TECHNICAL SPECIFICATION (CIVIL WORKS)

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All civil works shall conform to the latest Indian standards, codes etc as and where applicable, or to equivalent applicable international standards approved by the engineer-in-charge. Civil works include but are not limited to the following items whichever necessary, for implementation of the Solar PV Project. All civil works should be carried out as per the relevant standards and guidelines.

1. CIVIL FOUNDATION WORKS AND CROSS GIRDERS SUPPORTING THE SOLAR PV MODULE

1.1 SCOPE

This section covers activities related to design, manufacturing, testing, supply, insurance, transportation, delivery at project site, storage, erection, testing - of module mounting structure as detailed hereunder.

In this case the across the canal girders supporting the rafters overlaid by the purlins, as a whole, comprise the Module Mounting Structure (MMS). It is on this structure that the Solar PV Modules (inclined at the specified angle) rest.

Adequate number of Module Mounting Structure (MMS) shall be provided for installation of the required number of Solar PV Module. The contractor shall provide the details of this item in the detailed design report**.**

1.2 MODULE MOUNTING STRUCTURE

1.2.1 The Module Mounting Structure for the proposed Canal Top project shall be an integration of:

(i)Cross girder at periodic interval of about 8.5m along the canal.

(ii)Integrated module support structure over purlins.

(iii)Maintenance walkway and railing across the canal at regular intervals and along the canal, on both the sides.

(iv)Access ladder, at regular interval of about 5metre,across the canal.

(v)Cable tray etc.

1.3 TECHNICAL REQUIREMENTS

- The design of the Module Mounting Structure (MMS) shall be appropriate and innovative. The across the canal girders, of the MMS, appropriately designed should rest on the banks of the tailrace canal of Stage – II, Power House of TCFHP.
- Canal top support structure (MMS) should be so designed that the flow of canal is not impeded at any point.
- If during construction, any structure is damaged, even if inadvertently, the same has to be put back to the original condition.
- The Solar PV Module should be so placed as to avoid the two notorious villages intercepting the tailrace canal of Stage – II, Power House of TCFHP.
- The Module Mounting Structure (MMS) shall be designed to allow easy replacement of any module and shall be in line with the site requirement.
- Design drawings with material selected and their standards shall be submitted to the department, for prior approval.
- The bidder shall design the structure height considering highest flood level at the site. The minimum clearance between the lower edge of the module and the ground shall be the higher of (i) above highest flood level at the site and ii) 800 mm.

- There must be sufficient gaps between the rows of the panels and all precautions should be taken to avoid any shading on the panels.
- The module alignment and tilt angle shall be calculated to provide the maximum annual energy output. This shall be decided based on the location of array installation.
- The mounting structure shall be designed for simple mechanical and electrical installation. It shall support SPV modules at a given orientation, absorb and transfer the mechanical loads to the ground properly. Structural Sections i.e Hollow Square, Rectangular or Circular sections shall confirm to IS:4923 and IS:1161 standards with YST 310 grade of steel. Welding of structure at site shall not be allowed.
- Module mounting structure shall be made of G.I. The frames and leg assemblies of the array structures shall be made of M.S hot dip galvanized sections and shall conform with IS:2629 and IS:277(latest edition).Minimum thickness of galvanization should be 120 microns.
- The structure shall be designed with adequate factor of safety, and as per relevant Indian Standards(with latest edition).
- The array structure shall be so designed that it will occupy minimum space without sacrificing the output from SPV panels at the same time.
- All fasteners shall be of stainless steel of grade SS 316 and must sustain the adverse climatic conditions. Two numbers of anti-theft fasteners of stainless steel on two diagonally opposite corners for each module shall be provided. However if stainless steel (SS 304) fasteners are used they must have protective coating to ensure the life of 25 years. Clamps/bolts shall use EPDM rubber and shall be designed in such a way so as not to cast any shadow on the active part of the module.
- Nut & bolt, supporting structures including module mounting structures shall have to be adequately protected from atmosphere and weather prevailing in the area.
- The Mounting structure shall be grounded properly using maintenance- free earthing kit.
- The support structure & foundation shall be designed with reference to the existing soil condition in order to withstand wind speed of the location as given in relevant Indian code for wind (IS 875 Part III, latest edition) or 200 kmph whichever is higher and seismic load (IS 1893, latest edition),appropriate for the area under consideration.
- The module mounting structure shall be designed as per prevailing IS 800 and IS 801 and Sections shall be as per IS 808 and IS 811 (Latest edition) and shall be safe against wind and seismic force. Detailed design including STAAD output file shall be submitted for final approval. However the minimum thickness of the structural sections shall not be less than 4.0 mm. The members are to be designed taking into consideration the hot & humid nature of the area.
- The array structure shall be made of hot dipped galvanized steel of suitable size. The specification of steel should be as per relevant IS 2062 (Latest Edition). The thickness of galvanization should be as per the relevant standards for galvanization but not less than120 microns.
- It is to be ensured that before galvanization the steel surface shall be thoroughly cleaned of any paint, grease, rust, scale, acid or alkali or such foreign material as are likely to interfere with the galvanization process. The bidder should ensure that inner side should also be galvanized. All galvanized materials shall withstand tests as per IS 2633.
- Foundation is to be provided with piling if necessary. Foundation should be of minimum M25 grade of concrete (with provision of cube test as per relevant IS code)

and minimum Fe500 reinforcing steel (conforming to IS 1786, latest edition).The Design of foundation should be such that the safe Bearing Capacity of Soil (as obtained at site) is not exceeded. The work includes necessary excavation, concreting, curing, piling(if necessary) ,back filling, shoring,shuttering etc.

- For multiple module mounting structures located in a single row, the alignment of all modules shall be within an error limit of maximum 10 mm.
- The bidder/manufacturer shall specify installation details of the PV modules and the support structures with appropriate diagram and drawings.
- Bidder must submit all the quality test documents and test certificates complying with the requirement of the structure.

1.4 CABLE TRAY & CABLE TRENCH

Cable tray of approved make shall be provided, in order to carry the DC cables along the supporting structure and cable trench will be provided in the control room area for connecting the same to the inverters. The Trench shall be as straight as possible, with a firm and smooth base and cover, that allows sufficient air circulation inside the trench.

1.5 APPROVAL

- Proposed layout of the Module mounting structure fitted with equipments & other ancillaries as required over the proposed tailrace Canal of TCFHP shall be submitted with Detailed Design Report for approval.
- Design, drawings, specifications of all components with material selected & installation details shall also be included with the Detailed Design Report.
- Approval of the Engineer – in - charge should be taken before execution of the work at site.

The turnkey contractor shall deliver the product to the site only after receipt of such approval against their prayer in writing from WBSEDCL.

2.OTHER CIVIL WORKS

2.1 DETAILED CONTOUR SURVEY & SOIL INVESTIGATION OF THE SITE

The turnkey contractor shall be responsible for detailed soil investigation and contour survey at required locations for the purposes of foundation design and other design/ planning required for the successful completion of the project. The contractor must submit the detailed soil investigation report, bore log records, ERT reports and contour survey to WBSEDCL.

2.2 TOPOGRAPHICAL SURVEY

Topographical survey shall have to be done by the Successful Bidder of the proposed site at 5 m interval with the help of Total Station or any other suitable standard method of survey. All necessary Reduced Levels (RL) as entered in the Field Book have to be submitted along with pre contour layout of the total site. The formation levels of the proposed power plant have to be fixed with reference to High Flood Level of the proposed site. The ground level and plinth level of structures shall be fixed taking into consideration the highest flood level and surrounding ground profiles.

2.3 SOIL TEST

The Contractor is advised to and is solely responsible to carry out detailed Geotechnical investigation to ascertain soil parameters of the proposed site for the use of planning / designing / construction / providing guarantee / warranty of all civil work including but not limited to foundations / piling for module mounting structures, HT lines, etc. The Contractor shall carry out soil investigation through any Govt. approved / certified soil consultant. These reports shall be furnished to the Employer prior to commencing work. All RCC works shall be provided of required grade of concrete as per relevant IS specifications considering soil data ,appropriate earthquake/seismic zone, wind velocity, weather effect, soil characteristics etc.

2.4 SOIL INVESTIGATIONS

The scope of soil investigation covers execution of complete soil exploration- including boring, drilling, collection of undisturbed soil sample where possible, otherwise disturbed soil samples, conducting laboratory test of samples to find out the various parameters mainly related to load bearing capacity, ground water level, settlement, and other soil conditions and submission of detailed reports along with recommendation regarding suitable type of foundations for each bore hole with recommendation for soil improvement where necessary.

2.5 OTHER INVESTIGATIONS

Successful Bidder shall obtain and study earthquake and wind velocity data for design of module mounting structure, and considering all parameters related to the weathers conditions like Temperature, humidity, flood, rainfall, ambient air etc. The Successful Bidder shall carry out Shadow Analysis at the site and accordingly design strings and arrays layout considering optimal use of space, material and man-power and submit all the details / design to W.B.S.E.D.L for its review / suggestions / approval.

2.6 LAND DEVELOPMENT FOR SITE ACTIVITIES

The turnkey contractor is responsible for making the site ready and easily approachable by clearing of bushes, felling of trees (if required with appropriate approval from the concerned authority), leveling of ground (wherever required) etc. for commencing the project. It is to be ensured, that land is graded and leveled properly for the water to drain out of the project site. It is advisable to follow the natural flow of water at the ground. The Finished Ground Level shall be determined considering High Flood Level of the site area and accordingly, land development has to be done within the scope of this tender. WBSEDCL will assist in getting the High Flood Level from local authority.
If the land pocket needs any filling of sand, it is to ensure that the filled earth must be well compacted as per the relevant IS standards. In case the filled earth is brought from outside the plant, the contractor shall provide the necessary challans. On the other hand, additional earth, if any, must be disposed of properly. Bidder shall take reasonable care to ensure that the plant is aesthetically designed with proper landscaping by covering open areas with grass turf. Site access from the local road is within the scope of tender. Site will be handed over with demarcation.

2.7 FOUNDATIONS

The contractor is responsible for the detailed soil investigation and subsequent foundation design of the structures in the plant. The foundation of the module mounting structures, buildings and other important structures must be approved by SECI prior to construction. The contractor must provide the detailed design and calculations of the foundation. The foundations should be designed considering the weight and distribution of the structure and assembly, and a wind speed of 200 km per hour. Seismic factors for

the site have to be considered while making the design of the foundation. Successful Bidder shall also plan for transport and storage of materials at site.

2.8 SWITCH YARD CIVIL WORKS

Switchyard civil work includes step up transformer plinth, HT Switchgear kiosk plinth, double pole, 4 pole or lattice structure foundation, earth pits, gravel/metal spreading curb wall in and around switchyard and fencing. The transformer/ HT switchgear kiosk plinth shall be made of brickwork or Random Rubble masonry conforming to relevant standards. The height of transformer /HT Switchgear kiosk plinth shall be decided based on 33 kV ground clearances. Earth pit construction shall be of brickwork adequately filled up with common salt and covered with RCC (1:2:4) slabs. Switchyard/ double pole area must be surrounded by chain link fencing with pre-cast RCC post/ galvanized MS angle of suitable size with double leaf gate. Area enclosed within this perimeter must be filled with gravel of standard quality and high abrasive strength.

2.9 INSPECTION PATHWAYS

2.9.1 Inspection Pathways on the Ground

A two meter wide 1st class brick edge inspection pathways with joints set closed in cement mortar 1:6 with a cushion of sand below is required along the project area for accessibility of different components of the project and for easy transportation of the project equipments. Road slope is to be maintained as gentle as possible.

Details of inspection pathways with materials details are to be submitted with Detailed Design Report to WBSEDCL for approval.

2.9.2 Inspection Pathways On Canal Top

Inspection pathway on Canal Top shall consist of chequered plate, 1 m wide (approx.), laid across the canal and along the lower edge of each row of the Solar PV Module with service ladder giving access up to the top edge, and at 5 mtr. Interval (approx.),across the canal, supported by the rafter at the bottom. There should be adequate arrangement, with safety precaution to enable the maintenance staff to climb up to the path way from both sides of the canal. Proper locking arrangement should be made to prevent intruders form getting access to the pathways on the Canal top. Railing should be provided on both sides of the pathways to prevent the occurrence of accidents.
Details of inspection pathways with materials details are to be submitted with Detailed Design Report to WBSEDCL for approval.

2.10 BUILDINGS

Detailed designs, drawings, material specifications of control room of ample size are to be prepared as per project requirement. Local Control Rooms as per plant design and 01 (one) no. of two storied Main Control Room are to be constructed for evacuating the power of the 10 MW Solar PV Power to the existing Grid at the nearest switchyard of the Teesta Canal Fall Hydroelectric Power Station.

Control room should be of RCC frame structure with RCC roof. Minimum M25 grade of concrete (with provision of cube test as per IS 456, latest edition) & Fe500 reinforcement steel (conforming to IS 1786, latest edition) should be used. Size of control room should be made sufficient, keeping adequate space for easy installation & maintenance work of the machinery and easy alignment of cables. Provision of sufficient ventilation system should be made in the control rooms.

There will be a security & operator cabin in the main control room and for the same necessary arrangements like toilet, septic tank, soak pit, drinking water and portable

water supply arrangement, should be made. The main control room should have a provision of a storage room for spare materials. One number of Air conditioned conference room is to be made on the 1st floor of the main control room .Provision of deep tube well should also be kept,for supply of drinking water,to the working personnel. The control room structure is to be designed taking care of machinery load, vibration from machinery, wind load, seismic load and soil bearing pressure- as obtained at site.

Detailed Design, Drawing, material specification of the control rooms are to be submitted with Detailed Design Report for approval of WBSEDCL.

Equipment room shall be designed as per the OEM recommendations to ensure desired life of equipment. Plinth level of all buildings shall generally be kept minimum 600 mm above the FGL / 300 mm above the HFL whichever is higher. Bidder shall furnish the drawings of the proposed buildings to the Employer for approval, prior to construction. The construction of the same shall be as under:-

2.10.1 RCC WORKS

All RCC works shall be as per IS 456 and the materials used viz. Cement, reinforcement steel etc. shall be as per relevant standards with latest revision.

2.10.2 BRICK WORKS

Brick works in cement mortar (CM) 1:6 for 10" thick and 5" and thick wall and 1:4 for ceiling respectively should be provided, for all civil constructions. All brick works shall be made, using 1st class bricks of approved quality as per IS 3102.

2.10.3 DOORS & WINDOWS

Steel framed doors, Windows and ventilators shall conform to IS – 1081 with necessary glass panels including of all fixtures and painting etc. complete. Doors and windows shall be made of aluminum sections. All sections shall be 20 microns anodized. Sections of door frame and window frame shall be adopted as per industrial standards. Door shutters shall be made of aluminum sections and combination of compact sheet and clear float/ wired glass. The control room shall require a number of windows/ louvers to provide ventilation/ fresh air circulations.

2.10.4 PLASTERING

Plastering in cement mortar 1:6 and 1:4 shall be applied to all internal, external walls and ceiling of slab respectively as per IS 1542.

2.10.5 FLOORING

Flooring for stores shall be made of concrete, with mix 1:2:4 using 10 mm aggregates as per IS 2571. Flooring for control building, equipment room etc., shall be of vitrified tiles 8 mm. thick and that of battery room or of places where acid may get impregnated should be acid proof tiles. For toilet area, the floor shall be of ceramic tiles of 8 mm thicknesses. The floor finishing must include skirting up to a suitable height. The walls, of the battery room, shall be covered with acid proof tiles of 6 mm thickness up to lintel level and conforming to Indian Standard code of practice, with latest edition.

2.10.6 ROOFING

The roof of the building shall be properly insulated from heat and waterproofing shall be done as per relevant IS standard- preferably using specified FOSROC / PIDILITE / SIKA material.

2.10.7 PLINTH PROTECTION

Plinth protection 1000mm wide shall be provided around all the buildings.

2.10.8 WHITE WASHING & COLOUR WASHING

White washing and colour washing work shall be conforming to IS 6278.

- Internal walls - Acrylic distempering as per IS 427.
- External walls – Heat reflective synthetic enamel as per IS 428.
- For cement painting IS 5410 shall be followed.
- For painting of steel doors, wooden doors, ventilators - IS 2338, IS 1477 (Part I & II) shall be followed.

2.10.9 ROLLING SHUTTERS

Rolling shutters made of cold rolled strips, conforming to IS 4030 and IS 6248 with approved gauge thickness shall be provided with all fixtures, accessories, painting all etc. complete and at all front gates of buildings, stores,pump houses and other important installations.

2.10.10 WATER SUPPLY

GI pipes (B class) Tata or equivalent make with quality conforming to IS 1239 (Part I) and IS 1795 for Mild Steel pipes shall be used for all water supply and plumbing works.

2.10.11 PLUMBING AND SANITARY

Sanitary fittings, which include water closet (EWC/IWC), wash basins, sink, urinal fitting including flushing tank, and necessary plumbing lines shall be provided for office cum stores building and Security house.

2.10.12 ELECTRIFICATION OF BUILDING

Electrification of buildings shall be carried out as per IS 732 and other relevant standards. The lighting design of the buildings shall be carried out as per IS 3646. The building shall be provided with adequate quantity of light fittings, 5A/ 15A 1 phase sockets; fans etc., controlled by required ratings of MCBs and MCB, DBs. Supervisor room must be fitted with suitably sized HVAC system. It is encouraged that bidder shall use the latest energy efficient equipment for the electrification and illumination.

2.10.13 TOILET

Toilet shall be designed for 20 persons; and constructed with following finish

- Floor: Vitrified tiles/ ceramic tiles
- Door window: made out of aluminum sections, 6mm float glass
- Ventilators: Mechanical exhaust facility
- Plumbing fixtures: Repute make
- Sanitary ware: Repute make
- EWC: 390 mm high with health facet, toilet paper roll holder and all fittings
- Urinal (430 x 260 x 350 mm size) with all fittings.
- Wash basin (550 x 400 mm) with all fittings.
- Bathroom mirror (600 x 450 x 6 mm thick) hard board backing
- CP brass towel rail (600 x 20 mm) with C.P. brass brackets
- Soap holder and liquid soap dispenser.
- GI pipes (B class) of reputed makes
- Overhead water tank of reputed make, equivalent of 2,000 litre capacity
- Underground Storage Tank with Pump of not less than 50 m3 capacity

2.10.14 DRAINAGE FOR TOILETS

Drainage pipes shall be of PVC (6 kg/cm2) Supreme, Prince or equivalent make. Gully trap, inspection chambers, septic tank for 15 person and soak well, shall have to be constructed to cater to the day-to-day needs.

2.11 WATER SUPPLY & CLEANING

Suitable arrangement of water shall be ensured to cater the day-to-day requirement of drinking water and needs of Solar Photovoltaic cells and battery, during entire O&M period. The Bidder shall estimate the water requirements for cleaning the photovoltaic modules at least once in every week in order to operate the plant at its guaranteed plant performance. All necessary arrangement for wet cleaning of the solar panels shall be in the scope of the bidders and accordingly the agency has to provide suitable water source along with all the necessary equipment, accessories, tool & tackles, pumps, tankers, tractors and water storage, piping arrangement which as may be required for the same..

2.12 ROADS WITHIN SOLAR POWER PLANT

Approach roads should be suitable to carry out safe and easy transportation of equipment and material to and from project site. The road should provide easy and fast approach to each location of the plant. These roads are to be designed optimally to carry the crane load with all necessary chambers, gradients, super elevation, and radius of curvatures for the easy movement of cranes, trucks and public transport. Roads are to be of sufficient width (minimum 3.75m) with 0.5m wide well compacted shoulders on each side. The road must be well compacted and should be in line with the relevant IS standards and the MORTH specifications, with latest amendment. All approach and internal road shall be Bituminous Road with proper base development. Pathways would be either of concrete or brick soling with PCC of adequate thickness except for those on the Canal top, which are to be fabricated with chequered plate of adequate thickness with railings on one side,to prevent the maintenance staff from falling down. Also, all cable crossings and other crossings shall be provided with GI/ Hume pipes of requisite thickness and diameter.

2.13 PERIPHERAL BOUNDARY WALL AND FENCING:

The periphery of the project area shall be protected by means of boundary wall of about 2.4 meter height to avoid any unauthorized access to the plant. The Boundary wall shall comprise of c ast-in–situ RCC Columns of minimum height upto 1.8 m from FGL with beams as per design and 125 mm thick 1ST Class brick work. Top of the wall shall be provided with Zinc-Aluminum concertina barbed weir (2 ply / 3 ply) at top and steel angle post at every 3 m c/c may be used. The boundary wall must be provided with rugged main entry gate. The construction of peripheral wall and the main entry gate must confirm to relevant IS standard and practice with latest revision.

Switch Yard fencing may be of GI Chain Link of height about 1.8 m fitted & fixed with MS angle/flat with necessary nuts & bolts. Minimum 0.5 m below the original GL shall be made with 1ST Class brick work (1:6).

Wall and Fencing shall be with all necessary finish and colour/paint complete.

Details of wall/ fencing, material details along with design report and drawings are to be submitted for approval.

2.14 DRAINAGE

The storm water drainage shall be planned to ensure zero water stagnation in the plant. site conditions. The drains outfall must be connected to the nearest drain outside the plant premises. It is advised that the plant be designed keeping the natural flow of water

to the nearest exit point. Bidder is to provide RCC hume pipe at the crossing of road and drains and at required locations, to facilitate safe, smooth and easy crossing of cables. The peripheral drain shall be of brick pitching which should be backed up by cement mortar bed and all joints are to be filled up with cement mortar in the proportion, cement : mortar =1:4, with due plastering. All other internal drains which are on the side of roads, pathways to inverter room, control room, switchyards are to be done by excavating the drain of required size and with required trapezoidal section, and lining the same with, brick with cement mortar on the two sides with- base consisting of plain cement concrete . Appropriate slopes shall be maintained to prevent water logging at the site. The Bidder shall do the needful to drain the rain water out of the premises by providing necessary gradients and storm water drains made out of brick masonry with precast grating, etc. No impounding of water should be allowed in the plant area. Drainage layout with detail drainage work is to be submitted with Detailed Design Report to WBSEDCL for approval.

2.15 PAINTING & FINISH

All metal surfaces and support structures shall be thoroughly cleaned of rust, scale, oil, grease, dirt etc. Fabricated structures shall be pickled and then rinsed to remove any trace of acid. The under surface shall be made free from all imperfections before undertaking the finishing coat. After Phosphate treatment, two (2) coats of yellow zinc chromate primer shall be applied followed by two (2) coats of epoxy based synthetic enameled paint. Shade shall be Siemens Grey RAL- 7032. Thickness of paint shall be not less than 75 micron. All unpainted steel parts shall be cadmium plated or suitably treated to prevent rust formation. If these parts are moving elements then they shall be greased.

2.16 WATCH TOWER

Contractor shall provide adequate numbers of standard watch tower .Location of the Watch tower will be as directed by the Employer. A Security Cabin of size 3 meter x 3 meter at the main entrance gate made with bricks and with RCC roof shall be designed

and constructed by the Successful Bidder keeping in view the safety and security of the power plant. Watchtowers has to be constructed along the length of the project at a maximum distance of 700 meter from each other and with minimum M20 grade concrete & Fe500 reinforcement steel with platform height 4m with trussed roof & false ceiling has to be constructed at suitable locations of the project. Detail design of the watchtower to be submitted with Detailed Design Report for prior approval.

2.17 CABLE TRENCH

For cabling purposes of the plant, cable trench shall be provided as per requirement. The trench shall be as straight as possible with a firm and smooth base. The trench should be made of RCC with adequate foundation and should be covered with concrete slab. Sufficient arrangement shall be provided to drain out accumulated water inside the cable trench.

Detailed design & layout of cable trench to be prepared as per project requirement.