PART-B
EMPLOYER'S REQUIREMENT
TECHNICAL REQUIREMENT
CIVIL WORKS

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1. TOPOGRAPHICAL SURVEY

The Topographical survey of the land where some structures such as control building, transformers, inverter rooms, security rooms etc. shall be located shall be done by the Contractor and be approved by the Owner. The bathymetric/ hydrographic survey for water body for water depths at various locations including probable minimum and maximum water depths etc. shall be done by contractor and be approved by the owner.

Based on the above study, the Contractor there after shall prepare a detailed PV array layout which shall be used by the Contractor for designing the general layout with clear demarcation for location of control room, approach road, other structures on ground/ water body. All the maps should be prepared in digitised forms using computer software like AutoCAD – Release 2016 or latest.

2. GEO-TECHNICAL INVESTIGATIONS AND TESTING

Geo-Technical Investigations and Testing of the proposed site where structures to be founded shall be got done by the Contractor at his own cost. All testing shall be done in the presence of the engineer or his authorized representative in a NABL accredited / Govt. Laboratory acceptable to and approved by the Owner. This includes reputed government / autonomous laboratories / organizations, and other reputed testing laboratories. The test samples for such test shall be jointly selected and sealed by the engineer and contractor and thereafter these shall be sent to the concerned laboratory through the covering letter signed by Owner engineer. The interim and final reports shall be made available as and when received, to the Owner.

Field test shall include but not be limited to the following:

Boreholes, Standard Penetration Test (SPT), collection of disturbed and undisturbed soil samples (UDS), Trial Pits (TP), collection of water samples, Electrical Resistivity Test (ERT) etc.
Minimum 1 No. of borehole of 5m depth (min) shall be carried out in every 12.5 acres of land. Minimum 1 ERT & 1 TPs shall be carried out for 100 Acres or below.

SPT shall be carried out in all types of soil deposits and in all rock formations with core recovery upto 20%, met within a borehole. This test shall be conducted at every 1.5 m interval or at change of strata. The starting depth of SPT shall be 0.5m from ground level. UDS shall be collected at every 1.5 m interval or at change of strata.

Contractor is required to consider the Geo-Technical parameters of the proposed site as per the final Geo-Technical Investigations and Testing report vis-a.-vis locations of various structures required for the project to design suitable foundations for the - respective structures.

Further, based on the Geo-Technical Investigations and Testing report, the Contractor shall arrange for Geo-Technical improvement wherever necessary.

3. HYDROLOGICAL ASPECTS

The proposed floating solar plant is located in a reservoir due to which there is abundant availability of water. Based on the available data, provided by dam authorities, the highest recorded water level is 124.61m and the lowest recorded water level is 108.44m. The maximum rated water level for the dam is 125.4m. Based on the same, the minimum and maximum design water levels for the plant may be considered

as 108m and 125m respectively. However, it may be ascertained by proper investigation by the bidder.

Water requirements for the park for various activities such as cleaning of PV plants, park, green belt, common facilities etc. may be ascertained along with water availability at the site. Hydrological and hydrographic study shall be done as per norms of MNRE.

4. PLANNING AND DESIGNING

The solar plant shall be designed so as to conform to the latest engineering designs, architectural values and aesthetic features etc.

The Contractor has to plan and design all the Civil Engineering Structures/ Flotation device/ other items as per the standard practices.

All details related to internal electrification, water supply, fencing, access roads, sewerage system and other important features should be clearly shown in the drawing.

5. LAND DEVELOPMENT

Before submitting his bid, the bidder should inspect and examine the site and its surroundings and should satisfy himself as to the nature of the ground & water body and subsoil, the quantities and nature of work, materials necessary for completion of the work and their availability, means of access to site and in general shall himself obtain all necessary information as to risks, contingencies and other circumstances which may influence or affect his offer. No consequent extra claims on any misunderstanding or otherwise shall be allowed by the Employer.

All works related to site clearance including removal of bushes, trees, levelling, grading, finishing and other additional works shall be carried out by the Contractor. Mandatory permission/ licenses/ statutory clearances from Competent Authorities for site levelling activities like removal of tree and bushes, undertaking blasting related works, disposal of cutting material etc. shall be carried out by the contractor.

All works related to cleaning of weeds, water plants and other flora in the existing water bodies shall be carried out by the contractor.

Site grading level shall be fixed with due reference to site drainage of the whole area, existing drainage pattern, maximum flood level and system requirements.

Based on the spot level, contour survey done and meeting above requirements, bidder can propose different site grade levels. The site levelling may be carried in patches/blocks, if applicable.

In all kind of site levelling and grading or plant at natural topography schemes, bidders has to ensure to provide proper and effective drainage system. After performing the optimization of levels from the detailed site survey by the Contractor, the final formation level of the plot in various areas shall be finalized. The area shall be suitably cut and filled to suit the layout requirement. The site levelling and grading scheme incorporating the above aspects shall be submitted to employer for approval, if applicable.

Fill shall normally be made up of Cohesive Non swelling material capable of being compacted upto 95% Modified Proctor density. As far as possible the excavated material which is suitable for fill shall be used in project area itself. Waste material shall be disposed off in sites to be identified and arranged by contractor himself at his own cost. In case earth has to be borrowed from outside the plant boundary, the same shall be arranged by the Contractor himself. In case earth has to be borrowed from outside the plant boundary, the same shall be arranged by the Contractor himself. The slope at the edge of graded areas shall not be flatter than 1:1.5 (1 vertical to 1.5 horizontal)

in cutting and 1:2 in filling. In case of fill by rock material, the same shall be done in line with relevant Indian Standard.

All buildings & switchyard area/sub-station area shall be constructed in levelled area. No foundation shall be allowed on back filled soil and in that case the depth of foundations shall reach up to NGL. Final Level will be approved in detail engineering.

The slope protection measure shall be provided in case inter levelled patches level difference is more than 2.0m. Random rubble/boulder/stone pitching/concrete blocks etc. shall be provided for the slope protection for road side slope, storm water ditches/drainage, embankment slopes, inter levelled patches slopes etc. as per design requirements.

Suitable sand erosion control measure shall be provided in case any sand dune falls inside the plot area. The same may be made with Random rubble/boulder/stone pitching/concrete blocks etc. Bidder shall also provide sufficient grass/buses/trees covers on these dune.

6. FENCING OF THE PROJECT

The area of Control room, Switchyard and Transformer yard has to be protected from foreign ingress by Chain Link fencing with fence posts all along its periphery.

The galvanized chain link fence shall be of 3 mm dia (10 SWG), 50 x 50 mm mesh size confirming to IS 2721 (Zinc Coated -Medium).The height of fencing shall be min 2.5 m from free ground level (including height of barbed wire angle). Toe wall shall be provided between the fence posts all along the run of the fence with the foundation.

Above the chain link fence, three rows of 'Steel Barbed Wire, A-1 IS 278' shall be provided in the Half Y steel post. The reinforced barbed wire will be attached to angle iron posts vertical height 400 mm. All fence posts and stay post shall be 50X50X6 mm MS angles spaced at 3.0 meter c/c distance. All corner fence posts will have two stay posts in orthogonal directions. Concrete foundations for the angle iron posts and stays shall be provided. Other necessary fixtures required for erection of fencing such as cleats for eye bolts, eye bolt strainers, stretcher bars, droppers etc. shall be provided by the contractor as per standard engineering specifications. The complete design, materials and the erection of chain link fencing shall be done as per standard engineering specifications and the same shall be got approved by the owner before taking up erection.

The portion of the fence covering towards rail track shall be made of a removable type for movement of the transformer during erection /removal. In addition, a gate of 3 m and 1.2 m clear width shall be provided for an entry in switchyard and in transformer yards respectively. The fencing work shall conform to CEIG requirements. Transformer track rails shall conform to IS 3443.

The Solar Plant equipments which are placed on float or inside water body are fenced suitably as per standard practice. The complete design, materials and the erection shall be done as per standard engineering specifications and the same shall be got approved by the owner before taking up erection.

7. ENTRY GATES AND SECURITY CABIN/GUARD ROOM

ENTRY GATES

The entry gates shall include one main gate and another wicket gate for pedestrians and one number Security cabin/Guard room adjacent to each wicket gate. The main gate shall be of overall size of 5m width by 3m height. The main gate panels shall be

fabricated of mild steel frame and shall consist of two leaves of equal width with a steel plate of minimum 22 gauge welded to the steel frame and provided with required paint and accessories necessary for smooth operation of gate. The design of gate shall be submitted to the Owner for approval prior to its fabrication. The location and number of these gates shall be decided in consultation with owner during detailed engineering to meet site requirements.

SECURITY CABIN / GUARD ROOM:

Security/Guard room provided at entrance gate shall be of Pre-Fabricated type duly approved by the Owner. The size of security room shall be minimum 9 Sq Meter. In addition to this, a toilet including Indian type W/C, wash basin and other required accessories shall be provided with the security room. Toilet shall be Pre-Fabricated type. All the necessary plumbing, sanitary lines and electrical connections for lighting and exhaust fan in toilet shall be provided. Specifications for flooring, roofing, painting etc. shall be same as those provided for Inverter room. All the details of Security/Guard room including toilet shall be got approved from the Owner before erection.

8. PATHWAYS AND ROADS

The approach road to the Solar Power Plant shall originate from the main approach road and connect to all Inverter rooms, MCR building, Switchyard and gates.
Approach road shall be 3.00 meter wide with 1meter wide shoulder on both sides. Red moorum/brick, minimum 100 mm thick shall be provided for shoulder. The crown of the road shall be minimum 150 mm above FGL. The final finished roads shall have a camber of 1 in 50.

The minimum road section shall be as follows:

1) Topping: Wearing course of premix carpet 20 mm thick.
2) WBM, compacted 75 mm thick (Grade-III).
3) WBM, compacted 100 mm thick (Grade-II).
4) Granular Sub-base, compacted 150mm thick granular sub-base (Gr-I).
5) Sub-grade under road and its shoulders shall be compacted to achieve 95% or more of standard proctor's MDD. CBR value of the sub grade level should be minimum 4%. If actual CBR is less than 4% in a particular stretch then GSB thickness shall be increased suitably.

Approach road design shall confirm to IRC.

The methodology of road construction with material specifications shall be submitted for approval before start of works.

9. STANDARDS

a) Basic and Layout design of the project shall be in accordance with internationally accepted practice. Appropriate IS Codes (latest version) shall be used wherever available. The Contractor should be able to provide various international and national references, when required by owner, to substantiate his design.

b) All structures for civil works shall be designed for severe combination of loads which shall also include but not limited to wind, seismic and load due to snow or tidal waves as the case may be.

c) The Contractor shall get the structural design done as per the relevant IS codes or international practices subject to the approval of the Owner.

d) The structural design of all civil structures shall have to be proof checked by any reputed institution or any other consultant approved by the owner. The structural design shall have to be got approved from Owner, before actual start of the work.

e) The design of Floating, anchoring and Mooring system, including CFD modeling, comprising of Floating unit, MMS and anchoring and mooring system, shall be verified by suitable third party NABL accredited agency/ reputed institutions like IITs and submitted for employer's approval.

10. CONSTRUCTION SPECIFICATIONS

The Contractor shall propose construction specifications for other civil works of the project unless provided otherwise in these specifications.

Details of Module mounting Structures including design, manufacturing, supply, assembly and installation along with associated floating devices and civil Foundation/ pilings if required anywhere, shall be submitted by contractor for approval.

Appropriate mounting structure to support the solar PV modules and to absorb & transfer the mechanical loads to the water body /ground needs to be designed.

These specifications shall be conforming to National / CPWD / State Government Specifications/Construction Practices for similar projects and shall be supported by International/National references when so required by the Owner. These specifications in the draft form shall be first discussed with the Owner before they are duly approved by the Owner for the execution.

11. MODULE CLEANING ARRANGEMENT

Bidder shall propose solar modules cleaning system made of a combination of dry cleaning system as well as cleaning with water through pipe network, or either of these two complete cleaning systems.

Solar Module Washing System with Water

1. Bidder shall provide permanent arrangement for module washing in the SPV Plant. This shall include installing deep tube/bore wells with pump and motor, requisite storage arrangement and laying network of HDPE pipe conforming to IS 4984 and other relevant codes. The module washing shall be complete in all respect and the details shall conform to the relevant IS codes. The complete scheme shall be subject to approval of the owner including inputs points, design and drawings for the system. Opening from the HDPE pipe with manual isolating valves should be provided at regular intervals. The opening pipes for fixing the movable/Hose pipes for spraying water on module shall be made of GI pipe. Bidder shall install flow meter for measurement of water consumption.

2. Water for cleaning shall be arranged by contractor.

3. Design of solar PV module cleaning system shall be such that complete solar plant shall be cleaned with fresh water once in a month. Module cleaning system piping network shall be closed looped pipe network configuration consists of Main pipe, sub-main and branches. Module cleaning system piping network may be design for dead end/tree pipe network configuration. Minimum 3 tapping /washing point shall be functional at same time. Cut-off valves shall be provided at suitable junction point so that the repair works may be conducted at a particular area without disturbing the

whole area. The water used for cleaning should be of appropriate quality fit for cleaning purpose as per the recommendations of module manufacturer.

4. Bidder shall provide the piping and the instrumentation diagram (P&ID) of water washing arrangement including the physical sequence of branches, reducers, valves, pressure gauge, cleaning points with location of pump(s) and water storage tanks to Employer for approval during detailed engineering.

5. HDPE pipes shall run along separate floaters with suitable tapping points at appropriate locations. The floaters used for cable routing arrangement may be utilized for HDPE pipes. Maximum length of hose pipe shall be 50 meter from tapping point.

6. After laying and jointing, testing of main pipe, service pipe and fitting shall be checked by charging with water. The test pressure shall be minimum 0.5 N/mm2 or double the maximum working pressure, whichever is greater. The pressure shall be applied by means of a manually operated test pump or, in the case of long mains or mains of a large diameter, by a power-driven test pump, provided the pump is not left unattended.

7. End of the branch pipes/tapping points to be bent horizontal/downward to avoid entry of foreign materials like, earth, sand leaf, gravels, etc.

8. Bidder to ensure interconnection between the sub-systems of module washing system through isolating valve, so as module cleaning may be continued in case of outage of any sub-system.

The contractor shall also provide a water treatment plant at each source of water based on water quality. The treated water quality shall be suitable for washing of the Solar Modules. The details of the water treatment plant shall be submitted by the contractor to the owner for approval by the owner.

Supply and erection of necessary pumps, water-line and water tanks are in the scope of the Contractor. Contractor shall furnish calculations based on the head and discharge requirements of the pump rating and the water-line details. Contractor shall provide the single line diagram of water washing arrangement with location of pump to Owner for approval during detailed engineering.

Contractor shall also provide manual interconnecting valve to connect the water supply of one network to other to meet water requirement in case of outage of one pump.

Dry/ Robotic Solar Module Cleaning System

The Module mounting structure/ table shall be designed and modelled considering connection details for robotic cleaning for travelling from one table to another. Crossing of overhead lines, cables through trays & pedestals, connecting approach road between the rows of MMS/Table in layouts shall be avoided for optimum use of robotic cleaning system.

Model of working shall be automatic cleaning, IP65 protection level, self-powered system with battery backup (without external supply), it should be compatibility & integrated with SCADA.

Bidder shall supply the complete robotic cleaning system at site as per approved Array/Plant layout drawings, and supervision of installation & commissioning by supplier along with owner O&M team, all other activities related to robotic cleaning including storage, loading, unloading, transportation within site, its supply including start end docking station, bridge material required complete in all aspect, nuts and

bolts, fasteners, installation, coordination, commissioning and any other activity not specified herein but required for successful commissioning of robotic cleaning system is included in the scope of Bidder.

12. MAIN CONTROL ROOM

For the operation & maintenance of SPV Plant, Centralised Main Control Room shall be built. The Main control room shall be shall be RCC framed structure with bricks/concrete blocks masonry walls. The Main Control Room shall have entry lobby and portico with roof for vehicle stoppage. It should also consist of 2 rooms with attached bath & toilet to serve the purpose of transit camp. These rooms can be constructed on the roof of the main control room.

Parking shed to accommodate at least 2 cars and 10 bikes shall be provided near the Centralised Main Control Room building. The parking shed shall be made of structural steel with permanently colour coated roof sheets.

The Centralised Main Control Room building shall comprise (but not limited to) of the following rooms. The minimum size & major requirements of each room shall also be as per the details given hereunder.

1) Air conditioned SCADA Room (Size Min 30 Sq Meter for projects upto 250 MW & Min 40 Sq Meter for projects more than 250 MW)
2) Battery Room, ACDB and 33 kV Switchgear Room

   (The room sizes shall be based on manufacturer recommendations, easy passage of O&M Persons and cable trench layout required. Minimum clearance between back side of any floor mounted panel and the wall shall be 850 MM or manufacturer recommendation whichever is higher. Minimum working clearance before front panels of any switchgear, PCU or similar equipment generally shall not be less than 2200 MM.
3) 02 no Air-conditioned Rooms for office along with office furniture.

   i) Office Room-1 (for Owner): Min Size 15 Sq Meter
   ii) Office Room-2: Min Size 15 Sq Meter
4) Air-conditioned Conference Room (Size Min 20 Sq Meter) alongwith a table of appropriate size, Min 10 no of chairs, furnishings etc.
5) Record Room (Size Min 5 Sq Meter)
6) Store Room with sufficient no of modular rack for proper identification and storage of tools & spares (Size Min 50 Sq Meter).
7) Toilets (Male and Female) (Total Size Min 12 Sq Meter)
8) Pantry (Size Min 4 Sq Meter)
9) First Aid Room (As per requirement/ norms)
10) 2 no. fully furnished Air-conditioned rooms with attached bath and toilet for Transit camp including bed, side-table, chairs etc. - (rooms- each of size Min 14 Sq Meter, bath and toilet of size Min 4.5 Sq Meter)

The pantry shall consist of one number stainless steel pantry sink, as per IS : 13983, of size 610 x 510 mm, bowl depth 200 mm with drain board of at least 450 mm length with trap, with inlet and outlet connections and good quality concealed water supply

pipe of minimum 12 mm dia of medium class, sanitary pipe of minimum 75 mm diameter, floor trap with Stainless Steel grating, inlet and outlet connections for supply and drainage, with all bends, tees, junctions, sockets, etc., as are necessary for the commissioning and efficient functioning of the pantry (all sanitary fittings shall be heavy duty chrome plated brass, unless specified otherwise)

In addition, Contractor shall construct at least one security room of size minimum 3m x minimum 3m near the entry gate of main control room with toilet and water facility as specified in Clause 7 above.

One Store shed (in addition to all other stores), with Min size - 100 sq.m (for projects upto 250 MW), 150 sq.m. (for 250 to 500 MW projects) shall be also be constructed near Centralised Main Control Room for storage of Mandatory/specified spares during O&M Period by bidders and later on for Employer after O&M period. The Store shed shall be a Pre Engineered Building with framed structure. The design and drawing of the store shed shall be submitted for Employer approval before start of work.

The Contractor is required to submit the proposed drawing of Main Control Room during detail engineering to the owner for approval.

The buildings and allied works shall be designed to meet NATIONAL BUILDING CODE (SP: 07 2016) requirements. Finish floor level of all building/rooms shall be minimum 450 mm above the Finish graded level.

For enclosing the Air conditioned SCADA room, partition consisting of anodised aluminium extrusion and glazing (or Novopan board) shall be provided. Split AC Units shall be provided as per the details mentioned in SCADA Chapter of E & M Specification.

The SCADA room, Office Room and Conference Room shall be provided with false ceiling of 15 mm thick mineral fiber board, in tile form of size 600mm x 600mm, along with galvanized light gauge rolled form supporting system in double web construction pre painted with steel capping, of approved shade and colour, to give grid of maximum size of 1200x600 mm as per manufacturers details including supporting grid system, expansion fasteners for suspension arrangement from RCC, providing openings for AC ducts(if required), return air grills(if required), light fixtures, etc., all complete.

RCC terrace of Centralised MCR building shall also work as view point. View point shall be used for security purposes and viewing gallery. Suitable RCC half landing staircase shall be provided for access to roof of the RCC MCR building.

The details of AC units, furniture, furnishing etc for office rooms, conference room, SCADA Room and at other places for operator/ other personnel (if required) shall be proposed for the approval of the Owner and same shall be provided by the Contractor.

12.1. RCC WORKS

All RCC works shall be design mix as per IS: 456-2000. For structural concrete items, Ordinary Portland Cement (43 Grade) conforming to IS: 269-2015 shall be used. Type of cement for sub-structures shall be decided based on the final soil investigation report.

Coarse aggregate for concrete shall be crushed stones chemically inert, hard, strong, durable against weathering of limited porosity and free from deleterious materials. It shall be properly graded. It shall meet the requirements of IS: 383.

Sand shall be hard, durable, clean and free from adherent coatings of organic matter and clay balls or pellets. Sand, when used as fine aggregate in concrete shall conform to IS 383. For plaster, it shall conform to IS: 1542 and for masonry work to IS: 2116.

Reinforcement steel shall be of high strength deformed TMT steel bars with corrosion inhibitors, Corrosion Resistant Steel (CRS) re-bars, Fusion Bonded Epoxy Coated (FBEC) re-bars or Zinc Coasted re-bars of grade minimum Fe-500 and shall conform to IS: 1786. Ductile detailing in accordance with IS: 13920 shall be adopted for superstructure and substructure of all RCC buildings / structures.

The following minimum grades of concrete for design mix and nominal mix shall be adopted for the type of structures noted each unless not specified elsewhere.

M-30	All RCC structural elements above and below ground level, precast concrete, cable trench, oil pit, Grade Slab, Paving, culverts & road. All RCC structural elements above and below ground level. RCC cable trench, oil pit, Grade slab, Foundations for other misc. components, Auxiliary Transformers and Foundation for Switchyard Equipments.
M-20 (Equivalent nominal Mix of 1:1.5:3)*	Fencing work
M-15 (Equivalent nominal mix of 1:2:4)	. Base slab of drains
M-10 (Equivalent nominal mix of 1:3:6)	Plain Concrete Cement.

Note: M-30 shall be used in place of M-25 and M-20 shall be used in place of M-10 & M-15 in coastal areas.

* The use of nominal mix for M-20 grade may be accepted only in exceptional cases subject to approval of Employer Engineer-In-Charge. The same shall be the adopted subject to approval from employer for specific work.

The bidder shall carry out the design mix of M-30 grade concrete on priority. The design mix shall be approved from employer before start of work. In case Geotechnical investigations requires any special kind of cement or higher grade of concrete, the same shall be provided. All foundation system and foundation depth shall be decided based on the approved geotechnical investigation report.

All loads shall be considered in line with IS:875. Seismic loads for design shall be in accordance with IS:1893 and relevant standards.

IS: 2502 Code of Practice for Bending and Fixing of bars for concrete Reinforcement must be complied for reinforcement. IS: 5525 and Sp:34 shall be followed for reinforcement detailing.

A minimum of 75 mm thick PCC shall be provided below RCC wherever RCC is laid over the ground. Proper and sufficient formwork/shuttering shall be provided for the required period as per IS: 456.

Grouting

Cement mortar (1:2) grout with non-shrink additives shall be used for grouting below base plate of a column. The grout shall be high strength grout having a minimum characteristic compressive strength of min 30 N/mm2 at 28 days.

12.2. MASONRY WORK

All brick works (If proposed anywhere) shall be using at least Class designation 7.5 of approved quality as per IS: 1077, IS: 2212 and IS: 3495. The cement mortar for brick masonry shall be in the ratio 1 cement and 5 sand by weight. The cement mortar shall be machine mixed. Bricks required for masonry work shall be thoroughly soaked in clean water tank for approximately two hours before their actual use. Brick shall be laid in English bond style. Green masonry work shall be protected from rain. Masonry work shall be kept moist on all the exposed faces for a period of seven days from the day of execution.

12.3. DOORS,WINDOWS, VENTILATORS AND ROLLING SHUTTERS

Doors, windows and ventilators of air-conditioned areas, entrance lobby of all buildings, and all windows and ventilators of MCR building shall have, powder coated (minimum thickness of powder coating 50 micron) aluminium framework with glazing. Window shall be provided with suitable aluminium grill. Ventilators/duct shall be provided with bird guard.

Doors of toilet areas shall be of steel framed solid core flush shutter as per IS 2202. Minimum size of door provided shall be 2.1 m high and 1.2 m wide. However, for toilets and office areas minimum width shall be 0.75 m and 1.20 m respectively.

The Bidder can also propose uPVC extruded casement/ sliding windows and doors with complete fitting and accessories as per items mentioned in DSR 2016.

All external doors of MCR shall be provided with Collapsible metal grille with locking system.

Doors and windows on external walls of the buildings (other than areas provided, with insulated metal claddings) shall be provided with RCC sunshade over the openings with 300 mm projection on both side of the openings. Projection of sunshade from the wall shall be minimum 450 mm over window openings and 450 mm over door openings except for main entrance door to the control room where the projection shall be 1500 mm.

Rolling shutter (Mechanical gear operated) shall be fabricated from 18-gauge steel and machine rolled with 75 mm rolling centres with effective bridge depth of 12 mm lath sections, interlocked with each other and ends locked with malleable cast iron clips to IS: 2108 and shall be designed to withstand a wind load without excessive deflection. Metal rolling shutters and rolling grills as IS: 6248

12.4. GLAZING

All accessible ventilators and windows of all buildings shall be provided with min. 4mm thick float glass, plain or tinted for preventing solar radiations, unless otherwise specified.

For single glazed aluminium partitions and doors, float glass of 8mm or 10 mm thickness shall be used.

The glass to be used should be from the reputed manufacturers of glass like Glavebel (Belgium), Saint Gobain (France) or Fort (USA) or equivalent. The glass should be free from distortion and thermal stress.

12.5. PLASTERING

All external surfaces if any shall have 15 mm cement plaster in single coat 1:4 with water proofing compound. After plastering white cement primer shall be provided.

At least one coat of plaster shall be applied to interior walls by hand or mechanically, to a total thickness of 12 mm using 1:4 mortar. Plastering shall comply to IS: 1542, IS: 1661, IS: 1630. Oil bound washable distemper on smooth surface applied with 2 mm thick Plaster of Paris putty for control room.

Plaster of Paris (Gypsum Anhydrous) conforming to IS: 2547 shall be used for plaster of Paris punning. All the material used for water proofing, distempering and Plaster of paris shall be got approved from Owner before purchase.

12.6. FLOORING

The Cement shall be PPC as per relevant BIS/IS codes.

Flooring for all air conditioned areas and offices area shall be provided with vitrified ceramic tiles of size 600X 600 mm of min 9 mm thickness, laid with 3 mm ground joints as per approved pattern, painted neatly with 3X4 mm stainless epoxy grout or equivalent

Flooring for stores, security cabin shall be of cement concrete flooring as per IS: 2571.

Heavy duty (Grade V) dust pressed ceramic tiles (300X 300 mm) as per IS: 13755, shall be provided for flooring of toilets and pantries. Acid resistance tiles shall be used for battery room.

For pantry slab floor mirror polished (6 layers of polish) Granite stone (slab) of minimum thickness of 18 mm shall be used.

12.7. ROOFING

Roof of the main control room Building shall consist of Cast-in-situ RCC slab treated with a water proofing system which shall be integral cement based treatment conforming to CPWD specification (item no. 25.8 of DSR 1997 or equivalent in latest version of DSR). The roof of the building shall be water proof with tarfelt 5 layer over screeding. The roof shall be designed for a minimum superimposed load of 150 kg/sq.m.

For efficient disposal of rainwater, the runoff gradient for the roof shall not be less than 1: 100 and the roof shall be provided with RCC water gutter, wherever required. Gutter shall be made water tight using suitable watertight treatment. This gradient can be provided either in structure or subsequently by screed concrete M25A 12.5 and/or Cement mortar (1:4). However, minimum 25 mm thick cement mortar (1:4) shall be provided on top to achieve smooth surface.

The roof of the main control room shall be projecting out by at least 900mm all around the main control room building for protection of its external walls from rain water.

12.8. PAINTING OF WALLS & CEILINGS

INTERNAL WALL SURFACES: SCADA ROOM & CONFERENCE ROOM ALL OTHER ROOMS IN PLANT BUILDINGS	-ACRYLIC EMULSION -ACRYLIC DISTEMPER
EXTERNAL FACES OF WALLS:	-EXTERIOR EMULSION PAINT

WALLS OF BATTERY ROOM	-ACID ALKALI RESISTANT PAINT, AN EXPOSED WALL ABOVE DADO -2100 MM HIGH DADO OF ACID ALKALI RESISTANT TILING
ALL CEILING	-ACRYLIC DISTEMPER

The paint shall be anti-fungal quality of reputed brand suitable for masonry. All painting on masonry or concrete surface shall preferably be applied by roller. If applied by brush, then same shall be finished off with roller. For painting on concrete, masonry and plastered surface, IS: 2395 shall be followed. Minimum 2 finishing coats of paint shall be applied over a coat of primer.

For painting on steel work and ferrous metals, BS: 5493 and IS: 1477 shall be followed. The type of surface preparation, thickness and type of primer, intermediate and finishing paint shall be according to the painting system adopted.

Ceiling of all rooms except Battery room shall be white washed. The ceiling of Battery room (if provided) shall be acid/alkali resistant paint. Centralised MCR building outside colors of paining shall be similar to PEB painting colours. A standard color scheme for the different buildings/structures shall be prepared by the Contractor and the approval of the Owner shall be obtained, before commencement of work.

12.9. PLINTH PROTECTION

Plinth protection shall be provided around all the buildings.

12.10. WATER SUPPLY

Good quality pipes as per standard practice shall be used for all water supply and plumbing works.

The Syntax or equivalent make PVC storage water storage tank(s) conforming to IS:12701 shall be provided with minimum capacity 2500 liters, complete with all fitting including float valve, stop cock etc.

Required water connection to service the main control room shall be in the scope of the Contractor. Contractor shall furnish calculations based on the head and discharge requirements of the pump rating and the water-line details for approval by the Owner. The water samples obtained shall be tested at Owners approved laboratory and reports shall be furnished.

12.11. PLUMBING AND SANITARY

Each toilet shall have the following minimum fittings:-

(a) WC (Western type) 390 mm high with toilet paper roll holder and all fittings or WC (Indian Type) with all fittings (both types of WCs shall be provided at alternate locations).
(b) Urinal (430 x 260 x 350 mm size) with necessary C.P fittings.
(c) Wash basin (550 x 400 mm) with all fittings.
(d) Bathroom mirror (600 x 450 x 6 mm thick) hard board backing
(e) CP brass towel rail (600 x 20 mm) with C.P. brass brackets
(f) Soap holder and liquid soap dispenser

All fittings, fastener, grating shall be chromium plated. Necessary plumbing lines shall be provided for main control room building and Security cabin.

Wash basin provision for hand wash shall also be provided in battery room.

The Contractor shall design & provide underground one septic tank and two soak pits and assuming that a total of 20 No. personnel shall be working for the plant during O&M stage in combined two shifts. The waste water/effluents from the sewerage plants/septic tank shall meet the state pollution board requirement

12.12. ELECTRIFICATION OF BUILDING

Electrification of building shall be carried out by the Contractor as per the details mentioned elsewhere in technical specification and the same shall be as per IS: 732, IS: 4648 and other relevant standards.

12.13. STAIRS

To access the roof of MCR for maintenance of communication equipment and water tank, suitable RCC half landing staircase as per relevant BIS codes shall be provided. MCR building RCC terrace of Centralised MCR building shall also work as view point. View point shall be used for security purposes and viewing gallery.

12.14. FALSE CEILING

The Control Room, Conference Room, Server & SCADA Room and Office Rooms of the Main Control Room building shall be provided with false ceiling of 15 mm thick mineral fibre board, in tile form of size 600mm x 600mm, along with galvanised light gauge rolled form supporting system in double web construction pre painted with steel capping, of approved shade and colour, to give grid of maximum size of 1200x600 mm as per manufacturers details including supporting grid system, expansion fasteners for suspension arrangement from RCC, providing openings for AC ducts(if required), return air grills(if required), light fixtures, etc., all complete.

12.15. LIGHTING

The lighting design of the main control room building shall be carried out as per IS 3646. The average illumination level of control room shall be 300 Lux with Mirror optics with anti-glare type or Decorative Mirror optics type of fixture. The building shall be provided with adequate light fittings, 5A/ 15A 1 phase sockets, fans etc. controlled by required ratings of MCBs and MCB DBs. All MCBs / Isolators shall be mounted inside the panel and a bakelite/fibre glass sheet shall be provided inside such that operating knobs project out of it for safe operation against accidental contact. Operating handle of incoming MCCB/isolator shall project out of door. Wiring inside the panel shall be carried out with 1100V grade PVC insulated stranded copper conductors of adequate size.

Supply and providing of suitable illumination along the peripheral roads, control room, inverter rooms and other facilities like switch-yards and outside main control room etc. inside the plant shall be done by the Contractor as per relevant BIS Codes and as per other technical Electrical Specifications of this contract.

13. INVERTER ROOM

The inverters may be housed on floating platforms or area may be created for installing inverters by pile foundation if suitable in water or on land depending on suitability of design and area of dry land available. The number of Inverter rooms shall be as per requirement.

Inverter rooms consist of PCU’s, LT panels, batteries, etc. shall be provided based on manufacturer recommendation, easy passage of O&M persons and cable trench layout required.

The inverter rooms may be made of Pre Engineered Building (PEB) in line with PEB technical specification mentioned below or with RCC structure for buildings and containerized solutions.

The battery and its associated equipment shall be suitably segregated inside the Inverter room with proper ventilation arrangement.

The Inverter Room shall be made of Pre-Engineered Buildings (PEB). The PEB shall be made of structural steel construction with double skinned metal roofing and wall cladding of approved profile. It shall be designed, manufactured, supplied and erected by the bidder/PEB agency. PEB shall be complete with painting, metal facia, metal gutter, rain water down comers, sun-shades, openings, etc., along with associated structural steel, cladding and roofing work insulation, Trims & Flashings. Each item of PEB like panels, masonry, plastering, flooring, foundation, fittings etc. shall be suitable for complete life of solar plant. The construction methodology for PEB shall also be submitted for approval before start of works.

The layout of Inverter room shall be designed so as to divert the heat generated from each inverter outside the room. The inverter room shall be designed for a life of 25 years. The PEB shall have a robust water tightness at all joints and connections. The building shall have a high class durability and performance during the adverse weather conditions. The PEB supplied shall be complete in all respect meeting all the requirements and other technical and functional requirements like lighting, ventilations system etc. to ensure effective functioning. The PEB shall have robust water tightness at all joints and connections. The building shall have a high class durability and performance during the adverse weather conditions.

The area and number of inverter rooms required shall be proposed and submitted by the contractor for approval of the owner.

The structural design shall have to be got approved from Owner, before actual start of the work.

13.1. STRUCTURE AND MATERIAL SPECIFICATION

The PEB inverter room shall have steel frame primary structural members. All hot rolled primary structural members and Rod/Angle/Pipe bracing etc. shall conform to IS: 2062, minimum Grade E250 Quality A. Secondary members for Purlins and Girts shall conform to the specification of IS 811 or ASTM A1003-12 made from steel sheets conforming to ASTM A1011-12b Grade 50 having a minimum yield strength of 345 MPa. The minimum thickness of secondary members shall be 3mm. All other miscellaneous secondary members shall have minimum yield strength of 250 MPa.

Insulated wall cladding or roofing shall consist of double skin metal cladding with Poly Urethane Foam (PUF). PUF must be made of continuous method PU foam and must be CFC free, self-extinguishing, fire retardant type with density 40 +/-2 kg/m3 and thermal conductivity 0.019-2.2 W/(m.K) at 10°C. The PUF panels shall be a factory made item ready for installation at site.

13.2. FASTENERS & CONNECTIONS

Special coated self-drilling screws/fastener shall be used conforming to class 3 as per AS: 3566.1 and AS: 3566.2. Steel bolts, nuts and washers complying with AS 1112:2000. High Strength Bolts for Primary Connections shall be as per IS: 1367 (Part III) Gr. 8.8 /ASTM A325. Bolts for Secondary Connection shall be as per IS: 1367 (Part III) Gr. 4.6 /ASTM A307. Anchor/foundation Bolts shall conform to IS: 5624 and relevant IS code.

13.3. ROOF AND WALL CLADDING

PUF panels shall be made of troughed permanently colour coated metal sheets of steel for roofing and side cladding (internal and external) shall conform to the requirements of Table-I and IS: 513 for Hot-dip Zinc coated or Al/Zn coated sheets. The insulation material thickness and details shall be as specified at relevant para in the specification.

PUF insulated panels Metal Sheet for Roofing and side cladding consist of external sheet as troughed permanently colour coated sheet & internal sheet as plain permanently colour coated sheet.

Chemical composition of Troughed permanently colour metal sheet for roofing and side cladding shall conform to the provisions of same reference code to which the mechanical properties conform to.

Plain permanently colour coated steel metal sheet for ridge and hips, flashing, trimming, closure for vertical and horizontal joints, capping etc. shall conform to the same requirements as those of troughed permanently colour coated metal sheet for roof and side cladding.

The maximum spacing of the fastener shall be 390 mm c/c along the length of purlins /runners. However exact spacing shall be as per the design done by the bidder of the fastener considering the wind load, self-load and other associated load. Minimum diameter of the fastener shall be 5.5 mm and at-lest 3 nos. of fastener shall be used per sheet.

Fillers blocks as a trough filler shall be used to seal cavities formed between the profiled sheet and the support or flashing. The fillers blocks shall be manufactured from black synthetic rubber or any other material approved by owner.

13.4. ROOF INSULATION AND TYPE

Both metal sheets shall have an under insulation of minimum 70 mm thick PUF with density 40 +/- kg/m3 and thermal conductivity 0.019-2.2 W/(m.K) at 10°C with gutters and down take pipes along with Flashing &Top cap of required size and colour complete with all necessary hardware complete. Roof shall be projected at-least 300 mm from the wall.
Stiffening ribs / subtle fluting for effective water shedding and special male / female ends with full return legs on side laps for purlin support and anti-capillary flute in side lap.

Both upper and lower sheets shall be separated through spacers and fastened through zinc/zinc-tin coated self-drilling screws. The fastener size shall be calculated as per the design or manufacturers recommendations.

13.5. WALL INSULATION

All voids of external and internal metalled walls shall have an under insulation of minimum 60 mm thick PUF with density 40+/- kg/m3 and thermal conductivity 0.019-2.2 W/(m.K) at 10°C with proper supports etc. as approved.

Both the walls should be separated by spacers system made up of cold formed steel bars and fastened through zinc /zinc-tin coated self-drilling screws.

The external wall of Inverter room facing the transformer area shall be as per IS: 1646 - Code of practice for fire safety of buildings (general): electrical installations.

13.6. DOORS FRAMES

Door frames shall be of iron frame of mild steel sections. All doors shall be provided necessary fittings like hinges, handles, mortice locks, tower bolts, stopper, hydraulic door closer, etc. of CP brass complete fixed to Pre-Engineered structure including necessary filling up of gaps at junctions with required PVC/neoprene felt etc. including hinges / pivots and double action hydraulic floor spring of approved brand and manufacture IS: 6315 marked, lock, handle and all necessary fittings as detailed in tender drawing or submitted by bidder in shop drawing and approved by Employer.

The door entrance shall include Mild Steel single leaf door. The structural steel shall conform to IS: 7452 and IS: 2062. The holdfasts shall be made from steel flats (50 mm and 5 mm thick). The fixtures, fastenings and door latch are to be made with same materials

Bidder can also proposed uPVC extruded casement/ sliding doors, with complete fitting, accessories and panels as per items mentioned in DSR 2016.

13.7. WINDOWS FRAMES

Aluminium black powder coated section, frame shall be of 92x31 mm, minimum 16G thick as per approved design. Tinted glass and aluminium grill shall be provided. The Bidder can also propose uPVC extruded casement/ sliding windows with complete fitting and accessories as per items mentioned in DSR 2016.

13.8. VENTILATORS

Aluminium black powder coated frame of minimum size 62x25 mm and 16G thick as per approved design. Ventilators/duct shall be provided with bird guard. Size of opening at wall for ducts shall be as per PCU manufacture and min 18 gauge GI sheet. Ducts shall be supported with suitable means, as approved during detail engineering.

All accessible ventilators and windows of all buildings shall be provided with min. 4mm thick float glass, tinted for preventing solar radiations. Suitable sunshades made out of approved colour sheet will be provided to all external windows and door. The minimum projection for the sunshades will be 450 mm and 300mm wider than the width of the opening.

13.9. PLINTH PROTECTION

500 wide plinth protection minimum 75 mm thick of cement concrete 1:3:6 (1cement : 3 coarse sand : 6 graded stone aggregate 20 mm nominal size) over 75 mm bed of dry brick ballast 40 mm nominal size well rammed and consolidated and grouted with fine sand including finishing the top smooth, shall be provided around the Pre-Engineered Building.

13.10. FLOOR FINISH

Flooring, including preparation of surface, cleaning etc shall be of cement concrete flooring as per IS: 2571 with ironite hardener. The inverter room floor shall be atleast 45 cm above the ground level.

13.11. PAINT AND COATING

Metal sheet shall be colour coated with total coating thickness of 25 microns (nominal) dry film thickness (DFT) comprising of silicon modified polyester (SMP with silicon content of 30% to 50 %) paint or Super Durable Polyester (XRW) paint of 20 microns (nominal) on one side (exposed face) on 5 micron (nominal) primer coat and 10 microns (nominal) SMP or Super Durable Polyester paint over 5 micron (nominal) primer coat on other side. SMP and polyester paints system shall conform to Product type 4 as per AS/ANZ 2728.

The structural steel shall be hot-dipped galvanized, conform to IS: 4759 or relevant Indian standard

13.12. DESCRIPTION OF PEB STRUCTURES

Primary Members: Primary structural framing shall include the transverse rigid frames, columns, corner columns, end wall wind columns, beams, truss member, base pate.

Secondary Members: Secondary structural framing shall include the purlins, girts, eave struts, bracing, flange bracing, base angles, clips, flashings and other miscellaneous structural parts. Suitable wind bracings sag rods to be reckoned while designing the structure.

Sealant: Sealant used for cladding shall be butyl based, two parts poly sulphide or equivalent approved, non-staining material and be flexible enough not to interface with fit of the sheets.

Closures: Solid or closed cell closures matching the profiles of the panel shall be installed along the eaves, rake and other locations

Flashing and Trim: Flashing and / or trim shall be furnished at the rake, corners, eaves, and framed openings and wherever necessary to provide weather tightness and finished appearance. Colour shall be matching with the colour of wall. Material shall be 26 gauge thick conforming to the physical specifications of sheeting.

Gutters and Down Comers: Gutters shall be fabricated out of same metal sheet. Material shall be same as that of sheeting. Down comers shall be of galvanised steel pipes or PVC designed to ensure proper roof drainage system.

Group	Grade/ Reference code	Yield strength (minimum)	Tensile strength	Coating Class Designation	BMT (mm)	(+) ve Tolerance	Upper limit of BMT (mm)	(-) ve Tolerance	Lower Limit of BMT (mm)
I	G250/ AS1397	250	320	Z275	0.6	.04	.64	-.04	0.56
	SS255/A STM A653M	255	360						
	S250GD/ EN1032 6	250	330						
II	G350/ AS1397	350	420	Z150	0.5	.04	.54	-.04	0.46
	SS340 Class4/A STM A 792M	340	410						

	S350GD/ EN10326	350	420						
Note		Minimum elongation % shall be as relevant standard and code.							

All steel materials supplied by the agency shall be in a sound condition, of recent manufacture, free from defects, loose mill scale, slag intrusions, laminations, pitting, flaky, rust, etc. and be of full weight and thickness specified.

13.13. LIGHTING

The inverter room shall be provided with electric light to achieve proper illumination level as per standard. However room should be designed to utilise maximum natural light during the day. The Electrical Specifications in this contract shall be followed for Electrical works.

14. CABLE TRENCHES

In Main Control room, Inverter rooms & Switchyard area, cables shall be laid in concrete cable trenches on ground. Cable trenches of suitable dimensions with GI cable trays shall be provided. The trench cover in Main Control room and Inverter rooms shall be of steel grating type. The trench cover in Switchyard area shall be of concrete. Outdoor Cable Trenches for switchyard and inverter Rooms RCC Shall be provided pre-cast RCC removable covers with lifting arrangement, edge protected with suitable galvanized angle iron designed to withstand self-weight of top slab + concentrated load of 150 kg at center of span on each panel.

On flotation device all cables / wires are to be routed in non-corrodible / non degradable cable tray ad suitably tagged and marked with proper manner by good quality ferule or by other means so that the cable easily identified.

All other cables in the project area shall be buried cables with a provision for culvert/Hume pipe for protection of cables under the motorable roads. The details of buried cables are provided in the Electrical Specifications in this contract and the same shall be followed.

15. DRAINAGE SYSTEM

Drainage philosophy based on site area levels and invert levels of drains shall be developed and document/drawings for the same shall be submitted. Contractor shall design and construct suitable drainage system for rain & storm water. Also, cross drainages shall be designed and constructed by contractor after approval of respective drawings by the Owner. The drainage system shall consist of unlined drains. The Excavation of foundation trenches/Drains shall be done by mechanical means (Hydraulic excavator)/manual means depending on size of drain. The drains shall be of trapezoidal sections and shall be designed as per site rainfall data and other standard criteria. The construction shall include dressing of sides and ramming of bottoms including mucking of the excavated soil and disposal of surplus excavated soil as directed by the owner.

16. TRANSFORMER YARD/ SUBSTATION CIVIL WORKS

Transformer and equipment's foundations shall be founded on piles/isolated spread footings depending on the final geotechnical investigation report. It should be above HFL level considered as 1.0 m above shore level. Transformer foundations shall have its own pit which would cover the area of the transformer and cooler banks, so as to collect any spillage of oil or oil drainage in case of emergency. The area around the equipments shall be covered with gravel. The oil pit shall be provided with grating covers and gravel of 40-60 mm size uniformly graded shall be filled over grating cover. The individual oil pits shall be connected to an oil collection pit which shall be sized to accommodate oil volume of the transformer connected to it, without backflow. The oil pit shall be connected to oily water drainage system. Dimensions of the discharge pipe shall consider rainfall intensity also. The water shall be discharged into the nearest drain by gravity flow or pumping.

Transformer track rails shall confirm to IS:3443. The requirement of fire barrier wall between transformers shall be as per Electricity Rules and IS: 1646 recommendations.

17. GREEN BELT DEVELOPMENT

The green belt shall be developed by the bidder in the park area at appropriate locations such as around main control room, entrance area etc. The detailed proposal of green belt development shall be submitted by the bidder to the owner for approval during execution stage.

18. MODULE MOUNTING STRUCTURE, FLOTATION DEVICE AND ANCHORING & MOORING SYSTEM

SCOPE

This section covers activities related to Design, Manufacturing, Testing, Supply, Insurance, Transportation, Delivery at project site, Storage, Erection, testing of module mounting structure, Pre-fabricated flotation device and anchoring and mooring system.

The module mounting structure shall be installed over an appropriately designed modular and pre-fabricated flotation device with appropriate buoyancy to support the weight of at least one solar panel and one person per Mounting Structure.

Total designing and engineering for floating system and anchoring technology to be provided by the module mounting structure manufacturer/ EPC bidder shall be certified by third party agency for safety and strength of the system.

STANDARD

The PV module mounting structure must conform to the latest edition of any of the following IEC / equivalent BIS Standards for floater design qualification and type approval:

Sl. No.	Standards	Description
1	IS 800: 2007	Code of practice for general construction of steel
2	IS 875: 1987	Code of Practice for Design Loads (Other Than Earthquake) For Buildings And Structure.
3	IS 1893: 2002	Criteria for Earthquake resistant design of structures – General Provisions and buildings

4	IS 513: 2008	Cold-reduced low carbon steel sheets and strips.
5	IS 3043: 1987	Code of Practice for Earthing
6	ASTM D1693	Test for Environmental Stress Cracking of HDPE
7	ISO16770	Stress cracking resistance of HDPE
8	IS 15410:2003	Test for drinking water compatibility, Material safe for drinking water
9	RoHS directive 2002/ 95/EC	Test for Restriction of Hazardous Substances
10	ASTM D5397	Standard Test Method for Evaluation of Stress Crack Resistance
11	IEC:62548	Photovoltaic(PV)arrays-Design requirement
12	IEC:60068-2-68	Environmental testing :Test l; Dust and sand

TECHNICAL REQUIREMENTS

FLOTATION DEVICE

a) The flotation unit shall be prefabricated and designed for simple on-site installation. There shall be minimum requirement of welding, masonry or use of complex machinery at the installation site. The flotation unit shall be modular in nature to facilitate the ease of assembly / disassembling and provision to be scaled up. Walk way should be provided to access the flotation device.

b) The flotation device should be manufactured from appropriate thermoplastic (VIRGIN Material). The design of the flotation device should depict satisfactory rigidity, flexural strength (ASTM D790, ISO 178), tensile strength (ASTM D638, ISO 527) and compressive strength (ASTM D695, ISO 604) while loaded with maximum load under extreme environmental conditions. The grade of thermoplastic used should be tested under extreme weather conditions if sunlight, UV, heat, air, and water (ASTM D2565, ASTM D4329, ASTMG7/G7M-11), good Environmental stress crack resistance and a combination of hardness and impact strength (ASTM D1693). The thermoplastic used should be safe for use when in contact with water.(Above points to be confirmed by Manufacturer' data sheet and test certificates)

c) The material used shall be halogen, silicon free conforming to RoHS directive 2002/95/EC.(same to be confirmed by Manufacturer's data sheet and test certificates)

d) The flotation device should be resistant to acid, petrol & mineral oil.

e) The min. thickness of thermoplastic used for flotation device should be 3 mm.

f) The flotation device, when installed in the raw water reservoir, should not restrict the process of gas exchange across the air water interface. More specifically, the water plane area (WPA) does not allow the transmission of sun light into the water and the transfer oxygen across the air-water interface. In order to facilitate this, the design of the flotation device should be such that appropriate voids, greater than at least 30% of all area covered by the flotation device.

g) The design of the flotation device should incorporate appropriately sized walking platform for regular maintenance and inspection. The walking platform should have a continuous uninterrupted surface with width of at least 400mm.

h) In order to increase longevity and prevent unexpected loss of buoyancy, the floating unit shall have a minimum material thickness of 3 mm, with moisture retention of less than 5%. (Detailed buoyancy calculation to be submitted along with drawings at the time of drawing approval).

i) The flotation modules once assembled together should form an integrated structure and relative alignment of the flotation modules subsequent to complete installation (installing module mounting structure and solar PV modules) shall not misalign the solar panels and adversely affect their power generation capability.

j) The flotation device should be re-processable and recyclable at the end of its useful life.

k) Each flotation module should have its appropriate drainage facility such that there is no water logging on the floating module.

l) Min. guaranteed life of the flotation device / unit floater should be 25 years.

m) The design of complete system, including CFD modeling, comprising of Floating unit, MMS and anchoring and mooring system, shall be verified by suitable third party NABL accredited agency/ reputed institutions like IITs and submitted for employer's approval.

MODULE MOUNTING STRUCTURE

a) The array structure shall be so designed that it will occupy minimum space without sacrificing the output from SPV panels.

b) The structure shall be designed to allow easy replacement of any module by authorized personnel and shall be in line with the site requirements.

c) The array structure for metallic structure (if used) shall be made of anodized aluminum (aluminum alloys)/ SS 304 or SS of better grade, of suitable thickness size. (Same to be confirmed by suitable test report & material composition report) having sufficient strength and suitable size to mount / support all the PV panels / accessories / equipment required for the plant. (To be supported by structural analysis report). All design shall be submitted during drawing approval with suitable test reports.

d) The complete support structure, design shall normally be designed to withstand wind speed of the zone as defined in IS:875 Part III. (To be confirmed by suitable third party test report.)

e) The complete plant is to be designed with proper anchorage system so as to withstand the wind pressure in the zone as defined in IS:875 Part III.

f) In general bolts, nuts, shims and other hardware should be zinc plated. Fasteners visible outside shall be of stainless steel SS304. The generally applicable engineering principle will be that fasteners shall be equal to or of greater corrosion resistance than the most corrosion resistance metals being fastened.

ANCHORİNG AND MOORİNG SYSTEM

The water level variation and prevailing wind speed are the primary safety considerations, to be taken into account, while designing the plant such that the plant has no impact on the reservoir. The mooring system thus needs to be designed that it not only restricts the lateral movement of the proposed plant but also accommodates the water level variability. In addition, the mooring system should also have minimal impact on the overall ecosystem of the reservoir.

a) Placement of plant: The placement of the plant in the water body shall be decided during detail engineering after conducting bathymetric survey, topographical survey, hydrographic & hydrological studies and geotechnical assessment of the site,

b) Prevailing wind load: The mooring system should be designed for worst-case scenario; for a wind load as defined in IS:875 Part III. The design of the mooring system should prevent the lateral movement of the plant in case of maximum wind loads.

c) Water variability: The mooring system should accommodate fluctuations in water level. Further the orientation of the plant needs to be maintained; hence fluctuations in water level should not result in lateral movement of the plant.

d) The mooring system should minimize its impact on the reservoir and thus as far as possible pilings or movement of mooring system on the reservoir bed should be avoided.

e) Suitable wind breakers should be provided.

19. QUALITY ASSURANCE AND INSPECTION FOR CIVIL WORKS

The Contractor shall establish, equip and operate a comprehensive quality assurance set up at the site during the full period of execution of the works. The principal responsibilities and duties of this set up shall be to ensure that all works carried out and materials including floating devices produced or supplied by the Contractor comply fully with the specifications.

To meet with the objectives of the specifications and quality assurance, the Contractor shall provide for execution of works experienced supervisory staff, trained workman, work procedures, equipments and involvement of such specialist support from construction industry as required for correct execution.

Quality of work in progress shall be reviewed once in a month in the quality assurance meeting specially called by the owner and participated by the Contractor's organization.

In addition to the requirement of experienced manpower for the works, Contractor shall also provide for quality assurance staff both for the field testing and for the laboratory.

19.1 GENERAL

This part of the specification covers the sampling, testing and quality assurance requirement (including construction tolerances and acceptance criteria) for all civil and structural works including floating devices covered in this specification.

This part of the technical specification shall be read in conjunction with other parts of the technical specifications, general technical requirements & erection conditions of the contract which covers common QA requirements. Wherever IS code or standards have been referred they shall be the latest revisions.

The rate for respective items of work or price shall include the cost for all works, activities, equipment, instrument, personnel, material etc. whatsoever associated to comply with sampling, testing and quality assurance requirement including construction tolerances and acceptance criteria and as specified in subsequent clauses of this part of the technical specifications. The QA and QC activities in all respects as specified in the technical specifications/ drawings / data sheets / quality plans / contract documents shall be carried out at no extra cost to the owner.

The Contractor shall prepare detailed construction and erection methodology/ scheme which shall be compatible to the requirements of the desired progress of work execution, quality measures, prior approvals if any and the same shall be got approved by the Engineer. If required, work methodology may be revised/ reviewed by the Contractor at no extra cost to the Owner at every stage of execution of work at site, to suit the site conditions.

19.2 QA AND QC MANPOWER

The Contractor shall nominate one overall QA coordinator for the contract detailing the name, designation, contact details and address at the time of post bid discussions. All correspondence related to Quality Assurance shall be addressed by the Contractor's QA coordinator to Owner. Owner shall address all correspondence related to Quality issues to the Contractor's QA coordinator. The Contractor's QA coordinator shall be responsible for co-ordination of Quality activities between various divisions of the Contractor and their sub-vendors on one hand & with Owner on the other hand.

The Contractor shall appoint a dedicated, experienced and competent QA&QC in-charge at site, preferably directly reporting to the Project Manager, supported as necessary by experienced personnel, to ensure the effective implementation of the approved QAP. The Contractor shall finalize and submit a deployment schedule of QA&QC personnel along with their details to Owner for approval/ acceptance and further shall ensure their availability well before the start of the concerned activity.

19.3 SAMPLING AND TESTING OF CONSTRUCTION MATERIALS

The method of sampling for testing of construction materials/ fabrication materials and work / job samples shall be as per the relevant IS / standards / codes and in line with the requirements of the technical specifications / quality plans. All samples shall be jointly drawn, signed and sealed wherever required, by the Contractor and the engineer or his authorized representative.

The Contractor shall carry out testing in accordance with the relevant IS / standards / codes and in line with the requirements of the technical specifications / quality plans. Where no specific testing procedure is mentioned, the tests shall be carried out as per the best prevalent engineering practices and to the directions by the Engineer or his authorised representative. All testing shall be done in the presence of the engineer or his authorized representative in a NABL accredited / Govt. Laboratory acceptable to Owner. This includes all IITs, NCB, CSMRS, reputed government / autonomous laboratories / organizations, NITs and other reputed testing laboratories. The test samples for such test shall be jointly selected and sealed by the engineer and contractor and thereafter these shall be sent to the concerned laboratory through the covering letter signed by Owner's engineer. The test report along with the recommendations shall be obtained from the laboratories without delay and submitted to Owner.

19.4 PURCHASE AND SERVICE

Structural steel supply which is in the scope of the contractor shall be procured from reputed steel producers like SAIL, TISCO, IISCO, RINL, ESSAR STEEL, ISPAT INDUSTRIES, JSW STEEL, LLOYDS STEEL, JINDAL STEEL & POWER. In case of non-availability of some of the sections with main steel producers, the contractor may propose to procure the sections from the re-rollers of the main steel producers, the name of such re-rollers will have to be necessarily cleared by corporate quality assurance with owner. all details such as BIS approval, main steel· producer's approval, past experience for production of sections of specified material, details of machines plants testing facilities etc. shall be submitted by the contractor to facilitate such approval by owner. Confirmation that the process control and manufacturing of steel sections by re-rollers shall be the same as that of main steel producers that billets

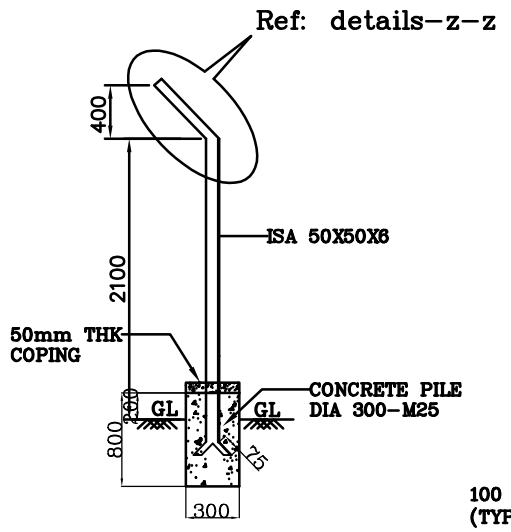
for re-rolling will be sourced from main steel producers only, shall also be furnished to the Owner with regard to re-roller.

Even after clearance of re-rollers, induction of billets with identified and correlated Mill test certificates (TC's) in the process of re-rolling, sampling of steel, quality checks thereof and stamping of final product for further identification and correlation with TC's prior to dispatch shall be the responsibility of the Contractor and these shall be performed in presence of the authorized representative of the Contractor.

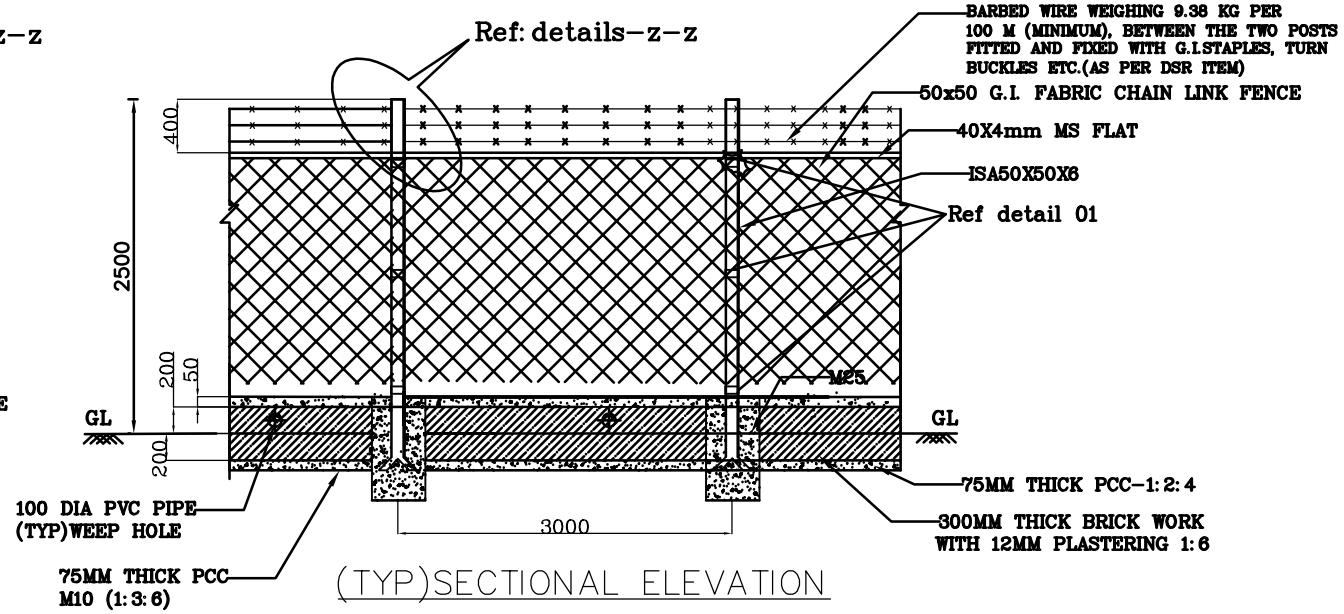
19.5 FIELD QUALITY PLAN

Well before actual start of the work, the Contractor shall prepare and submit the Field Quality Plans (FQP) and obtain approval of Owner, which shall detail out for all the works, equipment, services, quality practices and procedures etc in line with the requirement of the technical specifications to be followed by the Contractor at site. This FQP shall cover all the items / activities covered in the contract / schedule of items required, right from material procurement to completion of the work at site

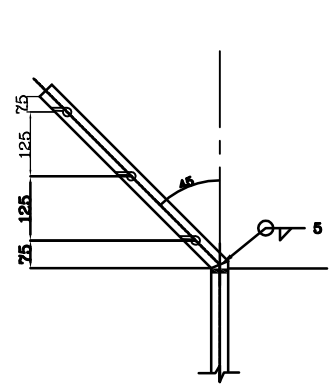
DRAWING NO:



TYP.SECTION AT PILLAR

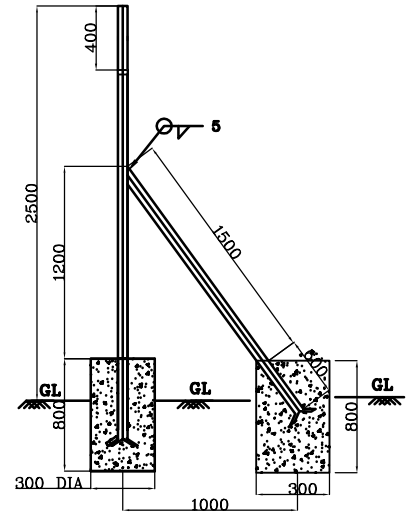


(TYP)SECTIONAL ELEVATION

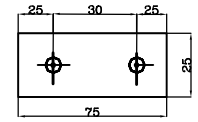


DETAIL Z–Z

PERIPHERAL FENCING POST WITH 45' INCLINATION @ TOP.

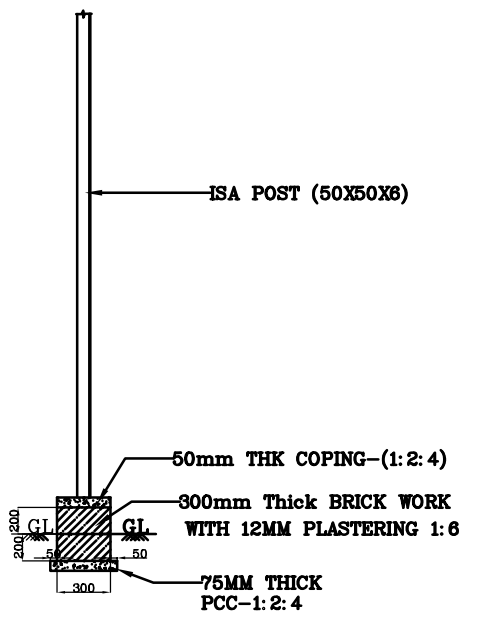


SIDE–C/S OF STAY POST DETAILS

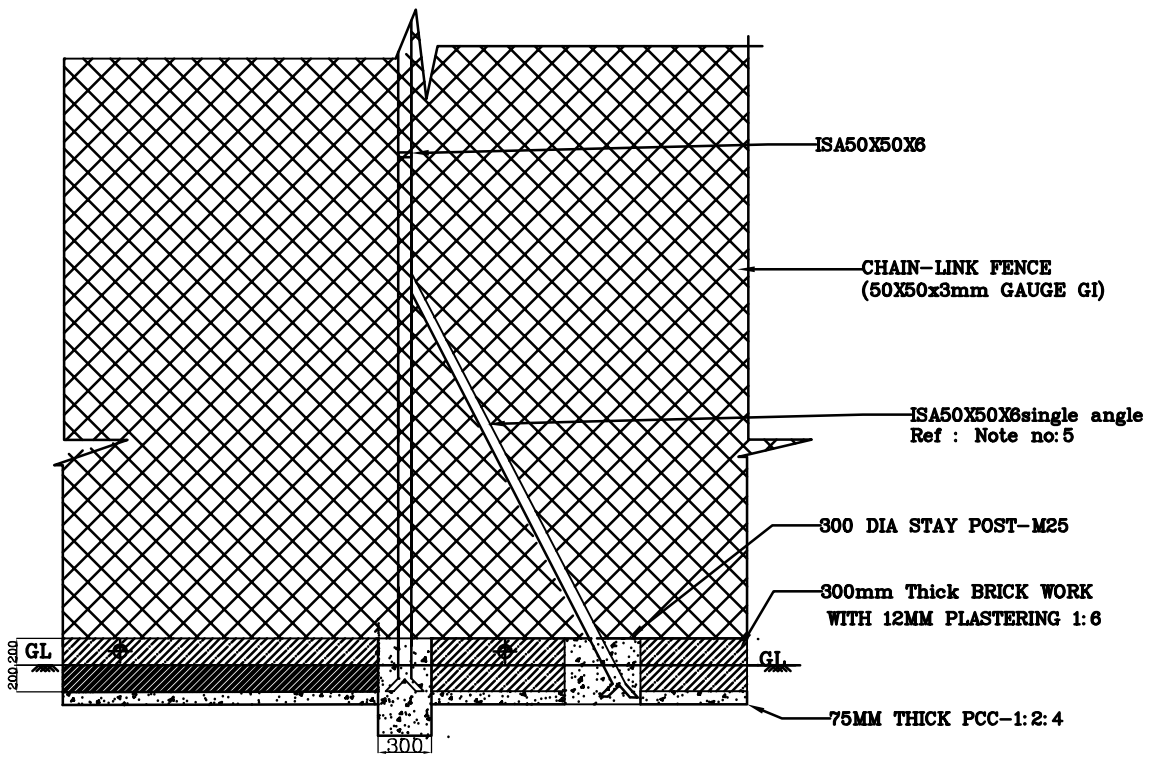


**75X25X4MM THICK PLATE SHOULD BE BOLTED WITH CHAINLINK FENCING & EACH VERTICLE POST (3NO'S PER POST).

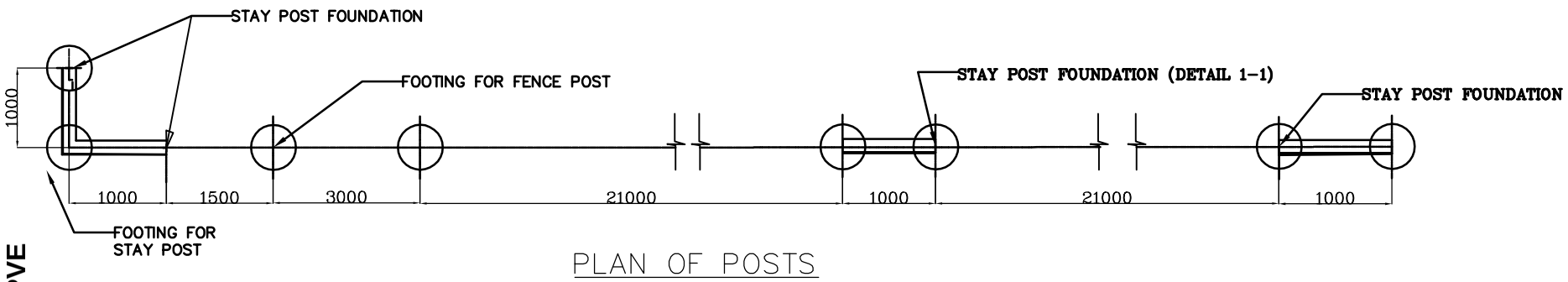
DETAIL : 01



SECTION AT TOE–WALL



(TYP) SECTIONAL ELEVATION at CORNER/JUNCTION



PLAN OF POSTS

NOTES:

1. ALL DIMESNSIONS ARE IN MM UOS.ALL MS ANGLES CONFIRMING TO IS 2062
2. VERTICAL POSTS SHALL HAVE SUITABLE PROVISIONS BY WAY OF NOTCHES OR HOLES TO FIX BARBED WIRES.
3. CHAIN LINK FENCE SHALL BE CONFIRMING I.S. 4826 AND BARBED WIRE SHALL CONFIRMING I.S. 278.
4. VERTICAL POSTS SHALL BE GIVEN A TWO (2) COATS OF PRIMER WILL BE APPLIED FOLLOWED BY TWO (2) COATS OF EPOXY BASED SYNTHETIC ENAMELLED PAINT.
5. 2100MM LONG STAY POST SHALL BE PROVIDED AT CORNER (REFER PLAN OF POST)/JUNCTIONS AND EVERY 10TH POST WILL HAVE A STAY POST IN THE DIRECTION OF FENCE. STAY POST SHALL BE AFFIXED TO VERTICAL POSTS AT ONE END AND EMBEDDED IN CONCRETE M25 (300 DIA POCKET) AT THE OTHER END.
7. CORNER POSTS SHALL BE PROVIDED USING THE METHODOLOGY AS MENTIONED IN POINT–6.
8. THE G.I. CHAIN LINK WIRE MESH WILL BE STRETCHED AND ATTACHED BY CLIPS AND KEPT UNDER TENSION WHICH IN TURNS ARE ATTACHED TO THE FENCE POST WITH SECURITY NUTS AND BOLTS.

TENDER DRG

REV.	DATE	ALTD	CHD	APPD	REV.	DATE	ALTD	CHD	APPD	REV.	DATE	ALTD	CHD	APPD	REV.	DATE	DRWN	CHD	APPD

DEPT.	SC&PV
STATUS	CONTRACT
DISTRIBUTION	

300MW RENGALI FSPV SITE FOR NHPC

BHARAT HEAVY ELECTRICALS LTD
SOLAR BUSINESS DIVISION, BANGALORE

CUSTOMER'S CONSULTANT :

TITLE: CHAINLINK FENCING LAYOUT PV PLANT

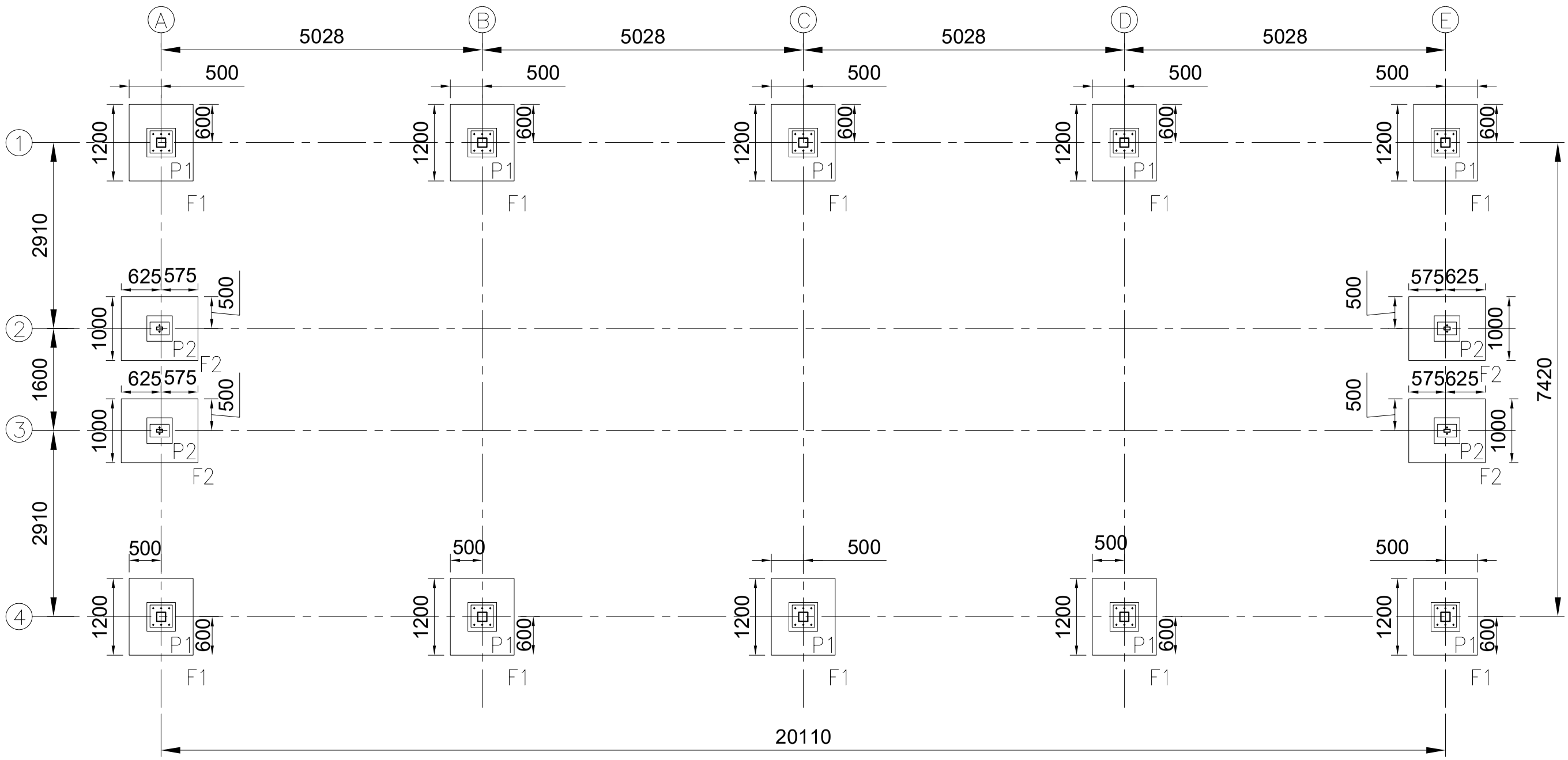
SCALE 1:100

DRAWING NO. XXX

SHEET 1 OF 1 REV. 00

4212/2024/SBD-PVE

ALL DIMENSIONS ARE IN "mm"



FOOTING LAYOUT

NOTE:

INTERNAL / EXTERNAL ARRANGEMENTS, FIXING OF WALL PANELS, ROOF PANELS, WINDOWS, DOORS, TRUSS WORK & ELECTRICAL ITEMS ETC. MAY SLIGHTLY VARY FOR BETTER ACCESSIBILITY. MAINTENANCE, AESTHETIC LOOK. HOWEVER OVERALL OUTER DIMENSIONS WILL REMAIN THE SAME.

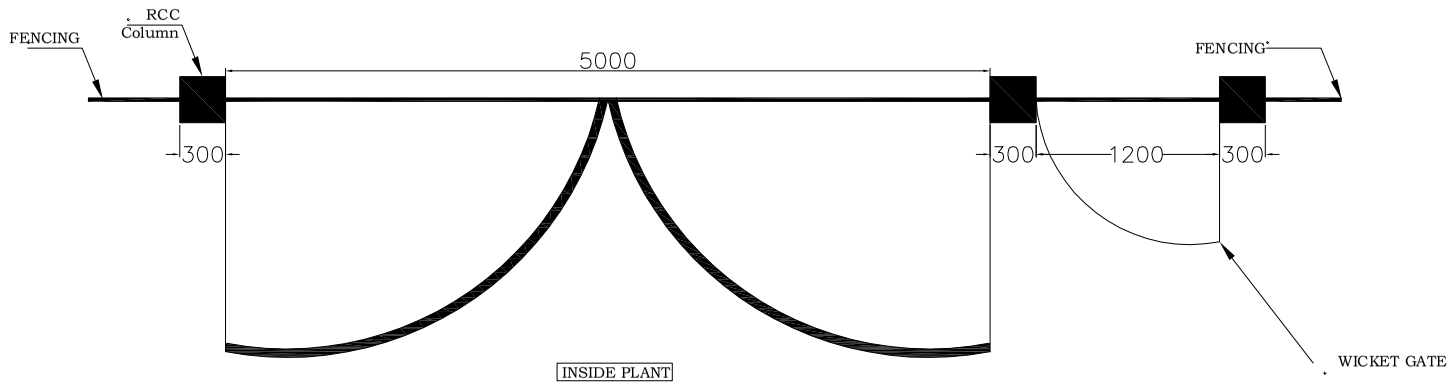
REFERENCE DOCUMENTS	PROJECT: 300 MW (AC) FSPV PLANT FOR NHPC AT RENGALI								
	REVISION	DATE					-		DRAWING No. 01
	REV 00		CHD.BY					PROJECTION	TITLE:- FOUNDATION LAYOUT FOR STORE ROOM
BHEL COMMENTS MAIL DT : 24.10.2017	REV 01	26.10.2017				DEPT.	DESIGN		
	REV 02		DATE			SCALE:	NTS		SHEET 01 OF 07 REV

CHEMIN C&I

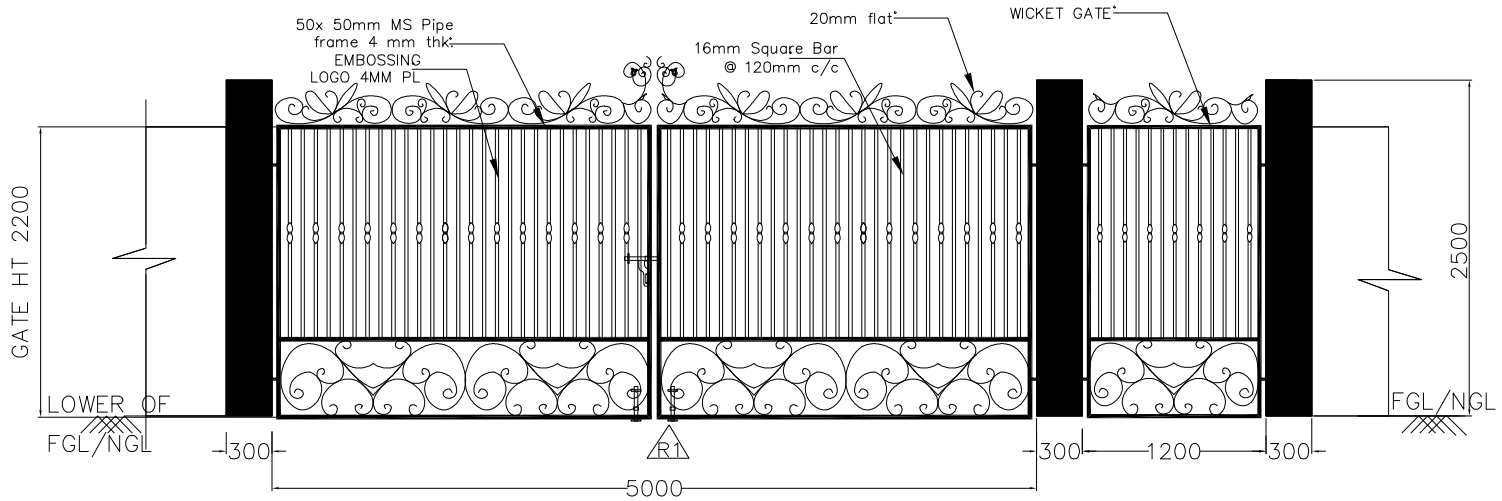
4232/2024/SBD-PVE

DRG. No.

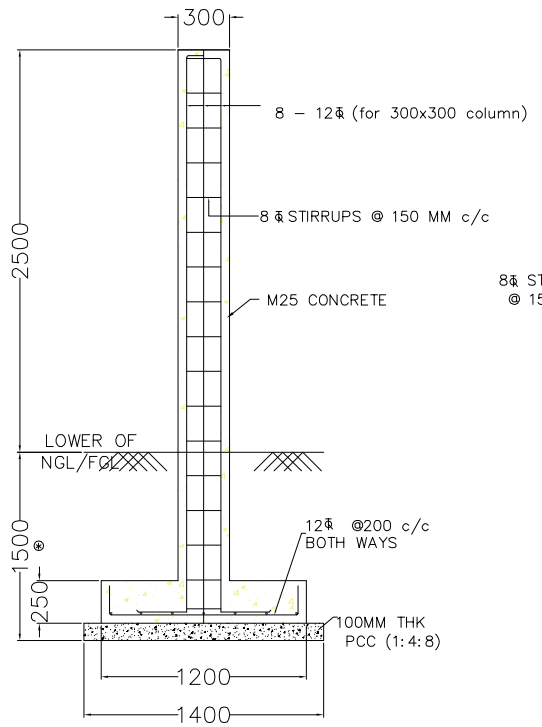
OUTSIDE PLANT



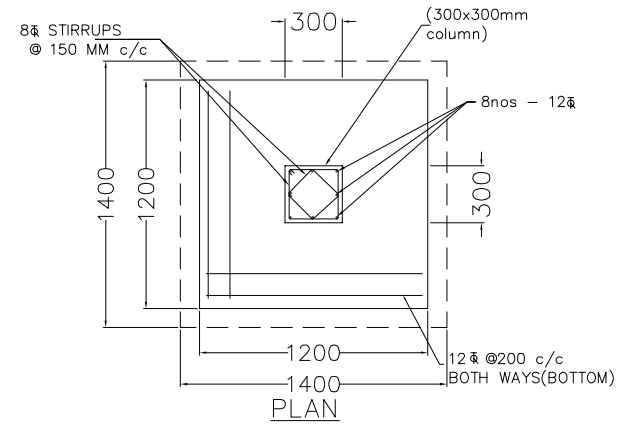
PLAN



FRONT ELEVATION



(TYP)SECTIONAL ELEVATION



PLAN

TENDERING PURPOSE

NOTES R1

1. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH CONTRACT TERMS AND CONDITIONS, SPECIFICATION AND SCHEDULE OF ITEMS.
2. ALL DIMENSIONS ARE IN MILLIMETER AND LEVELS ARE IN METERS, UNO.
3. FINISHED GROUND LEVEL CORRESPONDS TO EL(±)0.000M.
4. ALL DIMENSIONS ARE IN MILLIMETER AND LEVELS ARE IN METERS, UNO.
5. GRADE OF CONCRETE SHALL BE OF M25 WITH 20MM DOWN AGGREGATES.
6. REINFORCEMENT STEEL SHALL BE OF Fe 500 GRADE, CONFORMING TO IS 1786
7. CLEAR COVER TO REINFORCEMENT SHALL BE AS FOLLOWS:

DESCRIPTION	TOP	BOTTOM	SIDES
PEDESTAL	–	–	50
FOOTING	50	75	50

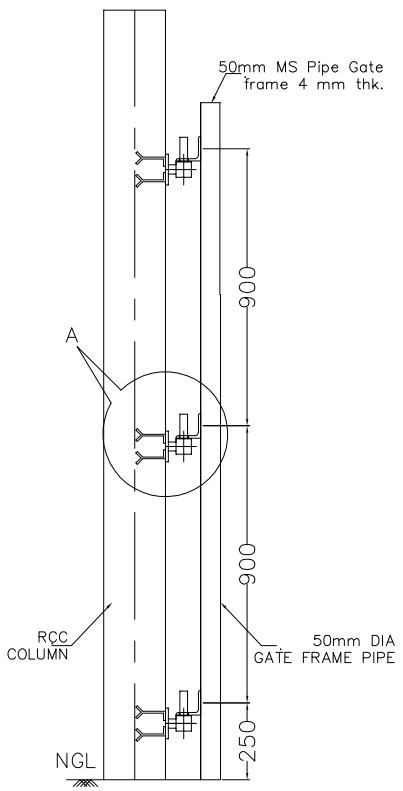
8. LAP LENGTH (Ld) FOR REINFORCEMENT SHALL BE 50 DIA OF SMALLEST BAR BEING LAPPED.
9. REINFORCEMENT IS CALLED UP AS THUS :

X XXϕ–XXX–T&B–B/W
- BOTHWAYS
- BOTTOM BAR
- TOP BAR
- BAR SPACING (CENTERS)
- TYPE OF STEEL (TOR–Fe 500)
- BAR SIZE
- NUMBER OF BARS

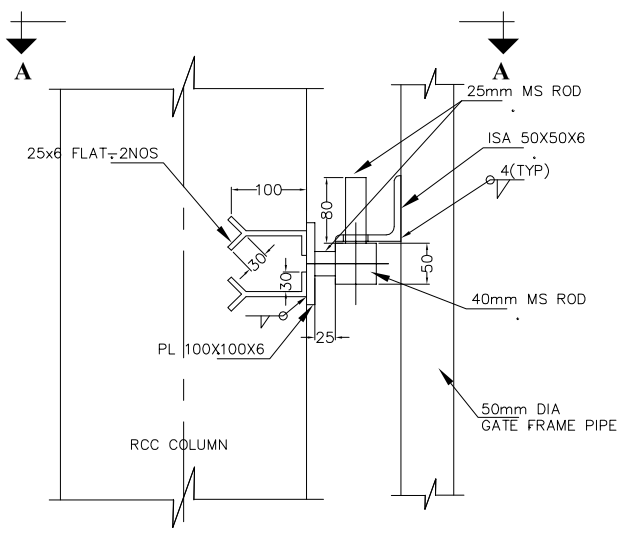
10. NET SAFE BEARING CAPACITY CONSIDERED AT FOUNDING LEVEL IS 15T/SQ.M AT 1.500M BELOW FGL (AS PER SOIL REPORT).
11. UNLESS OTHERWISE SPECIFIED ALL THE BACKFILLING IN FOUNDATION AFTER CONCRETE SHALL BE CARRIED BY USING FINE SAND ONLY.

LEGEND

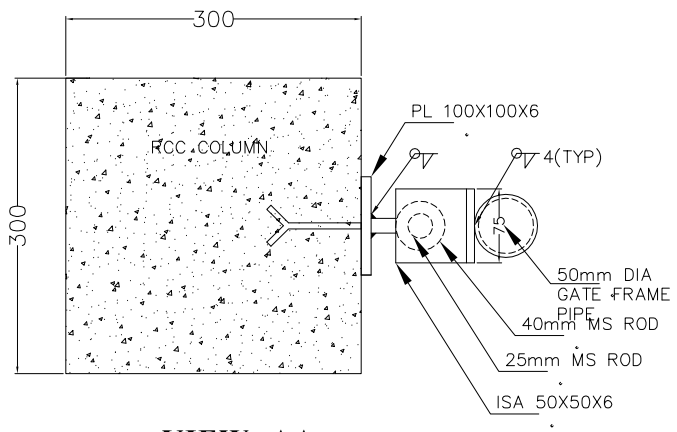
BOC	– BOTTOM OF CONCRETE	THK	– THICKNESS
℄	– CENTER LINE	TOC	– TOP OF CONCRETE
C.J	– CONSTRUCTION JOINT	TYP	– TYPICAL
EL	– ELEVATION	UNO	– UNLESS NOTED OTHERWISE
LVL	– LEVEL	Ld	– DEVELOPMENT LENGTH



HINGE FIXING DEATIL



ENLARGED VIEW -A



VIEW -AA

REV.	DATE	ALTD	CHD	APPD	REV.	DATE	ALTD	CHD	APPD	REV.	DATE	ALTD	CHD	APPD	REV.	DATE	DRWN	CHD	APPD
															00				

DEPT.	SC&PV
STATUS	CONTRACT
DISTRIBUTION	

300MW RENGALI FSPV PLANT FOR NHPC

BHARAT HEAVY ELECTRICALS LTD
SOLAR BUSINESS DIVISION, BANGALORE

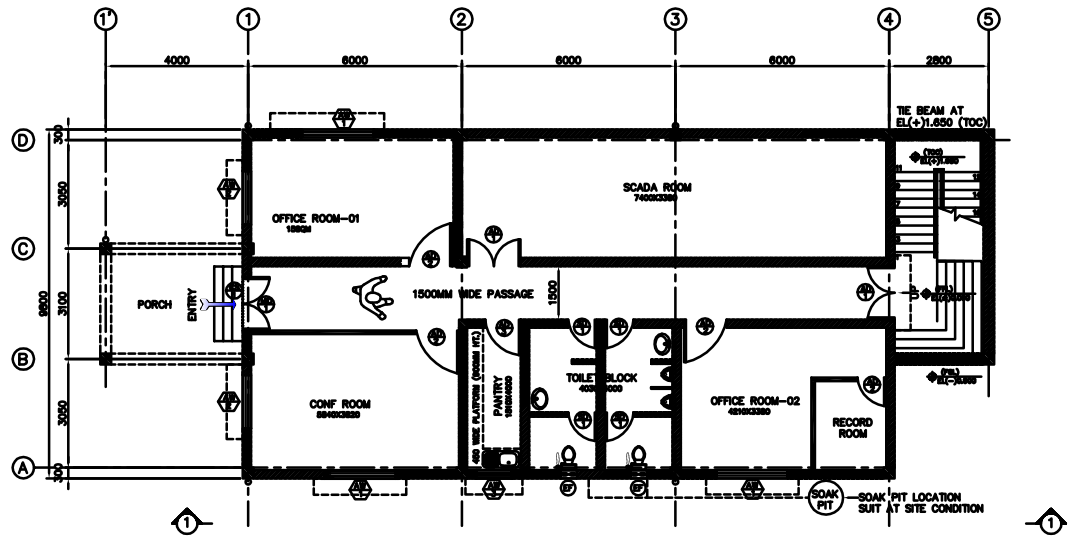
CUSTOMER'S CONSULTANT :

TITLE: MAIN GATE GA DETAILS

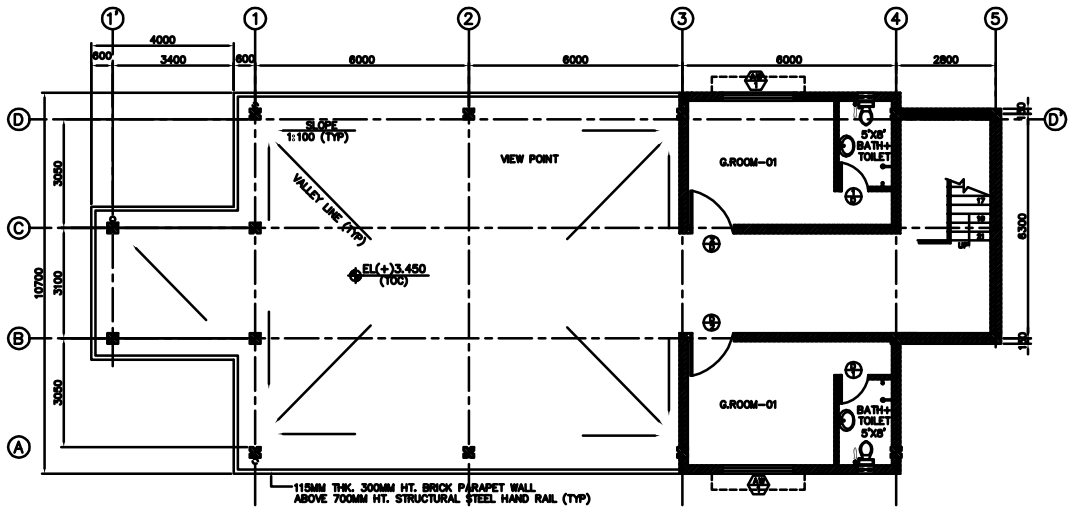
SCALE 1:100

DRAWING NO. BHEL–NHPC–CIV–GATE–001

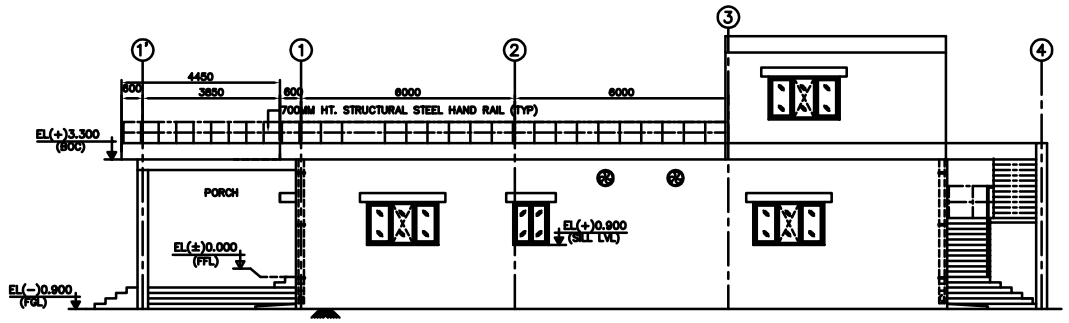
SHEET 1 OF 1 REV.



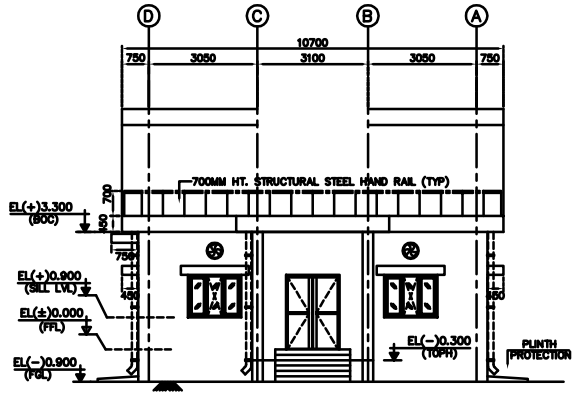
GROUND FLOOR PLAN
(SCALE 1:75)



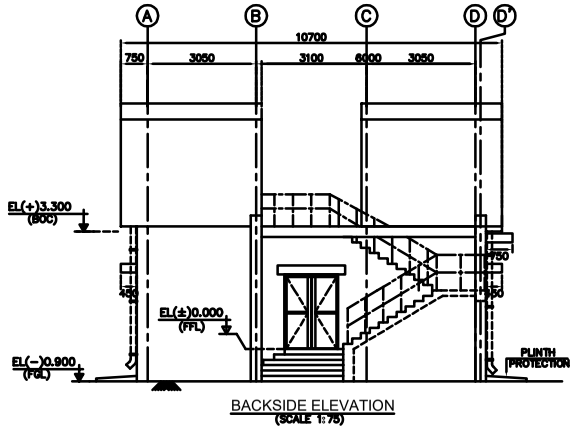
TERRACE FLOOR CUM FIRST FLOOR PLAN AT EL(+)3.450 (TOC)
(SCALE 1:75)



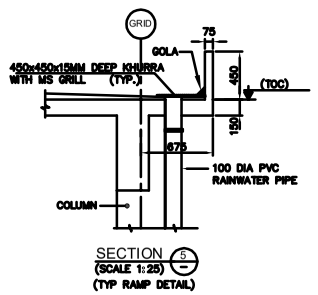
ELEVATION VIEW 1-1
(SCALE 1:75)



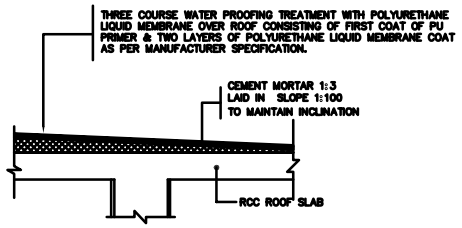
FRONT SIDE ELEVATION
(SCALE 1:75)



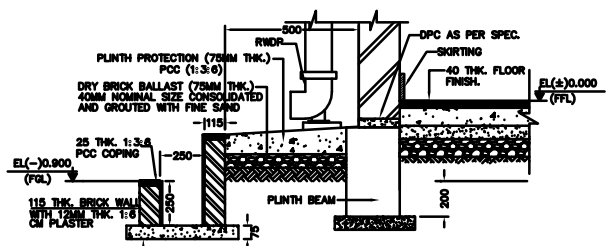
BACKSIDE ELEVATION
(SCALE 1:75)



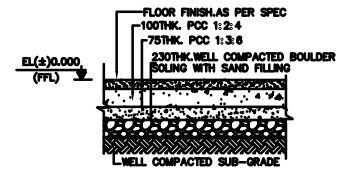
SECTION S
(SCALE 1:25)
(TYP RAMP DETAIL)



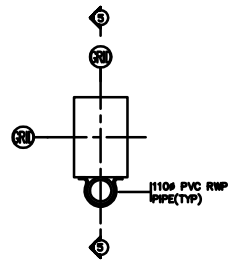
TYP.DETAIL OF ROOF WATER PROOFING TREATMENT
(SCALE 1:15)



TYP.DETAIL OF PLINTH PROTECTION AND GARLAND DRAIN
(SCALE 1:15)



TYP. FLOORING DETAIL
(SCALE 1:15)



TYP.DETAIL OF RAIN WATER DOWN PIPE
(SCALE 1:15)

KEY PLAN

NOTES

1. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH CONTRACT TERMS AND CONDITIONS, SPECIFICATION AND SCHEDULE OF ITEMS.
2. ALL DIMENSIONS ARE IN MILLIMETER AND LEVELS ARE IN METERS, UNO.
3. FINISHED FLOOR LEVEL CORRESPONDS TO EL(±)0.000M, WHICH IS AT 900MM ABOVE NGL/FGL. FGL/NGL SHALL BE CONSIDERED AT EXISTING ADJOINING ROAD CENTER.
4. FOR WINDOW FLOAT GLASS OF 4MM (TINTED), FOR DOORS AND PARTITION TOUGHENED GLASS OF 10MM.
5. ALUMINUM SECTION SHALL BE OF MINIMUM THICKNESS 1.65 MM.
6. ALL ALUMINUM SECTION SHALL BE POWDER COATED MINIMUM 50MICRON
7. WINDOWS SHALL BE PROVIDED WITH ALUMINUM GRILLS.
8. DOOR AND WINDOWS SHALL BE PROVIDED WITH ALL ACCESSORIES LIKE HANDLE, TOWER BOLT, HYDRAULIC DOOR CLOSER, ETC., AS PER THE REQUIREMENTS.
9. SMOOTH SURFACE PLASTERING 1:4 (INTERNAL WALL) 12MM AND ROUGH SURFACE PLASTERING 1:4 (EXTERNAL WALL) 18MM.
10. CEILING PLASTERING SHALL BE 6MM THK. IN 1:3 CEMENT SAND MORTAR.
11. FINISHING ITEMS SHALL BE OF REPUTED MAKE AND SHALL BE APPROVED BY BHEL.
12. ORIENTATION OF THE BUILDING AS PER ARRAY LAYOUT.

LEGEND

- 230 THK BRICK WALL/ 115 THK BRICK WALL
- ALUMINIUM PARTITION
- EL – ELEVATION
- FFL – FINISHED FLOOR LEVEL
- BOL – BOTTOM OF LINTEL
- LVL – LEVEL
- FGL – FINISHED GROUND LEVEL
- TOC – TOP OF CONCRETE
- TYP – TYPICAL
- TOP – TOP OF PARAPET
- BOC – BOTTOM OF CONCRETE
- UNO – UNLESS NOTED OTHERWISE
- TOPH – TOP OF PORCH

SCHEDULE OF JOINERY

SYMBOL	Nos	SILL LVL AT EL....	MASONRY OPENING WIDTH	MASONRY OPENING HEIGHT	REMARKS
CG	01	+0.000	1500	2100	COLLAPSIBLE STEEL GRILL
MD	01	+0.000	1500	2100	MAIN DOOR – AL FRAMED WITH GLAZED DOOR DOUBLE SHUTTER.
FD	02	+0.000	1500	2100	ALUMINUM FRAMED WITH GLAZED DOOR – DOUBLE SHUTTER
AD	02	+0.000	1200	2100	ALUMINUM FRAMED WITH GLAZED DOOR – SINGLE SHUTTER
AD	01	+0.000	1000	2100	ALUMINUM FRAMED WITH GLAZED DOOR – SINGLE SHUTTER
SD	04	+0.000	750	2100	STEEL FRAMED WITH SOLID CORE (MDF) FLUSH SHUTTER AS PER IS 2202 – SINGLE SHUTTER
AW	02	+0.900	2000	1200	ALUMINIUM FRAMED GLAZED WINDOW
AW	02	+0.900	1500	1200	ALUMINIUM FRAMED GLAZED WINDOW
AW	01	+0.900	1000	1200	ALUMINIUM FRAMED GLAZED WINDOW
EF	05	+2.550	300ø		EXHAUST FAN WITH BIRD GUARD

FINISH SCHEDULE:

SERIAL NUMBER	ROOMS	FLOORS: HEAVY DUTY VITRIFIED TILE FLOORING (TILE 8MM THK.)	FLOORS: CERAMIC ANTISKID TILE(8MM THK.) FLOORING WITH GLAZED TILE (8MM THK.) 2100MM HEIGHT DADO	FLOORS: KOTA STONE 20MM THK. FLOORING	FLOORS: HEAVY DUTY VITRIFIED TILE FLOORING (TILE 8MM THK.) WITH 2100MM HEIGHT DADO	INTERNAL WALLS – SKIRTING: 20MM THK POP IN WALL & CEILING	INTERNAL WALLS – SKIRTING: VITRIFIED TILE SKIRTING (100MM HEIGHT)	INTERNAL WALLS – PAINTING: ACRYLIC EMULSION PAINT	INTERNAL WALLS – PAINTING: ACRYLIC DISTEMPER	CEILING: WHITE WASH	CEILING: FALSE CEILING (15MM THK. MINERAL FIBER BOARD, 600MM X 600MM TILE)	EXTERNAL WALL
1	OFFICE ROOM & G.ROOM	●				●	●	●		●	●	ALL WEATHER PROOF CEMENT BASED ACRYLIC EMULSION PAINT (EXTERIOR GRADE)
2	SCADA ROOM	●				●	●	●			●	
3	CONFERENCE ROOM	●				●	●	●		●	●	
4	TOILET		●			●			●	●		
5	PANTRY				●	●		●		●		
6	STEPS			●								
7	PASSAGE	●				●	●	●		●		

TENDER DRG

300MWp RENGALI FLOATING SOLAR PV PLANT

NHPC

BHARAT HEAVY ELECTRICALS LTD
SOLAR BUSINESS DIVISION, BANGALORE

DEPT. PV-ENGG
STATUS CONTRACT
DISTRIBUTION

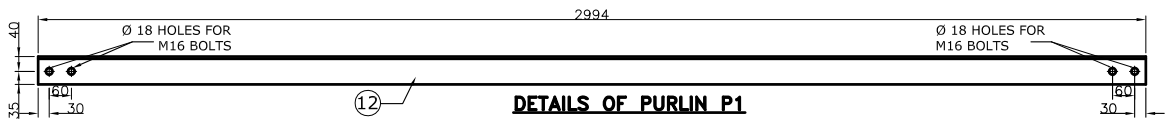
TITLE: MCR BLDG-ARCHITECTURE PLAN, ELEVATIONS, SECTION & FINISHING.

SCALE 1:100 | DRAWING NO. | SHEET 1 OF 1 | REV. 0

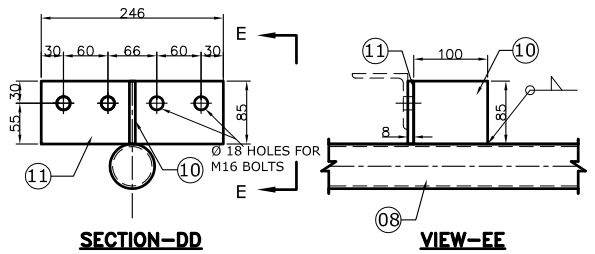
REV.	DATE	ALTD	CHD	APPD	SITE

4240/2024/SBD-PVE

ALL DIMENSIONS ARE IN MILLIMETERS

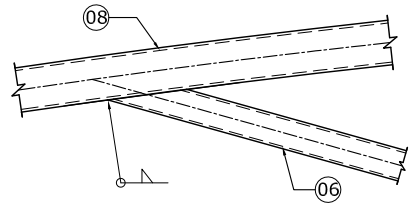


DETAILS OF PURLIN P1

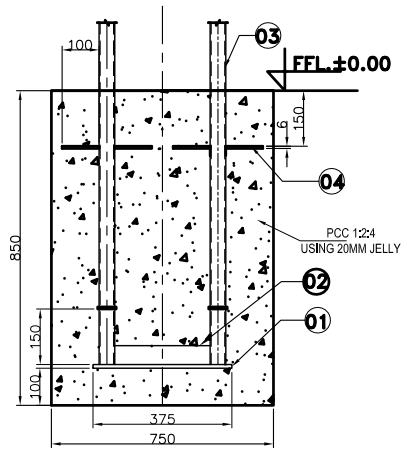


SECTION–DD

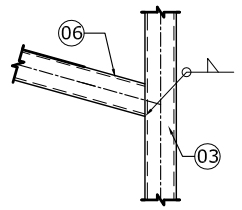
VIEW–EE



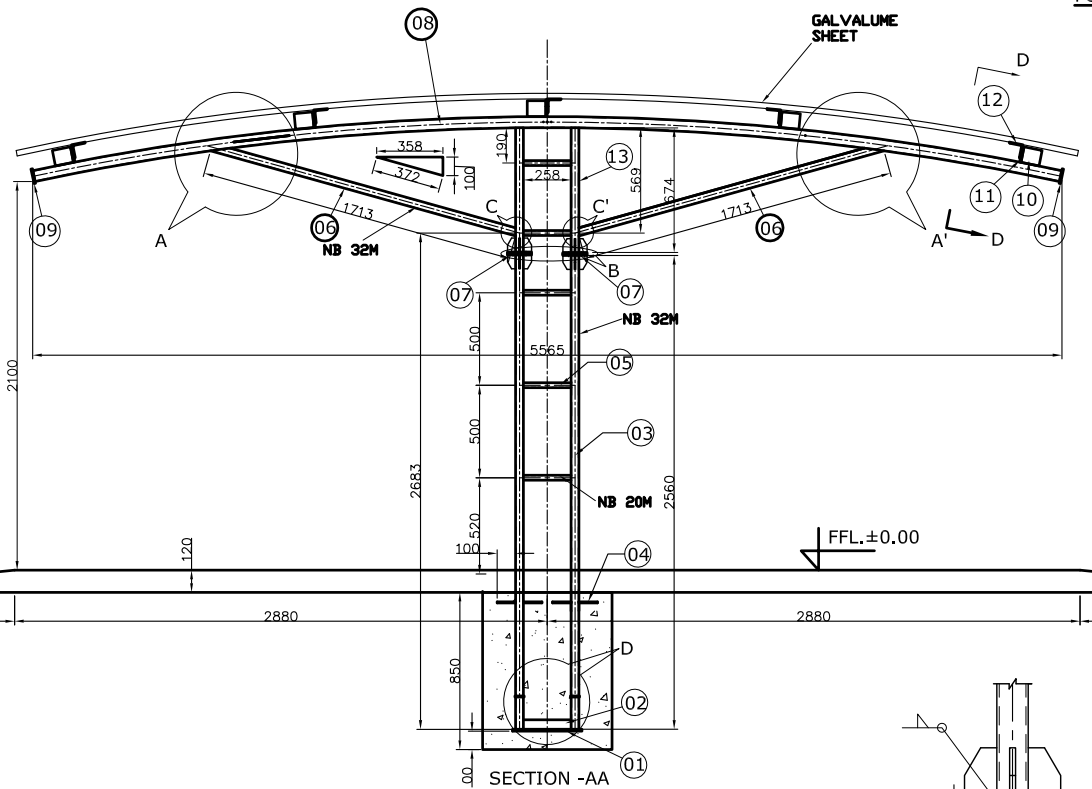
DETAIL-A
MIRROR IMAGE OF DETAIL-A'

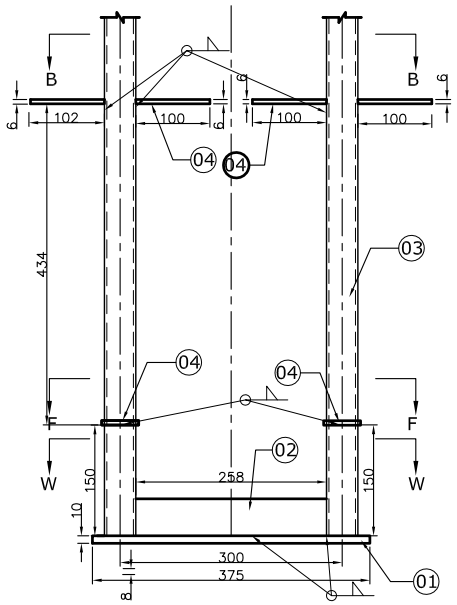


DETAILS OF FOUNDATION



DETAIL-C
MIRROR IMAGE OF DETAIL C'

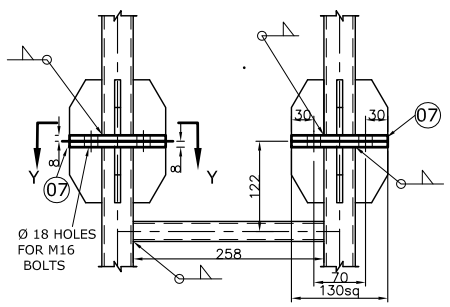




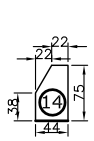
DETAIL-D

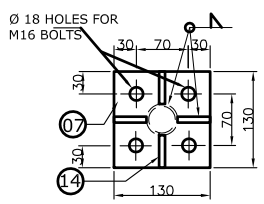
NOTES:

1. ALL DIMENSIONS ARE IN "mm" AND LEVELS ARE IN METRE
2. USE E 6013 ELECTRODE FOR ALL WELDING.
3. ALL STRUCTURAL STEEL CONFORMING TO IS - 2062 - LATEST.
4. ALL SS TUBE CONFORMING TO IS - 1161 - LATEST.
5. FILLET SIZE OF WELD SHALL BE AS INDICATED IN THE DRG. & MIN, FILLET WELD THICKNESS SHALL BE 3 MM.
6. EXACT SIZE AND SHAPE OF THE MEMBERS ARE TO BE TAKEN FROM THE MARKING PLATFORM.
7. ALL STRUCTURAL MEMBERS ARE TO BE WELDED FOR ITS FULL CONTACT LENGTH.
8. LOCATION SHALL BE DECIDED AT SITE.
9. REFERENCE FLOOR FINISH LEVEL (FFL ±0.000)

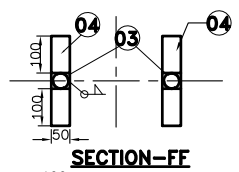


DETAIL-B

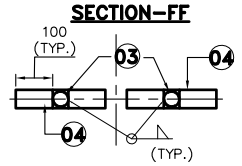




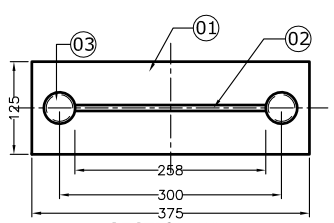
SECTION-YY



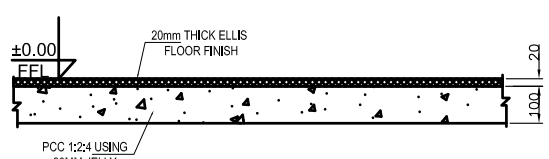
SECTION–FF



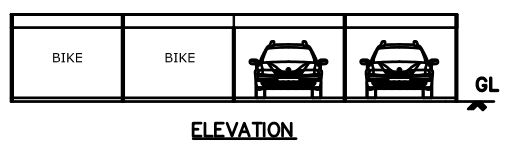
SECTION–BB



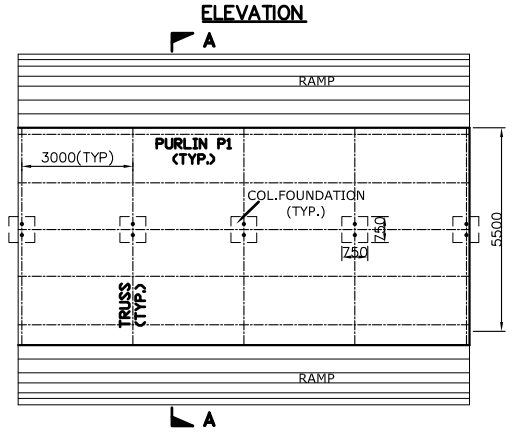
SECTION-WW



FLOORING DETAILS



ELEVATION



TOP VIEW

TOTAL Wt. 826.80 kg

ITEM NO.	DESCRIPTION	MATERIAL SPECN.	NOS	UNITWT. (KG)	GROSSWT (KG)	REMARKS
14	PL8–44x75	IS2062Fe410WA	80	0.21	16.80	
13	TUBE 32M–674	IS1161/1979	10	2.09	20.90	
12	ISA75x75x6–2994	IS2062 Fe410A	20	20.36	407.20	Purlin
11	PL8–246x85	IS2062Fe410WA	25	1.31	32.75	
10	PL8–100x85	IS2062Fe410WA	25	0.53	13.25	
9	PL8–80x80	IS2062Fe410WA	10	0.4	4.00	
8	TUBE 50M–5604	IS1161/1979	5	28.19	140.95	
7	PL8–130x130	IS2062Fe410WA	20	1.06	21.20	
6	TUBE 32M– 1713	IS1161/1979	10	5.31	53.10	
5	TUBE 20M–258	IS1161/1979	25	0.4	10.00	
4	FL50x6–100	IS2062 Fe410A	20	0.24	4.80	
3	TUBE 32M–2560	IS1161/1979	10	7.94	79.4	
2	PL8–50x258	IS2062Fe410WA	5	0.81	4.05	
1	PL10–375x125	IS2062Fe410WA	5	3.68	18.40	

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT: 300MW RENGALI FSPV PLANT

Bharat Heavy Electricals Ltd
UNIT: SOLAR BUSINESS DIVISION
BANGALORE – 560012

	NAME	SIGNATURE	DATE	NO. OF VAR.
DRWN CHD	R.Palanikumar			
APPD				

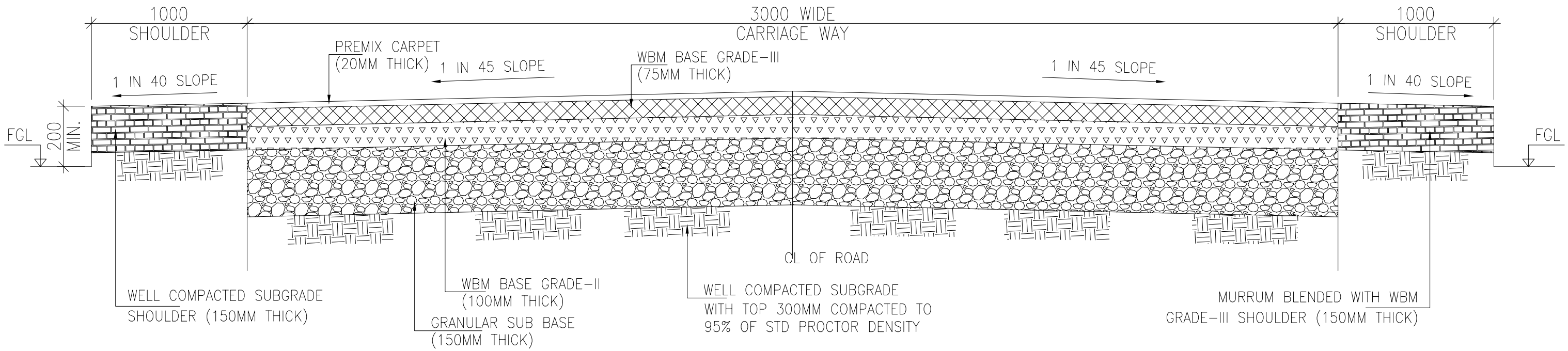
DEPT CODE	GRADE OF UNTOL. DIM	SCALE	WEIGHT (Kg)	REF TO ASSY / OLD DWG	ITEM NO	No OF ITEMS
	C/M/F					

TITLE: DETAILS OF TWO WHEELER & FOUR WHEELER PARKING SHED

CARD CODE: U 01

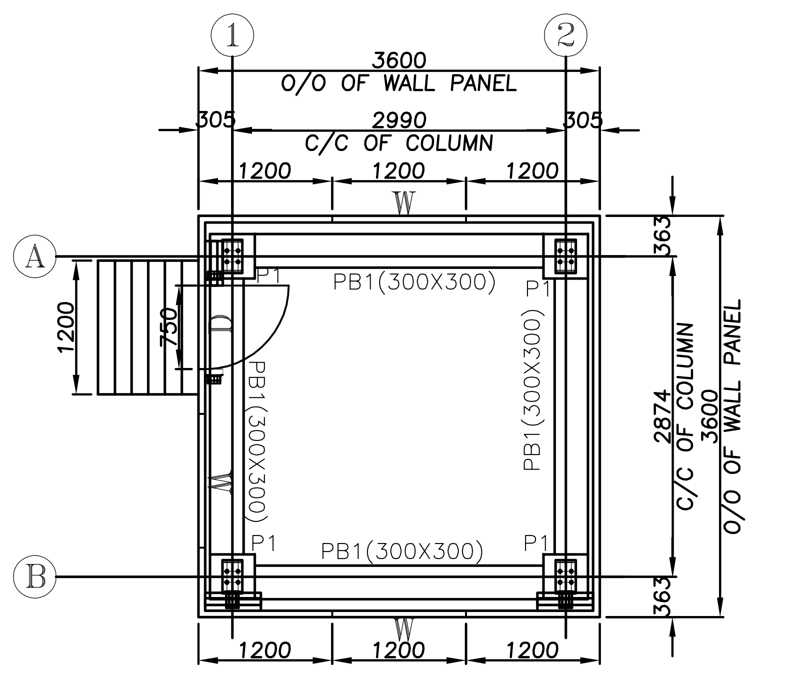
DRAWING NO : 4060/2024/SBD-PVE

REV: H

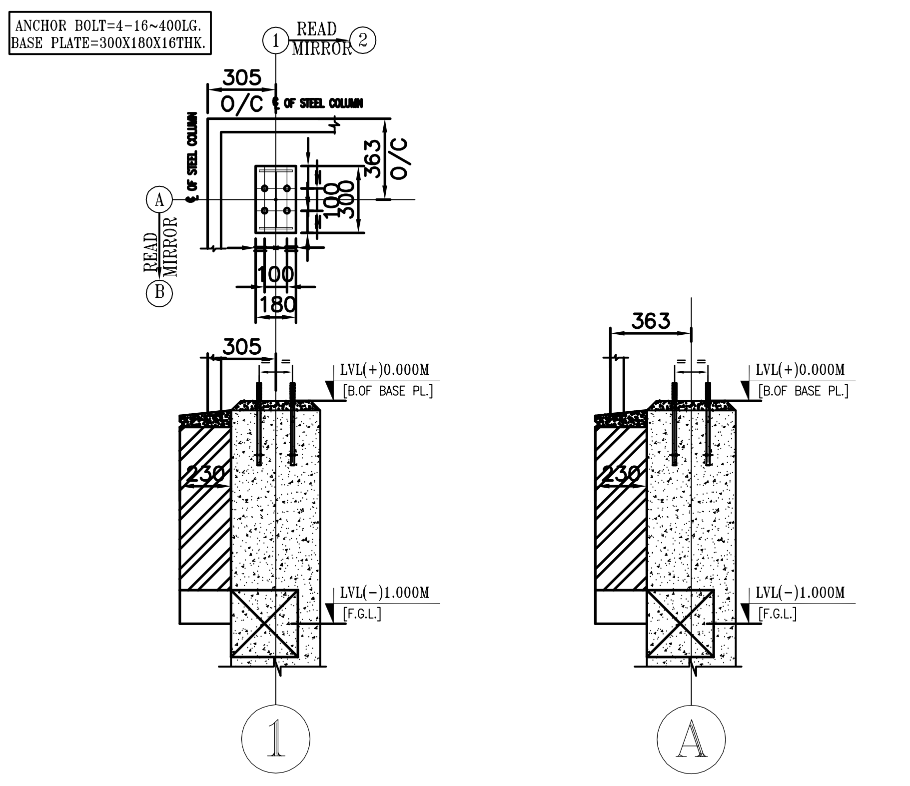


TYPICAL CROSS SECTION OF 3.00M CARRIAGE WAY ROAD +1M SHOULDER ON BOTHSIDE

4219/2024/SBD-PVE

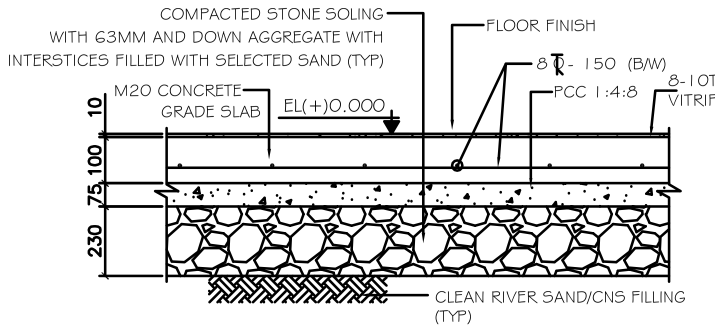


ANCHOR BOLT LAYOUT PLAN



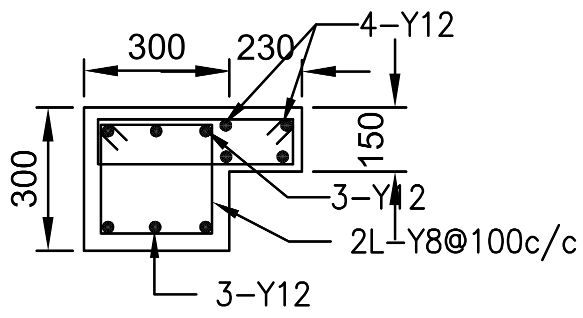
GRID -2 IS THE MIRROR OF GRID-1

GRID -B IS THE MIRROR OF GRID-A

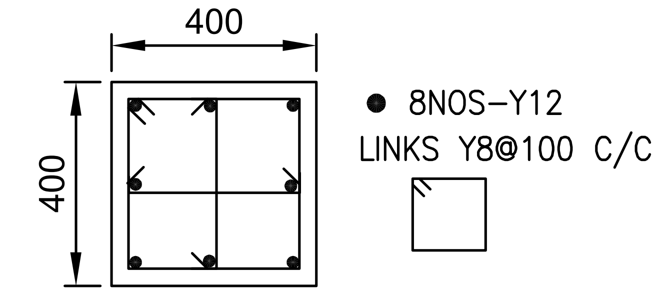


TYP. REINFORCEMENT DETAIL OF GRADE SLAB

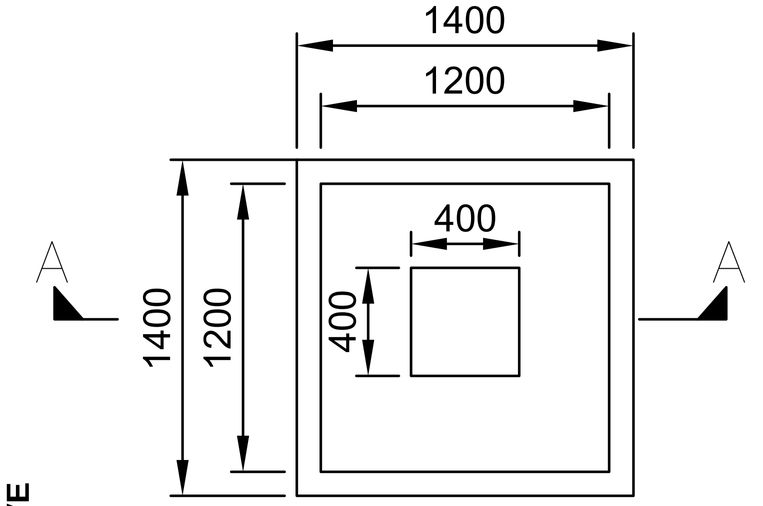
(SCALE 1:15)



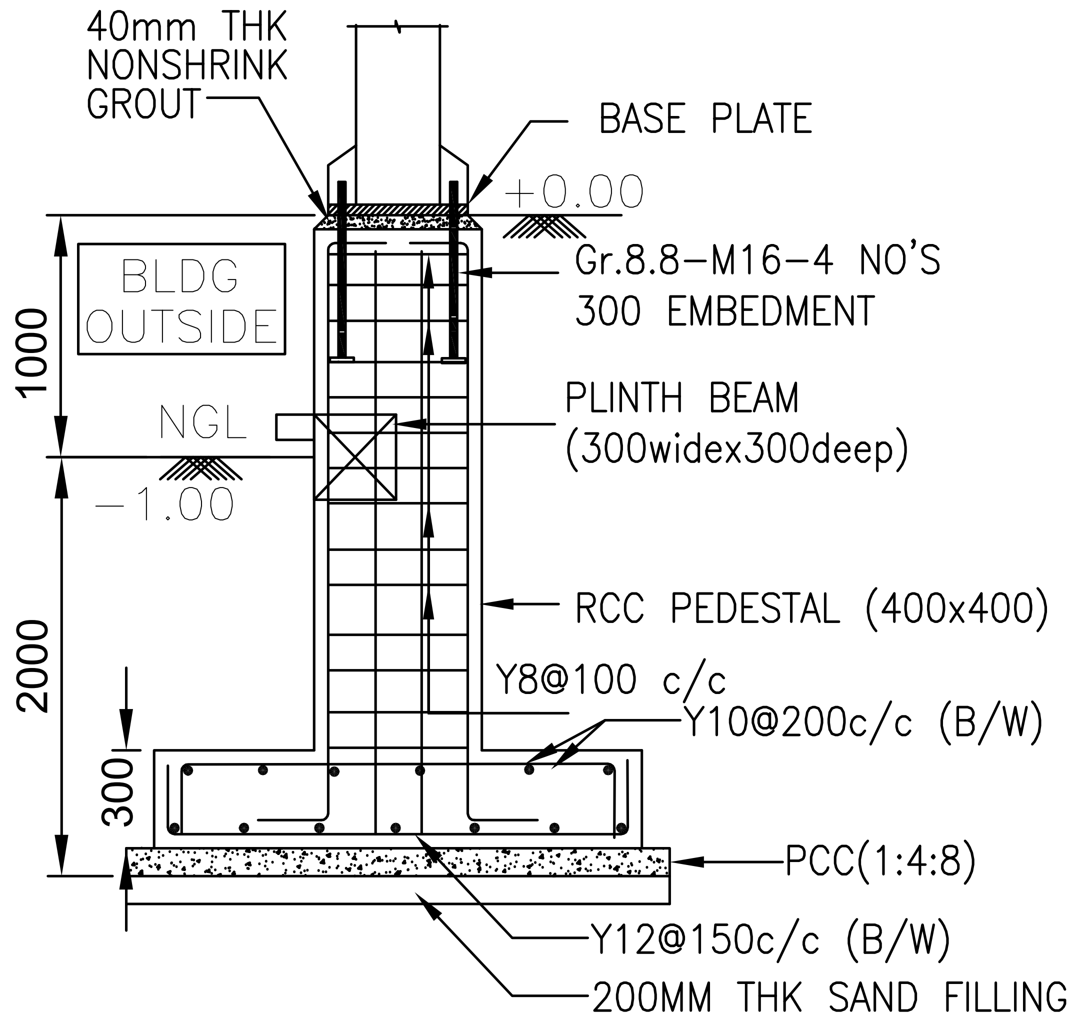
PB1(300X300)



PEDESTAL DETAIL (P1)



FOOTING PLAN



FOOTING SECTION-AA

NOTES

1. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH THE TERMS CONDITIONS, AND SPECIFICATIONS OF THE CONTRACT.
2. **EL(±)0.00M. CORRESPONDS TO THE FFL. OF THE BUILDING WHICH IS AT 1000MM ABOVE FGL.**
3. ALL DIMENSIONS ARE IN MILLIMETER AND LEVELS ARE IN METERS, DONT SCALE THE DRAWING.
4. GRADE OF CONCRETE SHALL BE OF M25 WITH 20MM DOWN AGGREGATES.
5. REINFORCEMENT STEEL SHALL BE OF Fe 500 GRADE, CONFORMING TO IS 1786
6. CLEAR COVER TO REINFORCEMENT SHALL BE AS FOLLOWS:
7. IF CLAYEY STRATUM OCCURS AT THE BOTTOM, FURTHER EXCAVATION OF 200 MM IS REQUIRED AND AFTER THOROUGH COMPACTION OF THE BOTTOM OF EXCAVATION, A LAYER OF CLEAN RIVER SAND, 200 MM THICKNESS, SHALL THEN BE LAID. THE SAND CUSHION LAYERS SHALL BE AT LEAST 200 MM WIDER ON ALL FOUR SIDES OF THE INDIVIDUAL COLUMN FOOTINGS OR COMBINED FOOTING OR STRIP RAFT COMBINING EACH ROW OF COLUMNS. THE SAND CUSHION LAYER SHALL BE WATERED AND WELL COMPACTED.
8. AT THE TIME OF EXCAVATION FOR FOUNDATIONS, IN CASE GROUND WATER TABLE OCCURS WITHIN THE RECOMMENDED DEPTH OF EXCAVATION, SUMPS MAY BE MADE TO AN ADDITIONAL DEPTH OF 0.3 M AT ONE OR MORE CORNERS OF THE FOUNDATION PITS FOR COLUMN FOOTINGS/COMBINED FOOTINGS OR AT DESIRED LOCATIONS ALONG THE PERIPHERY EXCAVATION FOR STRIP RAFT AND THE WATER COLLECTED IN THE SUMPS MAY BE BAILED OUT. DEWATERING SHALL BE MAINTAINED UNTIL THAT PART OF THE CONCRETE IN THE FOUNDATIONS, WHICH COMES BELOW THE GROUND WATER TABLE LEVEL, SETS.
9. REGARDING USE OF GROUND WATER, THE GROUND WATER IS NOT SUITABLE FOR CONSTRUCTION PURPOSES.

DESCRIPTION	TOP	BOTTOM	SIDES
PLINTH BEAM	25	25	25
COLUMN	-	-	40
FOOTING	50	50	50

10. LAP LENGTH (Ld) FOR REINFORCEMENT SHALL BE 50 DIA OF SMALLEST BAR BEING LAPPED.
11. **NET SAFE BEARING CAPACITY CONSIDERED IS 15T/SQ.M @ 2M DEEP FROM GL**

PROJECT:-

300MWp FSPV PLANT AT RENGALI FOR NHPC

BHARAT HEAVY ELECTRICALS LIMITED, ELECTRONICS DIVISION, BANGALORE

TITLE: DETAILS OF FOUNDATION FOR SECURITY CABIN

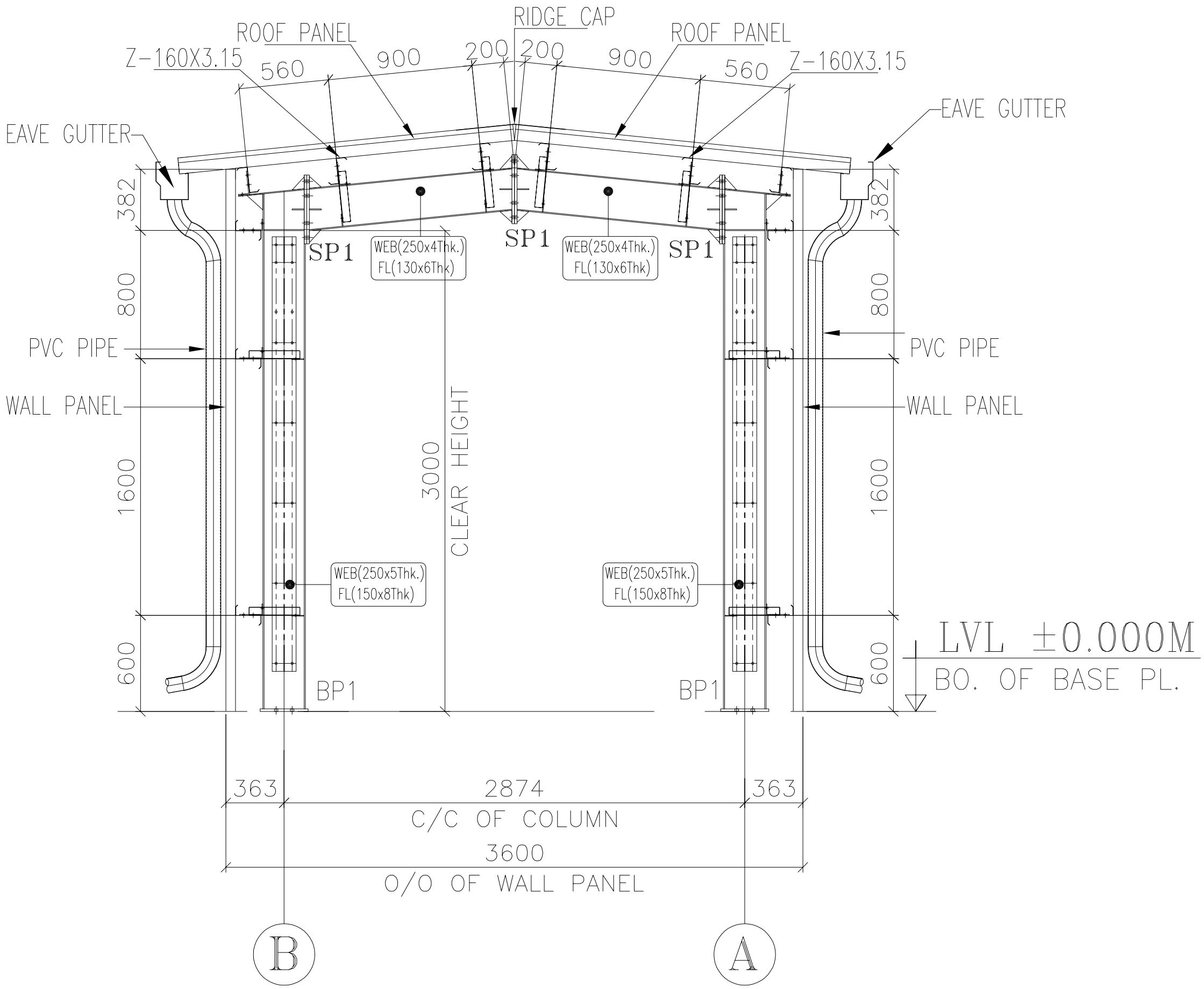
DRAWING NO.

FIRST ISSUE

FIRST ANGLE PROJECTION

ALL DIMENSIONS ARE IN mm

59



CROSS SECTION ALONG GRID 1&2

4225/2024/SBD-PVE

DRAWING CROSS REFERENCE

Drawing No:	Rev.	Description

GENERAL NOTES:-

1. ALL DIMENSIONS ARE IN mm & ALL LEVELS ARE IN Mtr. [U.N.O]
2. ONLY WRITTEN DIMENSIONS SHALL BE FOLLOWED AND DRAWINGS SHALL NOT BE SCALED FOR OBTAINING ANY DIMENSIONS
3. APPROVAL ON THESE G.A DRAWINGS TO BE GIVEN BY..... AS PER THE PURCHASE ORDER.

MATERIAL SPECIFICATIONS

1.	ANCHOR/FOUNDATION BOLTS	GR 8.8 HDG AS PER IS:5624
2.	BUILT-UP MEMBERS	CONFORMING TO IS-2062:2006 MINIMUM GRADE E 250 / ASTM A-572-12 GRADE 50 WITH MINIMUM YIELD STRENGTH OF 345 MPA.
3	COLD FORMED SECONDARY MEMBERS	IS: 811 WITH MINIMUM YIELD STRENGTH OF 345 MPA
4	X-BRACING MEMBERS, PIPE	CONFORM TO IS-1161:1998 GRADE E 240
5	WELDING	ONE SIDE CONTINUOUS WELDED AND OTHER SIDE INTERMITTENTLY WELDED.
6	SURFACE PREPARATION- STRUCTURE	STRUCTURE SHALL BE HOT DIPPED GALVANIZED CONFORMING TO IS: 4759
7.	HIGH STRENGTH BOLTS FOR PRIMARY CONNECTION	PRIMARY BOLT & NUT OF GRADE 8.8 OR EQUIVALENT AS PER IS:1367 (PART-III), GR 8.8/ASTM A325
8.	MACHINE BOLTS FOR SECONDARY CONNECTION	SECONDARY BOLT & NUT OF GRADE 4.6 OR EQUIVALENT AS PER IS:1367 (PART-III), GR 4.6/ASTM A307
9.	ROOFING PANEL	70MM (70+30MM THK CREST) THK PANEL. BLUE COLOUR OF RAL 5012 FOR TOPSIDE AND RAL 9002 (OFF WHITE) FOR BOTTOM SIDE
10.	WALL PANEL	60 MM THK PANEL. COLOUR CODE-RAL 9002 (OFF WHITE) FOR BOTH SIDE
11.	GUTTER	PRE PAINTED GALVALUME STEEL SHEET OF BLUE COLOR-RAL 5012
12.	DOWN TAKE PIPE	DOWN SPOUTS OF 100 MM DIA PVC

ISSUED FOR APPROVAL

SENT ON .....

IN ORDER TO SCHEDULE THIS PROJECT IN THE MOST EFFICIENT MANNER, RETURN THESE DOCUMENTS, MARKED WITH YOUR COMMENTS, WITHIN TWO WEEKS FROM THE ABOVE MENTIONED DATE

ANY CHANGES MADE AFTER APPROVAL OF THESE DRAWINGS MAY DELAY THE FABRICATION AND DELIVERY PROCESS.

THESE DRAWINGS ARE GOOD FOR CONSTRUCTION.

1. ☐ APPROVED
   NO CHANGES. PROCEED WITH FABRICATION.
2. ☐ APPROVED AS NOTED
   FABRICATION MAY PROCEED ON THE BASIS OF CORRECTIONS INDICATED.
3. ☐ NOT APPROVED, RE-SUBMIT FOR APPROVAL.

REVIEWED BY .....
NAME
....
SIGNATURE DATE

Rev.	Description	Name	Checked	Date

REVISIONS

Project:
SECURITY ROOM

Client:

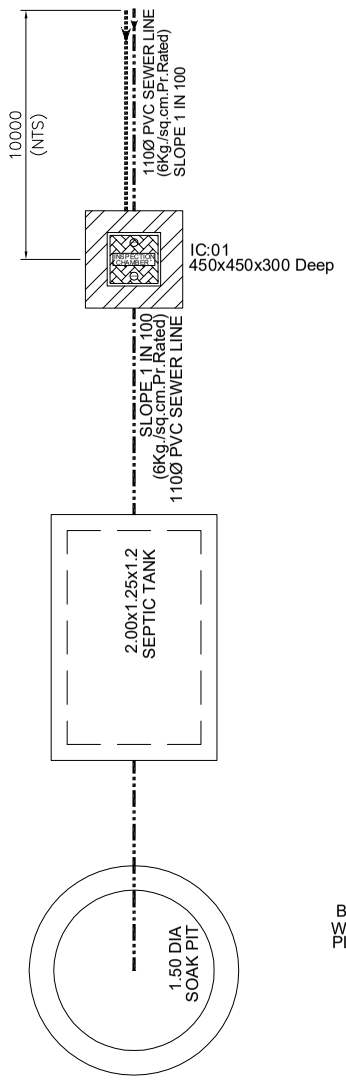
Drawing Title:
GENERAL ARRANGEMENT DRAWING
SECTION

Drawn by:	CP.SINGH	Scale: 1:50	Date:	
Checked by:	A.S.	Project No:	Drawing No:	Revision:
Approved by:	*****	EPPL-01329:01.01.01	G.A.-001	R0

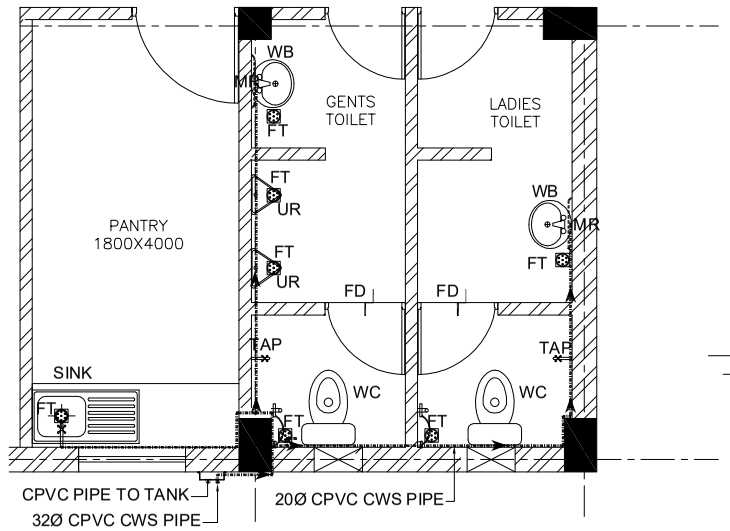
NOTE:-

SHEET SIZE-A1

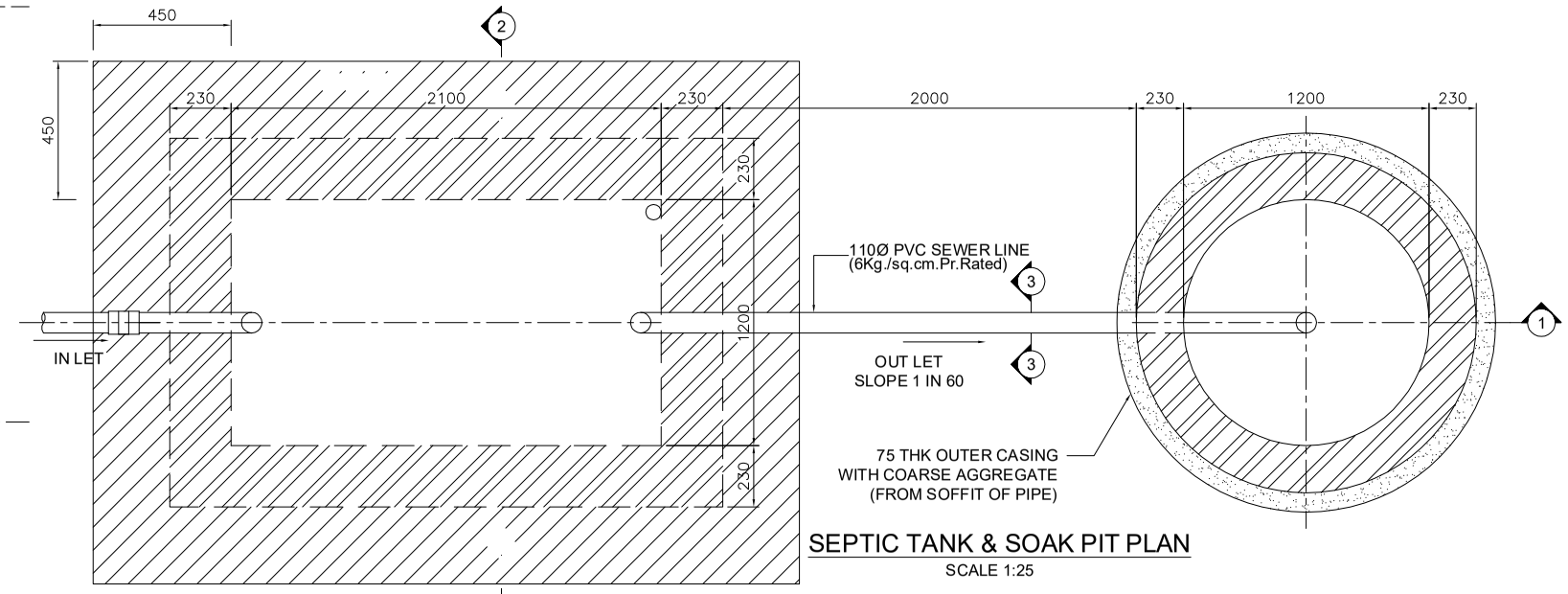
DRAWING NO: 56



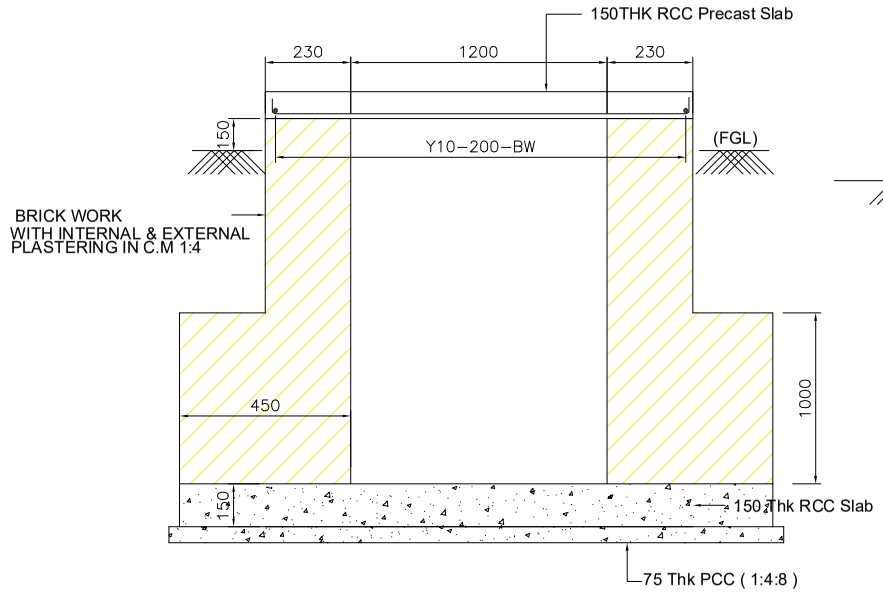
DRAINAGE LAYOUT
SCALE 1:75



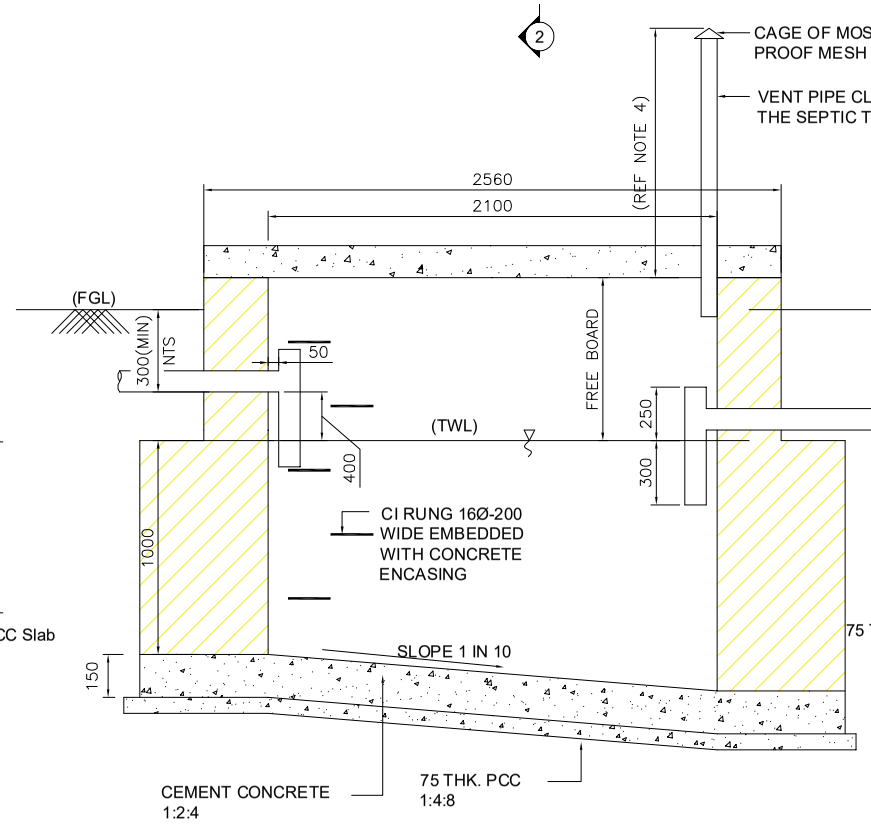
TENTATIVE WATER SUPPLY LAYOUT
SCALE: NTS

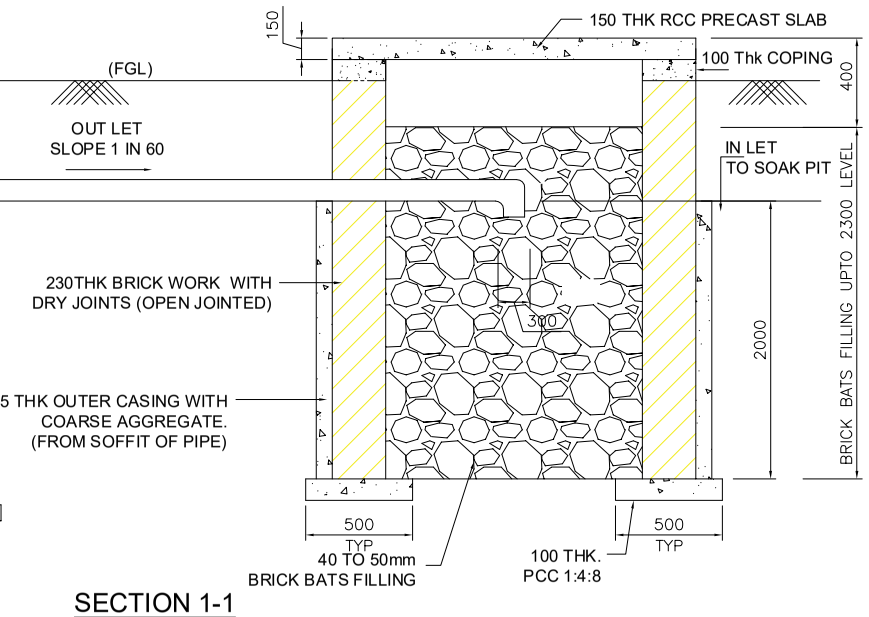


SEPTIC TANK & SOAK PIT PLAN
SCALE 1:25

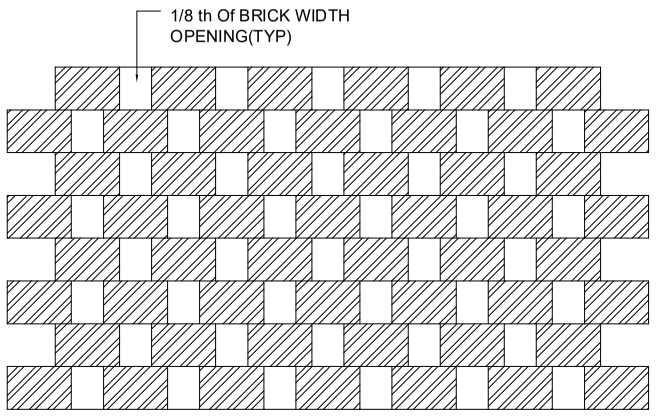


SECTION 2-2

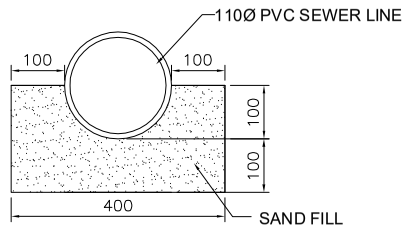




SECTION 1-1



TYP DET. OPEN JOINTED WALL



SECTION 3-3

PIPES SPECIFICATION		
SL #	DESCRIPTION	
01	SOIL AND WASTE PIPE PVC : (Poly Vinyl Chloride)	TYPE - 'B' IS : 13592
02	RAIN WATER PIPE	TYPE - 'A' IS : 13592
03	ALL WATER SUPPLY PIPES CPVC : SDR-11 GRADE (Chlorinated Poly Vinyl Chloride)	AS PER IS : 15778 ASTM-2485

LEGEND		
WC	WATER CLOSET	
	WITH CONCEALED FLUSH TANK)	
HF	HEALTH FAUCET FOR EWC	
WB	WASH BASIN	
Tr	TOWEL RING	
MR	MIRROR	
SH	SHOWER	
TR	TOWEL ROD	
SD	SOAP DISH	
FD	FLOOR DROP	
FT	FLOOR TRAP	
BV	BALL VALVE	
SP	SOIL PIPE 110 Ø PVC	
WP	WASTE PIPE 75 Ø PVC	
CWS	COLD WATER SUPPLY	

GENERAL NOTES:
1. ALL DIMENSIONS ARE IN MM. AND ELEVATIONS ARE IN METERS
2. DO NOT SCALE THE DRAWING ONLY WRITTEN DIMENSIONS TO BE FOLLOWED.
3. THE VENT PIPE HEIGHT SHALL BE 2.0M ABOVE RESPECTIVE BUILDING PARAPET HEIGHT PIPE AND VENT SHALL BE SUPPORTED ON RESPECTIVE BUILDING WALL.
4. READ THIS DRAWING ALONG WITH RELEVANT ARCHITECTURAL/STRUCTURAL/ELECTRICAL DRAWING.

4245/2024/SBD-PVE

DEPT.	SC&PV
STATUS	CONTRACT
DISTRIBUTION	

REV.	DATE	DRWN	CHD	APP'D
00	SUBMITTED FOR APPROVAL			

CUSTOMER

300MW FSPV PLANT AT RENGALI FOR NHPC

BHARAT HEAVY ELECTRICALS LTD
SOLAR BUSINESS DIVISION, BANGALORE

TITLE: DETAILS OF SEPTIC TANK AND SOAK PIT

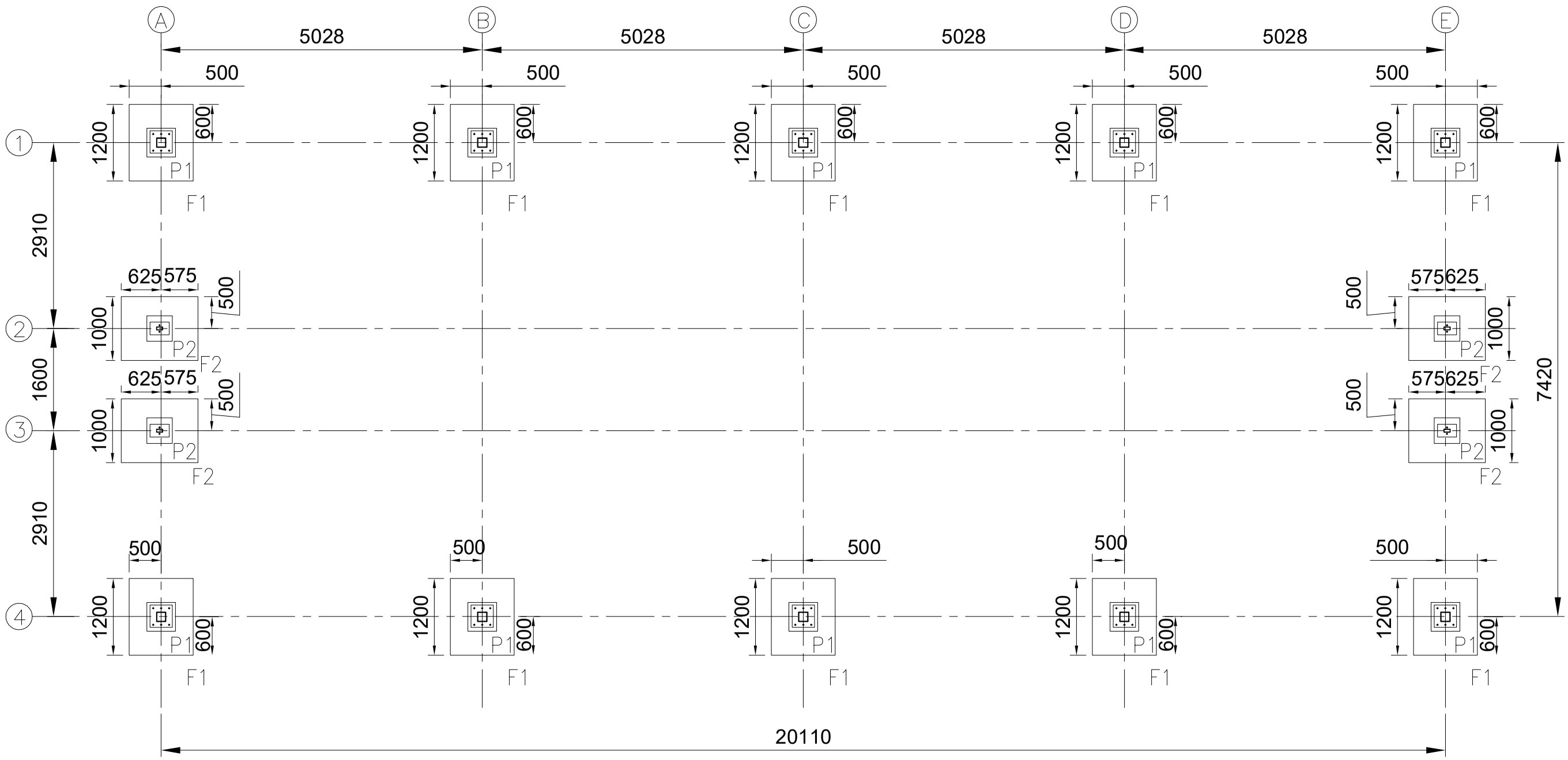
SCALE 1:100

DRAWING NO.

SHEET

REV. 0

ALL DIMENSIONS ARE IN "mm"



FOOTING LAYOUT

NOTE:

INTERNAL / EXTERNAL ARRANGEMENTS, FIXING OF WALL PANELS, ROOF PANELS, WINDOWS, DOORS, TRUSS WORK & ELECTRICAL ITEMS ETC. MAY SLIGHTLY VARY FOR BETTER ACCESSIBILITY. MAINTENANCE, AESTHETIC LOOK. HOWEVER OVERALL OUTER DIMENSIONS WILL REMAIN THE SAME.

REFERENCE DOCUMENTS	PROJECT: 300 MW (AC) FSPV PLANT FOR NHPC AT RENGALI								
	REVISION	DATE					-		DRAWING No. 01
	REV 00		CHD.BY					PROJECTION	TITLE:- FOUNDATION LAYOUT FOR STORE ROOM
BHEL COMMENTS MAIL DT : 24.10.2017	REV 01	26.10.2017				DEPT.	DESIGN		
	REV 02		DATE			SCALE:	NTS		SHEET 01 OF 07 REV

CHEMIN C&I

4232/2024/SBD-PVE