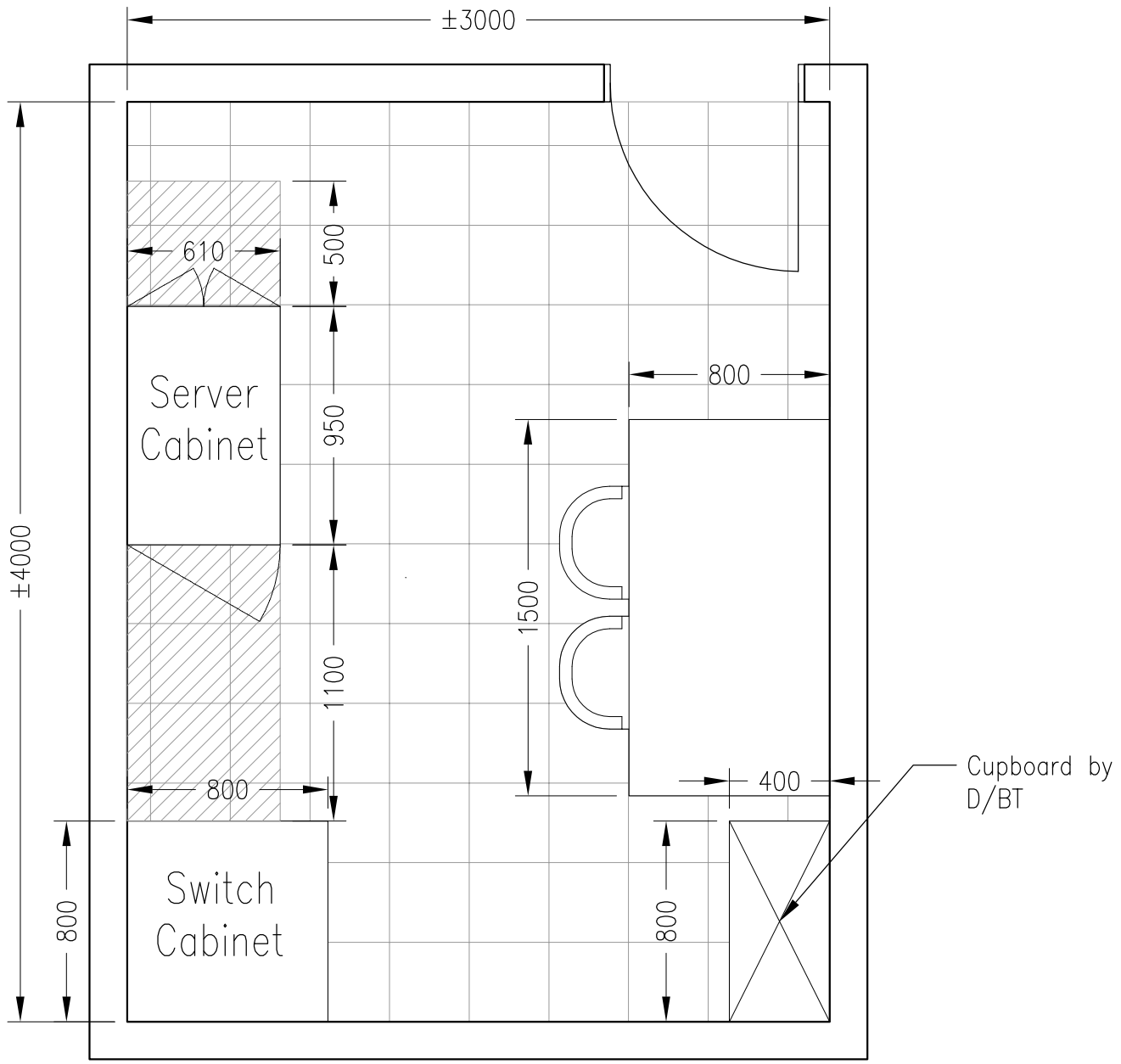
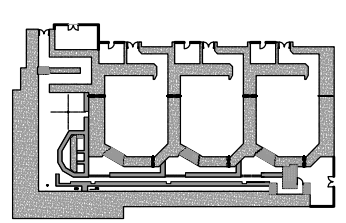


Clearance

35. PTEV SERVER ROOM

A room shall be reserved for the computer servers of the PTEV Therapy Control System (TCS) equipment. All cables from the PTEV data network shall emerge from under the raised floor in this room for connection to the PTEV server through adequate patch panel (*refer to Fig.67.01*).
The following is required:

1. Located at the treatment level.
2. As close as possible to the MCR.
3. Minimum of 12 m² (130 ft²).
4. Raised floor (antistatic computer floor), free height 30 cm (1'), flush with treatment level floor.
5. Suspended dismountable ceiling (height 2,5 m (8'-3") measured from finished floor).
6. Independent and stand alone air conditioning unit. This computer room shall be equipped with an air-cleaning system adapted for a proper server room. *See figure 61.01* for heat dissipation.
7. Dust shall not penetrate in a quantity to interfere with satisfactory operation of the apparatus or to impair safety.
8. The D/BT shall provide:
   - 8.1. 1 desk (150 cmx80 cm, 5'x2'-7") and 2 chairs
   - 8.2. 1 safe box and cupboard for backup tapes (±40 cm x 80 cm , 1'-4"x2'-8")
   - 8.3. 1 switch cabinet with min 12 U free for PTEV. A full height cabinet 80 cm (2'-8") depth is recommended.
9. The D/BT shall provide a high grade epoxy paint finish. The exposed concrete floor slab below the raised computer flooring shall receive an industrial type epoxy coating and the walls below the raised computer flooring shall be epoxy painted to control dust. The epoxy paint type shall be submitted to PETV for approval prior purchasing.
10. Lighting shall be on a dimming system to prevent computer screen glare.
11. The door will be lockable with auto-closing and a possibility to keep it open. The access keys (main and spare) will be handed over to PTEV only.
12. No sprinkler or wet pipes, drains in the ceiling or raised floor.
13. For network details refer to *Chapter VI* : Other technics Set : Network and for UPS details *Figure 52.32*



S.A. ION BEAM APPLICATIONS

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

MATERIAL: --
SCALE: 1/25 (A3)
DIMENSIONS: mm
TOLERANCES: --

PROJECT: PROTON THERAPY
SPROJECT: TATA HBTF MUMBA

II.
ROOMS

Other rooms

TITLE:
PTEV Server Room

07.42.33.

35.01 A

36. MACHINE SHOP

If the scope of the project includes a Machine Shop, it shall be equipped with the necessary equipment to produce treatment patient specific devices such as compensators. In addition to this, the customer may want to add equipment in this room for maintenance purposes.

Size will be determined in accordance with equipment to be located in this room.

The following is required:

1. If required a hatch in the ceiling of the machine shop, refer to ***Figure 50.01-1, Table 2: Definition of Hatches***, will be used as access for repairing or installing beam line equipment. Or an equivalent access through the building.

2. Double doors, giving access to the treatment corridor (minimum doors aperture: 185 cm (6') width x 240 cm (8') height. If the milling machine must be transported through these doors, refer to the dimensions given hereunder.

3. Compressed air outlets at each milling machine + 1 additional.

4. Industrial size double sink with cold and warm water.

5. Cold water outlet at each milling machine.

6. An electrical connection box and the connection for (depending contract):
   - 6.1 Each Milling Machine (400V, +/- 30kVA for each milling machine).
   - 6.2 Lathe
   - 6.3 Band Saw
   - 6.4 Additional Customer Equipment

7. Floor drain at each Milling machine.
8. Noise insulation/sound proofing in walls and ceiling.
9. Industrial heavy duty shelving will be provided by the D/BT. A detailed drawing of the shelves will be made by PTEV after the dimensions of the room are fixed.
10. Fire proof cabinet for oil and flammable liquids will be provided by the D/BT.
11. Special care need to be taken to ensure access into the building for the equipment.
    Example milling machine (Current size may be subject to small change):
    Weight: 4800 Kg (10500 lbs)
    Width: 270 cm (8'-10'')
    Depth: 320 cm (10'-6'')
    Height: 270 cm (8'-10'')

    Allow a minimum of 60 cm (2') clearances all around each milling machine for maintenance purpose and above for lighting and cabling

S.A. ION BEAM APPLICATIONS

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

PROJECT: PROTON THERAPY
SPROJECT: TATA HBTF MUMBAI

II.
ROOMS

Other rooms

TITLE:
Machine Shop

07.42.33.

N

36.01 A

37. OTHER PTEV ROOMS

1. MAINTENANCE ROOM

A room shall be reserved to make some maintenance on PTE small electrical and mechanical parts. The following is required:

1.1. Minimum 20 m² (215 ft²).

1.2. Connected or close to the Machine Shop or the PTEV office.

1.3. A sink with cold and hot water.

1.4. A desk and a chair.

1.5. Compressed air outlets.

1.6. Outlets 230 V (110V US).

1.7. Built-in caseworks and cabinets

1.8. Ductwork and piping in the ceiling areas should be kept to a minimum in order to maximize the space.

1.9. Fire proof cabinet for oil and flammable liquids will be provided by the D/BT.

1.10. The doors will be lockable with auto-closing and a possibility to keep them open.

2. PTEV SPARE PARTS STORAGE ROOM

Two rooms shall be reserved for the storage of PTE spare parts, accessible and equipped from the BOD.

One room at the treatment floor level

- Minimum of 50 m² (560 ft²)

One room at the upper level (PSR level)

- Minimum of 50 m² (560 ft²)
- As close as possible to the PSR

The following is required:

2.1. Dust shall not penetrate in a quantity to interfere with satisfactory operation of the apparatus or to impair safety. This must be operational since BOD.

2.2. Industrial heavy duty shelving and drawers (Vidmar type).

2.3. The final drawing of the shelves and drawers will be made by D/BT after the dimensions of the room are fixed and provided to PTEV at the latest 3 months prior to BOD.

2.4. Pallet jack capability (+/- 300 kg (600 lbs))

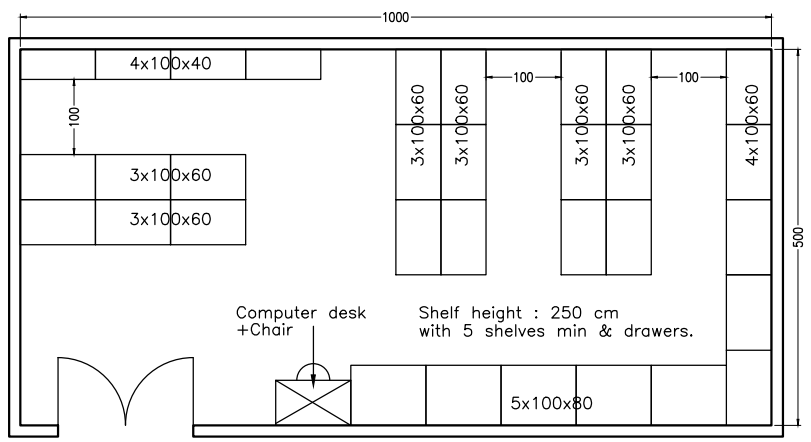
2.5. Standard double lockable door access with auto-closing and a possibility to keep them open.

2.6. 1 desk and chair in each room.

2.7. Lighting will be positioned according to shelves position.

2.8. Easy access to the service elevator with double doors all the way of routing.

2.9. Ceiling and walls will have a light dustproof painting and floors will have an industrial epoxy finish.



3. PTEV OFFICES AND TEMPORARY SPACES

Offices shall be reserved for the PTEV engineers and operators.

During construction:

- 3 months before BOD: Office with furniture for 3 people.
- 2 months before BOD: Storage for survey tools (see also ML-3)
- 2 weeks before BOD:
- Office with furniture for 8 to 10 people until move to permanent offices.
- Office with furniture for 3 people.

From BOD and after acceptance, permanent offices for maintenance /operation phases:

- One office space for 10 - 12 people with furniture (lockable and ergonomic desks, chairs and cabinets for 14 people) - Minimum of 85 m² (920 ft²).
- Two offices for 3 people (min 11m² (120 ft²) each) equipped with standard furniture - Located at the treatment level, as close as possible to the MCR.
- A storage and copy room (5 m² (55 ft²)) with network plugs.
- A temporary conference and meeting room from the beginning of the installation period up until the end of the acceptance phase. Equipped with desks and chairs for 12 people

4. ELEVATOR

At least one elevator must be available to transport a load of minimum 2500 kg (5500 Lbs) between different levels of the building. This shall be used occasionally for the transportation of spare parts. The elevator entry door shall be a minimum clear width of 140cm(4'-6") x245cm (8') high. The cab size would be at minimum 215cm (7') deep by 185cm (6') wide.

S.A. ION BEAM APPLICATIONS

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REV:	A																

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

PROJECT: PROTON THERAPY

S/PROJECT: TATA HBTF MUMBAI

II.
ROOMS

Other rooms

TITLE:
Other PTEV rooms

07.42.33.

37.01 A

38. RECOMMENDED ROOMS

Some rooms are recommended by PTEV for service optimizations. These rooms are however to be designed and located by the hospital and out of IBA standard scope.

1. TREATMENT PLANNING COMPUTER ROOM (TPCR)

A room shall be reserved for the installation of the Treatment Planning System (TPS) (computers; monitors; printers).

The following is suggested:

- Minimum of 40 m² (430 ft²)
- Office furniture for minimum 6 people
- Raised floor recommended
- Suspended dismountable ceiling
- Air conditioning

The hospital shall decide on the location of the room for its best convenience (Therapists use). The room will be adapted to comply with Customer requirements.

The hardware and software will be supplied based on Customer request.

2. TPS/OIS SERVER ROOM

Same requirements as PTEV Server Room. If the TPS/OIS is provided by PTEV, additional requirements may be detailed in this IBD.

3. PATIENT IMMOBILIZATION DEVICES STORAGE ROOM

This room is dedicated to the storage of the patient immobilization devices used to block the patient body on the PPS couch or chair.

For convenience it is strongly recommended to locate this room as close as possible to the treatment area, at the treatment level.

The size of the room will be determined by the type and the size of the immobilization devices chosen by the Customer.

4. PATIENT TREATMENT DEVICES STORAGE ROOM

This room is dedicated to the storage of patient specific devices such as apertures and compensators.

For convenience, it is strongly recommended to locate this room as close as possible to the treatment area. This room could also be combined, at hospital best convenience, with the patient immobilization devices storage room.

5. PATIENT TREATMENT DEVICES CONTROLLED STORAGE ROOM

This room (minimum 12 m² (130 ft²)) is a designated area for devices under decay period. It is located into a non-public access area.

Space shall be plan for use with pallet jack access and circulation.

6. PATIENT IMMOBILIZATION BODY DEVICES FABRICATION SHOP

This room should be located near the diagnostic or simulator areas.

The size of the room will be determined by the Customer depending upon number of patient at full operation.

7. DOSIMETRY EQUIPMENT STORAGE ROOM

This room shall be located near the treatment rooms. Size requirements shall be determined by the dosimetry equipment.

8. SNOUT STORAGE ROOM

This room shall be located near the treatment rooms.

The size of the room shall be +/- 18 m² (200 ft²)

This room shall have industrial shelves to accommodate all type of snouts.

9. PROCESSING LABORATORY

For QC, the physicists are using radiographic film for the proton beam calibration and verification.

PTEV recommends the buyer to provide one X-ray development machine in order to process the radiographic film that will be used by the physicist during the proton beam calibration and routine QC.

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

PROJECT: PROTON THERAPY
SPROJECT: TATA HBTF MUMBAI

II. ROOMS

Other rooms

TITLE: Recommended Rooms

07.42.33.

III. INSTALLATION

S.A. ION BEAM APPLICATIONS

50.INSTALLATION

ACRONYMS

BOD:	Building occupancy date
ESS:	Energy selection system
D/BT:	Design/building team
PTEV:	Proton therapy equipment vendor
BTS:	Beam transport system
PTE:	Proton Therapy Equipment
Ri:	Route i
PPS:	Patient Positioning System

TABLE OF CONTENTS:

REFER ALSO TO:

Fig. 01.11	(Beam Transport Components & Isocenters)
Fig. 01.11-2, Table 2:	Cyclotron Main Components
Fig. 01.11-2, Table 3:	ESS/BTS Main Components
Fig. 02.11, Table 1:	Gantry Structure Main Components & Nozzle by room
Fig. 02.13	(Gantry Loads)
Fig. 02.14	(PPS Loads)
Fig. 02.51	(Gantry Treatment Room Dimensions-Installation Beam & Lifting Points)
Fig. 02.52	(Gantry Nozzle Anchor for Lifting Device Installation)
Fig. 02.53	(PPS Pit Embeds)
Fig. 32.01, Table 2:	Cooling Room Main Components
Fig. 33.01, Table 1:	MCR Main Components
Fig. 34.01, Table 1:	Treatment Control Room Equipment
Fig. 52.11-2	(Cabinets Numbering)
Fig. 90.01	(Building Completion Requirements)
Fig. 90.02	(Milestones)

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REV:	A

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

PROJECT: PROTON THERAPY

SPROJECT: TATA HBTF MUMBAI

III.
INSTALLATION

TITLE:
Presentation

07.42.33.

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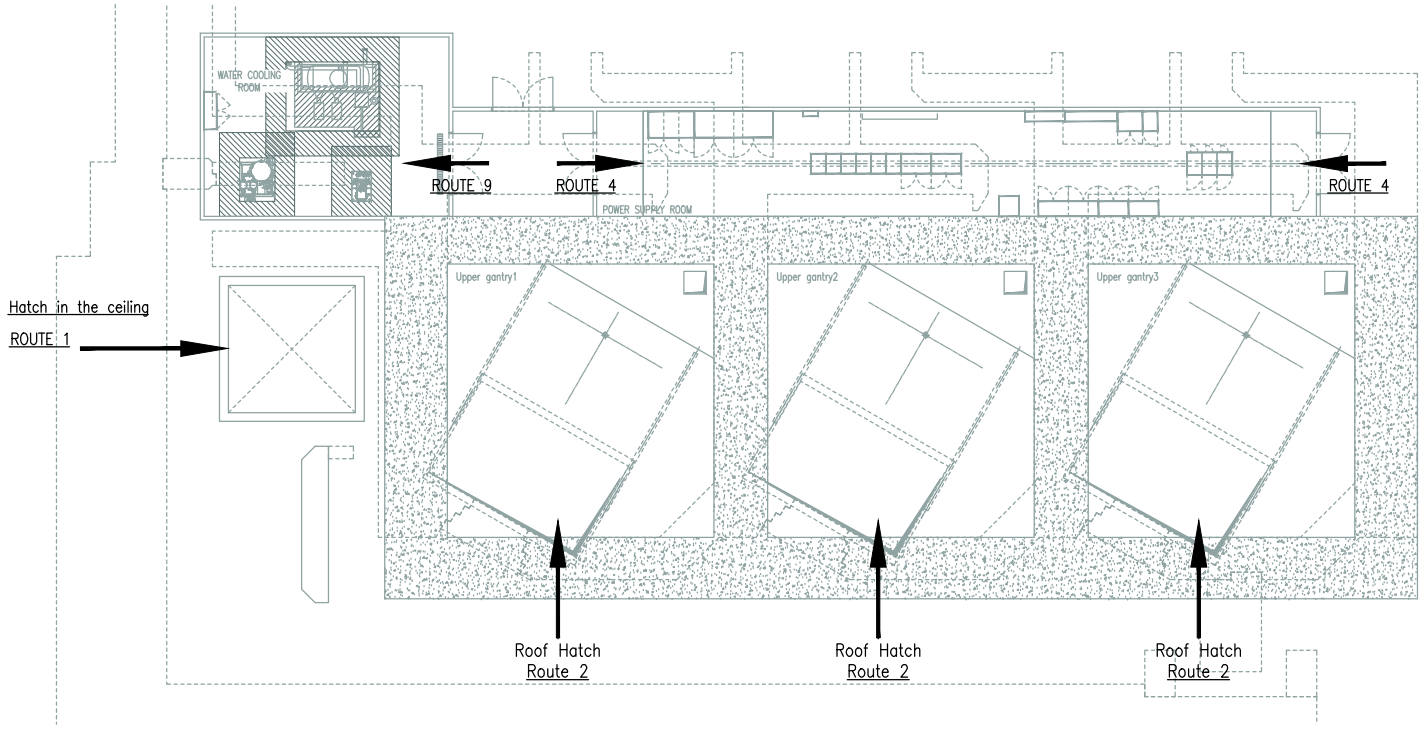
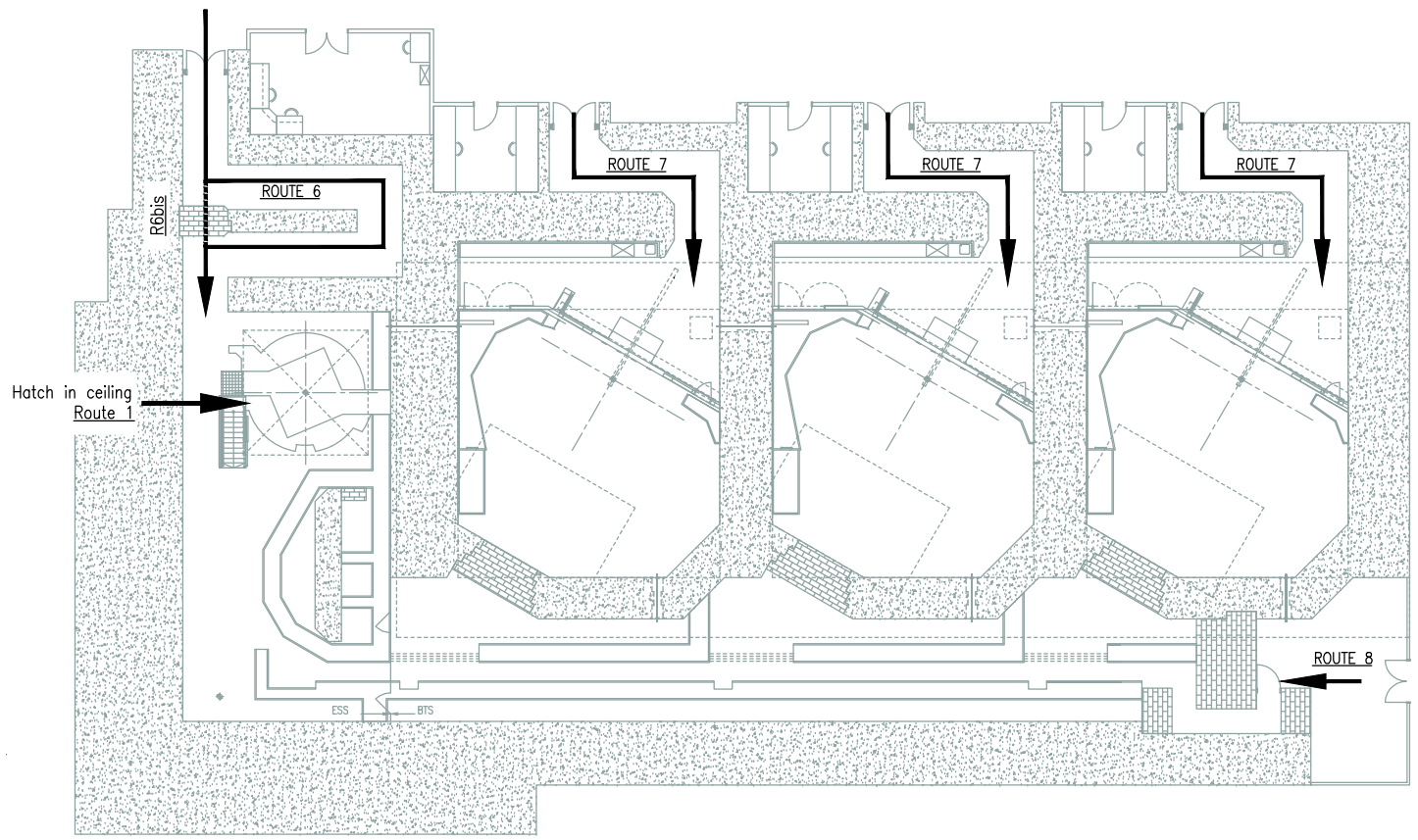


UPPER LEVEL



TREATMENT LEVEL

Table 1: Definition of Install and Replace Routes

Route	Route Goes Via -	Main Purpose
R1	Cyclotron Hatch	Install/Major Repair Cyclo, ESS
R2	Gantry Upper Level Ceiling Side Hatch	Install/Major Repair Gantry
R3	N/A	N/A
R4	Route to PSR	Install/Repair P/S room
R5	Route from outside of the building to the Main Control Room area	Install/Repair Control Room
R6	R5 + Cyclotron Maze	Repair Cyclo., ESS, BTS
R7	R5 + Treatment Room Maze	Install/Repair Nozzle and PPS
R8	BTS Maze	Install/ Major Repair Beamline
R9	Route to Cooling Room	Install/Repair Water Conditioners

1. INSTALLATION AND REMOVAL OF EQUIPMENT -SPECIFIC REQUIREMENTS

1.1. ***Table 1: Definition of Install and Replace Routes*** and ***Figure 50.01*** define egress routes for the installation and repair of the equipment in each area.

1.2. The equipment dimensions and weights given in ***Fig.01.11-2, Table2 & Table3; Fig.02.11, Table1; Fig.02.13, Table1; Fig.02.14 &Fig.02.53; Fig.32.01, Table2; Fig.33.01, Table1; Fig.34.01, Table1;Fig.52.11-2*** , are the actual sizes of the equipment and not necessarily the required total clearances. These tables also give the egress routes to be used.

1.3. Sufficient clearance must be provided to allow handling of the equipment through these routes without risk of collisions with the facility structure. The D/BT is responsible for assuring that the equipment defined in these Tables can be transported through the indicated routes and will then pay attention to avoid any obstacles such as stairs and to plan temporary access slopes if needed.

1.4. The egress routes include hatches as defined in ***Table 2: Definition of Hatches***.

1.5. The D/BT will provide temporary removable watertight hatch covers. These covers shall be removed and replaced as necessary by PTEV during installation of the PTE.

1.6. After installation completion, D/BT will install, seal and make watertight the permanent hatch panels upon PTEV request.

1.7. The D/BT will provide their own crane for the installation of these permanent hatch panels.

1.8. All the hatches shown must be accessible from outside the building to ensure free access to all equipment that will go through these hatches.

1.9. Vulnerable areas (for instance floor and wall finishing) can be finished later to avoid possible damage during rigging of the equipment. Damages shall be repaired by D/BT after installation.

1.10. D/BT will provide an accessible standard height loading dock with clear access to an elevator for installation and receiving of the spare parts if the access into the building is not easy and direct.

2. STORAGE FOR INSTALLATION

2.1. A fenced area of min. 1500 m² (16145 ft²) outside the building, close to the cyclotron hatch, must be available (no cover for this area is necessary) for temporary lay-down and staging of the equipment.

2.2. The ground resistance shall be of minimum 2.5 metric T/m² (512 PSF), with 2 areas of 5 m x 5 m (16'-8" x 16'-8") reaching 10 T/m² (2048 PSF) for cyclotron parts staging. Steel plates shall be installed by the D/BT to distribute adequately the mass constraints on the ground if needed.

2.3. In case the Facility is not ready to receive the Proton System Components when they arrive on Site, the D/BT will make available, at its own costs, a storage area of min 2000 m2 (21000 ft²) to temporarily store the Proton System Components until they can be rigged into the Facility. Supplies must be stored in their original packaging (being containers, crates or boxes). This area shall be covered, secured and protected against atmospheric agents, fire, humidity, dust and animals. Its entrance door shall be minimum 6 x 6 meter (20' x 20') (WxH) to pass the biggest crates (Gantry elements). Storage minimum requirements are (higher or lower figures may cause severe damage to the components):

- Temperature: between **-5 °C** and **+40 °C**.
- Relative humidity level: **10 to 80 % non-condensing**.
- Altitude: **< 1000 m** (air pressure between 75 and 105 kPa).

Weight of heaviest element: **120 T** (x2 for upper and lower cyclotron yokes)

No stacking of boxes, crates or containers is allowed: storage must be on ground level to allow for handling with suitable devices (crane, forklift, etc)

Storage ground surface and access roads must be adapted to support the weight of the supplies and their handling devices (trucks, cranes, forklifts, etc). Access roads (between the storage site and the final installation site) must be kept free of any obstruction at any time. Storage must be distant from any inflammable material or source

Nevertheless, these points will be discussed at a later stage – To be defined prior to BOD - between PTEV and the D/BT.

Table 2: Definition of Hatches

Hatch Description	Minimum Size
Cyclotron Hatch	508 cm square (200 inches)
Gantry Hatch	See Figure 02.51

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DATE:	30/04/15	
REV:	A	

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

PROJECT: PROTON THERAPY
S/PROJECT: TATA HBTF MUMBAI

III.
INSTALLATION

TITLE:
Routes definition

07.42.33.

50.01-1 A 1/2

3. CYCLOTRON - INSTALLATION & REMOVAL

3.1. The access to the Cyclotron hatch is over the ESS/ BTS ceiling. The roof of the ESS/BTS room where the crane may stand during the rigging must be able to carry the weight of the appropriate crane plus the weight of the upper or lower cyclotron yoke (110 metric tons each – 121 US tons each).

3.2. An alternate side wall entry can be integrated in the building if requested by the customer, or if the site or implantation doesn't comply with vertical rigging of the cyclotron.

3.3. The access road to the building must be as levelled as possible (meaning that the slope, if any, must be compatible with the maneuvering of the crane and of heavy platform trucks carrying the cyclotron parts), available during the cyclotron-rigging period, and able to carry the weights specified above.

3.4. D/BT will foresee an unobstructed crane access to the cyclo rigging area along the ESS/cyclo side of the building that can withstand 11 T/axle (12 UST/axle).

3.5. D/BT will foresee a free area of about 17m x 21m (56' x 69') along the ESS/cyclo side of building for crane deployment that can withstand 11 T/axle (12 UST/axle) and with four 250 cm x 450 cm (8'-2"x 14'-9") patches for crane feet support that can withstand in the order of magnitude of 3400 PSF (17T/m²) (exact location & resistance to be determined with rigging subcontractor).

3.6. To activate the hydraulic group during cyclotron rigging, the D/BT will provide a temporary power connection (20A, 400V 3phase+ground+neutral) near the cyclotron on the west wall.

3.7. Vulnerable areas (for instance floor and walls finishing) may be finished later to avoid possible damage during rigging of the equipment. Additionally, floor protection may be used if agreed upon by PTEV and D/BT.

3.8. The cyclotron hatch shall be opened by D/BT before equipment arrival. It may be removed by the crane used for the cyclotron rigging at the cost of the D/BT when the cyclotron arrives, and replaced by the same crane immediately after.

To minimize the rigging time, the roof plug shall be made of a minimum number of pieces, each not to exceed 20 metric tons (22 US tons).

The proper watertight sealing of the opening will be the D/BT responsibility.

4. ESS / BTS - INSTALLATION & REMOVAL

4.1. Any of the ESS/BTS components that are available at that time can be brought by PTEV into the building through the cyclotron hatch, before rigging the cyclotron.

4.2. After the cyclotron installation the route through the cyclotron (R1) hatch will not normally be accessible anymore. After the installation, the route through the cyclotron maze (R6) will be used. If necessary, the removable concrete shielding blocks on the route R6 can be removed.

4.3. The primary access route for installing and servicing beam line components inside the building is a clear path extending along the beam line, between the West wall and the ESS, and continuing around the corner along the beam line, between the BTS and the South wall. Keeping this route clear dictates that cable and conduits and other equipment serving the ESS and BTS beam lines will be located in trenches.

4.4. It is assumed that the unused BTS area will be empty and can be used for storage and staging of BTS equipment. This space will be in parts of the BTS areas not interfering with access. Intelligent staging of the equipment items when they are stored will allow them to subsequently be maneuvered into place in sequence.

4.5. Access to both sides of the BTS is gained simply by removing a section of beam pipe. Access to the East Side of the ESS beam line is gained by walking around the cyclotron.

5. GANTRY TREATMENT ROOM INSTALLATION & REMOVAL

5.1. The portion of ***Fig. 02.11, Table 1: Gantry Structure Main Components & Nozzle by room*** dealing with the Treatment Rooms contains a listing of the size and planned access route of each of the major Gantry components.

5.2. The gantry installation plan is to insert the major Gantry subassemblies through a hatch (removable concrete beam) in the ceiling of the Gantry.
The cross section view in ***Figure 02.51 (Gantry Treatment Room Dimensions – Installation Beams & Lifting Points)*** shows the wall hatch opening. The hatch consists of removable pre-cast concrete beam that spans the opening of the hatch.

5.3. Temporary removable waterproof rigid enclosure shall be designed and provided by D/BT to ensure a quick protection against weather conditions during the installation. The PTEV will remove and replace this temporary enclosure during the PTE installation process.

5.4. Upon completion of the Gantry installation, the PTEV shall instruct the D/BT to install the precast concrete Gantry hatch components and make the entire hatch and roof area permanently watertight. As mentioned previously, the opening of this hatch must remain possible during the life of the equipment.

5.5. To permit installation and maintenance of the Gantry, two I-beams shall be installed by the D/BT on the gantry upper level ceiling as shown in ***Figure 02.51 (Gantry Treatment Room Dimensions – Installation Beams & Lifting Points)*** .
The D/BT shall submit beams design to PTEV approval.

The D/BT will provide a load test report for these beams.

5.6. PPS installation: the Patient Positioner will be inserted into the building either through the gantry hatch (R2) or via R5 and the corridor into the treatment room (route R7) see ***Figure 50.01-1 (Routes Definition)*** .

5.7. NOZZLE installation: the nozzle, without its snout, will be transported on a wheeled support frame ("dolly") provided by PTEV that allows it to be easily rolled down hallways.
The nozzles will be installed via route R7 ***(See Figure 50.01-1(RoutesDefinition)*** . To be defined on a dolly in vertical position.
The total vertical clearance to be considered is 215 cm (7'-1"). This includes the nozzle frame length (range modulator assembly attached), the dolly and 5 cm (2") extra for door/ceiling clearance.

5.7.1. Gantry Room Nozzle Installation

Initial Gantry nozzle installation, as well as later removal and replacement, presents a special case because it is not possible to install it from the Gantry area side, but it must come from the Treatment Area side.
The patient positioner would be moved to the side during the nozzle installation operation.
The Gantry would be rotated to the "nozzle straight up" angle.
A lifting fixture and straps would then be used to lift the nozzle, in the "snout up" orientation, out of the support frame, using the movable monorail described in ***Figure 02.52 - Gantry Nozzle Anchor for Lifting Device Installation*** .
Once clear of its wheeled support frame, the nozzle can be pulled into position over the Gantry nozzle interface anchor plate configuration on the Gantry structure and lowered into place. The reverse process would be used to remove the nozzle.

S.A. ION BEAM APPLICATIONS

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A	30/04/15	Original issue	LCHEN	QBA	PV

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SCALE: (A3)
DIMENSIONS: --
TOLERANCES: --

PROJECT: PROTON THERAPY
SPROJECT: TATA HBTF MUMBAI

III.
INSTALLATION

TITLE:
Routes definition

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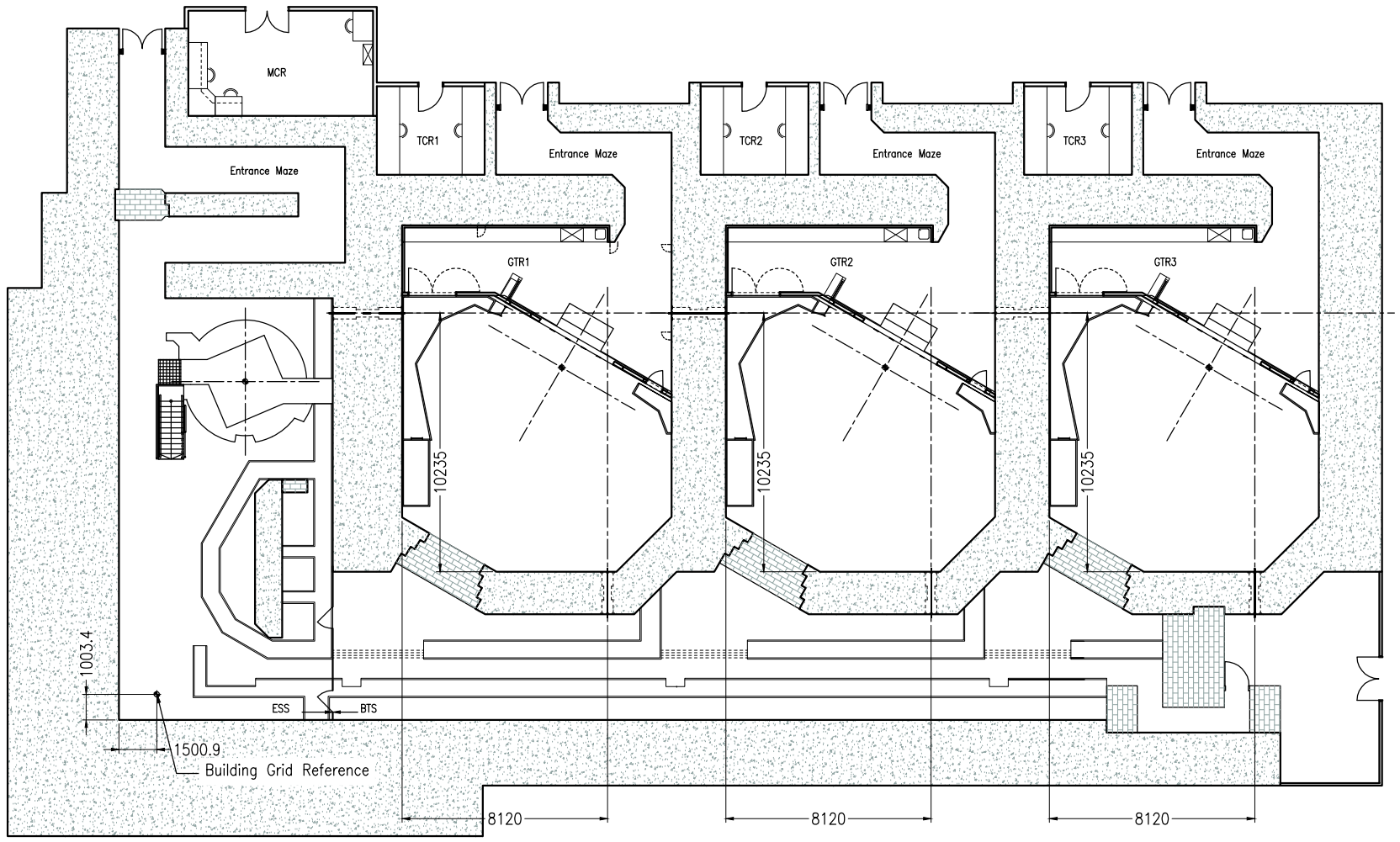

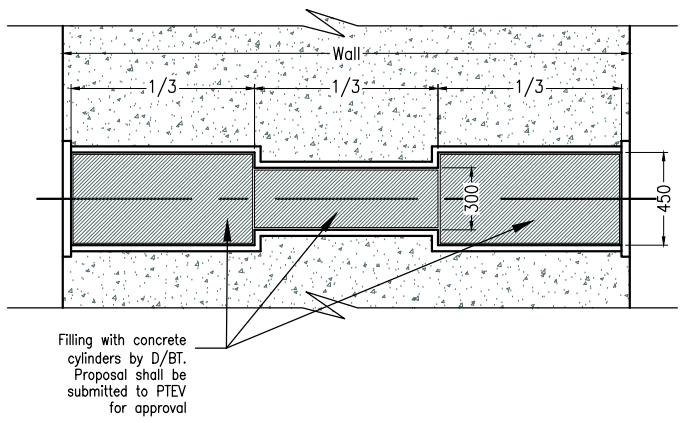

1. BENCHMARKS TO BE PROVIDED BY THE D/BT

The PTEV will layout the equipment alignment grid and delineate it with permanent monument markers to be installed after the BOD.
The D/BT shall provide a primary benchmark (Foundation Target Insert (FTI) as supplied by Hubbs Machine & Manufacturing, Inc) at a location surveyed with respect to the building grid system. The PTEV will define the equipment alignment grid including elevation with respect to this primary benchmark. The primary benchmark will be located in the floor near the corner between the North and West walls of the BTS.
This primary benchmark shall be documented by the D/BT.
The PTEV shall also install secondary benchmarks that are surveyed with respect to the above primary benchmark as indicated in ***Fig.01.11-1 - Beam Transport Components & Isocenters***
The exact coordinates of the secondary benchmarks will be determined during the equipment installation.
All benchmarks need to remain accessible all the time without putting any equipment .in front of them. In case of a finish wall need to be erected, access panels will be foreseen to keep access to the benchmarks.

2. ALIGNMENT SIGHTING PROVISIONS

The PTEV will require the D/BT to make provision for alignment sightings through the shield walls.
The quantities, size, and location of those sighting holes are specified in ***Fig.50.02***
When several alignment view axes intercept, it must be assured that a common volume is visible along all these view axes. All equipment or building components that may block the view must be removable such that a clear line of sight can be achieved during equipment realignment.
The D/BT must provide manually removable shielding plugs for the sighting holes (this can be accomplished using interlocking removable concrete shielding blocks). The design will be validated by PTEV and D/BT shielding consultant.

Closing of sighting holes by D/BT after PTEV agreement.

3. ALIGNMENT OF EQUIPMENT WITH RESPECT TO THE BUILDING

3.1 THERMAL STABILIZATION REQUIREMENTS

The Facility HVAC systems in all PTE equipment areas shall be operational prior to Building Occupation Date (BOD) by PTEV, per phased BOD dates. Please also refer to ***Fig 90.02***.
Before starting alignment of the equipment the Facility must be stabilized to room temperature and all structural walls and slabs must have reached thermal equilibrium. Therefore, the start date for the alignment process is linked to closing the building temporary hatches and completing a thermal soak period with the HVAC system in normal operation.

3.2 FLOOR REQUIREMENTS

The beam line equipment extending from the cyclotron through to the Gantries must be aligned to a level horizontal plane with high precision.
The first step in accomplishing this is using shims or equivalent under the beam line stand pads to level the stands and bring them to the correct height.
The second step is to fill the gap between the pads and floor with high strength, non-shrink, non-metallic grout (5000¨PSI (35 MPa) in 3 days). See also the building completion requirements in ***Fig.90.01***.
The grouting shall be done by D/BT on PTEV request, and sealed and epoxy painted.

S.A. ION BEAM APPLICATIONS

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

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

PROJECT: PROTON THERAPY
SPROJECT: TATA HBTF MUMBAI

III.
INSTALLATION

TITLE:
Alignment Sighting

07.42.33.

50.02 A

IV. COOLING / GASES

S.A. ION BEAM APPLICATIONS

51. COOLING & GASES

ACRONYMS

BOD:	Building Occupancy Date
D/BT:	Design Building team
PTEV:	Proton Therapy Equipment Vendor
BTS:	Beam Transport System
PSR:	Power Supply Room
WCR:	Water Cooling Room
PTE:	Proton Therapy Equipment
CC:	Cooling Circuit
GTR:	Gantry Treatment Room

TABLE OF CONTENTS:

REFER ALSO TO:

Figure 00.31-2 (Facility General Layout: Basement & Upper Level)

Figure 32.01 (Water Cooling Room)

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

S.A. ION BEAM APPLICATIONS

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A	30/04/15	Original issue	LCHEN	QBA	PV

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

PROJECT: PROTON THERAPY

SPROJECT: TATA HBTF MUMBAI

IV.
COOLING & GASES

TITLE:
Presentation

07.42.33.

51.00 A

INTRODUCTION

This chapter is related to water cooling system and gases necessary for PTE. First the cooling water distribution is detailed in schematic of the cooling circuits and in the tables. Then integration in the building and water conditioners details. Finally, we'll see the requirements related to the gases at the end of the chapter.

The water distribution is based on 3 independent circuits:

- Cyclotron Main Coils cooling circuit (#1)
- Cyclotron Vacuum Pumps cooling circuit (#2)
- Cyclotron (remaining)/ESS/BTS/GTR/PSR cooling circuit (#3)

Figure 51.12-2 (Cooling Ducts in the building) gives the implantation of the cooling circuits in the building. An overview of the flow rates necessary for cooling the different parts of the equipment is given in Table 1: Hydraulic Characteristics figure 51.03 .
As a convention, the Primary circuit is the PTEV side and the Secondary circuit is the D/BT side.

The 3 related water conditioners are located in the Water Cooling room. They will be provided and installed by the PTEV. See also Figure 00.31-2 (Facility General Layout: Basement & Upper Level) and Figure 32.01 (Water Cooling Room) for implantation in the building.

CIRCUIT DESIGN

FOR EACH COOLING CIRCUIT, THE FOLLOWING IS REQUIRED:

1. Refer to Figure 51.02 and 51.03 for pressure, temperature, flow and other calculation inputs.
2. The secondary circuit of the water-conditioner is a closed loop that feeds from the building chilled water supply. The secondary loop shall satisfy the parameters in Figure 51.03.
3. The D/BT shall provide and locate the primary and secondary water hookups in order to allow an easy connection between these hookups and the interface flanges of the water conditioner. The location and types of the flanges are shown in Figure 51.21, Figure 51.22 and Figure 52.23 and in embedded Table 2: Flanges Specification for the Water Conditioners. These flanges will be supplied to the D/BT by the PTEV.
4. The final piping sections going from the hookups to the PTEV water conditioners must be completed by the D/BT, after the equipment is installed in the water cooling room.
5. The secondary cooling circuit shall be run with a bypass before connecting it to the PTEV water conditioner in order to remove any construction waste in the pipes that could damage the heat exchanger. A pipeline strainer is needed with valves on both sides.
6. See embedded Table 1 for water quality.
7. The piping and any part in contact with water must be compatible with high purity de-ionized water. Materials compatibility will be checked by D/BT.

Table 2: Flanges Specification for the Water Conditioners

Item	Value for DN 50 (mm/inch)	Value for DN 100 (mm/inch)	Value for DN 150 (mm/inch)
Diameter A	165 / 6.50	220 / 8.66	285 / 11.2
Diameter B	125 / 4.92	180 / 7.09	240 / 9.4
Diameter C	~55 / 2.17	~110 / 4.33	~160 / 6.3
Diameter D	4 x 18 / 0.71	8 x 18 / 0.71	8 x 22 / 0.87

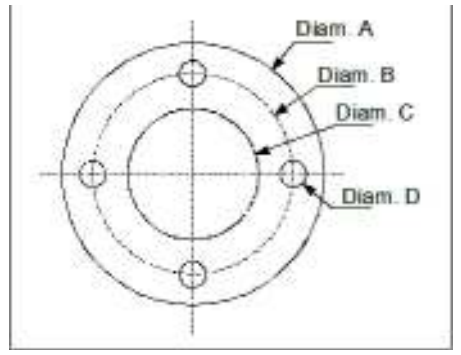

TABLE1: Water Quality

S.No.	Parameter	Standards	Rationale/Remarks
1.	pH range	6.5-8.5	The range is conducive for propagation of aquatic species and restoring natural system
2.	Turbidity	30 NTU	Reasonably clear water for Recreation, Aesthetic appreciation and Industrial cooling purposes.
3.	Dissolved Iron	0.5 mg/l or less	It is desirable to have the (as Fe) collective concentration of dissolved Fe and Mn less or equal to 3 x 10-5 pound/foot3 to avoid scaling effect.
4.	Dissolved Manganese(as Mn)	3 x 10-5 pound/foot3	
5.	water conductivity	< 1 µS/cm (< 2.54 µS/inch)	

S.A. ION BEAM APPLICATIONS

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A	30/04/15	Original issue	LCHEN	QBA	PV

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

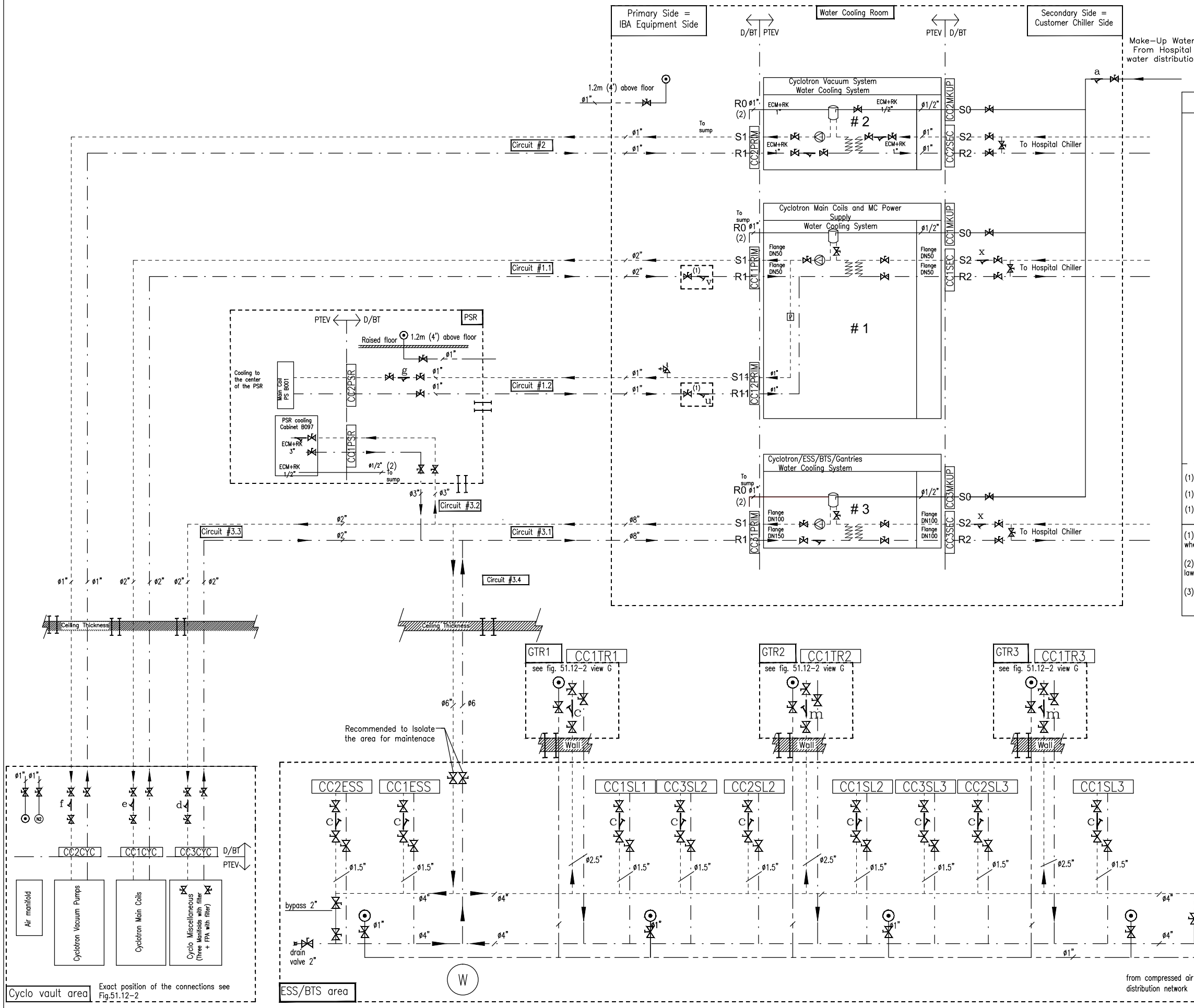
PROJECT: PROTON THERAPY
SPROJECT: TATA HBTF MUMBAI

IV.
COOLING & GASES

TITLE:
Introduction

07.42.33.

51.01 A



Legend

- Compressed air
- Supply Water
- Return Water
- Reduction
- Valve
- Release valve, 8 bars
- Compressed air connection
- Extra tube in the concrete installed as back-up if initial pipes are clogged or leaking
- a — Sediment Filter, 5 µm
- b — 1" Y Strainer, 250 µm, stainless steel mesh, PN10 bars
- c — 1,5" Y Strainer, 250 µm, stainless steel mesh, PN10 bars
- d — 2" Y Strainer, 250 µm, stainless steel mesh, PN10 bars
- e — 2" Y Strainer, 250 µm, stainless steel mesh, PN20 bars
- f — 1" Y Strainer, 500 µm, stainless steel mesh, PN10 bars
- g — 1" Y Strainer, 500 µm, stainless steel mesh, PN20 bars
- h — 2" Y Strainer, 500 µm, stainless steel mesh, PN10 bars
- i — 1" Y Strainer, 1 mm, stainless steel mesh, PN10 bars
- m — 2,5" Y Strainer, 250 µm, stainless steel mesh, PN10 bars
- x — Y Strainer, 250 µm, stainless steel mesh, PN10 bars, Size to be determined by D/BT.

(1) u — 1" Y Strainer, 1 mm, stainless steel mesh, PN20 bars
(1) v — 2" Y Strainer, 1 mm, stainless steel mesh, PN20 bars
(1) w — 4" Y Strainer, 1 mm, stainless steel mesh, PN10 bars

(1) Filter and its isolating valve are temporary equipments that can be removed when the return piping is very cleaned of any impurities.

(2) Any water in excess must be evacuated out in conformity with the regional law.

(3) Some filter type may not be applicable for this configuration.

S.A. ION BEAM APPLICATIONS

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SCALE: (A3)
DIMENSIONS: mm
TOLERANCES: –

PROJECT: PROTON THERAPY
S/PROJECT: TATA HBTF MUMBAI

IV.
COOLING & GASES

TITLE:
Cooling Schematic Distribution in the Building

07.42.33.

51.02 A

Table 1: Hydraulic characteristics

		Cyclo / ESS / BTS / Gantry / PSR	Main coil	Cyclo vacuum system
		Fill in (MakeUp)		
Input differential pressure	Bar	4 to 6		
Supply Temperature	°C	5° - 35°		
Flow	m³/h	> 2 m³/h		
		Secondary circuit (Chiller side)		
		Interface Circuit 3	**Interface Circuit 1**	**Interface Circuit 2**
Water conditioner max static pressure	Bar gauge	4	4	4
Input differential pressure	Bar	1	1	0.6
Supply Temperature	°C	5 < t° < 15	5 < t° < 15	5 < t° < 15
Flow	m³/h	110	20	ODP: 0,6
Max. Power to be removed	kW	730	210	ODP: 5
		Primary circuit (iba Equipment side)		
		Circuit 3.1	**CC1CYC, Circuit 1.1: Main Coil,**	**CC2CYC, Circuit 2**
Piping test static pressure	Bar gauge	12	25	6
Water conditioner max static pressure	Bar gauge	8	18	4
Max flow	m³/h	133	8	ODP: 0,6
Max water return temperature	°C	40	50	35
Building Pipe diameter	inch	8	2	1

		CC1PSR, Circuit 3.2, Power supply Room	**CC2PSR, Circuit 1.2: Main Coil Power Supply**
Piping test static pressure	Bar gauge	12	25(*)
Water conditioner max static pressure	Bar gauge	8	6
Max flow	m³/h	13	1.5
Max water return temperature	°C	40	35
Building Pipe diameter	inch	3(**)	1
		(**) this value is requested by the PSR cabinet.	(*) this value is needed in case of dysfunction of the pressure regulator.

		CC3CYC, Circuit 3.3, Cyclo Miscellaneous
Piping test static pressure	Bar gauge	12
Water conditioner max static pressure	Bar gauge	8
Max flow	m³/h	20
Max water return temperature	°C	40
Building Pipe diameter	inch	2

		Circuit 3.4, ESS/BTS/Gantry
Piping test static pressure	Bar gauge	12
Water conditioner max static pressure	Bar gauge	8
Max flow	m³/h	100
Max water return temperature	°C	40
Building Pipe diameter	inch	6

Circuit 3.4, Sub-circuits
See figure 51.02

Table 2: Water Distribution Legend

Connection ID	Equipment	Fitting size	PN	Fitting type	Fitting material	Pipes material
					Brass	PVC-C (chlorinated polyvinyl chloride, high pressure) pipes is acceptable, nevertheless stainless steel is recommended
CCIMKUP		1/2"	10	BSP Fem + ECM-RK	Brass	
CC1SEC	Main Coil Water Conditioner	2"	10	Flange DN50	Brass	
CC2SEC	Cyclo vacuum conditioner	1"	10	BSP Fem + ECM-RK	Brass	
CC3SEC	Cyclo/Ess/Gantry / PSR	4"	10	Flange DN100	Brass	
CC11PRIM	Main Coil	2"	20	Flange DN50	Stainless steel	Stainless steel
CC12PRIM	Main Coil PS	1"	20	BSP Fem + ECM-RK	Stainless steel	Stainless steel
CC2PRIM	Cyclo Vacuum pump	1"	10	BSP Fem + ECM-RK	Brass	PVC-C (chlorinated polyvinyl chloride, high pressure) pipes is acceptable, nevertheless stainless steel is recommended
CC31PRIM	Cyclotron misc. (FPA + manifolds)	Supply: 4" Return: 6"	10	Supply: Flange DN100 Return: Flange DN150	Brass	
CC1CYC	Cyclotron main coils	2"	20	Flange DN50	Stainless steel	Stainless steel
CC2CYC	Cyclotron vacuum pumps	1"	10	BSP thread, female	Brass	PVC-C (chlorinated polyvinyl chloride, high pressure) pipes is acceptable, nevertheless stainless steel is recommended
CC3CYC	Cyclotron misc. (FPA + manifolds)	2"	10	BSP thread, female	Brass	
CC1PSR	Power supplies in PSR	3"	10	BSP thread, female	Brass	
CC2PSR	Main Coil Power supply in PSR	1"	20	BSP thread, female	Stainless steel	Stainless steel
CCIESS	ESS	1.5"	10	BSP thread, female	Brass	PVC-C (chlorinated polyvinyl chloride, high pressure) pipes is acceptable, nevertheless stainless steel is recommended
CC1SLI	Static line TR1 (B1,...) + 2 quads of static line for next TR	1.5"	10	BSP thread, female	Brass	
CC1TR1	GTR1	2.5"	10	BSP thread, female	Brass	
CC1TR2	GTR2	2,5"	10	BSP thread, female	Brass	
CC1TR3	GTR3	2,5"	10	BSP thread, female	Brass	

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

IV.
COOLING & GASES

TITLE:
Cooling Schematic: Tables

07.42.33.

51.03 A

Integration in the building

GENERAL REQUIREMENTS

1. The D/BT is responsible for providing and installing all the pipes described in this section.

2. The pipe sizes are estimated by PTEV according to the values defined and schematically represented in Figure 51.02 (Cooling Schematic Distribution in the Building) . Nevertheless, the pipe sizing and the final configuration remain the responsibility of the D/BT. Any change shall be submitted to the PTEV for approval.

3. The pipes shall be designed for maximum pressures drop of 0.5 bar (7.25 PSI) in each line at nominal flow rate.

4. All the pipes shall be leak tight; the leak test will be performed by D/BT at the pressure referenced as piping test static pressure in Figure 51.02 (Cooling Schematic Distribution in the Building).

5. The pipes shall be closed at their ends to avoid dust, concrete, obstructing the ducts until final connection.

6. The water trenches will be for the PTEV use only. No other equipment can be installed in the trenches without the PTEV agreement. In that case, trenches should be made larger and the design adapted and validated by PTEV

7. D/BT shall provide removable walk-on aluminum or galvanized steel metal gratings on all water trenches, similar to those requested for the wiring trenches.

8. The trenches and lowest points in all rooms dedicated to PTEV shall be provided with drains connected to the main floor drain system.

9. Metallic water conduits shall be grounded according to the applicable regulations.

10. Pipe routing must be designed to minimize the radiation leakage.

11. A purge outlet shall be provided at the lowest point of each circuit.

12. When water pipes are embedded in the concrete, 2 spare pipes (supply/return) shall be added for back-up connections.

Table 1: Estimated Total Water Capacity of Water Circuits in Cubic Meters (Gallons) –to be updated

	Circuit #1 Conditioner	Circuit #2 Conditioner	Circuit #3 Conditioner
Conditioner	0.5 (132)	0.03 (8)	1.7 (450)
Piping	0.2 (53)	0.1 (26)	0.4 (105)
Equipment	0.45 (118)	0.23 (61)	0.4 (106)
Contingency	0.3 (80)	0.2 (53)	1 (264)
TOTAL	1.45 (383)	0.73 (193)	3.5 (925)

FLOOR DRAIN REQUIREMENTS

13. Floor drains and/or sump capacity shall be provided in any area of the building entered by water pipes.

14. The drains shall be sufficient to capture, without flooding, the total water volume estimated in Table 1: Estimated Total Water Capacity of Water Circuits in Cubic Meters (Gallons) for any cooling water circuit passing through that area.

15. A sump filter shall also be installed on all the drains. In both trenches (along the beam line), drains shall be foreseen every 5 meters (±17').

16. Floor drains shall receive same finish as the trenches and slabs.

BSP THREAD DEFINITION

Male thread fittings shall be tapered and female thread fittings shall be parallel.
Threads according to the British Standard Institute - BS 21 "Specification for pipe threads for tubes and fittings where pressure-tight joints are made on the threads".

PARALLEL (STRAIGHT) THREADS TYPE:
BS parallel threads are also referred to as British Gas, British Pipe Parallel or Parallel Fastening Thread. Common symbols used for the thread: BSP, BSPP, BSSPI, BSPF, BSPG, PS, Rp, G.
The BSPP (parallel) male will mate with a BSPP (parallel) female or a female port.
Usually marked: G size ISO

TAPER THREADS TYPE:

BSP taper threads are also referred to as British Standard Taper Pipe, Pipe Taper or Conical Thread. Common symbols used for the thread: BSPT, BSPTr, PT, KR, R, Rc
Usually marked: Rc size ISO

Characteristics of BSPT taper threads:

- tapered thread 1°47'
- truncation of roots and crests are rounded
- 55° thread angle
- pitch is measured in threads per inch
- taper is 3/4" per foot or 1 in 16 on the diameter

Example of supplier for NPT to BSP adapter fittings: Mac Master-Carr. http://www.mcmaster.com
(example: 1-1/2" NPT male x 1-1/2" BSPT male brass fitting ref. 5832T118)

THREAD DIMENSIONS: see Table 2

Table 2: THREAD DIMENSIONS

Pipe Size (inch)	Pitch (threads per inch)	Major Diameter OD (inch)
1/8"	28	0.383
1/4"	19	0.518
3/8"	19	0.656
1/2"	14	0.825
3/4"	14	1.041
7/8"	14	1.189
1"	11	1.309
1-1/4"	11	1.650
1-1/2"	11	1.882
2"	11	2.347
2-1/2"	11	2.960
3"	11	3.460

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

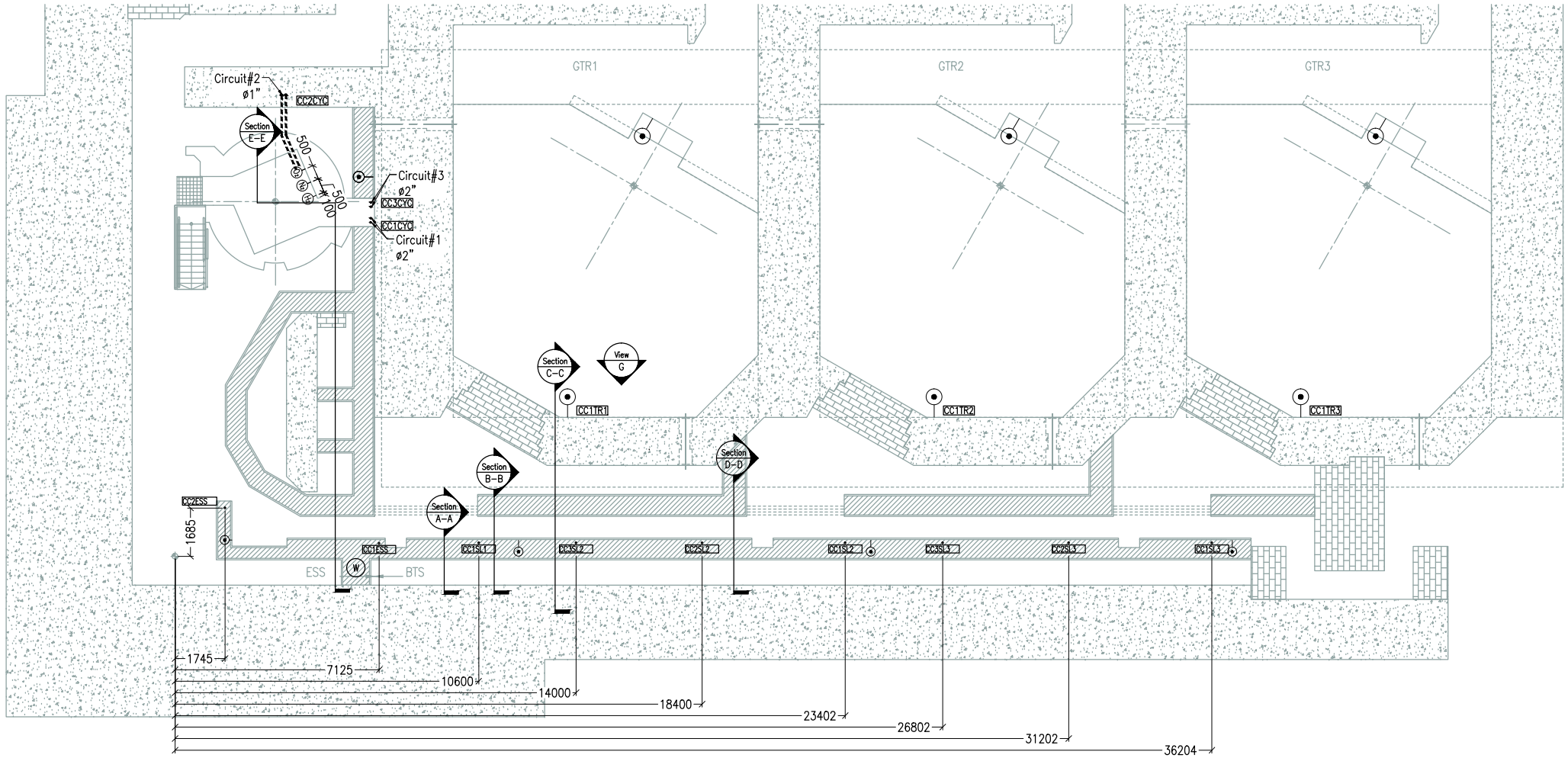
MATERIAL: --
SCALE: (A3)
DIMENSIONS: mm
TOLERANCES: --

Refer to figure 51.12-2

1. The main supply and return pipes of cooling circuit # 3 (as well as the compressed air service) shall enter in the BTS area at the point W located in this figure.

2. From this point, all the pipes will run in a trench called “Water Service Trench”, located on the right hand side of the beam line when looking in the beam direction. It means that several pipes will run in this trench.

3. The supply and return pipes of cooling circuit #1, #2 and CC3CYC of circuit #3 will enter the cyclotron vault area through the ceiling shielding.

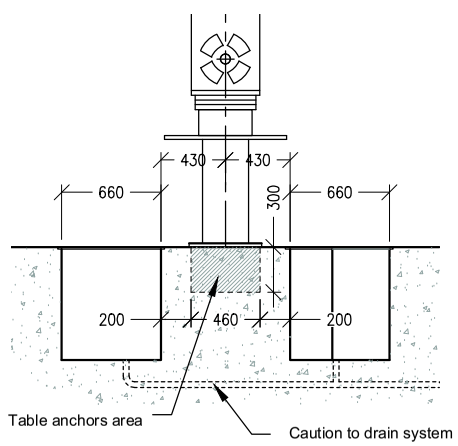


- Compressed air
- Nitrogen
- Oxygen
- Hydrogen

O2 and H2 outlets shall be installed as indicated on this drawing whether the bottles are installed in the pit or located elsewhere in the building

Caution: water from cooling system might be considered activated depending on local regulations. In this case, it shall be stored for decay during 1 day or according to local regulation.

Pipes going under the BTS shall be installed at minimum 300 mm (1') under treatment level, to prevent from interactions with table anchoring.



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

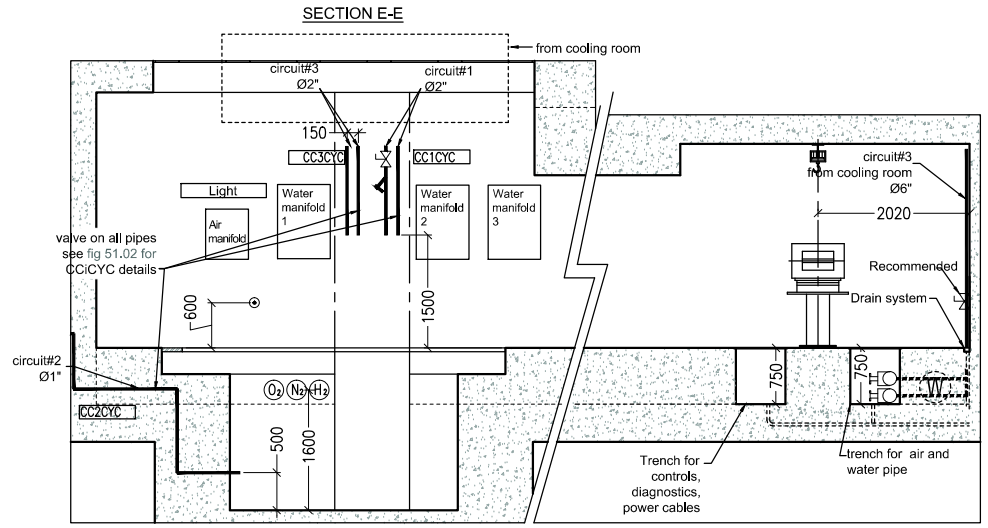
SPROJECT: TATA HBTF MUMBAI

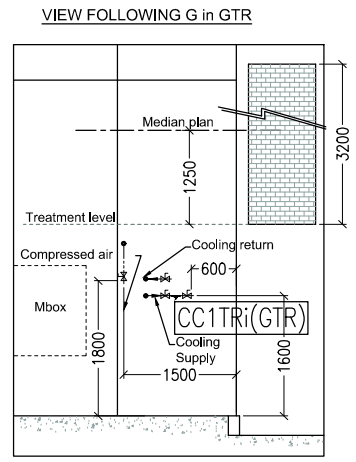
IV.
COOLING & GASES

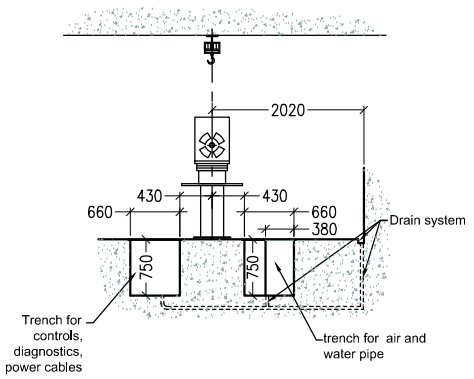
TITLE:
Cooling Ducts in the Building

07.42.33.

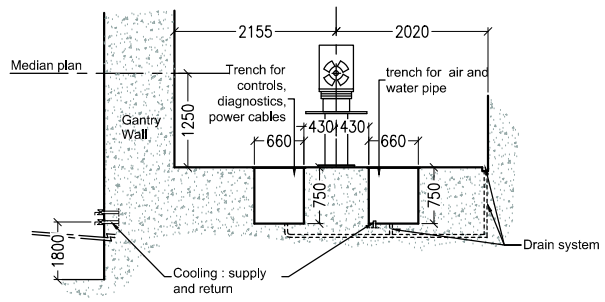
51.12-1 A 1/2



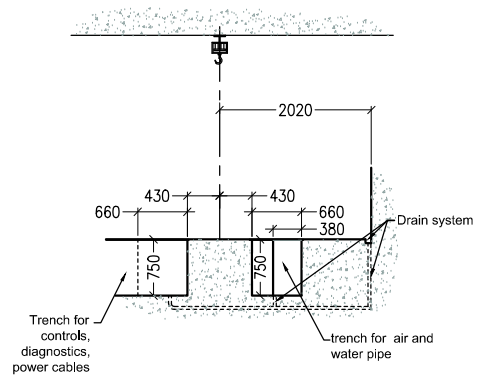




SECTION B-B



SECTION C-C



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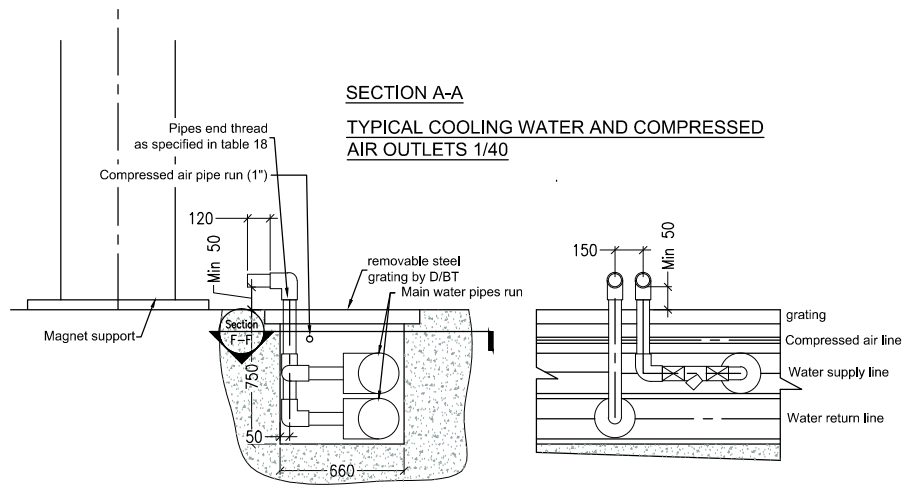
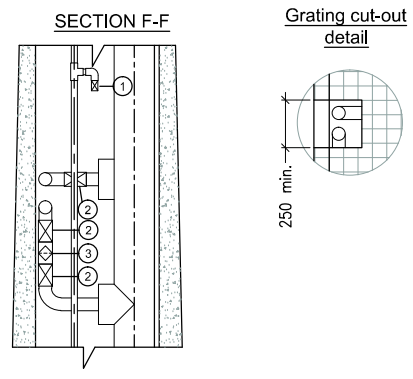




① Valve by DB/T. Pipe end 1" BSP fem. Provide thread adapter as needed.
② Valve by DB/T.
③ Filter by DB/T. See fig 51.02.

Refer to figure 51.12-1

Two kinds of outlets can be distinguished.

The first kind is all the outlets excepting CC1TR1/TR2/TR3

- Each of these outlets supplies water to a set of quads/dipoles along the ESS and BTS or to cyclotron equipment in the cyclotron area. Different views in Figure 51.12-1/2 (Cooling Ducts in the building) show how these outlets shall be made.

- The D/BT shall provide and install all the parts described up to the insulation valves and filters.
  These valves and filters must be easily accessible after removing the trench grating.

- The valves shall be placed in order to allow the pipes to emerge from the trench as close as possible from the beamline side of the trench. The cutouts in the gratings covering the trench will be located and sized according to the location where the pipes will emerge from the trench and will be designed to allow the removal of the gratings when all the pipes will be installed. These hoses will be installed later by the PTEV and connected to manifolds fixed on the magnet stands feet.

2. The second kinds of outlets CC1TR1/TR2/TR3 are identical to the previous ones, except that they will not be connected to a manifold, outside of the trench.

- At each of these outlets, the D/BT will embed in the concrete 2 pipes (+ 2 spares) (See pipes properties Figures 51.02 and 51.03). One end of these pipes will emerge from the wall beside the junction box in the Gantry Area. The other end will emerge from the bottom side of the water cooling trench (BTS), close to the outlet, on the beam line side of the trench (easily accessible) as shown in Figure51.12-1/2 (Cooling Ducts in the building).

S.A. ION BEAM APPLICATIONS

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

MATERIAL: –
SCALE: 1/100 (A3)
DIMENSIONS: mm
TOLERANCES: –

PROJECT: PROTON THERAPY
SPROJECT: TATA HBTF MUMBAI

IV.
COOLING & GASES

TITLE:
Cooling Ducts in the Building

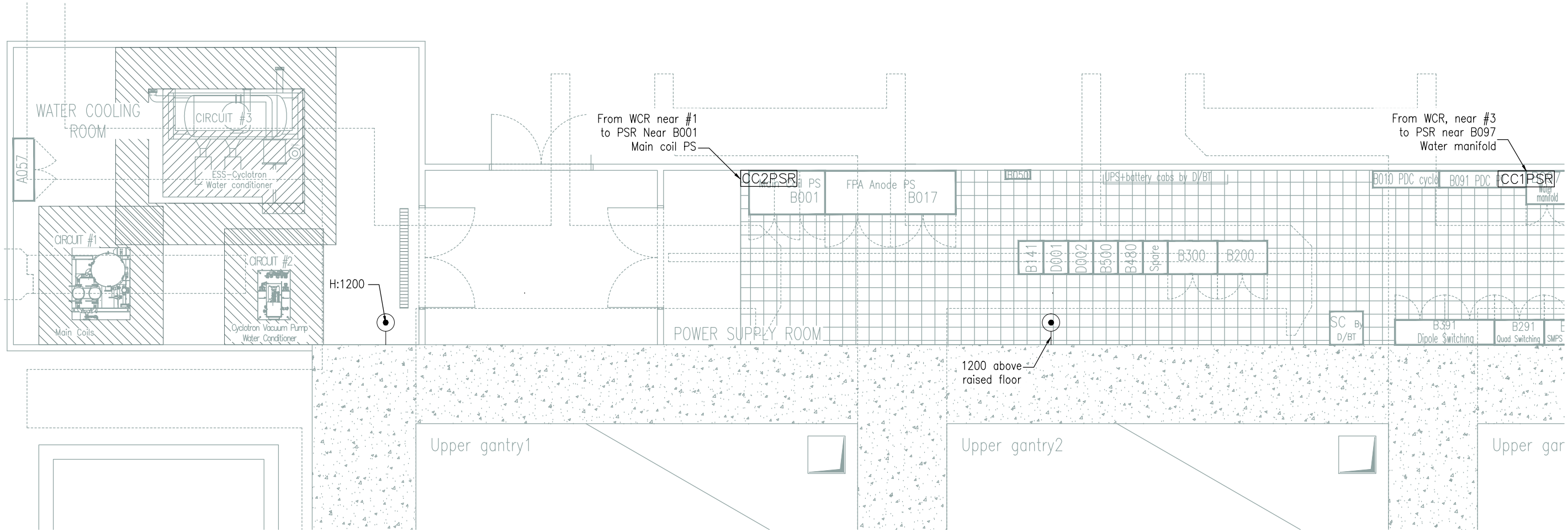
07.42.33.

51.12-2 A 2/2

POWER SUPPLY ROOM WATER DISTRIBUTION

1. 4 Pipes (Supply & Return) shall pass through the walls separating the water-cooling room and the power supply room. If the water pipes are embedded in the concrete, then 4 additional spare pipes shall be foreseen. They will emerge under the access floor and stop at the wall.

2. The water characteristics for Cyclotron/ESS/BTS/PSR/Gantry distribution are also valid for the power supply room water distribution. The diameter of the pipes shall be according to Figure 51.02.



compressed air

S.A. ION BEAM APPLICATIONS

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

MATERIAL: –
SCALE: 1/100 (A3)
DIMENSIONS: mm
TOLERANCES: –

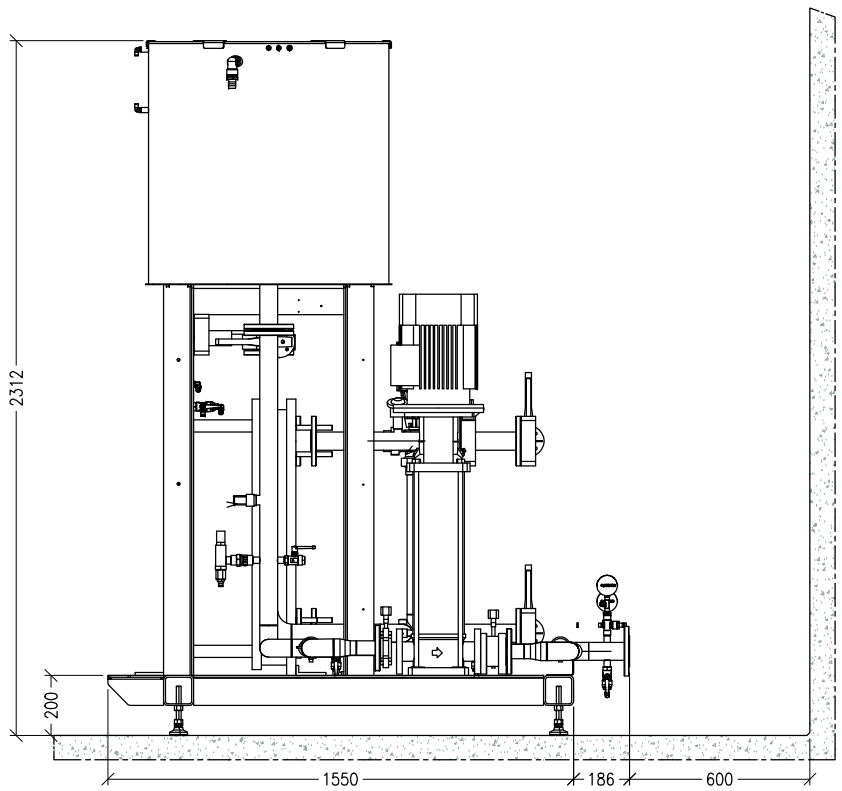
PROJECT: PROTON THERAPY
SPROJECT: TATA HBTF MUMBAI

IV.
COOLING & GASES

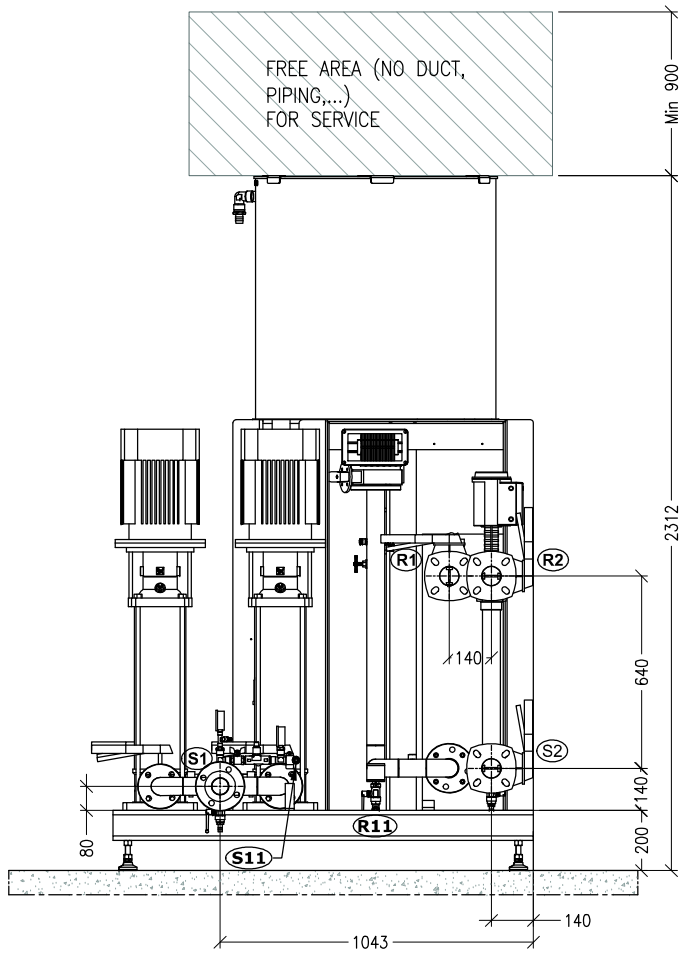
TITLE:
Water Cooling Room & Power Supply Room Water Distribution

07.42.33.

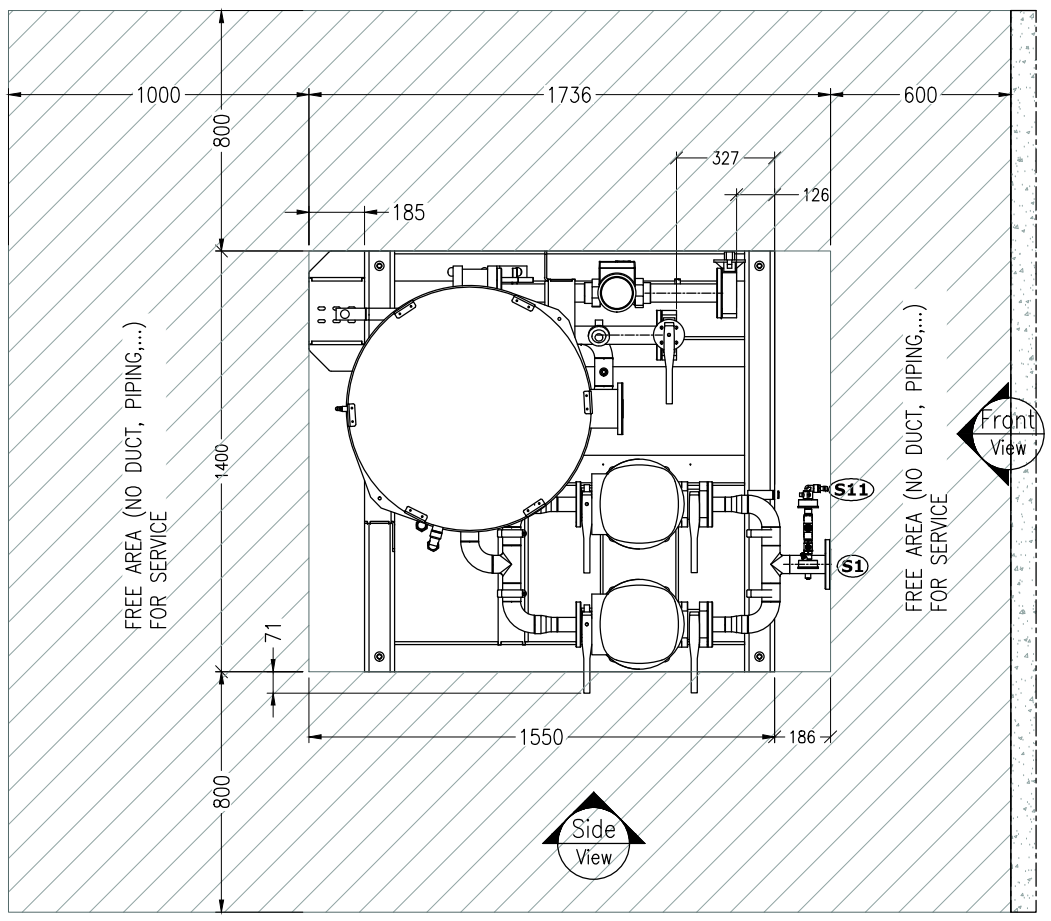
51.13 A

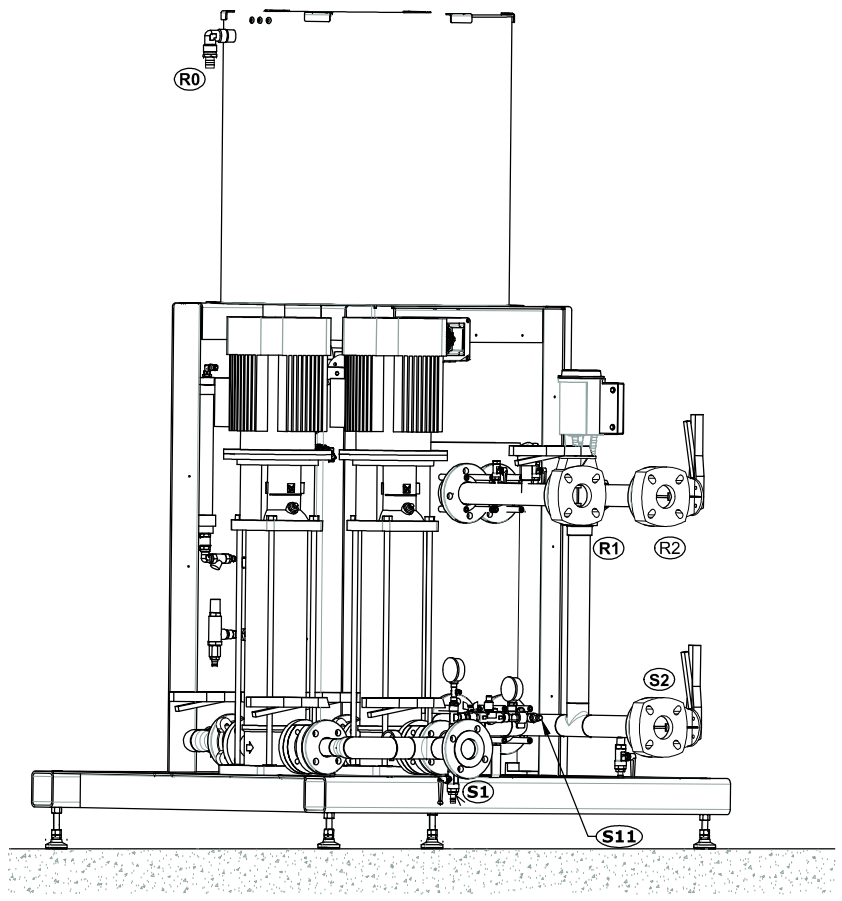


SIDE VIEW



FRONT VIEW





PORT	PURPOSE
S2	OUTLET SECONDARY, connected to Chiller
R2	INLET SECONDARY, connected to Chiller
R1	INLET PRIMARY, connected to Cyclotron
S1	OUTLET PRIMARY, connected to Cyclotron
S0	Fill in (MakeUp)
R0	Drain
S11	Outlet to IBA equipment in PSR
R11	Intlet from IBA equipment in PSR

Water conditioner weight:
- empty : 640 kg / 1410 lb
- loaded (water): 1050 kg / 2315 lb

INDICATIVE VALUE ONLY
SUBJECT TO SMALL MODIFICATIONS

S.A. ION BEAM APPLICATIONS

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

MATERIAL: –
SCALE: 1/25 (A3)
DIMENSIONS: mm
TOLERANCES: –

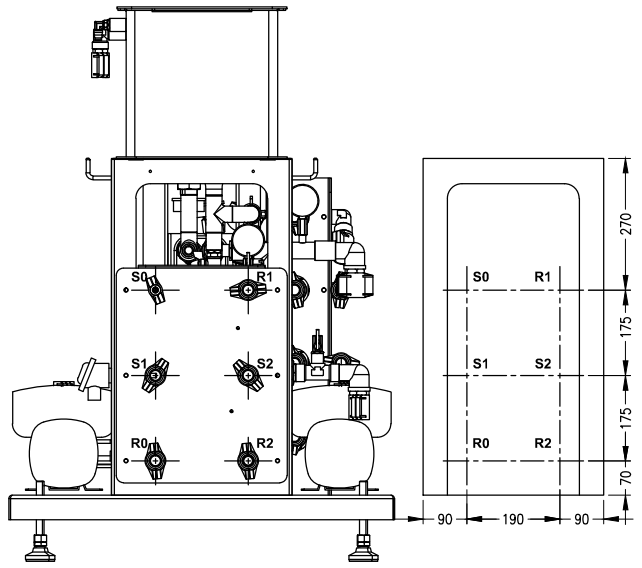
PROJECT: PROTON THERAPY
SPROJECT: TATA HBTF MUMBAI

IV.
COOLING & GASES

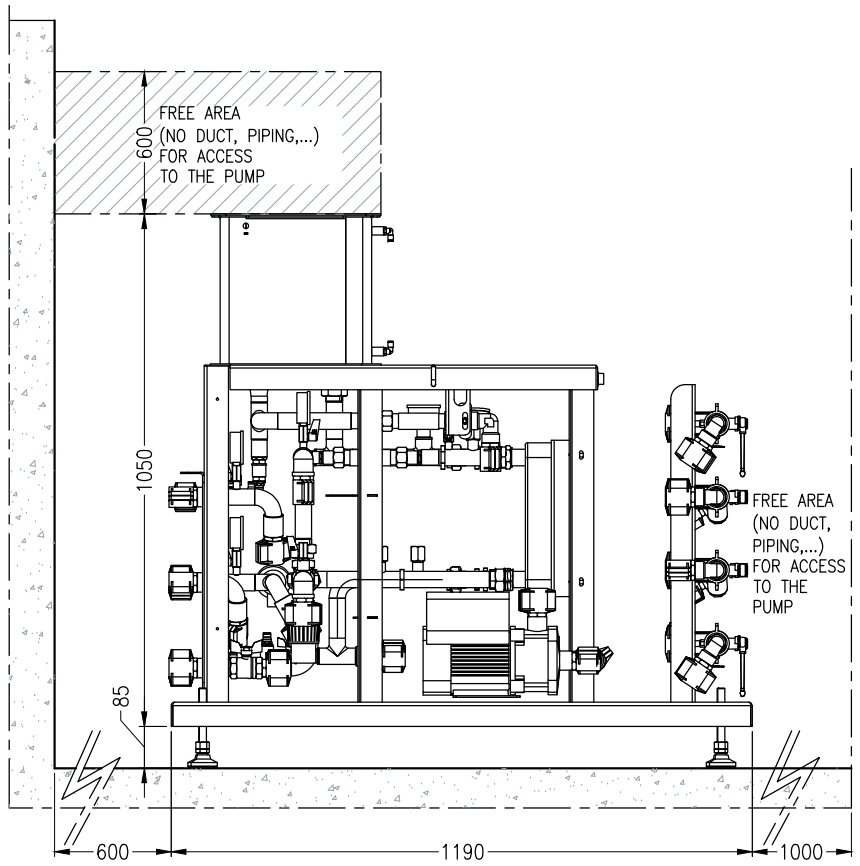
TITLE:
Main coil water conditioner #1

07.42.33.

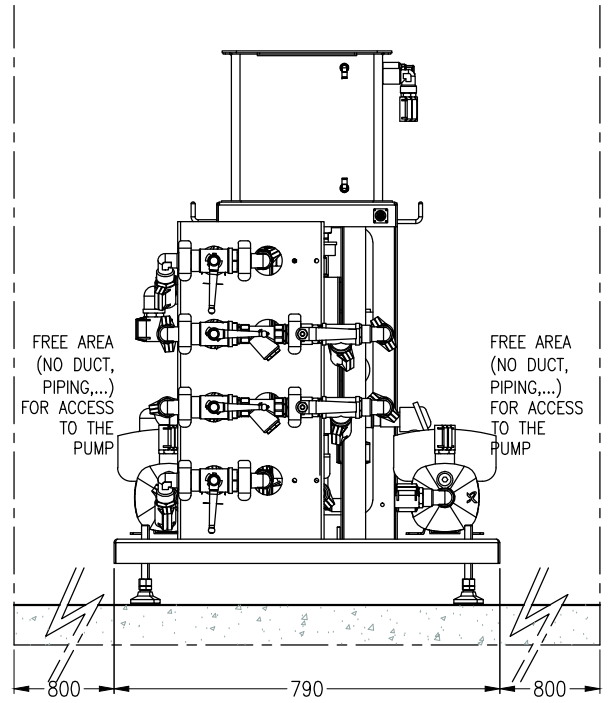
51.21 A



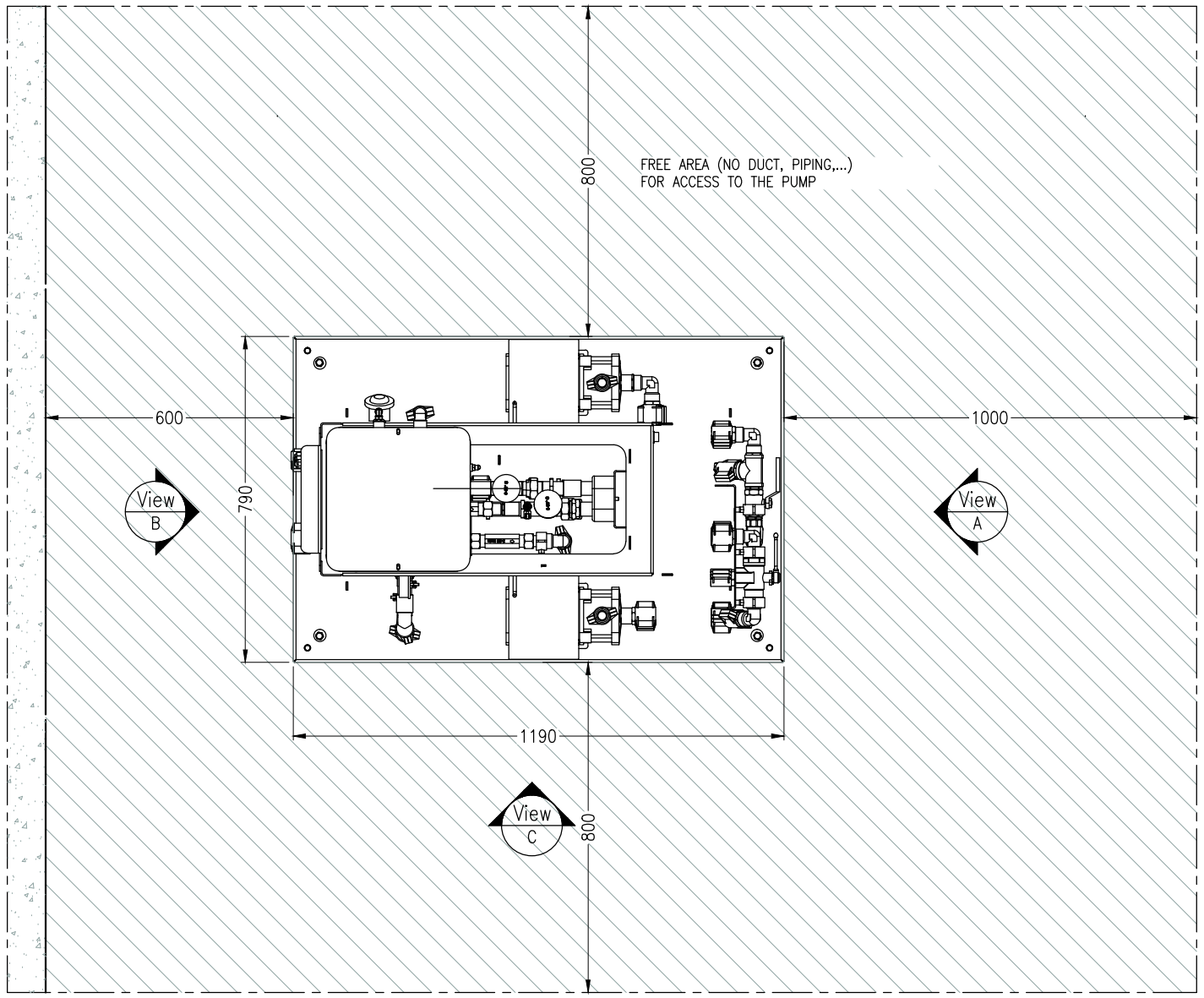
VIEW B

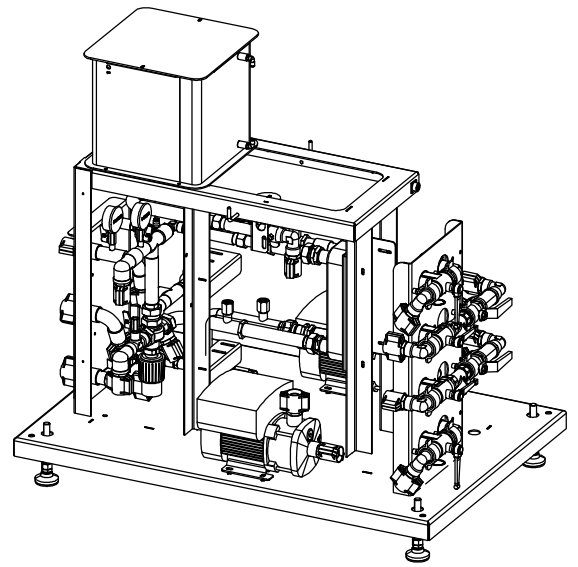


VIEW C



VIEW A





PORT	FUNCTION	WATER FLOWS DIRECTION
S0	Fill In (MakeUp)	
R0	Drain	
S1	Outlet to IBA equipment	Water conditioner to IBA equipment
R1	Inlet from IBA equipment	IBA equipment to water conditioner
S2	Inlet from customer	Chiller to water conditioner
R2	Outlet to customer	Water conditioner to chiller

Water conditioner weight:
- empty : 70 kg / 154 lb
- loaded (water): 100 kg / 220 lb

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:
Cyclotron vacuum pump #2

07.42.33.

51.22 A