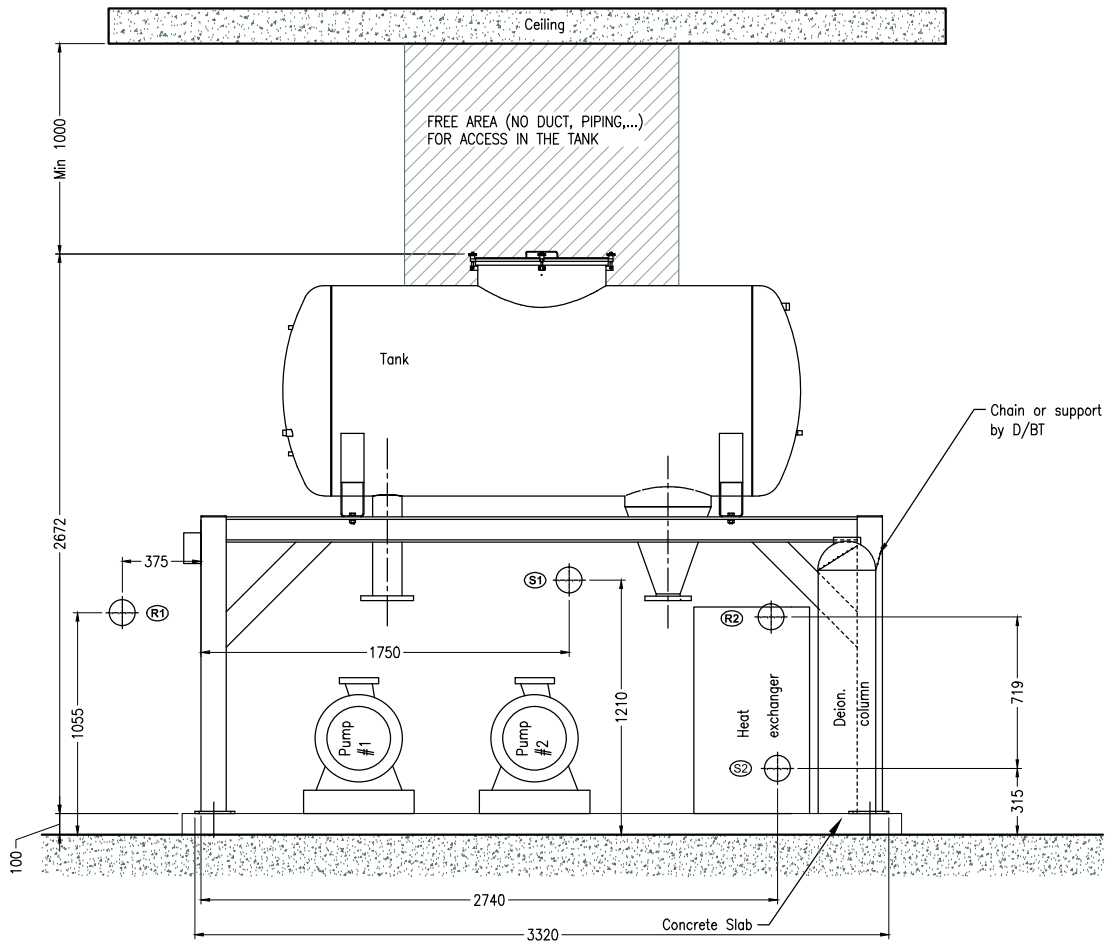
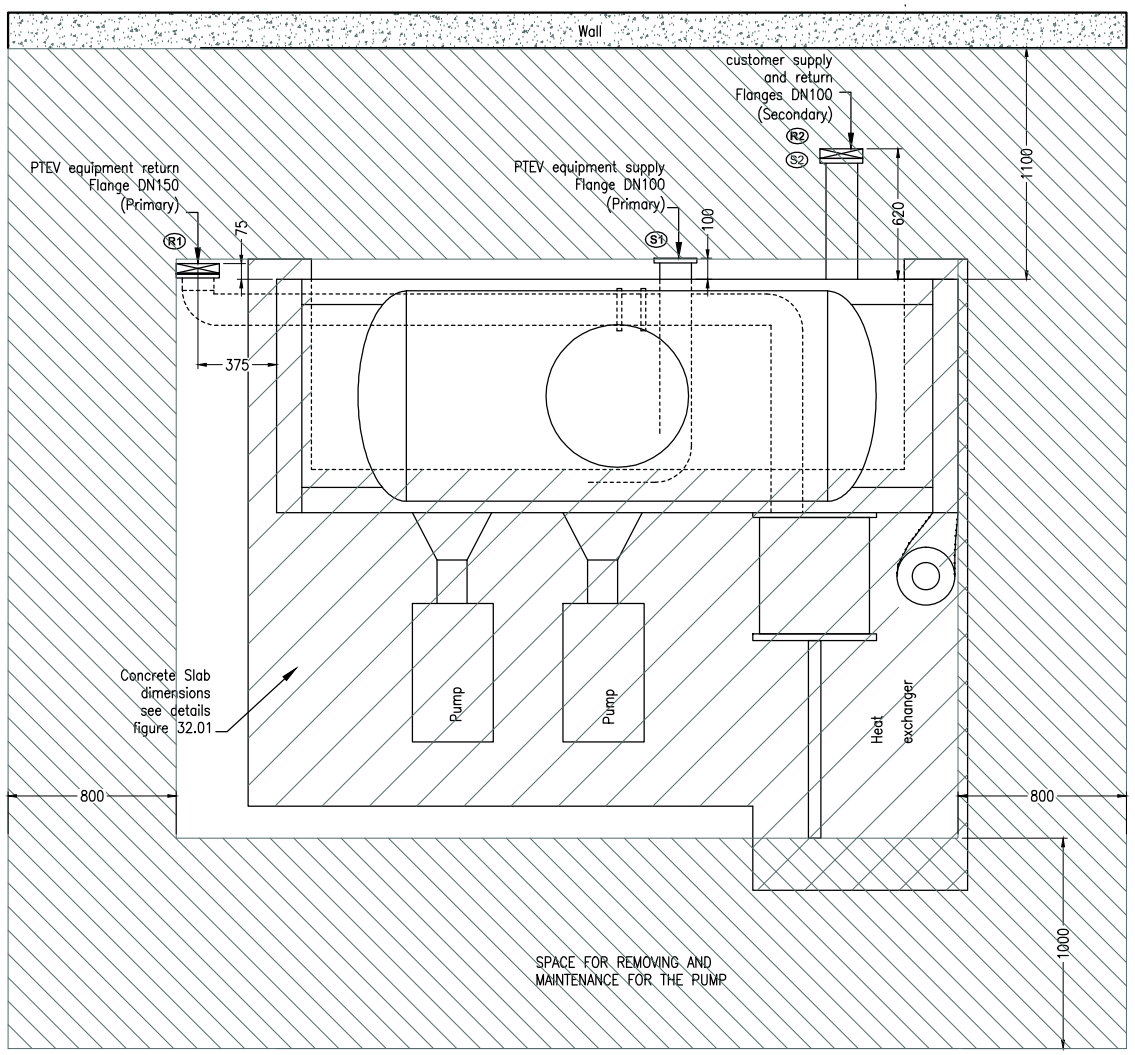




PORT	PURPOSE
R2	OUTLET SECONDARY, connected to Chiller
S2	INLET SECONDARY, connected to Chiller
R1	INLET PRIMARY, connected to Cyclotron & BTS
S1	OUTLET PRIMARY, connected to Cyclotron & BTS
R0	Drain
S0	Fill in (MakeUp)

Water conditioner weight:
- empty : 2600 kg / 5732 lb
- loaded (water): 4900 kg / 10803 lb

THIS DOCUMENT IS THE PROPERTY OF I.B.A AND SHALL NOT BE ALTERED COPIED OR COMMUNICATED WITHOUT THE WRITTEN CONSENT OF I.B.A.

S.A. ION BEAM APPLICATIONS

REV:	DATE:	MODIFICATION:	DRAFTMAN:	CHECKED BY:	VALIDATED BY:
A	30/04/15	Original issue	LCHEN	QBA	PV

MATERIAL: –
SCALE: (A3)
DIMENSIONS: mm
TOLERANCES: –

PROJECT: PROTON THERAPY

S/PROJECT: TATA HBTF MUMBAI

IV.
COOLING &
GASES

TITLE:

Cyclo, ESS, BTS
& Gantry water
conditioner #3

07.42.33.

N

51.23 A

COMPRESSED AIR

Compressed air is required to operate pneumatic actuators (for valves, beam stops), to vent parts of the PTE which are under vacuum and, finally, for the Gantry pneumatic brakes. The required compressed air outlets are indicated in Figure 51.12-1/2 (cooling Ducts in the building).

General requirements:

1. Compressed air is required in all the rooms where PTEV equipment is installed as indicated, except in the main control room and treatment control rooms. For the Power Supply Room and the Water Cooling Room the compressed air feed point shall be in a central location of the room. The D/BT shall provide a valve and threaded connection as described below in paragraph No. 9 at this location.
2. Two independent and redundant compressors provided by the D/BT are required to ensure the availability of the Facility.
3. At least one reservoir must be provided by the D/BT in order to have compressed air in case of a power failure. Air accumulator capacity in case of power supply failure to be globally 200 liters (52 gallons).
4. Flow is discontinuous with peak flow 4 l/second (one gallon/second), but not more than once a minute, and normally less than once an hour.
5. Required pressure is between 6 & 10 bars (87 psi & 145 psi).
6. The D/BT will provide pressure test reports of the pressure vessel(s).
7. Compressed air must be dust-free, oil free and industrial dry (per standard commercial practice for shop air) with a dew point of –20°C (-4°F).
8. D/BT will provide all the outlets fittings in brass, 1" BSP female thread.
9. D/BT will provide one independent circuits for the PTE side.

ESS/BTS COMPRESSED AIR SPECIAL REQUIREMENTS

10. A compressed air pipe provided by the D/BT (one inch diameter) will run in the cooling water service trench all along the beam line as shown in Figure 51.12-2 (Cooling Ducts & in the building) & Figure 51.02(Cooling Schematic Distribution in the Building) . This pipe will be used for purging the equipment of the beam line.

GANTRY COMPRESSED AIR SPECIAL REQUIREMENTS

11. Clean and industrial dry air is required in the PPS pit and at the rear support roller assembly (as shown in Figure 51.12-1 (Cooling Ducts & in the building) .
12. Dual airlines are required in order to enhance Facility availability.
13. The average airflow rate per Gantry based on braking once every 1.5 minutes is 1 SCFM (1.7Nm³/h).
14. Air to the junction box is to allow for pneumatic actuators on the Gantry. Valve and threaded connection shall be provided as described above.

MAINTENANCE ROOM

15. If this rooms are part of the project scope, clean and industrial dry air outlets are required in the Maintenance Room.

DRY NITROGEN

Dry nitrogen outlet provided by the D/BT is required in order to vent the cyclotron PTE. see Figure 51.12-1/2 (Cooling Ducts & in the building) . This outlet shall be connected to interchangeable nitrogen bottles (equipped with pressure regulator) to be placed by D/BT in a location dedicated for gas bottle storage, as required by the local regulation.
PTEV recommends locating the nitrogen bottles in a rated closet.

General requirements:

1. Industrial nitrogen 99.9 %
2. b50 x 4 (4 bottles, a manifold and retention rack following local regulation)
3. Pressure: between 1 & 2 bars (14.5 & 29 psi)
4. Estimated consumption: 4 m³ (140 ft³) (STP) maximum per venting.
5. Flow : > 2m³ in 5 minutes (70 ft³ in 5 min)
6. Piping : Brass, copper, or stainless steel with label
7. D/BT will provide the outlets fitting, 3/8" BSP female thread. Final connection to the cyclo will be made by PTEV.

OXYGEN

Oxygen is required for the deflector inside the cyclotron. See Figure 51.12-1/2 (Cooling Ducts in the building) for outlet position.

If allowed by local regulation, the bottles will be located close to the cyclotron, at the degrader height, on the wall holding the manifolds.
If not allowed by local regulation, the bottles will be place as close as possible to the cyclotron vault (piping < 30m if possible).

General requirements:

1. Purity: Oxygen N45 (i.e. 99.995 %) provided and installed by D/BT
2. 2. Bottle type : b20 x 2 (1 bottle connected and 1 spare, a manifold and retention rack following local regulation)
3. Pressure regulation: between 1 & 3 bars (15 & 45 psi)
4. Manometer on high and low pressure levels
5. Flow : between 1 and 2 cm³/min (STP) (between 0.06 and 0.12 in ³/min)
6. Piping : Stainless Steel 1/16" with label
7. Located in the pit with 300 cm (±10') free length to connect directly on the cyclotron.
8. All equipment on the line will be in Stainless steel

HYDROGEN

Hydrogen is required inside of the Cyclotron. See Figure 51.12-1/2 (Cooling Ducts in the building) for outlet position.

If allowed by local regulation, the bottles will be located inside the cyclotron pit and there will be no interference with the building.
If not allowed by local regulation, the bottles will be place as close as possible to the cyclotron vault (piping < 30 m (±100') if possible).

General requirements:

1. Purity: Hydrogen N60 (i.e. 99.9999 %)
2. Bottle type : b10 x 2 (1 bottle connected and 1 spare, a manifold and retention rack following local regulation)
3. Pressure regulation: between 1 & 3 bars (15 & 45 psi)
4. Manometer on high and low pressure levels
5. Flow : between 1 and 2 cm³ /min (STP) (between 0.06 and 0.12 in³/min)
6. Piping : chromatography grade, steam cleaned stainless steel 1/16" with label on it
7. Located in the pit with 5 m (±17') free length to connect directly on the cyclotron.
8. All equipment on the line will be in Stainless steel
9. D/BT shall ensure that pipes can be replaced easily in case of leakage or breakage

HELIUM

Helium is not used by the cyclotron. See Figure 51.12-1/2 (Cooling Ducts in the building) for outlet position.

General requirements:

1. Purity: Helium N45 (i.e. 99.995 %)
2. 2. Bottle type : b5 or b10 x 2 (1 bottle on a carrier to roll along the whole beam line and 1 spare, a manifold and retention rack following local regulation)
3. Provided with a flexible pipe of min. 4 m (±12') and a blow gun.
4. Pressure regulation: between 1 & 1.5 bars (15 & 22 psi)
5. 5. A retention rack for 1 spare bottle, following local regulation. Provided and installed by D/BT in a place following local regulation.

INDUSTRIAL GASES - SPECIAL REQUIREMENTS

THIS DOCUMENT IS THE PROPERTY OF I.B.A. AND SHALL NOT BE ALTERED COPIED OR COMMUNICATED WITHOUT THE WRITTEN CONSENT OF I.B.A.

S.A. ION BEAM APPLICATIONS

REV:	DATE:	MODIFICATION:	DRAFTMAN:	CHECKED BY:	VALIDATED BY:
A	30/04/15	Original issue	LCHEN	QBA	PV

MATERIAL: –
SCALE: (A3)
DIMENSIONS: mm
TOLERANCES: –

PROJECT: PROTON THERAPY
SUBPROJECT: TATA HBTF MUMBAI

IV.
COOLING & GASES

TITLE:
Compressed air, dry nitrogen & Gases requirements

07.42.33.

51.31 A

V. ELECTRICAL SET

S.A. ION BEAM APPLICATIONS

THIS DOCUMENT IS THE PROPERTY OF I.B.A AND SHALL NOT BE ALTERED COPIED OR COMMUNICATED WITHOUT THE WRITTEN CONSENT OF I.B.A.

52. ELECTRICAL SET

ACRONYMS

UPS:	Uninterruptible Power Supply
BTS:	Beam Transport System
PTE:	Proton Therapy Equipment
D/BT:	Design & Building Team
PSR:	Power Supply Room
PTEV:	Proton Therapy Equipment Vendor
WCR:	Water Cooling Room
CBCT:	Cone Beam Computed Tomography
PT:	Proton Therapy
ESS:	Energy Selection System
TSS:	Therapy Safety System
TCR:	Treatment Control Room
MCR:	Main Control Room
HK:	Hook Up
CT:	Cable Tray
PPS:	Patient Positioning System
BTB:	Building Terminal Box
SC:	Switching Cabinet

TABLE OF CONTENTS:

For reference documents, refer to figure 00.00
Refer also to **Chapter II** (ROOMS) for architectural specifications of the rooms

THIS DOCUMENT IS THE PROPERTY OF I.B.A. AND SHALL NOT BE ALTERED COPIED OR COMMUNICATED WITHOUT THE WRITTEN CONSENT OF I.B.A.

S.A. ION BEAM APPLICATIONS

REV:	DATE:	MODIFICATION:	DRAFTMAN:	CHECKED BY:	VALIDATED BY:
A	30/04/15	Original issue	LCHEN	QBA	PV

MATERIAL: –
SCALE: (A3)
DIMENSIONS: mm
TOLERANCES: –

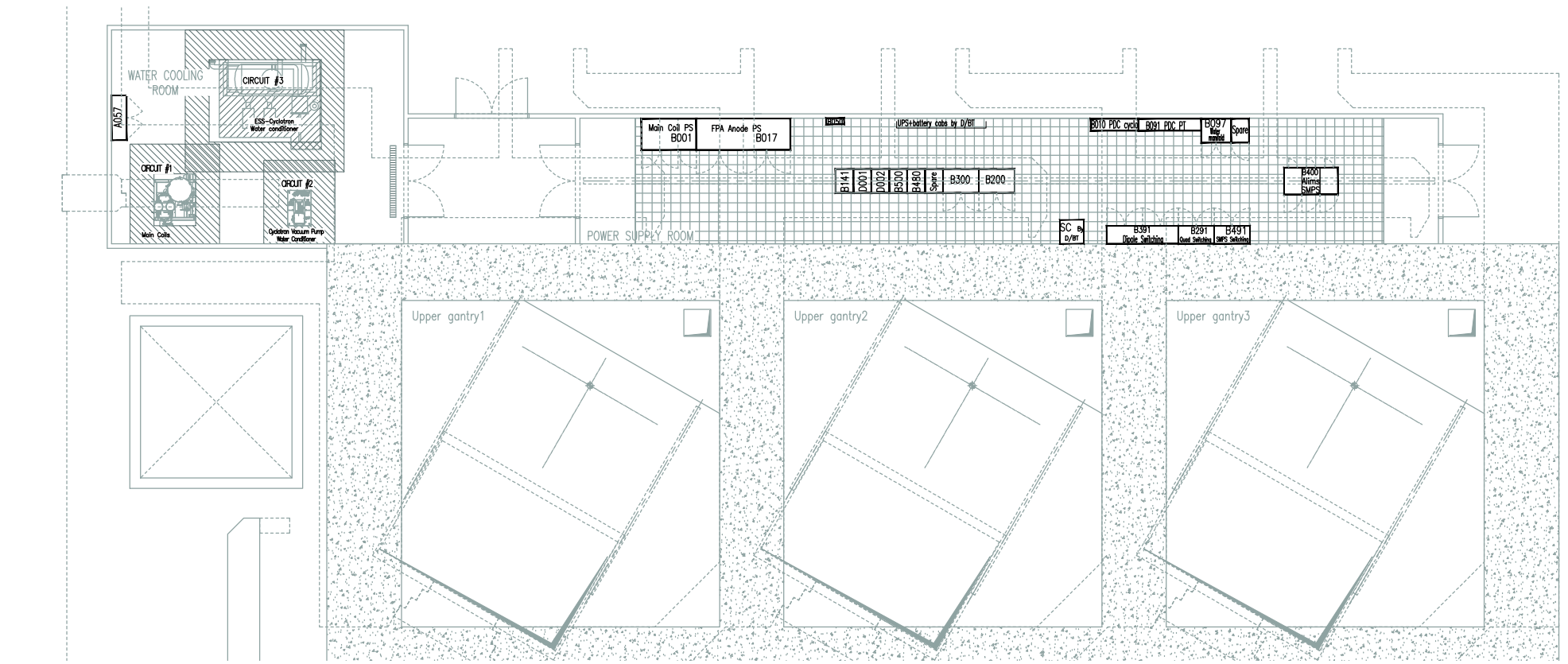
PROJECT: PROTON THERAPY
S/PROJECT: TATA HBTF MUMBAI

V.
ELECTRICAL SET

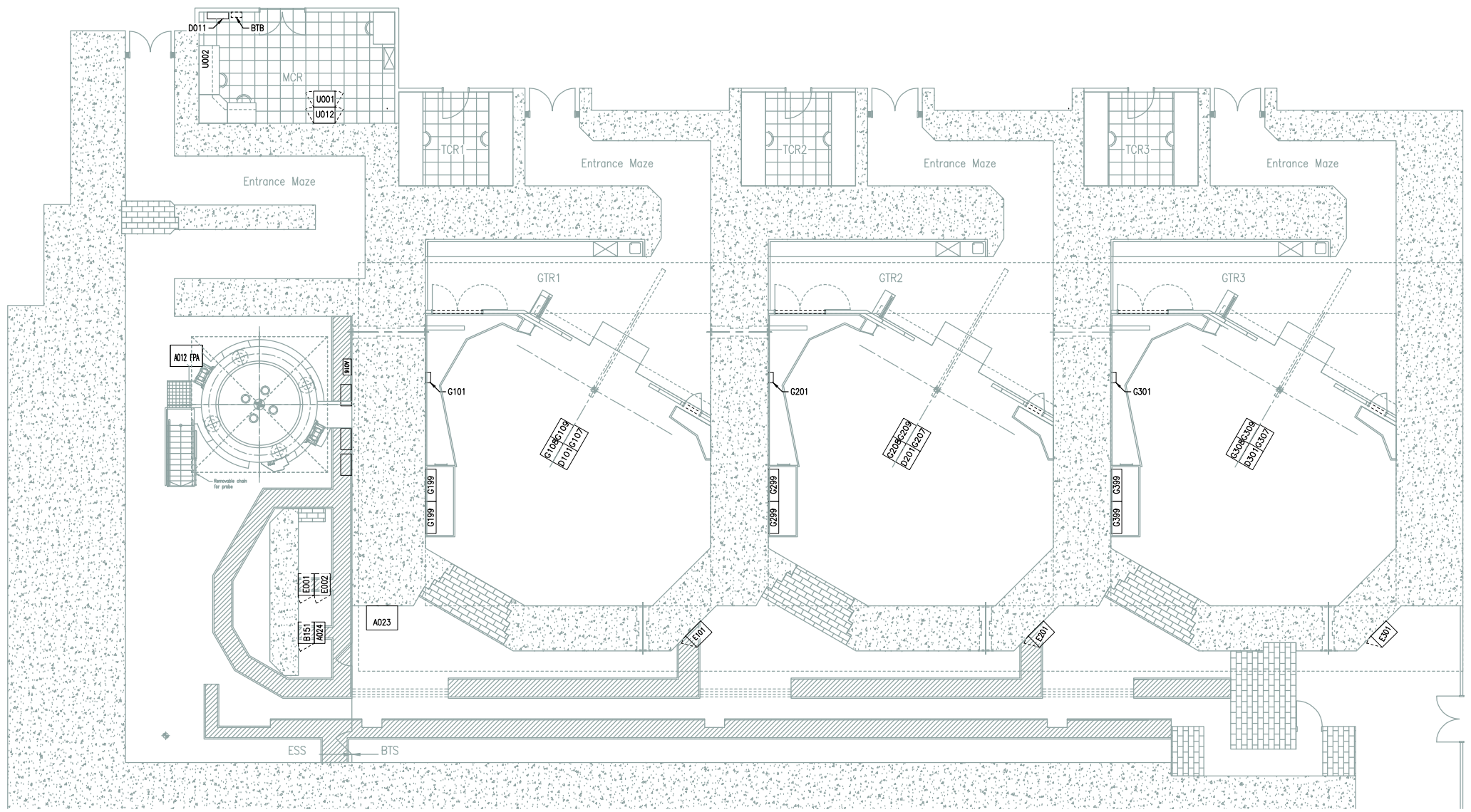
TITLE:
Presentation

07.42.33.

52.00 A



UPPER LEVEL



TREATMENT LEVEL

THIS DOCUMENT IS THE PROPERTY OF I.B.A AND SHALL NOT BE ALTERED COPIED OR COMMUNICATED WITHOUT THE WRITTEN CONSENT OF I.B.A.

iba

S.A. ION BEAM APPLICATIONS

REV:	DATE:	MODIFICATION:	DRAFTMAN:	CHECKED BY:	VALIDATED BY:
A	30/04/15	Original issue	LCHEN	QBA	PV

MATERIAL: –
SCALE: 1/200 (A3)
DIMENSIONS: mm
TOLERANCES: –

PROJECT: PROTON THERAPY

S/PROJECT: TATA HBTF MUMBAI

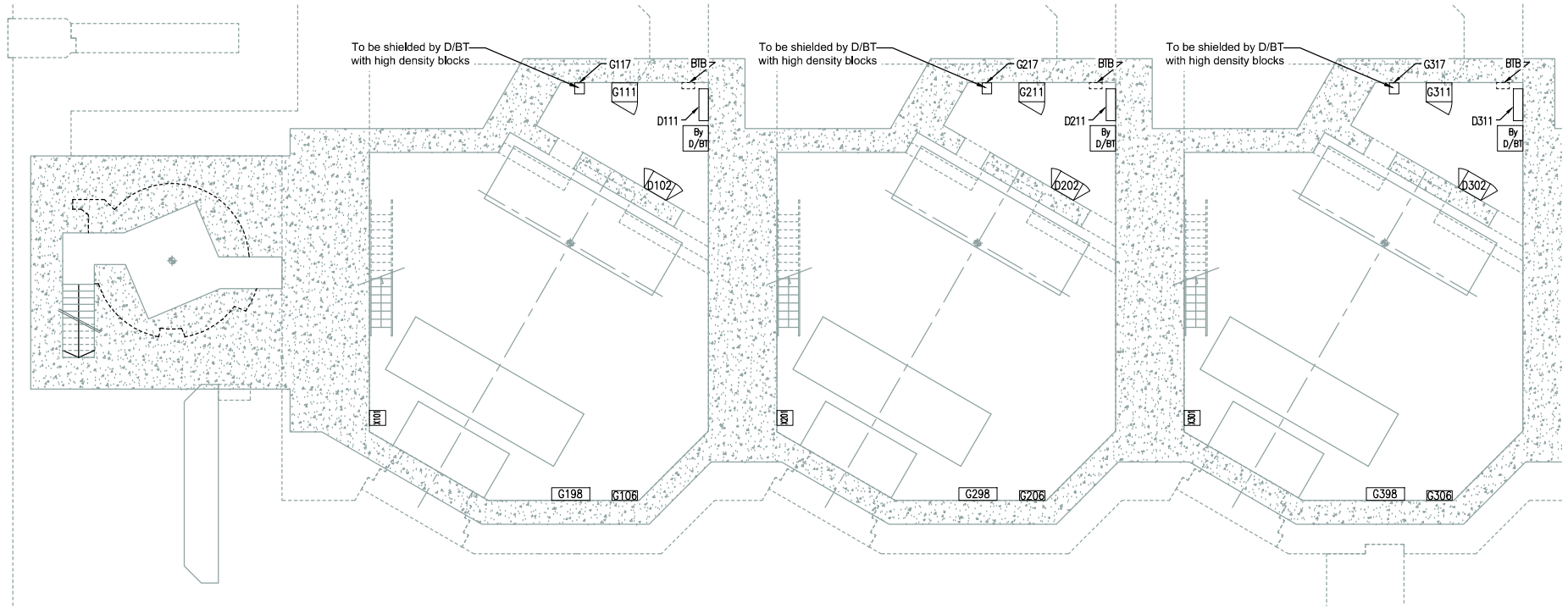
V. ELECTRICAL SET

TITLE:

Cabinets numbering

07.42.33.

52.11-1 A



BASEMENT

Cabinet Details			Cabinet Dimensions				
Area Code	Cabinet Name	Location	W mm	D mm	H mm	Weight kg	Mounting
B001	Cyclotron Main Coil PS	PSR	1836	1050	1800	2000	Stand
B017	EPA Anode PS	PSR	3150	1050	2100	2500	Stand
B050	Yoke Heater	PSR	600	210	600		TBD
B818	Power Distribution Cyclo	PSR	1600	400	?		Stand
B091	Power Distribution PT	PSR	1100	400	?		Stand
B200	Quadrupoles General Transformer PS	PSR	1200	800	2000	1700	Stand
B300	Dipoles General Transformer PS	PSR	1200	800	2000	1350	Stand
B400	SMPS (Scanning Magnet Power Supply)	PSR	1805	900	1000		Stand
B480	SMPS EU Cab	PSR	800	600	2100		Stand
B491	SMPS Switching	PSR	1200	600	1000		Stand
B897	PSR Water Manifold	PSR	1000	800	1000		Stand
A012	Final Power Amplifier (100 KW)	Cyclotron	1200	800	1800	900	Floor
B393-B293	250_3604 Switching System PS 55_100_1404 Switching System PS 1	PSR	3600	600	2000	420	Stand
B351	IMPA (5 kW RF Driver Cabinet)	ESS	600	800	1800	450	Floor
B341	Water/Vacuum/T°/Electronic Cabinet	PSR	600	800	1800	450	Stand
D002	BLCU	PSR	600	800	1800	450	Stand
D001	ACU Cabinet	PSR	600	800	1800	450	Stand
B500	Trim Power Supply Cabinet	PSR	600	800	1800	900	Stand
E001	ESS Electronic Cabinet (Cyclo)	ESS	600	800	1800	450	Floor
E002	ESS Electronic Cabinet (PT)	ESS	600	800	1800	450	Floor
E101	BTS Electronic Cabinet 1	BTS Vault	415	220	600	200	Wall
E201	BTS Electronic Cabinet 2	BTS Vault	415	220	600	200	Wall
E301	BTS Electronic Cabinet 3	BTS Vault	415	220	600	200	Wall
A016	Air Distribution Cabinet	Cyclotron	600	310	800	100	Wall
D003	Positionning Control Unit N°1	Pulling Room 1	600	800	1800	450	Floor
X101	X-Ray Generator Cabinet TR1	Pulling Room 1	506	468	1101	148	Floor
G306	Gantry Driver Cabinet TR1	Gantry Pit 1	800	400	1000	?	Wall
G311	Robot Controller Unit TR1 (PPS)	Pulling Room 1	810	600	1250		Floor
G317	Robot Controller Unit TR1 (PPS) RDC Box	Pulling Room 1					
D101	Treatment Control Unit N°1	Gantry 1	600	800	1800	450	Floor
G301	Distribution Box TR1	Gantry 1	400	400	200	15	Wall
G307	Nozzle 1 Electronic Units Cabinet N°1	Gantry 1	600	800	1800	450	Floor
G308	Nozzle 1 Electronic Units Cabinet N°2 (ICE Us)	Gantry 1	553	780	767	200	Floor
G309	Gantry 1 Electronic Cabinet N°3 (BPMEU)	Gantry 1	553	780	767	200	Floor
D111	SRCU1	Pulling Room 1	1000	300	1000	70	Wall
G399	Gantry Derivation Box TR1 - Power Panel#1	Gantry Pit 1	1200	400	1200	100	Wall
G399	Gantry Derivation Box TR1 - Power Panel#2	Gantry Pit 1	1200	400	1200	100	Wall
G398	Gantry Derivation Box TR1 - Control Panel#1	Gantry Pit 1	1200	400	1200	100	Wall
D003	Positionning Control Unit N°2	Pulling Room 2	600	800	1800	450	Floor
X201	X-Ray Generator Cabinet TR2	Gantry Pit 2	506	468	1101	148	Floor
G306	Gantry Driver Cabinet TR2	Gantry Pit 2	800	400	1000	?	Wall
G311	Robot Controller Unit TR2 (PPS)	Pulling Room 2	810	600	1250		Floor
G317	Robot Controller Unit TR2 (PPS) RDC Box	Pulling Room 2					
D101	Treatment Control Unit N°2	Gantry 2	600	800	1800	450	Floor
G301	Distribution Box TR2	Gantry 2	400	400	200	15	Wall
G307	Nozzle 2 Electronic Units Cabinet N°1	Gantry 2	600	800	1800	450	Floor
G308	Nozzle 2 Electronic Units Cabinet N°2 (ICE Us)	Gantry 2	553	780	767	200	Floor
G309	Gantry 2 Electronic Cabinet N°3 (BPMEU)	Gantry 2	553	780	767	200	Floor
D211	SRCU2	Pulling Room 2	1000	300	1000	70	Wall
G299	Gantry Derivation Box TR2 - Power Panel#1	Gantry Pit 2	1200	400	1200	100	Wall
G299	Gantry Derivation Box TR2 - Power Panel#2	Gantry Pit 2	1200	400	1200	100	Wall
G298	Gantry Derivation Box TR2 - Control Panel#1	Gantry Pit 2	1200	400	1200	100	Wall
D302	Positionning Control Unit N°3	Pulling Room 3	600	800	1800	450	Floor
X301	X-Ray Generator Cabinet TR3	Gantry Pit 3	506	468	1101	148	Floor
G301	Distribution Box TR3	Gantry 3	400	400	200	15	Wall
G306	Gantry Driver Cabinet TR3	Gantry Pit 3	800	400	1000	?	Wall
G311	Robot Controller Unit TR3 (PPS)	Pulling Room 3	810	600	1250		Floor
G317	Robot Controller Unit TR3 (PPS) RDC Box	Pulling Room 3					
D301	Treatment Control Unit N°3	Gantry 3	600	800	1800	450	Floor
G307	Nozzle 3 Electronic Units Cabinet N°1	Gantry 3	600	800	1800	450	Floor
G308	Nozzle 3 Electronic Units Cabinet N°2 (ICE Us)	Gantry 3	553	780	767	200	Floor
G309	Gantry 3 Electronic Cabinet N°3 (BPMEU)	Gantry 3	553	780	767	200	Floor
D311	SRCU3	Pulling Room 3	1000	300	1000	70	Wall
G399	Gantry Derivation Box TR3 - Power Panel#1	Gantry Pit 3	1200	400	1200	100	Wall
G399	Gantry Derivation Box TR3 - Power Panel#2	Gantry Pit 3	1200	400	1200	100	Wall
G398	Gantry Derivation Box TR3 - Control Panel#1	Gantry Pit 3	1200	400	1200	100	Wall
D011	SRCU0	MCR	800	350	800	70	Wall
U001	MCR Electronic Cabinet 1	MCR	600	800	1800	450	Floor
U012	MCR Electronic Cabinet 2	MCR	600	800	1800	450	Floor
U002	MCR Control Consel (Desk)	MCR	3895.6	2133.6	1955.8		Floor
A057	Water Cooling Pump Elect Cabinet	Water Cooling Room	1500	500	1400	300	Wall
A033	Hydraulic Group	BTS Vault	1160	900	1400	660	Floor
A024	Hydraulic Group	BTS Vault	400	800	1800		Floor

THIS DOCUMENT IS THE PROPERTY OF I.B.A. AND SHALL NOT BE ALTERED COPIED OR COMMUNICATED WITHOUT THE WRITTEN CONSENT OF I.B.A.

S.A. ION BEAM APPLICATIONS

REV:	DATE:	MODIFICATION:	DRAFTMAN:	CHECKED BY:	VALIDATED BY:
A	30/04/15	Original issue	LCHEN	QBA	PV

MATERIAL: –
SCALE: 1/200 (A3)
DIMENSIONS: mm
TOLERANCES: –

PROJECT: PROTON THERAPY

S/PROJECT: TATA HBTF MUMBAI

V.
ELECTRICAL SET

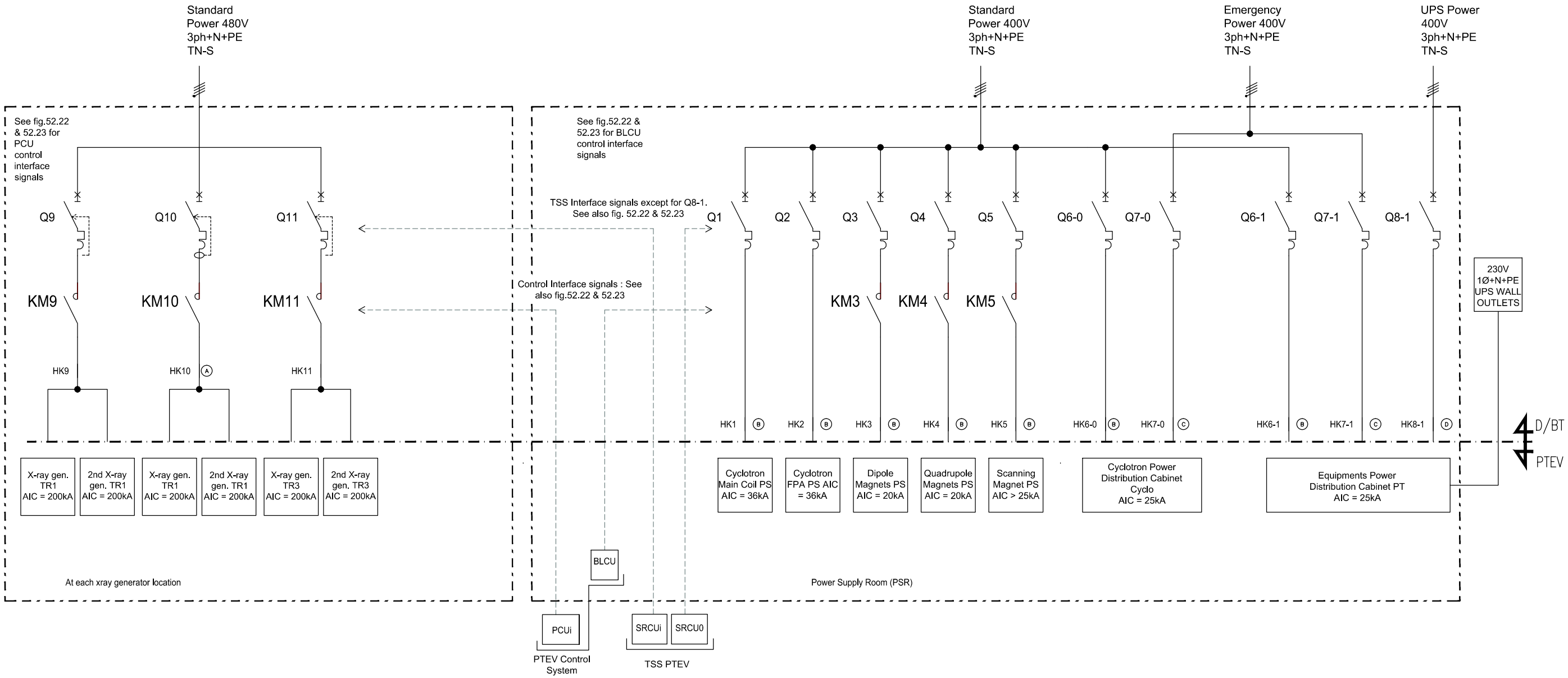
TITLE:

Cabinets numbering

07.42.33.

N

52.11-2 A



Remarks :

- Electrical schematics and symbols according IEC standards
- The circuit breakers shall be suitable for isolation and lockable in the "OFF" position. Padlocks to be provided by D/BT.
- D/BT shall provide to PTEV :
  - Complete electrical execution drawings
  - As-built electrical drawings
  - Short-Circuit and Coordination Study of the facility's power distribution system (from city power to hook ups) demonstrating proper coordination of overcurrent protective devices and demonstrating that the short circuit current at each hook up termination is inferior to the corresponding Ampere Interrupting Capacity (AIC) given in the figure above.
  - Arc Flash Study of the facility's power distribution system documenting the available incident energy and the Arc Flash boundary at each hook up circuit breaker as well as at each hook up termination, and documenting the working distance assumed for the calculation.

HK references, see also figure 52.31:

- (A) • Hook up 480V Standard
- (B) • Hook up 400V Standard (See also table for options on Folio 4/4)
- (C) • Hook up 400V Emergency
- (D) • Hook up 400V Uninterruptible Emergency

THIS DOCUMENT IS THE PROPERTY OF I.B.A. AND SHALL NOT BE ALTERED COPIED OR COMMUNICATED WITHOUT THE WRITTEN CONSENT OF I.B.A.

S.A. ION BEAM APPLICATIONS

VALIDATED BY:	PV	
CHECKED BY:	QBA	
DRAFTMAN:	LCHEN	
MODIFICATION:	Original issue	
DATE:	30/04/15	
REV:	A	

MATERIAL: –
SCALE: (A3)
DIMENSIONS: mm
TOLERANCES: –

PROJECT: PROTON THERAPY

S/PROJECT: TATA HBTF MUMBAI

V.
ELECTRICAL SET

TITLE:
Main Power distribution Schematic

07.42.33.

52.21 A

Interface to Control Unit (BLCU or PCUi)

The D/BT shall provide an individual interface to the corresponding Control Unit (BLCU or PCUi) for each individual main contactor (KM).

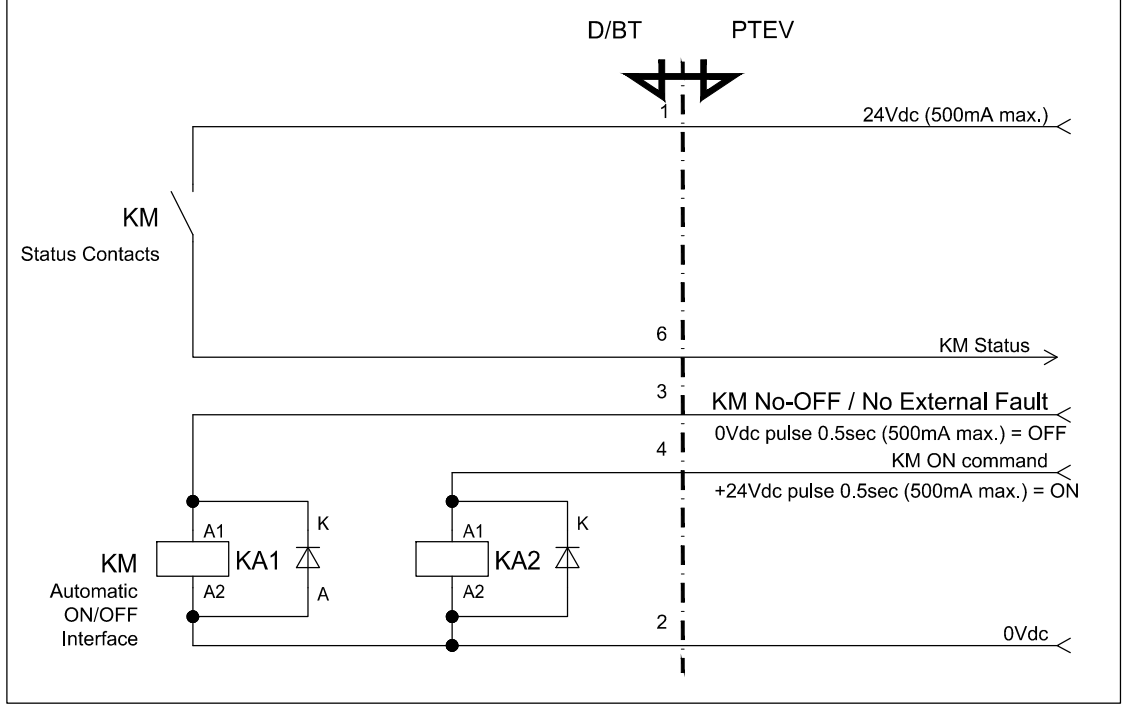
Each interface shall include:

- Auxiliary contacts for status information.
- Indicator (e.g., led) which signals the presence of voltage downstream of the main contactor.
- Latch circuit for command of the main contactor. The latch circuit shall be capable to take manual and automatic ON/OFF commands.
- Manual ON/OFF interface (e.g, via momentary push buttons).
- Automatic ON/OFF interface (interface signals shown below).
- Automatic opening of the main contactor (KM) when the upstream main circuit breaker (Q) opens. Any command to the main contactor shall be blocked while the main circuit breaker remains open.
- For main contactors connected to X-ray generators, an emergency switch (turn to release type, with red mushroom head) for local emergency OFF action.
- A cable with 12 numbered wires. The cable shall terminate with a loose end (~5m free) to be connected later by the PTEV to the corresponding BLCU or PCUi equipment (see figure 52.11). The wires shall be connected as shown below.

Remarks:

- The interface shall be electrically isolated from the rest.
- The main contactor shall not be necessarily located in the same room as the equipment being supplied. But the voltage presence indicator and the manual ON/OFF interface shall be located in the same room as the equipment being supplied.
- For each main contactor connected to an X-ray generator, the voltage presence indicator, the manual ON/OFF interface and the emergency switch shall be located in line of sight of the X-ray generator.
- An example of implementation is given at figure 52.23.

Interface to Control System (BLCU or PCUi)



Interface to TSS (SRCU0 and SRCUi)

The D/BT shall provide an individual interface to TSS for each individual main circuit breaker (Q), except for Q8-1.

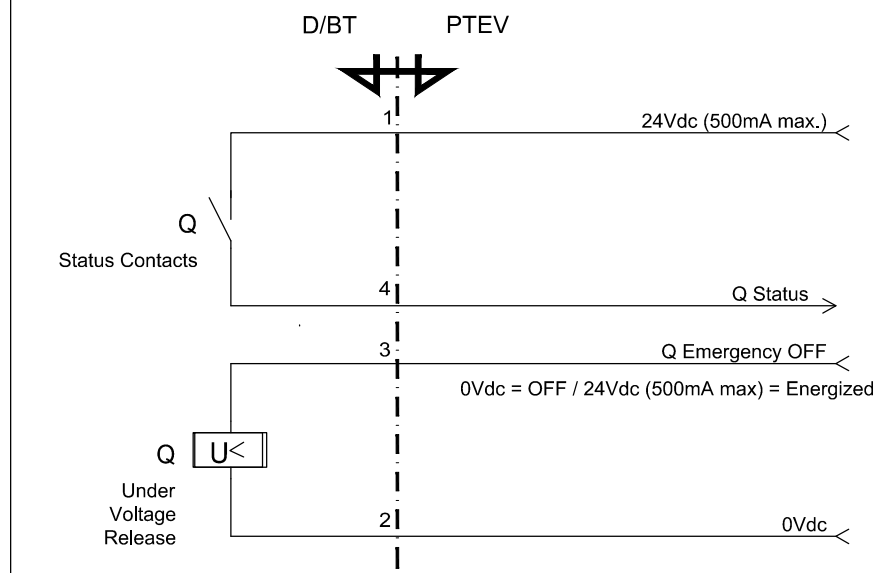
Each interface shall include:

- Auxiliary contacts for status information.
- Under Voltage Release for emergency OFF.
- A cable with 4 numbered wires. The cable shall terminate with a loose end (~5m free) to be connected later by the PTEV to the corresponding SRCU equipment (see figure 52.11). The wires shall be connected as shown below.

Note:

- The interface shall be electrically isolated from the rest.

Interface signals to TSS (SRCU0 and SRCUi)



THIS DOCUMENT IS THE PROPERTY OF I.B.A. AND SHALL NOT BE ALTERED COPIED OR COMMUNICATED WITHOUT THE WRITTEN CONSENT OF I.B.A.

S.A. ION BEAM APPLICATIONS

REV:	DATE:	MODIFICATION:	DRAFTMAN:	CHECKED BY:	VALIDATED BY:
A	30/04/15	Original issue	LCHEN	QBA	PV

MATERIAL: –
SCALE: (A3)
DIMENSIONS: mm
TOLERANCES: –

PROJECT: PROTON THERAPY
S/PROJECT: TATA HBTF MUMBAI

V.
ELECTRICAL SET

TITLE:
Interfaces Requirements

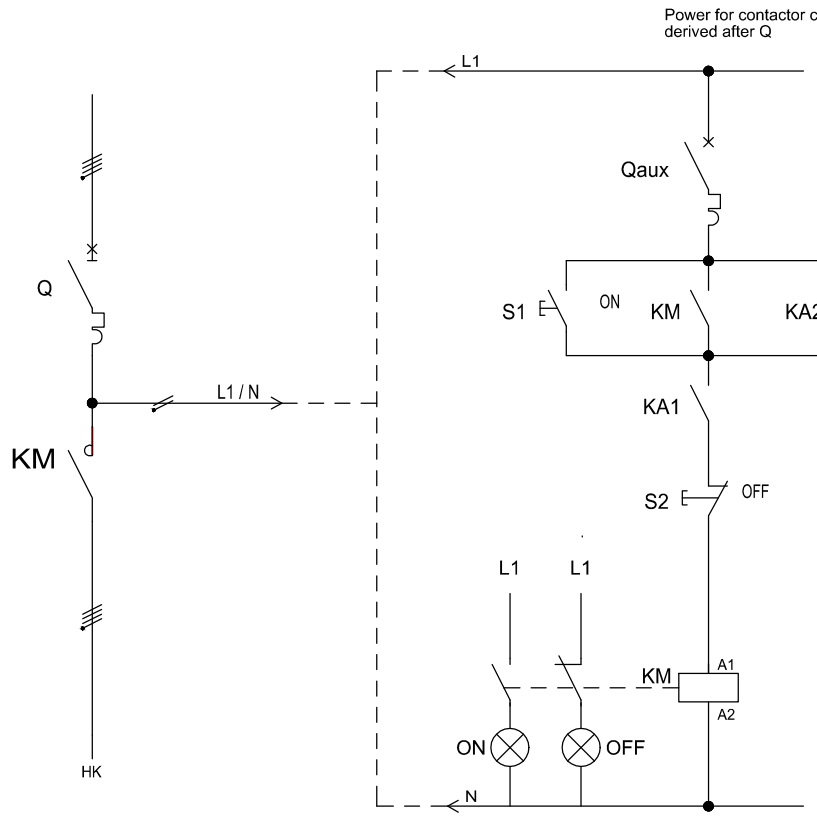
07.42.33.

52.22 A

EXAMPLE of Interface to Control System BLCU

Circuit Breaker equipped with :
- Auxiliary contacts for status information
- Under Voltage Release for Emergency OFF

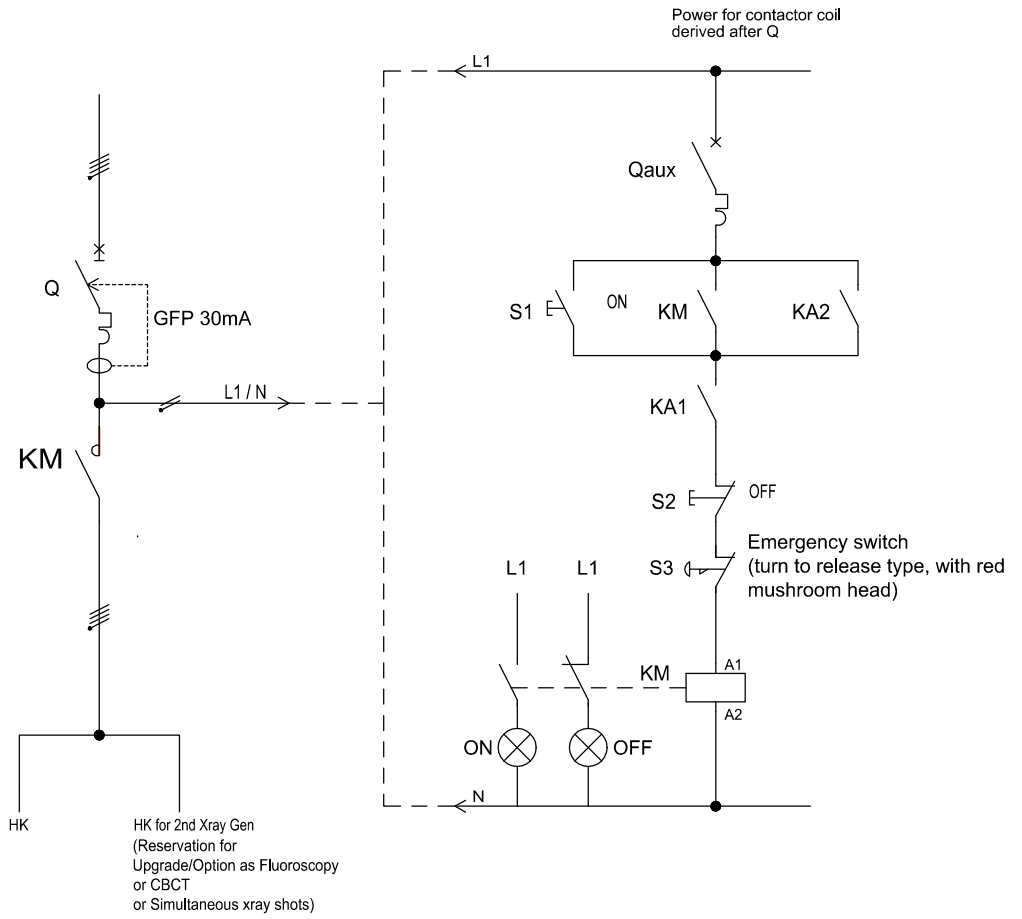
Contactor equipped with :
- Auxiliary contacts for status information



EXAMPLE of Interface to Control System PCU

Circuit Breaker equipped with :
- Auxiliary contacts for status information
- Under Voltage Release for Emergency OFF
- Ground Fault Protection

Contactor equipped with :
- Auxiliary contacts for status information



THIS DOCUMENT IS THE PROPERTY OF I.B.A. AND SHALL NOT BE ALTERED COPIED OR COMMUNICATED WITHOUT THE WRITTEN CONSENT OF I.B.A.

S.A. ION BEAM APPLICATIONS

VALIDATED BY:	PV
CHECKED BY:	QBA
DRAFTMAN:	LCHEN
MODIFICATION:	Original issue
DATE:	30/04/15
REV:	A

MATERIAL: –
SCALE: (A3)
DIMENSIONS: mm
TOLERANCES: –

PROJECT: PROTON THERAPY

S/PROJECT: TATA HBTF MUMBAI

V.
ELECTRICAL SET

TITLE:
Interfaces Examples

07.42.33.

52.23 A

Required Electrical Hookups in the Power Supply Room, BTS and Treatment Rooms

Hook-up	Load Type	Voltage	Phases	Frequency	Operating Power (a)	Peak Power	Input Current THD (b)	Power Factor	Power Category (c)	INPUT Cables
		Volts		Hz	kVA	kVA				mm²
HK1	Cyclotron Main Coils PS	400 or 480	3 phases + Neutral + Ground (h)	50 or 60 Hz	210	300(g)	>=15%	>=0,90	Standard	
HK2	Cyclotron FPA Anode PS	400 or 480			90	160(g)	>=10%	>=0,90	Standard	
HK3	Dipole PS	400			210	315(d)	39% 6 pulses rectifier	0.93	Standard	
HK4	Quadrupole PS	400			145	220 (e)	39% 6 pulses rectifier	0.93	Standard	
HK5	SMPS	400 or 480			80	N/A	>10%	0.99	Standard	
HK6-0	Cyclo Power Distribution Cabinet	400			100	N/A			Standard	
HK7-0	Cyclo Power Distribution Cabinet	400			20	N/A			Emergency	
HK6-1	PT Power Distribution Cabinet	400			70	N/A			Standard	
HK7-1	PT Power Distribution Cabinet	400			90	N/A			Emergency	
HK8-1	PT Power Distribution Cabinet	400			60(i)	N/A			Uninterruptible	
HK9	TR1 x-ray generator	480			0,5 (f)	100 (f)			Standard	
HK10	TR2 x-ray generator	480			0,5 (f)	100 (f)			Standard	
HK11	TR3 x-ray generator	480			0,5 (f)	100 (f)			Standard	

(**a**) "Operating Power": This is the power necessary to operate all the equipment at nominal power

(**b**)THD: Total Harmonic Distortion

(**c**)• "Standard power" is defined as the city power available under normal circumstances. It is used by the system for operating and maintenance purposes.
• "Emergency power" shall always be available, including during a loss of standard power. However, there may be momentary interruption of power service (15 seconds maximum). Emergency power will be used to operate the Gantry and Patient Positioner for purposes of removing the patient following a city power failure.
• "Uninterruptible power" shall always be available, without interruption, even in the event of loss of standard or emergency power. The capacity of the UPS is designed to last 15 minutes at full load. It is required for computers and other critical equipment.

(**d**) During 0,5s every 60s

(**e**) During 0,2s every 60s

(**f**) Each generator (=100KVA) consumes 500 VA stand-by; 120A RMS max. during x-ray shots (less or equal to 1 second).If CBCT or fluoroscopy option up to 15 shots per second.

We propose this table to find gauge wire for X-Ray Hook up cable as a function of length (in accordance with X-Ray Generator Cabinet provider document).

Total Length Hook-Up --> Gauge Cable 3Ph. + N + Ground

between 0m to 15m --> 4x35mm² + G16mm² or 4 x AWG2 + Ground

between 15m to 30m --> 4x70mm² + G35mm² or 4 x AWG2/0 + Ground

between 30m to 45m --> 4x95mm² + G50mm² or 4 x AWG3/0 + Ground

between 45m to 60m --> 4x120mm²+ G70mm² or 4 x AWG4/0 + Ground

between 60m to 75m --> 4x150mm²+ G95mm² or 4 x #300MCM + Ground

between 75m to 90m --> 4x185mm²+ G95mm² or 4 x #350MCM + Ground

If the D/BT Would like to use another Gauge Cable, the D/BT must produce a calculation sheet which proves that this choice complies with a the total impedance

of less than 0.16 Ohm in accordance with IEC 60601-2-7 paragraph 10.2.2.

(**g**) During more than 60s.

(**h**) The D/BT shall assure that the 5 wire power cabling shall continue to all IBA loads.

(**i**) 80 if TPS/OIS system provided by PTEV

THIS DOCUMENT IS THE PROPERTY OF I.B.A. AND SHALL NOT BE ALTERED COPIED OR COMMUNICATED WITHOUT THE WRITTEN CONSENT OF I.B.A.

S.A. ION BEAM APPLICATIONS

VALIDATED BY:	PV
CHECKED BY:	QBA
DRAFTMAN:	---
MODIFICATION:	Original issue
DATE:	30/04/15
REV:	A

MATERIAL: –
SCALE: (A3)
DIMENSIONS: mm
TOLERANCES: –

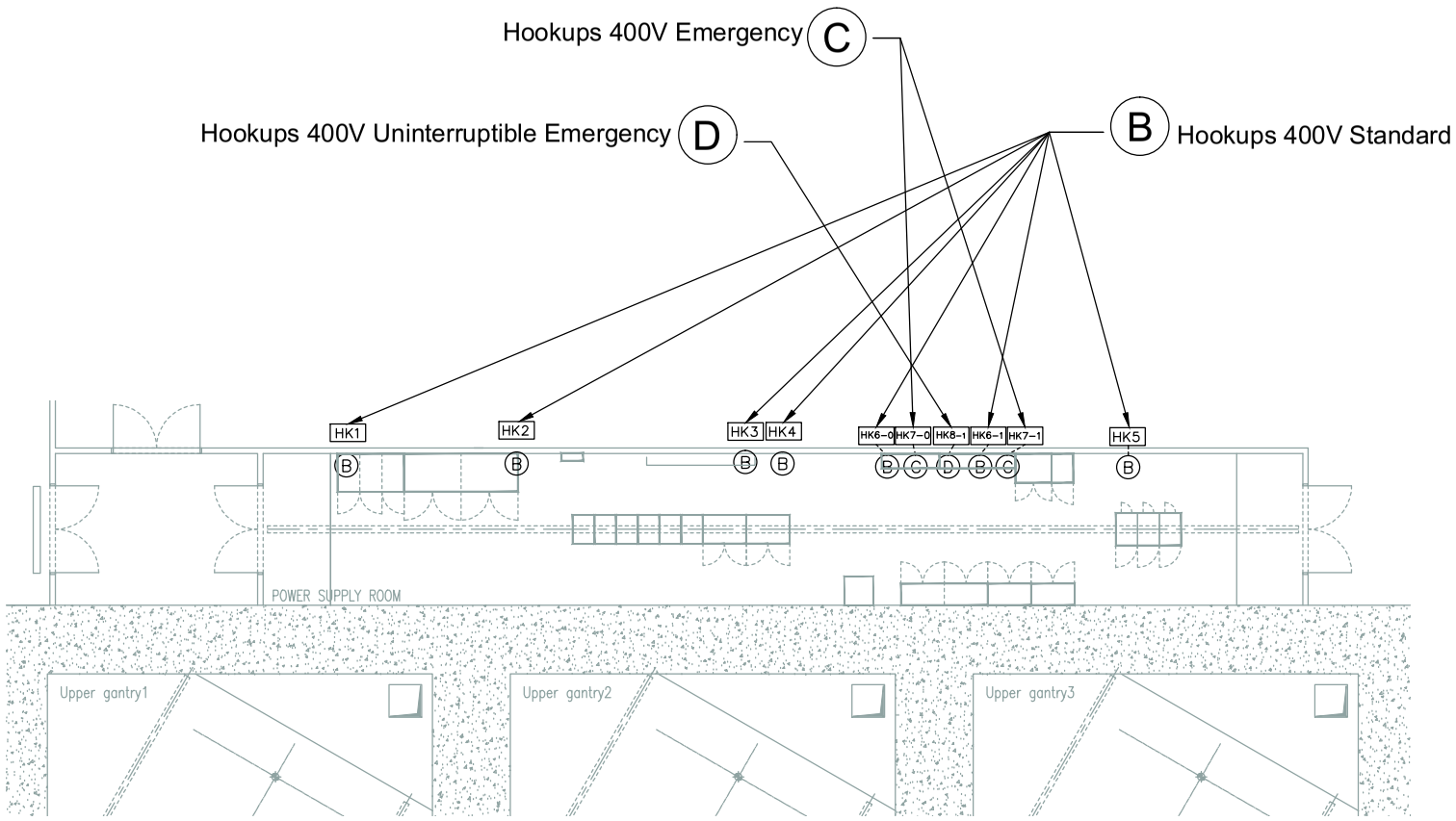
PROJECT: PROTON THERAPY
S/PROJECT: TATA HBTF MUMBAI

V.
ELECTRICAL SET

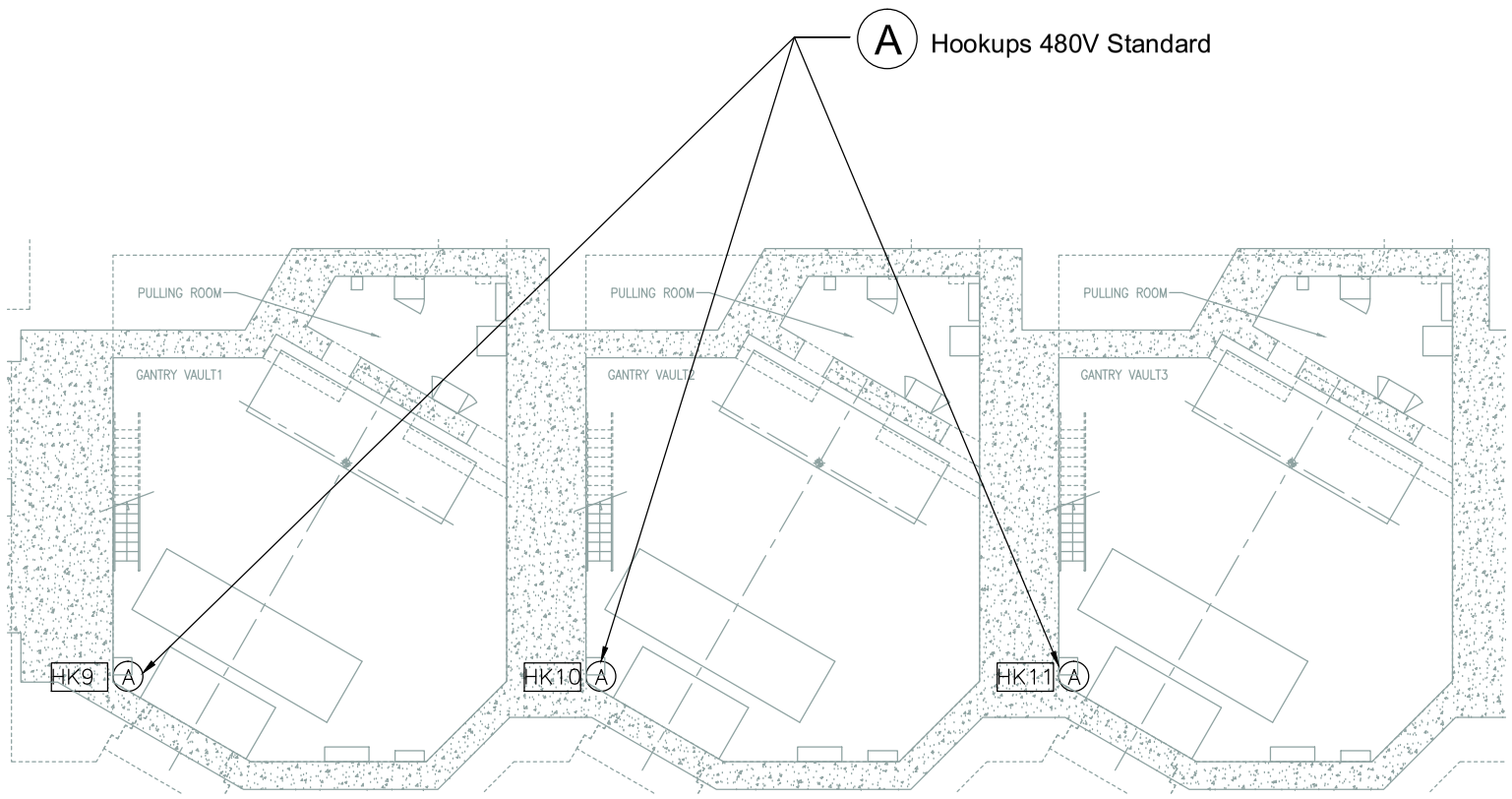
TITLE:
Required Electrical Hookups Table

07.42.33.

52.24 A



UPPER LEVEL



BASEMENT

POWER REQUIREMENTS

1. The power to be provided is based on the figure 52.24 : Required Electrical Hookups Table

   D/BT will provide, install and terminate electrical hookups with power and voltage as described in Figure 52.21- Main Power Distribution Schematic at the location shown on this figure

2. D/BT shall verify compliance with local regulation and add a quick disconnect box if required.

3. All hook-ups terminations shall be at 250 cm(±100") from the floor with a loose end (~5m (±200") free) to be connected later by the PTEV to the cabinets.

4. Rapid access to the circuit breakers protecting the HK must be provided at all times to PTEV for service purposes. The hookups breakers must disconnect the Neutral conductor line for safety reason.

5. The required voltage stability for all the hook-ups is a +/- 10% . Over-voltage suppression will be provided by the D/BT.

6. The D/BT shall provide Power OFF button on each x-ray generator hook-up.
   A Power OFF button shall be located in each X-ray control area (near the x-ray console).
   A Power OFF button shall be located in the TCR for PT center having an x-ray console located in TCR (CBCT or fluoroscopy PT center).
   The power OFF button shall power off the X-ray generator hook-up.
   The power OFF button shall be red.
   The power OFF button shall be labeled “X-ray generator hook-up power OFF button”
   The power OFF button shall be connected to the x-ray generator hook-up
   A model of Power OFF button is the XALD112 from Schneider.

7. The time delay of the feeder breakers (customer side) shall be adjustable in order to avoid that those breakers trip before the PTEV secondary breakers. The over-current time delay before tripping will be adjustable in the following range: between 15 ms to 230 ms.

THIS DOCUMENT IS THE PROPERTY OF I.B.A. AND SHALL NOT BE ALTERED COPIED OR COMMUNICATED WITHOUT THE WRITTEN CONSENT OF I.B.A.

S.A. ION BEAM APPLICATIONS

REV:	A	
DATE:	30/04/15	
MODIFICATION:	Original issue	
DRAFTMAN:	LCHEN	
CHECKED BY:	QBA	
VALIDATED BY:	PV	

MATERIAL: –
SCALE: 1/200 (A3)
DIMENSIONS: mm
TOLERANCES: –

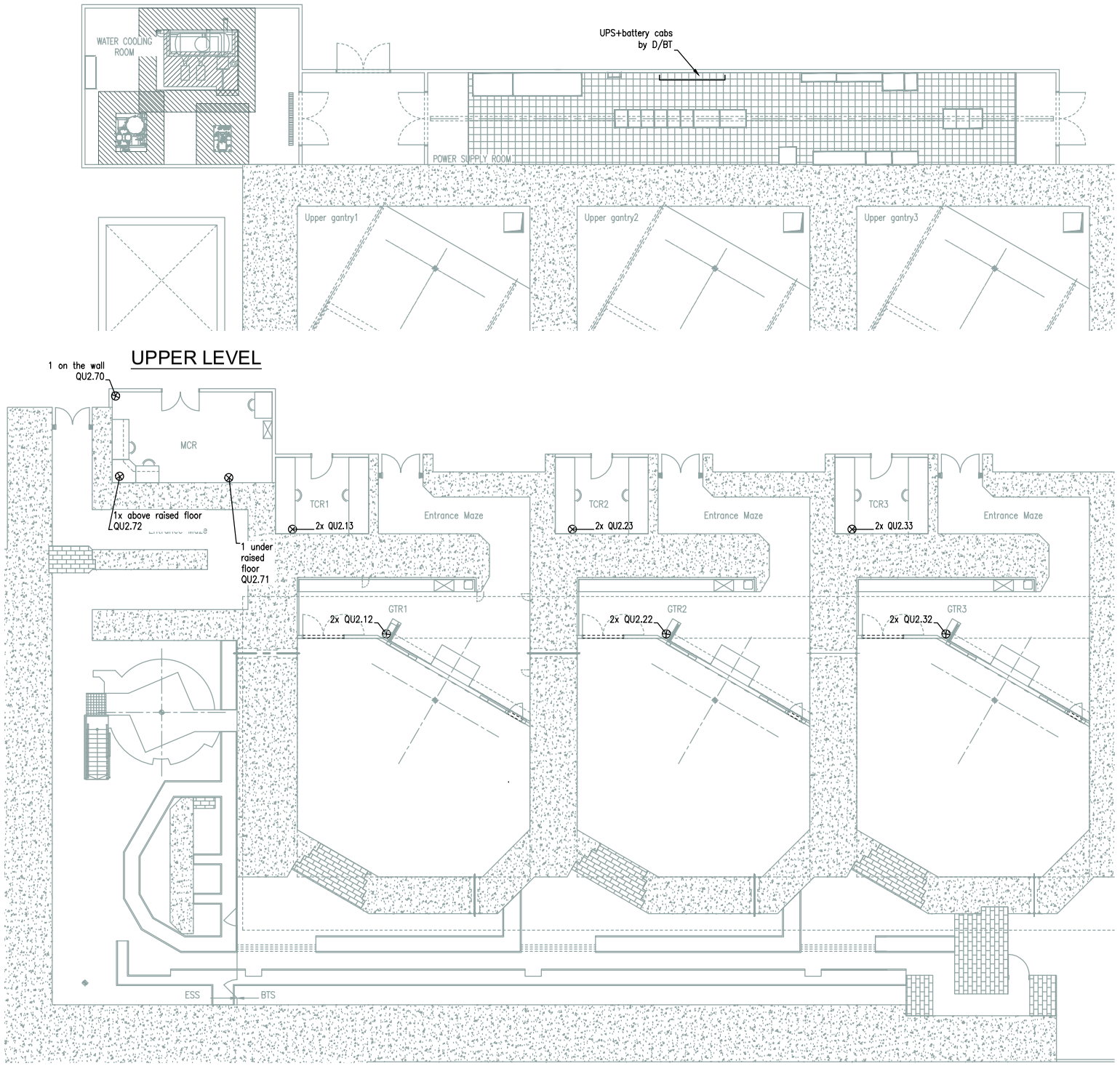
PROJECT: PROTON THERAPY
SPROJECT: TATA HBTF MUMBAI

V.
ELECTRICAL SET

TITLE:
Electrical Hookups Locations

07.42.33.

52.31 A



See also Figure 52.24

UPS REQUIREMENTS

1. UPS outlets for PTEV use only will be located as described on this Figure.These outlets will be installed and wired by D/BT.
2. The UPS outlets will have a color as per local code and a receptacle to prevent accidental connection of non-UPS equipment and to prevent from accidental disconnection of UPS powered equipment.
3. The UPS will be supplied and installed and maintained by D/BT and will comply with IEC62040-1 for safety and IEC62040-2 for EMC.
   A declaration of conformity from the manufacturer of the UPS certifying the compliance to these 2 standards shall be provided by D/BT.
4. If the UPS is installed in the same room as the PTE, the D/BT should prevent against any risk of contamination of PTE in case of a liquid spillage coming from the batteries.
5. Type: Online - double conversion UPS with static and manual bypass (VFI-SS-111 according IEC 62040-3)
6. Output : 3x400V+N+PE (TN-S)
7. Output rating : see table on figure 52.24
8. Backup time at full load : 15 minutes
   D/BT will provide test report proving that the load can be fed for the requested time
9. The cable coming from each individual UPS wall outlet shall terminate with a loose end (≈ 5 m free) to be connected later by PTEV to the equipment power distribution cabinet.
10. Each individual UPS wall outlet shall be on a single circuit
11. CAUTION: extra plugs needed if RT cameras included in configuration

UPS plugs in other PTEV areas			
Room	Quantity	Circuit n°	Position
in TPS/OIS server room*	1x16A	TBD	At the desk On the wall
in TPS/OIS server room*	4x16A 2x32A	TBD	At the rack Under raised floor

* Only if TPS/OIS servers are provided by PTEV

⊗ IEC 60309 2P+E socket outlet with min IP44 protection degree: 16A, except 32A in TPS/OIS server room (see table).
EX: type P17 (Legrand)

THIS DOCUMENT IS THE PROPERTY OF I.B.A AND SHALL NOT BE ALTERED COPIED OR COMMUNICATED WITHOUT THE WRITTEN CONSENT OF I.B.A.

S.A. ION BEAM APPLICATIONS

REV:	DATE:	MODIFICATION:	DRAFTMAN:	CHECKED BY:	VALIDATED BY:
A	30/04/15	Original issue	LCHEN	QBA	PV

MATERIAL: –
SCALE: 1/250 (A3)
DIMENSIONS: mm
TOLERANCES: –

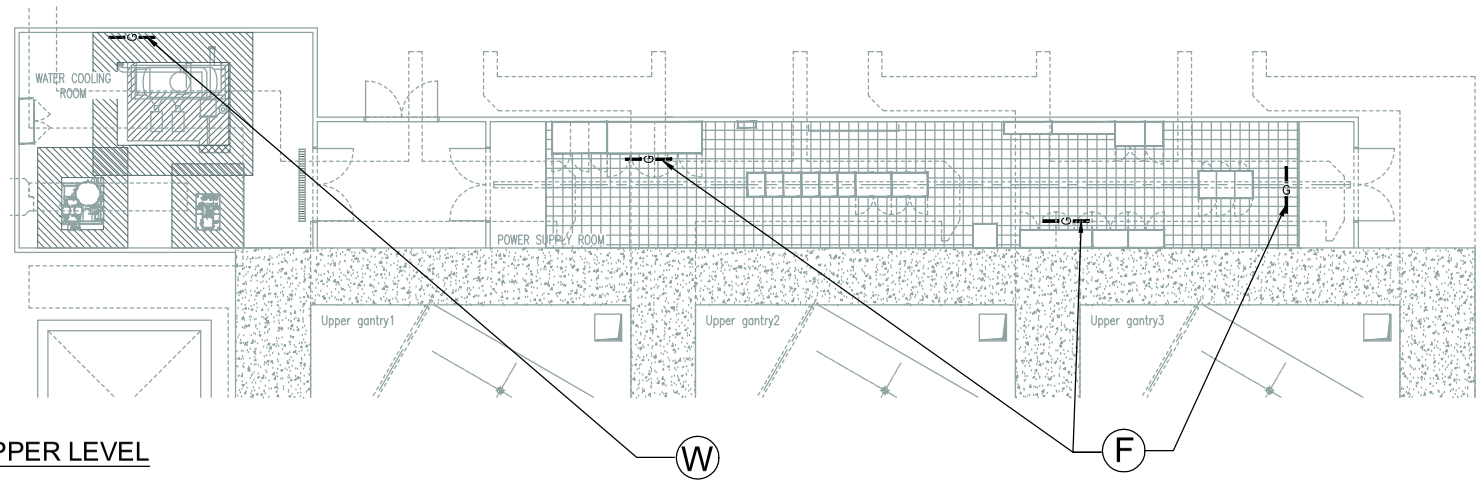
PROJECT: PROTON THERAPY
SPROJECT: TATA HBTF MUMBAI

V.
ELECTRICAL SET

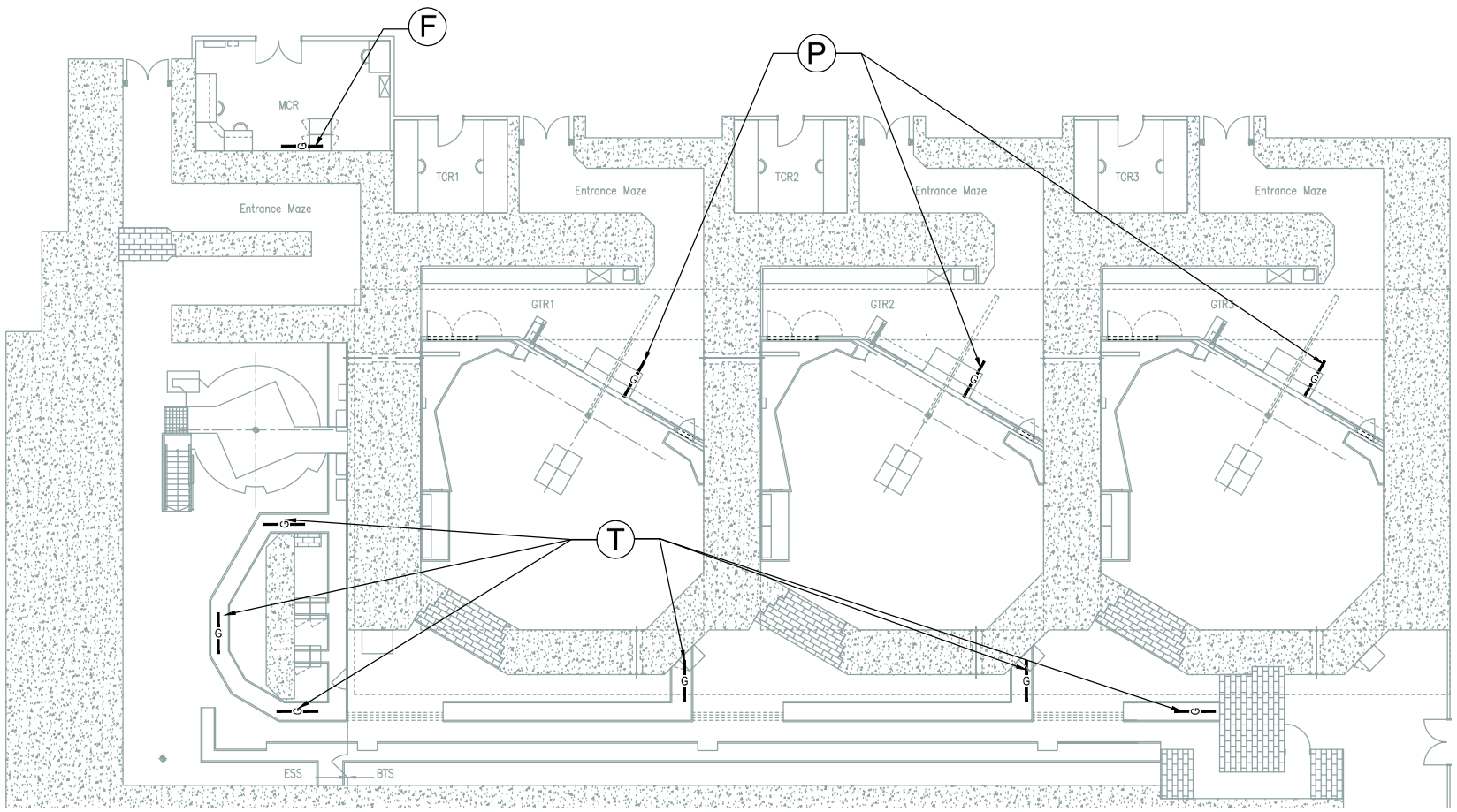
TITLE:
UPS connections locations

07.42.33.

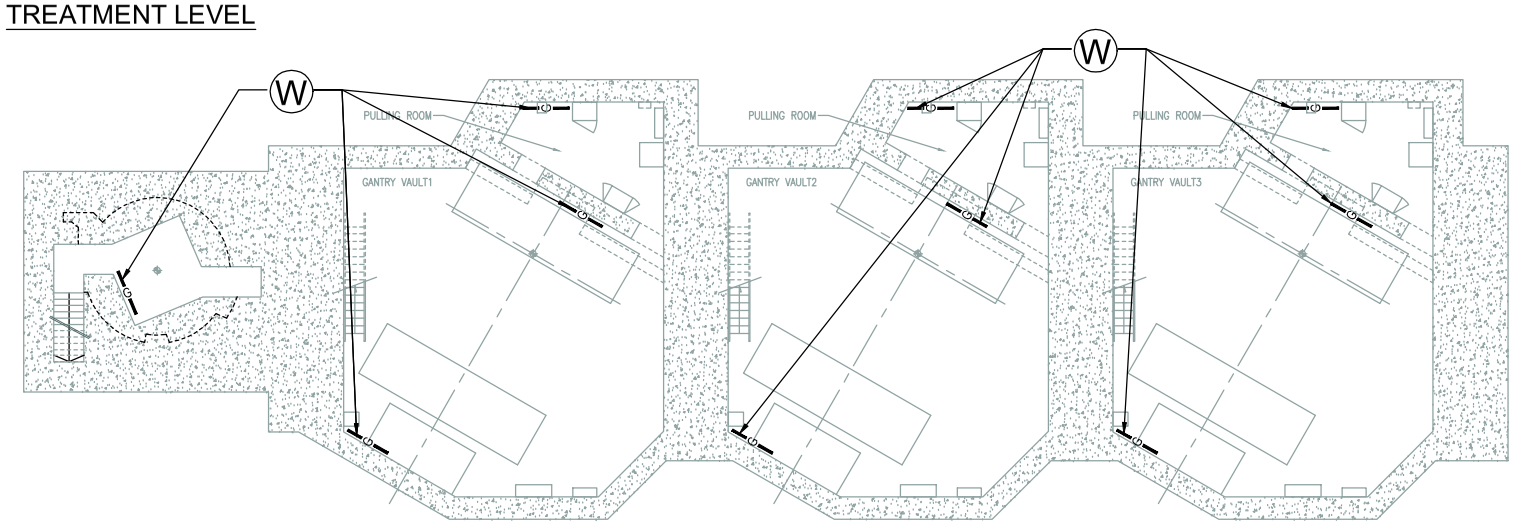
52.32 A



UPPER LEVEL



TREATMENT LEVEL



BASEMENT

GROUNDING

1. Grounding (earthing) shall be in accordance with applicable national or local electrical codes.
2. The grounding (earthing) shall be constructed to achieve the lowest practical earth impedance. Multiple ground rods, mesh or grid networks, ground plates, building perimeter ground loops, and other solutions can be used for this purpose. The earth ground resistance shall in any case be less than 10 Ohms.
3. The earth path shall be permanent and continuous. Protective Earth (PE) shall contain no switch or fuse and be such that the disconnection of one assembly does not disconnect other assemblies.
4. Main bonding shall be achieved. Building components, such as structural steel and metallic piping systems, shall be connected to the main electrical ground in accordance with national or local electrical codes.
5. Supplementary bonding shall be achieved. Metallic raceways, cabinet stands, cable trays, metallic water pipes, metallic floor tiles, catwalks, frames, etc. shall be bonded.
6. Grounding busbars shall be installed at the locations described in this Figure to allow for the connection of PTE. Each grounding busbar shall be individually connected to the main earthing terminal with a resistance less than 0.1 Ohm. Each grounding busbar shall also be bonded to the closest accessible building steel.
7. The Neutral (N) and Protective Earth (PE) conductors shall be routed separately as from the transformer or the feeding point and a continuous 5-conductor network L1/L2/L3/N/PE must exist in the building (TN-S electrical distribution network).
8. The D/BT will provide an official inspection report related to the grounding and bonding. The report shall at least contain the measured earth ground resistance, the measured resistance between each grounding busbar and the main earth terminal, and the results of the continuity testing of protective conductors including main and supplementary equipotential bonding.

(W) On the wall 40 cm (1'-4") from finished floor

(F) On the concrete floor

(T) In the trench, 20 cm (8") from top of trench, opposite wall of cable tray

(P) In PPS pit

Grounding : rectangular copper bar with min. 8 threaded holes M12 (Ø¼")

THIS DOCUMENT IS THE PROPERTY OF I.B.A. AND SHALL NOT BE ALTERED COPIED OR COMMUNICATED WITHOUT THE WRITTEN CONSENT OF I.B.A.

S.A. ION BEAM APPLICATIONS

REV:	DATE:	MODIFICATION:	DRAFTMAN:	CHECKED BY:	VALIDATED BY:
A	30/04/15	Original issue	LCHEN	QBA	PV

MATERIAL: –
SCALE: 1/250 (A3)
DIMENSIONS: mm
TOLERANCES: –

PROJECT: PROTON THERAPY
SPROJECT: TATA HBTF MUMBAI

V.
ELECTRICAL SET

TITLE:
Grounding connections locations

07.42.33.

52.33 A

CABLE TRAYS AND DUCTS

The cables will run from one room to another using ducts or cable trays. This section gives information in order for the D/BT to provide means of getting these cables through the building.
In figure 52.42, a schematic shows the cable distribution in all the Facility and indicates each location where a set of ducts shall begin or end, and references them by a label. It also indicates the quantity and the diameters of the ducts.

All the information provided in this section relates to PTEV needs for PT equipment installation.
Additional needs for equipment not provided by the PTEV, like general lighting, power outlets, CCTV, fire detection ect. are not taken into account.

1. All ducts and cable trays defined hereafter will be for the PTEV use only. No other equipment or cabling can be installed in those without the PTEV written agreement. In that case, ducts or cable trays shall be made larger and their design will be adapted.

2. The detailed design of cable ducts and the routing of cable trays are the responsibility of the D/BT but will be reviewed by the PTEV to ensure compatibility with the cables pulling

3. All ducts and cable trays will be supplied and installed by the D/BT.

4. The Therapy Safety System wiring will be placed in separate and dedicated ducts or cable trays.

CABLE TRAYS REQUIREMENTS

1. All required cable trays must be ladder or wire mesh types, to facilitate getting cables in and out.

2. For all cable trays, wire type is recommended (for example Cablofil CF105 from Cablofil inc.) to minimize installation time and cost. A sufficient number of cable tray supports shall be installed to avoid any bending under the cable weight. If the cable trays are bending due to the cable weight, the D/BT will replace the required parts at its own cost and upon PTEV request. A site survey can be realized by PTEV and the D/BT to list the damaged cable trays.

3. All the cable trays running under a raised floor, will be easily accessible by removing the raised floor panel located just above the tray .

4. The D/BT will avoid sharp edges that could damage the cable insulation.

5. Metallic cable trays shall be grounded. The connection shall be made in such a way that if one section of the tray is removed the other sections are not disconnected. It is recommended to run a ground conductor along the length of the tray, and to connect it to the electrical ground system in at least one point and to each cable tray section via grounding clamps. The applicable national or local electrical codes shall be followed to determine the ground conductor minimum size.

6. All visible cable trays in the MCR, TR and TCR will be closed by the D/BT with an appropriate cover easily removable.

DUCTS REQUIREMENTS

1. Ducts must be designed to minimize radiation leakage.

2. In case the ducts are metal, each duct shall be grounded according to applicable regulations.

3. The D/BT will avoid all cutting edges at the duct ends that could damage the cable insulation.

4. Special care shall also be taken to avoid any obstacles within the tubes. They shall therefore be seamless.

5. All electrical conduits for PTE cabling shall be permanently tagged and numbered at each end by the D/BT, using a convention developed by PTEV. See Figure 52.41 - General comments & legend. The labels will be placed on the wall and on the pulling tapes or cords.

6. All ducts shall be closed by the D/BT at each end during construction to avoid dust or concrete obstructing the ducts.

7. Pulling tapes or cords shall be placed in the ducts from end to end with 100 cm (±40") extra at each end by the D/BT.

8. All ducts passing under the beam line shall be embedded minimum 20 cm (±8") under the concrete surface to avoid interferences with the equipment anchoring. This is also valid for non-PTE ducts.

9. If requested by local regulation, the D/BT will provide fireproof sealing in all PTEV electrical ducts after installation of PTEV cabling and coordinate with PTEV.

10. Electrical conduits ducts end:

    10.1 Duct emerging horizontally from the concrete will be minimum at 5 cm (±2") above the ground to avoid water to enter.

    10.2 Duct emerging vertically from the floor or ceiling, will exceed at least 5 cm (±2") of the concrete.

11. A list of the conduits lengths or close estimation (±2 m (±7')) based on figure 52.43 shall be transmitted by D/BT to PTEV 6 months before BOD.

THIS DOCUMENT IS THE PROPERTY OF I.B.A. AND SHALL NOT BE ALTERED COPIED OR COMMUNICATED WITHOUT THE WRITTEN CONSENT OF I.B.A.

S.A. ION BEAM APPLICATIONS

VALIDATED BY:	PV
CHECKED BY:	QBA
DRAFTMAN:	LCHEN
MODIFICATION:	Original issue
DATE:	30/04/15
REV:	A

MATERIAL:	–
SCALE:	(A3)
DIMENSIONS:	mm
TOLERANCES:	–

PROJECT: PROTON THERAPY

SPROJECT: TATA HBTF MUMBAI

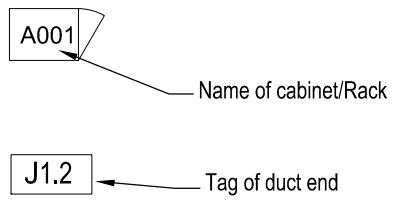
V.
ELECTRICAL SET

TITLE:
Cable trays & ducts requirements

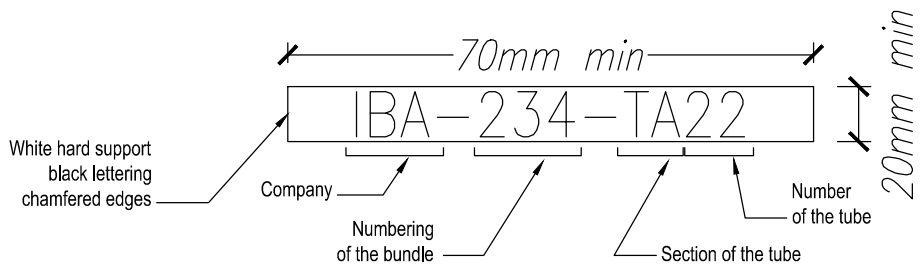
07.42.33.

52.41 A

LEGEND

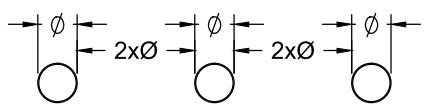


Labels of the tubes to be provided by D/BT according to this numbering structure; following a list provided by PTEV:

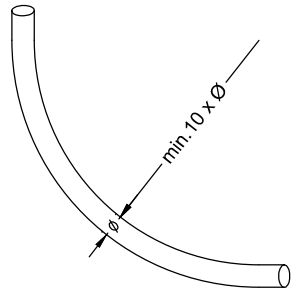


1. All the Cable trays to be installed by D/BT.
2. The cable trays are dedicated for PTEV equipment only. Other cable trays (type and routing) will be foreseen by D/BT.
3. Coordination and execution drawings will be developed and coordinated with PTEV.

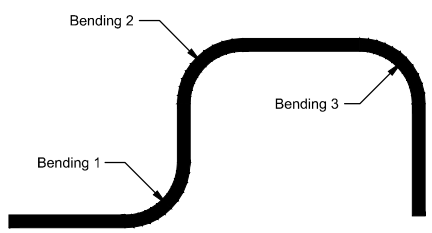
GOOD DUCTS INSTALLATION PRACTICE AND RADIOPROTECTION RECOMMENDATION



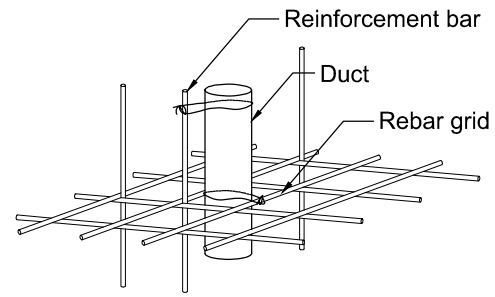
Note: Space between 2 ducts must be equal to 2xØ of the ducts to allow the concrete to fill correctly the space in between.



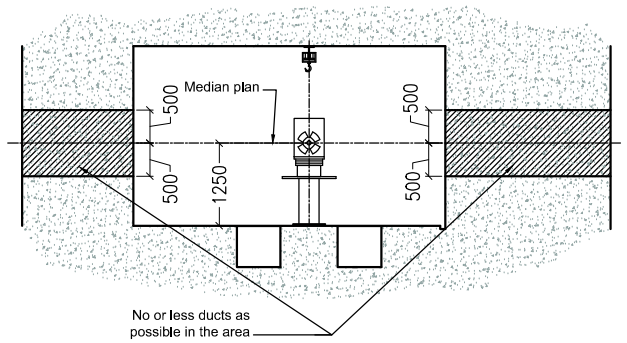
Note: Minimum bending radius of a duct must be equal to 10xØ of duct to ease cable pulling



Note: Maximum 3 bendings along a duct routing



Note: Bind the ducts to steel bars or steel grids into concrete to avoid displacement during the pouring



Note: No or less ducts as possible in an area around the beamline located between 75 cm (±30") to 175 (±70") cm from the floor (50 cm (±20") above and under the beamline). If really needed, after validation by PTEV, the D/BT shall apply strictly the routing and arrangements validated.

Cable Trays

Additional cable trays shall be provided wherever cables will run between 2 locations unlinked by conduits or trenches.

D/BT shall install 1 row of cable tray 100 mm (±4") in the trenches of every treatment room.

To be revised if modification of configuration

THIS DOCUMENT IS THE PROPERTY OF I.B.A. AND SHALL NOT BE ALTERED COPIED OR COMMUNICATED WITHOUT THE WRITTEN CONSENT OF I.B.A.

S.A. ION BEAM APPLICATIONS

REV:	DATE:	MODIFICATION:	DRAFTMAN:	CHECKED BY:	VALIDATED BY:
A	30/04/15	Original issue	LCHEN	QBA	PV

MATERIAL: –
SCALE: (A3)
DIMENSIONS: mm
TOLERANCES: –

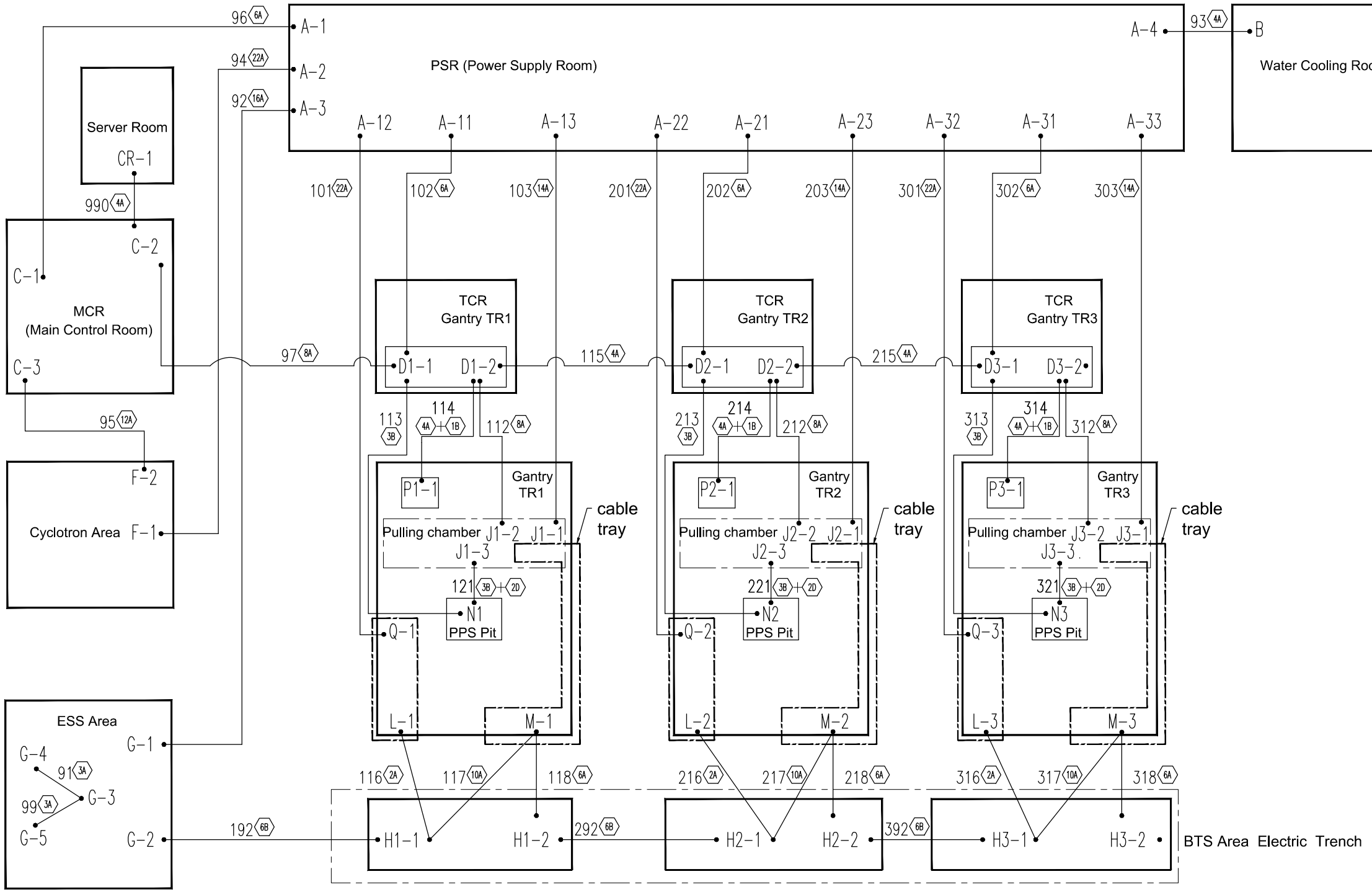
PROJECT: PROTON THERAPY
SPROJECT: TATA HBTF MUMBAI

V.
ELECTRICAL SET

TITLE:
General comments & legend

07.42.33.

52.42 A



——·——·—— : Connection made by cable tray

⟨nA⟩ = n x ø65 mm/ø2,5" (internal diameter)
⟨nB⟩ = n x ø100 mm/ø4" (internal diameter)
⟨nC⟩ = n x ø25 mm/ø1" (internal diameter)
⟨nD⟩ = n x ø200 mm/ø8" (internal diameter)

To be revised if modification of configuration

THIS DOCUMENT IS THE PROPERTY OF I.B.A. AND SHALL NOT BE ALTERED COPIED OR COMMUNICATED WITHOUT THE WRITTEN CONSENT OF I.B.A.

S.A. ION BEAM APPLICATIONS

REV:	DATE:	MODIFICATION:	DRAFTMAN:	CHECKED BY:	VALIDATED BY:
A	30/04/15	Original issue	LCHEN	QBA	PV

MATERIAL: –
SCALE: (A3)
DIMENSIONS: mm
TOLERANCES: –

PROJECT: PROTON THERAPY
S/PROJECT: TATA HBTF MUMBAI

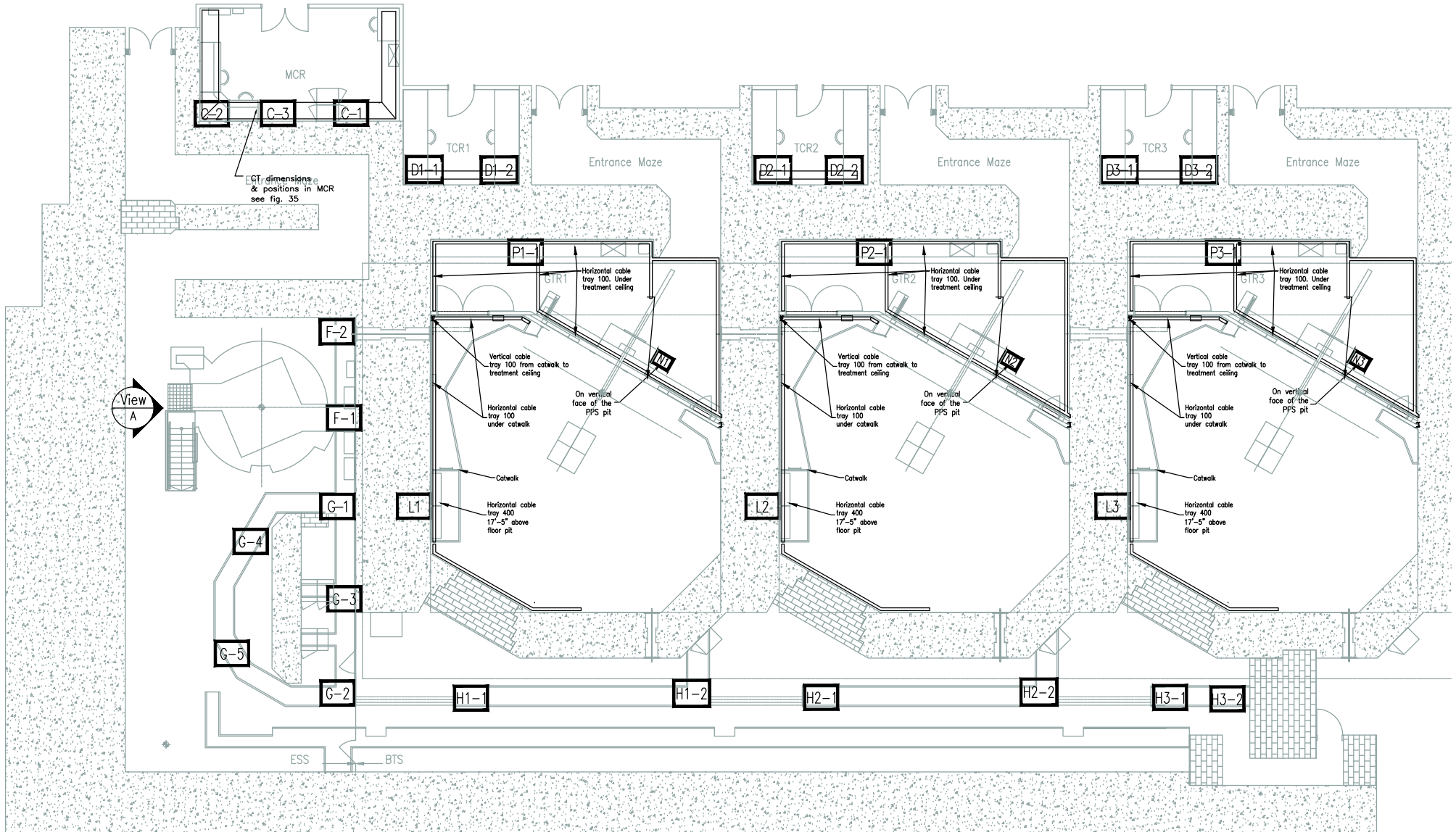
V.
ELECTRICAL SET

TITLE:
Schematic:
Cable distribution
in the building

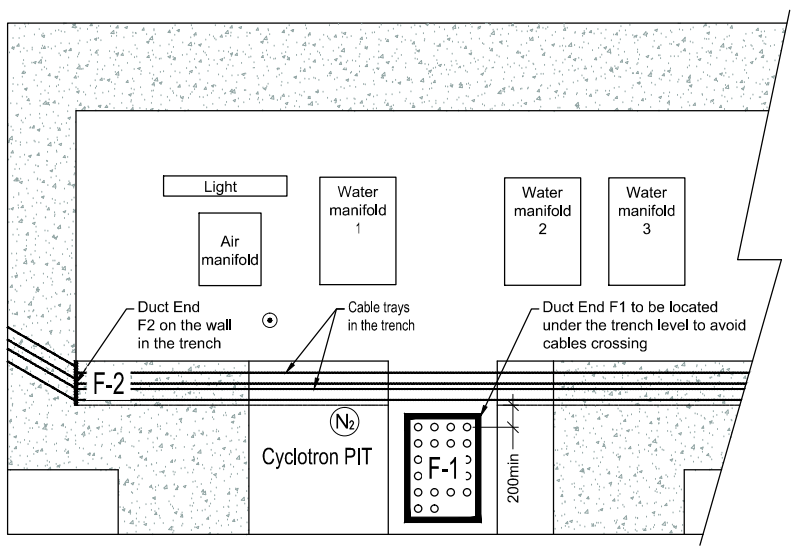
07.42.33.

52.43 A

See fig. 52.43 for numbering of the sections and of the tubes



TREATMENT LEVEL



VIEW A

To be revised if modification of configuration

THIS DOCUMENT IS THE PROPERTY OF I.B.A. AND SHALL NOT BE ALTERED COPIED OR COMMUNICATED WITHOUT THE WRITTEN CONSENT OF I.B.A.

S.A. ION BEAM APPLICATIONS

REV:	DATE:	MODIFICATION:	DRAFTMAN:	CHECKED BY:	VALIDATED BY:
A	30/04/15	Original issue	LCHEN	QBA	PV

MATERIAL: –
SCALE: 1/200 (A3)
DIMENSIONS: mm
TOLERANCES: –

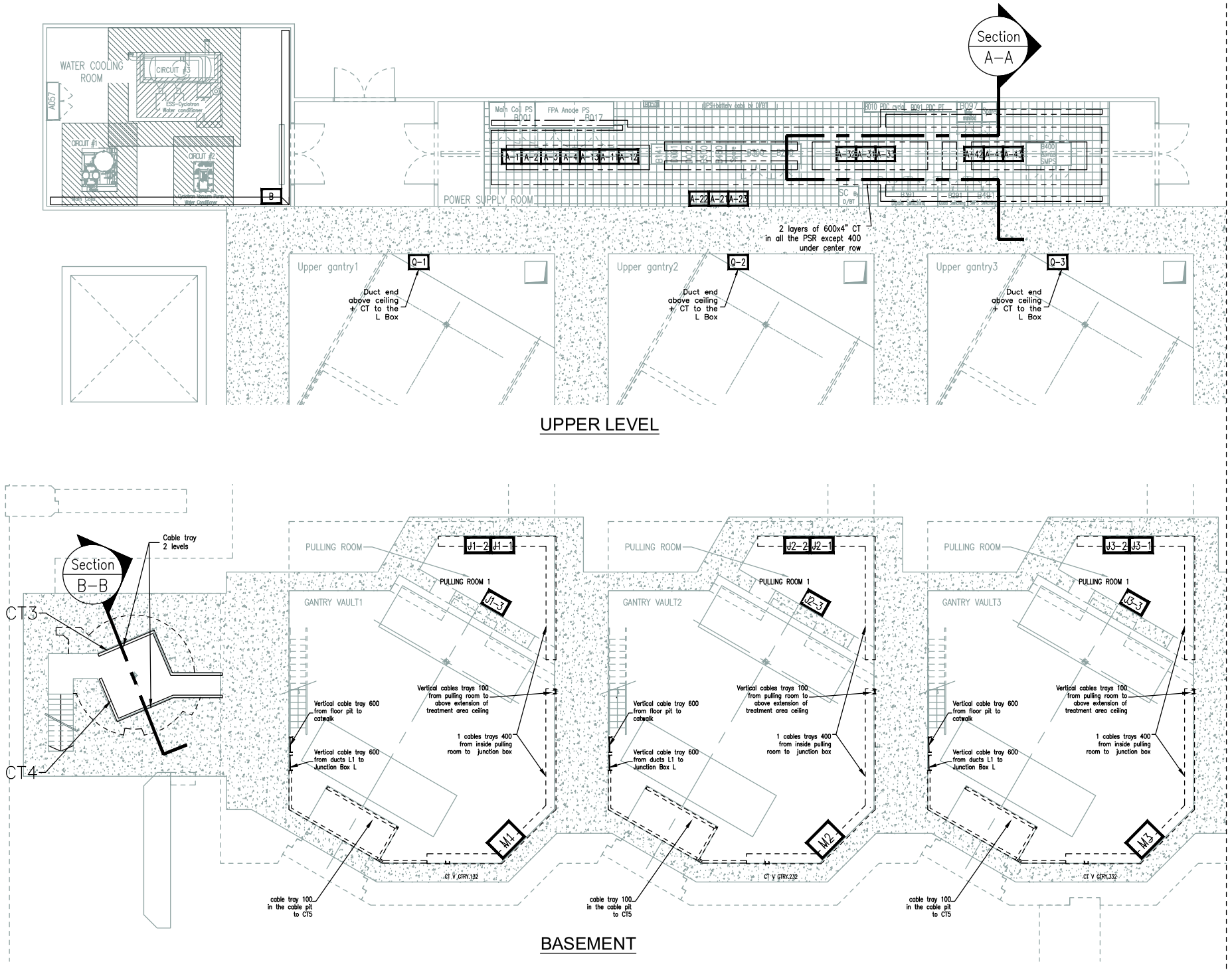
PROJECT: PROTON THERAPY
S/PROJECT: TATA HBTF MUMBAI

V.
ELECTRICAL SET

TITLE:
Location of cable trays & duct ends Treatment Level

07.42.33.

52.44 A



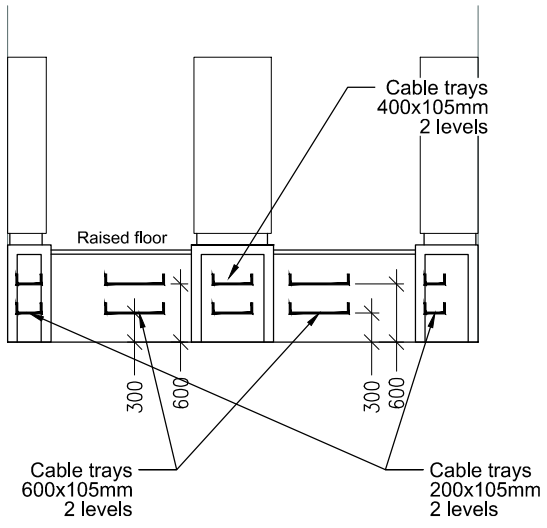
See Fig. 52.43 for numbering of the sections and the tubes

CABLE TRAYS IN PSR & CYCLO PIT

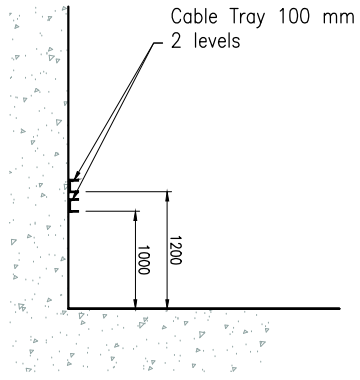
1. The cable trays for the PSR need to be able to support the weight of the cables (40 kg/m (30 lbs/ft)) and workers pulling the cables. Therefore, D/BT will install appropriate cable trays and support framing. See Section A-A for cable trays positioning.

2. In the cyclotron pit, it will consist of 2 cable trays high installed vertically on the wall on 2 levels. See section B-B.

SECTION A-A Typical CT Section



SECTION B-B



To be revised if modification of configuration

THIS DOCUMENT IS THE PROPERTY OF I.B.A. AND SHALL NOT BE ALTERED COPIED OR COMMUNICATED WITHOUT THE WRITTEN CONSENT OF I.B.A.

S.A. ION BEAM APPLICATIONS

REV:	DATE:	MODIFICATION:	DRAFTMAN:	CHECKED BY:	VALIDATED BY:
A	30/04/15	Original issue	LCHEN	QBA	PV

MATERIAL: –
SCALE: 1/200 (A3)
DIMENSIONS: mm
TOLERANCES: –

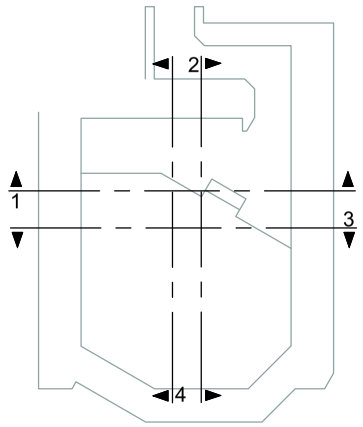
PROJECT: PROTON THERAPY
S/PROJECT: TATA HBTF MUMBAI

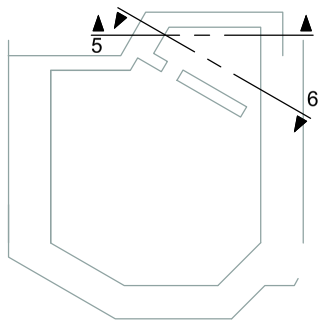
V.
ELECTRICAL SET

TITLE:
Location of cable trays & duct ends
Upper Level
Basement

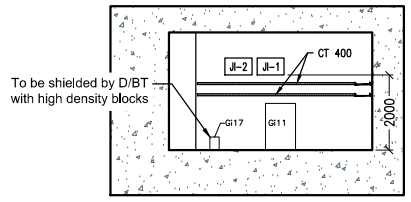
07.42.33.

52.45 A

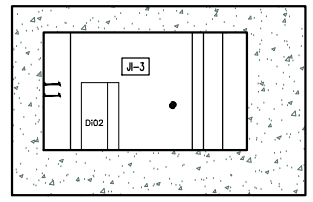




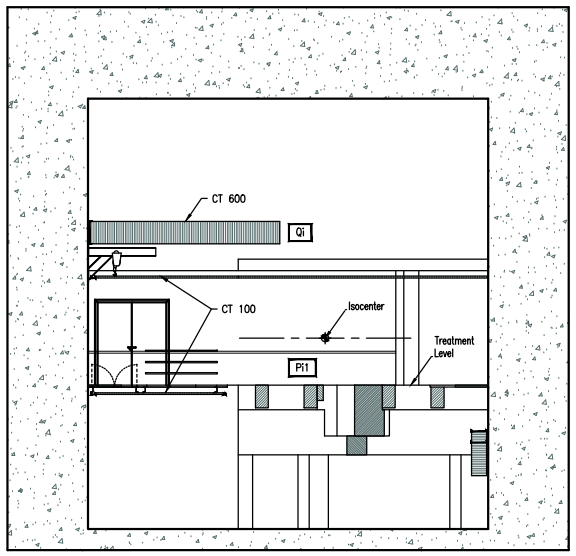
PULLING ROOM



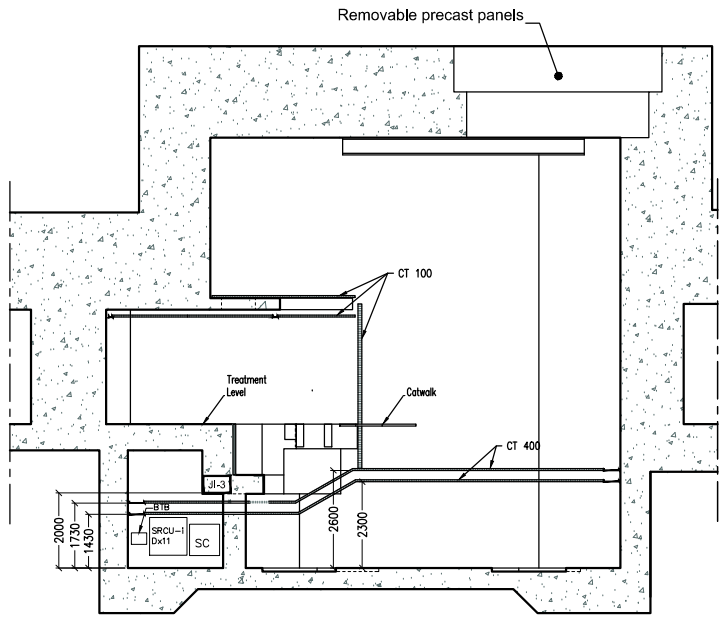
VIEW 5



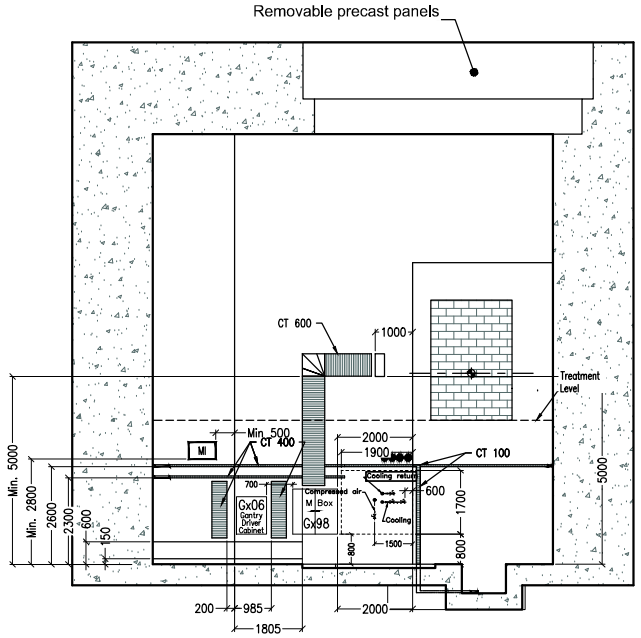
VIEW 6



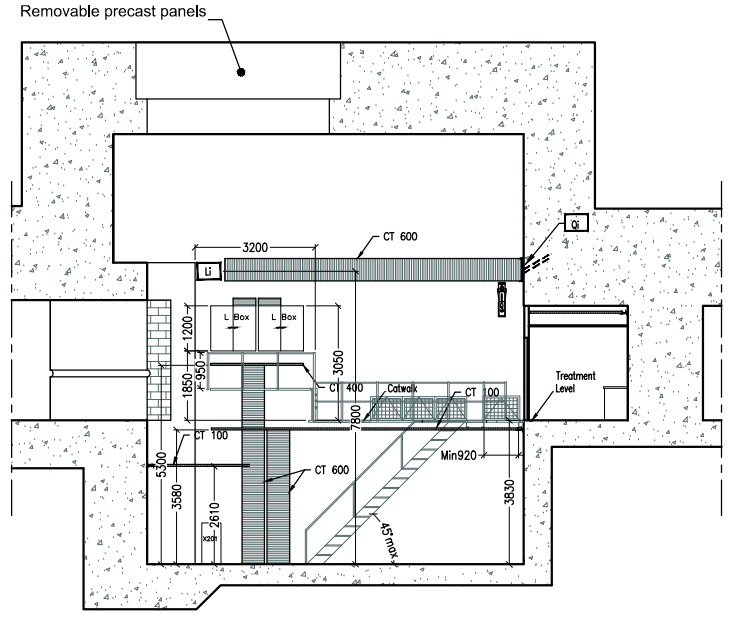
VIEW 1



VIEW 2



VIEW 3



VIEW 4

To be revised if modification of configuration

THIS DOCUMENT IS THE PROPERTY OF I.B.A. AND SHALL NOT BE ALTERED COPIED OR COMMUNICATED WITHOUT THE WRITTEN CONSENT OF I.B.A.

S.A. ION BEAM APPLICATIONS

REV:	DATE:	MODIFICATION:	DRAFTMAN:	CHECKED BY:	VALIDATED BY:
A	30/04/15	Original issue	LCHEN	QBA	PV

MATERIAL: –
SCALE: 1/200 (A3)
DIMENSIONS: mm
TOLERANCES: –

PROJECT: PROTON THERAPY

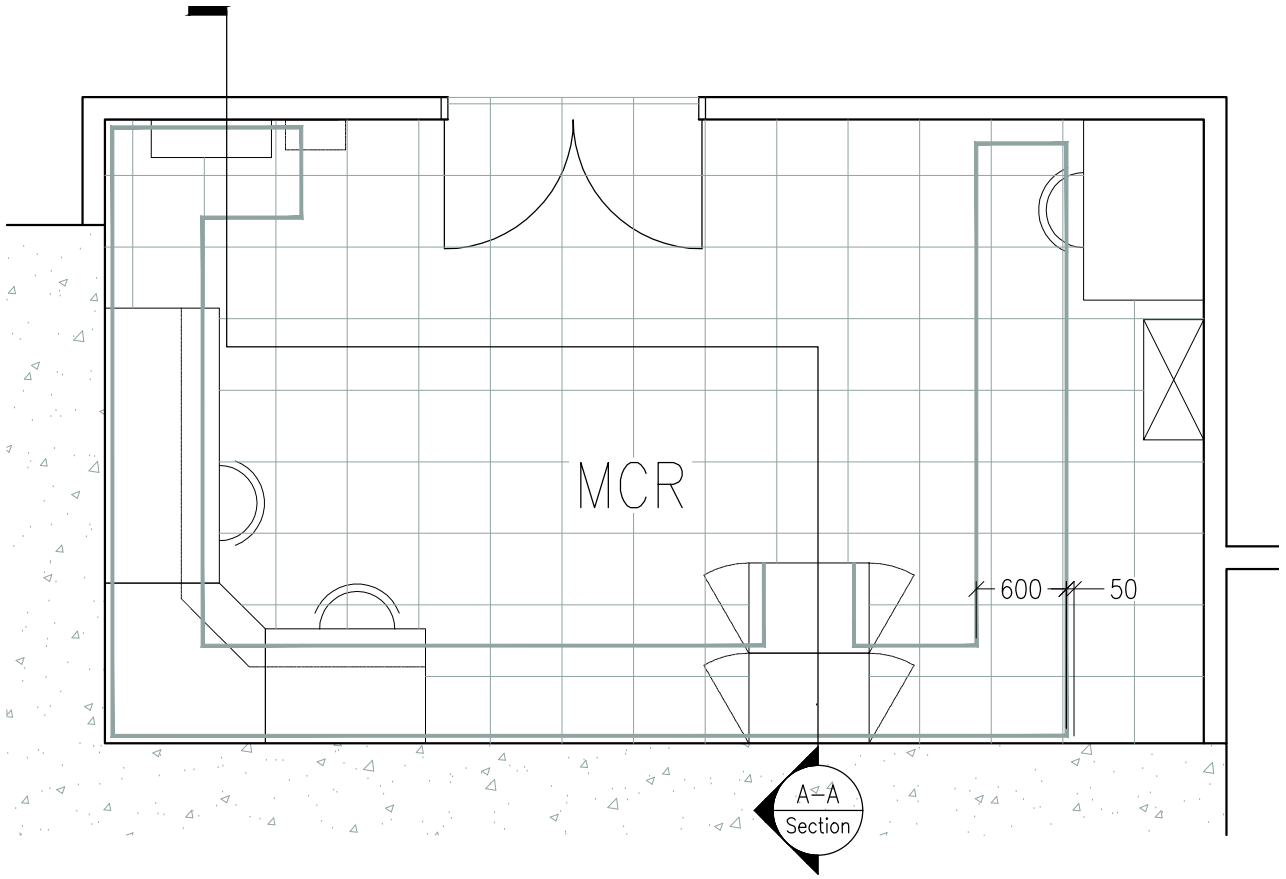
SPROJECT: TATA HBTF MUMBAI

V.
ELECTRICAL SET

TITLE:
Cable trays & ducts ends : views and details

07.42.33.

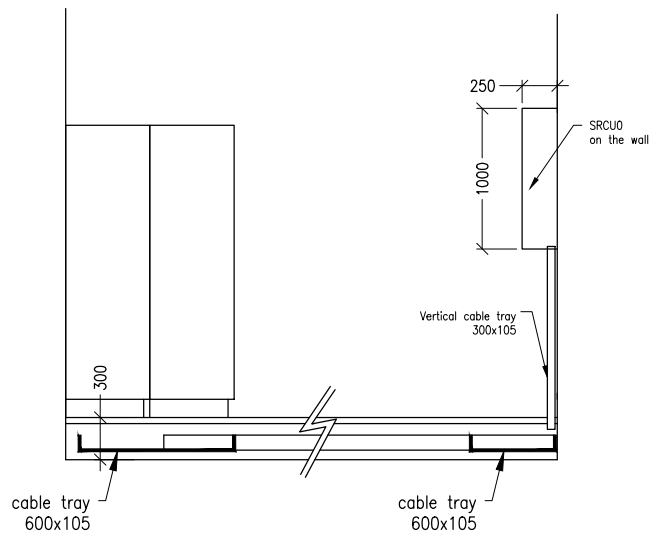
52.46 A



CABLE TRAYS IN MCR

1. The cable trays for the MCR need to be able to support the weight of the cables (20 kg/m, 15 lbs/ft) and workers pulling the cables. For that purpose, D/BT will install appropriate cable trays and support framing. See Section A-A on this figure for cable trays positioning.

Section A-A



THIS DOCUMENT IS THE PROPERTY OF I.B.A. AND SHALL NOT BE ALTERED COPIED OR COMMUNICATED WITHOUT THE WRITTEN CONSENT OF I.B.A.

S.A. ION BEAM APPLICATIONS

REV:	DATE:	MODIFICATION:	DRAFTMAN:	CHECKED BY:	VALIDATED BY:
A	30/04/15	Original issue	LCHEN	QBA	PV

MATERIAL: –
SCALE: 1/50 (A3)
DIMENSIONS: mm
TOLERANCES: –

PROJECT: PROTON THERAPY

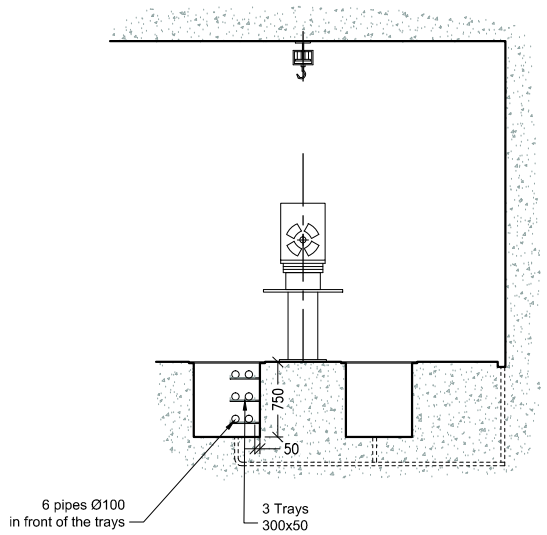
S/PROJECT: TATA HBTF MUMBAI

V.
ELECTRICAL SET

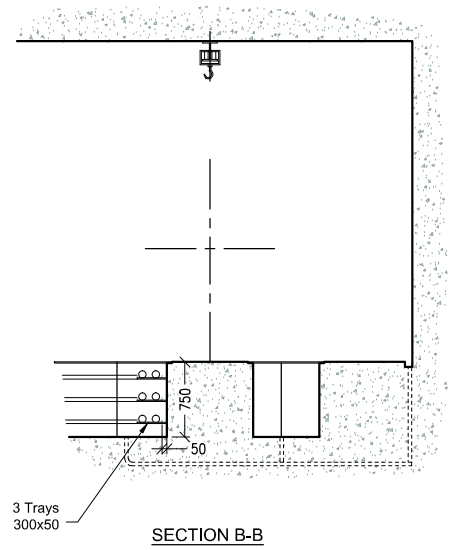
TITLE:
Main Control Room cables trays

07.42.33.

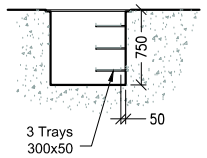
52.47 A



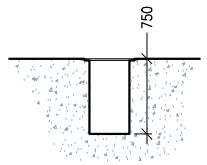
SECTION A-A



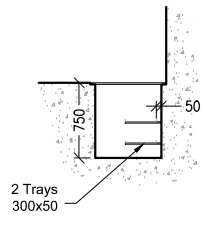
SECTION B-B



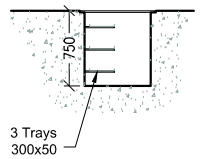
SECTION C-C



SECTION D-D



SECTION E-E



SECTION F-F

CABLE TRAYS IN CYCLO VAULT, ESS/BTS

Considering beam direction as reference, the left-hand side trenches will be dedicated for the electrical service of the beam line.
Plan view and sections of the wiring trenches on the treatment level are shown on this Figure.

1. D/BT shall provide removable walk-on aluminium or galvanized steel metal gratings on all wiring trenches.
   Gratings shall be designed not to exceed 25 kg (55 lbs) for manipulation purposes.
   They will have 10 x 5 cm (4" x 2") cut-outs along grating edges on beam line side for cable and pipe passage from the trench to the equipment (provided by the D/BT). The gratings shall be able to support a moving point load of 1500 kg (3000 lbs).

2. The trenches shall be provided with drains connected to the main floor drain system.

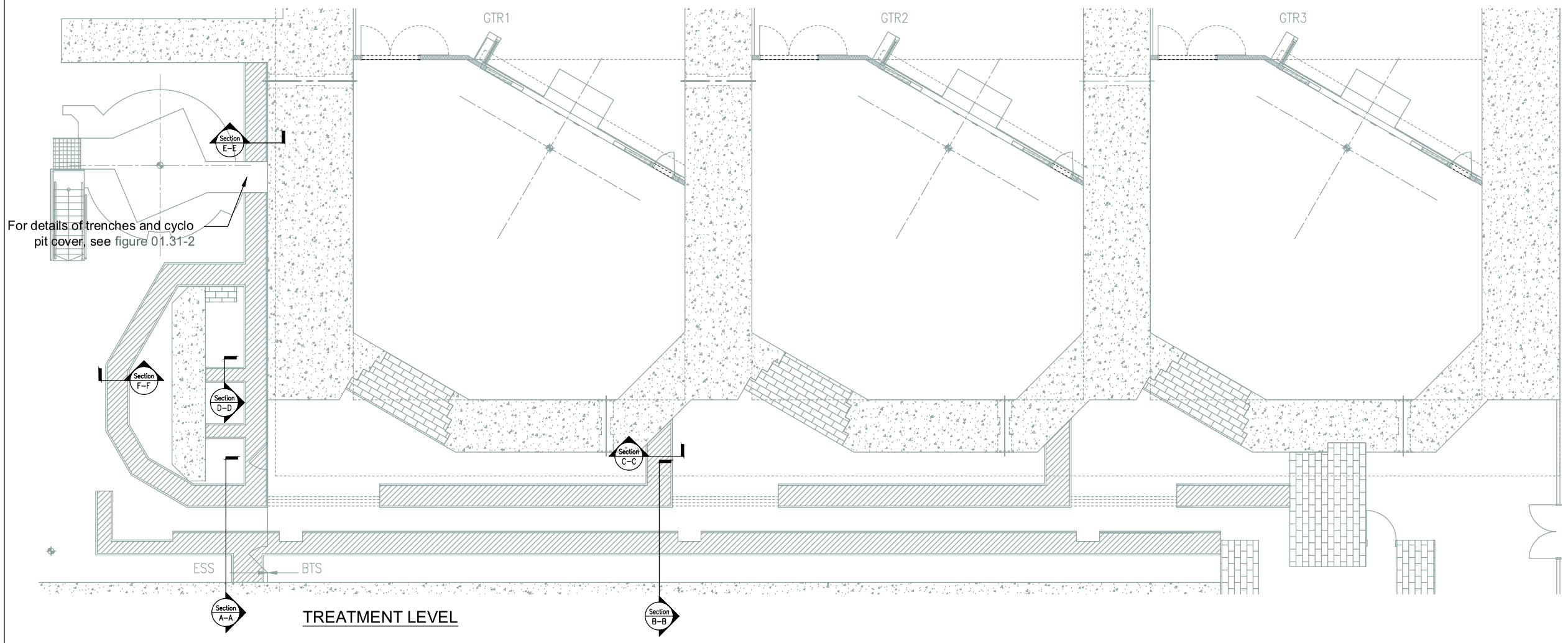
3. Where the trenches must be interrupted due to magnet stands or shielding walls located on their way, the trenches will be connected together by 6 or 8 ducts embedded in the concrete of 100 mm (4") diameter. See cross section A-A on this figure .

4. The cable ducts ending in the trenches will emerge from the side of the trench, exceeding max 2,5 cm (1") the concrete surface.

5. The cross sections view on this figure shows how cable trays shall be installed in the electrical trenches of the Cyclotron/ESS/BTS areas.

6. In the ESS/BTS area, it consists of 3 cable trays of 30 cm (1') width installed on 3 levels (one for control cables, one for signal cables, one for power cables).

7. A free space shall be kept between the cable trays and the beam line side of the trench wall.



TREATMENT LEVEL

THIS DOCUMENT IS THE PROPERTY OF I.B.A. AND SHALL NOT BE ALTERED COPIED OR COMMUNICATED WITHOUT THE WRITTEN CONSENT OF I.B.A.

S.A. ION BEAM APPLICATIONS

REV:	DATE:	MODIFICATION:	DRAFTMAN:	CHECKED BY:	VALIDATED BY:
A	30/04/15	Original issue	LCHEN	QBA	PV

MATERIAL: –
SCALE: 1/150 (A3)
DIMENSIONS: mm
TOLERANCES: –

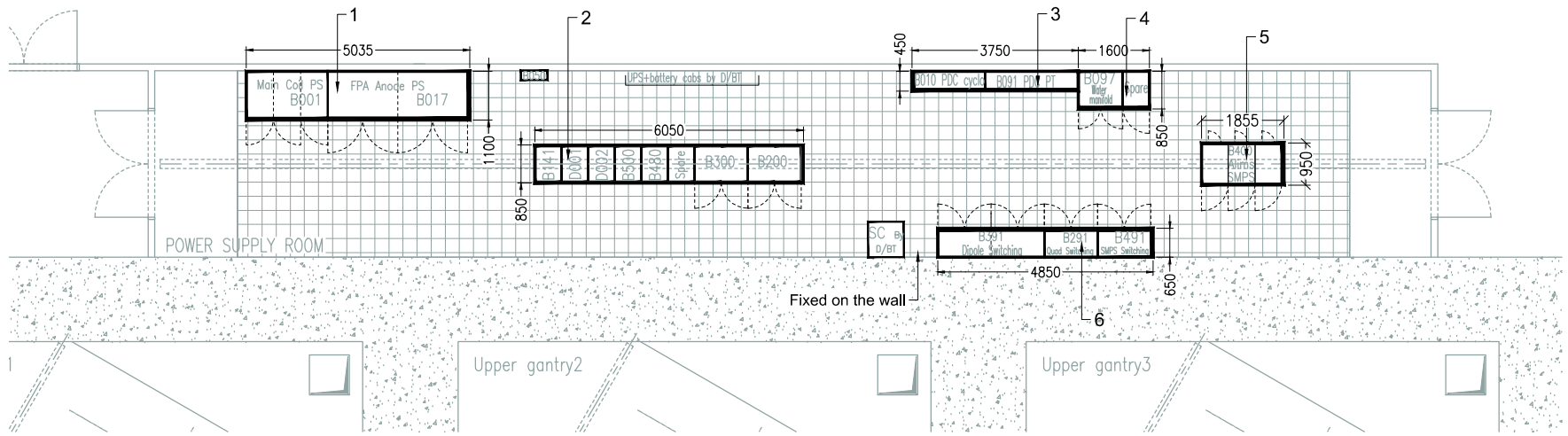
PROJECT: PROTON THERAPY
SPROJECT: TATA HBTF MUMBAI

V.
ELECTRICAL SET

TITLE:
Cable trays in cyclo vault, ESS/BTS

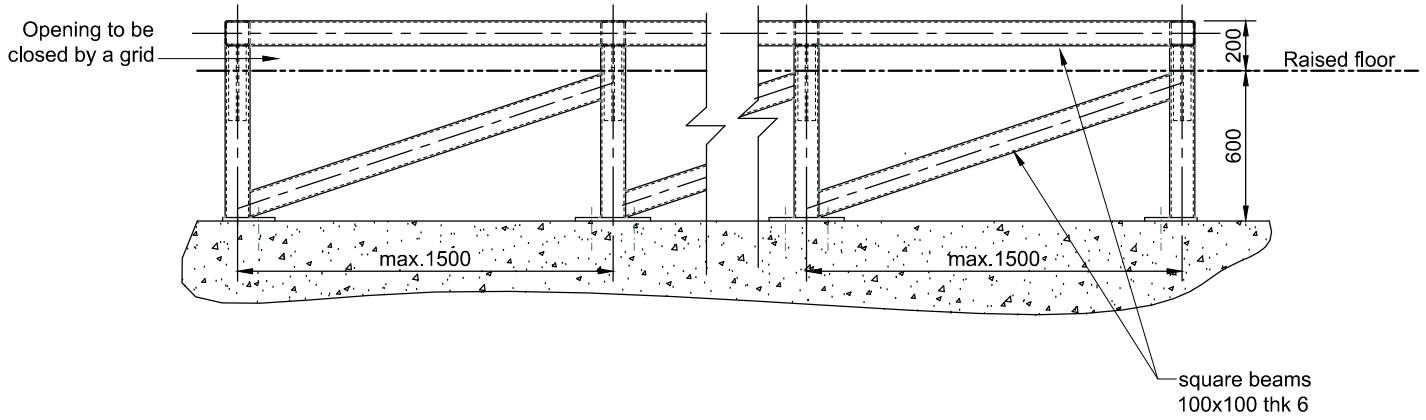
07.42.33.

52.48 A

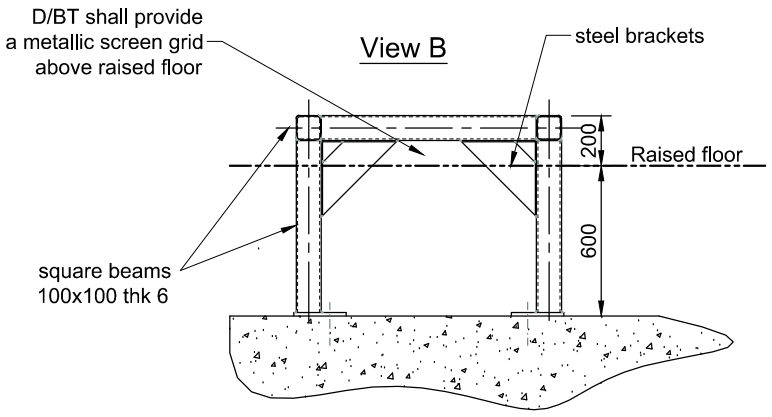


UPPER LEVEL

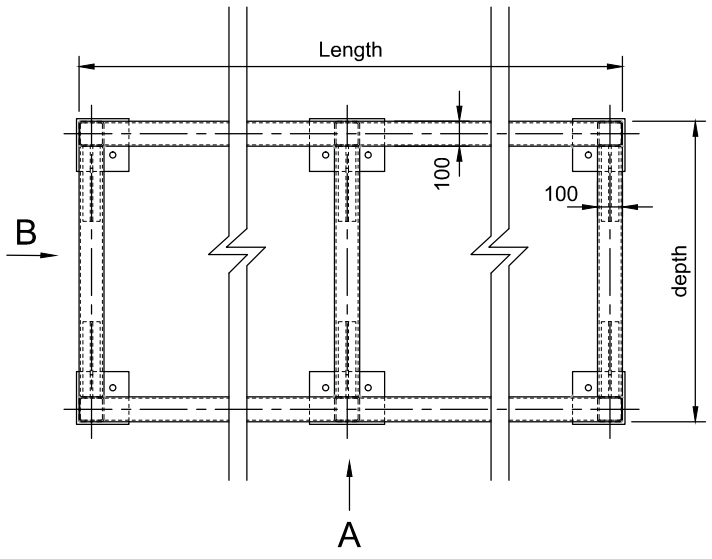
View A



View B



Top View



NUMBERING	LENGTH	DEPTH	
1	5035	1100	May be divided by the D/BT
2	6050	850	
3	3750	450	
4	1600	850	May be divided by the D/BT
5	1855	950	
6	4850	650	May be divided by the D/BT

DIMENSIONS IN [mm]

1. Very long stands can be divided in length by D/BT as indicated next to the table
2. Dimensions for information only, they can be subject to small modifications.
3. All the final dimensions will be confirmed by PTEV minimum 3 months before installation.
4. The closing of the stands above the raised floor is depending on the cooling system selected.

THIS DOCUMENT IS THE PROPERTY OF I.B.A. AND SHALL NOT BE ALTERED COPIED OR COMMUNICATED WITHOUT THE WRITTEN CONSENT OF I.B.A.

S.A. ION BEAM APPLICATIONS

REV:	DATE:	MODIFICATION:	DRAFTMAN:	CHECKED BY:	VALIDATED BY:
A	30/04/15	Original issue	LCHEN	QBA	PV

MATERIAL: –
SCALE: 1/150 (A3)
DIMENSIONS: mm
TOLERANCES: –

PROJECT: PROTON THERAPY
S/PROJECT: TATA HBTF MUMBAI

V.
ELECTRICAL SET

TITLE:
Power Supply Room cabinets stands

07.42.33.

52.51 A

VI. OTHER TECHNICS

S.A. ION BEAM APPLICATIONS

THIS DOCUMENT IS THE PROPERTY OF I.B.A AND SHALL NOT BE ALTERED COPIED OR COMMUNICATED WITHOUT THE WRITTEN CONSENT OF I.B.A.

60. OTHER TECHNICS

ACRONYMS

PT:	Proton Therapy
ESS:	Energy Selection System
D/BT:	Design Building team
PTEV:	Proton Therapy Equipment Vendor
BTS:	Beam Transport System
TSS:	Therapy Safety System
MCR:	Main Control Room
SRCU:	Safety Redundant Control Unit
TPS	Therapy planning System
OIS:	Oncology information System
PSR:	Power Supply Room
BOD:	Building Occupancy Date
TPS:	Treatment Planning System
OIS:	Oncology Information System
SRCU:	Safety Redundant Control Unit
BTB:	Building Terminal Box
NC/NO:	Normally Closed / Normally Open
PPS:	Patient Positioning System

TABLE OF CONTENTS:

Refer also to **Chapter II** (ROOMS) for architectural specifications of the rooms

THIS DOCUMENT IS THE PROPERTY OF I.B.A. AND SHALL NOT BE ALTERED COPIED OR COMMUNICATED WITHOUT THE WRITTEN CONSENT OF I.B.A.

S.A. ION BEAM APPLICATIONS

REV:	A	DATE:	30/04/15	MODIFICATION:	Original issue	DRAFTMAN:	LCHEN	CHECKED BY:	QBA	VALIDATED BY:	PV						

MATERIAL: –
SCALE: (A3)
DIMENSIONS: mm
TOLERANCES: –

PROJECT: PROTON THERAPY

SUBPROJECT: TATA HBTF MUMBAI

VI.
OTHER
TECHNICS

TITLE:
General
Presentation

07.42.33.

60.00 A