Elekta Medical Linear Accelerator

Site Planning Construction Information

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Referenced documents

Elekta does not supply all the documents that we refer to in this document with the equipment. Elekta reserves the right to make the decision on which of the documents we supply with the equipment.

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1 General safety and regulatory information

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1.1 Introduction

This chapter gives the general safety and regulatory information about the Elekta Medical Linear Accelerator.

1.2 Function of this document

The function of this document is to help persons to plan and design for installation of Elekta equipment.

1.3 Compatibility

Only operate the equipment with Elekta supplied or approved, compatible equipment or parts. Contact Elekta for information about the compatibility of other equipment or parts.

Do not use accessories, transducers, and cables that are not specified by Elekta. They can have an effect on the performance of the electromagnetic compatibility (EMC), which can increase the emissions or decrease the immunity of the equipment.

1.4 Accompanying documentation

This document is a part of the set of documents that Elekta supply with the equipment. The other documents in the set are:

Elekta Oncology Products - Site Planning Introduction

Elekta Oncology Products - Site Planning Reference Information

Elekta Oncology Products - Site Planning Electrical Information

Elekta Oncology Products - Site Planning Construction Information

Elekta Oncology Products - Site Planning Environmental Information

Elekta Oncology Products - Site Planning Delivery Information

Elekta Oncology Products - Site Planning Computer Hardware, Software & Network Information

HexaPOD™ evo RT System Planning Guide (for use with Elekta Digital Accelerators).System Diagrams

1.5 Conventions for the directions of the digital accelerator

Figure 1.1 gives the conventions that Elekta uses to refer to the directions of the digital accelerator in the treatment room. The conventions are applicable only when the patient is in the head first *(anatomical supine)* position on the treatment table.

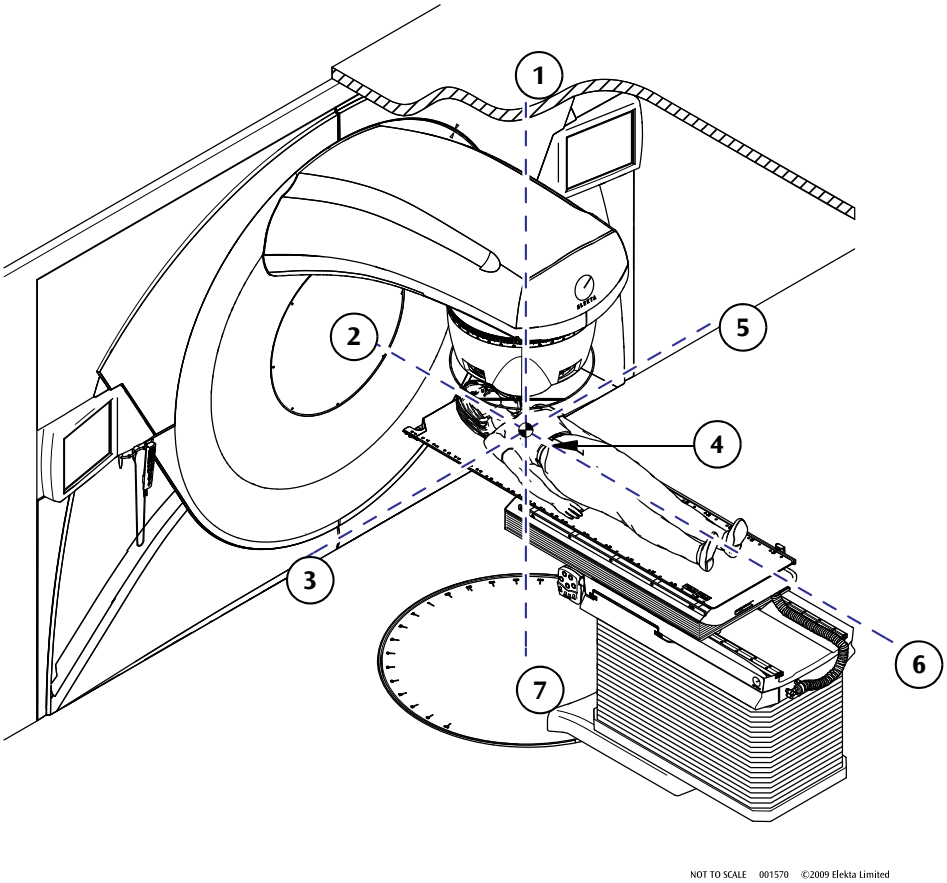

Figure 1.1 Conventions for the directions of the digital accelerator

(1)	Treatment room ceiling (top) *(anatomical anterior)*	(5)	Digital accelerator B-side *(anatomical left)*
(2)	Digital accelerator gun (G-end) *(anatomical superior)*	(6)	Digital accelerator target (T-end) *(anatomical inferior)*
(3)	Digital accelerator A-side *(anatomical right)*	(7)	Treatment room floor (bottom) *(anatomical posterior)*
(4)	Machine isocenter		

Note: *The A and B positions in* **Figure 1.1** *are correct with the gantry at 0° only. The A and B positions rotate with the gantry. Therefore, with the gantry rotated 180°, A and B are opposite.*

1.6 Abbreviations and acronyms

These are the conventions for the abbreviations and acronyms that you can find in this document.

Abbreviation	Definition
BLD	beam limiting device
BMDM	beam monitor unit display module
CCTV	closed circuit television
CITB	client interface terminal box
CT	computed tomography
EIM	electrical interface module
ESD	electrostatic discharge
FKP	function keypad
G-end	digital accelerator gun end
HHC	handheld controller
IEC	International Electrotechnical Commission
IMKM	In-room Monitor, Keyboard and Mouse
kV	kilovolt (or kilovoltage)
LCD	liquid crystal display
LED	light emitting diode
Linac	(digital) linear accelerator
MeV	mega electron volts
MLC	multileaf collimator
MV	megavolt (or megavoltage)
N/A	not applicable
PSS	patient support system
RIC	reeling interface cabinet
T-end	digital accelerator target end
TCC	treatment control cabinet
TCS	treatment control system (includes the TCC)
TRM	treatment room monitor
UPS	uninterruptible power supply
VDU	visual display unit
XVI	X-ray volume imaging

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2 Room design

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2.1 Overview

This chapter gives information about the specifications necessary to make a room in which the Elekta oncology system can be installed and used safely.

2.2 Treatment room radiation protection

The digital accelerator must be installed and used in a room that is shielded against the emission of radiation. A radiation hazard is present in the vicinity of the digital accelerator.

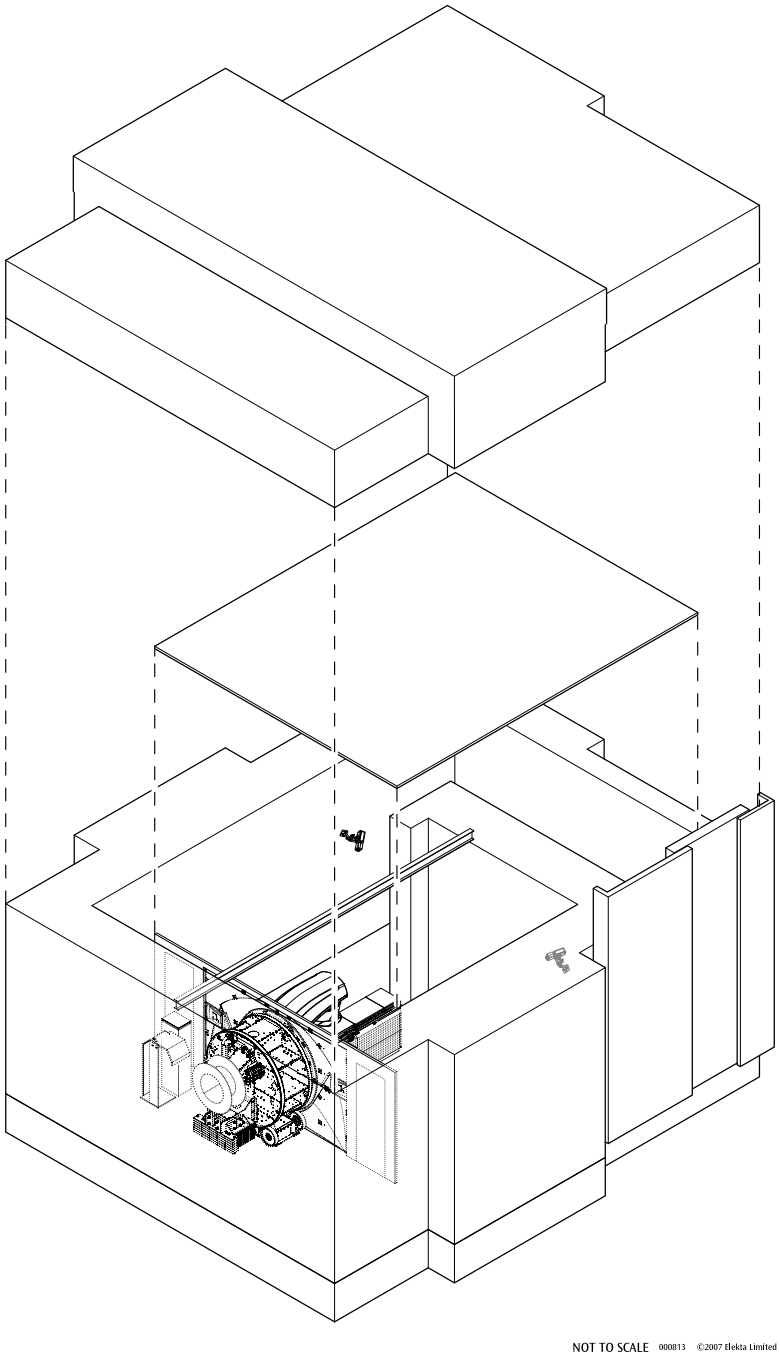

Figure 2.1 Digital accelerator in a shielded room

2.2.1 Feasibility

The radiation protection necessary for the treatment room is calculated from the X-ray energy of the machine.

It is necessary that the protection requirements are accurately calculated before you know if an installation is feasible.

2.2.2 Protection considerations

It is the responsibility of the radiation protection advisor (RPA) to calculate the wall thickness and maze design to reduce the radiation outside the treatment room to a level that is in accordance with applicable radiation regulations.

The treatment room can be made for the highest likely X-ray energies of the next two generations of digital accelerator. It is less expensive to meet this contingency at this time, rather than afterwards, if the subsequent generation of machine is to be installed.

2.2.2.1 Suggested calculation process

1 Identify the locally applicable radiation regulations (for example, national laws implementing ICRP 60).

2 Define all areas that must be protected.

3 Using the applicable radiation regulations, identify the limits that apply to this installation.

Using the design principles given in a standard text (e.g. '*The Design of Radiotherapy Treatment Room Facilities' IPEM Report No 75*), calculate the wall thickness and protection features necessary to decrease the radiation to a level that is as low as reasonably practicable in the defined areas. The radiation in any area must be within the defined limits.

The design of the treatment room must be approved by the RPA in conjunction with the National Radiation Protection Authority.

2.2.3 Shielding data

Shielding data in the following sections are example values used for estimating the wall thickness of a radiotherapy bunker for use with an Elekta digital accelerator. This data is for guidance only and not intended for use in detailed design and build or upgrade of a bunker. Bunker shielding designs must always be verified with a qualified radiation protection expert and must comply with the local radiation regulations applicable to the installation.

2.2.4 Radiation hazards

Table 2.1 lists the radiation hazards necessary for consideration when designing the protection for a treatment room.

Table 2.1 Radiation hazards and protection implications

Radiation	Definition	Important note	Protection implication
Primary X-rays	The conical beam of radiation from the BLD with the diaphragms fully open. The half angle subtended at the target = 14°.	The dimensions of the wall protection should extend 50 cm beyond the edge of the projection of the primary beam on the wall. This allows for an inherent safety factor.	Dimensions and thickness of primary wall protection.
Leakage X-rays	Radiation from the treatment machine. The maximum intensity of the leakage radiation outside the primary beam cone, measured at 1 meter from the target/ longitudinal axis of the accelerating wave guide, is a maximum of 0.1% of the intensity of the main beam at the isocenter.	For calculation purposes the energy of the leakage radiation is assumed to be the same as that of the primary radiation. The source of the leakage radiation is assumed to be at the isocenter. This allows for an inherent safety factor.	Thickness of secondary wall protection.
Scattered X-rays	Radiation generated when the primary beam strikes matter. Scattered radiation is emitted in all directions.	The energy and dose rate of the scattered radiation are much lower than the primary radiation.	Design of maze. Thickness of outer walls of maze and treatment room door.
Neutrons	Neutrons generated by the high atomic number materials in the BLD. Due to gamma-n reactions caused by X-rays at energies greater than 8 MV. Neutrons are emitted in all directions.	Protection materials are only important for X-ray energies greater than 10 MV. Although neutrons are produced at 8 MV, they are only clinically significant at energies more than 10 MV. The neutron dose for maze shielding calculation purposes will depend upon room geometry, but typically will be approximately 50% of the primary beam neutron dose at isocenter.	Additional treatment room door and maze wall protection.
Induced radioactivity	Radioactive gases (^{13}N+$^{15}0$) produced during the gamma-n reactions. Some activation of materials such as aluminium may also occur.	Only important for X-ray energies greater than 10 MV.	Length of maze. Avoid the use of aluminium door furniture and keep materials such as chrome and nickel out of the primary high energy X-ray beam.

2.2.5 Typical treatment room protection

Figure 2.2 is a schematic representation of the radiation hazards and room design features necessary for treatment room protection.

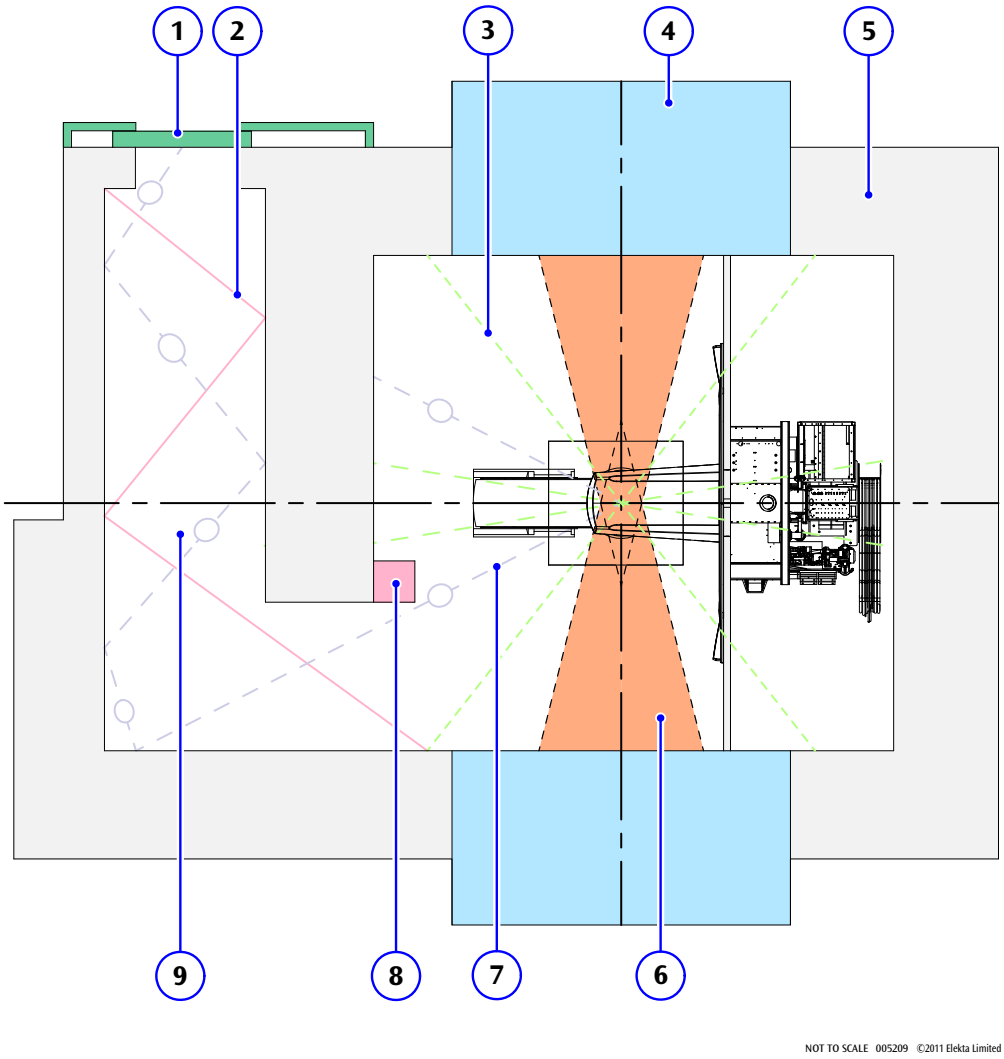

Figure 2.2 Radiation protection considerations

(1) Door
(2) Scattered radiation
(3) Leakage radiation
(4) Primary protection
(5) Secondary protection
(6) Primary radiation
(7) Neutron radiation
(8) Concrete nib
(9) Maze

2.2.5.1 Beam quality data

In order to calculate bunker shielding requirements, it is necessary to know the parameters relating to the X-radiation beam characteristics of the Elekta digital accelerator. This data is provided in **Table 2.2** and **Table 2.3**.

Table 2.2 Beam characteristics for flattened energies

Nominal energy (MV)	**4**	**6**	**8**	**10**	**15**	**18**	**25**
Depth of dose maximum, dmax (cm)	1.2	1.5	1.9	2.1	2.6	3.0	3.5
Percentage dose at 10 cm depth, D10 ± 1%	63.0	67.5	71.0	73.0	76.5	78.5	82.0
Quality index, $TPR_{20,10}$	0.62	0.68	0.72	0.73	0.76	0.78	0.80
Nominal dose rate	230	500	500	500	600	600	500

Table 2.3 Beam characteristics for unflattened high dose rate energies

Nominal energy (MV)	**6 HDR**	**10 HDR**
Depth of dose maximum, dmax (cm)	1.7	2.4
Percentage dose at 10 cm depth, D10 ± 1%	67.5	73
Nominal dose rate	1400	2200

From **Table 2.3**, it can be seen that the dose rate for high dose rate mode (unflattened) beams can be up to four times higher than for flattened beams and therefore the bunker wall shielding thickness may need to be increased, especially if instantaneous dose rates are a consideration.

Note that the dose rates listed in **Table 2.2** and **Table 2.3** above are nominal and actual maximum dose rates measured on site may be higher. For the purpose of site planning, it is recommended that a maximum dose rate of 850 MU/min is used for flattened energies and 2500 MU/min for unflattened energies.

2.2.5.2 Tenth value thickness

Tenth value thickness (TVT) is the thickness of a material which decreases the exposure rate by a factor of ten when put in the path of radiation.

Table 2.4 gives an example of primary beam TVT values for shielding based on average density of materials. **Table 2.5** shows an example of leakage TVT values away from the primary beam. The TVT values can vary especially where large quantities of concrete are used.

The TVT values for bunker design must be determined by a qualified expert.

Table 2.4 Primary beam TVT values

		Photon Energy (MV)						
		4	**6**	**8**	**10**	**15**	**18**	**25[1]**
Material	**Density (tm^{-3})**	**TVT (cm)**						
Concrete	2.35	31	34	36	38	41	43	46
Steel	7.85	9.7	10	10.2	10.4	10.8	11	11.2
Lead	11.35	5.3	5.6	5.6	5.6	5.6	5.5	5.2

1 Option avaliable only as an NSR.

Table 2.5 Leakage TVT values

		Photon Energy (MV)						
		4	**6**	**8**	**10**	**15**	**18**	**25[1]**
Material	**Density (tm^{-3})**	**TVT (cm)**						
Concrete	2.35	25.4	28	29.5	31	33	34	36
Steel	7.85	8.5	8.8	8.8	8.9	8.9	9.1	9.0
Lead	11.35	5.1	5.1	5.1	5.1	5.1	5.1	5.1

1 Option available only as an NSR.

These values in **Table 2.4** and **Table 2.5** are independant of dose rate.

2.2.6 Additional neutron considerations

2.2.6.1 Important protection considerations

For machines with X-ray energies greater than 8 MV, the design of the maze is important in reducing neutron dose at the maze entrance.

For concrete walls, it is not necessary to consider the neutron radiation when calculating the wall thickness.

2.2.6.2 Reducing the neutron dose

If the neutron dose is too high, it can be reduced by adopting the following measures:

1 Contour surfaces for lower scatter.

2 Construct the maze as long as possible, with minimum cross sectional area, consistent with access requirements.

3 Reduce the cross sectional area of the maze using concrete lintels or nibs.

4 Put a door at the maze entrance.

5 Fix boron or lithium loaded polyethylene panels to the inside surface of the maze door. Details of the characteristics of such panels should be agreed with the RPA.

6 Use boron or lithium loaded panels and borated plaster on the treatment room and maze surfaces.

Note: *To reduce the inconvenience of a maze door, it can be interlocked to close only in the high power mode, only when the attenuation of the maze is sufficient.*

2.2.6.3 Neutron radiation dose

Neutron radiation dose values are used for protection calculations. **Table 2.6** lists the required information for machines from Elekta, in which neutron radiation dose values are shown as % Gray (neutron) per Gray (photon).

Table 2.6 Neutron radiation dose for machines from Elekta

Photon Energy (MV)	Neutron leakage outside the main beam at 1 meter from target (% Gy neutron per Gy photon)
25[1]	0.030
18	0.015
15	0.007
10	0.003
8	0.0003

1 Option available only as an NSR.

2.3 Typical room design

This section gives details of typical treatment room constructions for the digital accelerator.

2.3.1 Position of the isocenter

The position of the isocenter (1) is shown in **Figure 2.3**:

- 700 mm from the inside edge of the rear wall of the treatment table pit (G-end)
- 830 mm from the inside edge of the front wall of the pit (T-end)
- 700 mm from the side edges of the pit (in the A/B direction).

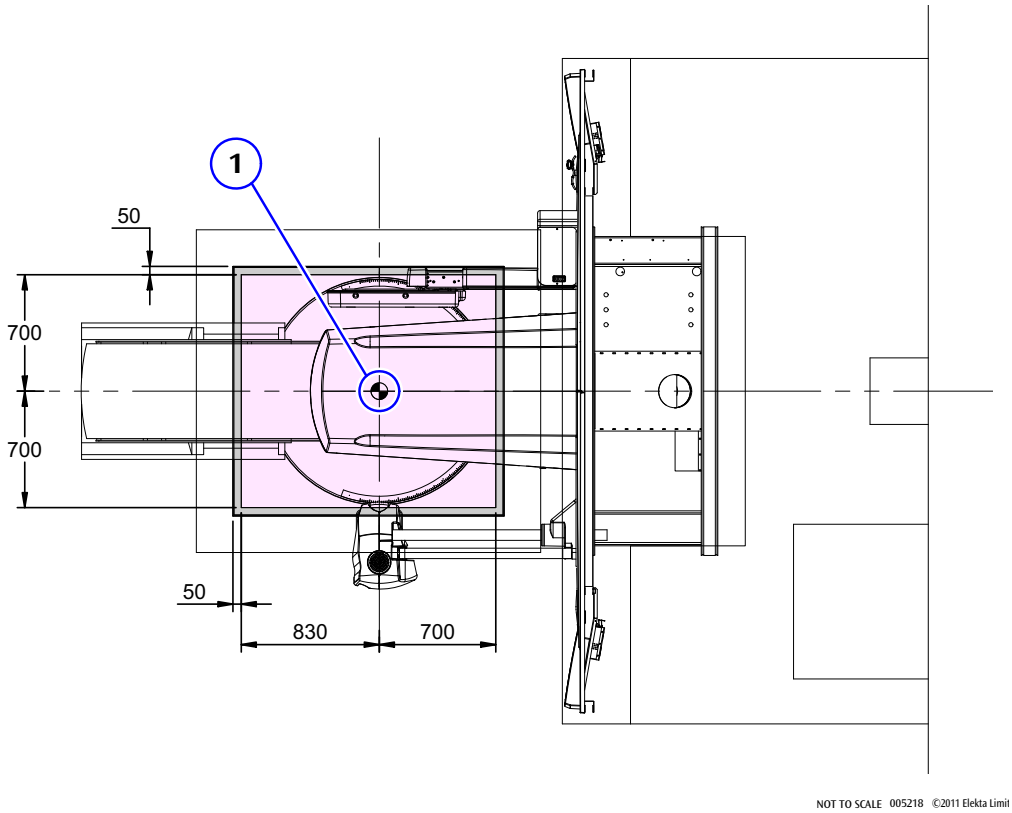

Figure 2.3 Isocenter position

2.3.1.1 Marking the isocenter on the pit

The architect for the design of the treatment room must make accurate marks showing the isocenter on the top edge of the iron frame that surrounds the treatment table pit (see **Figure 3.6**). These marks must be permanent, so that they are not erased during room construction.

Elekta recommends that the marks are cut into the frame to a minimum depth of 2 mm using a hacksaw.

2.3.2 Typical room dimensions

The shielded room dimensions should be calculated by the local qualified radiation expert.

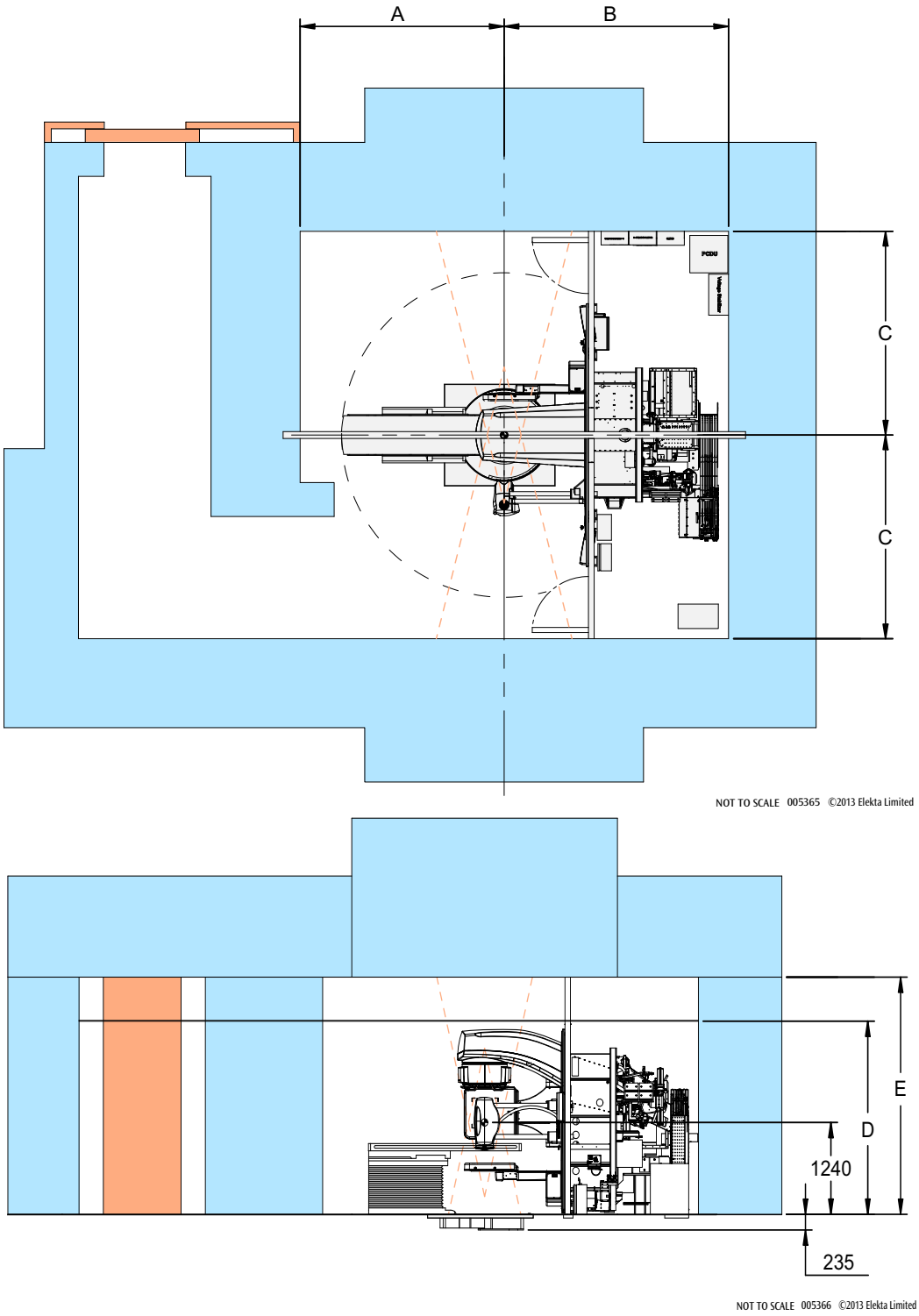

Figure 2.4 Example of treatment room construction for digital accelerator

2.3.3 Recommended minimum room dimensions

Table 2.7 and Table 2.8 give the minimum dimensions of the treatment room, with usual clinical functionality. These dimensions do not include false walls and fixings, or furniture in the treatment room.

Table 2.7 Minimum treatment room dimensions allowing normal clinical functionality

Dimension	Description	Distance (mm)
A	Isocenter to front wall	2495[1]
B	Isocenter to rear wall: 1 fascia door 2 fascia doors	 3700[1] 3300[1]
C	Isocenter to side wall: With no fascia door With fascia door	 2400[1] 3000[1]
D	Floor to false ceiling	2600
E	Floor to concrete ceiling	3200

1 *Dimensions **A** and **C** can be decreased but this can cause hazards and decrease clinical functionality. If the dimensions are decreased, a risk assessment must be done.*

A number of assumptions are made:

- The system is installed with a narrow cover set.
- Dimension **A** lets the treatment table be fully extended in the T direction (2390 mm), but with no lateral movement
- Dimension **B** can be reduced, but access in the equipment room behind the digital accelerator will be restricted.
- There is one door in the B-side of the fascia (this will require a larger isocenter to rear wall dimension of 3700 mm to allow access to the rear of the machine). Dimension **C** of 2400 mm lets the treatment table be fully extended in the T direction (2390 mm), but with no lateral movement.
- Dimension **C** does not let the modulator assembly pass through the fascia door during installation and maintenance.
- A single A-frame cannot be used for installation with dimension N being 2600 mm. An A-frame height of 2900 mm is necessary to lift the gantry drum onto the gantry base with a single A-frame. The false ceiling and central section of the client fascia must be removed if a single A-frame is to be used for installation. Alternatively, two smaller A-frames can be used to lift the gantry from each side. The smaller A-frames must be identical and less than 2540mm in height to move through the gap in the client fascia.

Some dimensions can be increased if necessary. For example, if the width of the fascia door is increased from 750 mm to 880 mm (to let the modulator assembly pass through during installation and maintenance), then dimension **C** will be 3100 mm.

*Table 2.8 Minimum detailed dimensions for **C** for a two door fascia cover set*

Half of fascia width	2000 mm
Door	880 mm
Door pillars	22 mm

2.3.4 Water cooler room dimensions

The treatment suite can include a dedicated water cooler room.

The digital accelerator and water cooler can be connected by a water hose or copper pipes. The maximum length of this connection is 50 meters. This distance includes the connections to the digital accelerator and water cooler.

The minimum dimensions around the water cooler are dependent on the water cooler used.

The dimensions of the water cooler supplied by Elekta are shown in **Table 2.9** and **Figure 2.5**.

Table 2.9 Water cooler dimensions

Dimension	Value (mm)
Length	1200
Width	600
Height	1500

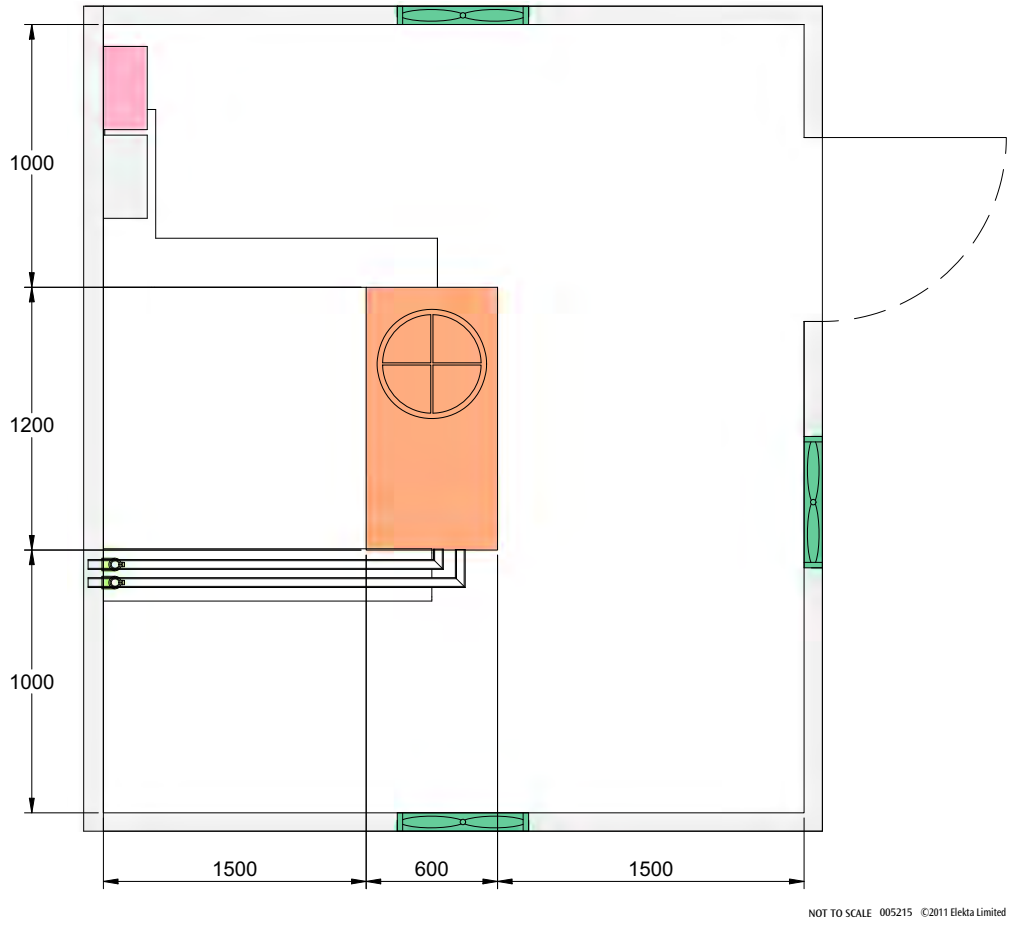

Figure 2.5 Suggested water chiller room dimensions

There must be a minimum clearance of 1 meter at the front and rear side of the water cooler.

There must be a minimum of 1.5 meters clearance at the sides and above the water cooler to permit efficient expulsion of hot air from the cooler.

3 Concrete and floor specifications

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3.1 About this chapter

Because of the large mass of the digital accelerator and the treatment table, concrete with a compressive strength of 30 MNm^{-2} must be used in areas where the machine is attached to the floor. The concrete must have the minimum specifications given in this section.

3.2 Concrete specification

Figure 3.1 shows the areas where the different types of concrete must be poured.

3.2.1 Certification

When the concrete has set, the responsible sub-contractor must supply the Elekta® representative with a certificate showing that the concrete has the necessary specification.

3.2.1.1 Test sample for certification

A cylindrical sample of 100 mm in diameter can be tested and measured by a nationally recognized tester no earlier than 28 days from pouring.

The cylindrical sample must have a compressive strength of 25 MNm^{-2} and a density of no less than 2.35 tonnes m^{-3}.

If a cube sample is taken, it must have a compressive strength of not less than 30 MNm^{-2}.

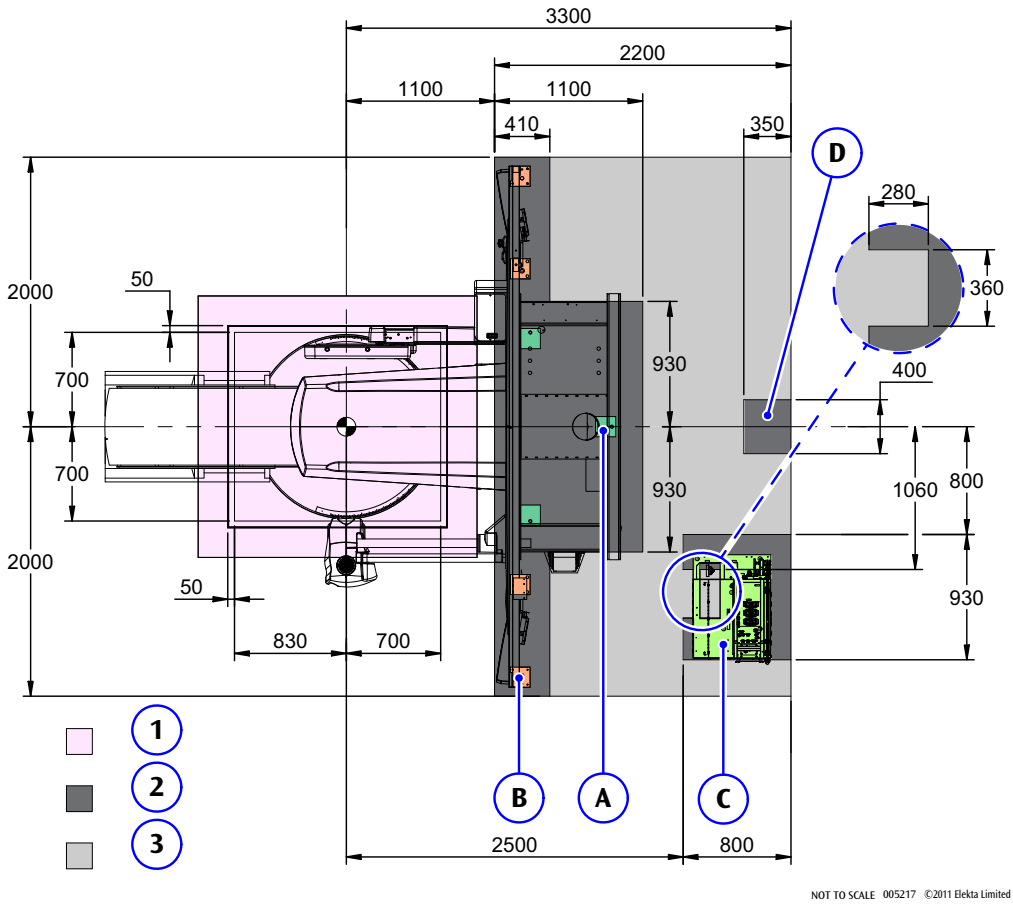

Figure 3.1 Areas under high load conditions (dimensions in mm)

Table 3.1 Legend for **Figure 3.1**

1	This area must be concrete, with a minimum thickness of 220 mm
2	These areas must be concrete, with a minimum thickness of 200 mm
3	
A	Gantry base plate[1]
B	Fascia support plate[1]
C	RIC base plate[1]
D	Gantry arm support bracket position

*1 All items **A**, **B**, **C** and **D** are supplied and installed by Elekta*

The gantry arm support bracket (**D**) is used during installation and service.

The floor can be made in two ways:

- Concrete the entire area around fascia support and gantry base pads, reeling interface cabinet (RIC) and the treatment table pit. See item **1**, item **2** and item **3** in **Figure 3.1**.
- Only concrete high load areas around fascia support and gantry base pads, RIC and the treatment table pit. See item **1** and item **2** in **Figure 3.1**.

The area shown as item **1** in **Figure 3.1** (treatment table pit area), must be concrete with a minimum thickness of 220 mm and must have the specification given in **Table 3.2**.

The areas shown as item **2** and item **3** in **Figure 3.1** (gantry area) must be concrete with a minimum thickness of 200 mm and must have the specification given in **Table 3.2**.

The quality of the concrete used in the treatment table pit must be equal to that used to support the gantry.

Table 3.2 Minimum specification of concrete

Compressive strength	30 MNm^{-2}
Density	2350 kg m-3 (2.35 tm^{-3})
Cement content	275 kg m^{-3}
Thickness - gantry area	200 mm
Thickness - treatment table pit area	220 mm
Concrete flatness - gantry area	±5 mm
Concrete flatness - treatment table pit area	±2 mm
Minimum curing time	28 days

The only area that can be covered with a finishing screed layer, is the floor of the treatment room surrounding the treatment table pit. Do not put a finishing screed layer in the treatment table pit or in the equipment room. Seal the floor to keep the room clear of concrete particles.

3.2.2 Floor fixings for the digital accelerator

3.2.3 Digital accelerator mounting plates, bases, and fixings

Details of the various mounting plates, bases, clamps and fixings are shown in **Figure 3.2**.

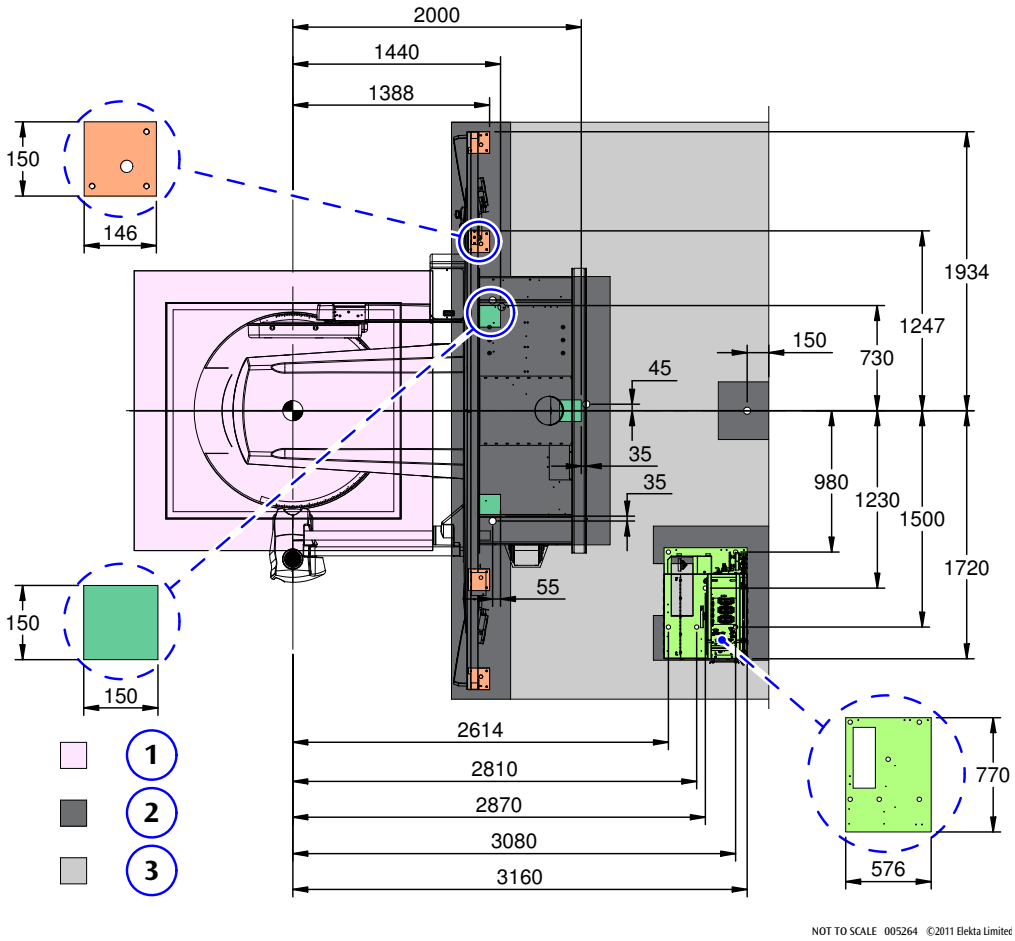

Figure 3.2 Digital accelerator mounting plates, bases and fixings

Table 3.3 Legend for **Figure 3.2**

	Fixing	Size (mm)	Loading[1] (kg)
A	Gantry base	M20 × 215	2067
B	Fascia support	M16 × 125	70
C	RIC	M12 × 100	–
D	Gantry arm support bracket	M12 × 70	–

1 Approximate loading per plate

The gantry base is attached to the floor by clamps.

3.3 Pit specification

The shallow floor pit is necessary to install the treatment table. The pit must comply with the conditions stated here. Seismic regulations may apply in certain sites.

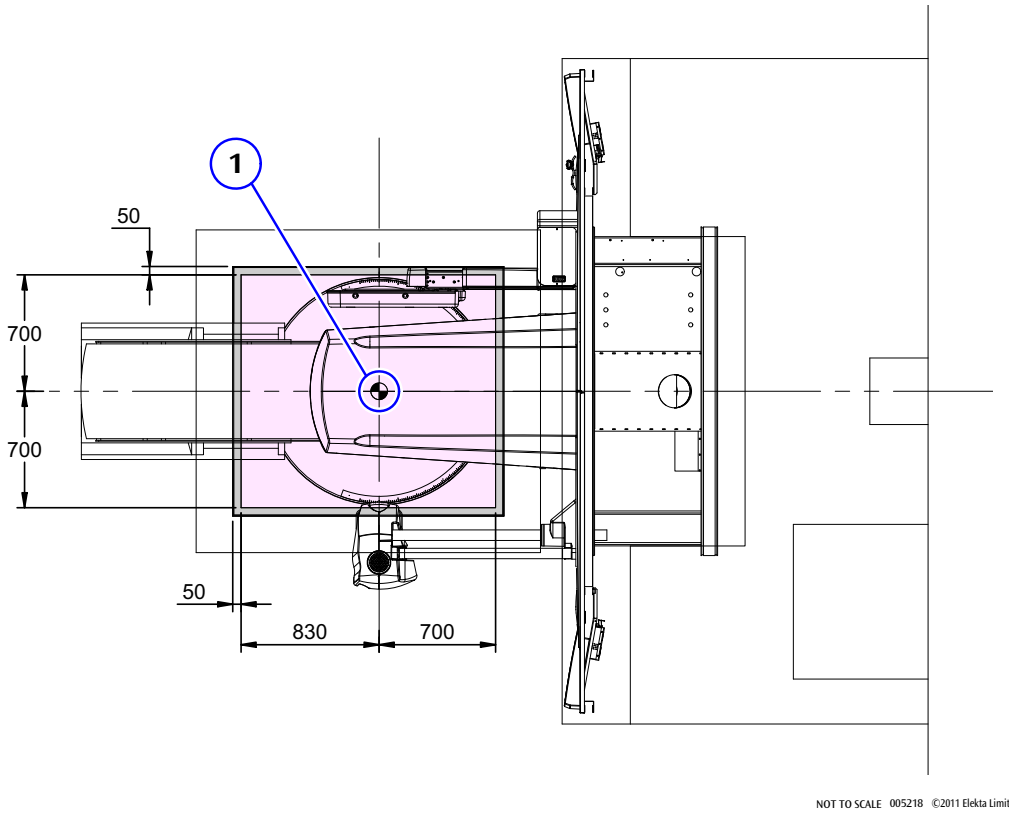

Figure 3.3 Dimensions of the treatment table pit (plan view)

(1) Isocenter

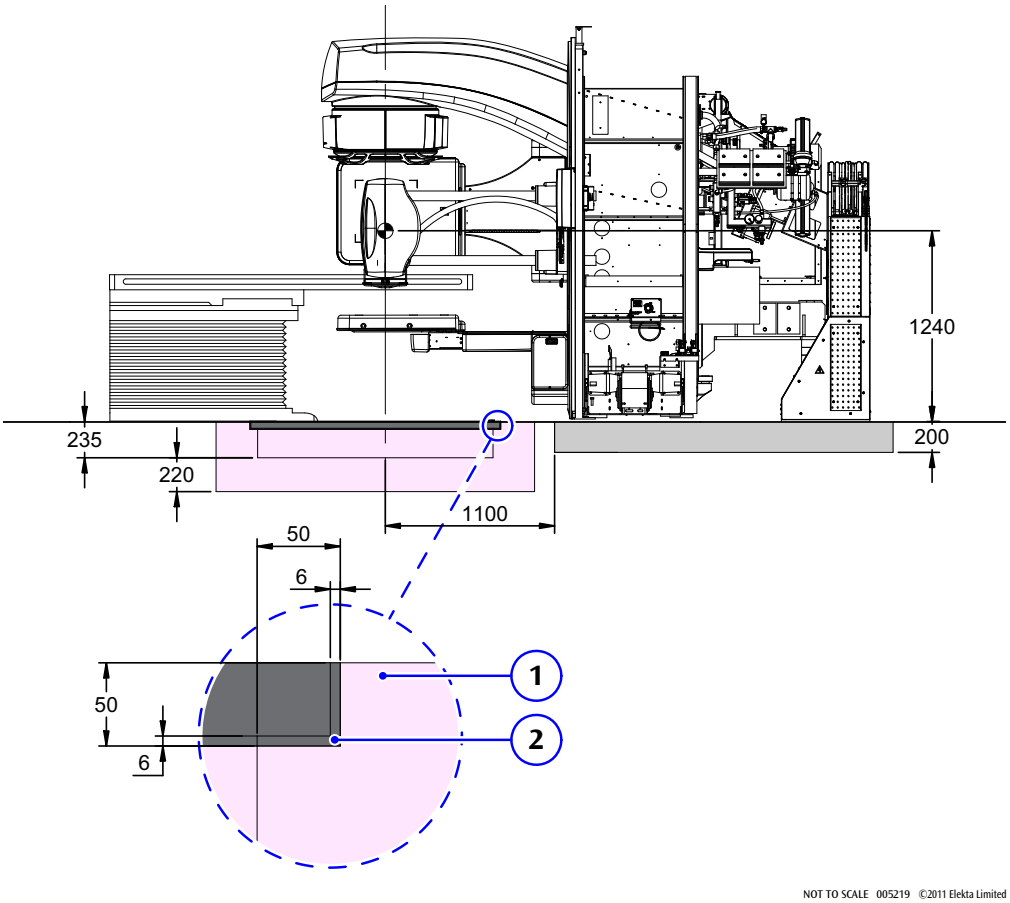

Figure 3.4 Dimensions of the treatment table pit (elevation view)

(1) Finished floor level
(2) 50 mm × 50 mm × 6 mm mild steel angle (anchored to concrete)

3.3.1 Pit construction

The concrete must be a solid homogeneous mass, which is reinforced by steel bars.

The pit must be 235 mm deep. There must be a minimum concrete thickness of 220 mm below the pit to install the anchor fixings. The concrete must also extend 150 mm in all directions around the holes for the anchor fixings (see **Section 3.3.2**).

All concrete must have the specification given in **Table 3.2**.

3.3.1.1 Pit floor

The concrete floor of the pit must be flat to a tolerance of ±2 mm.

The pit floor must not be covered by flooring materials (i.e. vinyl), but must be sealed against dust and water.

Screed must not be put in the pit.

3.3.1.2 Pit edging and angle iron frame

The client must accurately install a horizontal, mild steel angle frame (50 mm × 50 mm × 6 mm) around the top edge of the pit (see **Figure 3.3**).

The frame must be installed so that its top edge is level with the finished floor (usually 3 mm above the concrete).

The degree of tilt must not cause a height difference of more than 2 mm between any two points around the top edge of the frame

The client must make accurate marks which show the position of the isocenter on the top edge of the frame. These marks must be permanent and not erased during room installation. Elekta recommends that the marks are cut into the frame to a minimum depth of 2 mm with a hacksaw.

3.3.1.3 Finished floor level

The treatment room floor (including covering) must be level with the top edge of the pit angle frame. It must also be flat to a tolerance of ±2 mm in a radius of 1500 mm from the isocenter.

If the floor is more than 2 mm above the pit edge, then the bottom of the treatment table column rotation base will collide with the floor and expensive correction work will be necessary (see **Figure 3.5**).

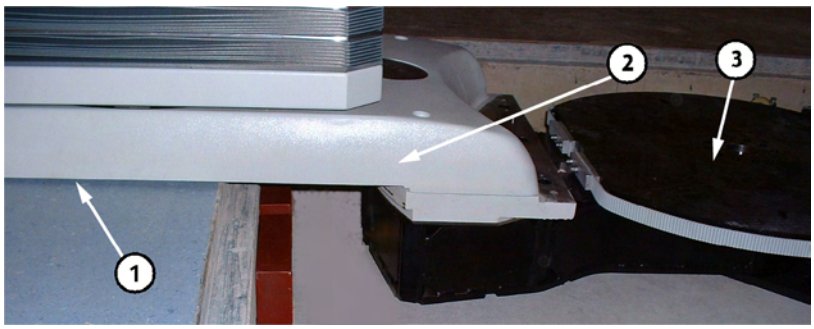

Figure 3.5 Floor clearance of the treatment table

(1) Table clearing floor
(2) Column rotation base
(3) Iso-rotation base

3.3.1.4 Pit duct

The duct laid into the concrete from the equipment room must enter the pit and must agree to the layout in this document.

Figure 4.5 shows the recommended duct layout. This duct layout is compatible with US seismic codes.

Figure 4.6 shows the alternative duct layout for those sites that do not need to conform to the US seismic codes.

3.3.2 Precise Treatment Table™ fixings

The treatment table must be fixed to the pit floor. **Figure 3.6** shows the location of the fixings in the pit.

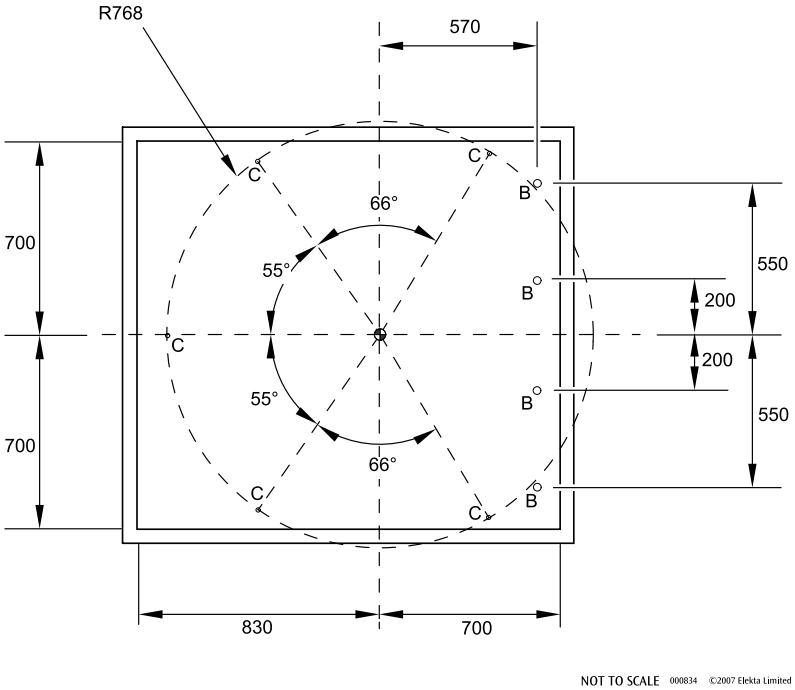

Figure 3.6 Precise Treatment Table - fixing locations and anchor details

Table 3.4 Legend for **Figure 3.6**

	Fixing	Size	Loading (kN)
A	Isocentre	M20	32[1]
B	Rear	M20	13[1], 17[2]
C	Support roller	M12	13[1], 17[2]

1 Compressive/shear
2 Tensile/shear at corner fixings

The fixings are supplied by Elekta and the necessary holes will be marked out using a template and drilled during the installation.

3.3.3 Pit floorboards

Pit floorboards are supplied by Elekta. A floorboard is made of two medium density fiber (MDF) boards bonded together. Each MDF board is 18 mm in thickness, so the total thickness of a floorboard is 36 mm.

The MDF floorboards supplied by Elekta are installed on the angle frame after the treatment table has been installed. They are accurately aligned to the edges of the frame so that with the cover, they will be level with the complete floor level around the pit.

3.3.3.1 Client responsibility for the floorboards

It is the responsibility of the client to get a carpenter to cut the floorboards to the correct dimensions.

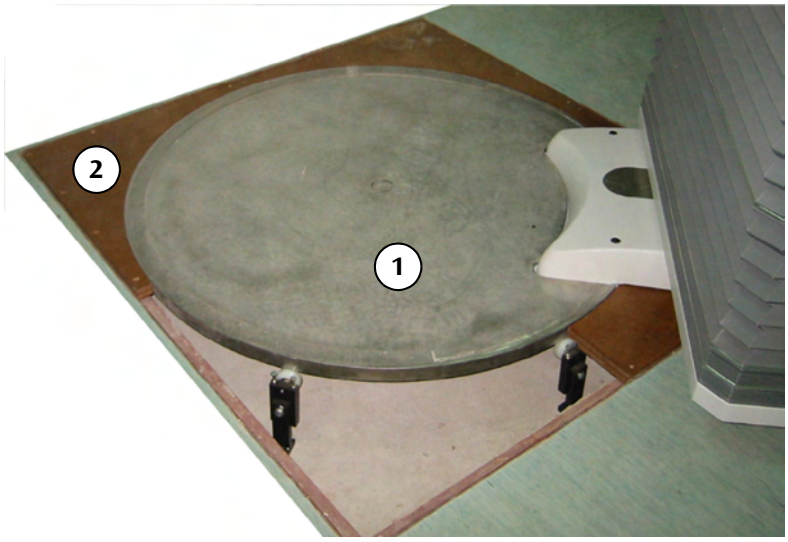

Figure 3.7 Cut and positioned floorboards (one quadrant exposed for clarity

(1) Iso-rotation base
(2) Floorboards

When the floorboards are installed, the client must add their own flooring material to the boards and iso-rotation base.

3.4 Upgrades

When a Precise Treatment System™, SLi, or SL series digital accelerator is replaced with an Elekta Synergy® Platform, the floor layout around the new digital accelerator can be different.

3.4.1 Gantry base fixings

The existing fixings can be in the same position as the gantry base motor on the new digital accelerator. This will prevent installation of the new digital accelerator.

3.4.2 Ducts around the gantry base

The existing ducts can be in the same position as the gantry base of the new digital accelerator. Use the information in this document to identify if changes to the existing ducts are necessary.

3.4.3 Fascia fixings

It is possible that the gantry base of the new digital accelerator may not be in the same position as that of the existing digital accelerator. Then the fascia floor fixings will not align because these are aligned to the gantry position.

An alternative procedure of attaching the fascia floor fixings must be made locally, or the existing fascia floor fixings must be removed and the concrete re-laid so that new fixings can be used.

4 Duct information

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4.1 Cable ducts

This chapter gives information about cable ducts for the digital accelerator, treatment table and XVI systems. Cable ducts are necessary to keep cables between items in an environment with low-interference and protection from damage.

Figure 4.1 shows a suggested layout of ducting for the Elekta Synergy® Platform.

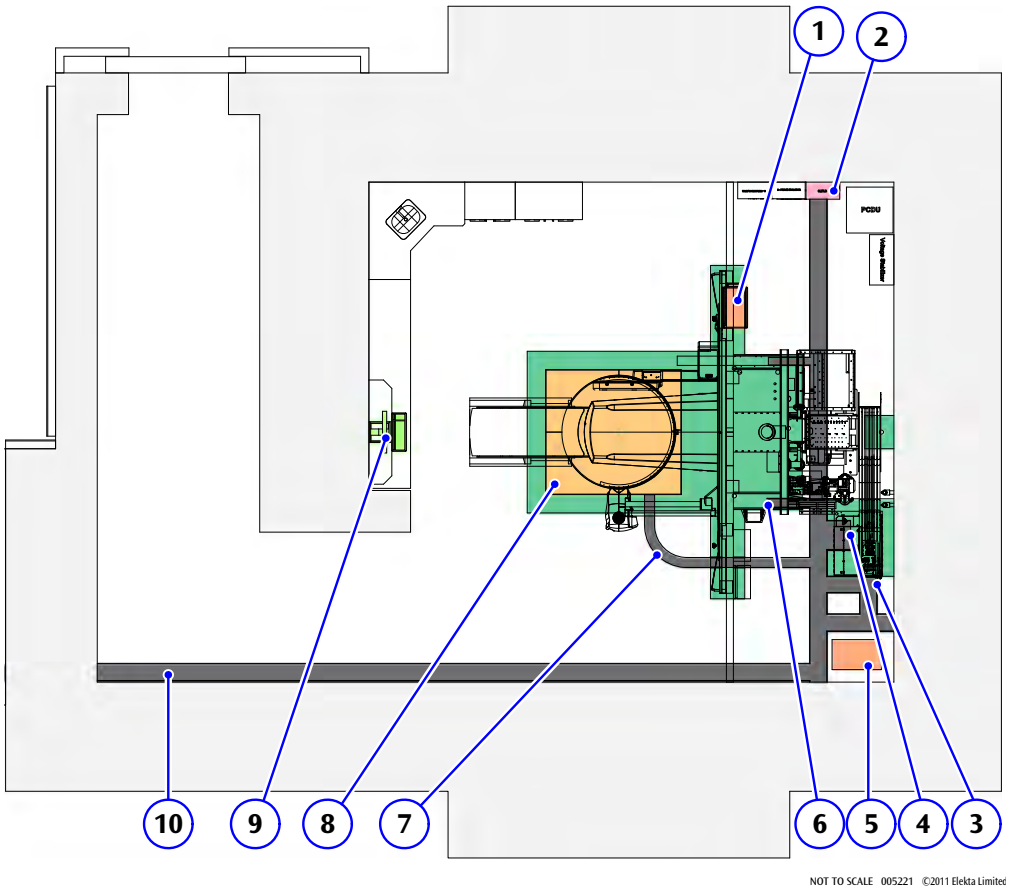

Figure 4.1 Suggested layout of ducts

(1) EIM
(2) CITB
(3) RIC side duct exit
(4) RIC main duct exit
(5) XVI kV generator
(6) Gantry base duct exit
(7) Treatment table duct
(8) Treatment table pit
(9) IMKM
(10) Duct to control room

Note: *All ducts that exit the treatment room or equipment room are to have radiation traps as specified by the RPA.*

This duct layout is compatible with US seismic codes.

4.1.1 Regulations

It is good practice to have separate ducts for signal, power cables, and water. Local regulations will dictate the final ducting types.

4.1.2 Duct specifications

The cable ducts must be calculated to meet the following criteria:

- Cable ducts can be made of steel or polyvinyl chloride (PVC), or concrete.
- Ducts must have suitably placed, removable, access covers
- If made of steel, ducts must be connected to the earth reference terminal (ERT)
- Ducts must have no sharp edges.

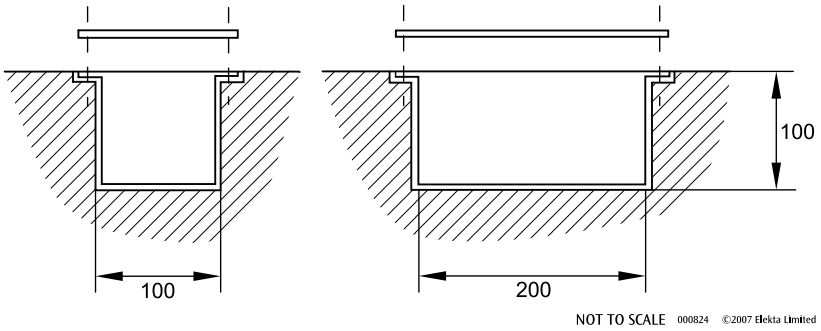

Figure 4.2 Example dimensions of steel ducts (cross section)

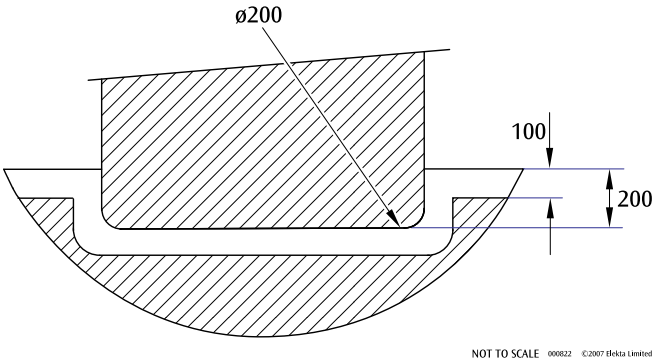

Figure 4.3 Example dimensions of plastic ducts (cross section)

4.1.3 Cable ducts in the control room

Cable ducts in the control room can be installed to suit the room design. The TCC can be in the control room, but it can also be installed in a server room.

If the cable duct terminates at floor level, then a cable tray must be supplied to continue this route to the control desk.

Note: *The maximum length of cable ducting from the position of the treatment control cabinet to the reeling interface cabinet must not exceed 29 meters.*

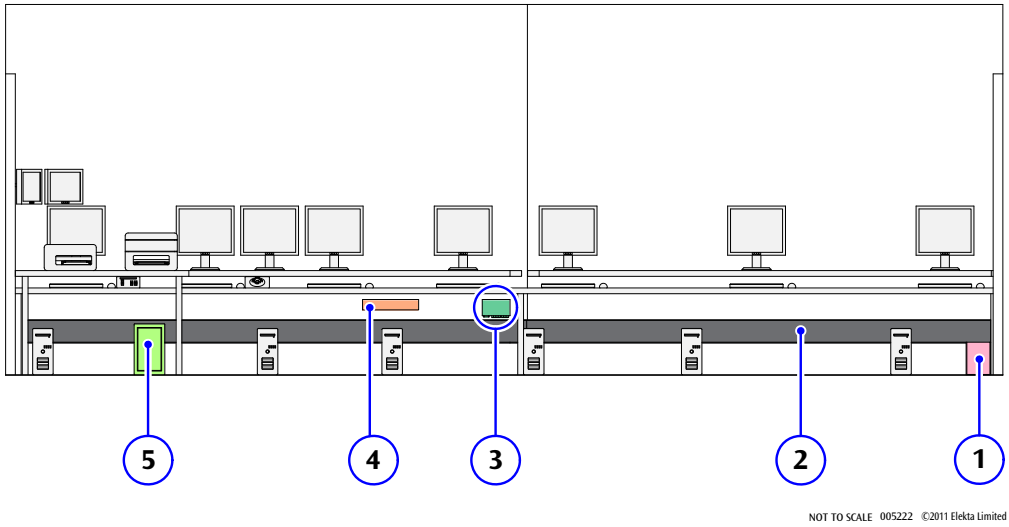

Figure 4.4 Example of ducting in the control room

(1) Cable duct from treatment room
(2) Cable duct or tray on wall
(3) Mains distribution unit (MDU)
(4) Service terminal box
(5) Treatment control cabinet

4.1.4 Cable ducts in the treatment and equipment room

This section gives information about the routing of cable ducts around the digital accelerator.

All cable ducts in the equipment room must agree to the layout in this document.

Figure 4.5 shows the recommended duct layout. This duct layout is compatible with US seismic codes.

Figure 4.6 shows the alternative duct layout for sites that do not need to conform to the US seismic codes.

The routing of these cable ducts must obey these criteria:

- Ducts must have cable exit points in the correct positions
- Some items can be placed in alternative positions. But, ducts must not exceed maximum lengths
- Ducts must not decrease the radiation protection of the room, for example, ducts must have angles or convoluted paths through walls to prevent radiation leakage from the treatment room.

The cables for the A-side handheld controllers (HHC), and treatment room monitor (TRM) power and signal are usually installed beneath the gantry base. When this is not possible, a duct can be installed from the reeling interface cabinet to the A-side of the fascia. This duct must not interfere with the concrete specifications given in **Table 3.2**.

If the client wishes to put the electrical interface module (EIM) on the A-side, this must be confirmed with your Elekta representative.

The iViewGT™ system uses the same ducts as the digital accelerator.

More ducts will be necessary for the XVI system, which includes a kV generator.

Any proposed changes to these ducts must be agreed with Elekta in advance of room construction. A non-standard request (NSR) is necessary for differences between the maximum lengths given and changes at the site.

Duct specifications for XVI

The XVI system includes a kV generator. The kV generator is normally put next to, or installed on, the back wall. The ducts can be changed to get to this position.

The recommended ducting for the kV generator is also shown in **Figure 4.5**. More ducts can also be made, depending upon the location of the kV generator.

- Some of the ducts will not be used until installation of the XVI components. These ducts must be made before the installation of an Elekta Synergy® Platform
- The kV generator can be put any place in the equipment room within the maximum stipulated duct lengths.

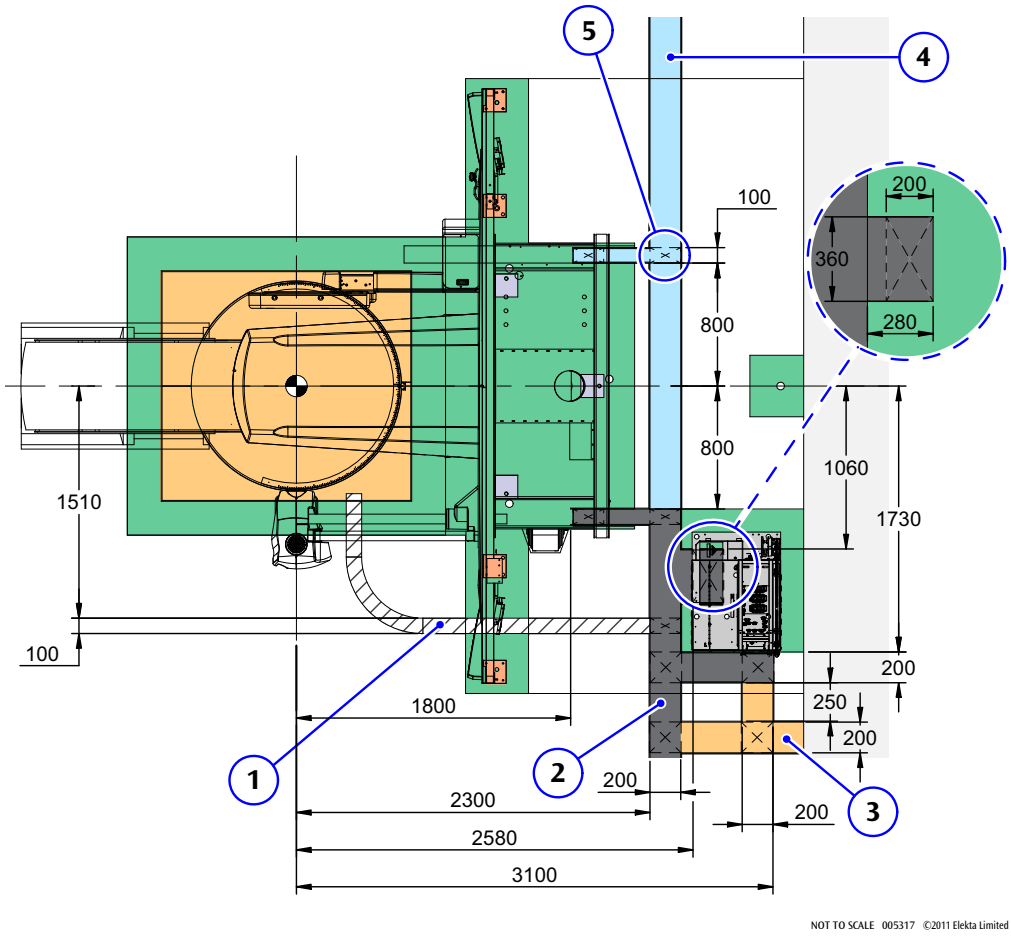

Figure 4.5 Recommended duct layout

(1)	Treatment table pit duct (below floor level)	(4)	Optional extended duct (at floor level)
(2)	Minimum digital accelerator duct layout (at floor level)	(5)	Removeable access cover
(3)	Recommended duct layout for XVI kV generator (at floor level)		

This duct layout is compatible with US seismic codes.

Do not install ducts within 150 mm of the fixing positions shown in **Figure 3.2**.

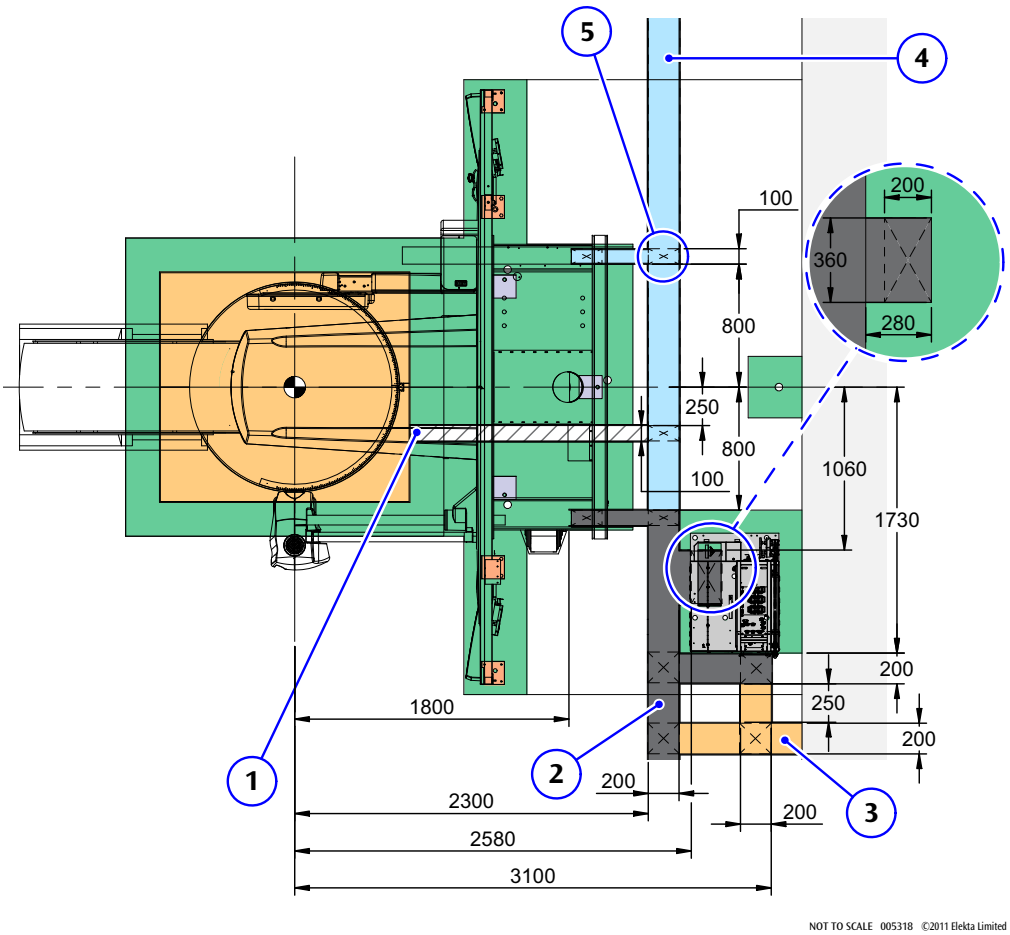

Figure 4.6 Alternative duct layout

(1)	Treatment table pit duct (below floor level)	(4)	Optional extended duct (at floor level)
(2)	Minimum digital accelerator duct layout (at floor level)	(5)	Removeable access cover
(3)	Recommended duct layout for XVI kV generator (at floor level)		

Do not install ducts within 150 mm of the fixing positions shown in **Figure 3.2**.

4.1.5 Duct dimensions

Table 4.1 lists the dimension and routing of the cable ducts for the digital accelerator.

Table 4.1 Cable duct dimensions and routing

From	To	Recommended Size W x D (mm)	Minimum Size W x D (mm)	Maximum Length (m)
Reeling interface cabinet	Gantry base	100 × 200	100 × 200	1.5
	Treatment table pit	100 × 100	100 × 50	3.0
	XVI kV generator	200 × 150	150 × 150	4.0
	EIM	100 × 200	100 × 200	6.0
	CITB	200 × 150	200 × 100	13.0
	iViewGT™ control cabinet	100 × 200	100 × 200	22.0
	Service terminal box	200 × 150	200 × 150	22.5
	Peripheral tie tray	200 × 150	200 × 150	22.5
	MDU	200 × 150	200 × 150	28.0
	Treatment control cabinet	200 × 150	200 × 150	29.0
	XVI control cabinet	100 × 200	100 × 200	33.0
	Water cooler	200 × 150	200 × 100	50.0
	Single-phase isolator for digital accelerator vacuum system	100 × 100	100 × 50	N/A
	Three-phase isolator for digital accelerator	100 × 100	100 × 50	N/A
XVI control cabinet (TRM line driver)	TRM line receiver	200 × 150	150 × 100	29.0
XVI control cabinet	kV generator	100 × 200	100 × 200	32.0
CITB	Laser alignment system	100 × 75	75 × 75	N/A
	Emergency STOP switch	50 × 50	25 × 25	N/A
	Door interlocks	50 × 50	25 × 25	N/A
	Warning lights	50 × 50	25 × 25	N/A
	Room lights	75 × 75	50 × 50	N/A
	Time delay	50 × 50	25 × 25	N/A
Electrical supply	Voltage stabilizer	100 × 100	100 × 100	N/A

Depending on the configuration of the system, the ducts from the control room to the equipment room can be combined.

4.2 Duct requirements for HexaPOD™ evo

For ducting requirements for the HexaPOD™ evo system, refer to *HexaPOD™ evo RT System Planning Guide (for use with Elekta Digital Accelerators)*.

5 Fascia panels

5.1 Fascia in the treatment room

The fascia is a vertical partition between the treatment room and equipment room. It is made up of two parts, the Elekta fascia and the client fascia. (see **Figure 5.2**).

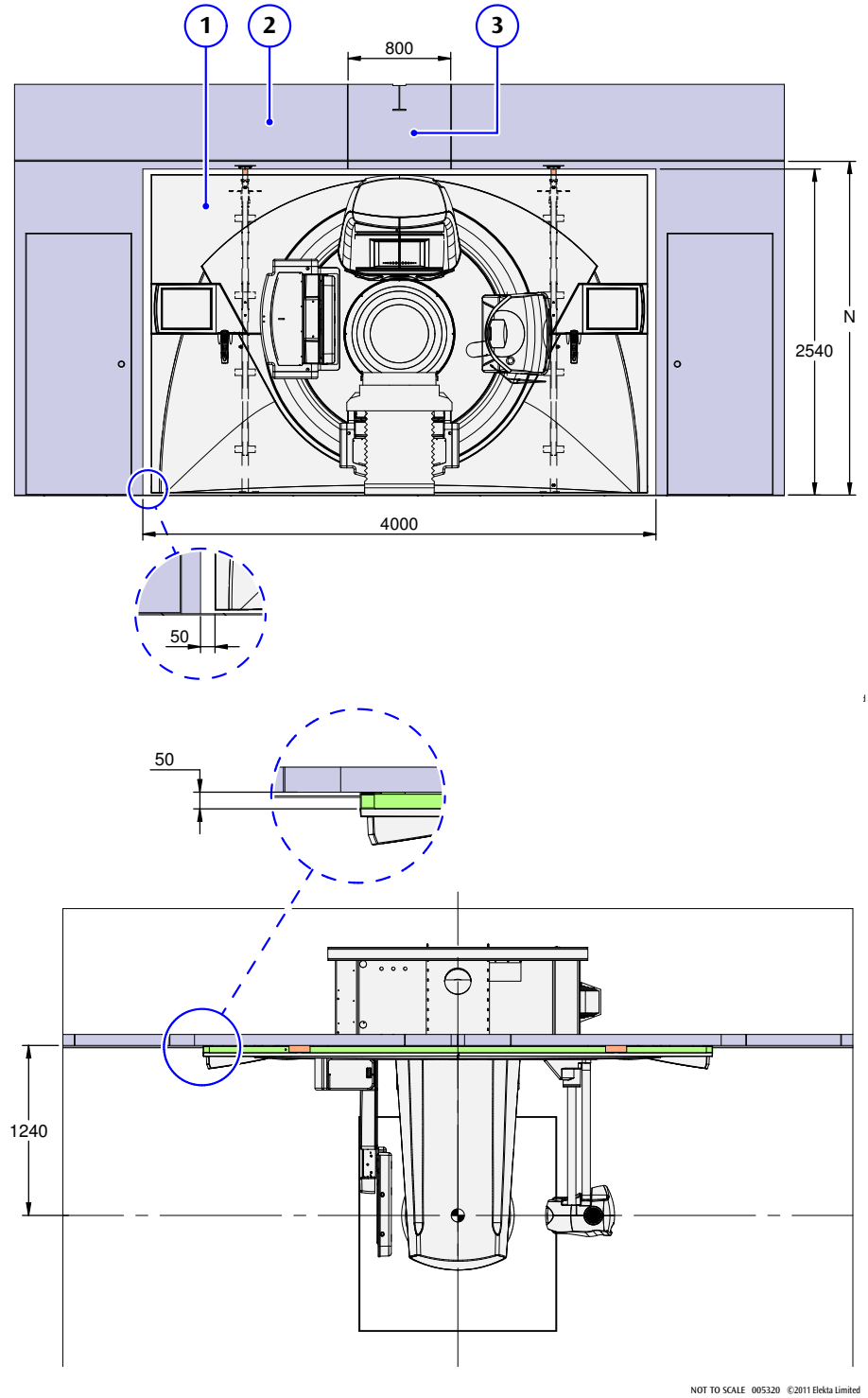

Figure 5.1 Digital accelerator fascia

(1) Elekta fascia
(2) Client fascia
(3) Cover panel for hoist
N Floor to false ceiling height

The Elekta fascia panels are installed by Elekta.

The wall around the panels is called the client fascia.

It is recommended that it be made by the client before the installation of the digital accelerator. If a single A-frame lifting device is to be used for the assembly of the digital accelerator, the client fascia must be erected after the machine assembly is finished.

There must be 50 mm between the two fascias when they are installed to allow the machine position to be adjusted.

5.1.1 Client fascia

Figure 5.1 shows the required dimensions of the client fascia and the aperture required by the Elekta fascia.

It is necessary that the dimensions of the client fascia agree with **Figure 5.1**. If not, this will cause installation problems and unsatisfactory finish to the appearance of the digital accelerator.

Elekta can supply fascia panels where the site has certain restrictions with the width of the treatment room. Information about the narrow cover set is given in **Section 5.2**.

The client fascia header must be made of wood or wood-backed metal struts and must be structurally stable.

The fascia can be installed with one or two doors between the equipment room and the treatment room.

It is the responsibility of the client to:

- Make sure that only authorized personnel have access to the equipment room
- Supply lockable fascia door(s) which are **NOT** self closing.

Note: *If self closing doors must be installed to satisfy local rules, a time delay interlock system must be installed.*

Note: *The door interlocks must be installed before the installation of the digital accelerator.*

5.1.1.1 Area labelling in the equipment room

The equipment room must be labelled as a restricted access area, it is mandatory under IEC rules.

5.1.2 Elekta fascia

The positional values of the digital accelerator are shown on two thin-film transistor (TFT) monitors in the treatment room, one on each side of the fascia. These are known as the treatment room monitors (TRMs).

The Elekta fascia is made of fiberglass panels. Four quadrants surround the front surface of the gantry drum and two outer panels (one on each side of the gantry) surround the TRMs. The Elekta fascia panels are attached to the fascia frame.

There are more panels on the front surface of the gantry drum, the BLD, the gantry arm, and around the treatment room monitors.

The inner posts of the fascia frame have telescopic extensions. See **Figure 5.2**. Provision must be made for the location and installation of the Elekta fascia brackets to the ceiling, or to the bottom surface of the client fascia.

A narrow cover set is also available for sites with certain restrictions. Information about the narrow cover set is given in **Section 5.2**.

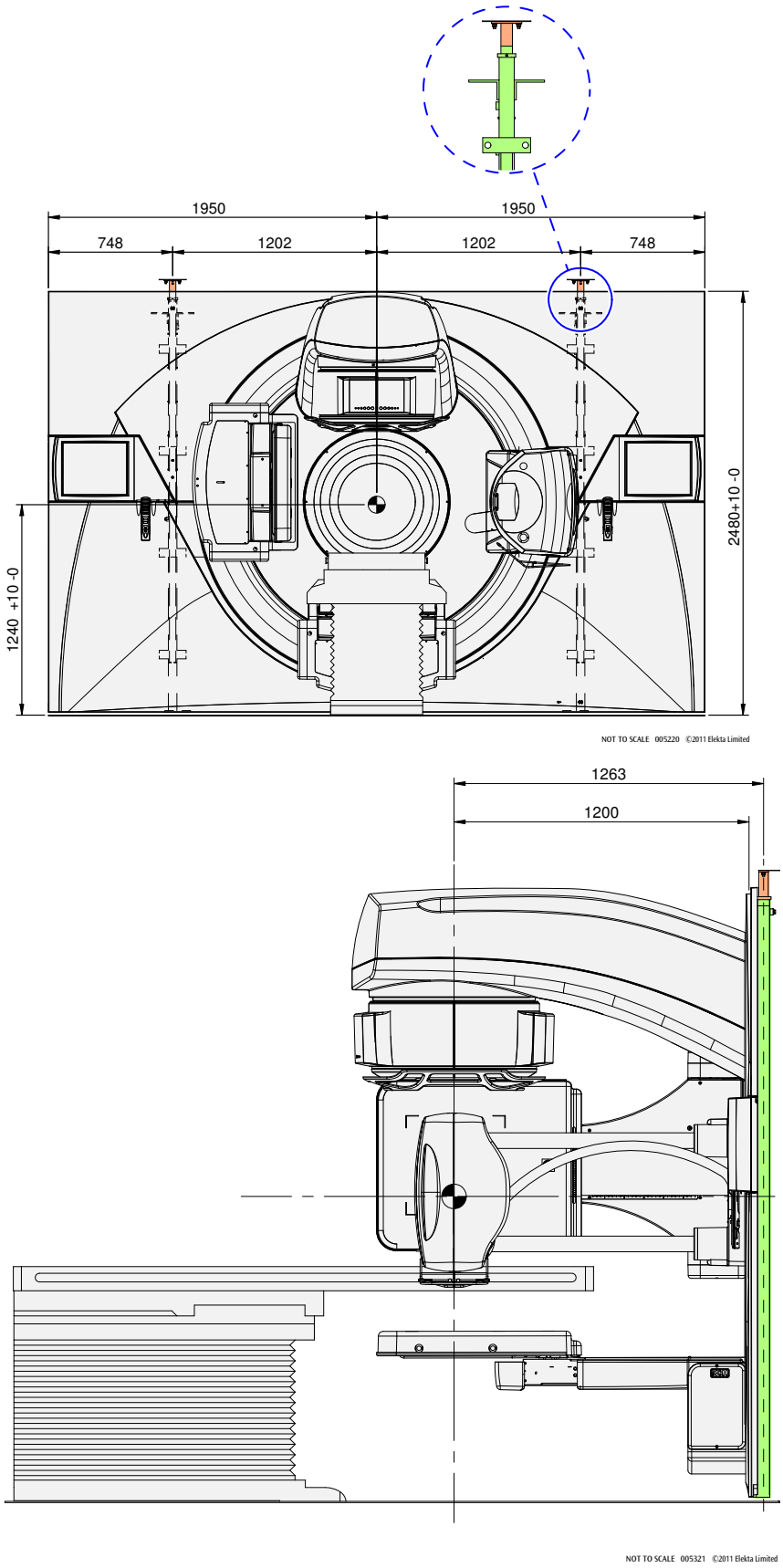

Figure 5.2 Elekta fascia

It is the responsibility of the client to fill the space with a strip of filler material after the installation of the digital accelerator is completed.

Figure 5.3 Client fascia as viewed from the treatment room

(1) Gap in fascia (unfilled)

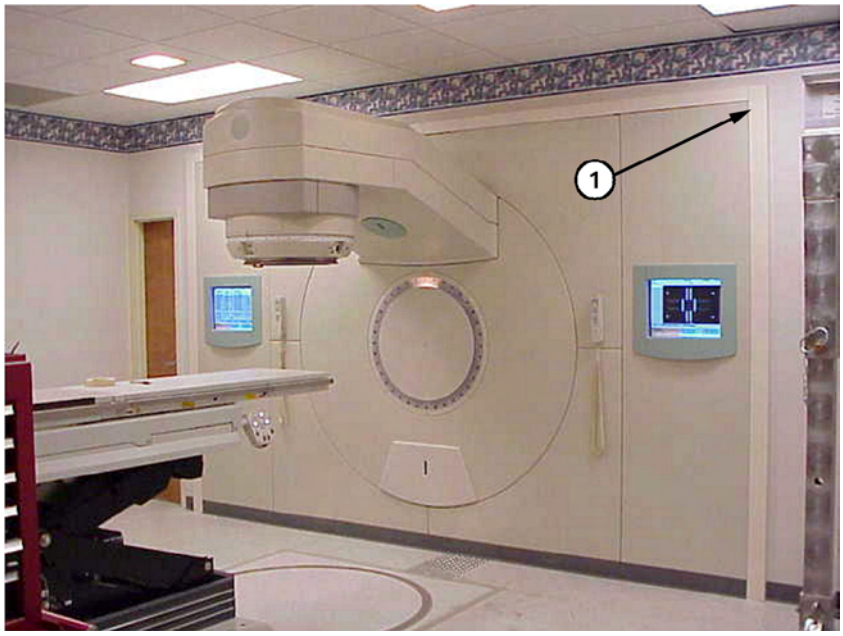

Figure 5.4 Client fascia as viewed from the treatment room

(1) Gap in fascia (filled by client)

5.2 Narrow cover set

A narrow cover set is available for treatment rooms with a small width.

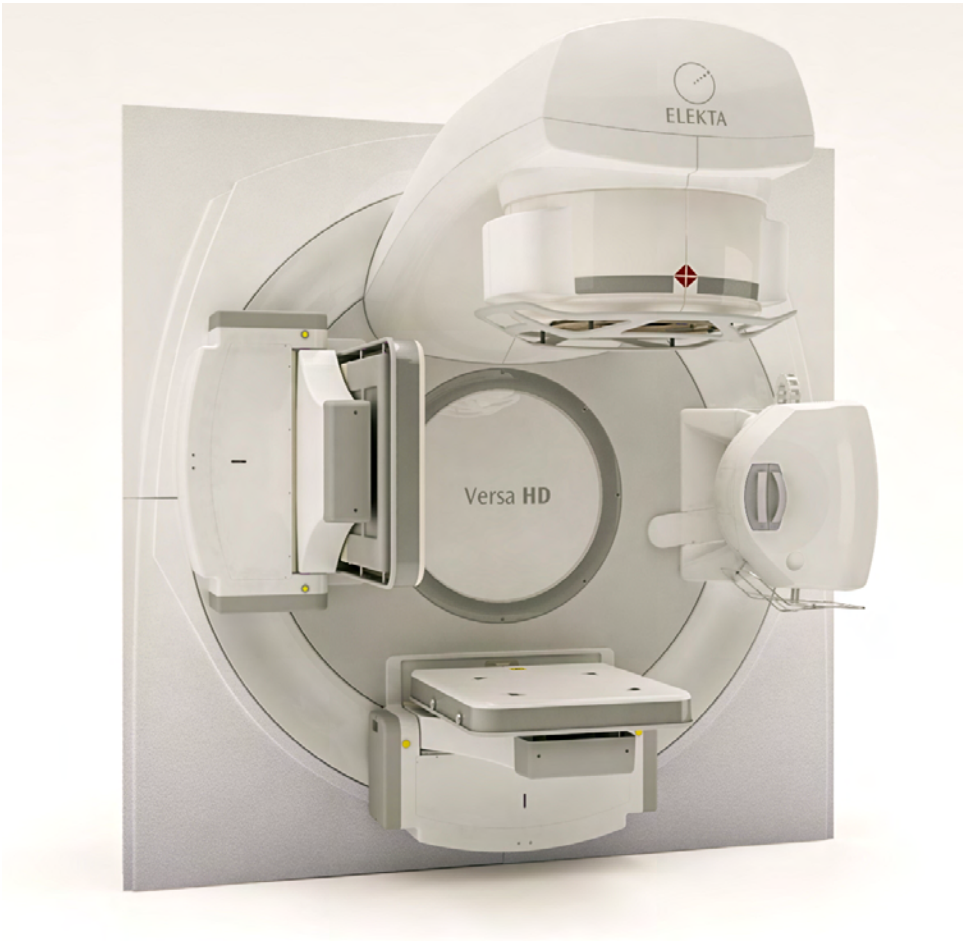

Figure 5.5 Versa HD™ narrow cover set

The narrow cover set is 2500 mm wide. The width of the aperture required by the Elekta narrow cover set is 2600 mm. All other dimensions are unchanged..

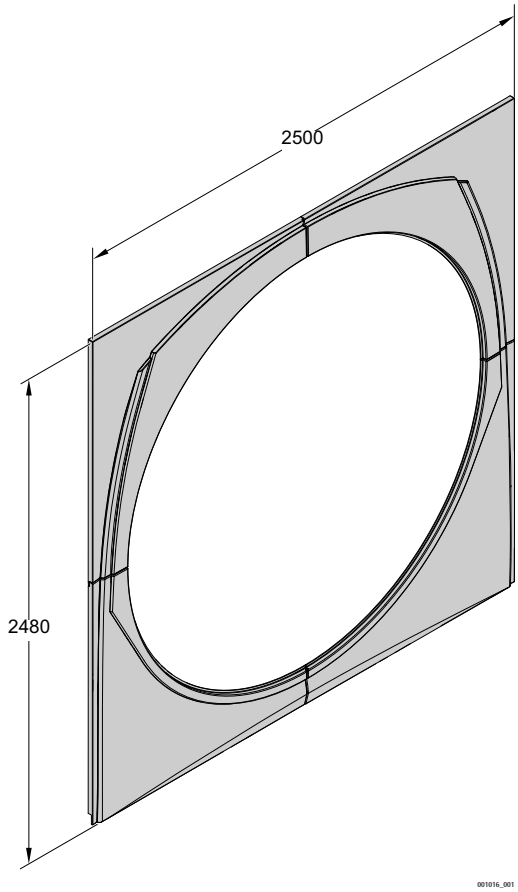

Figure 5.6 Narrow cover set

TRMs and HHCs will have to be relocated, see **Section 5.2.1** to **Section 5.2.3**.

5.2.1 Treatment room monitors

For installations with the narrow cover set, the location and installation of treatment room monitors (TRM) is the responsibility of client.

The TRM can be installed using shelves or brackets on the walls adjacent to the digital accelerator. It can also be mounted on the equipment room doors. The dimensions of the monitors can be obtained from your Elekta representative.

For this type of installation a full cable kit is supplied, which contains:

- An IEC male to female electrical power supply cable.
- 2-off male and 2-off female 10 A IEC 320 (straight) plugs will be supplied to enable assembly of 2-off IEC mains cables on-site if cable lengths of greater than 2 meters are required. In this case, additional electrical power cables must be bought locally.
- A CAT5 cable and coupler is supplied, where 30 meters is defined as the maximum distance between the TRM and the VGA line driver in the treatment control system.

Note: *The length of the CAT5 cable must be 30 meters or less, if not, the picture quality can become degraded and the CE certification invalidated.*

5.2.2 Location of the treatment room monitors

Elekta supply a cable to connect the TRM to the electrical power supply. The TRM must be installed in the area (4) shown in **Figure 5.7**. If you install the TRM outside of this area, for example, with a VGA cable no greater than 3 m from the video switch, the quality of the picture can become degraded.

Figure 5.7 (5) shows the radiation beam area. This area is the path of movement for the digital accelerator and is not safe to install the TRMs in this area. If installed in this area, the digital accelerator can cause performance problems and reduce the life expectancy of the equipment, or cause a collision with other equipment.

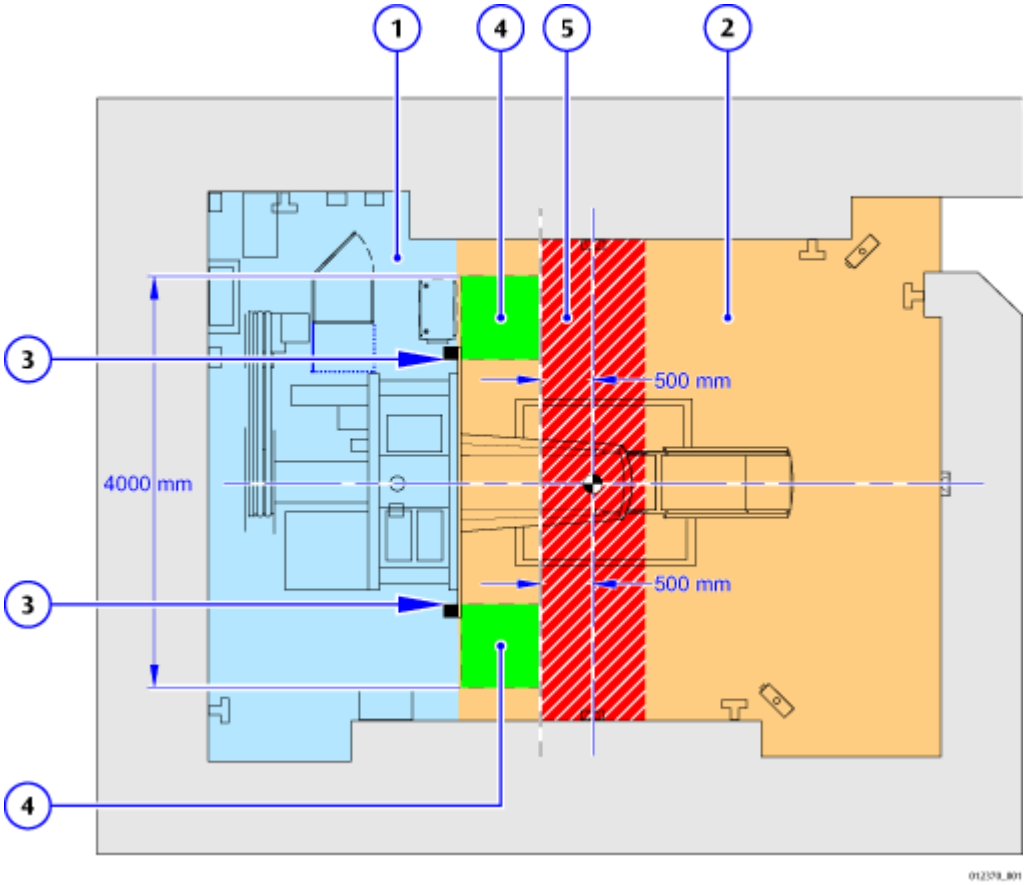

Figure 5.7 Location of TRM in smaller treatment room

(1) Equipment area
(2) Treatment room
(3) Fascia support posts
(4) Area to install the TRM and HHC
(5) Radiation beam area

Note: *The size of a treatment room can be different in all sites. **Figure 5.7** (4) shows the recommended location for the installation of a treatment room monitor. The installation must be in the 4000 mm as shown in the illustration.*

5.2.3 Location of HHC, receiver mounting bracket and video switch

The digital accelerator with narrow cover set can have a maximum of four handheld controllers (HHCs). For installations with the narrow cover set, the location and installation of handheld controllers (HHC) is the responsibility of client.

It is also the responsibility of the client to make sure that the HHC receiver mounting bracket and video switch are installed correctly. For more information, see the Digital Accelerator Phase 1 Installation information manual.

Figure 5.7 (5) shows the radiation beam area. This area is the path of movement for the digital accelerator and is not safe to install the HHCs in this area. If installed in this area, the digital accelerator can cause performance problems and reduce the life expectancy of the equipment, or cause a collision with other equipment.

Elekta recommends that the handheld controllers are installed on the client fascia in the treatment room. They must be less than 2.5 meters from isocenter, and in easy access for the operator. See (4) in **Figure 5.7**. If the HHCs are installed more than 2.5 m away from isocenter, the operator will have to pull on the cable to extend the HHC, and possibly cause damage to it.

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6 Components in the equipment room

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6.1 About this chapter

This chapter gives information about the items in the equipment room.

The figures in this section show a suggested layout of the equipment room, and the dimensions of individual items. All dimensions given are in mm.

Figure 6.1 shows the necessary items in the equipment room.

6.2 Digital accelerator items

6.2.1 Gantry assembly

The gantry assembly consists of a rotating drum with a projecting gantry arm. The arm contains the waveguide of the accelerator, and carries the radiation to the beam limiting device. Components are mounted within the gantry drum or on its faces.

The drum is supported on wheels attached to the gantry base. The gantry base is mounted on the floor of the equipment room.

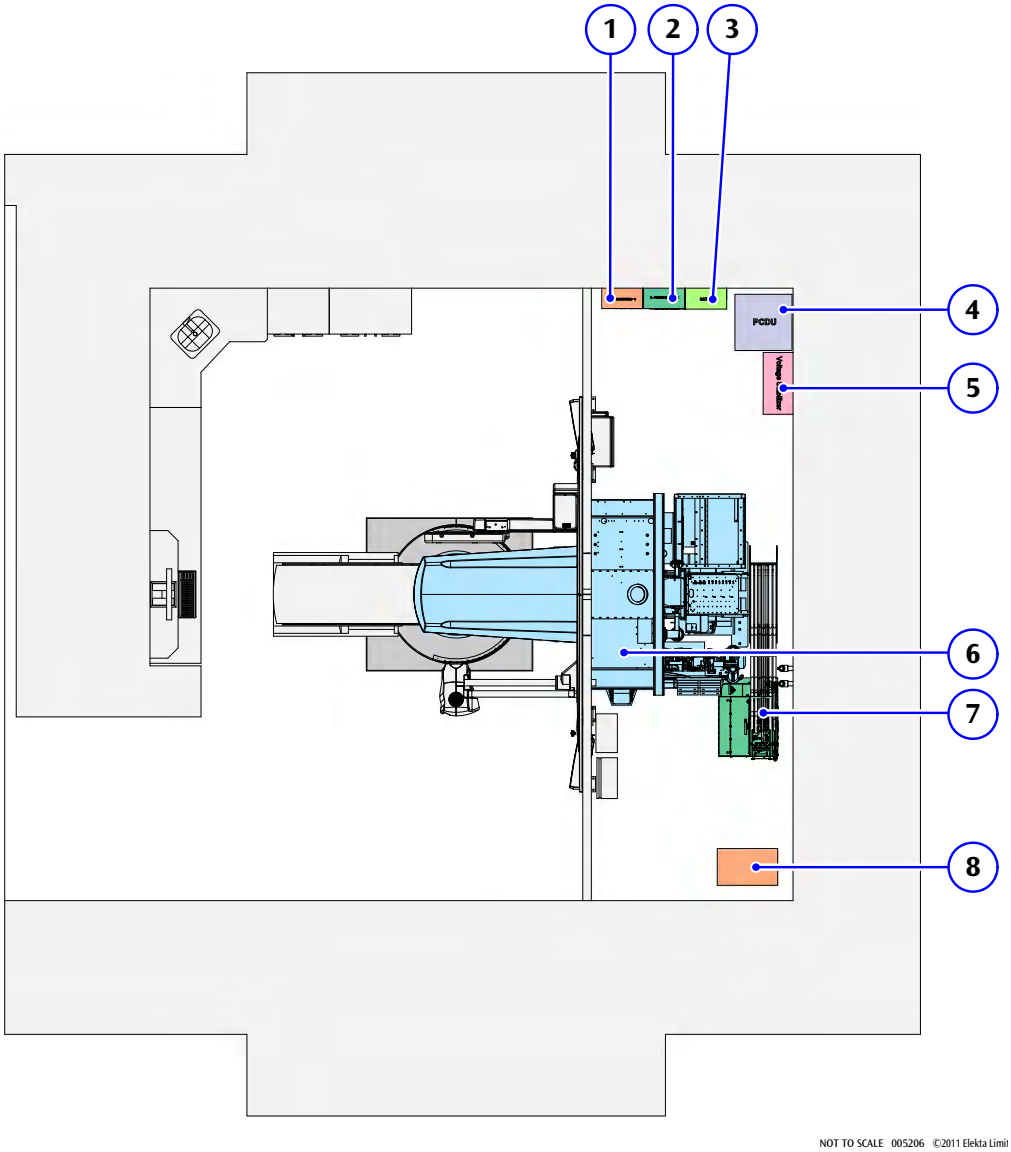

Figure 6.1 Equipment room items

(1)	XVI kV generator three-phase isolator EIM	(5)	Voltage stabilizer
(2)	Digital accelerator three-phase isolator and distribution board	(6)	Gantry drum
(3)	CITB	(7)	Reeling interface cabinet
(4)	PCDU	(8)	XVI kV generator[1]

1 *The distance between the XVI kV generator and the reeling post must be no more than 4 m.*

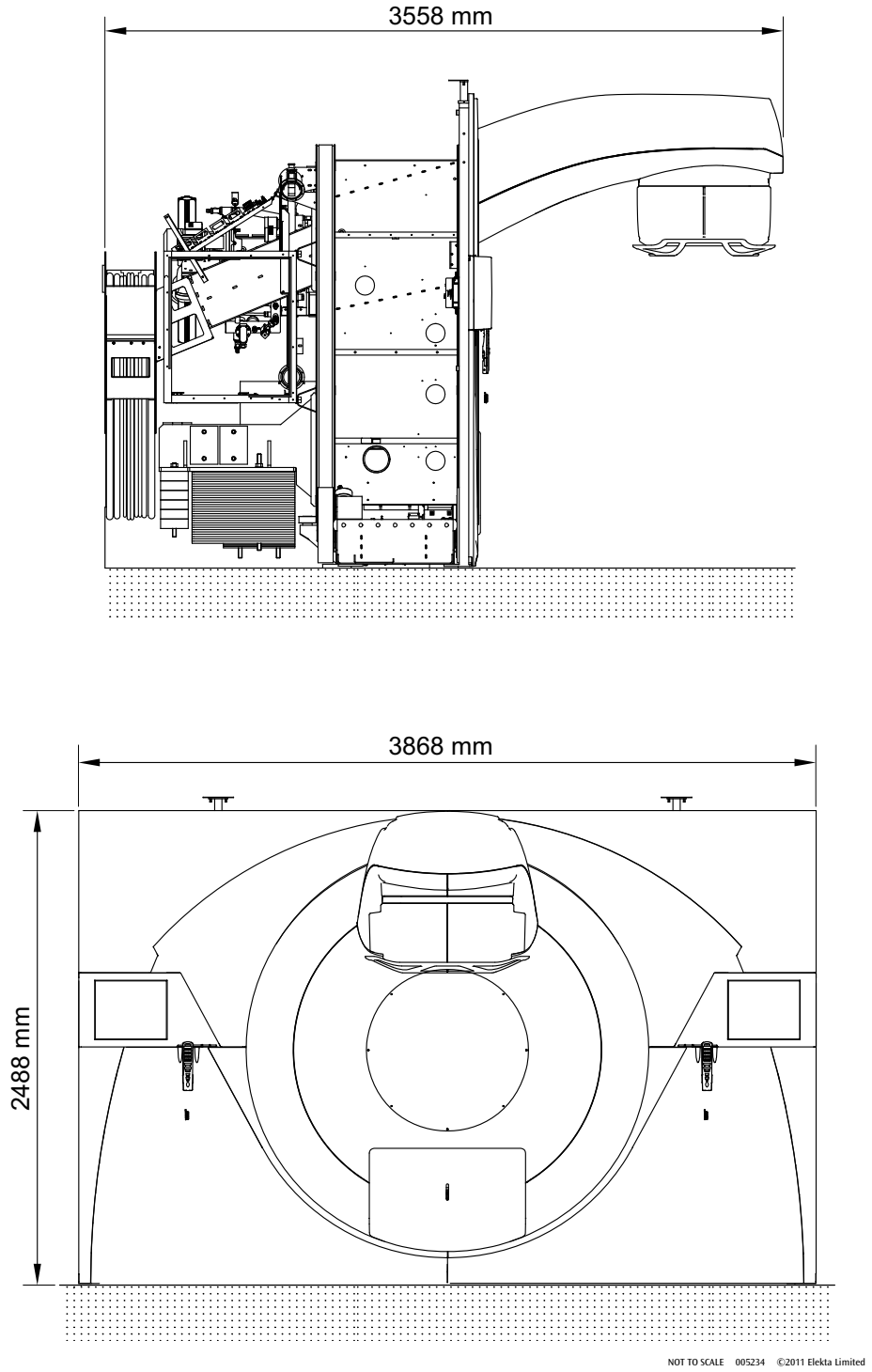

Figure 6.2 Dimensions of the digital accelerator

6.2.2 Reeling interface cabinet

The reeling interface cabinet (RIC) contains:

- The contactors and circuit breakers for electrical power distribution
- The interface cabinet control area (ICCA)
- Some control electronic parts.

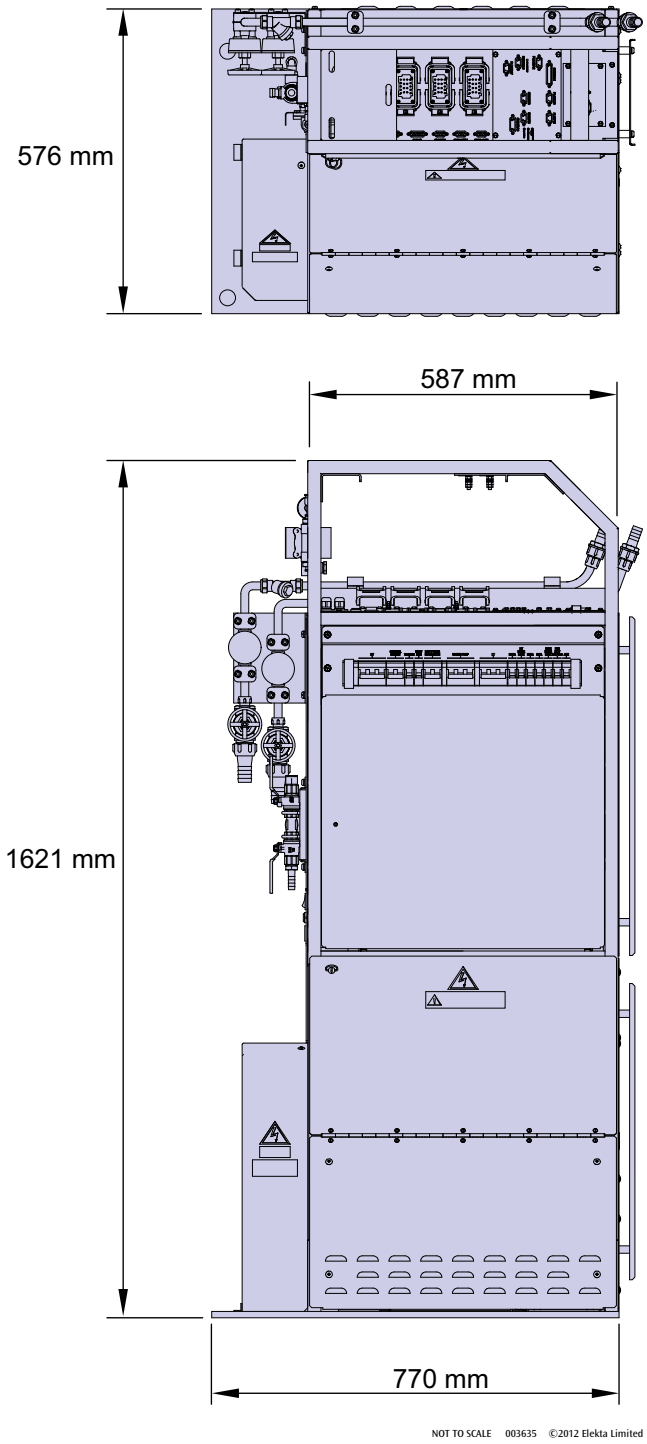

Figure 6.3 Dimensions of the reeling interface cabinet

The reeling interface cabinet is located level with the cable reeling assembly on the T-end of the digital accelerator. The unit cannot be moved from this position.

The reeling interface cabinet will be located exactly as shown in **Figure 6.4**.

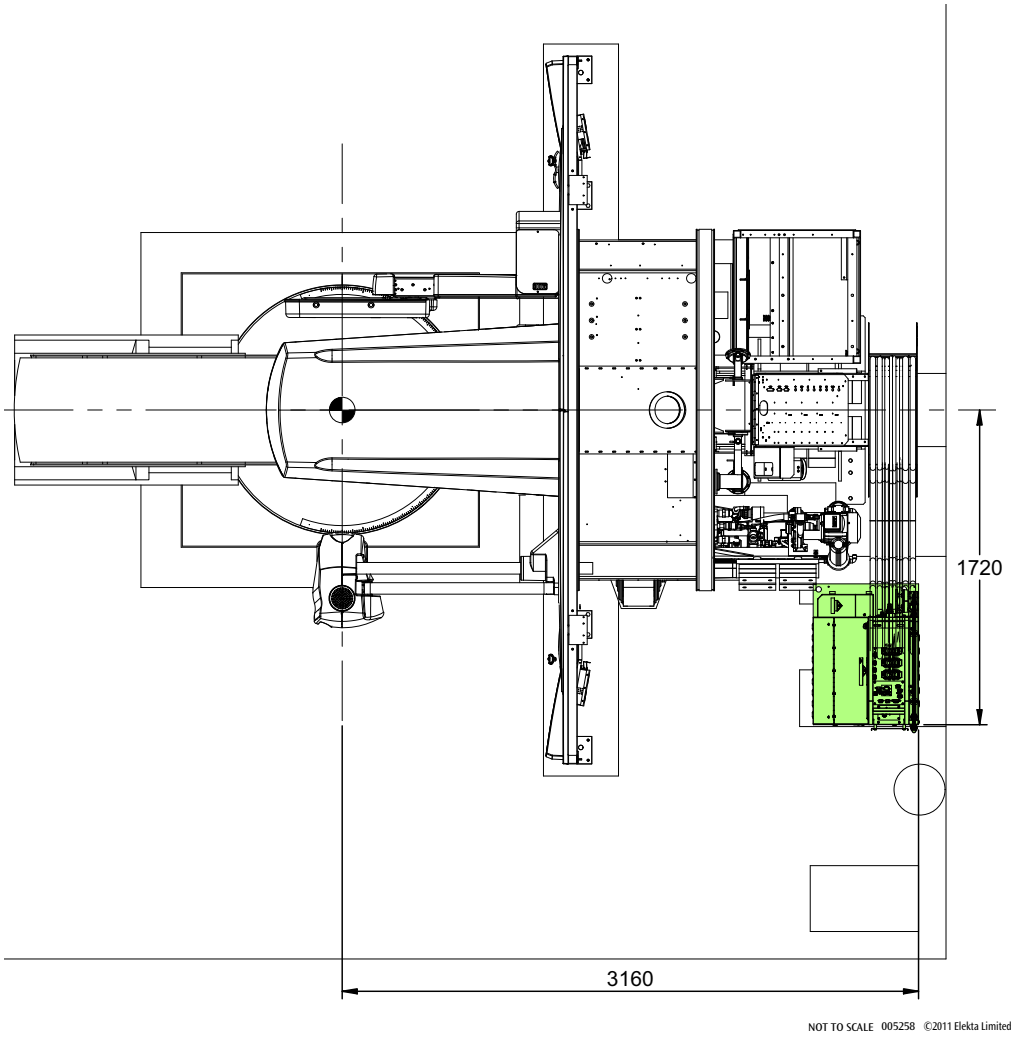

Figure 6.4 Plan view of location of reeling interface cabinet

Cables go into the reeling interface cabinet through the bottom of the unit. The cables that run to the gantry are supported on the reeling interface cabinet and fed on to the cable reeling assembly at the rear of the gantry. The cooled water supply and SF6 gas are terminated at the reeling interface cabinet before passing to the gantry.

The reeling interface cabinet has an access door. If necessary for access, it can be hinged on the left or right side of the cabinet.

Space equivalent to the size of the cabinet should be left in front of the cabinet for service.

6.2.3 Client interface terminal box

The client interface terminal box (CITB) is usually installed on a wall in the equipment room. See **Figure 4.1** for the suggested location.

The cable access is at the bottom of the cabinet. The CITB must be installed above a cable duct exit.

The holes for fixing the CITB to the wall are at the rear of the cabinet.

The door opens to the left side or the right side of the cabinet.

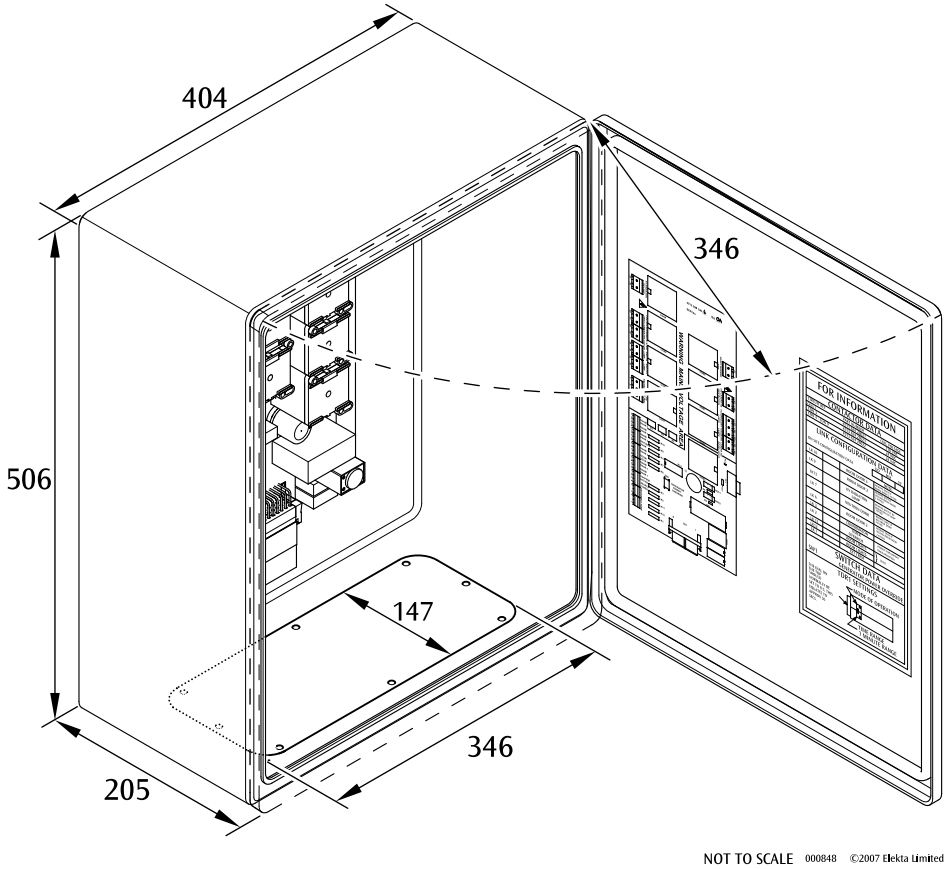

Figure 6.5 CITB dimensions

6.2.4 Voltage stabilizer (optional)

The voltage stabilizer should be positioned on the floor, adjacent to the mains isolator for the digital accelerator.

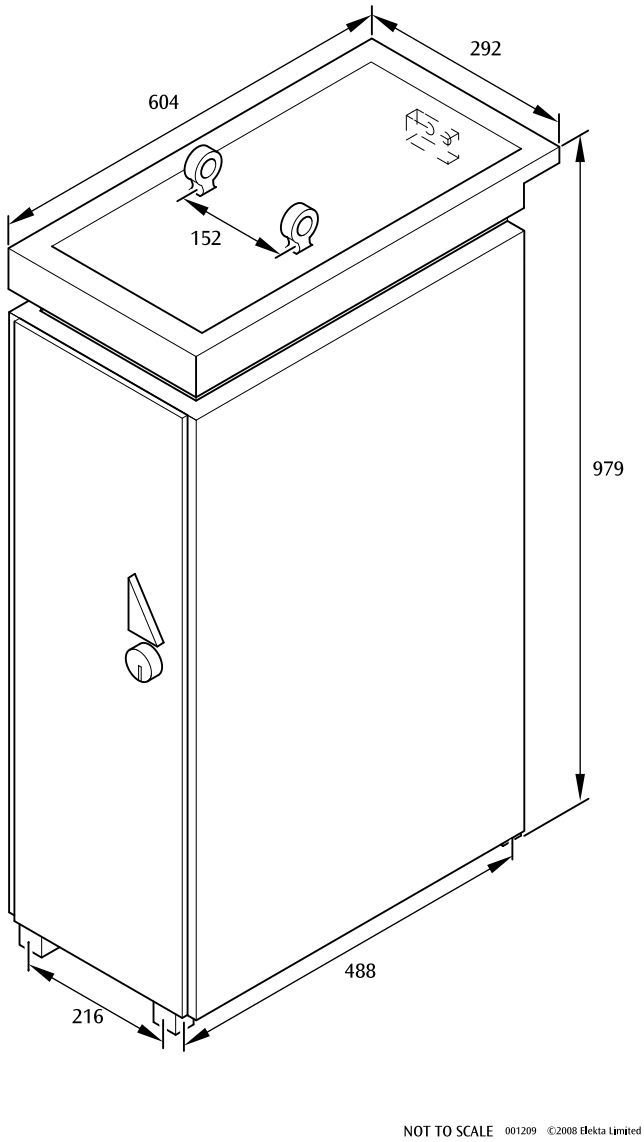

Figure 6.6 Dimensions of the voltage stabilizer

Access to the front of the voltage stabilizer is required for adjustment and service, Access to the rear is required for cable access, and access to the top for cable connection.

6.2.5 Power conditioning distribution unit (optional)

The power conditioning distribution unit (PCDU) is mainly used in the USA or regions with a 110 V supply.

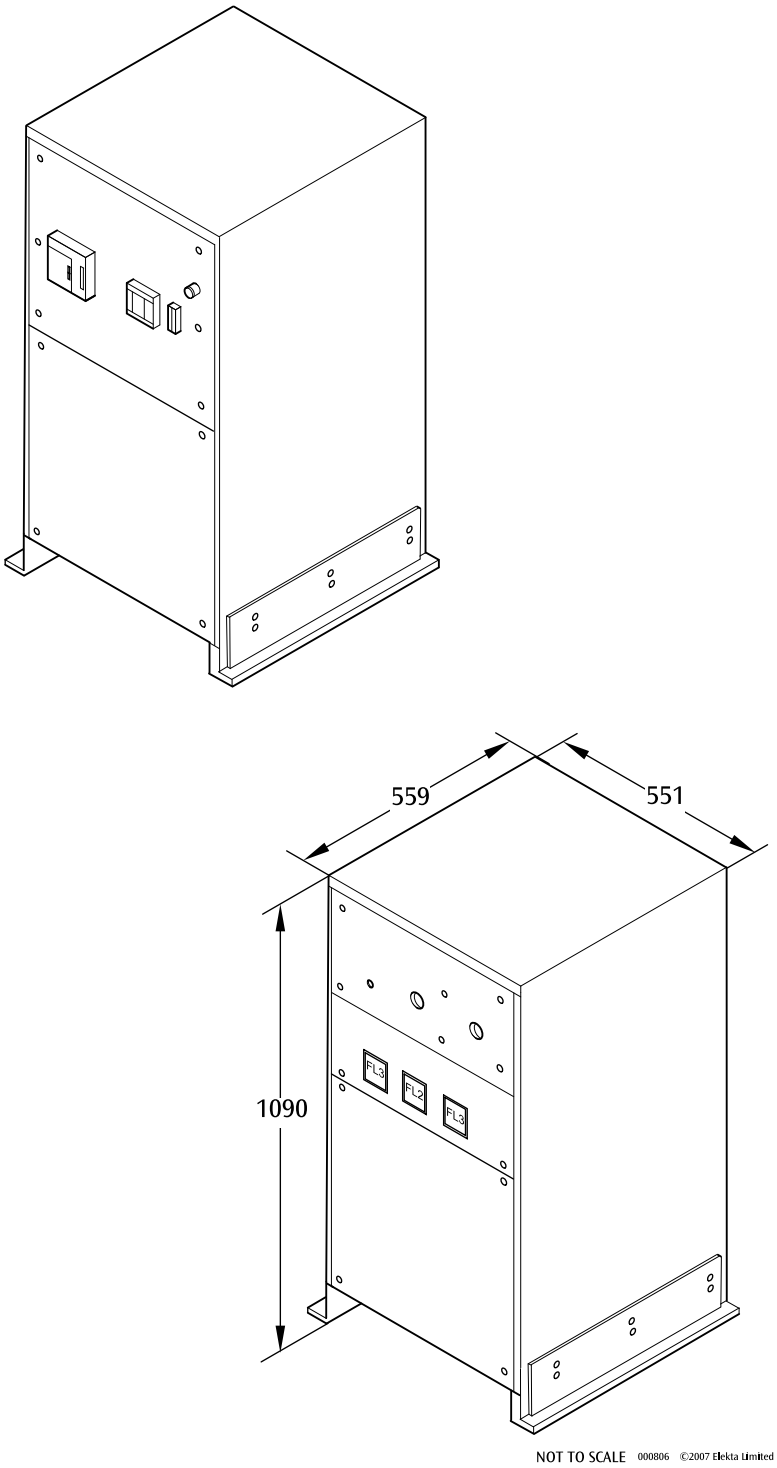

Figure 6.7 Dimensions of the PCDU

6.3 Precise Treatment Table™ items

6.3.1 Electrical Interface Module (EIM)

The Precise Treatment Table™ is delivered with the electrical interface module (EIM). The EIM is a cabinet that houses the connections between the treatment table and the host machine.

The EIM is installed behind the fascia below the treatment room monitor. The EIM must not be put in the primary beam of the digital accelerator.

The dimensions of the EIM are shown in **Figure 6.8**.

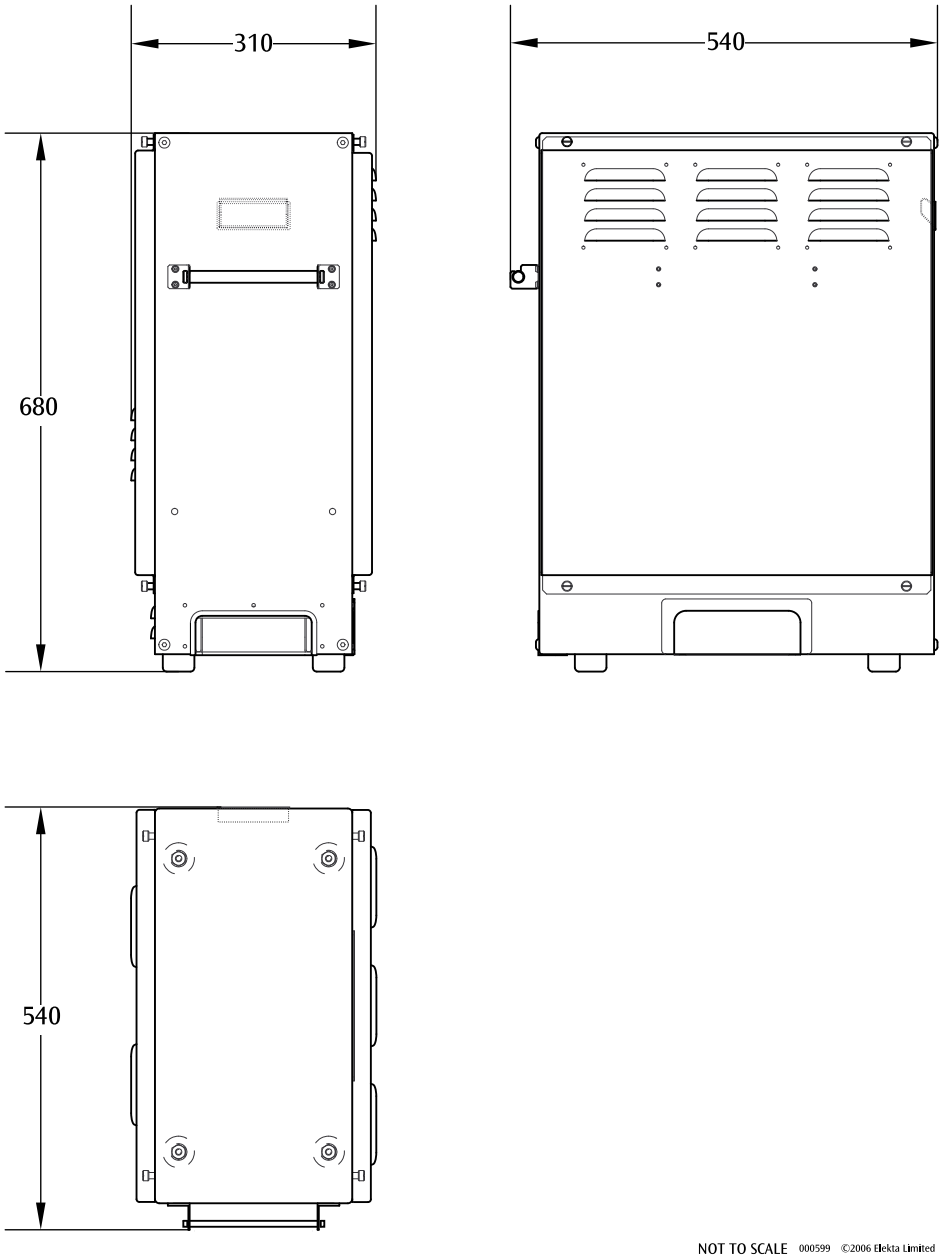

Figure 6.8 Dimensions of the EIM

6.4 XVI items

6.4.1 kV generator

The kV generator provides high tension (HT) voltage to the X-ray tube, which is located on the gantry drum. The kV generator is located in the equipment room and is connected to the X-ray tube by HT cables.

Additional planning requirements are:

(1) Space for the kV generator must be made in the equipment room behind the gantry and the isolator for the kV generator should be installed close to this space where possible.

(2) There must be additional space in the cable ducts from the reeling interface cabinet to the generator.

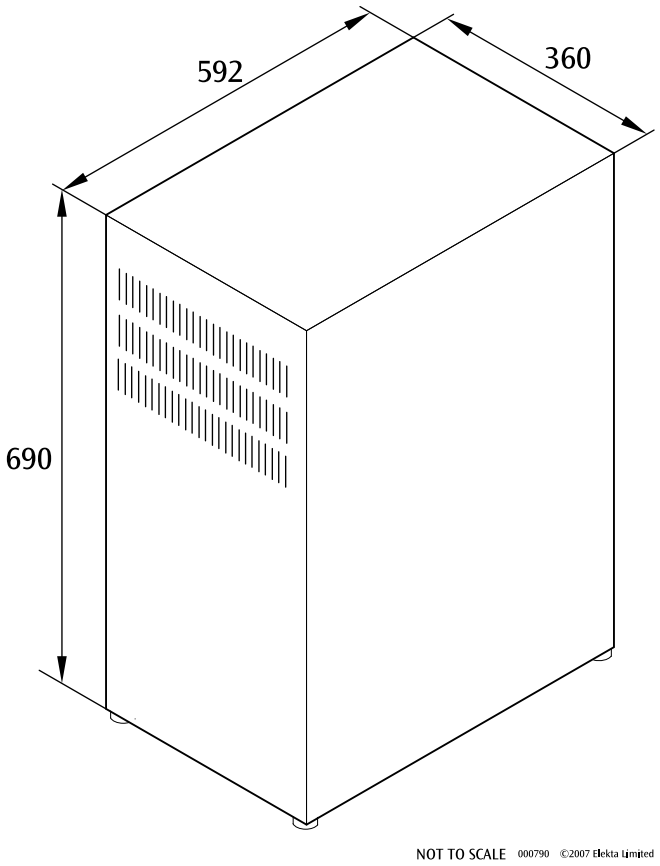

Figure 6.9 SHF-435-DSI Hi-Speed kV generator cabinet from Sedecal

The generator is connected to the CITB, the reeling interface cabinet and the XVI control cabinet in the control room. The kV generator cabinet can be located anywhere in the equipment room where sufficient cable ducting is present, but must not be more than 4 m duct length from the reeling interface cabinet.

The generator comes with cabling from Elekta. A non-standard request (NSR) must be raised to get cables longer than those available.

The kV generator can be wall mounted using a supplied support plate (**Figure 6.10**). A minimum of four fixings are necessary, though the type and depth of the fixings is dependent upon the characteristics of the wall on which the generator is to be mounted.

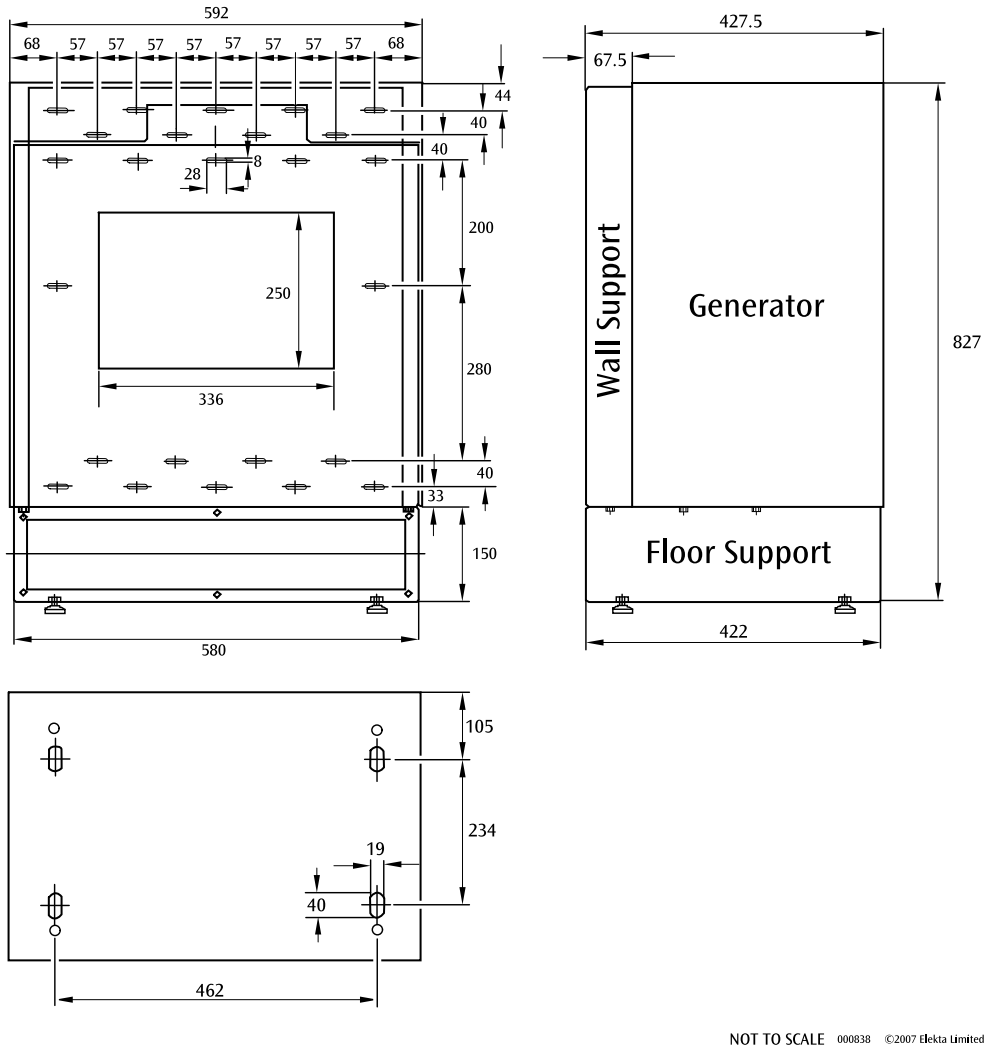

Figure 6.10 kV generator mounting plate dimensions

Ventilation conditions require to keep a minimum free distance of 150 mm from both lateral sides of the generator cabinet.

If the generator is put on the floor, a minimum of 150 mm is recommended behind the generator for airflow. When the generator is attached to the wall there is approximately 67 mm of clearance behind the generator. This is permitted, because more airflow is supplied from below the generator.

A clearance volume equivalent to that of the generator cabinet must be supplied above the generator for installation and service. Clearance is needed in front of the generator to enable the generator service door to be opened. The door is located beneath the generator cover.

The necessary clearances around the kV generator are in **Table 6.1**.

Table 6.1 Clearance around the kV generator

Free Distance (mm)					
Left Side[1]	**Right Side[1]**	**Front**	**Rear[2]**	**Top**	**Bottom**
500	500	1000	67	690	N/A

1 *Minimum distance 150 mm.*
2 *Minimum distance for floor mounting 150 mm.*

For further information about the kV generator refer to the *Pre-Installation* document from Sedecal.

6.5 HexaPOD™ evo items

For further information regarding the HexaPOD™ evo refer to *HexaPOD™ evo RT System Planning Guide (for use with Elekta Digital Accelerators)*.

7 Components in the treatment room

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7.1 About this chapter

This chapter gives information about the items in the treatment room.

The figures in this section show a suggested layout of the treatment room, and the dimensions of individual items. All dimensions given are in mm.

Figure 7.1 shows the necessary items in the treatment room.

7.2 Digital accelerator items

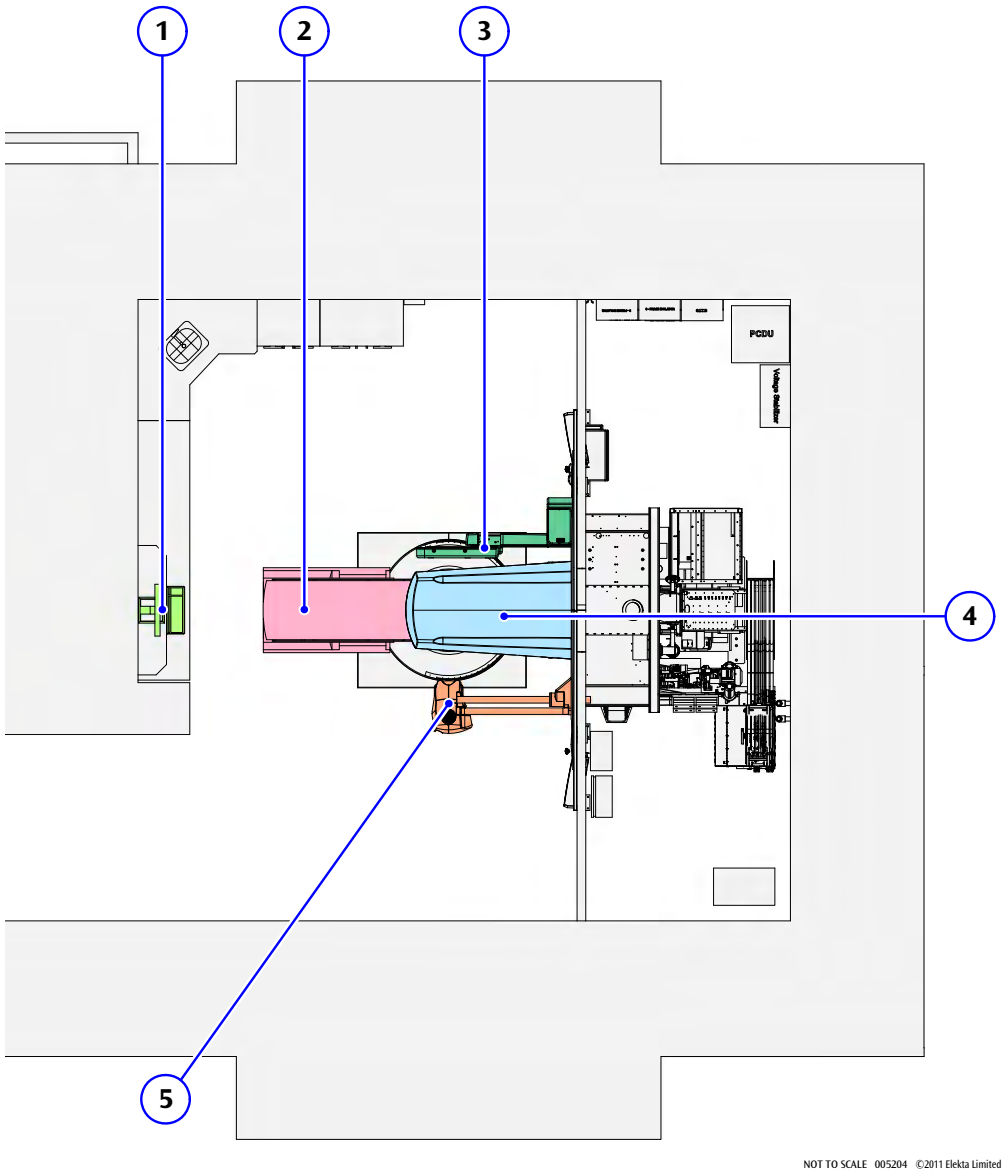

Figure 7.1 Treatment room items

(1) Treatment room workstation (IMKM)
(2) Precise Treatment Table
(3) XVI kV detector arm
(4) Gantry arm and BLD
(5) XVI kV source arm

7.3 Precise Treatment Table™ items

The Precise Treatment Table™ is compatible with tabletops from Elekta and third-party vendors. For specific and up-to-date information contact the local Elekta representative.

7.3.1 Movement ranges and swept area

Figure 7.2 shows the movement range and the area swept by the treatment table.

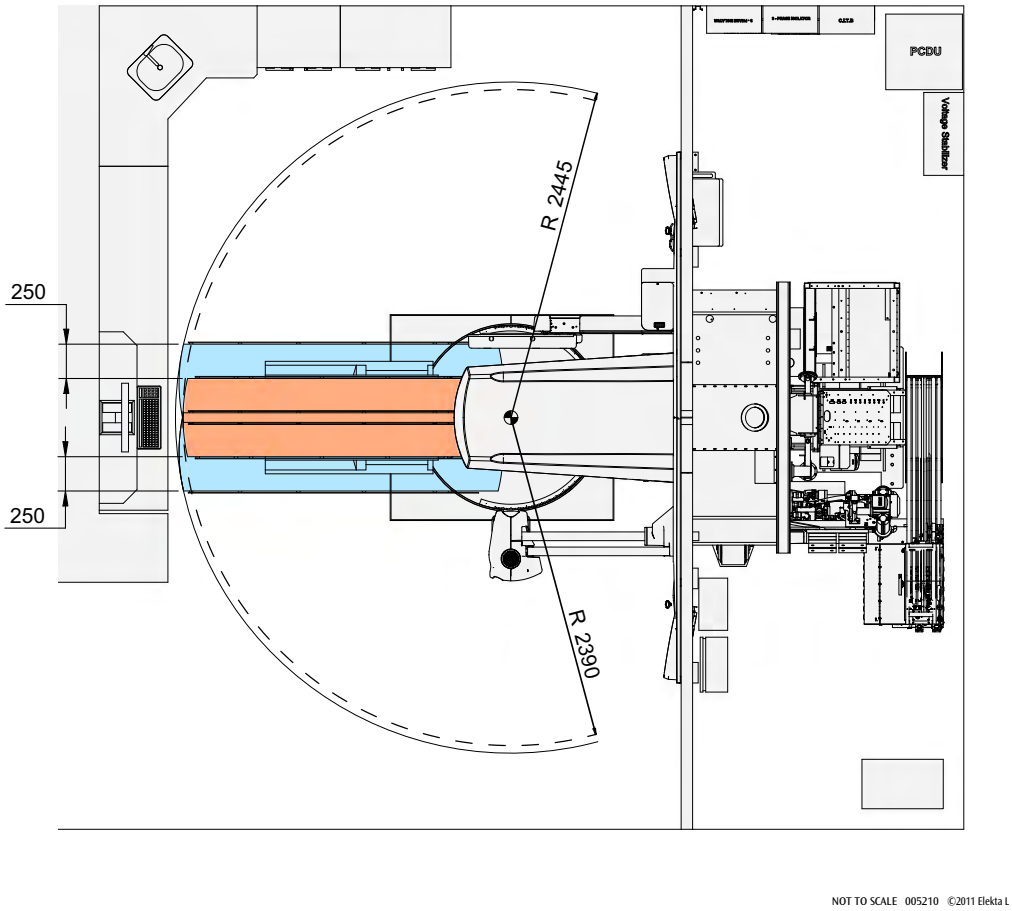

Figure 7.2 Movement range and swept area of the treatment table

Lateral offset of the treatment tabletop	±250 mm
Rotation of the support column	±180°
Isocentric rotation of the turntable	±100° ±5°
Swept radius with tabletop fully extended and laterally centered	2390 mm
Swept radius with tabletop fully extended and fully offset laterally	2445 mm

7.4 iViewGT™ and XVI items

7.4.1 Movement ranges

Figure 7.3 shows the movement range of the XVI kV source arm and XVI kV detector arm. The same dimensions are applicable for the iViewGT™ MV detector arm.

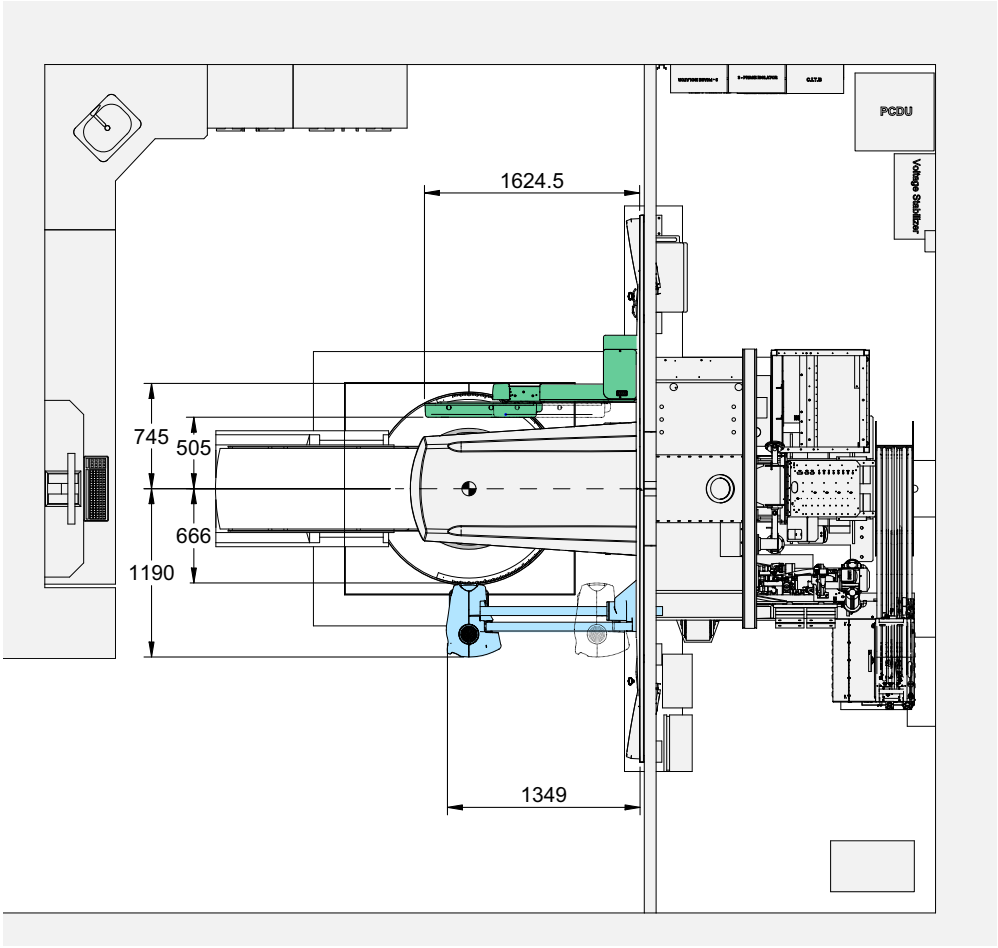

Figure 7.3 Movement range of XVI kV source arm and XVI MV detector arm

7.5 Laser alignment system

The laser alignment system is an optional peripheral. It shows the position of the isocenter of the digital accelerator.

7.5.1 Location of the lasers

The system will have three lasers installed on the walls of the treatment room. An optional a fourth laser is attached on the ceiling or I-section girder of the treatment room. This is shown as item **2** in **Figure 7.4**.

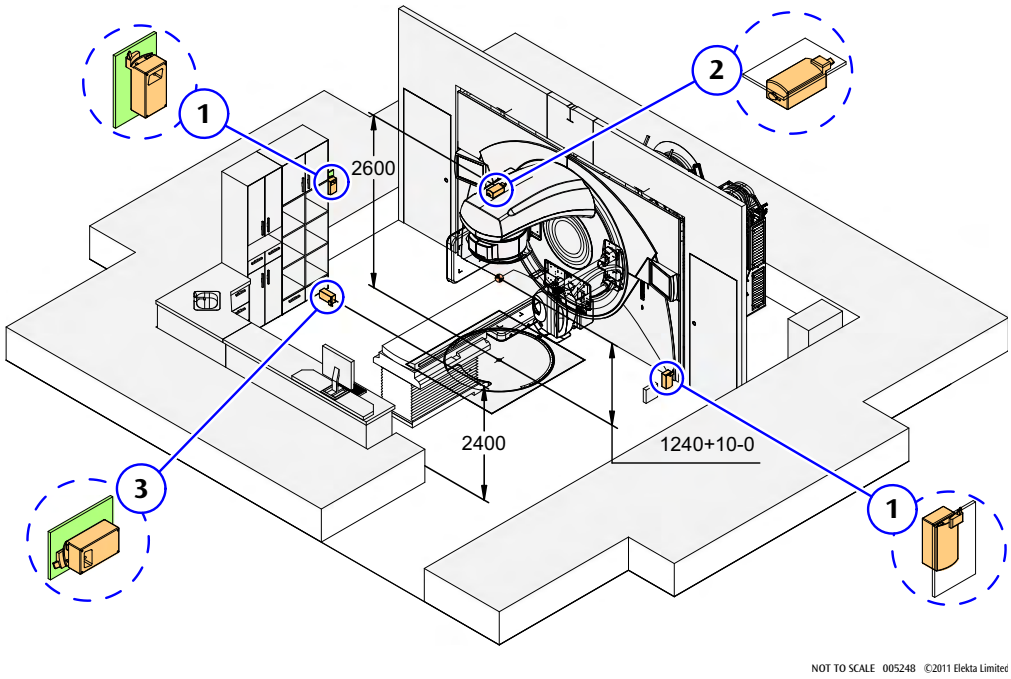

Figure 7.4 Location of lasers in the treatment room

(1) Wall laser (×2)
(2) Ceiling laser (optional)
(3) Sagittal laser

The lasers supplied by Elekta are made by LAP. Further technical information can be found at **www.lap-laser.com**.

7.5.2 Laser wall holes

For protection, lasers are installed in spaces in the treatment room wall. The holes must have metal plates (usually steel) at the rear to supply attenuation by the decreased depth of concrete in the wall.

Figure 7.5 to **Figure 7.7** show the recommended dimensions (in mm) of the hole for a LAP laser.

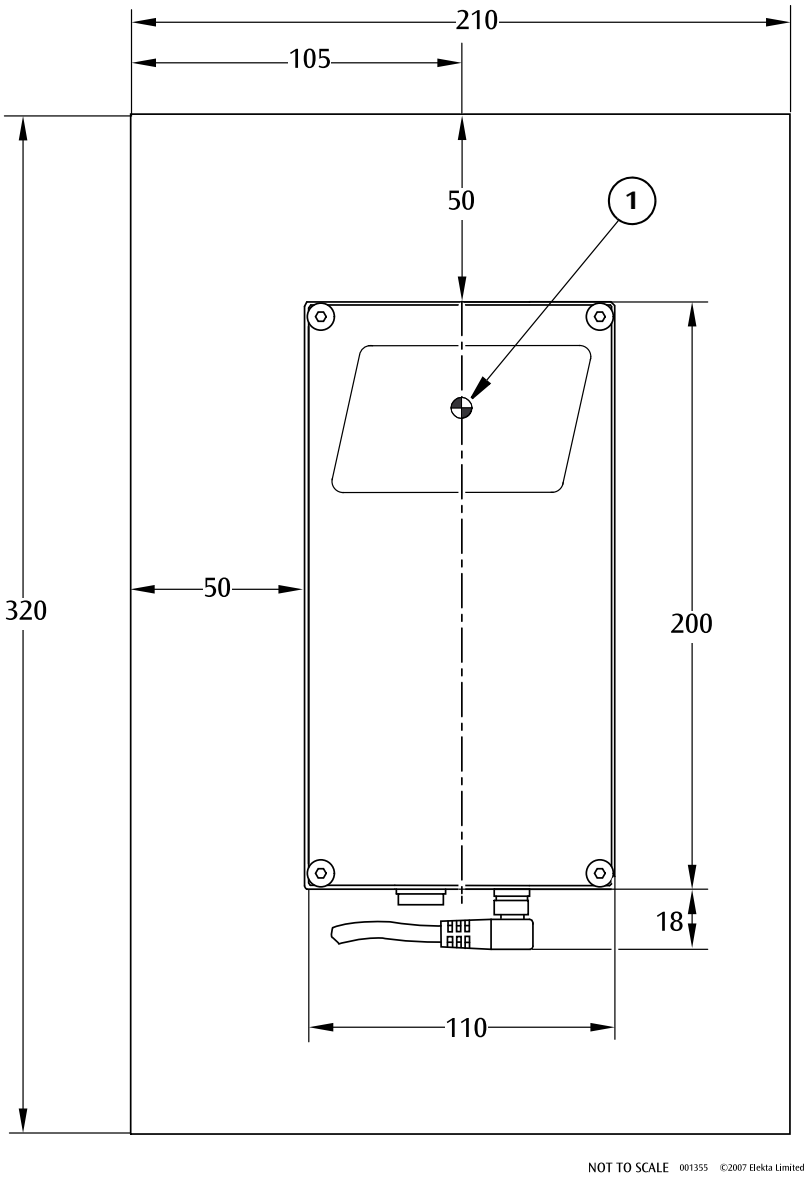

Figure 7.5 LAP laser hole dimensions (elevation view)

(1) Isocenter axis

The sagittal laser is installed horizontally, as shown in **Figure 7.4**.

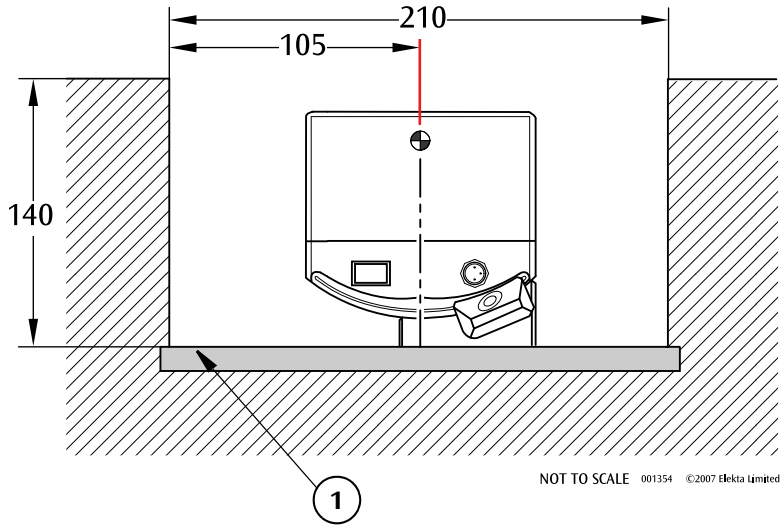

Figure 7.6 LAP laser hole dimensions (plan view)

(1) Metal shielding plate

Figure 7.7 shows the recommended dimensions of the hole for a tilted LAP laser.

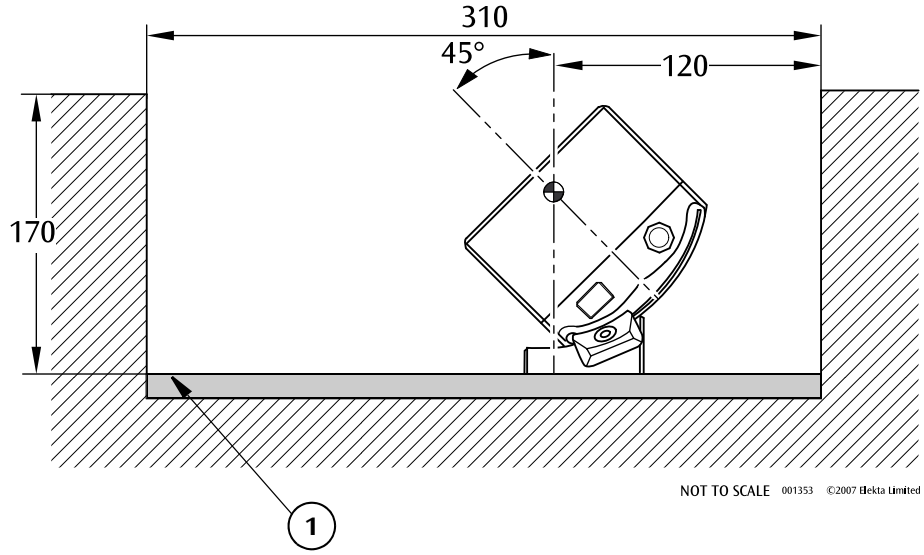

Figure 7.7 Tilted LAP laser hole dimensions (plan view)

(1) Metal shielding plate

The lasers are installed and aligned to isocenter after the digital accelerator has been installed. To allow for maximum movement during the adjustment of the laser, the mains input sockets should be located outside the laser cavity. If the socket is placed inside the cavity, allowance should be made for any physical adjustments.

Figure 7.8 shows a LAP laser installed without a cavity, making it susceptible to damage.

Figure 7.8 LAP laser without cavity (not recommended)

7.6 Optional items and accessories

7.6.1 In-room monitor, keyboard, and mouse (IMKM)

The in-room monitor, keyboard and mouse (IMKM) is located in the treatment room.

The IMKM must be installed in easy reach of an emergency stop button and in clear view of the CCTV camera. This is to make sure that clinical users can see if settings are being changed from the remote terminal.

7.6.1.1 IMKM mains isolator

The IMKM requires an isolated mains supply. The isolator is shown in **Figure 7.9**.

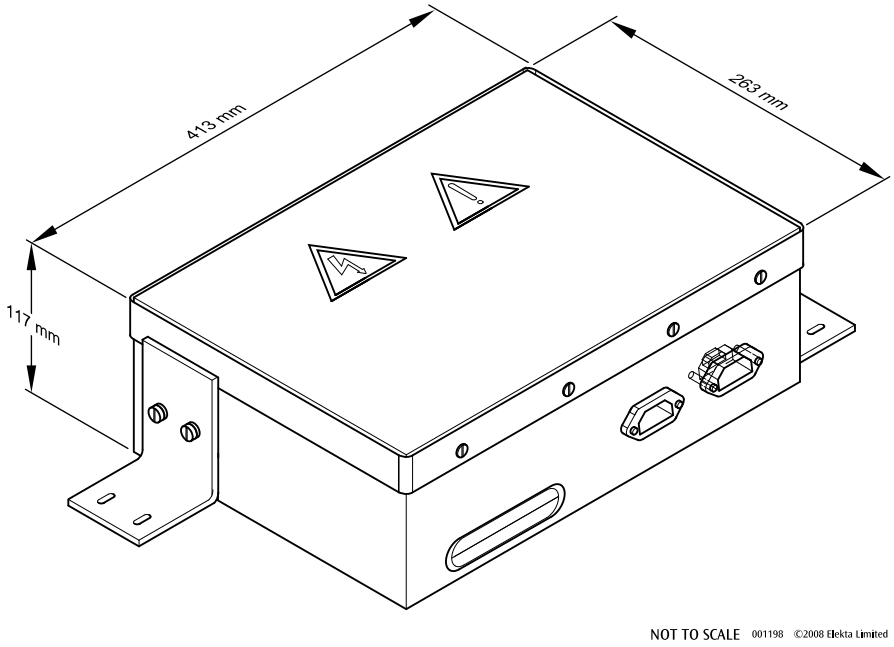

Figure 7.9 IMKM mains isolator

The IMKM mains isolator must be installed within 1.5m of the IMKM workstation.

7.6.2 Remote KVM extender

The remote KVM extender is connected to the peripherals in the treatment room. The remote extender is connected to the local extender (see **Section 8.5.1**) in the control room through a CAT5 cable.

The dimensions of the remote KVM extender are given in **Table 7.1**.

Table 7.1 Dimensions (in mm) of the remote KVM extender

Width	98 mm
Depth	138 mm
Height	29 mm

7.6.3 Accessories

Adequate space should be supplied in the treatment room for storage of accessories such as electron applicators and shadow trays. This can be in the form of shelves or cupboards.

If possible, the applicators must be kept in their vertical position, to avoid damage.

Figure 7.10 and **Figure 7.11** shows the dimensions (in mm) of the largest applicator and a shadow tray.

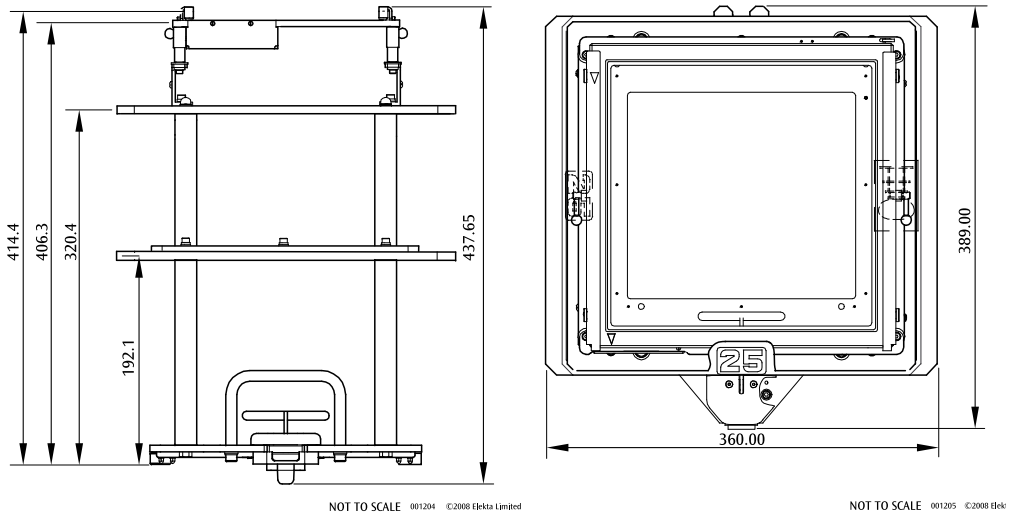

Figure 7.10 25 cm x 25 cm electron applicator

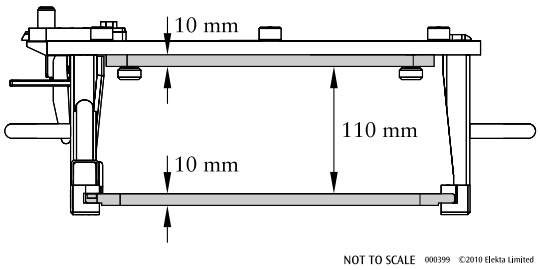

Figure 7.11 Shadow tray

7.6.4 CCTV

Because of local rules, it could be necessary to have real time audio-visual patient monitoring in the control room. In this instance the treatment room must be equipped with an intercom and a closed circuit television system (CCTV).

7.7 HexaPOD™ evo items

For further information regarding the HexaPOD™ evo items, refer to *HexaPOD™ evo RT System Planning Guide (for use with Elekta Digital Accelerators)*.

8 Components in the Control Room

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8.1 About this chapter

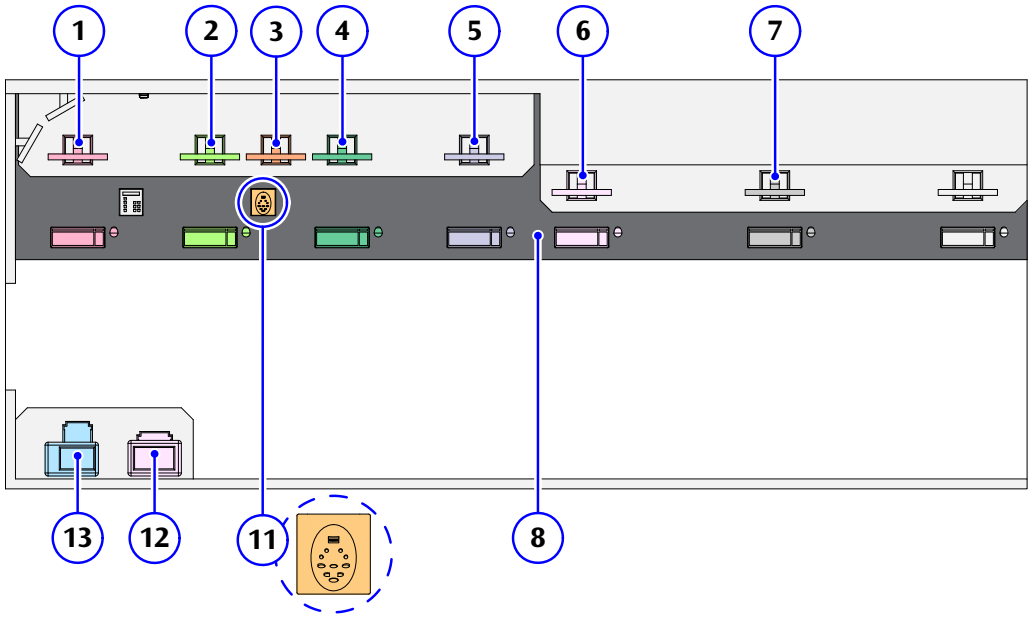
This chapter give information about the items in the control room.

The figures in this section show a suggested layout of the control room, and the dimensions of individual items. All dimensions given are in mm.

When planning the control room always follow local regulations for display screen equipment. Ensure that the control room layout follows local guidelines for ergonomics.

Many of the control room items, such as keyboards and monitors, are locally purchased items. These items are known as procurement radiotherapy (PRT) items. Elekta writes a specification for each PRT. Contact your local Elekta representative for information.

8.2 Control room items



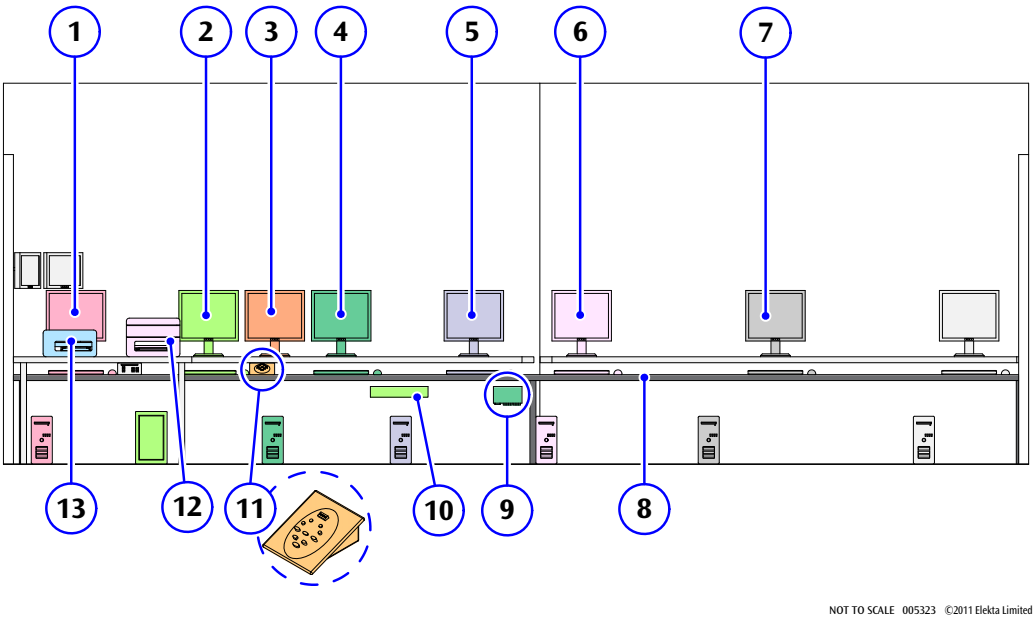


Figure 8.1 Control room items

(1) MOSAIQ®/SYNERGISTIQ™ workstation
(2) Radiotherapy workstation
(3) Additional radiotherapy workstation monitor[1]
(4) iViewGT™ workstation
(5) XVI workstation[1]
(6) iGUIDE® workstation[1]
(7) Apex™ workstation[1]
(8) Cable duct from treatment room
(9) Service terminal box
(10) Mains distribution unit (MDU)
(11) Function keypad
(12) High quality printer[1]
(13) Daily record printer

1 Optional.

8.3 Control desk

The TCC and computers can be installed below the control desk, or in a dedicated server room.

If the TCC and computers are below the control desk, then there must be sufficient space for them.

There must also be space for cooling and maintenance of the TCC and computers.

The space necessary will depend on the options purchased by the client.

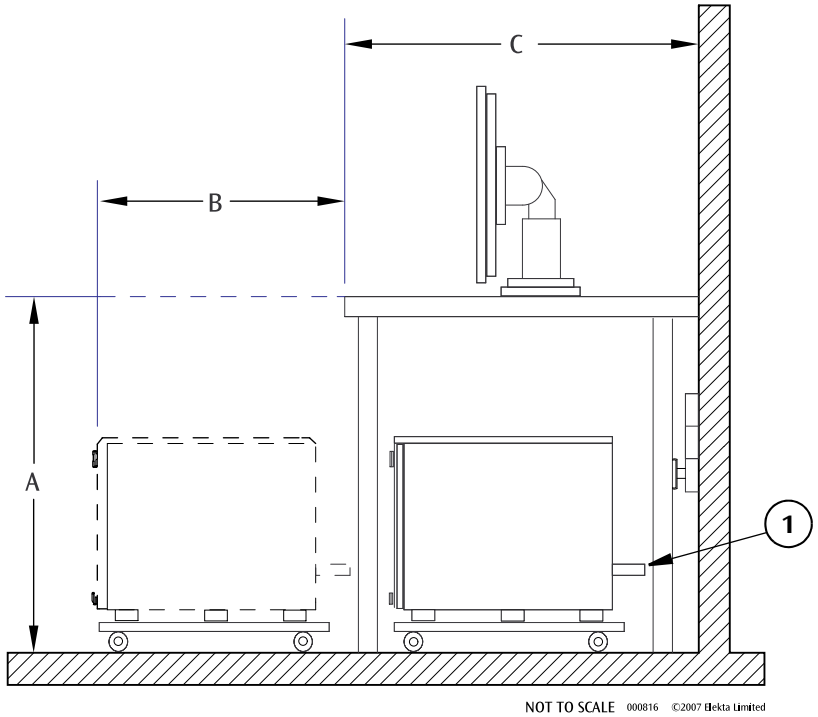


Figure 8.2 Control desk (side view)

A Minimum 720 mm (minimum 710 mm under desk)
B Minimum 700 mm
C Minimum 900 mm
(1) 110 mm clearance required for cables

Access holes in the desk of 80 mm in diameter will be necessary, for routing of connectors and cables.

Panels on some desks and tables can prevent access to the cable tray, tie tray, and other electrical items. If necessary, some equipment can be attached to these panels.

8.4 Server room

The TCC and other computers can be installed in a server room. This will give lower noise, less heat and more space below the control desk.

The server room can be in the control room, or it can be in a different room near the control room. There must be space around the TCC and computers for cooling and maintenance.

The distance from the TCC to the control desk is dependent on the TCS version.

The distance from the other computers to the control desk will depend on the connection.

Table 8.1 Integrity™ R1.x server room to control room cable length

From	To	Maximum length (m)
Integrity™ R1.x TCS and earlier	Radiotherapy workstation	15.0[1]
iViewGT™ control cabinet	iViewGT™ workstation	15.0[1]
XVI control cabinet	XVI workstation	15.0[1]
MOSAIQ®/SYNERGISTIQ™ computer	MOSAIQ®/SYNERGISTIQ™ workstation	15.0[1]
Apex™ computer	Apex™ workstation	15.0[1]
iGUIDE® SwitchBox	iGUIDE® workstation	15.0[1]

1 *KVM extender kits must be used. Without KVM extender kits, the distance between the computers and the workstations must be no more than 1.5 m.*

Table 8.2 Integrity™ R3.x server room to control room cable length

From	To	Maximum Length (m)
Integrity™ R3.x TCS and later	Radiotherapy workstation	30.0[1]
iViewGT™ control cabinet	iViewGT™ workstation	15.0[2]
XVI control cabinet	XVI workstation	15.0[2]
MOSAIQ®/SYNERGISTIQ™ computer	MOSAIQ®/SYNERGISTIQ™ workstation	30.0[1]
Apex™ computer	Apex™ workstation	15.0[2]
iGUIDE® SwitchBox	iGUIDE® workstation	15.0[2]

1 *KVM extender kits are included with Integrity™ R3.0 TCS.*
2 *KVM extender kits must be used. Without KVM extender kits, the distance between the computers and the workstations must be no more than 1.5 m.*

8.4.1 Integrity™ R1.*x* TCS

Figure 8.3 shows a server room for the Integrity™ R1.*x* and earlier TCS.

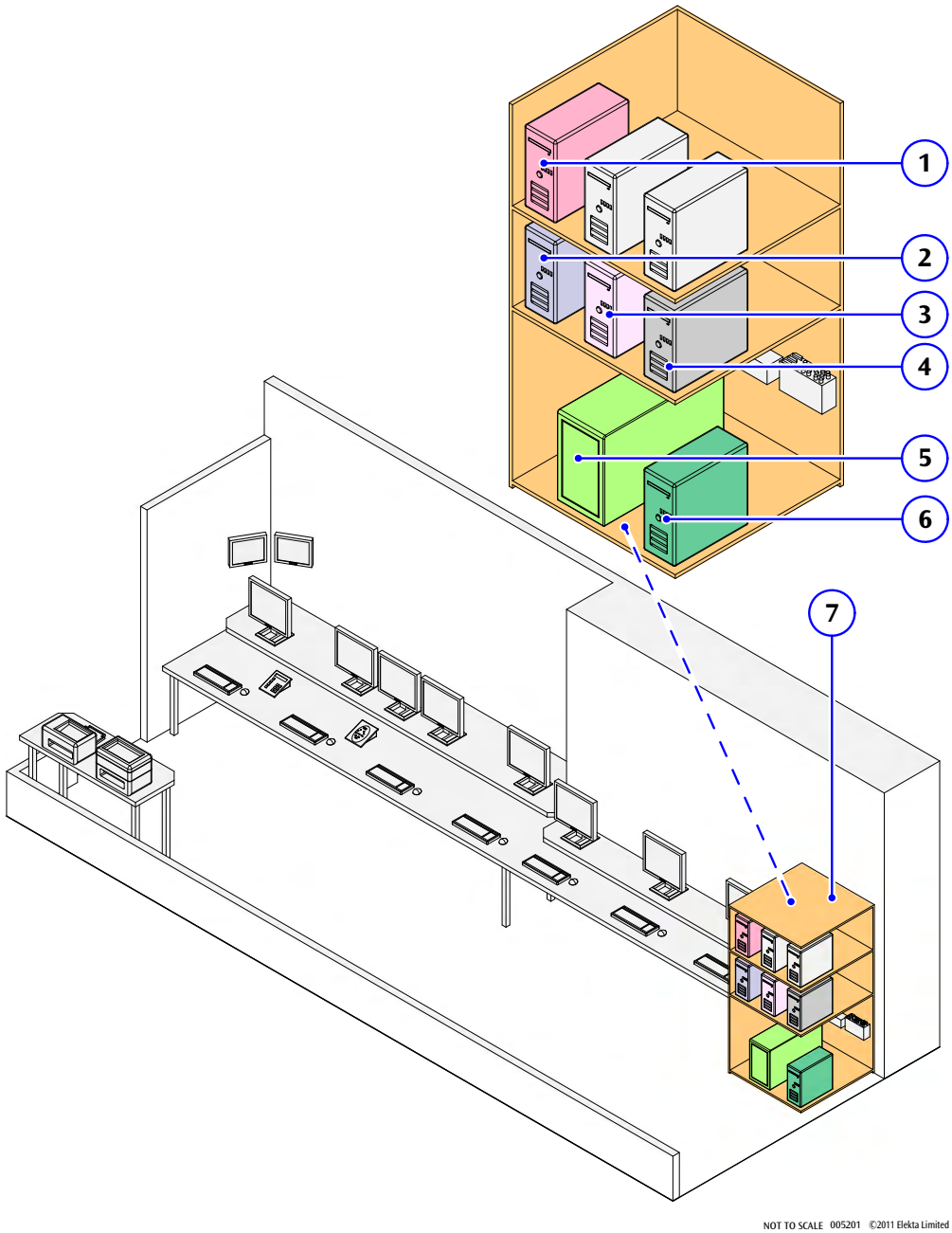


Figure 8.3 Server room parts for Integrity™ R1.x and earlier

(1) MOSAIQ®/SYNERGISTIQ™ computer[1]
(2) XVI control cabinet[1]
(3) iGUIDE® computer[1]
(4) Apex™ computer[1]
(5) Integrity™ R1.*x* TCC
(6) iViewGT™ control cabinet
(7) Server room

1 Optional.

8.4.2 Integrity™ R3.x TCS

Figure 8.4 shows a server room for the Integrity™ R3.x TCS.

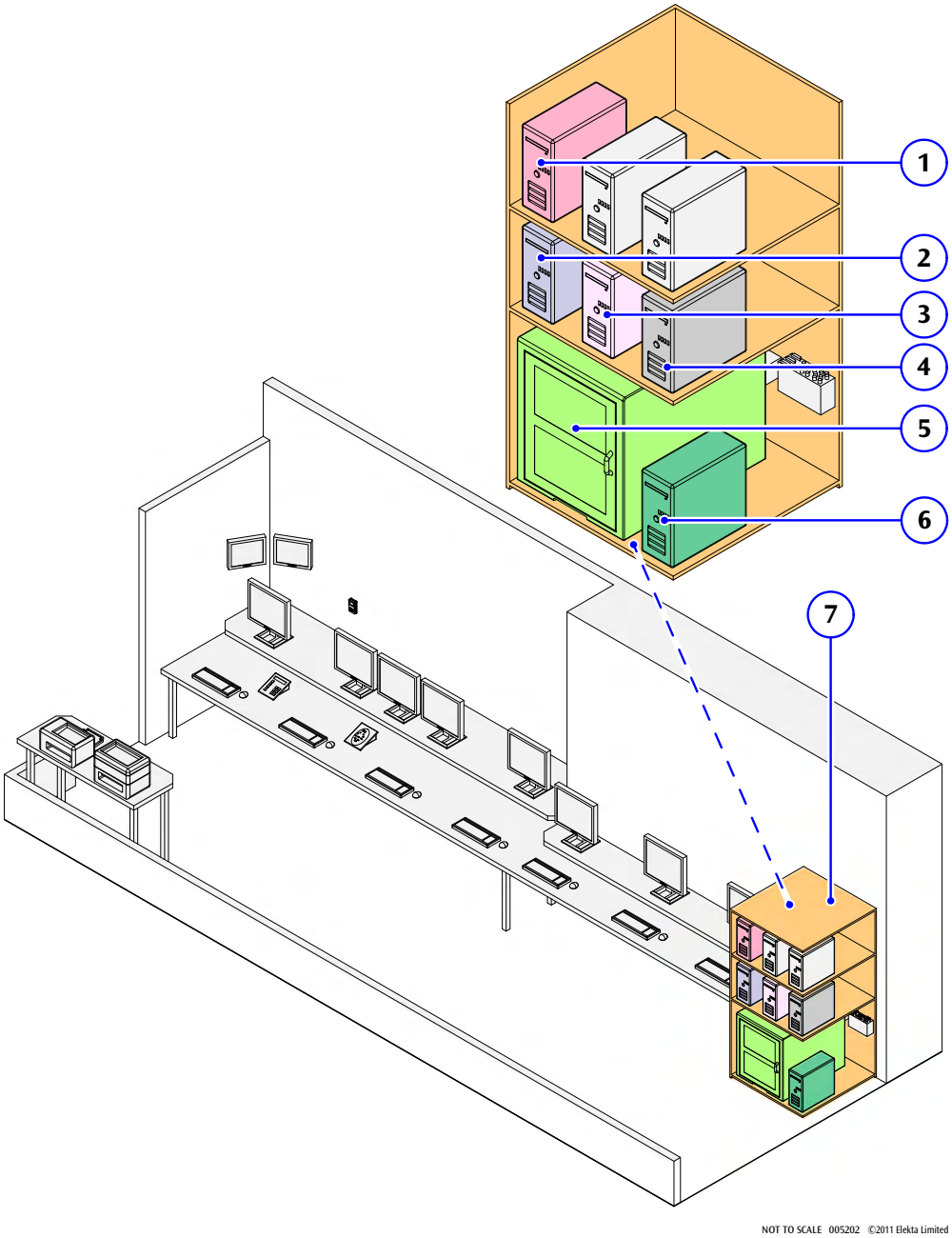


Figure 8.4 Server area parts for Integrity™ R3.0

(1) MOSAIQ®/SYNERGISTIQ™ computer[1]
(2) XVI control cabinet[2]
(3) iGUIDE® computer[2]
(4) Apex™ computer[2]
(5) Integrity™ R3.x TCC
(6) iViewGT™ control cabinet
(7) Server room

1 *If MOSAIQ®/SYNERGISTIQ™ computer not installed in TCC*
2 *Optional.*

8.5 Digital accelerator and treatment control system items

8.5.1 Integrity™ R1.*x* and earlier treatment control cabinet

The Integrity™ R1.*x* and earlier treatment control system controls the digital accelerator with MLCi2 or Beam Modulator™ BLD.

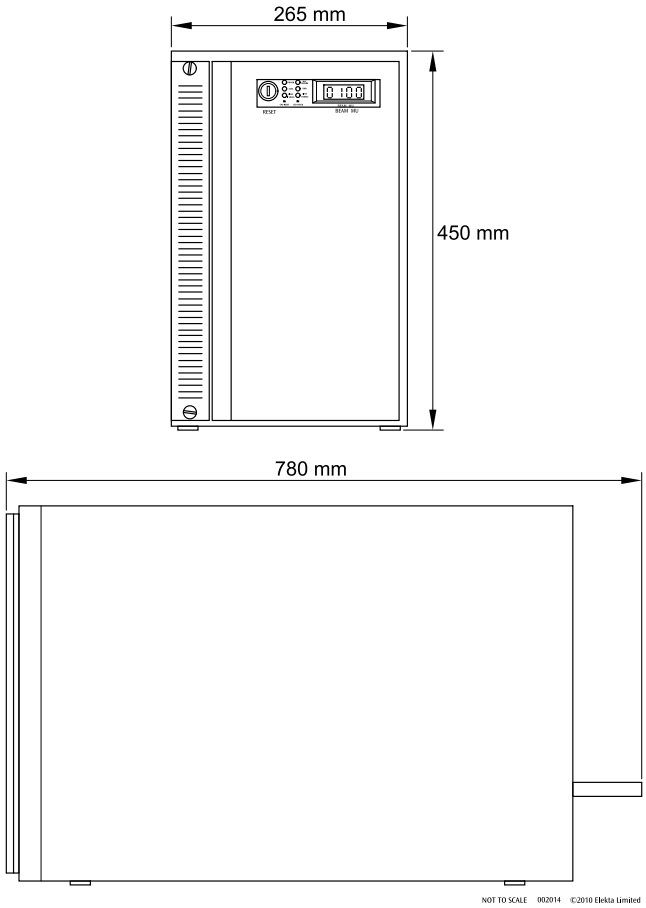


Figure 8.5 Dimensions of the Integrity™ R1.x treatment control cabinet

It is recommended to place the treatment control cabinet on a raised platform to prevent dust and fluids entering the chassis.

8.5.2 Integrity™ R3.x treatment control cabinet

The Integrity™ R3.x and later treatment control system controls the digital accelerator with Agility™ BLD.

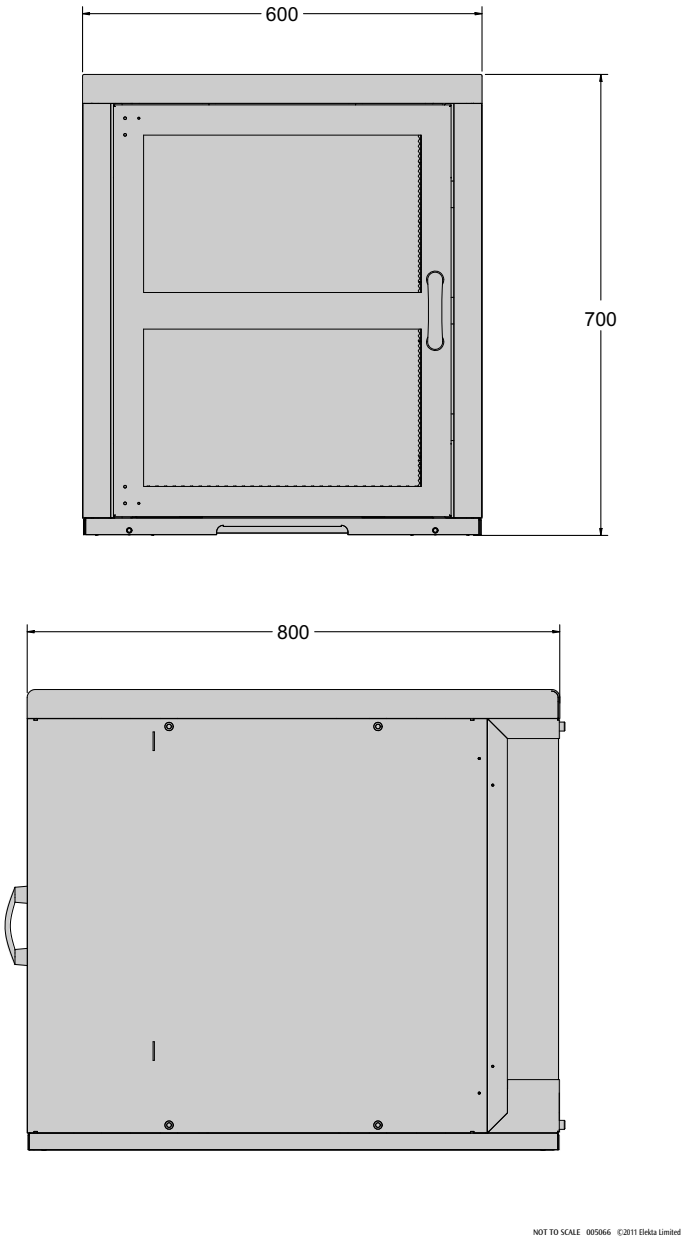


Figure 8.6 Dimensions of the Integrity™ R3.x treatment control cabinet

8.5.3 Function keypad (FKP)

The FKP is for control of the digital accelerator, treatment table, iViewGT™ detector arm, and XVI. It is installed on the control desk near to the radiotherapy workstation.

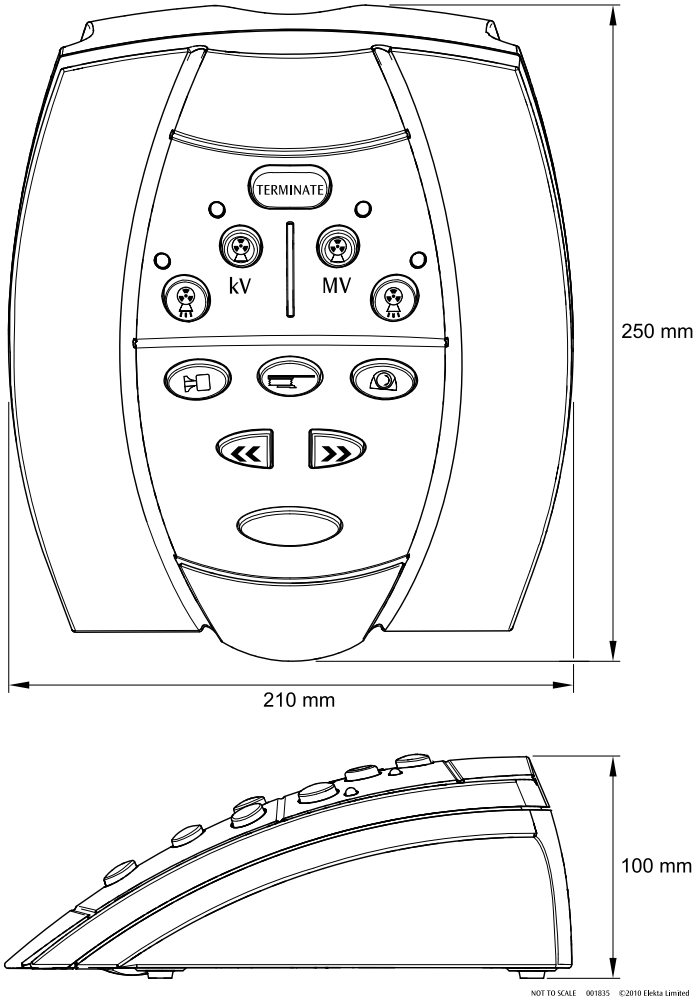


Figure 8.7 Dimensions of the function key pad

The FKP uses a 37-way D-type connector and a hole of 80 mm diameter in the control desk is necessary.

8.5.4 Beam monitor unit display module (BMDM)

The beam monitor unit dispaly module (BMDM) is used with the Integrity™ R3.x treatment control system.

It is placed on the control desk or can be attached to a wall near to the radiotherapy workstation.

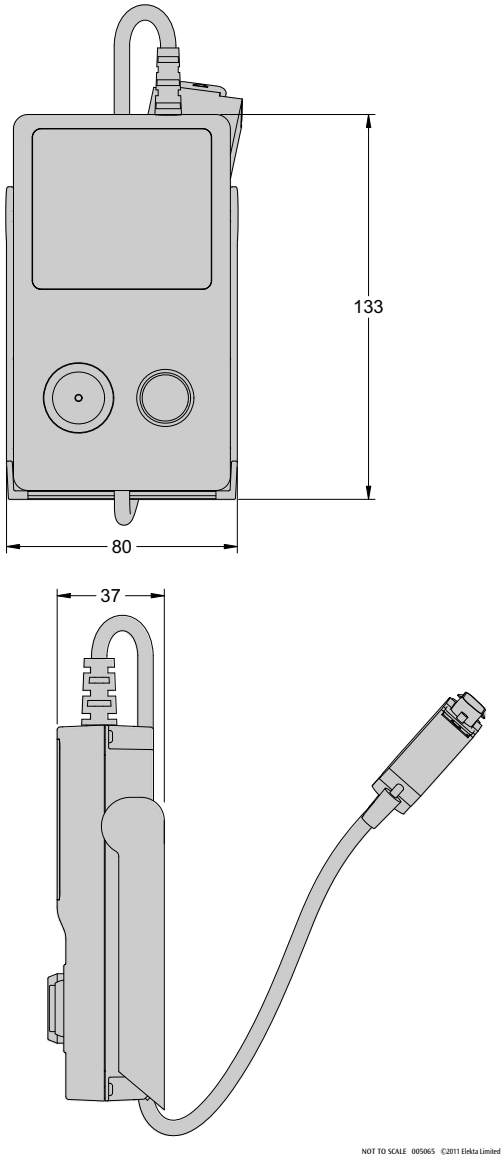


Figure 8.8 Dimensions of the Integrity™ R3.0 BMDM

8.5.5 Mains distribution unit

The power supply for many Elekta components in the control room is the mains distribution unit. There should be sufficient space for the mains distribution unit.

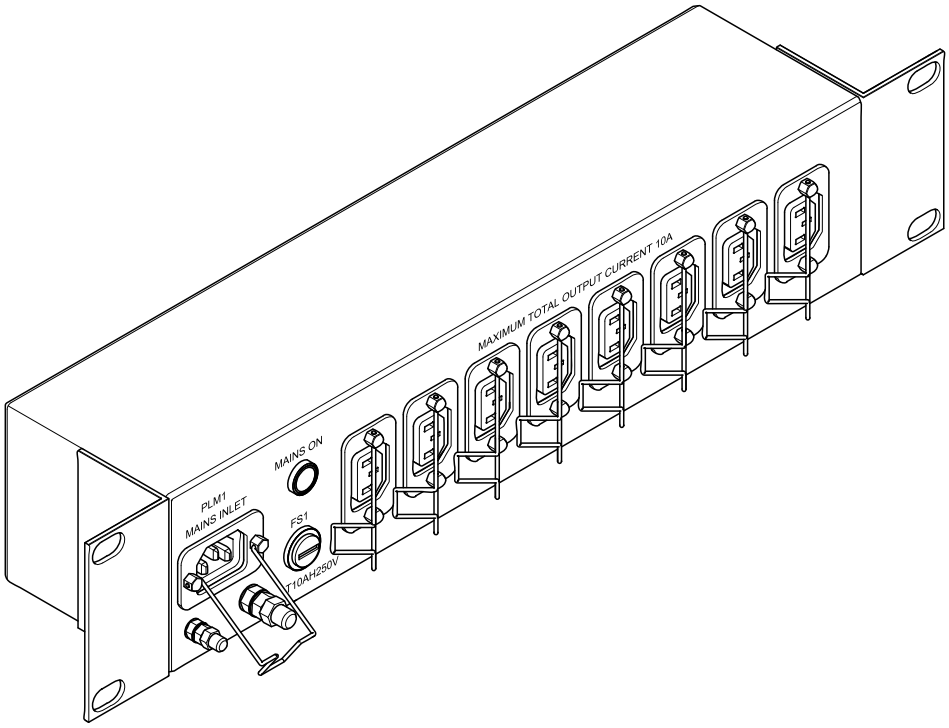


Figure 8.9 Mains distribution unit

Width	485 mm
Depth	90 mm
Height	90 mm

8.5.6 Service terminal box

The service terminal box allows the service engineer to monitor the digital accelerator performance.

Cables exit from the rear of the unit and go to the equipment room through the ducts

There should be sufficient space for the service terminal box.

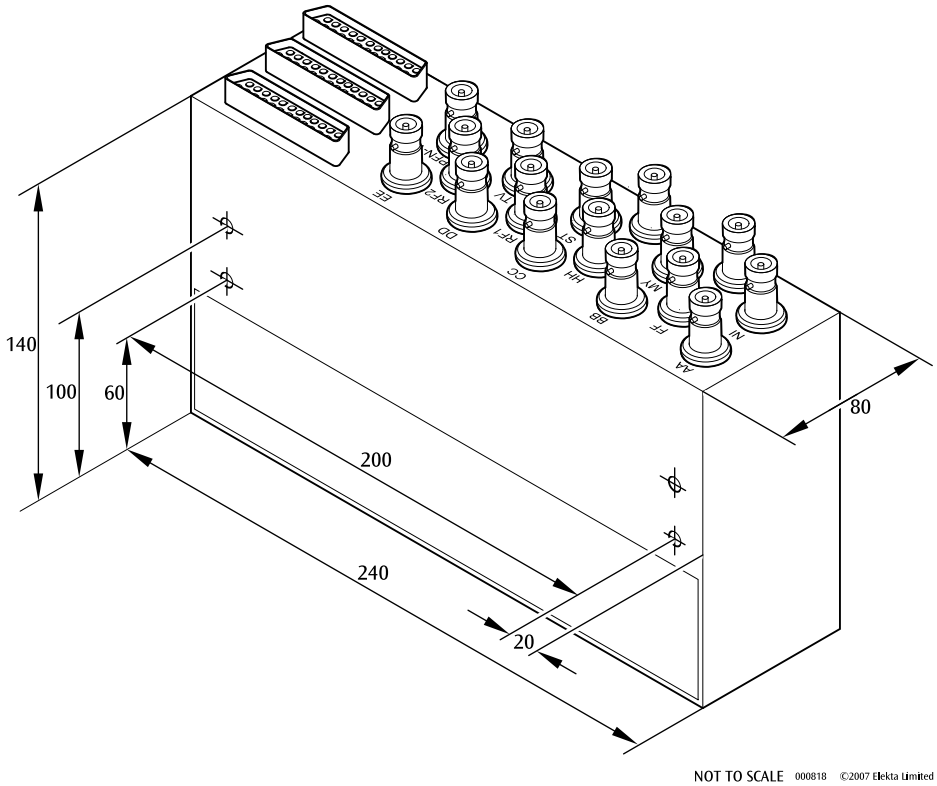


Figure 8.10 Dimensions of the service terminal box

8.5.7 Cable tray

The cable tray is used to hold connected cables.

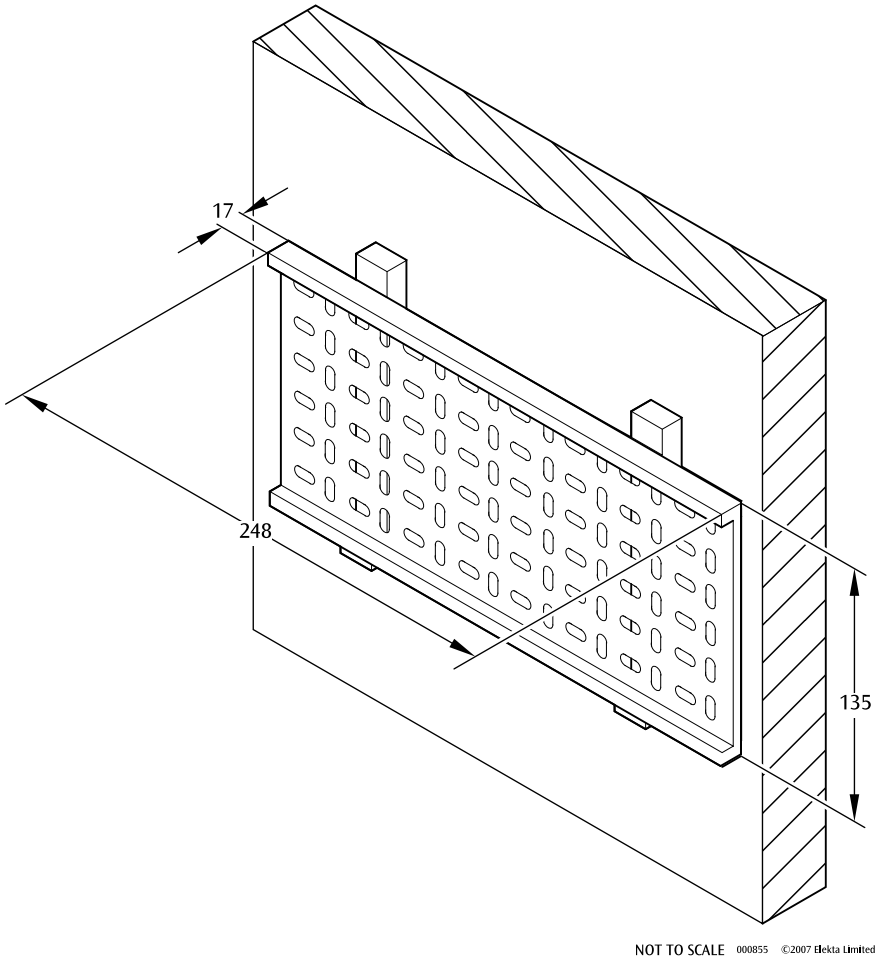


Figure 8.11 Dimensions of the peripheral cable tray

8.5.8 VGA line driver

The VGA extender, or line driver, connects the TCC to the treatment room monitors through a CAT5 cable.

The line driver is powered by the TCC.

There should be sufficient space to connect a line driver to the treatment control cabinet. If XVI is installed, there should be sufficient space to connect a line driver to the XVI control cabinet.

Different types of VGA line driver are used for different TCS versions. **Figure 8.12** shows the line driver used for Integrity™ R1.*x* TCS.

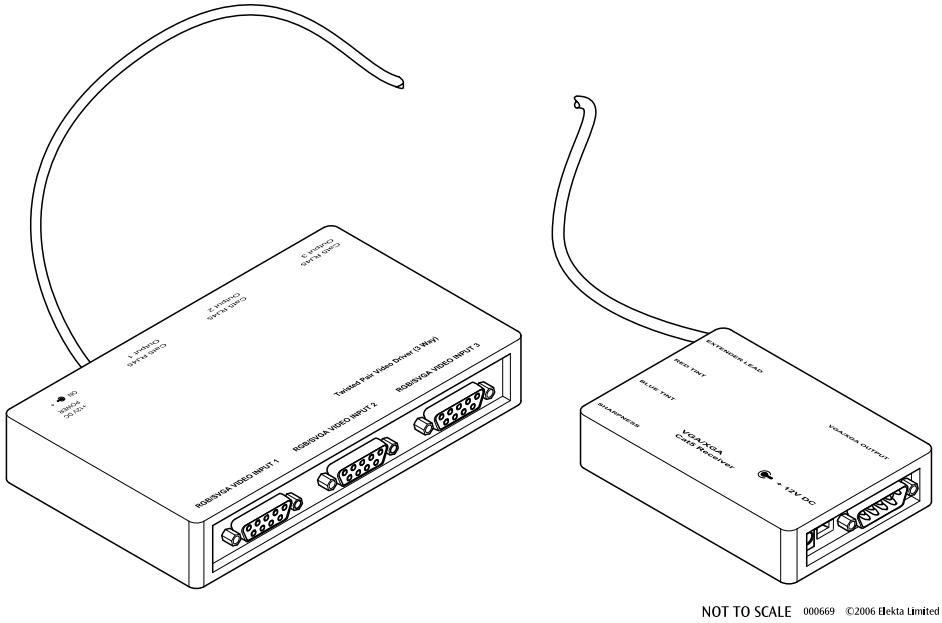


Figure 8.12 Line driver

Width	170 mm
Depth	100 mm
Height	30 mm

8.5.9 KVM extender

The KVM extender connects a computer to a remote workstation through a CAT5 cable.

The KVM extender can be connected to the TCC, iViewGT™ computer, XVI computer, iGUIDE® computer, and the MOSAIQ®/SYNERGISTIQ™ computer.

The local KVM extender is connected to the TCC in the control room. The extender transmits signals through a CAT5 cable to the remote KVM extender, which is located in the treatment room.

The dimensions of a KVM extender are given in **Table 8.3**.

Table 8.3 Dimensions of the KVM extender

Width	120 mm
Depth	110 mm
Height	29 mm

8.6 Control room optional items

8.6.1 iViewGT™ control cabinet

The iViewGT™ control cabinet is put in the control room.

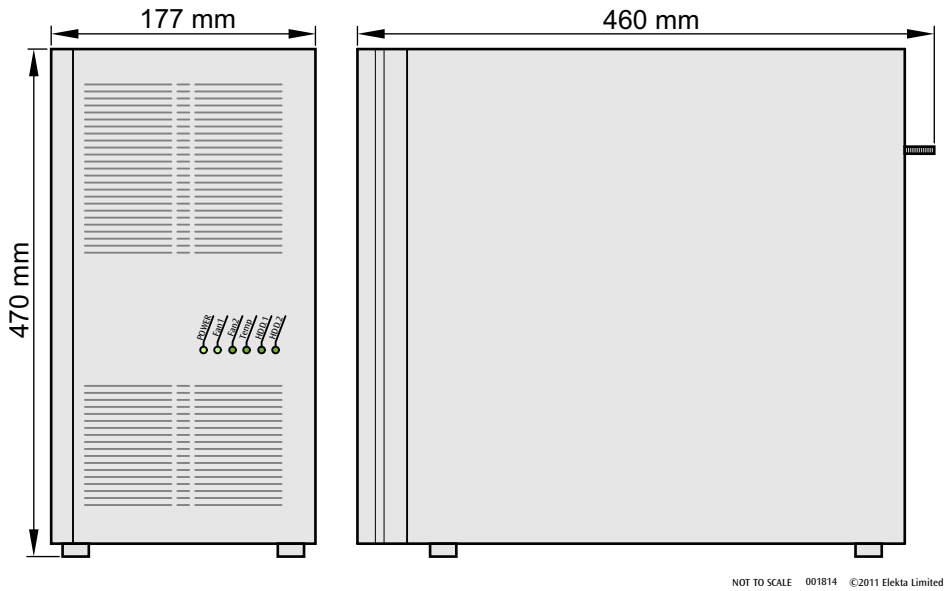


Figure 8.13 Dimensions of the iViewGT™ control cabinet

There must be sufficient space for the iViewGT™ control cabinet and its peripherals.

It is recommended to put the iViewGT™ control cabinet above ground level for protection from unwanted material and spilled fluids.

8.6.2 XVI control cabinet

The XVI control cabinet is put in the control room.

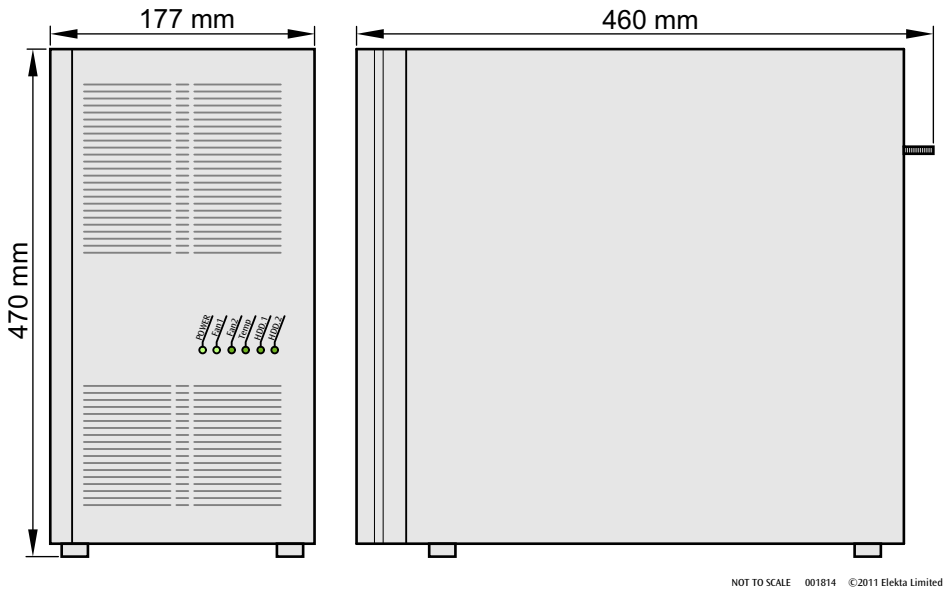


Figure 8.14 Dimensions of the XVI control cabinet

There must be sufficient space for the XVI control cabinet and its peripherals.

It is recommended to put the XVI control cabinet above ground level for protection from unwanted material and spilled fluids.

8.6.3 XVI archive

The XVI archive is put near the XVI control cabinet

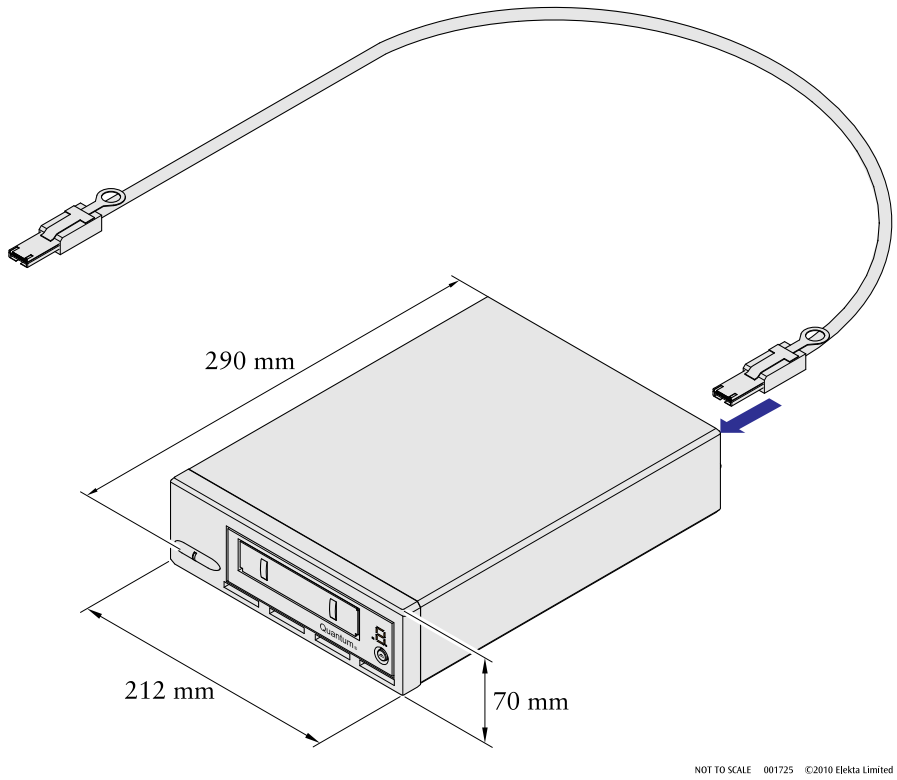


Figure 8.15 Dimensions of the XVI archive

There should be sufficient space to keep the data cartridges that the archive uses.

8.7 Other items

8.7.1 NSS

The NSS is required for the TCC.

For Integrity™ R1.x and earlier, the NSS is a separate unit. There should be sufficient space for the NSS near to, or on top of, the TCC.

For Integrity™ R3.x and later the NSS is part of the TCC.

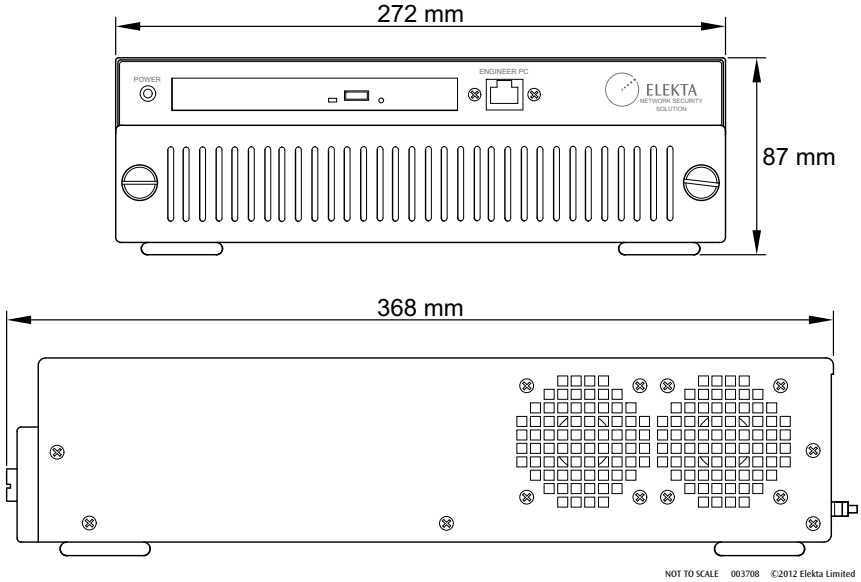


Figure 8.16 Dimensions of the NSS for Integrity™ R1.x and earlier

8.7.2 UPS

A UPS is necessary for the TCC.

For Integrity™ R1.*x* and earlier, the UPS is a separate unit. There should be sufficient space for the UPS near to the TCC.

For Integrity™ R3.x and later the UPS is part of the TCC.

8.7.3 Elekta IntelliMax™

Elekta IntelliMax™ is a suite of services for the remote support of Elekta products.

IntelliMax™ Connect is a software program for remote desktop sharing, text-based chat, and file transfer. An IntelliMax Connect session connects two users at the same time through the internet. They are referred to as:

- The hospital-based user: the user who operates the Elekta product in a hospital. They can be a Clinical User or a Service User.
- Elekta IntelliMax™ support user: an Elekta approved user who can give support for one or more Elekta products. They are not at the hospital.

IntelliMax Connect can only be run from the Elekta product. This is to make sure that the hospital-based user is in front of the Elekta product during the session.

IntelliMax Agent is a software program that is installed on a dedicated computer in the medical facility. IntelliMax Agent is the only access point for IntelliMax Connect sessions from supported Elekta products out of the hospital network. IntelliMax Agent collects machine data from supported Elekta products, which it sends to IntelliMax Enterprise on a secure internet connection. IntelliMax Agent does not collect patient data.

IntelliMax Enterprise is used for the analysis of data collected by IntelliMax Agent, and is also used to administer IntelliMax Connect sessions to connected Elekta products. Approved users can get access to IntelliMax Enterprise through a web-based interface.

8.7.3.1 IntelliMax Agent with the digital accelerator

IntelliMax Agent is installed on the NSS.

For Integrity™ R1.*x* and earlier the NSS is installed near to, or on top of, the TCC.

For Integrity™ R3.0 and later the NSS is installed in the TCC.

If IntelliMax Agent is installed on a dedicated computer, then there should be sufficient space for the computer.

8.7.3.2 IntelliMax Agent on iViewGT™

From iViewGT™ 3.4 and later, IntelliMax Connect can be installed on the iViewGT™ control cabinet to supply remote desktop sharing for support.

8.7.4 iViewGT™ Remote viewing station (RVS)

The remote viewing station (RVS) is an optional item for iViewGT™.

The location of the workstation is site-dependent.

8.7.5 ERGO++

For more information, contact your Elekta representative.

8.8 HexaPOD™ evo items

For further information regarding the HexaPOD™ evo refer to *HexaPOD™ evo RT System Planning Guide (for use with Elekta Digital Accelerators)*.

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9 Lifting information

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9.1 About this chapter

This section gives the specifications of the lifting equipment that is necessary.

Lifting equipment will be used during installation, and for maintenance during the service life of the digital accelerator.

9.2 Lifting equipment

9.2.1 Responsibilities for lifting equipment

It is the responsibility of the client, or the construction contractors of the client, to supply the equipment necessary to lift heavy items. This equipment is usually an I-section girder or A-frame lifting device, an applicable hoist and a pallet truck. A single large A-frame or two smaller A-frames can be used for installation.

The I-section girder is permanently installed in the treatment room.The A-frame lifting device is not in the treatment room permanently.

9.2.2 Safe working load certificate

Before the installation starts, a safe working load certificate for all lifting equipment must be available to the local Elekta representative, the installation engineer, or to the local rigging crew responsible for working with the lifting equipment and tools.

It is the responsibility of the client to calibrate and do maintenance on all lifting equipment.

After the installation is complete, a safe working certificate for the installed lifting equipment and tools must be available to the hospital and Elekta by the supplier or constructor of this equipment.

9.2.3 Specification for I-section girder

If an I-section girder is installed, it must meet the requirements that follow:

- Attached to concrete ceiling parallel to and vertically above the G-T axis of the gantry drum
- A safe working load of 2200 kg (static lift of 3300 kg)
- Has a mechanically operated hoist
- Has a safety gated hook
- Can lift the hook to a height of 2.4 meters
- Has end stops if girder is open ended.

There must be a clear path for the girder and hoist to go through the treatment room fascia.

After installation, the 2200 kg SWL hoist can be replaced by a 750 kg SWL hoist for maintenance work on the machine.

Figure 9.1 shows the recommended dimensions for an I-section lifting girder.

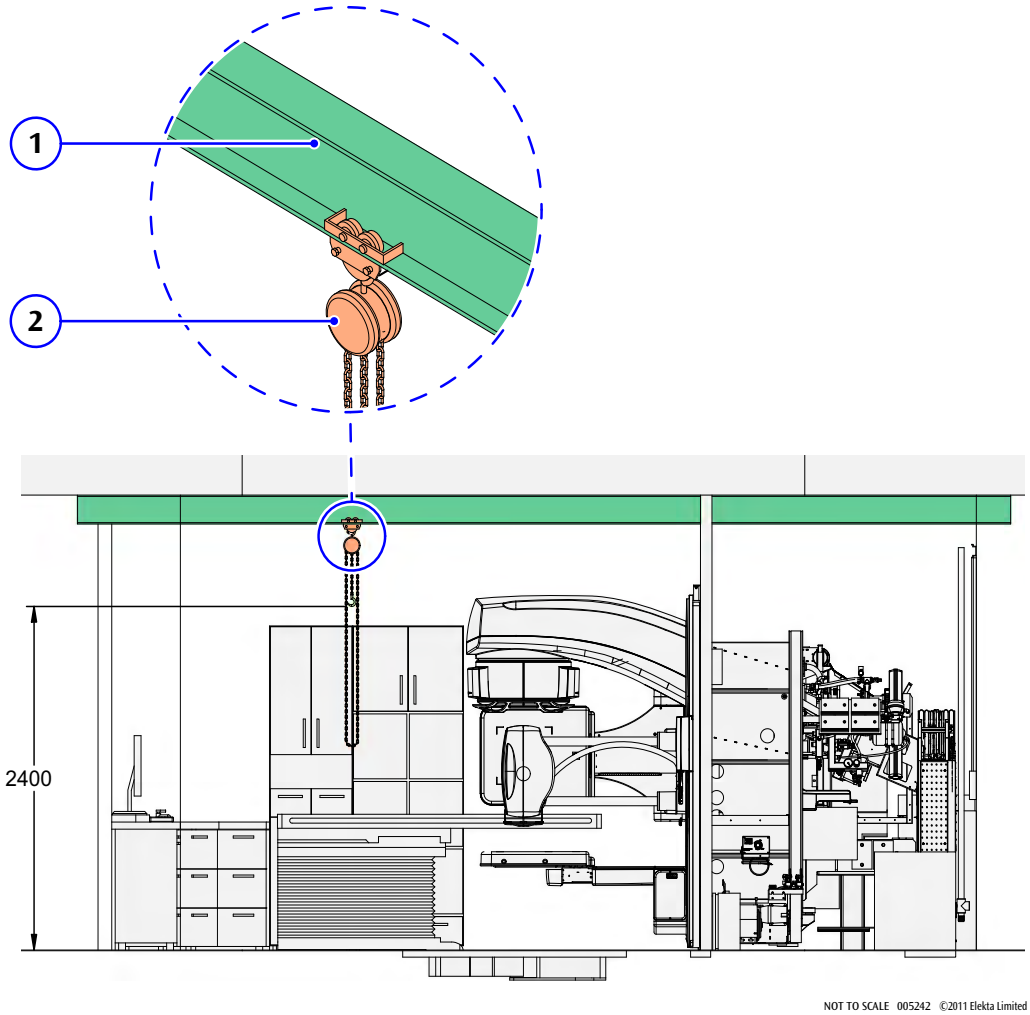

Figure 9.1 Typical I-section girder

(1) I-section girder (2) Mechanical hoist

Figure 9.2 Properly installed false ceiling with I-section girder

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