

	PURCHASE SPECIFICATION Design, supply and erection of Pre-Engineered Building (PEB) rooms including civil works for 15 MW SPV plant side at Charanka Solar Park, Gujarat	PS-439-1140
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Technical specification For Design, supply and erection of Pre-Engineered Building (PEB) rooms including civil works for 15 MW SPV plant side at Charanka Solar Park, Gujarat
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Approved by : NHK			
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1.0 Introduction

Bharat Heavy Electricals Limited (BHEL), Electronics Division, Bangalore is setting up 15MWp Grid-connected Solar PV Power Plant for Gujarat Alkalies & Chemicals Limited (GACL), Vadodara at Charanka Solar Park, Gujarat. This technical specification describes the vendor scope of design, supply and erection of PEB-based rooms of the power plant (three inverter rooms, one control room, one security room and two watchman cabins).

2.0 Location / approach particulars of the power plant

15MW (AC) Solar Photovoltaic Power Plant
Charanka Solar Park
Patan district
Gujrat

3.0 Pre-qualification criteria (PQC)

Following are PQC criteria that the bidders shall essentially meet in order to qualify in the tendering process. Offers from bidders not meeting this PQC shall be rejected.

- a) Vendor shall essentially be an OEM (Original Equipment Manufacturer) of PEB structures. Vendor shall along with technical bid, furnish the postal address of their factory/works where the structures are manufactured and also the details (names/phone) of contact persons.
- b) Vendor should have supplied and installed PEB structures with PUF insulation (for wall cladding/roofing) for a minimum base area of 100 sqm per building and minimum cumulative base area of 700 sqm considering all PEB rooms supplied and installed. Vendor shall, along with technical bid, enclose copies of purchase orders/ completion certificate (during the past 3 years from the date of RFQ from their clients for same. Vendor shall also enclose supporting documents (PO copies, drawings etc) for supply of PUF insulation based PEB structures.
- c) Vendor shall, along with technical bid, submit a duly-signed undertaking (in their company letter head) that they shall be willing to submit all necessary structural design calculations proof checked and endorsed by IIT/NIT, as per applicable clauses the tender specification

4.0 Overview of solar PV power plant

Solar PV modules employed at the plant generates DC electricity that in turn shall be inverted to AC in the range 300-400V. Output of each solar block (5.7 MWp) with independent inverter room/ transformer yards shall be stepped up to 33kV. Combined AC output is stepped up to 66kV using a 16MVA power transformer. At this outgoer level, there is outdoor switchyard together with necessary gantries/ towers/ beams/Cables to facilitate 66kV transmission.

Power generated at the above SPV plant shall be transported to CTU/STU substation using 66kV underground cables. Distance between SPV plant and substation is 400m approximately. At substation, an outdoor switchyard bay exclusive for this plant shall be constructed with necessary gantries/ towers/ beams to facilitate 66kV transmission

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The various electrical panels such as inverters, 33kV vacuum circuit breakers (VCB), AC/DC distribution boards, UPS panels, SCADA panels etc are housed in 4 control rooms. Among these, three are inverter rooms and one no of control room of PEB type. Each inverter room is equivalent to 5MWp. Thus, all three rooms collectively generate 15MWp. The output of these three inverter rooms are combined at control room to generate and transmission of 15 MWp. In addition to the inverter rooms, control room the security room and watchman cabin is also of PEB type.

The inverter rooms and control room are located at distributed locations within the power plant. AC outputs from all these rooms are combined at CMCS room. Security room is located near the entrance gate.

5.0 Vendor scope

#	Item Description	Quantity
5.1	Supply of PEB structural materials such as columns, rafters, beams, purlins, steel sheets, insulation etc for inverter rooms as per clause 8.1. (Note: 1 set is for one inverter room).	3 set
5.2	Supply of PEB structural materials such as columns, rafters, beams, purlins, steel sheets, insulation etc for control rooms as per clause 8.1.	1 set
5.3	Supply of PEB structural materials such as columns, rafters, beams, purlins, steel sheets, insulation etc for security room and watchman cabin as per clause 8.1.	1 set
5.4	Supply of PEB architectural items such as doors, windows, rolling shutters, etc for inverter rooms as per clause 8.2. (Note: 1 set is for one inverter room).	3 set
5.5	Supply of PEB architectural items such as doors, windows, rolling shutters, partitions etc for control room as per clause 8.2. (Note: 1 set is for one inverter room).	1 set
5.6	Supply of PEB architectural items such as doors, windows, etc for security room and watchman cabin as per clause 8.2.	1 set
5.7	Supply of electrical items like LED lights, fans, switchboard, cables etc for inverter rooms as per clause 8.3. (Note: 1 set is for one inverter room).	3 set
5.8	Supply of electrical items like LED lights, fans, switchboard, cables etc for control room as per clause 8.3 (Note: 1 set is for one inverter room).	1 set
5.9	Supply of electrical items like LED lights, fans, switchboard, cables etc for security room and watchman cabin as per clause 8.3.	1 set
5.10	I&C: Erection of PEB inverter room structural materials as per clause 8.5 (Note: 1 AU represents one inverter room)	3 AU
5.11	I&C: Erection of PEB control room structural materials as per clause 8.5 (Note: 1 AU represents one control room)	1 AU
5.12	I&C: Erection of PEB security room and watchman cabin structural materials as per clause 8.5	1 AU
5.13	I&C: Erection of PEB inverter room architectural items as per clause 8.6 (Note: 1 AU represents one inverter room)	3 AU

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5.14	I&C: Erection of PEB control room architectural items as per clause 8.6	1 AU
5.15	I&C: Erection of PEB security room and watchman cabin architectural items as per clause 8.6	1 AU
5.16	Construction of Civil Foundation including cable trench for inverter room as per clause 8.4	3 AU
5.17	Construction of Civil Foundation including cable trench for control room as per clause 8.4	1 AU
5.18	Construction of Civil foundation for Security room and watchman cabin as per clause 8.4	1 AU
5.19	I&C: Electrical items like LED lights, fans, switchboard, cables etc for inverter rooms as per clause 8.7. (Note: 1 set is for one inverter room).	3 AU
5.20	I&C: Electrical items like LED lights, fans, switchboard, cables etc for control room as per clause 8.7. (Note: 1 set is for one inverter room).	1 AU
5.21	I&C: Electrical items like LED lights, fans, switchboard, cables etc for security room and watchman cabin as per clause 8.7.	1 AU
5.9	Warranty Vendor shall provide warranty for 12 months for the supply and erection of PEB rooms from the date of start of erection or 18 months from the date of completion of erection whichever is earlier.	-

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6.0 Enclosures to this tender specification

6.1	Vicinity map of project site
6.2	Typical site layout with solar array, CMCS room, PEB inverter rooms (tender purpose only)
6.3	Typical layout of PEB inverter room showing electrical panel placement (tender purpose only)
6.4	Typical layout of PEB control room showing electrical panel placement (tender purpose only)
6.5	Indicative field quality plan of GACL
6.6	Request for Quotation with instructions, terms and conditions, formats for filling-up etc.

Notes:

- 1) Overall base area of PEB inverter room shall be as per the typical layout mentioned above.
- 2) Overall base area for PEB security room shall be 9 sqm minimum.
- 3) Overall base area for PEB watchman cabin shall be 4 sqm minimum
- 4) Height of vertical column structure of PEB inverter room / control room / security room shall be 3.5m minimum above FFL.

7.0 Instructions to bidders on bid submission

7.1	Offer shall be submitted in two-parts (Two-part bid). Both parts shall be in separate sealed envelopes as per instructions in tender. The individual envelopes shall be enclosed in a common bigger envelope with markings (address etc) on the envelope as per instructions provided in tender.
7.2	First-part shall be techno-commercial bid. Following details shall be furnished: 1. Supporting documents as per pre-qualification criteria 2. Techno-commercial offer covering letter 3. Filled-up enclosures as per BHEL formats (meant for first-part) provided in tender. 4. This specification duly signed by the bidder with seal indicating compliance in total. 5. In case of deviations in the offer from this specification, separate clause-wise list shall be enclosed. 6. Details of company of the bidder
7.3	Second-part shall be price bid with filled up enclosures as per BHEL formats provided in tender.
7.4	In addition to the above instructions, tender document provides detailed instructions for bid submission. Vendor shall submit the bid based on instructions in tender document.

8.0 Technical specification – Design, supply and erection of PEB rooms

8.1 Design and supply of PEB structural materials

- a) After receipt of BHEL PO, following documents shall be submitted to BHEL/GACL for approval:
 1. Structural design calculations including STADD.Pro
 2. GA drawings along with BOM.
- b) Design calculations, checked and certified by IIT/NIT, shall be submitted to BHEL/GACL for approval.

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- c) Vendor shall supply the structural materials such as columns, rafters, beams, purlins, tie rods, sheets, wall cladding/roofing PUF insulation, hardware etc to the site as per the GACL approved drawings. Raw materials for steel sections, sheets etc shall be of reputed make such as Jindal, RINL, SAIL, Tata steel etc. Vendor shall take prior approval from BHEL for the make prior to proceeding with procurement action.
- d) Vendor shall also supply the J bolts/nuts/washers, alignment plates and other related hardware that are used for positioning and anchoring of the PEB structures to the RCC foundation.
- e) All the items shall be supplied directly to the project site.
- f) Relevant clauses of **“Detailed specification of PEB rooms”** section shall be adopted.

8.2 Design and supply of PEB architectural items

- a) After receipt of BHEL PO, vendor shall submit GA drawings along with BOM (item-wise description, quantity, make, model etc) of the architectural items for BHEL/GACL approval.
- b) The architectural items submitted for approval shall meet the requirements of various aspects of the room such as electrical, illumination, ventilation, exhaust, thermal, safety, security etc.
- c) Accordingly, this shall include all items such as windows with shades, doors with shades/lock/key, rolling shutters with lock/key, ventilator provisions, exhaust provisions, rain water gutters/ downcomers/ pipes etc.

- Vendor shall take prior approval from BHEL for the make prior to proceeding with procurement action.

- d) Vendor shall supply the items directly to the project site.
- e) Relevant clauses of **“Detailed specification of PEB rooms”** section shall be adopted.

8.3 Design and supply of PEB room electrical items

- a) After receipt of BHEL PO, vendor shall submit Electrical layout drawings along with BOM (item-wise description, quantity, make, model etc) for BHEL/GACL approval.
- b) The electrical items submitted for approval shall meet the requirements of various aspects of the room such as electrical, illumination, ventilation, exhaust, thermal, safety, security etc.
- c) Accordingly, this shall include all items such as lighting fixtures, fans, exhaust fans, sockets, switchboards, LDBs, cables etc. Vendor shall take prior approval from BHEL for the make prior to proceeding with procurement action.
- d) Vendor shall supply the items directly to the project site.
- e) Relevant clauses of **“Detailed specification of PEB rooms”** section shall be adopted.

8.4 Design and construction of PEB room foundations including cable trench

- a) After receipt of BHEL PO, vendor shall submit the foundation drawing of PEB rooms including cable trench for BHEL/GACL approval.
- b) The foundation drawing submitted for approval shall be supported with design documents.
- c) Cable trench shall be constructed as per drawing enclosed in this tender specification.
- d) Necessary cable tray support structures and panel support structure shall be provided in the cable trench

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- e) Vendor shall supply the items directly to the project site.
- f) Relevant clauses of “**Detailed specification of PEB rooms**” section shall be adopted.

8.5 Erection of structures of PEB rooms:

- a) Vendor shall erect the structural items such as columns, rafters, beams, purlins, tie rods, sheets, wall cladding/roofing insulation, hardware etc as per the BHEL/GACL approved drawings / BoM.
- b) Vendor shall also carry out necessary finishing activities such as painting etc.
- c) Vendor shall deploy qualified/competent team at site to carry out the above erection activity.
- d) Vendor shall also deploy their specialized team during plinth casting of J bolts / alignment (base) plates etc.
- e) All necessary labour, tools & tackles, shuttering materials, measuring instruments, machinery shall be in vendor scope of supply. This shall include spanner sets, drilling machines, welding machines, hydra, JCB, truck, trolley etc as required for the erection work.
- f) For the above, relevant clauses of “**Detailed specification of PEB rooms**” section shall be adopted.

8.6 Erection of architectural items of PEB room:

- a) Vendor shall carry out erection of the architectural items such as windows with shades, doors with shades/lock/key, rolling shutters with lock/key, structural provisions for ventilators / exhausts, rain water gutters/ downcomers/ pipes etc as per the BHEL/GACL approved drawings / BoM.
- b) Vendor shall also carry out necessary finishing activities such as painting etc.
- c) Vendor shall deploy qualified/competent team at site to carry out the above erection activities.
- d) All necessary labour, tools & tackles, shuttering materials, measuring instruments, machinery shall be in vendor scope of supply. This shall include spanner sets, drilling machines, welding machines, hydra, JCB, truck, trolley etc as required for the erection work.
- e) For the above, relevant clauses of “**Detailed specification of PEB inverter room/ PEB security room**” section of this specification shall be adopted.

8.7 Erection of electrical items of PEB rooms:

- a) Vendor shall carry out erection of the electrical items such as lighting fixtures, fans, exhaust fans, sockets, switchboards, LDBs, wiring etc as per the BHEL/GACL approved drawings / BoM.
- b) Vendor shall deploy qualified/competent team at site to carry out the above erection activities.
- c) All necessary labour, tools & tackles, measuring instruments, machinery shall be in vendor scope of supply. This shall include spanner sets, drilling machines, welding machines, hydra, JCB, truck, trolley etc as required for the erection work.
- d) For the above, relevant clauses of “**Detailed specification of PEB inverter room/ PEB security room**” section of this specification shall be adopted.

9.0 Detailed specification of PEB rooms:

9.1 PEB inverter room / control room / security room / watchman cabin

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The Inverter room / control room / Security room / watchman cabin 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, 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 or complete life of solar plant. The construction methodology for PEB shall also be submitted for GACL approval before start of works.

The layout of Inverter room / Security room shall be designed so as to divert the heat generated from each inverter outside the room. The inverter room / security room shall be designed for a life of 25 years. The successful bidder shall have to get the structural design done as per the prevailing Indian standard codes and International Standard. **The structural design of inverter room of each type shall have to be proof checked by any IIT / NIT and subsequently submitted to GACL for approval before actual starts of the work.**

) to provide general idea about work to be performed under the scope of the contract. 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.

9.2 Structure and material specification

The PEB inverter room / security room shall have a steel frame primary structural members. Primary members fabricated from plates shall conform to IS2062 min Grade E250 Quality BR/ ASTM A572-12 Grade 50 with minimum yield strength of 345 MPa. Steel shall be semi-killed/killed. Minimum thickness of steel plates shall be 4 mm. Hot rolled primary structural members and Rod/Angle bracing shall conform to IS2062 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 3.15 mm. 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.

9.3 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 IS: 1367 (Part III) Gr. 8.8 / ASTM A325. Bolts for Secondary Connection IS: 1367 (Part III) Gr. 4.6 / ASTM A307. Anchor/foundation Bolts shall conform to IS: 5624 and relevant IS code.

9.4 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-1 and IS: 513 for Hot-dip Zinc coated or Al/Zn

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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 least 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 engineer.

9.5 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.

Bidder may also alternatively make the PEB roofing with composite slab (RCC slab with permanent formwork). The composite slab scheme, design and drawings shall be subject to approval from GACL before start of work.

9.6 Wall Insulation:

All voids of external and internal metallised 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.

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

9.7 Doors Frames:

Door frames shall be of T-iron frame of mild steel Tee-sections as per DSR-2013 item no 10.13. All doors shall be provided necessary fittings like hinges, handles, mortice locks, tower bolts, stopper, hydraulic door closer, etc. of CP brass complete.

Black powder coated aluminium doors shall be with extruded built up standard tubular sections, appropriate Z sections and other sections of approved make conforming to IS: 733 and IS: 1285, 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 GACL

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.

9.8 Windows Frame:

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.

9.9 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.

9.10 Rolling shutter:

Rolling shutter (Hand 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.

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9.11 Paint and Coating:

Steel 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

9.12 Lighting:

The building shall be provided with electric light to achieve average illumination level of 400 Lux. However building should be designed to utilize maximum natural light during the day.

All Compact Florescent Lamp fixtures shall be indoor type & pre-wired comprising of Lamp(s) with lamp holder(s) and Electronic Ballast(s) with metal reflector(s). The lamp fitting shall be covered by Glass or Perspex material. The PF of the electronic ballast shall be more than 0.9. The fixtures should be of reputed make like Philips/Bajaj/Crompton/G.E. etc., however, vendor shall submit the sample of lighting fixtures to BHEL for approval before supply & installation. Alternatively, LEDS may be used after submitting detailed descriptions illumination computations and Test certificates from reputed test centers.

9.13 Plinth Protection:

1000mm wide plinth protection 50 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 Structure

9.14 Foundation and platform with cable trench

Required foundation shall be designed by the vendor to safely take the equipment load as per the details given below and drawings shall be furnished for BHEL approval and all the civil works is in vendor scope.

- each Inverter Room -15 Tons
- Control Room-10 Tons
- Each Security Room-1 Ton

Highest weight of individual equipment is 3 Ton. Design shall be done for highest weight

Cable trench details shall be furnished during detailed engineering.

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9.15 Floor Finish

Flooring, including preparation of surface, cleaning etc shall be of cement concrete flooring as per IS 2571-1970 with ironite hardener. The building floor shall be atleast 50cm above the ground level.

- Store area: Cement flooring in concrete mix (1:2:4) using 10 mm aggregates as per IS 2571: 1970.
- Control Room cum supervisor room: Heavy Duty Vitrified tiles 10 mm thickness.
- SCADA Room: Heavy Duty Vitrified tiles 10 mm thickness.
- Equipment room: Heavy Duty Vitrified tiles 10 mm thickness.
- Battery Room: Acid/ Alkali resistant tiles of suitable thickness.
- Toilets: Ceramic tiles 8 mm thickness.
- Lobby: Vitrified Tiles 10 mm thickness.

9.16 Provision for Ducting arrangement

Ducting, exhaust fans etc. are required for extracting hot air from inverters which is required for healthy air circulation. Drawings for ducting arrangement shall be provided by BHEL during detailed engineering. Necessary provisions for placing of ducting arrangement shall be provided by the vendor. Supply of ducting materials shall be the in the scope of BHEL.

9.17 Point wiring

This shall include all works necessary for wiring to the point of utilization of the load to be applied for the wiring of light, fan or plug point etc.,

Point wiring shall include all works necessary in complete wiring of a Piano Type switch Circuit of any length from the tapping point from the Junction Box to the following, via the switch.

Ceiling Rose in case of all lighting & fan points.

Socket Outlet in case of sockets.

The followings shall be deemed to be included in the point wiring:

Switch & ceiling rose as required, Bushed Conduit or Porcelain tubing or PVC pipe where cable through etc., Earth wire for three pin socket point to the common earth station, all metal blocks, board & boxes sunk type including those required for mounting fan regulator bus excluding those under the DB and control switch, All fixing accessories such as nails, screws, plugs etc., as required., Joint for junction Boxes & connecting the same as required.

Indoor point wiring will be casing capping type with 1.1 kV PVC insulated 2 x 1.5mm² (min. size) copper wire including Wooden switch Board covered with Bakelite Cover, Ceiling Rose supply of wire, casing-capping, appropriate size bare copper earth wire, screw & and other accessories etc., as such where required. The work includes supply of all requisite materials. Standard ISI marked Anchor or equivalent good make materials are to be used for point wiring.

PVC casing capping and all accessories shall be of Heavy gauge Polyphene with all accessories and white in colour. Conduit / buses through wall shall be flash after cutting wall and including mending well the damages. Casing capping on wall shall be fixed with suitable screws at an interval not less than 300mm.

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All out door point wiring will be with hard PVC conduits of approved make. Suitable hard PVC bends, saddles, Tees etc., are to be used for outdoor wiring

9.18 Plumbing and sanitary items

Vendor shall supply and install required plumbing and sanitary items of reputed make for toilets. Toilets shall be provided in Control room. Construction of soak pits and septic tanks as required shall be in vendor's scope. Inspection chambers for letting out sewage and sullage are to be constructed. Septic tank to be provided with RCC lid with ventilation pipe. The septic tank (15 persons capacity) PVC pipes of 160mm dia for transmission of sewage to be used.

The toilet room in Control room shall have separate partitions for gents and ladies, each shall contain a Western commode (W.C) and wash basin with mirror. The layout shall be as shown in the control room layout drawing enclosed. The toilets shall have CP brass towel rail, soap holder and liquid soap dispenser.

For toilets and pantry, the water required shall be supplied from an overhead tank of min. 1000 litres capacity which shall be mounted on the roof of pre-fab building (wherever toilets are considered). Roof shall be designed take the load of overhead tank. Supply of overhead tanks (sintex or reputed make as approved by BHEL) shall be in the scope of vendor. GI pipes of Medium quality conforming to IS 1239 (Part I) and IS 1795 for Mild Steel pipes shall be used for all water supply and plumbing works. Required piping and pump connection from and to tank shall be in vendor's scope.

9.19 False Ceiling and partition

SCADA room and Office room in control room should have false ceiling. (Grid type-Mineral fiber board).

The partition wall shall be of brick for toilets and for the other rooms it can be metal framed gypsum partition / brick work partition

9.20 Design Parameters and Design Loads:

The structure shall be designed for loads and load combination as per Indian Standards (latest revisions) such as IS: 875, IS: 1893, IS: 800, IS: 456 etc.

Dead Load: Self Weight of Structure including Purlins, Sheeting, Girts, Bracings, weight of turbo ventilators to be added as Dead load etc.

Imposed Load (Live Loads) Live loads shall be as per IS - 875. For sloped roofs up to 10 deg. it shall be 0.75 KN/M².

Wind Load: The basic wind speed of the site is taken as 150 km/hr. Design wind load co-efficient shall be as per IS: 875-III.

Earthquake Load: All PEB structures shall be designed for Seismic forces. Vertical Deflection and Horizontal Sway Limits:

a) Limiting Deflection: The limiting permissible vertical deflection for structural steel members shall be as per IS 800 2007.

b) The limiting permissible horizontal deflection for as per IS 800 2007 code where 'h' is height of building at eaves.

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9.21 Descriptions 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 plate.

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

Group	Grade/ Reference code	Yield strength (min) MPa	Tensile strength (min) MPa	Coating class designation	BMT (mm)	+ve tolerance (mm)	Upper limit of BMT	-ve tolerance (mm)	Lower limit of BMT (mm)
I	G250/ AS1397	250	320	Z275	0.6	0.04	0.64	-0.04	0.56
	SS255/ ASTM A653M	255	360						
	S250GD/ EN10326	250	330						
II	G350/ AS1397	350	420	AZ150	0.5	0.04	0.54	-0.04	0.46
	SS340 Class 4/ ASTM A792M	340	410						
	S350GD/	350	420						

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	EN10326								
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NOTE: Minimum elongation % shall be as per 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.

10.0 General Specification of Civil works

1. Foundation bed concrete for leveling course to be laid in cement concrete 1:4:8 for a depth of 15 Cms.
2. Size stone masonry in cement mortar 1:6 for foundation as per IS specification
3. Size stone masonry in cement mortar 1:6 for basement and the size stones neatly dressed with quoins for a width of 50mm for all the corner stone's on both the edges.
4. Pointing of joints by racking to a depth of 20mm and filled with cement mortar 1:3.
- ~~5. Plinth concrete in 1:1.5:3 to be laid as per the approved design drawing.~~
- ~~6. RCC 1:1.5:3 for columns, beams, Lintels to be laid with steel frame work and compacted with needle vibrator.~~
All RCC works shall be as per IS 456 and the materials used viz. Cement, reinforcement steel etc. shall be as per relevant standards. As the subsoil is corrosive in nature, concrete shall be designed for severe \ exposure condition. So minimum grade of concrete is M30 .
7. Plastering in cement mortar 1:5, 1:6 and 1:3 shall be applied to all internal cable trench respectively as per IS1542.
8. Painting of internal walls shall be of Acrylic distempering.
9. Table molded bricks with minimum compressive strength of 50 ksc are to be used for burnt brick masonry in CM 1:6. For every 5000 bricks test reports are to be submitted for its suitability
10. 115 mm thick brick wall for partition are to be constructed with CM 1:4 by providing 2 Nos of 6 mm tor steel tied with binders at 30 Cms C/C and extended in main walls.
11. Door frames with Honne / Nandi wood of size 105 X 65 mm with cills wherever necessary and as per the directions of the Engineer in charge.
12. 40mm thick water proof flush doors with one side teak wood veneering as approved by BHEL.
13. Glazed aluminum doors of standard gauge, covered with glass of 5.5mm thick with aluminum handles, lever, locks, chrome plated floor type door latches, heavy duty double action floor springs as per the approved drawing.
14. For bath and toilets standard make PVC door frames with PVC shutters to be provided.
15. Three way track glazed aluminum windows with ventilators as per standard with necessary guard bars as per the approved drawing.
16. The fixtures for doors, windows and ventilator are to be approved by the Engineer.
17. External Plastering for a thickness of 18mm with CM 1:6 with cement finish.
18. Parapet wall for a height of 85 Cm with 5 Cm thick coping concrete with intermediate brick pillars as per the approved drawings.
19. Granite slab flooring for accommodations wherever necessary as approved by BHEL Engineer.
20. Acid proof flooring tiles for the accommodations wherever necessary as approved by BHEL Engineer.
21. Anti skid ceramic tiles for flooring in bath and toilets and glazed tiles dadoing for a height up to linter level for bath rooms and 0.90 Mtrs. Height glazed tiles dadoing in toilets.

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22. Flagging Concrete : To be laid for a width of 0.90 Mts from the basement in Cc 1:4:8 and plastered with CM 1:4.
- ~~23. Painting: Internal painting with 2 coats of oil bound distemper over a primer coat. External painting to be carried out with 2 coats APEX paint over a coat of under coat. Doors, Window, collapsible gate, rolling shutters, grill works and entrance gates are to be painted with enamel paint over a coat of primer~~
24. Anti termite treatment for foundation and all round the structure.

11.0 General construction requirements

11.1 Structural Steel

All structural steel design shall be carried out as per IS 800. Structural steel shall conform to IS 2062, Pipe shall be as per medium/high grade of IS 1161, checkered plates shall conform to 3502 and Hollow steel sections for structural use shall conform to IS: 4923.

11.2 Grouting

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

11.3 List of applicable Indian Standards

Indian codes, and/or standards shall govern, in all the cases wherever they are available. In case of a conflict between such codes and/or standards and the specifications, the stringent provisions shall govern. Such codes and/or standard referred to shall mean the latest revision, amendments/changes adopted and published by the relevant agencies. In case of any further conflict in this matter the same shall be referred to the Engineer-in-charge, whose decision shall be final and binding.

Other internationally acceptable standards shall be accepted, only if, no Indian Standards are existing. However, other standards also will be accepted if the Contractor establishes that the works are meeting the requirements of Indian Standards also. A brief list of Indian Standards applicable to these works is as below:

General

IS: 875-I	Code of Practice for Design Dead Loads for Building and Structures
IS: 875-II	Code of Practice for Design Imposed Loads for Building and Structures
IS: 875-III	Code of practice for design loads (other than earthquake) for buildings and structures.
IS: 1893	Criteria for earthquake resistant design of structures.
IS: 4326	Code of Practice for earthquake resistant design and construction of buildings

Steel structures

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IS:800	Code of practice for use of structural steel in general building construction
IS:801	Code of practice for use of cold-formed light gauge steel structure members
IS:802	Code of practice for use of structural steel in overhead transmission line towers
IS:806	Code of practice for use of steel tubes in general building construction
IS:808	Dimensions for hot rolled steel beam, column channel and angle section
IS:811	Specification for cold formed light gauge structural steel sections
IS:813	Scheme of symbols for welding
IS:1079	Hot rolled carbon steel sheet and strip – specification
IS:2062	Hot rolled medium and high tensile structural steel – specification
IS:4923	Hollow steel sections for structural use.
IS:1161	Steel tubes for structural purpose
IS:2721	Galvanized steel chain link fence fabric – specification

Painting and coating

IS:4736	Hot dip zinc coatings on mild steel tubes
IS:4759	Hot dip zinc coatings on structural steel and other allied products – specification
IS:1868	Anodic coatings on aluminium and its alloys
IS:2395-I	Paintings of concrete, Masonry and plaster surfaces – code of operations and workmanship
IS:2395-II	Code of practice for painting concrete, masonry and plaster surfaces: schedule
IS:1477-I	Code of practice for painting of ferrous metals in buildings: pre-treatment
IS:1477-II	Code of practice for painting of ferrous metals in buildings: painting

Miscellaneous

IS:19805	Code of practice for structural use of un-reinforced masonry
IS:3067	Code of practice for general design details and preparatory works for damp/water proofing
SP:6	Handbook for structural engineers (all parts)
SP:7	National Building Code of India
SP:16	Design Aids for reinforced concrete to IS:456
SP:20	Handbook on masonry design and construction
SP:22	Explanatory handbook on codes for earthquake engineering
SP:24	Explanatory handbook on Indian Standard Code of Practice for plain and reinforced concrete
SP:25	Handbook on causes and prevention of cracks in buildings
SP:32	Handbook on functional requirements of industrial buildings
SP:34	Handbook of concrete reinforcement & detailing

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12.0 General conditions applicable during supply, installation and commissioning phase

12.1	Vendor shall organize construction power supply on their own. Accordingly, if required, DG sets of suitable capacity shall be deployed by the vendor for construction works.
12.2	Similarly, water required for construction works shall be organized by vendor.
12.3	All machinery such as cranes, hydra, JCBs, forklifts, transport trucks, trolleys, concrete mixers, Ajax machines etc necessary for movement and installation of materials shall be organized by the vendor.
12.4	All necessary tools and tackles such as screw driver set, power screw drivers, cutting pliers, nose pliers, spanner sets, adjustable spanners, hole saw cutter set, bending tools, torque wrenches, hack saw blades, pipe wrenches, flat / round files, drilling machines, welding machines, steel bar bending tools / templates for RCC works, spade, shovel, hammer etc shall be organized by the vendor.
12.5	All necessary measuring instruments such as measuring tapes, digital multimeters, electrical testers, meggers etc shall be organized by the vendor.
12.6	Vendor shall make their own arrangements for necessary food, drinking water and accommodation for their labour and employees posted at the site. Similarly, food and drinking water required at the site, during the construction operations, shall also be in scope of vendor.
12.7	Vendor shall organize all necessary steps to meet statutory requirements such as labour license, PF, ESI, insurance etc and also ensure compliance with relevant acts such as minimum wages act, income tax act, employee insurance act etc for their labour deployed at site.
12.8	Vendor shall organize activities such as receipt of all supply items of PEB rooms at site, unloading from the trucks, safe storage at site, movement from storage location to point of construction etc. Vendor shall deploy their own security watch and ward to safeguard their supply items from pilferage. Insurance for the supplied items until the completion of erection of all the PEB rooms shall be the responsibility of vendor.
12.9	Vendor shall maintain updated labour register, with name, age, qualification, salary, attendance details etc at the site.
12.10	Vendor shall use danger boards, wherever required, to ensure safety of the persons during the work at site.
12.11	Vendor shall adhere to all necessary safety norms such as use of helmet, goggles, hand gloves, gumboots, aprons etc. It is the ultimate responsibility of the vendor in all respect to prevent accidents at the site and safeguard their labour from accidents.
12.12	Vendor shall, at the completion of every work, clear off the debris, which resulted out of the work.
12.13	Vendor shall carry out the work without causing inconvenience to other contract groups at the site. In case of conflicts with other groups, vendor shall ensure that the matter is resolved at once amicably so that the progress of work is not affected.
12.14	Any damages on the other buildings, structures etc of the site, if attributable to the acts of labour / employees of vendor, shall be rectified and made good by the vendor at their own cost.
12.15	No child labour shall be employed for execution of the present contract.

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12.16	Any miscellaneous materials, which are found essential for technical completion of the contract but not mentioned explicitly in this specification, shall be deemed to be included in the specification. Accordingly, such materials shall be included by the vendor as part of the offer.
12.17	BHEL / GACL shall witness routine / acceptance tests performed at manufacturer works for the items supplied by vendor. Vendor shall accordingly provide inspection call to BHEL with submission of quality assurance plan in advance. For the items bought out from dealers, test certificates, as per relevant IS / IEC standards, as issued by manufacturer shall be submitted to BHEL. However, prior approval shall be obtained from BHEL/GACL for procurement of the item from dealers.
12.18	Field Quality Plan / Quality control system: Vendor shall make arrangements for testing of all construction materials in accordance with FQP (Field quality control plan) as approved by BHEL/GACL. If required for this purpose, an exclusive testing laboratory shall be established at site. Vendor shall deploy a well experienced quality control engineer to monitor all QC activities at site as per approved FQP.
12.19	Any deviations during construction shall be discussed with BHEL / GACL site engineers and implementation shall be taken up only after approval from BHEL / GACL.
12.20	Vendor shall submit periodic status report, on daily as well as weekly consolidated basis, to BHEL on the progress of the contract.