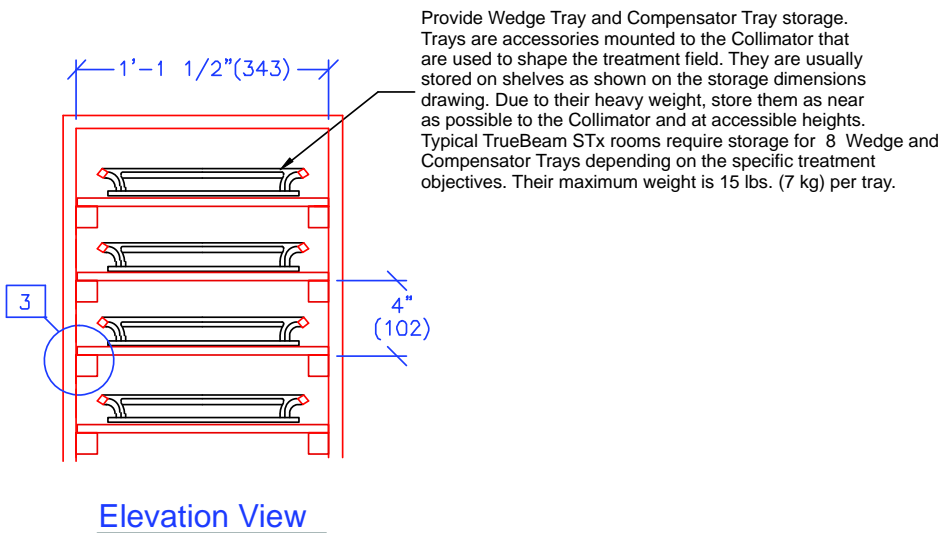
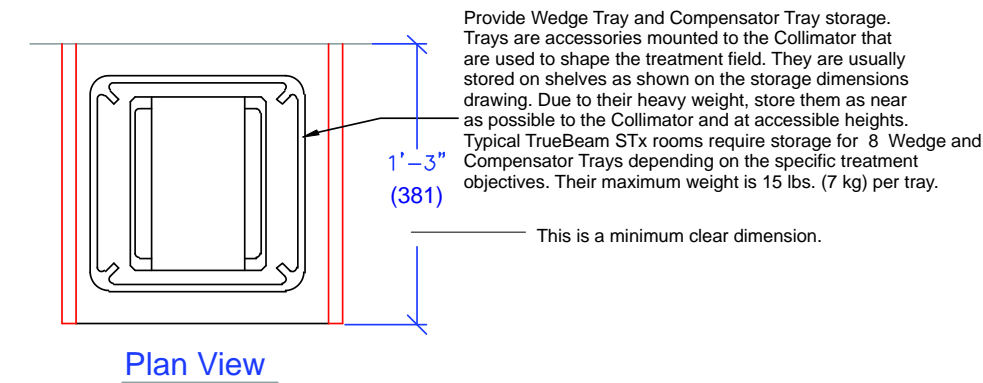
General TrueBeam STx room storage requirements are outlined below. This is only a partial list of storage items required for a typical TrueBeam STx room:

- > Treatment room furniture - chair, mirror, coat rack, foot stool, waste can, I.V. poles, oxygen bottle cart, film holder cart, soiled linen cart and total body irradiation "stage."
- > Miscellaneous storage items - spare parts, demineralized water, physics dosimetry equipment, film markers (letters), solder wire, restraints, "easy mover" stretchers, immobilization devices, patient shielding accessories, patient set-up accessories, patient marking accessories, arm/shoulder extenders, hand grips, breast boards and "alpha cradles (formed foam cradle)."

The storage drawing shows a suggestion only of possible storage provisions and is intended as a guide to aid in the design of site specific casework. Due to differences in treatment practices, the exact quantity and types of accessories varies with each institution. Verify requirements and storage preferences with the Customer. This is not a construction document. All casework/storage shall be provided by the Customer.

Figure 5-6 Typical Room Storage Elevation

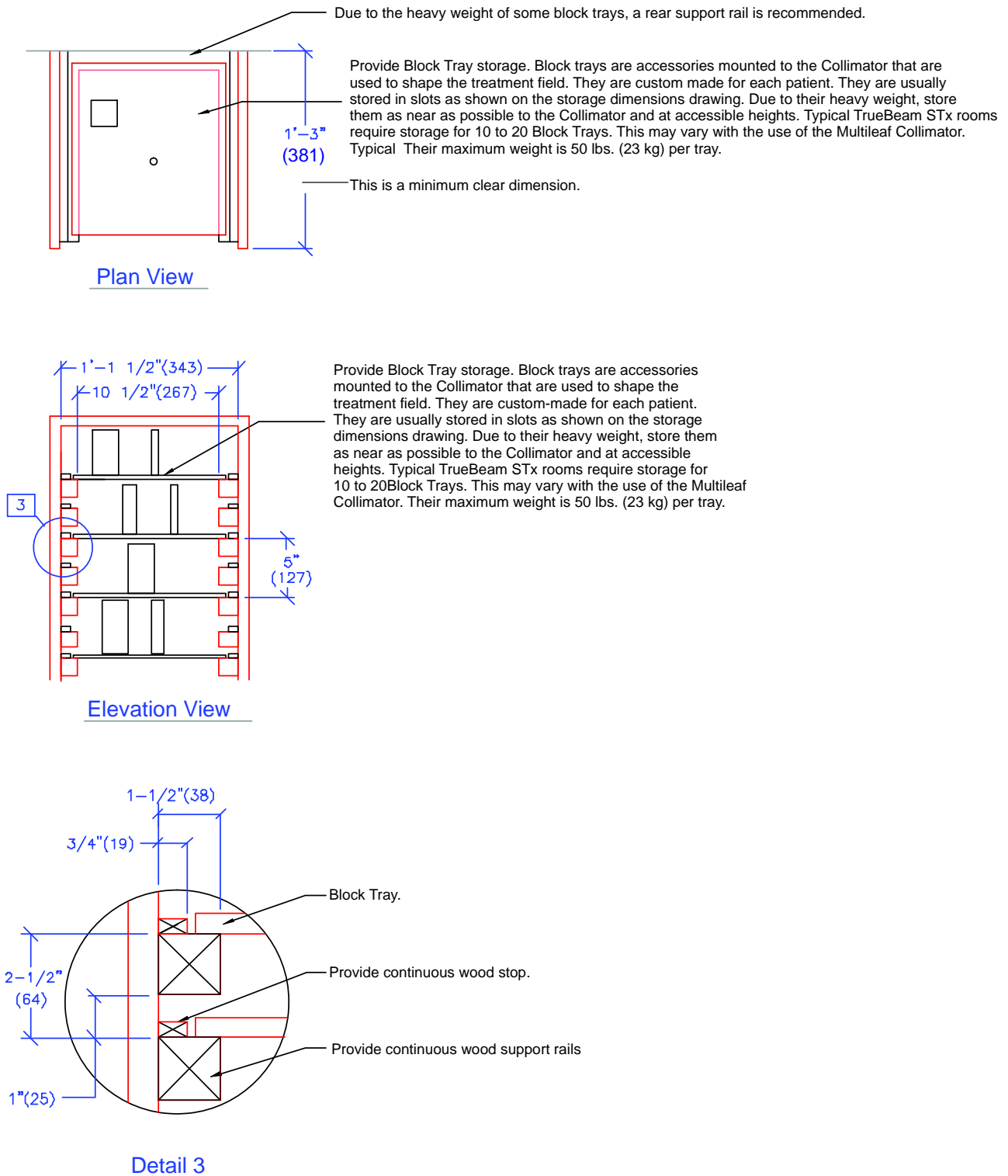
5.3 Typical Accessory Storage Dimensions



Provision should be considered for labeling Accessory Storage Compartments.

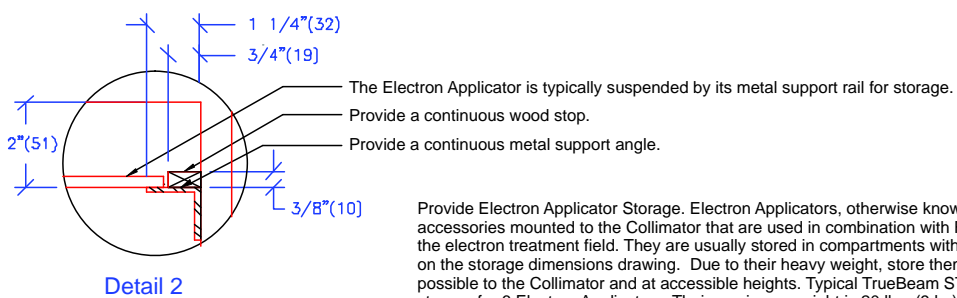
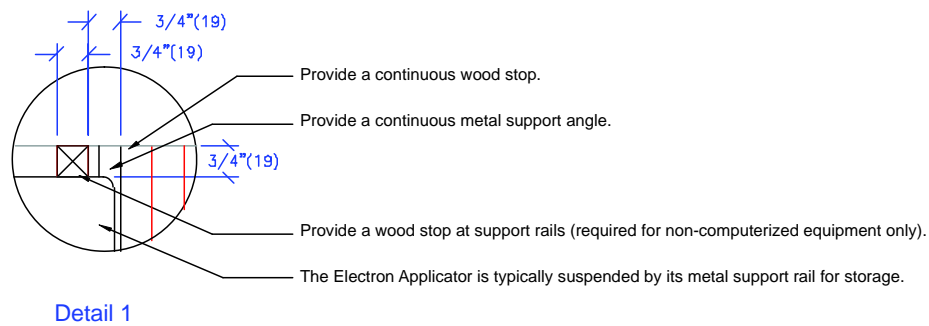
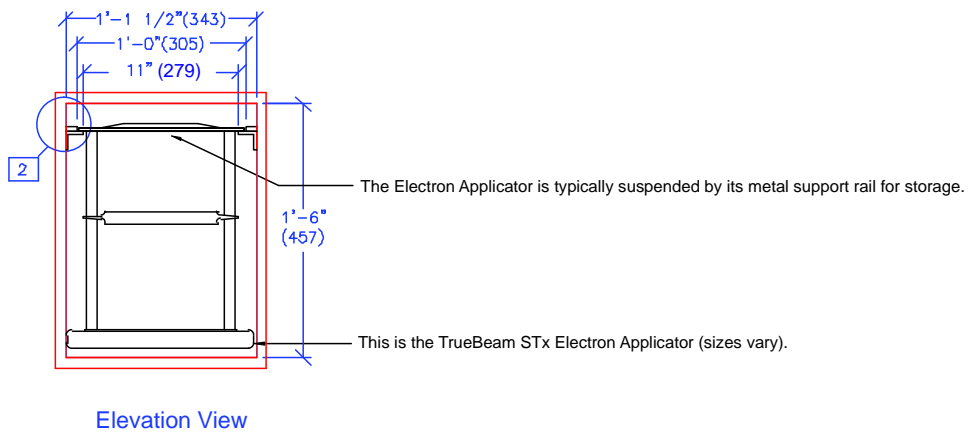
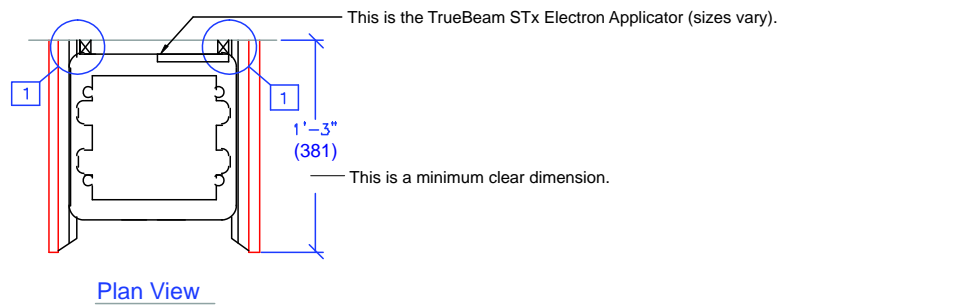
ST035-1

Figure 5-7 Wedge Storage



ST036-1

Figure 5-8 Block Storage



Provide Electron Applicator Storage. Electron Applicators, otherwise known as "cones" are accessories mounted to the Collimator that are used in combination with FFDAs to shape the electron treatment field. They are usually stored in compartments with slots as shown on the storage dimensions drawing. Due to their heavy weight, store them as near as possible to the Collimator and at accessible heights. Typical TrueBeam STx rooms require storage for 6 Electron Applicators. Their maximum weight is 20 lbs. (9 kg) per applicator.

Provision should be considered for labeling Accessory Storage Compartments.

ST034-1

Figure 5-9 Applicator Storage

5.4 Carpeting and Flooring Requirements

As with most computer components, the electronic components for this equipment are sensitive to localized static electricity. Vinyl composite tile (VCT) or vinyl sheet goods (VSG) adjacent to the equipment in the room or at the control equipment area should be considered as *static dissipative* as outlined in EOS/ESD S7.1 and ANSI/ESD S20.20. Retrofit static dissipative coatings are also available from various manufacturers. Similarly, carpeting should not exceed a 2.0 kV rating at 20% relative humidity when measured as outlined by the methods in AATCC-134. Carpet, while having advantages, can make gurney movement difficult. In addition, floor stains on carpeting are common due to the use of dyes to mark reference points on patients. Those facilities that do choose carpeting often use carpet squares that can be replaced or cleaned and allow access to floor conduit/duct if used.

To avoid damage during rigging, it is recommended that the final floor covering be installed after the equipment has been rigged onto the Baseframe and major assembly of the equipment has been completed. Coordinate floor covering and rigging with Installation Project Manager. Seal or *skim coat* the entire floor prior to machine delivery to eliminate dust and dirt.

5.5 Acoustical Requirements

There are no recognized acoustical standards for therapy rooms. The primary sound source on TrueBeam STx systems is the Modulator Cabinet. Varian has encountered no acoustical problems when the Modulator is located 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. Noise is a concern, however, when the Modulator Cabinet is located next to therapists or others who are exposed to it often. When located outside the vault, placing the Modulator in a nearby closet is acceptable and the use of acoustically absorbent materials is recommended. Consult with the Customer regarding preferred location.

5.6 Ceiling Finishes

Varian Medical Systems does not specify a type of ceiling finishing. However, experience has shown the benefit of a 2' x 4' (600 x 1200) or 2' x 2' (600 x 600) Lay-in Acoustical Tile. Among its benefits are easy access to above ceiling structures/systems, low repair and modification cost, acoustical attenuation, and the aesthetic benefits of modern ceiling grids and tiles.

The recommended minimum finish floor to finish ceiling clearance is 9'-0" (2743). For sites with ceiling clearance issues, a portion of the ceiling not located directly above the TrueBeam STx may be installed below the recommended height. However, to allow for rigging, assembly, and operational clearances, certain area central to the accelerator must remain 9'-0" (2743) or greater. See [Figure 5-10, Typical Reflected Ceiling Plan](#) for additional information.

To avoid interference with the overhead laser start the ceiling support grid pattern so that Isocenter is at the center of a tile. If a solid ceiling is used, provide an access panel with adequate space for servicing the laser. See [Figure 5-10, Typical Reflected Ceiling Plan](#).

When laying out the air conditioning and fire suppression systems, do not route the duct or water pipes directly over the accelerator. Inadvertent leaks may occur and can seriously damage the accelerator and mechanical systems within the Baseframe.

Verify ceiling height requirements with local and regional regulatory agencies.

For ceiling conflicts located directly above the TrueBeam STx, contact your Regional Planning Manager.

The In-Room Monitor and the Optical Imaging camera are located as shown. Coordinate all HVAC, electrical, structural, and plumbing systems to ensure 1'-0" (305) clear radius around these brackets. For bracket mounting locations, see section 3.6.

The recommended minimum finish floor to finish ceiling clearance is 9'-0" (2743). For sites with ceiling clearance issues, the ceiling may be installed below the recommended height.

To allow for rigging, assembly, and operational clearances, the finish ceiling in this area must be 9'-0" (2743) or greater.

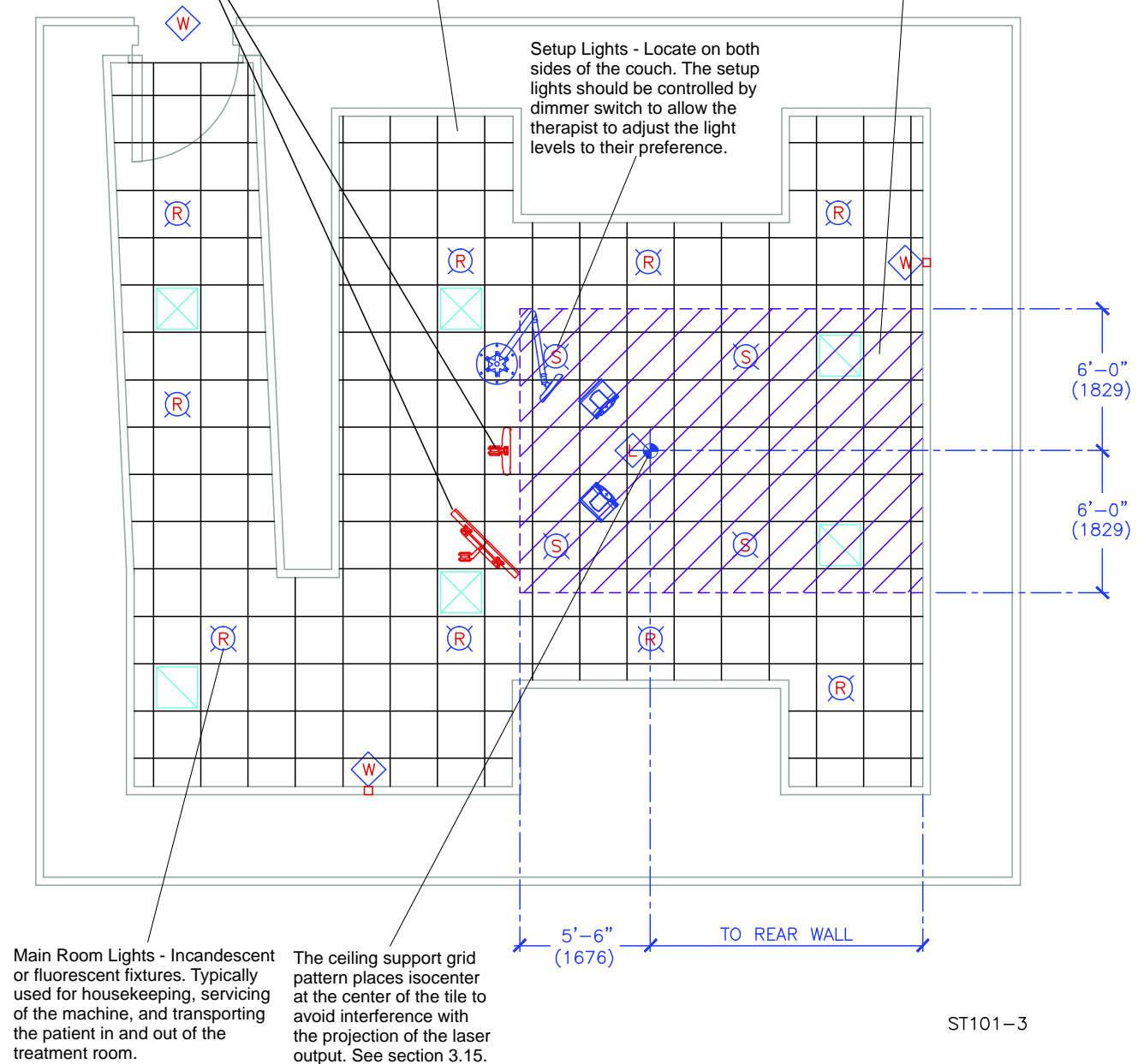


Figure 5-10 Typical Reflected Ceiling Plan

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Appendix A TrueBeam STx Pre-Installation Checklist

TrueBeam™ STx Pre-Installation Checklist

In accordance with current Varian "Standard Terms and Conditions of Sale" RAD 1652 the following are minimum facility requirements to be accomplished before the machine can be released for shipment. Requests for any exceptions should be referred to your Varian Installation Project Manager. The Customer is responsible for meeting these minimum requirements prior to the scheduled day of this inspection. If delays in facility completion postpone Varian's installation, the Customer shall reimburse Varian, at Varian's standard service rates, for any extra time and/or travel by Varian made necessary by the delay. I have explained these requirements to the Customer on this date along with the specific requirements listed below.

		TrueBeam STx
Site Name	<input type="checkbox"/> Address same as ship request	Equipment Type Serial Number
Address 1:		
Address 2:		
City, State, Postal Code:		

NOTE: The Customer is responsible to confirm, provide, and/or demonstrate to the Varian Project Manager the following items meet or exceed minimum requirements set forth in Varian's Designers' Desk Reference (DDR). The Varian work area defined as the treatment room, control room, and ancillary areas wherein Varian equipment will be installed.

Y N NA GENERAL REQUIREMENTS:

- ☐☐☐ 1. A&E Drawings reviewed by Varian Planning Department and a copy of the drawing review on file.
- ☐☐☐ 2. Customer has applied for or obtained all approvals or licenses, as required.
- ☐☐ 3. Building is dry and secure.
- ☐☐ 4. Customer affirms they have met Varian's HVAC requirements for the equipment to be installed.
- ☐☐ 5. Debris removal arranged for approximately 30 cu. yds. on day of delivery.
- ☐☐☐ 6. The area is isolated from the general construction area if construction continues elsewhere in the building. This area should be sealed to ensure that construction dust particles from those adjoining areas do not enter the Varian work area through any means.
- ☐☐☐ 7. Varian personnel have access to the building for all purposes related to product installation.
- ☐☐ 8. No trades allowed during equipment installation.
- ☐☐ 9. Walls, lighting, and ceilings are complete and/or operational. Primer coat paint is required at a minimum on all walls.
- ☐☐ 10. Casework is complete, if not located in the rig path.
- ☐☐ 11. Flooring has been completed or prepared as previously agreed.
- ☐☐ 12. Working lavatory facilities, with hot and cold running water, available for the installation.
- ☐☐ 13. Customer confirms arrangements have been made for initial and ongoing debris removal by others.
- ☐☐ 14. For safety purposes, demonstrate a working telephone available, number: _____
- ☐☐ 15. Network live and in-place.
- ☐☐ 16. High-speed internet access available.
- ☐☐ 17. A clear rig path exists – measure all clearances from the unloading/staging area to the vault. Remove all construction materials and other obstacles from the rig path on the day of delivery and sweep the rig path clean.
- ☐☐ 18. Permanent power live and in-place.

Y N NA TREATMENT ROOM (VAULT):

- ☐☐ 19. Treatment room door and related hardware on-hand. Door should be hung only if it does not interfere with machine rigging.
- ☐☐ 20. Clear 4'-0" x 7'-0" (1225mm x 2125mm) opening at vault entry.
- ☐☐ 21. Varian Baseframe is properly grouted in place and ready for machine installation.

Y N NA

- ☐☐ 22. Correct number and size of conduits. All conduits must be clean and dry.
- ☐☐ 23. Primary power wiring and ground conductors meet Varian minimum requirements.
- ☐☐ 24. Room interface wiring complete with sufficient drop allowed for final connection.
- ☐☐ 25. Baseframe pull-box installed or formed in concrete.
- ☐☐ 26. Relay junction box installed and wiring run to Baseframe pull-box.
- ☐☐ 27. Main room lights and set-up lights installed and operational.
- ☐☐ 28. Door interlock switches installed, tested, and connected to the relay junction box.
- ☐☐ 29. Facility emergency-off switches installed, tested, and connected to the relay junction box. Sensing resistors installed per A&E Drawings.
- ☐☐ 30. Warning lights installed, tested, and connected to the relay junction box.
- ☐☐ 31. Laser light wiring, receptacles, and mounting plates installed. Verify location, heights, and recess size.
- ☐☐ 32. In-room Monitor location(s), mounting kit installed, power ready, and data cable conduit installed.
- ☐☐ 33. Optical Camera location, mounting plate installed, power ready, and data cable conduit installed.
- ☐☐ 34. Closed Circuit TV camera locations, power ready, and data cable conduit installed.
- ☐☐ 35. Live-view Camera and directional microphone location(s), power ready, and data cable conduit installed.
- ☐☐ 36. Data conduit installed at In-room keyboard location (point-to-point CAT-5 cable with RJ-45 jacks acceptable).
- ☐☐ 37. Accessory pull-box installed and connected to in-room device locations, recommended.
- ☐☐ 38. Cooling water supply system is complete and available in service pit, valved below floor level, pressure tested, flushed clean, and terminated with threaded body, 1" NPT, female, shut-off valves.
- ☐☐ 39. Compressed air is available in service pit and valved below floor level with supply pressure tested and terminated with a threaded body ½" NPT, female, shut-off valve.
- ☐☐ 40. Electrician will be available to pull Varian interconnect cables, and/or assist under direction, before or at rig-in. Qualified personnel available to connect utilities to Varian equipment as required.
- ☐☐ 41. Acceptable clearances to install and operate equipment.

TrueBeam™ STx Pre-Installation Checklist

Y N NA CONTROL ROOM:

- ☐ ☐ 42. Main disconnect breaker is complete, wired, and ready for service.
- ☐ ☐ 43. Console breaker is complete, wired, and ready for service.
- ☐ ☐ 44. Three (3) grounded 4-plex electrical power receptacles available for control equipment components, minimum.
- ☐ ☐ 45. Casework is complete and ready. Cable routing access provided with 3" grommets.
- ☐ ☐ 46. Ventilation sufficient for removal of heat from console equipment.
- ☐ ☐ 47. Control cabinets ☐ stacked or ☐ split.
- ☐ ☐ 48. Control cabinet positioning bracket(s) installed.

Y N N/A EXACTRAC SYSTEM

- ☐ ☐ ☐ 44. Both Flat Panels and the Camera System ceiling mount locations and ceiling dimensions verified & measured, free & clear of obstructions (if not already installed).
- ☐ ☐ ☐ 45. Location of Touch Screen Monitor identified: Option A) ceiling-mounted location free & clear OR Option B) wall-mounted location contains sufficient backing and pull box. Either option needs a conduit going from location to in-room power box.
- ☐ ☐ ☐ 46. Specify ExacTrac generator voltage (208V or 480V), cable lengths, and junction box (16" x 16" x TBD depth).
- ☐ ☐ ☐ 47. Specify the location of the ExacTrac Computer Cabinet w/ floor junction box (16" x 16" x TBD depth), include network drop, power, and conduits.
- ☐ ☐ ☐ 48. Equalization cable locations and installation discussed with customer.
- ☐ ☐ ☐ 49. Electrician available to make final electrical connection to the X-ray Generator.
- ☐ ☐ ☐ 50. X-ray tube floor boxes located, installed, including (1) 5" conduit (or equivalent) going from each floor box to the X-ray Generator.
- ☐ ☐ ☐ 51. X-ray Generator disconnect installed and specified power pulled to it (208V or 480V).
- ☐ ☐ ☐ 52. Electrician to pull 110/120V (30A) power to the location of the Computer Cabinet.

Y N NA

- ☐ ☐ ☐ 53. Breaker installed for the Computer Cabinet and located within close proximity.
- ☐ ☐ ☐ 54. ExacTrac "X-ray In Use" warning lights located and 3/4" min. conduit supplied, going from Computer Cabinet to each ExacTrac-supplied fixture
- ☐ ☐ ☐ 55. Electrical outlet installed at the foot of the couch wall if Robotics ordered and in the ceiling for Bluetooth.
- Y N N/A BRAINLAB I-PLAN/NET** ☐ *if not applicable*
- ☐ ☐ ☐ 56. Each sign-off sheet has been completed and copies are on file with BrainLAB Project Manager (i.e. Shipment Review, Generator Power Supply, Ceiling Mounts, etc.).
- ☐ ☐ ☐ 57. Four (4) Static Network IP addresses (ETX, Iplan, NET, etc.).
- ☐ ☐ ☐ 58. Racking location for IplanNET servers determined
- ☐ ☐ ☐ 59. Antivirus and Backup Solution discussed with IT.
- ☐ ☐ ☐ 60. Domain Groups for Iplan and IplanNET discussed with IT.

Y N NA OTHER:

- ☐ ☐ ☐ 49. Power Conditioning Unit installed and ready for service, if applicable.
- ☐ ☐ ☐ 50. Chiller Unit installed and ready for service, if applicable.
- ☐ ☐ ☐ 51. Varian installation cables on site. If not on-site, provide due date: _____
- ☐ ☐ ☐ 52. MICAP survey has been completed and submitted.
- ☐ ☐ ☐ 53. Customer confirms they will supply 2 boxes of localization X-Ray film and wet processor or radio chromic dry film for the Varian installation.
- ☐ ☐ ☐ 54. Secure, environmentally controlled, storage area (located near Varian work area) available for approximately 300 sq. ft. of material. Varian installation personnel will require continuous access.
- ☐ ☐ ☐ 55. Qualified physicist available for preliminary radiation survey. Coordinate timing with installation personnel and record physicist's name and number: _____
- ☐ ☐ ☐ 56. Qualified physicist and dosimeter calibration equipment available for acceptance testing. Coordinate timing with installation personnel and record physicist's name and number: _____

In the box below, precede all notes with the respective item number from the list above.

Please use the box below for general comments.

- ☐ **STOP DELIVERY**
- ☐ **RIG AND HOLD**
- ☐ **RIG AND CONTINUE – high risk for completion date.**
- ☐ **RIG AND CONTINUE – at risk for completion date.**
- ☐ **SITE READY**

Varian Representative

BrainLAB Representative

Customer Representative

Date

Appendix B Shipping Lists

B.1 Varian TrueBeam STx Shipping List (Typical)



Note: Table removed pending final system validation.

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Appendix C H.E. Accelerator vs. TrueBeam STx Site Requirement Comparison Summary

HE Clinac IDP Specification	IDP Page #	TrueBeam STx DDR Specification Vol. 10, No. 2	DDR Page #	Change in Requirement
Architectural				
Typical Room Shielding Tables	1.21	Typical Room Shielding Tables	2-1	
Shielding information including SRS procedure update		Shielding information including SRS procedure		No change required.
In-Room Isometric	1.22	New TrueBeam STx In-Room devices	2-2	Additional information summarized below and detailed in DDR.
Typical Room Configuration	1.23	TrueBeam STx Plan View	2-5	No change required.
		TrueBeam STx Section View	2-7	No change required.
Overlay – Shipping Configuration	1.24	Shipping/Rigging Dimensions Clearances	2-14 to 2-17	No change required.
Overlay – Plan View	1.25	Detail Plan View	2-9	No change required.
Overlay – Elevations	1.26	Detail Elevation	2-11, 2-13	No change required.
Typical Control Equipment Casework	1.27	Typical Control Equipment Casework	5-1 to 5-7	
Three electronic cabinets, multiple monitors, requires 16 (~4.9m) linear feet		Two electronic cabinets, two monitors, requires ~12 linear feet (~3.7m) – less with stacked cabinet option.		Counter height is lowered to 2'6" (762). Cabinets secure to floor-mounted plates. Existing iX or TrueBeam STx sites will accommodate TrueBeam STx.
Shows two circuit breaker panels (main CB and optional OBI panel).		Shows one main circuit breaker panel and 200V-240V TrueBeam STx Control Cabinet outlet.		TrueBeam STx requires new MCB and conduits from MCB to Control console. ^a See electrical section below.

HE Clinac IDP Specification	IDP Page #	TrueBeam STx DDR Specification Vol. 10, No. 2	DDR Page #	Change in Requirement
Laser Positioning Lights	1.29	Patient Positioning Lasers	3-41 to 3-46	
Unspecified-brand Laser Recess: 16"x25" (406 x 635)		LAP laser recess: 10 1/2"x26" (267x660)		Existing iX or TrueBeam STx sites will accommodate TrueBeam STx.
		LAP laser mounting plate provided by Varian		GC must mount plate directly to concrete wall or existing steel plate.
Typical Closed Circuit Television (CCTV) System	1.32	Minor System Components	3-20 to 3-24	
Details two CCTV system		Two CCTV cameras, Varian-furnished and location specific. Additional camera sets are optional.		Locations for primary set are specified. Locations for optional sets are suggested. Requires new conduit runs from Console Pull Box via Accessory Pull Box located above vault ceiling. ^a
		Live view CCTV, Varian-furnished	3-21	Location is specified. Requires new conduit runs from Console Pull Box via Accessory Pull Box located above vault ceiling. ^a
Intercom System with integrated microphone and speaker		Two, Varian-furnished microphones		Locations are specified/suggested. Requires new conduit runs from Console Pull Box via Accessory Pull Box located above vault ceiling. ^a
		Two speakers supplied	3-24	Locations are specified/suggested. Requires new conduit runs from Console Pull Box via Accessory Pull Box located above vault ceiling. ^a

HE Clinac IDP Specification	IDP Page #	TrueBeam STx DDR Specification Vol. 10, No. 2	DDR Page #	Change in Requirement
In-Room Monitor (IRM)	1.33	TrueBeam STx Dual In-Room Monitors (IRM)	3-15 to 3-19	
Single IRM, usually wall mounted		Dual IRM display with ceiling-mount bracket		Location is specified. Requires new conduit runs from Console Pull Box via Accessory Pull Box located above vault ceiling. ^a
Optical Guidance Platform (optional, not shown)		TrueBeam STx Optical Imaging Subsystem with ceiling-mount bracket (Standard feature on all TrueBeam STxs)	3-12 to 3-14	Location is specified. Requires 3" conduit runs from Console Pull Box via Accessory Pull Box located above vault ceiling.
Structural				
Baseframe Pit and Installation	1.35	Baseframe Pit and Installation	3-34 to 3-37	No change required.
Electrical				
Modulator Cabinet	1.34	Major System Components – Modulator	3-9 to 3-19	
Three 4" (100) conduits from Stand		Three 4" (100) conduits from Stand		No change required.
Two 4" (100) conduits from Console		Not required		Abandon in place. May be used as spares for Value Engineering. ^a
One 2" (50) conduit from MCB (power)		Two 2" (50) conduits from MCB (power and signal)		Add one 2" (50) conduit from MCB to Modulator. ^a
Two 2" (50) conduits from RJB		Two 2" (50) conduits from Relay Junction Box (RJB) to Stand		Provide two 2" (50) conduits from RJB to Stand. In a retrofit scenario, route cables to Stand via Modulator conduits.

HE Clinac IDP Specification	IDP Page #	TrueBeam STx DDR Specification Vol. 10, No. 2	DDR Page #	Change in Requirement
Baseframe Cable Access Details (main conduits)	1.36	Baseframe Cable Access Details	3-38 to 3-40	No change required.
Cable Access Diagram	1.37	Cable Access Diagram	3-2 to 3-7	
Console to Stand – three 4" (100) conduits		Console to Stand – four 4" (100) conduits		Add one 4" (100) conduit from Console to Stand. ^a
Console to Modulator – two 4" (100) conduits		Not required		Abandon in place. May be used as spares for Value Engineering. ^a
Modulator to Stand – three 4" (100) conduits		Modulator to Stand – three 4" (100) conduits		No change required.
RJB to Modulator – two 2" (50) conduits		RJB to Stand – two 2" (50) conduits		Provide two 2" (50) conduits from RJB to Stand. In a retrofit scenario, route cables to Stand via Modulator conduits.
Clinac Main Circuit Breaker – one 2" (50) to Modulator		TrueBeam STx MCB – Two 2" (50) conduits to Modulator (power and signal) TrueBeam STx MCB – One 2" to Console Pull Box TrueBeam STx MCB – One power outlet at Console, spec. per code, with Varian-furnished receptacle		Add one 2" (50) conduit from MCB to Modulator. ^a Add one 2" (50) conduit from MCB to Console Pull Box. ^a Install one outlet at Console, spec. per code, with IEC 60309-32A receptacle. Location is specified in Section 4.6.5.3 .
OBI Breaker – one 2" (50) to Stand		Not required.		Abandon in place. May be used as spares for Value Engineering. ^a

HE Clinac IDP Specification	IDP Page #	TrueBeam STx DDR Specification Vol. 10, No. 2	DDR Page #	Change in Requirement
Additional Console to In-Room devices (Minor System Components)		Additional Console to In-Room devices (Minor System Components)		Install one 3" (75), and two 2" (50) conduits from Console Pull Box to Accessory Pull Box in vault. ^a
Interconnection Wiring Diagram	1.39	Electrical Requirements	Chapter 4	
Clinac Main Power Specification and Main Circuit Breaker (CBB-series)		TrueBeam STx Main Power Specification and Main Circuit Breaker (VWR-series) – multiple voltage compatibility		Increased power from 45kVA to 48kVA. Now compatible with multiple incoming voltages. Requires new GE VWR-series MCB. ^a
OBI (optional) Main Power Specification and GE OBI-series Circuit Breaker		Not required		Abandon in place. May be used in Value Engineering. ^a
Control Console: multiple outlets for components		Control Console: single outlet for components		Install one outlet at Console, spec. per code, with IEC 60309-32A receptacle. Location is specified in Section 4.6.5.3 .
Relay Junction Box (RJB) connects to Modulator (GC-furnished)		Relay Junction Box (RJB) connects to Stand (Varian-furnished)		Install Varian-furnished RJB. Provide two 2" (50) conduits from RJB to Stand. In a retrofit scenario, route cables to Stand via Modulator conduits.

HE Clinac IDP Specification	IDP Page #	TrueBeam STx DDR Specification Vol. 10, No. 2	DDR Page #	Change in Requirement
<i>Mechanical</i>				
HVAC and Plumbing Requirements	1.40	HVAC and Plumbing Requirements	3-25 to 3-30	
Clinac air load – 5.0 kW (17,065 Btu/hr) max		Clinac air load – 7.0 kW (23,891 Btu/hr) max		2.0 kW (6,826 Btu/hr) increased capacity required.
Modulator max air load – 3.0 kW (10,239 Btu/hr) max		Modulator max air load – 5.0 kW (17,065 Btu/hr) max		2.0 kW (6,826 Btu/hr) increased capacity required.
Clinac chilled water heat load – 25 kW (85,379 Btu/hr) max		Clinac chilled water heat load – 25 kW (85,379 Btu/hr) max		No change required.
Clinac chilled water pressure differential – 20 PSI (1.4 kg/cm ²)		Clinac chilled water pressure differential – 24 PSI (1.7 kg/cm ²)		System must accommodate additional 4 PSI (0.3 kg/cm ²) pressure differential.

a. Opportunities for Value Engineering and re-use of existing infrastructure possible. Please consult with your Regional Planning Manager for details.

Glossary

Term	Definition
Acuity™	Varian tradename for its simulator. The simulator is used to assist with treatment planning for determining the method and position to use during actual treatment.
Arc Therapy	A form of radiation therapy in which the radiation beam is continuously directed toward the isocenter as the Linear Accelerator Gantry is rotated in an arc.
ARIA®	An advanced information platform designed to unify the clinical and administrative aspects of radiation oncology. This Varian product consists primarily of software that will run on Customer or Varian-supplied computer hardware. The effect of ARIA system on the architectural requirements is limited to an increase in the control console size requirement. The Clinac and Acuity Workstations can be linked by the Network Fileserver to form a local area Network. Editing Workstations are optional stations located away from the Clinacs and/or Acuity consoles. See also Network .
Attenuation	The reduction of intensity upon passage of radiation through a medium caused by absorption and scattering.
Backpointer Laser	A Linear Accelerator accessory, usually mounted to the Gantry, used to identify the central axis of the radiation beam.
Baseframe/Plate	Varian-supplied assembly that anchors the Stand/Gantry and the Couch to the building structure.
Blocks and Block Trays	Accessories used to shape the treatment field. Blocks are custom made for each patient and are supported by the Block Tray at the Clinac Collimator. 10 to 20 Block Trays may be in use daily.
Breakdown	The manner in which a Clinac is disassembled for shipment. The two-piece breakdown, or standard configuration, leaves the Stand and Gantry connected. A three-piece breakdown, or factory breakdown, separates the Stand and Gantry and is used to shorten the space required for passage into the treatment room. The factory breakdown might involve extra cost.
CCTV	A closed-circuit television is used for observing patients from the control console. The system is typically color but can be black-and-white and consists of two or more cameras and two or more monitors. Verify quantity of cameras required with regional regulatory agencies. The primary camera will normally include an auto-focus and low-light level lens with power zoom. It will be mounted on a bracket incorporating pan-tilt features. The control console must include remote controls for the zoom and pan-tilt.

Term	Definition
Circuit Breaker	An automatically-operated electrical switch designed to protect an electrical circuit from damage caused by overload or short circuit. Unlike a fuse, which operates once then has to be replaced, a circuit breaker can be reset, either manually or automatically, to resume normal operation.
Clinac®	Varian trade name for a range of Linear Accelerator models used in cancer treatment and stereotactic radiosurgery. Low Energy (600C, 4EX, 6EX, and 600SR) models have different facility requirements from Dual Energy (2100C/D, 2300C/D, 21EX, 23EX, iX, and Trilogy) models. Rebuilt Clinacs (4R, 6XR, and 18R) have similar characteristics to the in-production models.
Collimator	A movable, radiation-limiting device, located in the head of the Gantry, used to define the radiation field.
Computerized Tomography (CT)	Technique for making computer-generated images of a predetermined plane section of a patient's body by rotating an x-ray tube around a patient.
Cone	See Electron Applicator .
Console Cabinet	An electronics enclosure provided by Varian that houses computing workstations and other electronics that operate the Clinac or TrueBeam machine.
Control Equipment Casework	Casework designed to accommodate Varian control equipment and workstations. The Control Equipment Casework is located outside the Clinac, TrueBeam, VariSource, or GammaMed room and usually located behind a wall within the Acuity room. The control equipment is used for setting mechanical and treatment parameters.
Couch	The assembly used to support the patient during treatment or simulation. It can move vertically, longitudinally, and transversely to position the patient treatment field at isocenter. The minimum travel radius must be free of obstructions. Its maximum travel radius defines the maximum distance from isocenter throughout its travel range that the couch can operate. As the couch is seldom used in all orientations, the maximum travel radius can have obstructions without detriment, but it is recommended that the Customer and Varian's Planning Department be consulted.
Door Interlock	A switch that enables a fail-safe safety circuit linked to the Clinac, VariSource, GammaMed, or Acuity when the door to the room is closed. The door must be closed before radiation treatment or simulator can proceed. If the door is opened during treatment or simulation, the beam is turned off.
Dynamic Wedge	An accessory used to generate a wedge-shaped isodose contour, analogous to physical wedges, by moving one of the Collimators during the course of an x-ray treatment.

Term	Definition
Dynamic Compensation	A superset of the Dynamic Wedge where one or more mechanical axes move during the course of an x-ray treatment to conform the dose distribution to the treatment volume.
Eclipse™	A comprehensive treatment planning system that simplifies modern radiation therapy planning for all kinds of treatment, allowing clinicians to quickly customize treatment plans for any disease site with precision and accuracy.
Electron Applicator	An accessory, often called a cone that is mounted to the accelerator or Acuity Collimator that defines the treatment field for electron therapy. These are required for accelerators with energies above 10MV and are optional with the Acuity. There are five, and one additional optional, units per set. They measure approximately 1'-0" x 1'-0" x 1'-4" (305x305x406) and weigh up to 20 lbs. (9kg) each. Their storage requires special design attention when it is incorporated into the treatment and Simulator room cabinetry.
Electron Radiation	A Primary Beam of radiation generated by the Clinac for treatment. Low energy accelerators have no electron mode, while Dual Energy accelerators have several selectable electron energies. Electron Radiation is less penetrating than Photon Radiation, and is used less often than Photon Radiation.
Electronic Cart Assembly	The VariSource Transportable 200t system comprises the VariSource Remote Afterloader (VRA) and Electronic Cart Assembly (ECA). The ECA houses the VariSource, GammaMed Control Console and Treatment Planning System plus peripherals and storage for accessories. The ECA and VRA form a single articulated vehicle facilitating transport and installation once at the designated site. This ECA is connected via Varian supplied cables to the Wall Box and the grounded duplex electrical power receptacle located in the control console area.
Emergency-Off Switch (also known as Emergency Power Off Switch or [EPO] or as Emergency Stop Switch)	A “mushroom” button used to disable the Clinac, TrueBeam, VariSource, GammaMed or Acuity. The switch must have a manual reset feature. Emergency-Off switches are provided at equipment Stand, Couch, and Modulator Cabinet. Additional switches must be provided to disable the TrueBeam without entering the Primary Beam and in accordance with local regulations.
Emergency Stop Switch	A “mushroom” button used to disable the TrueBeam. The switch must have a manual reset feature. Emergency-Stop switches are provided at the equipment Stand, Couch, and Modulator Cabinet. Additional switches must be provided to disable the TrueBeam without entering the Primary Beam and in accordance with local regulations.

Term	Definition
ExacTrac (ETX)	A high resolution stereo x-ray imaging system that targets tumors and corrects patient positioning with sub-millimeter precision. The room-based design enables continuous tracking of patient and tumor movement, including IGRT verification, throughout the treatment. This system is combined with the Varian Clinac Linear Accelerator to form the Novalis TX.
Experimental Access Conduit (also known as Physics Port)	The installation of an experimental access (physics) conduit between the interior of a Clinac or VariSource, GammaMed treatment room and an accessible point outside the treatment room, may be requested by the Customer. It is used periodically with a Water Phantom/Beam Scanner System in Clinac treatment rooms. The conduit should be oriented as perpendicular to the isocenter as possible.
Final Field Defining Aperture (FFDA)	An accessory that is fabricated to shape a patient's electron beam treatment field. It installs into the Electron Applicator during patient set-up.
Fluoroscopy	Real-time imaging by means of a fluoroscope, which is a device used for viewing patients during simulations. Fluoroscopic capability is a standard feature of the Acuity.
Freight	Refers typically to the shipment of Varian equipment, beginning with the pick-up at the factory and ending freight-on-board (FOB) at the facility. See also Rigging .
GammaMedplus™	See VariSource™ .
Gantry	Rotating part of the Stand/Gantry assembly. The Clinac or TrueBeam Gantry contains the accelerator guide, bending magnet (Dual Energy Accelerators) and Collimator.
In-Room Monitor	Display that describes the status of the equipment setup and patient parameters. The staff uses this monitor in the treatment room as they set up the patient. It is important to locate the monitor such that viewing the monitor during the Setup process shall not distract the therapist from the patient. Consult with the Customer regarding monitor location preference. The In-Room monitor should not be located in any x-ray primary beam.
Installation Product Acceptance (IPA)	The IPA procedure provides testing procedures and data recording tables to enable Varian to demonstrate that Varian Products have been successfully installed and meet required manufacturer specifications.

Term	Definition
Intercom	Two-way electronic communication device used to monitor the patient audibly in the treatment room from the control console during treatment. The intercom is important for dialog between the therapist setting the patient up and the radiation equipment operator, and to monitor the patient when the therapist is out of the treatment room. The intercom should have duplexing and be voice-activated or continuous-on in the room and push-to-talk at the control console. When the Acuity and its console are in two adjacent areas with no door between, an intercom may not be needed.
Isocenter	The point in three-dimensional space about which the Gantry, Collimator and Couch turntable rotate in common. This point is the central reference for all calibrations and critical shielding dimensions. It is the reference for positioning the Baseframe pit, Lasers, Couch, Clinac/TrueBeam/Acuity and the patient during treatment procedures.
Junction Box	A conduit body that is used to access and terminate conductors or house an electrical device. For purposes of Clinac and Acuity requirements, the Varian-supplied cables are pulled and housed in conduits terminated at Pull Boxes, while the lighting control relays are housed in a junction box.
Laser Positioning Lights	Laser devices used to position the patient on the couch for treatment or simulation. Four lasers are used in the treatment room. Their light beams intersect at the isocenter. The side and overhead lasers throw both vertical and horizontal beam planes that create a crosshair. The sagittal laser is located ahead of the Couch and at least seven feet above the floor and throws only a vertical beam plane. Rigid installation of the lasers is critical. A back pointer laser, which is mounted on the Gantry counterweight or beamstopper, may be ordered with the equipment. The back pointer laser, along with the wall-mounted lasers, creates an intersection of light defining the radiation exit axis.
Last Man Out	See Search/Evict .
Longitudinal Axis also known as Sagittal Plane	An imaginary vertical plane that coincides with the rotational axis of the Gantry and bisects the patient couch.
Maze	A treatment room entrance hallway designed to reduce radiation levels, particularly neutrons, at the entrance door. The length of and occupancy beyond the maze affects the amount of shielding required in and around the door.
Modulator Cabinet	Power control unit for all Dual Energy Accelerators. The Modulator is located in the cabinet behind the machine. Cable length should be considered relative to the console.

Term	Definition
Multileaf Collimator (MLC)	Collimator system designed to define the silhouette of a beam of radiation. This optional system, available on all Varian Accelerators, reduces the need for blocks and block trays. The effect of the MLC system on the architectural requirements is limited to an increase in the control console requirements.
MV Imager	Real-time MegaVoltage imaging system for monitoring and verifying treatment field in relation to anatomical landmarks.
Network	A system of interconnected computers. A computer network usually links two or more personal computers (Workstations) to a centralized storage device (File Server). Networks provide users at different locations with the capability to share software, information and peripheral devices, such as printers. See ARIA® .
Neutron Radiation	A particle form of Secondary Radiation produced by high (≥ 10 MV) energy photons incident on high atomic number materials such as steel and lead.
Occupancy	The purpose or activity for which a space is used with regard to an occupant's length of stay while radioactivity is present. The values used for determining requirements in Varian documents are: 0% for no occupancy within a 60 foot (18,300) radius from the radiation source; 10% for exterior areas; 25% for service or circulation areas; 50% for treatment, exam and waiting areas; 100% for control, office or areas of unknown occupancies.
Pendant	Hand-held remote control unit attached to the Couch that is used to position and adjust the Couch, Gantry and Collimator for patient treatment. The Pendant also houses controls for room lights and Laser Positioning Lights.
Photon Radiation	A Primary Beam of low (< 10 MV) or high (≥ 10 MV) energy penetrating x-ray radiation generated by the accelerator for treatment. Low energy accelerators have a single x-ray energy of less than 10 MV, while Dual Energy accelerators have one similar low energy, and one high energy x-ray energy of 10 MV or greater. The term "Photon Radiation" also refers to the x-ray leakage radiation and scatter radiation that is either emitted from the accelerator or scattered from the shielding barriers, respectively.

Term	Definition
Physicist of Record	The physicist with the responsibility for assessing parameters and limits associated with the Clinac, TrueBeam, VariSource, or GammaMed. With regard to facility shielding, the Physicist of Record is responsible for designing the treatment room radiation shield barriers and confirming they meet applicable regulatory requirements. The facility design is based on regulatory requirements of the regulatory body tasked with oversight of Radiation Producing Devices in the Region, and recommendations of the National Council of Radiation Protection and Measurement (NCRP). Confirmation of the shielding adequacy is assessed with a radiation survey performed by a qualified physicist, which may or may not be the Physicist of Record. The Physicist of Record will correspond with the Region's Department of Health Services (or equivalent) regarding the design and results of the radiation survey.
Physics Port	See Experimental Access Conduit (also known as Physics Port) .
PortalVision™ (PV)	Real-time imaging system for monitoring and verification of treatment field and shielding blocks in relation to anatomical landmarks. The effect of PortalVision on the architectural requirements is limited to an increase in the control console requirement.
Power Panel	An assembly of circuit protection and control devices.
Primary Beam Radiation	The emission or propagation of photons or electrons along the main axis or direction of the generating equipment (see Photon Radiation and Electron Radiation). Varian accelerators generate a 28-degree primary radiation beam cone from a source in the Gantry (measured one meter back from isocenter). Acuity generates a 39-degree primary radiation beam cone from a source in the Gantry (measured one meter back from isocenter). Shielding for the primary beam must consider the 360-degree rotation of the Gantry and should extend at least one-foot (305) beyond the beam cone.
Pull Box	A conduit body that is used only to access conductors. The distinction is made to simplify the NEC or other regulatory agency requirements for placement and construction of these structures. The Control Console, Baseframe, and Modulator boxes are Pull Boxes.
Radiation monitor/detector	Device that senses radiation and issues a warning when the radiation level exceeds the preset standards. Some jurisdictions require them in accelerator rooms as a precautionary measure.
Radiosurgery	A method of treatment that uses a single, high dose of radiation to alter the tissue to cause necrosis or fibrosis. This procedure uses Gantry, and sometimes Couch, movement during the treatment to minimize exposure to surrounding tissue.
Radiotherapy	A method of treatment using multiple, small radiation doses to gradually shrink and kill malignant tumor cells.

Term	Definition
Relay	Automatic electromagnetic or electromechanical device that responds to a small current by activating switches in an electric circuit. Lasers and room lights are connected through relays to the switches in the Pendant and on the Couch.
Rigging	Positioning of the Baseframe and the accelerator, VariSource, GammaMed or Acuity components into the treatment room. The Baseframe is rigged prior to the rest of the equipment. A rigging company is usually hired by the Customer to off-load these items from the truck and to move them through the facility into the treatment room. The Customer's architect and structural engineers must review the entire rig route for adequate clearances and structural support. The work can include temporary demolition and shoring. Final equipment positioning is part of the rigging contract. See also Freight and Breakdown .
Safety and Monitoring Devices	Special equipment required to assure that the technical and service personnel are not exposed to radiation. These items are Emergency-Off Switch (also known as Emergency Power Off Switch or [EPO] or as Emergency Stop Switch) , Radiation monitor/detector , and Warning Light . (See definitions.) Other monitoring equipment is used to observe and position the patient during treatment. These items are CCTV , Intercom , Laser Positioning Lights , and View Window . (See definitions.)
Sagittal Plane also known as Longitudinal Axis	An imaginary vertical plane that coincides with the rotational axis of the Gantry and bisects the patient couch.
Search/Evict	A procedure, usually involving some form of electro-mechanical interlock to the equipment, which provides added assurance that only the patient is in the room during treatment. (Also called "Last man out" procedure.)
Secondary Radiation	The emission or propagation of neutrons and/or photons as a result of bouncing or reflecting in various directions. Its sources are leakage from the equipment head and scatter from the room surfaces (see Electron Radiation , Neutron Radiation , and Photon Radiation).
Simulator	Radiotherapy equipment, such as the Varian Acuity, that uses radiographic and fluoroscopic imaging to duplicate the beam geometry of medical Linear Accelerators as a means to localize the treatment field.
Stand	Fixed part of the Stand/Gantry assembly containing the Klystron, power converters, cooling water heat exchanger, microwave generator and other elements of the Linear Accelerator and similar components of the Acuity.
Start Button	An override connected to the Emergency-Off circuit and to a separate, interim power source, which allows interim power to close the UVR circuit until Clinac power is available.

Term	Definition
Stereotaxis (n), Stereotactic (adj)	The principle of locating a point in three dimensional space, within the brain, with a high degree of accuracy, by using an external reference coordinate system or plane.
Total Body Irradiation (TBI)	A technique during which a large-field x-ray or electron beam is used to treat the entire patient's body. Due to the increased field size, a distance of 10 to 20 feet (3 to 6 meters) is required from the isocenter to the wall on one side of treatment rooms designed to accommodate the procedure.
Under Voltage Release (UVR)	Safety feature that trips the breaker when an under-voltage condition occurs. Used in conjunction with the accelerator and Acuity emergency off circuits to trip the main circuit breaker power to the equipment.
VariSource™	Varian's high dose rate remote afterloader delivers high radiation doses to patients by way of a radioactive source wire that is extended through catheters into body cavities.
View Window	Patient monitoring opening in the wall between the Control Equipment Casework and the Acuity room spanned with leaded glass. Low energy accelerators occasionally have view windows but this is not recommended.
Warning Light	A light (usually red) that indicates “beam-on” condition. A light for “ready” mode may be required also.
Water Phantom/Beam Scanner System	A clear tank, part of a set of components, used to simulate a human body on the treatment couch to determine an accurate radiation output and dose distributions of a Linear Accelerator. The water phantom, which measures up to 2'-0" x 2'-0" x 2'-0" (610 x 610 x 610), is used by the therapists and physicists. It needs to be filled with water before use and the water needs to be siphoned off after use. Water supply, drain, and water-resistant storage space for the tank should be provided within the treatment room.

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