TECHNICAL SPECIFICATION FOR PRE ENGINEERED BUILDING

PROJECT : **1X50 MWp SPV POWER PLANT,NTPC,MANDSAUR,MP**

CUSTOMER : **NATIONAL THERMAL POWER CORPORATION LIMITED**

Ref. Doc

CONTENT LIST

1.0.0. **INTENT OF SPECIFICATION:**

1.1.0. The intent of this document is to establish the minimum requirement of design, design certification, engineering, selection, manufacture, assembly, inspection, shop testing, shop painting, delivery FOR site properly packed for transportation suitably protected from weather including transit insurance of all materials, unloading at site, transportation to stores, safe storage at site, insurance against pilferage, transportation from stores to site, final painting, erection, testing, final handling over as mentioned hereinafter for the Pre-Engineered Buildings (PEB), which form part of project.

1.2.0. It is not the intent to completely specify all details of design, manufacture and construction. Nevertheless the installations shall conform to high standard of engineering/quality and shall be capable of serving the intended purpose continuously for entire life span of the power plant in a manner acceptable to the purchaser (BHEL) and end customer (NTPC).

2.0.0. **SPECIAL NOTES TO BIDDERS**

2.1.0. This specification shall be read in conjunction with all its enclosures. In case of any discrepancy arising between this job specification & its enclosures, the most stringent of all (as determined by purchaser) shall be followed. Further, if a requirement in this specification or any of the enclosures, calls for a decision from the Purchaser, it shall be bidder's sole responsibility to clearly bring out/highlight the same distinctively in his pre-bid queries, so as to enable purchaser to furnish their decision/clarification. If such issues/requirements are not duly addressed by bidder during the pre-bid stage and if such issues/requirements have been observed later during order execution stage, it shall be binding on the bidder to comply with the final decision made by the purchaser subsequently, without any cost, delivery, or any other commercial implications.

2.2.0. Any additional equipment, material, services etc., which are not specifically mentioned in this specification, but required to make the PEBs complete in all respects, in accordance with the intent of this technical specification, contractual agreement, statutory requirements, relevant/applicable codes/standards, good engineering practices, and safety shall be deemed to be covered under the scope of this specification.

2.3.0. Any specific hardware/item/ etc. required as indicated in 2.2.0 above but not listed elsewhere in this specification or its enclosures, shall be deemed to be included in the basic price quoted by the bidder.
Also, all mounting hardware/ accessories/fittings etc. required for above and the E&C of the PEBs shall be deemed to be included in the basic price quoted by the bidder.
Bidder, at no point of time, shall be eligible to raise any extra claim in this regard.

2.4.0. The Bidder shall accept full responsibility for the completeness and for the faultlessness of all the PEBs as a whole. These shall be executed on the basis of proven and certified design principle and in accordance with the latest state of the art in such a manner that the purpose to be served by the plant is fulfilled in every respect. Standardization of equipment, materials etc. shall be employed in the design. Care shall be taken to ensure safety.

2.5.0. By accepting the contract, the bidder shall be deemed to have accepted the obligation of supplying everything that is necessary for the purpose mentioned above, regardless of any omission in the specification or on the drawings for the fulfillment of completion of the PEB package.

2.6.0. Even though, the requirements are specified in detail to the extent possible, bidder to apply good engineering practices in the design, selection of equipment, manufacturing, procurement, transportation, fabrication, painting, erection, inspection & testing, commissioning of package etc., wherever same is not clearly spelt out.

2.7.0. Bidder shall quote strictly as per the scope of supply and requirements of this specification.

2.8.0. Bidder offer shall be strictly as per these specification requirements. Unsolicited or Alternate offers from the bidders will not be entertained.

2.9.0. In case bidder feels that it is necessary to exclude some components of scope of supply or some of the features of specification requirements due to any technical constraints, bidder shall bring the same to the notice of purchaser during pre-bid stage and take their prior approval before submission of their bid.

2.10.0. All such clarifications required by the bidder shall be intimated to BHEL together as a single notice within a week of receipt of enquiry by bidder.

In case no such clarifications are sought during pre-bid stage, it will be assumed that bidder has no comments or observations on BHEL's specification and no deviations to the specifications will be taken by the bidder.

2.11.0. Bidder to quote strictly as per BHEL's price format. Failure to do shall make their offer liable for rejection. Any tampering/modification/change of the BHEL's price format is not allowed and is liable for rejection of bidders offer.

2.12.0. Incase Bidder is unable to offer due to any specific requirement of specification, Bidder may bring out the same in their regret letter. Otherwise it will be considered that non participation by the bidder is attributable to reasons other than any specification requirements.

2.13.0. Compliance with this specification shall not relieve the bidder of the responsibility of furnishing equipment and accessories/auxiliaries of proper design, materials and workmanship to meet the specified purpose.

Accordingly, bidder to furnish their comments if any on this specification as a part of pre-bid query

2.14.0. The design information, specifications and drawings indicate the "Minimum" requirements and are intended to enable Bidders to ascertain the extent of the work involved. Bidders are expected to supplement the information included in this specification as required and submit a comprehensive bid.

3.0.0. **PROJECT DESCRIPTION**

3.1.0. National Thermal Power Corporation Ltd (NTPC), a premier Maharatna public sector undertaking in the field of power generation, is setting up a 250 MWp solar PV power plant, primarily at two villages Runija & Gujerkhedi (Tehsil Suwasra), Mandsaur Dist., Madhya Pradesh state.

3.2.0. The entire 250 MWp solar PV power plant comprises of five nos. blocks of capacity 50 MWp each. BHEL is setting up in P4 block of 50 MWp capacity. Refer VicinityMap in **Annexure-3.**

3.3.0. To house the Power Conditioning Units (inverters) employed in the plant (for overview of the plant refer section 5.0.0) and also for the security room near the gate Pre-Engineered Buildings are envisaged in accordance with the specification detailed in this document.

4.0.0. **LOCATION OF THE PLANT**

Plant Location	:	Mandsaur District
State	:	Madhya Pradesh
Nearest Important Town	:	Suwasra (Tehsil)
Nearest Railway Station	:	Suwasra
Nearest Airport	:	Udaipur
Nearest National Highway:		NH-14

5.0.0. **OVERVIEW OF SOLAR PV PLANT**

The 1x50 MWp solar photovoltaic power plant for M/S NTPC at Mandsaur District in Madhya Pradesh, comprises of an array of solar PV modules that produce DC output. Power Conditioning Units (inverters) are deployed to convert the electricity from DC to AC. The inverter output is further stepped by outdoor transformers. Power generated is exported to transmission grid. The various electrical panels such as inverters, circuit breakers (VCB), AC/DC distribution boards, UPS panels etc. are housed in 11 nos. rooms. Among these, 10 nos. are inverter rooms of PEB type for which foundation up to plinth level is of RCC structure and above plinth, PEB steel structures/sheets shall be used for construction. Generation from each PEB inverter room is 5MWp. Thus, all 10 nos. inverter rooms collectively generate 45MWp. In addition to the inverter rooms, the security room (~4 sqm) is also of PEB type.

The 10 nos. PEB inverter rooms 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.

6.0.0. **BIDDER'S SCOPE OF SUPPLY AND ERECTION-COMMISSIONING :**

6.1.0. **PRE-ENGINEERED BUILDING**

6.1.1. Major supply and services included in bidder's scope: 01

S.No	Description	Quantity
1.	Supply of PEB structural materials such as columns, rafters, beams, purlins, steel sheets, insulation etc for inverter rooms. (Note: 1 set is for one inverter room).	10 Sets
2.	Supply of PEB architectural items such as doors, windows, rolling shutters, etc for inverter rooms. (Note: 1 set is for one inverter room).	10 Sets
3.	Supply of PEB structural materials such as columns, rafters, beams, purlins, steel sheets, insulation etc for security room	1 Set
4.	Supply of PEB architectural items such as doors, windows, etc for security room	1 Set
01 5.	Supply of Electrical Services	1 Set
6.	E&C: Erection of PEB inverter room structural materials. (Note: 1 set represents one inverter room)	10 Set
7.	E&C: Erection of PEB inverter room architectural items (Note: 1 set represents one inverter room)	10 Set
8.	E&C: Erection of PEB security room structural materials	1 Set
9.	E&C: Erection of PEB security room architectural items	1 Set
01 10	E&C : Erection and Commissioning of Electrical Services	1 Set

7.0.0. **BIDDER'S SCOPE OF SERVICES**

7.1.0. **LIST OF MAJOR SERVICES INCLUDED IN BIDDER'S SCOPE:**

I. Detailed Engineering and certification of the design from NITs/IITs
II. Submission and obtaining approval of all engineering documents before start of works
III. Engineering for procurement
IV. Preparation of all MTOs and MRs, as required
V. Ordering of all materials
VI. Overall Project Management and progress reporting to owner/consultant
VII. Expediting suppliers and sub vendors
VIII. Procurement
IX. Manufacture, fabrication and assembly at works and site
X. Inspection and testing including third party Inspection
XI. Painting at works , painting at site including touch up paint
XII. Dispatch and transportation of materials, consumables, construction aids etc to site.
XIII. Establishment of site office complete with all facilities and communication network, as required
XIV. Storage, loading, unloading, security and handling at site

XV. Construction at site including fabrication, erection and installation. Supervision of work during fixation of foundation bolts. Grouting, alignment and necessary activities for installation of complete Pre-Engineered buildings.
XVI. Insulation with cladding and painting
XVII. Engineering for interfacing all inputs and outputs
XVIII. Site clearing and cleaning
XIX. Liaisoning with other contractors in the plant
XX. Handing over the PEBs to the owner
XXI. Supply of all test reports / certificates
XXII. Providing as built drawings

Notes:

Bidder to note that the above list is not exhaustive and any other service required as per the intent of this specification / project requirements /good engineering practice shall be deemed to be included in bidder's scope without any commercial implication to the purchaser.

8.0.0. **CLARITY OF SCOPE IN OTHER AREAS (In addition to Cl.7.0.0):**

S.No	Item	By BHEL	By Vendor	Remarks
1	Complete civil foundation works for all the PEB inverter rooms and the security room	Yes	No	Vendor shall submit the loading details for foundation design
2	RCC cable trenches within all inverter rooms	Yes	No	
3	Flooring works within all inverter rooms and security room	Yes	No	
4	Plinth protection around all inverter rooms and security room	Yes	No	
5	Steps/ ramps on front/back sides of the room as applicable	Yes	No	
6	Composite slab, if adopted by bidder, incl. all shuttering, reinforcement, bolts, decking, form work, fasteners, painting, finishes, waterproofing, etc.	No	Yes	
7 01	Electrical works including supply and E&C of wiring, room appliances (lights, ceiling fans, exhaust fans, ventilators, etc), switch boards, MCB boxes etc for the inverter rooms and the security room as specified in clause 9.6.0	No	Yes	
8	Cut out/ provision of supports & fixtures for the room appliances	No	Yes	

9.0.0. **TECHNICAL DETAILS**

9.1.0. **Design, supply and erection of PEB invertor rooms/PEB security room**

9.1.1 Design and supply of PEB structural materials

a) After receipt of BHEL PO, following documents shall be submitted to BHEL/NTPC 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/NTPC for approval.

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 NTPC approved drawings. Raw materials for steel sections, sheets etc shall be of reputed make such as Jindal Steel and Power, RINL, SAIL, TISCO, JSW Steel, Essar Steel, Ispat Industries, Lloyd Steel Industries. Vendor shall take prior approval from BHEL for the make prior to proceeding with procurement action.

d) Vendor shall also supply the J bots/nuts/washers, alignment plates and other related hardware that are used for positioning and anchoring of the PEB structures to the RCC foundation plinth.

e) All the items shall be supplied directly to the project site.

f) Relevant clauses of "**Detailed specification of PEB inverter room / PEB security room**" section shall be adopted.

9.1.2 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/NTPC 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 (except the electrical wiring and appliances as listed under BHEL scope) 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. Raw materials for steel sections, sheets etc shall be of reputed make such as Jindal Steel and Power, RINL, SAIL, TISCO, JSW Steel, Essar Steel, Ispat Industries, Lloyd Steel Industries. 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 inverter room / PEB security room**" section shall be adopted.

9.1.3 Erection of structures of PEB invertor room/ PEB security room

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/NTPC 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 in order to provide the needed support/guidance to the BHEL civil construction team at site.

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 inverter room / PEB security room**" section shall be adopted.

9.1.4 Erection of architectural

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/NTPC 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.

9.2.0. Detailed specification of PEB inverter room / PEB security room

9.2.1. The Inverter room / Security 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 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 structural item like columns, rafters, beams, purlins, steel sheets, insulation etc and also each architectural item like doors, windows, rolling shutters etc of PEB shall be suitable for complete life of solar plant. The construction methodology for PEB shall also be submitted for BHEL/NTPC approval before start of works.

9.2.2. 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 BHEL/NTPC for approval before actual starts of the work.

9.2.3. The architectural drawing of double skin insulated roofing & cladding system are given in the tender relevant drawing (Pre Engineered Building Drawing No: 5711-004-POC-A-005, Rev A) 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.

9.2.4. Bidder shall submit design calculations, duly checked and certified by IITs/NITs for approval of BHEL/NTPC

9.2.5. Bidder 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 BHEL/NTPC approved drawings. Bidder's scope of supply of structural materials shall include the J bots/nuts/washers, alignment plates and other related hardware that are used for positioning and anchoring of the PEB structures to the RCC foundation plinth. Raw materials for steel sections, sheets etc shall be of reputed make such as Jindal Steel and Power, RINL, SAIL, TISCO, JSW Steel, Essar Steel, Ispat Industries, Lloyd Steel Industries. Bidder shall take prior approval from BHEL for the make prior to proceeding with procurement action.

9.2.6. Bidder shall submit itemized description, quantity, make, model etc for architectural items for approval of BHEL/NTPC. The items shall include all items (except the electrical wiring and appliances as listed under BHEL scope) 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. Raw materials for steel sections, sheets etc shall be of reputed make such as Jindal Steel and Power, RINL, SAIL, TISCO, JSW Steel, Essar Steel, Ispat Industries, Lloyd Steel Industries. Vendor shall take prior approval from BHEL for the make prior to proceeding with procurement action.

9.2.7. **Structure & 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 IS811 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.

9.2.8. **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.

9.2.9. **Roof & 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 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.

9.2.10. **Roof Insulation & Type:**

Both metal sheets shall have an under insulation of minimum 80 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 BHEL/NTPC before start of work.

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

9.2.12. **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 NTPC/BHEL.

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.

9.2.13. **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.

9.2.14. **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

9.2.15. **Rolling Shutters:**

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.

9.2.16. **Painting 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

9.2.17. **Lighting:**

Vendor shall ensure that the room is designed to utilize maximum natural light during the day. ~~BHEL scope includes furnishing the room with electric lights to achieve average illumination level of 150 Lux.~~ 01

9.2.18. **Design Parameters & 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 170 km/hr. Design wind load co-efficient shall be as per IS: 875-III, however the minimum value of these factors shall be considered as K1=1.0, K2=1.0 & K3 =1.0 for the design of PEB.

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 IS800 2007.

b) The limiting permissible horizontal deflection for as per IS800 2007 code.

9.2.19. **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 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.

Table-1

Group	Grade/Ref. Code	Yield Strength (min)	Tensile Strength (min)	Coating Class Designation	BMT	+ve Tole-rance	Upper Limit BMT	-ve Tole-rance	Lower Limit BMT
		MPa	MPa	on	mm	mm	mm	mm	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 A792 M	340	410						
	S350GD/ EN10326	350	420						
Note: Minimum elongation % shall be as per relevant code & standard									

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.

9.3.0. **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/mm^2 at 28 days.

9.4.0. **Applicable Codes & Standards:**

Following codes and standards (latest editions) including their latest addenda shall be followed wherever applicable unless otherwise specified:

Sl No	Code	Description
1	IS:875-I	Code of Practice for Design Dead Loads for Building and Structures
2	IS:875-II	Code of Practice for Design Imposed Loads for Building and Structures
3	IS:875-III	Code of practice for design loads (other than earthquake) for buildings and structures.
4	IS:1893	Criteria for earthquake resistant design of structures.
5	IS:4326	Code of Practice for earthquake resistant design and construction of buildings
6	IS: 800	Code of practice for use of structural steel in general building construction
7	IS: 801	Code of practice for use of cold-formed light gauge steel structure members
8	IS:802	Code of practice for use of structural steel in overhead transmission line towers
9	IS:806	Code of practice for use of steel tubes in general building construction
10	IS:808	Dimensions for hot rolled steel beam, column channel and angle section
11	IS:811	Specification for cold formed light gauge structural steel sections
12	IS:813	Scheme of symbols for welding.
13	IS:1079	Hot rolled carbon steel sheet and strip – specification
14	IS:2062	Hot rolled medium and high tensile structural steel – specification
15	IS:4923	Hollow steel sections for structural use.
16	IS:1161	Steel tubes for structural purpose
17	IS:2721	Galvanized steel chain link fence fabric – specification
18	IS :4736	Hot dip zinc coatings on mild steel tubes
19	IS:4759	Hot dip zinc coatings on structural steel and other allied products – specification
20	IS:1868	Anodic coatings on aluminium and its alloys
21	IS:2395-I	Paintings of concrete, Masonry and plaster surfaces – code of operations and workmanship
22	IS:2995-II	Code of practice for painting concrete, masonry and plaster surfaces: schedule

23	IS:1477-I	Code of practice for painting of ferrous metals in buildings: pre-treatment
24	IS:1477-II	Code of practice for painting of ferrous metals in buildings: painting
25	IS:1905	Code of practice for structural use of un-reinforced masonry
26	IS:3067	Code of practice for general design details and preparatory works for damp/water proofing
27	SP:6	Handbook for structural engineers (all parts)
28	SP:7	National Building Code of India
29	SP:16	Design Aids for reinforced concrete to IS:456
30	SP:20	Handbook on masonry design and construction
31	SP:22	Explanatory handbook on codes for earthquake engineering
32	SP:24	Explanatory handbook on Indian Standard Code of Practice for plain and reinforced concrete
33	SP:25	Handbook on causes and prevention of cracks in buildings
34	SP:32	Handbook on functional requirements of industrial buildings
35	SP:34	Handbook of concrete reinforcement & detailing

Unless covered otherwise by Indian codes & standards and in case nothing to the contrary is specifically mentioned elsewhere in the specifications, the latest editions (as applicable as on date of bid opening), of the codes and standards given below shall also apply:

(a) Japanese Industrial Standards (JIS)

(b) American National Standards Institute (ANSI)

(c) American Society of Testing and Materials (ASTM)

(d) American Society of Mechanical Engineers (ASME)

(e) American Petroleum Institute (API)

(f) Standards of the Hydraulic Institute, U.S.A.

(g) International Organization for Standardization (ISO)

(h) Tubular Exchanger Manufacturer's Association (TEMA)

(i) American Welding Society (AWS)

(j) National Electrical Manufacturers Association (NEMA)

(k) National Fire Protection Association (NFPA)

(l) International Electro-Technical Commission (IEC)

(m)Expansion Joint Manufacturers Association (EJMA)

(n) Heat Exchange Institute (HEI)

Other International/ National standards such as DIN, VDI, BS, GOST etc. shall also be accepted for only material codes and manufacturing standards, subject to the Employer's approval, for which the Bidder shall furnish, along with the offer, adequate information to justify that these standards are equivalent or superior to the standards mentioned above. In all such cases the Bidder shall furnish specifically the variations and deviations from the standards mentioned elsewhere in the specification together with the complete word to word translation of the standard that is normally not published in English.

In case of any contradiction between various referred standards/ specifications/ data sheets and statutory regulations, the requirement of Technical Specification shall govern. Decision

of purchaser in this regard will be final and will be binding on the bidder without any commercial or delivery implication to BHEL.

For provisions not covered by any of the codes & standards, applicable good engineering practices and norms shall govern.

In case of any change in codes, standards & regulations between the date of bid opening and the date when vendors proceed with fabrication, the Employer shall have the option to incorporate the changed requirements or to retain the original standard. It shall be the responsibility of the Contractor to bring to the notice of the Employer such changes and advise Employer of the resulting effect. The cost effect on account of any additional requirements as per the revised codes and standard shall be borne by the bidder.

9.5.0. **STATUTORY REQUIREMENTS**

In addition to the codes and standards specifically mentioned in the relevant technical specifications for the equipment / plant / system, all equipment parts, systems and works covered under this specification shall comply with all currently applicable statutory regulations and safety codes of the Republic of India as well as of the locality where they will be installed, including the following:

(a) Bureau of Indian Standards (BIS)
(b) Indian electricity act
(c) Indian electricity rules
(d) Indian Explosives Act
(e) Indian Factories Act and State Factories Act
(f) Indian Boiler Regulations (IBR)
(g) Regulations of the Central Pollution Control Board, India
(h) Regulations of the Ministry of Environment & Forest (MoEF), Government of India
(i) Pollution Control Regulations of Department of Environment, Government of India
(j) State Pollution Control Board.
(k) Rules for Electrical installation by Tariff Advisory Committee (TAC).
(l) Any other statutory codes / standards / regulations, as may be applicable.

9.6.0. **ELECTRICAL SERVICES** 01

A. Supply, erection and commissioning of following electrical services items shall be in the scope of PEB vendor.

A.1 Electrical services BOQ per Inverter room

S. no.	DESCRIPTION (FIXTURES / LAMPS / ACCESSORIES)	UNIT	QTY
1	40W LED batton type fixture (Bajaj Catalog no. BICDP 40W LED or Equivalent model of approved makes)	Nos	18
2	30W LED Street lighting fixture (Bajaj Catalog no. BCLST 30W LED or Equivalent model of approved makes)	Nos	4
3	1200mm long 150 deg bend 50NB pipe with 2 nos suitable clamp with base	Nos	4
4	SSB-3 surface mounted swbd with 3 nos 5A piano type switches with provision for fan regulator (modular type)	Nos	4

5	Surface mounted 5/15A receptacle with switch	Nos	3
6	32A TPN welding receptacles (Safe area)	Nos	1
7	3 Way 1Ph Indoor type UPS Power distribution board (Surface mounted) with 32A DP RCBO at the incomer & 3 Nos 10A SPN MCB at the outgoing	Nos	1
8	6 Way TPN Indoor type Lighting Panel (Surface mounted) with 32A, 4pole RCBO at the incomer & 6 Nos 10A SPN MCB at the outgoing	Nos	1
9	Ceiling Fan 1200mm blade	Nos	2
10	Modular Electronic Regulator for Ceiling Fan	Nos	2
11	Exhaust Fan (3ph, 0.55kW) with local starter	Nos	2
12	Data connector Box (Surface Mounted)	Nos	1
12	Wires, cable, glands (Double compression Nickel plated brass along with PVC shroud), lugs(tinned copper heavy duty), conduits (rigid and flexible), accessories for Conduits (All conduits shall be 25mm dia heavy duty PVC type) for above item-1 LOT	Lot	1
13	E&C for above items (lumpsum)	Lot	1

A.2 Electrical services BOQ per Security room

S. no.	DESCRIPTION (FIXTURES / LAMPS / ACCESSORIES)	UNIT	QTY
1	40W LED batton type fixture (Bajaj Catalog no. BICDP 40W LED or Equivalent model of approved makes)	Nos	1
2	Surface mounted 5/15A receptacle with switch (Industrial metal clad type)	Nos	1
3	SSB-2 surface mounted swbd with 2 nos 5A piano type switches (modular type)	Nos	1
4	Ceiling Fan 1200mm blade	Nos	1
5	Surface mounted switchboard with 1 no. Electronic Regulator for Ceiling Fan with individual Switch	Nos	1
6	Data connector Box (Surface Mounted)	Nos	1
7	E&C for above items (lump sum)	Lot	1

Notes:

1. Illumination Layout shall be provided by BHEL after order placement. Illumination fixture, conduits etc. as mentioned in above table shall be erected as per the illumination layout.
2. Installation & commissioning of above equipments and its associated cabling work within the PEB / Security room shall be in the scope of PEB vendor.
3. Above items shall be supplied as per the below makes and technical specification furnished elsewhere in this document.

A.2 MAKE OF COMPONENTS:

Item	Vendor	Remark
Lighting panel	Positronics, Vadodara	BOIs preferably with VDE/CE/UL/CSA marked or BIS approved with valid CML no. VDE/CE/UL/CSA marking certification preferably from third party agency or BIS

		approval letter shall be submitted for NTPC, verification.
	Control Devices, Kolkata	
	Jasper, Noida	
	Conquerent control systems, Manesar	
	Havells, Faridabad	
	Novateur electrical & distribution system, Murthal	
	Avaid Technovator, Manesar	
	Switching circuits, Kolkata	BOIs preferably with VDE/CE/UL/CSA marked or BIS approved with valid CML no. VDE/CE/UL/CSA marking certification preferably from third party agency or BIS approval letter shall be submitted for NTPC, verification.
	Tricolite, Sahibabad/Manesar	
	Hindustan control & equipment ltd, Kolkata	
	Maktel, Vadodara	
	Jakson, Greater Noida	
	Vidyut Control, Ghaziabad	
	Adlec Power, Rohad (Jhajjar)	
	Pyrotech (Udaipur)	
	Anand Power limited, Noida	
	L&T, Mumbai/ Coimbatore/ Ahmednagar	BOIs preferably with VDE/CE/UL/CSA marked or BIS approved with valid CML no. VDE/CE/UL/CSA marking certification preferably from third party agency or BIS approval letter shall be submitted for NTPC, verification.
	GE, Bangalore	
	Siemens, Mumbai	
	C&S Electric, Noida/Hardwar	
	Schneider, nasik	
	Unilec, Gurgaon	
LED Lighting fixtures	Wipro, Pune	
	Bajaj, Mumbai	
	Surya Roshni, Noida	
Cable Lugs	Dowell, Mumbai	
	Billets Electro worke ltd., Umbergaon	
	Chetna, Nasik	
MCB	Any make-Model shall have mark of CE/VDE/UL/CSA/BIS with CML no.	
Axial flow Fans	Khaitan, Kolkata	
	Marathon Electric, Kolkata	
	CB-Doctor, Ahmedabad	
	Solyvent Flakt, Kolkata	
	Advance ventilation, Sonepat	
	Krugar, Singapore	
	TCH Nadi, Chennai	
	Almonard, Chennai	
Propeller Fan (Up to 2 HP)	Khaitan, Kolkata	
	Marathon Electric, Kolkata	
	CB-Doctor, Ahmedabad	

	Solyvent Flakt, Kolkata	

B. Erection of following items for fire detection and alarm system shall be in the scope of PEB vendor. Below item shall be free issued to vendor.

B.1) FDA BOQ for each Inverter Room and 1 no. security room			
Sl. No.	**Items**	**Quantity**	**Unit**
1	Local Fire alarm Panel (Applicable for only 1 IR)	1	No.'s
2	Multi sensor detector	8	No.'s
3	Hooter cum Strobe	2	No.'s
4	Interface Modules	2	No.'s
5	MCP	2	No.'s
6	Isolator Modules	2	No.'s
7	Loop Cable (2C x 1.5 sqmm)	60	mts.
8	Power cable (3C x 2.5 sqmm)	20	mts.
9	24 Volt power supply for Hooter with battery back up (wall mounted)	1	No.
10	Erection for above item	1	Lot

Notes:

1. FDA layout shall be provided by BHEL after placement of order. Erection of above equipments and its associated cabling shall be carried out as per this layout.
2. Above material shall be free issued by BHEL, **however supply of all erection hardware's like saddle, clamps, screws, nut, bolt, glands, lugs etc. required for Eerection of above equipments shall be in the scope of vendor**. Installation of above equipments and its associated cabling work within the PEB / Security room shall be in the scope of PEB vendor.
3. Vendor's terminal point for cabling inside PEB shall be at the boundary point of PEB at two locations i.e. at loop in and loop out cable route.
4. All the cables inside the building shall be directly mounted/routed on ceilings/walls.
5. In addition to above equipment's provision of fixing wall mounted equipment's like CCTV camera, Battery Isolation box, Portable fire extinguishers, wall mounted DB's, local starter inside PEB, security room shall be in the scope of PEB vendor. Details shall be finalized during detail engineering.

TECHNICAL SPECIFICATION FOR ELECTRICAL SERVICES

Lighting panels shall be powder coated with colour shade RAL9002. Lighting panels shall have IP55 degree of protection.

Wires of different phase shall normally run in separate conduit.

Electrification of all building shall be carried out as per IS 732-1989, IS 4648-1968 and other relevant standards.

All luminaries and their accessories and components shall be of type readily replaceable by available Indian makes.

Following test reports to be submitted for LED chip/LED luminaires:

a) LED parameters like Lumen per watt, CRI, Beam angle from manufacturer.

b) LM 80/IS: 16105 report.
c) LM 79/IS: 16106 report

LIGHTING WIRES

Lighting wires shall be 1100 V grade, light duty PVC insulated unsheathed, stranded copper/ aluminium wire for fixed wiring installation. Colour of the PVC insulation of wires shall be Red, Yellow, Blue and Black for R, Y, B phases & neutral, respectively. Minimum size of wire shall not be less than 1.5 sq.mm Copper for lighting fixture & 4 Sq.mm Copper for receptacles.

Lighting panels etc. shall be earthed by two separate and distinct connections with earthing system.

RECEPTACLE

Receptacles boxes shall be fabricated out of MS sheet of 2mm thickness and hot dipped galvanised or of die-cast aluminium alloy of thickness not less than 2.5 mm. The boxes shall be provided with two nos. earthing terminals, gasket to achieve IP55 degree of protection, terminal blocks for loop-in loop-out for cable of specified sizes, mounting brackets suitable for surface mounting on wall/column/structure, gland plate etc. The ON-OFF switch shall be rotary type heavy duty, double break, AC23 category, suitable for AC supply. Plug and Socket shall be shrouded Die-cast aluminium. Socket shall be provided with lid safety cover. Robust mechanical interlock shall be provided such that the switch can be put ON only when the plug is fully engaged and plug can be withdrawn only when the switch is in OFF position. Also cover can be opened only when the switch is in OFF position. Wiring shall be carried out with 1100 V grade PVC insulated stranded aluminium/copper wire of adequate size. The Terminal blocks shall be of 1100 V grade. The Terminal blocks shall be of 1100 V grade made up of unbreakable polymide 6.6 grade with adequate current rating and size. The welding receptacles shall be provided with inbuilt ELCB rated for suitable mA sensitivity.

GALVANISING

Galvanising of steel components and accessories shall conform to IS:2629 , IS4759 & IS:2633. Additionally galvanising shall be uniform, clean smooth, continuous and free from acid spots.

The amount of zinc deposit over threaded portion of bolts, nuts, screws and washers shall be as per IS:1367. The removal of extra zinc on threaded portion of components shall be carefully done to ensure that the threads shall have the required zinc coating on them as specified.

CONDUITS/PIPES/DUCTS INSTALLATION

GI pull wire of adequate size shall be laid in all conduits before installation. Metallic conduit runs at termination shall have two lock nuts wherever required for junction boxes etc. Conduit runs/sleeves shall be provided with PVC bushings having round edge at each end. All conduits/pipes shall have their ends closed by caps until cables are pulled. After cables are pulled, the ends of conduits/pipes shall be sealed with Glass wool/Cement Mortar/Putty to prevent entrance of moisture and foreign material. Exposed conduit/pipe shall be adequately supported by racks, clamps, straps or by other approved means. Conduits /pipe support shall be installed square and true to line and grade with an average 1Meter spacing between the supports.

10.0.0 GENERAL TECHNICAL REQUIREMENTS:

The life span to be considered in the design, materials and component selection shall be minimum of 25 years.

For the design of the plant, it is necessary to consider the requirements (by suitably planning the layout) of the convenience of inspection, cleaning, maintenance and repair.

Equipment design and engineering shall incorporate adequate safety features (as per applicable specifications of respective installation as well as Health, Safety and Environment Codes & Standards applicable for the subject project) to provide protection to operating personnel, equipment and environment.

If during the execution of works, it is found that there is interference with other facilities/structures, the Bidder shall revise his design/detailed drawings to clear the interference and shall provide all necessary measures for the safety of structures under construction.
No claim in terms of cost or relaxation in time shall be entertained for any redesign, rework and for the safety measures provided. If at any stage of work, any dismantling or modification or relocation of any facilities is required to be done to complete the work in bidder's scope and which has been agreed by the Owner, the same shall be done by the bidder at no extra cost or time implication to the Owner. All such changes will be executed only after the proposed drawings and work plan are approved by the purchaser.

The Bidder shall take all necessary precautions to protect all the existing equipment, structures, facilities and buildings etc. from damage. In case any damage occurs due to the activities of the Bidder on account of negligence, ignorance, accidental or any other reason whatsoever, the damage shall be immediately made good by the Bidder at his own cost to the satisfaction of the Owner. The Bidder shall also take all necessary safety measures at his own cost, to avoid any harm or injury to his workers and staff from the equipment and facilities of the power station.

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.

11.0.0 CONSTRUCTION REQUIREMENT:

Erection & commissioning of all the items supplied by bidder is included in bidder's scope.

Bidder is advised to visit the project site and appraise himself about the local conditions and infrastructure available in the area for fulfilling their commitments under the contract. BHEL will not admit any claims whatsoever on account of Contractor's non-familiarization of local conditions.

Bidder to note that the fronts for erection & commissioning activity of the PEBs shall be made available to the bidder, as & when available and ready at site. Bidder shall plan his E&C activities accordingly.

Bidder to take cognizance of the fact that the E&C activities of PEBs, being dependent on the progress of the erection of other agencies at site, may get delayed due to non-availability of fronts etc. due to reasons beyond purchaser's control. Bidder to note that will not be entitled to raise any extra claim on account of these delays. All the cost of any eventual delay in the E&C of the PEBs shall be deemed to be included in the price quoted by the bidder.

The contractor shall establish an office at site and keep posted an authorized representative for the purpose of the contract till the contract closure.

Bidder shall organize construction power supply on their own. Accordingly, if required, DG sets of suitable capacity shall be deployed by the bidder for construction works.

Similarly, water required for construction works shall be organized by the bidder. Bidder shall organize bore wells at the site if required. In case bore well is not successful, vendor shall make their own alternate arrangements (water tankers etc).

Free open space shall be provided by BHEL for storage and fabrication works on "on as is where is basis". Material may have to be brought up to project site by traveling. Bidder shall ensure the good housekeeping practices and safety, security of the supplied items. Necessary arrangement for site store, shade / cover for material etc shall be arranged by bidder. Exact location of the storage shall be informed as per project specification otherwise shall be asked by bidder specifically.

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 bidder. Bidder shall arrange all the items required like scaffolding, rope, sling etc. for construction of the facilities in their scope. Bidder to ensure availability of required manpower (skilled, semiskilled, unskilled, certified etc) for the construction. Bidder shall bring to the notice of the purchaser sufficiently prior to an event if any resource is under the scope of supply of the purchaser. It is bidder's responsibility to ensure smooth progress of construction and at any point of time progress shall not get hindered due to non-availability of resources.

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 bidder.

All necessary measuring instruments such as measuring tapes, digital multimeters, electrical testers, meggers etc shall be organized by the bidder.

The contractor shall submit to the employer, draft instruction manual specifically compiled for the project, containing full detail required for E&C and Maintenance if any. The E&C manuals/checklists shall be submitted prior to the commencement of erection activities. The erection manual should contain following as minimum :

a) Erection Strategy
b) Sequence of erection
c) Erection instructions
d) Critical checks and permissible deviations/tolerances.
e) List of tool, tackles. Heavy equipment like cranes dozers, etc.
f) Bill of materials
g) Procedure for erection
h) General safety procedures to be followed during erection/installation
i) Procedure for initial checking after erection.
j) Procedures for testing and acceptance norms.
k) Procedure/ Check list for pre-commissioning / commissioning activities
l) Safety precautions to be followed in electrical supply distribution during erection.

The contractor shall maintain at his site office up-to date copies of all drawings, specifications and other contract documents and any other supplementary data complete with all the latest revisions thereto. The contractor shall also maintain in addition the continuous record of all changes to the above contract documents, drawing, specifications, supplementary data etc. effected at the field and on completion of his total assignment under the contract shall incorporate all such changes on the drawings and other engineering data to indicate as installed conditions of the installation furnished and erected under the contract. Such drawings and engineering data shall be available for inspection and review to the purchaser.

The contractor shall keep the purchaser informed in advance regarding his field activity plans and schedules for carrying out each part of the work. Any review of such plan or schedule or method of work by the purchaser shall no relieve the contractor of any of his responsibilities towards the field activities. Such reviews shall also not be considered as an assumption of any risk of liability by the purchaser or any of his representatives and no claim of the contractor will be entertained because of the failure or inefficiency of any such plan or method of work reviewed. The contractor shall be solely responsible for the safety adequacy and efficiency of the installations and his erection method.

All the materials furnished under the contract and arriving at site shall be promptly received, unloaded and transported and stored in the storage space by the contractor. Contractor shall be solely responsible for any storages or damage in transit, handling and / or in storage and erection of the materials at site. Any demurrage, wharfage and other such charges claimed by the transporters, railways etc. shall be to the account of the contractor.

Bidder 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 the bidder.

Bidder 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.

Bidder 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. Bidder 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 and handing over of the facilities to purchaser of all the PEB rooms shall be the responsibility of bidder.

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.

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.

Bidder shall maintain updated labour register, with name, age, qualification, salary, attendance details etc at the site.

It is advised to Bidders to visit the site and ascertain all site intensive requirements such as Health, Safety and Environment (HSE) requirement, work permits and other special requirements of site etc. Bidder shall ensure safety of man and machinery during work at site. For this necessary safety measures like use of PPEs, use of danger board/tapes etc to be ensured by the bidder. It is the ultimate responsibility of the bidder in all respect to prevent accidents at the site and safeguard man and machinery from accidents.

Bidder shall, at the completion of every work, clear off the debris, which resulted out of the work.

All defects in erection shall be corrected to the satisfaction of the purchaser. The dismantling and reassembly of the contractor furnished installations to remove defective parts, replace parts, or make adjustments shall be included as a part of the work under these specifications.

Any damages on the other buildings, structures etc of the site, if attributable to the acts of labour / employees of bidder, shall be rectified and made good by the bidder at their own cost and without any delay.

Surplus/ excess material, scrap. Is the property of purchaser and shall have to be returned by the bidder to purchaser's store/ warehouse within the plant at no extra cost.

Bidder to note that they have to comply with the special requirements of project site, if any, during order execution stage without any price implication to the Purchaser.

Bidder shall prepare daily progress report, weekly progress report, erection plan etc and submit the reports to the purchaser on regular basis. Formats/protocols as required to record event completion is required to be prepared by the bidder. Prior to the inspection associated with the completion of an event, it shall be responsibility of the bidder to submit and get approval of related formats from the purchaser. Bidder to note, any such record of event completion does not relieve the bidder from the obligation to complete the facilities in all respect in accordance with this specification.

Tools & Tackles: The bidder shall supply with the items one complete set of all special tools and tackles and other instruments required for the erection, assembly, disassembly and proper maintenance of the installations. These special tools will also include special material handling equipment, jigs and fixtures for maintenance and calibration / readjustment, checking and measurement aids etc. A list of such tools and tackles shall be submitted by the bidder along with the offer. The price of each tool / tackle deemed to be included in the total bid price. These tools and tackles shall be separately packed and sent to site. The contractor shall also ensure that these tools and tackles are not used by him during construction. All the tools and tackles shall be of reputed make acceptable to the purchaser.

QUALITY ASSUARANCE:

11.1.0 All materials, components, and equipment covered under this specification shall be procured, manufactured, erected, commissioned and tested at all the stages as per a comprehensive Quality Assurance Program (QAP). It is bidder's responsibility to draw such QAP duly approved by the purchaser. Schedule of finalization of such quality plans will be finalized before award on enclosed format (Refer Annexure no. 5).

11.2.0 Bidder shall submit their comprehensive Manufacturing Quality Plan (MQP) and Field Quality Plan (FQP) on enclosed format for approval of BHEL/NTPC.

11.3.0 It will be the responsibility of the bidder to adhere to the approved Quality Plans. The bidder shall further identify specific hold points beyond which work will not proceed without purchaser's consent so as to further ensure that he performs the above quality functions effectively.

11.4.0 MQP will detail out for all the components, various tests/inspection, to be carried out as per the requirements of this specification and standards mentioned therein and quality practices and procedures followed by contractor's/subcontractor's/sub-supplier's Quality Control Organization, the relevant reference documents raised etc., during all stages of material procurement, manufacture, assembly and final testing/performance testing. The quality Plan shall be submitted on electronic media e.g. email in addition to hard copy, for review and approval. After approval the same shall be submitted in compiled form on CD-ROM.

11.5.0 Field Quality Plans will detail out for all the items, the quality practices and procedures etc. to be followed by the bidder at site, during various stages of site activities starting from receipt of materials at site.

11.6.0 Bidder to note that all the cost involved in the various Inspection and testing as per approved QAPs / ITPs shall be deemed to be included in bidder's quoted price. Bidder at no point of time shall be eligible to raise any extra claim on account of any requirement necessitated as a part of approval of QAPs/ ITPs.

11.7.0 At various stages of manufacturing, procurement, construction, as per approved QAP inspection/testing shall be carried out by Inspection Agency (BHEL / Third Party appointed by BHEL / Customer / Customer appointed third party). The inspection agency shall be indicated in the quality plan and shall be as per the approved quality plan.

11.8.0 Bidder shall notify in writing to the Purchaser, at least two weeks (Ten working days) in advance of the date and the place at which the items will be ready for witnessing of inspection / testing by Purchaser and / or PMC. In case any postponement becomes necessary, the CONTRACTOR shall provide written notification at least 48 hours prior to the original scheduled date.

11.9.0 In case bidder find any deviation or non- conformity with respect to the agreed specifications, during manufacturing of the item and where corrective action is not feasible, the bidder shall report the same to Purchaser and / or PMC in the designated "Waiver / Deviation Request" format and seek prior approval from Purchaser / PMC before proceeding with the job.

11.10.0 Bidder after satisfying that all inspection requirements as per approved ITP and applicable specifications / documents have been taken care by Inspection Agency, shall submit copy of the Inspection Certificate and all Quality control records to Purchaser in requisite copies along with Statutory Certificates if any, duly endorsed by their Quality Control Manager.

11.11.0 Purchaser and / or PMC – End customer reserve the right to carry out surprise checks on all material either at manufacturer's works or at site. In case of any rejection at site, the whole lot will be rejected and bidder shall get the entire lot replaced without any time or delivery implication to the purchaser.

11.12.0 Inspection Agency shall check the calibration status and traceability of all instruments used by the supplier, for testing. In case, TPIA uses their own instruments for testing purposes, similar certification shall be ensured.

11.13.0 Bidder shall submit, copy of each Inspection Certificate (IC) / Inspection Release Note (IRN) issued by Inspection Agency, along with all attachments mentioned therein.

11.14.0 No material shall be dispatched from the manufacturer's works before the same is accepted, subsequent to pre-dispatch final inspection including verification of records of all previous test/inspections by authorized Inspection Agency and duly authorized for dispatch by issuance of Material Despatch Clearance Certificate (MDCC).

12.0.0. **MARKING , PACKING AND DESPATCH**

12.1.0. MARKING

12.1.1. All items shall be marked (stamped/etched) in accordance with the applicable Code/standard/specification. In addition, the item code, if available, shall also be marked.

12.1.2. For ease of identification, the color of painted strip (wherever required) shall be as per the applicable standard.

12.1.3. Paint or ink for marking shall not contain any harmful metal or metal salts which can Cause corrosive attack either ordinarily or in service. Special items/smaller items shall have attached corrosion resistant tag providing salient features.

12.2.0. DESPATCH

12.2.1. All the materials shall be divided into several sections for protection and ease of handling during transportation. The equipment shall be properly packed for transportation by hip/rail or trailer.

12.2.2. Special notations such as 'Fragile', 'This side up', 'Center of gravity', 'Weight', 'Owner's particulars', 'PO Nos.' etc. shall be clearly marked on the package together with other details as per purchaser order.

12.2.3. The equipment may be stored outdoors for long periods before installation. The packing shall be completely suitable for outdoor storage in areas with heavy rains/high ambient temperature, unless otherwise agreed.

12.3.0. The following minimum packing procedures shall be followed :

12.3.1. All items shall be dry, clean and free from moisture, dirt and loose foreign material of all kind.

12.3.2. All items shall be protected from rust, corrosion, and mechanical damage during Transportation, shipment and storage.

12.3.3. Rust preventive on machined surfaces to be welded shall not be harmful to welding and shall be easily removable with a petroleum solvent.

12.3.4. Ends shall be suitably protected, and the protectors shall be securely and tightly attached.

12.3.5. Each variety and size of item shall be supplied in separate packaging marked with the purchase order no., item code (if available), and the salient specifications.

12.3.6. Prior to shipment components of the unit shall be completely cleaned, Flange faces, threaded portion and other machined surfaces shall be protected by coating with easily removable rust preventive. All the items shall be properly packed to prevent damage during transit damage, loading, unloading and storage.

13.0.0. **DOCUMENTATION:**

13.1.0. MASTER DOCUMENT LIST

13.1.1. A master documentation shall be prepared during kick off meeting identifying all the DOCUMENTS / DRAWIGS to be submitted by the bidder as part of documentation.

13.1.2. Vendor shall ensure submission of all documentation as per approved Master Document List.

13.1.3. The following minimum documentation shall be submitted by the vendor:

I. All PEBs GA drgs indicating base plates, anchor bolts connection Detail, purlin, roof panels, wall panels, scope demarcation etc.
II. BOM for Structural items.
III. BOM of architectural items with detail of item wise make, model Quantity etc.
IV. Design analysis in STADD.PRO along with loading detail on Foundation.
V. Design certified by NIT/IIT
VI. Civil interface details
VII. Welding specification charts
VIII. Nondestructive Testing specifications
IX. Quality plan
X. Painting schedule & procedure (shop painting & site painting)
XI. Packing procedure
XII. Erection drawings
XIII. Site storage procedure

XIV. Erection procedure
XV. Testing procedure
XVI. 'AS BUILT' drawings
XVII. Any other document, as deemed necessary BY BHEL, during detail engineering or erection – commissioning stage.

13.2.0. All the drawings / documents shall be submitted as per the following details:

Sl. No.	Document Name / Type	To Contain	Required With Offer	Required After P.O	
			Compliances from Bidder	No. of Sets Required – Engg. & Approval/ Review Activities.	No. of Sets Required- For Site & Customer Submission
1	(a) Drgs, , Data Sheets , Catalogues. BOM etc.	Adequate Information & essential for proper Technical Evaluation of the Offers. Other Information to be furnished as defined in the applicable Tech Specs. Confirmation to BHEL specification in totality	Y	–	–
2	Pre-bid queries	To be clearly listed, furnishing detailed reasons			
3	Deviations if any	No deviation will be permitted. Refer details elsewhere in this document.	Y	–	–
4	Confirmation to BHEL spec in totality		Y	–	–
5	Master Document List	**a)** List of all Documents & Drgs., Spares Items etc. which are applicable for the Project. They shall be group wise enlisted in MDL Doc. **b)** Submission of Up-dated MDL Doc.is required at the time of each submission of Drgs./Doc or group of Drgs. / Docs..	-	3	16
6	Project completion activity "Bar-	Required for packages & for contracts and also for projects where Erection &	Compliance required to	3	16

Sl. No.	Document Name / Type	To Contain	Required With Offer	Required After P.O	
			Compliances from Bidder	No. of Sets Required – Engg. & Approval/ Review Activities.	No. of Sets Required- For Site & Customer Submission
	chart" matching with BHEL Project Schedule	Commissioning activities are in bidder scope.	meet project Delivery Sch.		
6	(a) Drgs , Data Sheets , Catalogues. BOM etc.	While carrying out Detailed Engg. during Post-Ordering Stage.	-	3	16
10	Bidder's "Bill of Material" Doc. This Doc. shall be Enlisted in MDL Doc.	1. Submission of this Document is essential during initial Submission stage of Engg. Docs. & the same to be progressively updated as the Detail Engg. progresses. 2. All Dispatchable Units shall be identified in this Doc with "Dispatch Tag-No 3. Dispatch tag number philosophy will be finalized during kick of meeting. 4. The Dispatch Tag no. shall be written on an 'Al- Strip' and tied to the dispatchable Unit or be prominently painted on each Item with washable paint. **PL NOTE**– This Standard Unified System shall be followed being an essential part of Field Quality Assurance Practices & for proper	-	3	16

Sl. No.	Document Name / Type	To Contain	Required With Offer	Required After P.O	
			Compliances from Bidder	No. of Sets Required – Engg. & Approval/ Review Activities.	No. of Sets Required- For Site & Customer Submission
		Identification of Items at Site.			
11	Quality Assurance Plan (QAP) & Factory Testing Procedure Documents	1. Approval from BHEL required. 2. Submission along with the Engg. Docs. 3. Will be reviewed and finalized during detail engineering stage	Y	3	4
12	FQAP (Field Quality Assurance Plan) & Site Erection, Testing & Commissioning Procedure documents	1) Approval from BHEL required 2) Submission along with the Engg. Docs.	same as for Sl-11 above	3	4
13	<u>Erection Documents & Drawings:-</u>	1) To contain final MDL, BOM, Handling & Storage Instructions Doc., Initial-Fill & Consumables Items list, Erection & Commissioning Spares List, Operation & Maintenance spares list / Mandatory Spares List etc. 2) Submission well before eqpt. schedule dispatch. 3) The drgs. shall be kept in plastic pouches and neatly arranged, submitted in an aesthetic, appropriate & durable folder(s). Documents filed appropriately in Folder in – seriatim of MDL.	-	-	16

Sl. No.	Document Name / Type	To Contain	Required With Offer	Required After P.O	
			Compliances from Bidder	No. of Sets Required – Engg. & Approval/ Review Activities.	No. of Sets Required- For Site & Customer Submission
		vii) Operational & Maintenance s / Items with adequate ; etc., Catalogue information Model no. marked therein), viii) Lubrication Schedule **viii**) Initial-Fill Items List **ix**) Approved QAP's Shop Tests & Calibration Reports. **x**) Approved FQAP - along with related docs. , with site testing & commissioning Protocols etc.			
15	"As –Built" Drawings & Documents	Submission within three weeks -after commissioning at site	-	-	4
16	Compact Disc (CD)	1) MDL, All drawings, Documents, Data sheets – as Listed in Approved MDL Doc. , all applicable Catalogues (Scanned), BOM & all items covered in the O&M Manuals & the "As-built" Drgs. 2) To submit along with the submission of "As-built" drgs. & docs.	-	-	3

TABLE-42

13.3.0. **FOLLOWING MAY BE NOTED WRT THE DRAWING SUBMISSION SCHEDULE:**

SL NO.	DESCRIPTION	NUMBER OF COPIES TO BE SUBMITTED	WHEN TO SUBMIT
1	Initial drawings/documents under approval and information category.	4	As per approved Master document list
2	Revised drawings/documents incorporating BHEL's comments.	8	Within 1 week of receipt of commented Drawings from BHEL
3	Erection Documentation	8	1 Month before dispatch of equipment, The list of documents

SL NO.	DESCRIPTION	NUMBER OF COPIES TO BE SUBMITTED	WHEN TO SUBMIT
			identified under master document list for erection to be furnished in 5 nos. of folders.

19

14.0.0. DOCUMENT SUBMISSION PROCEDURE

14.1.0. All Drawings/Datasheet/Design calculation etc. shall be submitted in soft as well as hard copy.

14.2.0. Soft submission of all drawings/documents is mandatory.

14.3.0. All drawings/ shall be submitted in AutoCAD format & all documents in MS office/PDF

14.4.0. It has been observed that at times mails fail to deliver because of problem in sender's /receiver's server. Hence it will be mandatory on the part of bidder to intimate concerned BHEL personal about any soft copy submission over phone immediately after any drawing / document is submitted for BHEL's review / approval.

14.5.0. Hard copies of all the documents shall be forwarded to the following address:

Name: (Name will be intimated during detail engineering)
Address: Bharat Heavy Electrical Limited
2nd Floor, New PE&SD Building
RC Puram, Hyderabad- 502032

14.6.0. Date of receipt of hard copies shall be considered as date of submission of any document. Soft copy submission shall be considered as advance submission of drawing/document

14.7.0. BHEL's normal working hour is 8.00 AM to 4.30 PM from Monday to Saturday.

14.8.0. Bidder to ensure that all documents are received with in BHEL working hours. Any submission done after normal office hour/ weekly Off/Public Holidays shall be deemed as submitted on next working day.

14.9.0. BHEL shall furnish Approval/Observation of Drawings/Datasheet/Design calculation etc. on Soft Copy only.

15.0.0. INPUT DRAWINGS

15.1.0. On receipt of order, it shall be solely the bidder's responsibility to spell out the requirement of the base engineering drawings/documents required by him to go ahead with the engineering of the package, and shall not expect the owner/BHEL to automatically supply the same after order placement – the required base drawings/documents shall be furnished to the Bidder within reasonable period of receipt of such requisition from Bidder. Any ultimate delay arising out of the delay by the successful bidder in putting up such a requisition shall solely be to the bidder's account.

15.2.0. Drawings attached with this specification are preliminary in nature & are not exhaustive. These drawings may get revised and /or new drawings will be furnished to bidder during

detail engineering .Bidder to however note that they will not be eligible to raise any extra charges on account of this.

15.3.0. All relevant input drawings will be made available to the bidder during detail engineering stage as when they are revised or prepared.

15.4.0. Bidder to note that they won't be eligible to raise any extra claim on account of furnishing of new drawings or revised drawings by BHEL during offer execution stage.

16.0.0. DRAWINGS REVIEW AND APPROVALS

16.1.0. Review of drawings and documents issued by vendor shall be carried out by Purchaser / PMC /End customer.

16.2.0. Approval/ review of the drawings/ documents by the Purchaser / PMC/End customer would be only limited to the review of compatibility with basic designs and concepts.

16.3.0. The approval and /or review by the Purchaser / PMC/End customer shall not be construed by the bidder as limiting any of his responsibilities and liabilities for mistakes and deviations from the requirements, specified under these specifications and drawings.

16.4.0. The sole responsibility of the correctness of Design, Engineering & construction shall lie with the bidder, irrespective of the fact that the Drawings / Documents submitted are reviewed or not by the Purchaser / PMC/End customer.

16.5.0. The bidder shall correct all faulty designs & constructions detected at any stage of work, without any cost and time implication to the Purchaser.

16.6.0. The Bidder shall be responsible for and shall pay for any alterations of the Work to be accrued out by other agencies due to any discrepancies, errors or omissions in the Drawings or other Particulars supplied by him whether such drawings or particulars have been approved by the BHEL/ End customer or not.

16.7.0. Revisions in drawings/documents shall be clearly marked within clouds. No revision without clouding shall be recognized and the same shall not be considered reviewed and approved.

16.8.0. The bidder shall thoroughly review and approve all drawings including sub-vendor documents, before forwarding to Purchaser.

16.9.0. Only the approved drawings duly stamped and signed by a competent engineer of bidder shall be submitted to purchaser for review.

17.0.0. REVIEW MEETINGS & KICK OFF MEETING:

17.1.0. A kick off meeting shall be held at Purchaser's office, preferably within one week of receipt of order

17.2.0. An agenda shall be prepared for this meeting and would include the following points related to technical aspects.

a. Any clarifications required by the Bidder on purchaser's order.
b. Bidder Data Index & Schedule.
c. Bidder Data Review/approval modalities.
d. Sub-Bidder lists proposed by Bidder.
e. Utility requirements.
f. List of input drawings required from BHEL
g. Preliminary General Arrangement & layout drawings

17.3.0. As and when required, the bidder will be called upon to attend design co-ordination meeting / review meeting with the end customer/PMC/BHEL during the period of the Contract. The Contractor shall attend such meetings at his own cost at venues decided by BHEL.

18.0.0. DELIVERY SCHEDULE & PRICE BID FORMAT

i. Pre-Engineered Building package as envisaged in this bid document shall be executed by the bidder on Lump Sum Turnkey (LSTK) basis.

ii. All the items included in the price bid format shall be quoted as per tender specification and subsequent tender stage correspondences, if any. Responsibility of ensuring correctness & completeness of scope of supply as per spec. requirement solely lies with bidder.

iii. The equipment supplied shall be complete in all respects. The bidder shall not be eligible for any extra payment in respect of such mountings, fittings, fixtures and accessories if required for the safety and reliability of the installations. Any additional equipment, material, etc., which are not specifically mentioned here, but are required to make the supplied facilities complete in all respect, in accordance with the intent of this technical specification, contractual agreement, statutory requirements, relevant/applicable codes/standards, good engineering practices, and for safety and reliability shall be deemed to be in bidder scope only. It will be the bidders sole responsibility to specifically highlight any of the missing materials / items required for the proper & intended use of the Pre-Engineered Buildings as a part of their offer. In case nothing is highlighted by the bidder, it will be assumed that all the major items are included in the bidder's scope of supply for the intended purpose of PEBs.

iv. All hardware/software/item/ etc. required as per tender specification or subsequent tender correspondences or for desired satisfactory operation of package or due to good-engineering practice or as prescribed by relevant/applicable code/standard, but not listed exclusively in this specification, shall be deemed to be included in the basic price quoted by the bidder. Also, all mounting hardware / accessories /fittings/conduits/etc. required for above the package shall be included in the basic price of respective item. Bidder, at no point of time, shall be eligible to raise any extra claim in this regard.

v. Drawings attached with this specification are preliminary & are not exhaustive in nature. These drawings may get revised during detail engineering. All other inputs required for engineering of the Pre-Engineered Building will be furnished to the bidder during detail engineering stage, as and when the same is available with BHEL. Bidder to note that they shall not be eligible to raise any extra claim on account of revision of input drawings or any other input drawings during detail engineering stage.

vi. Only main items shall be considered for price bid evaluation. Optional items (RO – rate only)shall not be considered for price bid evaluation

vii. Prices quoted by the bidder shall remain firm till the successful handing over of PEBs to end customer. Any request for upward revision of price during any intermediate stage before handing over the plant to end customer will be summarily rejected by BHEL.

viii. Bidder to quote only base rates for all the items, Applicable taxes and duties shall be indicated separately.

ix. Bidder to confirm to the unpriced bid as part of their offer.

x. **Schedule of Delivery:**

a. Drawings/documents Submission : 1 week from PO date
(BHEL will furnish their approvals / comments within 15 days after submission of drawings/documents)

b. Supply : vendor to supply in staggered manner to ensure timely delivery at site within the scheduled date

c. E&C : vendor to take up E&C of each PEB in staggered manner to ensure completion at site within scheduled date

19.0.0. DEVIATIONS TO SPECIFICATIONS:

i. Bidders are advised to quote strictly as per BHEL's specification requirements. In case bidder excludes some components of scope of supply or some features of specification requirements, the bidder will be required to include the same in the scope during offer evaluation stage /contract execution stage without any additional commercial and price implications on account of the same. Bidder to note that they won't be entitled for any price impact on account of withdrawal of deviation taken from BHEL spec during technical scrutiny stage. Price impact will be allowed by BHEL only to the extent of change of specification during tender evaluation stage, if any, from BHEL end.

ii. In case bidder feels that it is necessary to exclude some components of scope of supply & some features of specification requirements, due to genuine constraints if any, bidder has to clearly bring out the same to the notice of BHEL and take their prior approval before submission of bid. Bidders are requested to bring out only those deviations which are impractical to meet (or) not technically advisable as per the experience of bidder, for BHEL's review before the submission of bid. **All such clarifications required by the bidder shall be intimated to BHEL together as a single notice within a week of receipt of enquiry by bidder.**

iii. All such deviation or variation from the scope, requirement and/or intent of this specification shall be clearly defined under relevant attachment of the Bid forms irrespective of the fact that such deviations/ variations may be standard practice or a possible interpretation of the specification by the Bidder. Except for those deviations/ variations covered as a part of pre bid clarification, it will be the responsibility of the bidder to fully meet the intent and the requirements of the specification within the quoted price. No other deviation whatsoever from this specification, except for those that have been specifically agreed by purchaser as a part of pre-bid clarification shall be considered.

iv. Bidder to note that all such applicable deviations /clarification shall be listed separately in the format attached with this specification (Annexure -7) and submitted to BHEL as a part of pre-bid query. All such applicable deviations /clarification shall have cross reference to page number /section / clause /para etc. of this specification or its annexure with proper reasons for the deviations for purchaser's consideration. Any such applicable deviations /clarification not listed under the above section, even if reflected in any other portion of the bidder's proposal shall not be considered applicable.

v. In case the vendor considers requirement of additional instrumentation, controls, safety devices and any other accessories/auxiliaries essential for safe and satisfactory operation of

the equipment, he shall recommend the same along with reasons in a separate section along with his proposal and include the same in his scope of supply.

20.0.0. Sub Vendor List:

The NTPC proposed sub supplier list for Civil works is attached in Annexure-11. For items placed in the list, the review and final acceptance shall be given by NTPC-EIC/FQA on the basis of MTC/certificate of conformance in line with indicative FQP/Technical specifications.

21.0.0. ANNEXURES:

Following input documents and specifications are enclosed to facilitate the bidder to furnish the offer:

Annexure No.	Document/ Drawing Title	Doc. No.	Rev
1	Inverter room architectural plan	5711-004-POC-A-005	A
2	Indicative Invertor room Layout (tender purpose only)	PY-LE-3-M086-2037-01	0P 01
3	Vicinity Map	5714-004-(R)POC-A-001	B
4	Array layout (tender purpose only)	--	-
5	Quality Assurance	--	-
6	Pre-Bid Queries format	--	-
7	No deviation format	--	-
8	Price bid format	--	-
9	General Technical Requirements	--	-
10	Erection Conditions of Contract	--	-
11	NTPC proposed Sub Supplier List	--	-

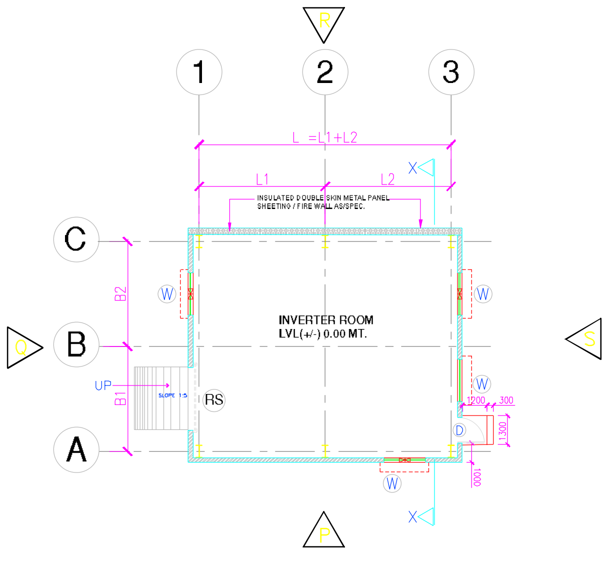
Notes: Incase if bidder found any document/annexure no. listed in the technical specification and is missing from the attachment, it is bidder's responsibility to highlight the missing attachment.

PROJECT ENGINEERING & SYSTEM DIVISION
BHEL, HYDERABAD –32.

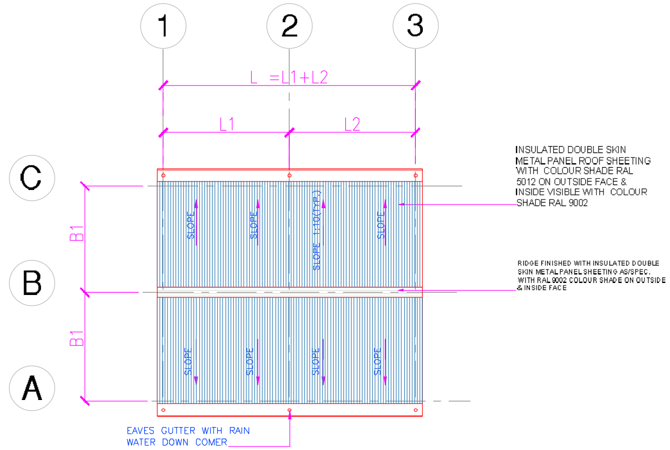
RECORD OF REVISIONS

Rev. No.	Date	Revision Details	Prepared by	Approved By
00	04.05.16	ORIGINAL ISSUE	PVG	EC
01	16.06.16	REVISED AS MARKED 01	PVG	EC

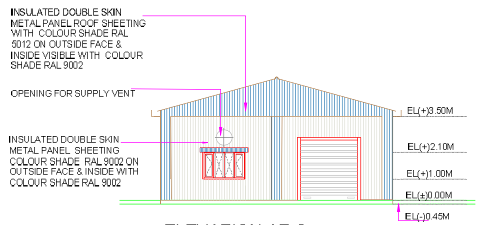
Ref. Doc.



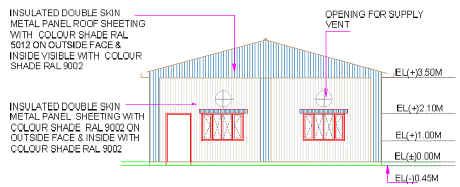
PLAN AT ± 0.0 MTS. LVL.



ROOF PLAN



ELEVATION AT Q



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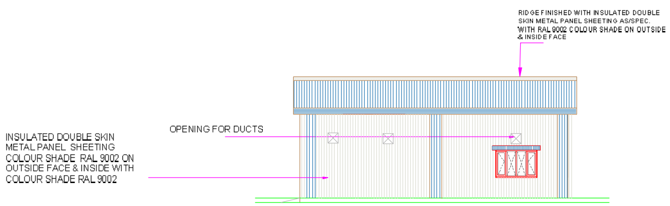

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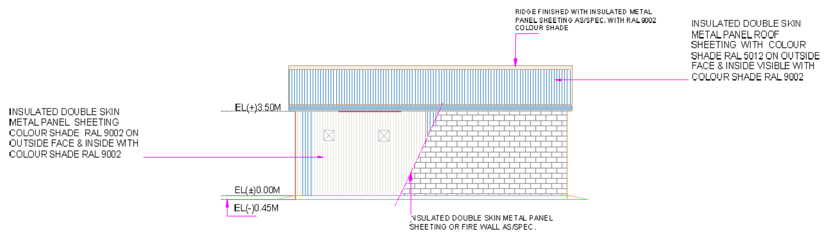

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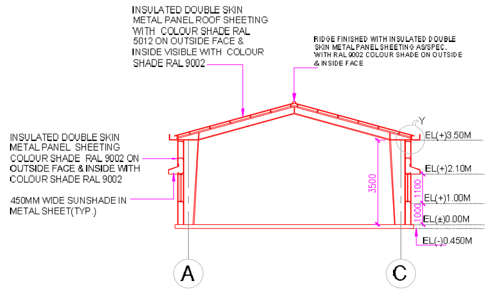
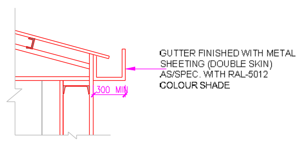


SECTION AT X-X



DETAIL AT Y

DOOR/ROLLING SHUTTER/WINDOWS/VENTS/DUCTS

TYPE	SIZE	CILL LVL.	LINTEL LVL.	DESCRIPTION
D	1200X2100	0.00	2100	1200 / 2100 / D
RS	REFER NOTE 5 & 6	0.00	H	W / H / RS
WINDOWS VENTILATORS DUCTS	REFER NOTE 5 AND 6.			HEIGHT / WIDTH / W / VENT / DUCT

NOTES:-

1. ALL DIMENSIONS ARE IN MM & LEVELS ARE IN METERS.
2. DRAWING SHALL NOT BE SCALED ONLY WRITTEN DIMENSIONS SHALL BE FOLLOWED.
3. ANY DOUBT OR DISCREPANCY IN THE DRAWING SHALL BE BROUGHT TO THE NOTICE OF THE ENGINEER-IN-CHARGE BEFORE EXECUTING THE WORK.
4. WORK SHALL BE CARRIED OUT BASED ON DETAIL WORKING DRAWINGS TO BE PREPARED BY THE VENDOR & GOT APPROVED FROM NTPC, BEFORE EXECUTION.
5. OPENING FOR ROLLING SHUTTER, DUCT'S AND VENTILATOR'S SHALL BE AS PER INVERTER (PCU) MANUFACTURER RECOMMENDATIONS.
6. LOCATIONS OF DOOR, ROLLING SHUTTER, WINDOWS, VENTS & DUCTS ARE INDICATIVE ONLY.
7. REFER TECHNICAL SPECIFICATION FOR PEB-INVERTER ROOM IN CIVIL WORKS.

FOR TENDER PURPOSE ONLY

NTPC Limited
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

PROJECT: DEVELOPMENT OF 250 MW (5X50 MW) SOLAR PV PROJECT IN MANDSUAR DISTRICT OF MP.

TITLE: INVERTER ROOM-PRE ENGINEERED BUILDING ARCHITECTURE PLAN, ELEVATIONS, SECTION DETAILS

REV.NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	APPD	DATE
A	RELEASED FOR TENDER PURPOSE ONLY	LDB	LDB	CMV		

SIZE: A1 | SCALE: NTS | DRG. NO. 5714-004-POC-A-005 | REV. NO. A

DRG. NO. 5714-004-POC-A-005 REV. NO. A

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

DRG. NO. PY-LE-3-M086-2037-01
SHT. 1 OF 1

PEB type-1 (quantity 4no.'s)

PEB type-2 (quantity 6no.'s)

NOTES:

1. LAYOUT GIVEN IS INDICATIVE AND SHALL BE FINALISED DURING DETAILED ENGINEERING.
2. WIDTH OF THE INVERTER ROOM SHALL BE MEASURED INNER TO INNER OF COLUMNS AND LENGTH SHALL BE CENTERLINE TO CENTERLINE.
3. INVERTER ROOM AREA FOR PEB TYPE-1 IS SUBJECTED TO CHANGE BY ±10% DEPENDING ON OGA VENDOR OF RESPECTIVE EQUIPMENTS AND SAME SHALL BE FINALIZED DURING DETAIL ENGINEERING.
4. LOUVER (QTY. 3, EACH OF DIM. 475X475MM) SHALL BE PROVIDED AT THE BOTTOM OF WALL NEAR PCU FOR THE FRESH AIR INTAKE. LOCATION SHALL BE FINALIZED DURING DETAIL ENGINEERING.
5. EAVE HEIGHT OF BUILDING SHALL BE 3.895M.
6. ROLLING SHUTTER DIMENSIONS SHALL BE 3X3M.
7. ~~2 NO.S OF 700MM DIA CUT OUT SHALL BE PROVIDED (AT SITE) FOR EACH INVERTER ROOM FOR THE INSTALLATION OF EXHAUST FAN. LOCATION SHALL BE PROVIDED DURING DETAIL ENGINEERING.~~ deleted
8. 4 NO.S OF CUT OUTS SHALL BE PROVIDED FOR PCU DUCTS. DIMENSIONS / ELEVATIONS SHALL BE AS PCU VENDOR RECOMMENDATION, SAME SHALL BE FINALIZED DURING DETAIL ENGINEERING.
9. LOCATION/DIMENSION OF WINDOWS, DOORS, WALLS, COLUMNS ETC ARE INDICATIVE AND SHALL BE FINALISED DURING DETAILS ENGINEERING. CIVIL ENGG TO DECIDE FINAL DETAILS AS PER RELEVANT CODE.
10. For PEB type-1 Column location A-3, C-3 are subjected to change by ±1m.
11. For PEB type-2 Column location A-3, C-3 are subjected to change by ±1m.

LEGEND:-

W1,2,3,4 : WINDOW
▭ : CUT OUT
▭ : DOUBLE DOOR

REFERENCE DRAWINGS:-

PROJECT :	50MWp SOLAR POWER PLANT (P4 BLOCK)
CUSTOMER :	NTPC- MANDSAUR MP
CONSULTANT :	

BHARAT HEAVY ELECTRICALS LTD.
UNIT : HYDERABAD

	NAME	SIGN.	DATE	NO.OF VAR.
DRN.	AM		16.06.16	N.A.
CHD.	AM		16.06.16	
APPD.	JKP		16.06.16	

DEPT. PED	UNTOL. DIMS. GR.	SCALE	WEIGHT (KG)	REF. TO ASSY. DRG.	ITEM NO.	NO.OF ITEMS
CODE 450	~~C~~/M/~~F~~		N.A.	N.A.	N.A.	N.A.

TITLE	CARD CODE	DRAWING NO.	REV.
INDICATIVE INVERTER ROOM LAYOUT	NA	PY-LE-3-M086-2037-01	0P
		SHT. No 02 NO. OF SHT. 02	

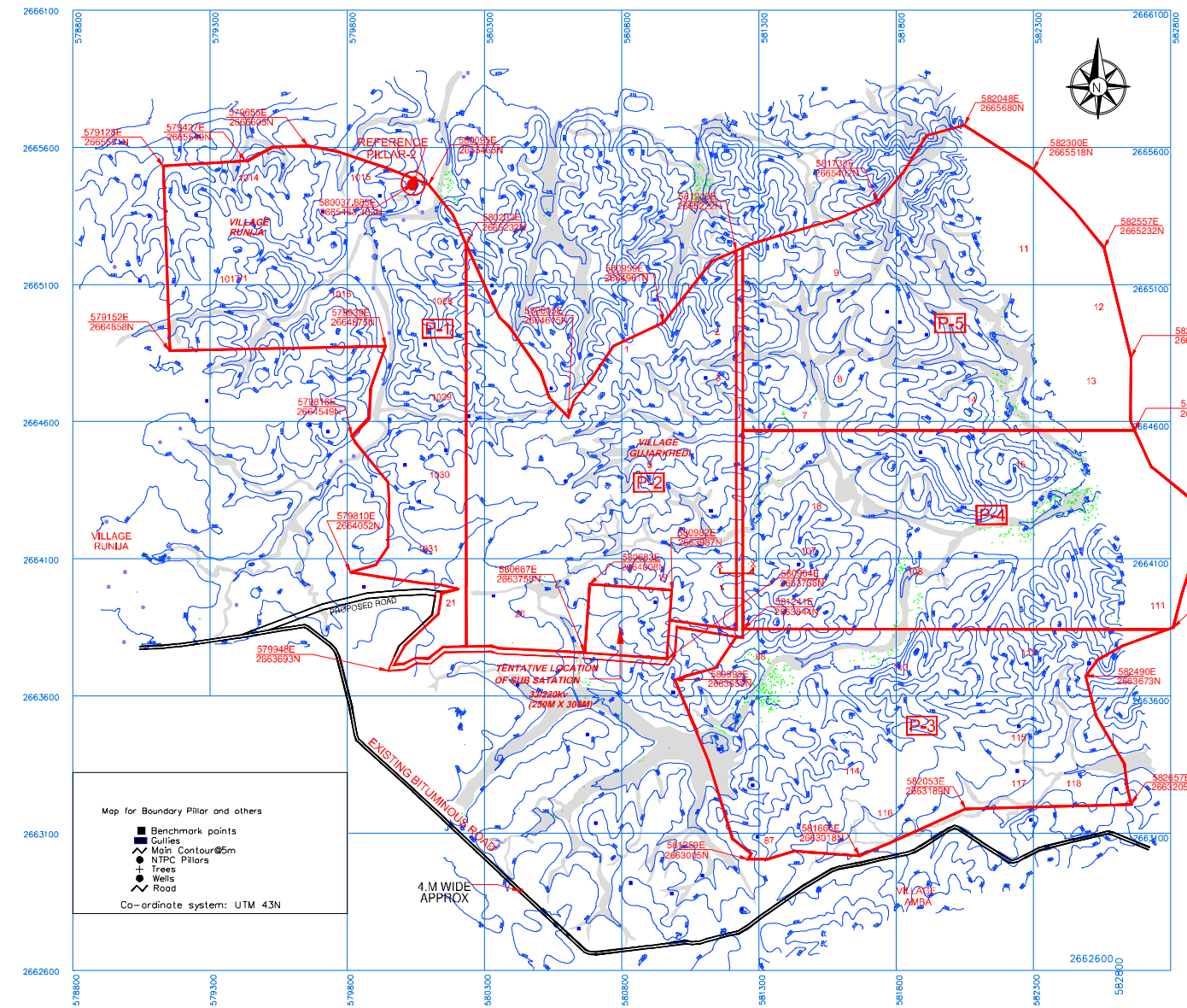
BHEL'S CONSULTANT:

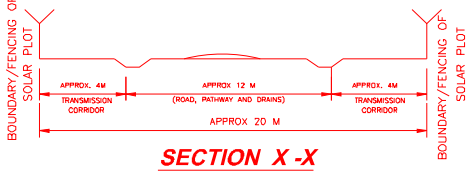
	NAME	SIGN.	DATE
DRN.			
CHD.			
APPD.			
DRG. NO.			REV. 0P

REV.	DATE	ALTERED CHD/APPD	REV.	DATE	ALTERED CHD/APPD	REV.	DATE	ALTERED CHD/APPD	REV.	DATE	ALTERED CHD/APPD	REV.	DATE	ALTERED CHD/APPD	REV.	DATE	ALTERED CHD/APPD
ZONE			ZONE			ZONE			ZONE			ZONE			ZONE		

GENERAL DIMENSIONAL LIMITS,FITS & TOLERANCES AS PER HY0230261

INVENTORY NO	SIGN. AND DATE	REF. DRG. NO.	COMPUTER FILE NAME





SECTION X -X

LEGEND:

PLOT BOUNDARY. . . . . .

KHASRA NO OF PLOT 13
FALLING INSIDE THE SOLAR PLANT

LOCATION OF REFERENCE PILLER . . . . . .

PRIMARILY FOLLOWING KHASRA NOS. OF RUNIJA AND GUJARKHEDI VILLAGES FALL INSIDE THE PROPOSED 250MW NTPC SOLAR PLANT BOUNDARY LINES.

VILLAGE	KHASRA NO.
RUNIJA	1014, 1015, 1016/min-1, 1016/min-2, 1017/1, 1028/min-1, 1029, 1030, 1031.
GUJARKHEDI	1, 2, 3, 4, 5, 7, 8/min 1, 9/min- 2,11, 12, 13, 14, 15, 17, 18, 19, 20, 21, 87, 88, 102, 103, 105, 107, 110, 111, 112, 113, 114,115, 116, 118.

NOTES:

1. THE DRAWING CONSISTS OF FIVE PLOTS/BLOCKS NAMED AS P-1, P-2, P-3, P-4 AND P-5.
2. SITE PLOTS ARE PRIMARILY IN TWO VILLAGES RUNIJA & GUJERKHEDI (TEHSIL SUWASRA), DISTRICT MANDSAUR, M.P.
3. IN EACH PLOT, USABLE AREA OF APPROX 100 HECTARE SHALL BE GIVEN TO EACH BIDDER FOR DEVELOPMENT OF 50MW.
4. THE TENTATIVE BOUNDARY CO-ODRINATES OF EACH PLOT ARE MARKED IN DWG. THE SAME MAY CHANGE DEPENDING UPON ACTUAL LINE OF LAND ACQUISITION & KHASRA NUMBER AND SURVEY WITH RESPECTED TO POINT NO.2. & .
5. THE DETAILS OF MAJOR KHASRA NOS. IN EACH PLOT ARE MARKED IN PLOT LAYOUT.
6. A REFERENCE PILLAR HAS BEEN ESTABLISHED AT POINT NO.2, AS MARKED IN THE DWG. (CO-ORDINATES 580037.885E, 266563.483N, HEIGHT = 382.844)THE SAME MAY BE USED BY ALL 5 VENDORS FOR ESTABLISHING BENCHMARK IN THIER RESPECTIVE PLOTS & TO FURTHER CARRY OUT TOPOGARPHICAL SURVEY.
7. BIDDER SHALL CARRY OUT TOPOGRAPHICAL SURVEY OF ITS PLOT AT ITS OWN IN LINE WITH TECHNICAL SPECIFICATION.
8. BIDDER HAS TO CONNECT THE PLOT DRAINAGE WITH THE NEAREST NATURAL DRAIN PASSING THROUGH/NEAR HIS PLOT, IN LINE WITH DRAINGE SCHEME, SUBJECT TO APPROVAL FROM OWNER.
9. THE DETAILS OF 'ROADS' LAYOUT (OUTSIDE THE FIVE PLOTS) WITH DETAILS OF SCOPE OF WORK IN EACH VENDOR SCOPE SHALL BE ISSUED BY SEPARATELY.
10. THE DETAILS SHOWN IN DRAWING ARE SUBJECT TO MINOR CHANGES BASED ON ACTUAL LINE OF ACQUISITION AND NTPC SITE DISCRETION.THE PLOTS DEMARCATIONS, ROAD AND TRANSMISSION CORRIDORS ARE ALSO TENTATIVE AND ARE SUBJECT TO MINOR CHANGES.
11. THE CONTOUR DETAILS WITH CONTOUR INTERVAL 5M. HAS BEEN SHOWN IN THE DWG.

SCALE 0 100 200 300 400 500M

REV.NO	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	GM	ES	APPD	DATE
B	RELEASE FOR CONSTRUCTION	AMR	LDB	DBN							07.04.16

CLEARED BY

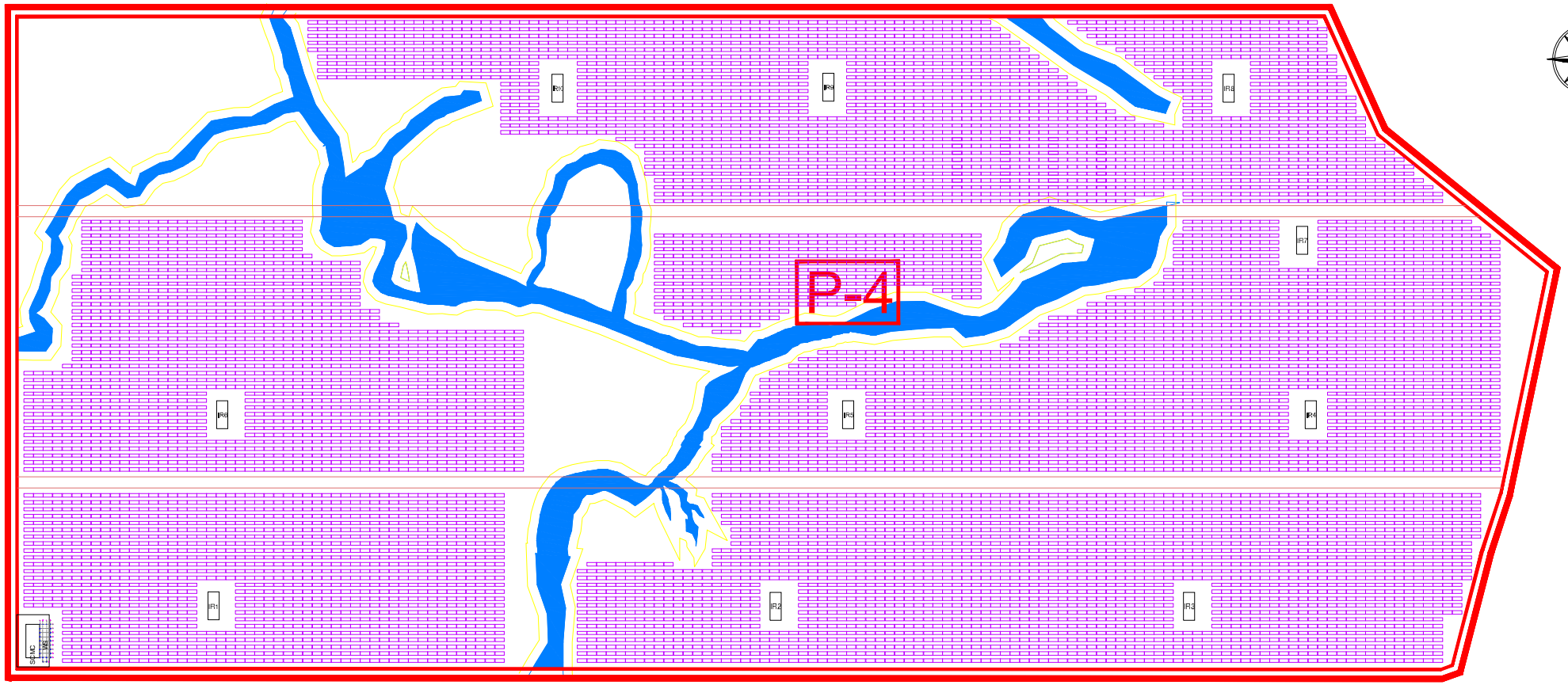
NTPC Limited
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

PROJECT: DEVELOPMENT OF 250MW (5X50MW) SOLAR PV PROJECT IN DISTT. MANDSAUR MADHYA PRADESH

TITLE: VICINITY MAP & PLOTS LAYOUT

SIZE	SCALE	DRG. NO.	REV. NO.
A0	1:4000	5714-004-(R)POC-A-001	B

NTPC MANDSAUR 50 MWp SOLAR PV POWER PLANT (ARRAY LAYOUT)



MODULE MOUNTING STRUCTURE

IR INVERTER ROOM (IR1 to IR10)

CMCS MAIN CONTROL ROOM

SW 33kV SWITCHYARD

DAGRYRTNE

QA Annexure to TECHNICAL SPECIFICATION FOR PRE ENGINEERED BUILDING

NTPC Solar Photo Voltaic Project Madhya Pradesh (1 Block of 50MW)

CONTENT

QA Annexure to TECHNICAL SPECIFICATION FOR PRE ENGINEERED BUILDING (PECC-00479)
NTPC Solar Photo Voltaic Project Madhya Pradesh (1 Block of 50MW)

General Quality Requirements

Section-IV-GCC

7.3.1.6 The quality plan and the inspection requirement finalised for the main equipment will also be applicable to the corresponding spares.

23. Test and Inspection

23.1 The Contractor shall at its own expense carry out at the place of manufacture and/or on the Site all such tests and/or inspections of the Plant and Equipment and any part of the Facilities as are specified in the Contract.

23.2 The Employer and the Project Manager or their designated representatives shall be entitled to attend the aforesaid test and/or inspection, provided that the Employer shall bear all costs and expenses incurred in connection with such attendance including, but not limited to, all travelling and board and lodging expenses.

23.3 Whenever the Contractor is ready to carry out any such test and/or inspection, the Contractor shall give a reasonable advance notice of such test and/or inspection and of the place and time thereof to the Project Manager. The Contractor shall obtain from any relevant third party or manufacturer any necessary permission or consent to enable the Employer and the Project Manager (or their designated representatives) to attend the test and/or inspection.

23.4 The Contractor shall provide the Project Manager with a certified report of the results of any such test and/or inspection. If the Employer or Project Manager(or their designated representatives) fails to attend the test and/or inspection, or if it is agreed between the parties that such persons shall not do so, then the Contractor may proceed with the test and/or inspection in the absence of such persons, and may provide the Project Manager with a certified report of the results thereof.

23.5 The Project Manager may require the Contractor to carry out any test and/or inspection not required by the Contract, provided that the Contractor's reasonable costs and expenses incurred in the carrying out of such test and/or inspection shall be added to the Contract Price. Further, if such test and/or inspection impedes the progress of work on the Facilities and/or the Contractor's performance of its other obligations under the Contract, due allowance will be made in respect of the Time for Completion and the other obligations so affected.

23.6 If any Plant and Equipment or any part of the Facilities fails to pass any test and/or inspection, the Contractor shall either rectify or replace such Plant and Equipment or part of the Facilities and shall repeat the test and/or inspection upon giving a notice under GCC Sub-Clause 23.3.

23.7 If any dispute or difference of opinion shall arise between the parties in connection with or arising out of the test and/or inspection of the Plant and Equipment or part of the Facilities that cannot be settled between the parties within a reasonable period of time, it may be referred to Adjudicator for determination settled in accordance with GCC Clause 6.1 (Adjudicator).

23.8 The Contractor shall afford the Employer and the Project Manager, at the Employer's expense, access at any reasonable time to any place where the Plant and Equipment are being manufactured or the Facilities are being installed, in order to inspect the progress and the manner of manufacture or installation, provided that the Project Manager shall give the Contractor a reasonable prior notice.

23.9 The Contractor agrees that neither the execution of a test and/or inspection of Plant and Equipment or any part of the Facilities, nor the attendance by the Employer or the Project Manager, nor the issue of any test certificate pursuant to GCC Sub-Clause 23.4, shall release the Contractor from any other responsibilities under the Contract.

23.10 No part of the Facilities or foundations shall be covered up on the Site without the Contractor carrying out any test and/or inspection required under the Contract. The Contractor shall give a reasonable notice to the Project Manager whenever any such part of the Facilities or foundations are ready or about to be ready for test and/or inspection;
such test and/or inspection and notice thereof shall be subject to the requirements of the Contract.

23.11 The Contractor shall uncover any part of the Facilities or foundations, or shall make openings in or through the same as the Project Manager may from time to time require at the Site, and shall reinstate and make good such part or parts. If any part of the Facilities or foundations have been covered up at the Site after compliance with the requirement of GCC Sub-Clause 23.10 and are found to be executed in accordance with the Contract, the expenses of uncovering, making openings in or through, reinstating, and making good the same shall be borne by the Employer, and the Time for Completion shall be reasonably adjusted to the extent that the Contractor has thereby been delayed or impeded in the performance of any of its obligations under the Contract.

Section-VI Technical Specifications

Part A-2 Scope of Supply & Services: 2.6 Testing

During detailed engineering, the contractor shall submit for Owner's approval the reports of all the type tests as listed in this specification. Unless specified, the type test should have conducted within last ten years from the date of bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.

However if the contractor is not able to submit report of the type test(s) conducted within applicable period or in the case of type test report(s) are not found to be meeting the specification requirements, the contractor shall conduct all such tests under this contract at no additional cost to the owner either at third party lab or in presence of client /owners representative and submit the reports for approval.

All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.

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9.00.00 **QUALITY ASSURANCE PROGRAMME**

9.01.00 The Contractor shall adopt suitable quality assurance programme to ensure that the equipment and services under the scope of contract whether manufactured or performed within the Contractor's works or at his sub-contractor's premises or at the Employer's site or at any other place of work are in accordance with the specifications. Such programmes shall be outlined by the Contractor and shall be finally accepted by the Employer/authorised representative after discussions before the award of the contract. The QA programme shall be generally in line with IS/ISO-9001.A quality assurance programme of the contractor shall generally cover the following:

9.02.00 His organisation structure for the management and implementation of the proposed quality assurance programme

(a) Quality System Manual

(b) Design Control System

(c) Documentation and Data Control System

(d) Qualification data for bidder's key personnel.

(e) The procedure for purchase of materials, parts, components and selection of sub-contractor's services including vendor analysis,

source inspection, incoming raw-material inspection, verification of materials purchased etc.

(f) System for shop manufacturing and site erection controls including process, fabrication and assembly.

(g) Control of non-conforming items and system for corrective actions and resolution of deviations.

(h) Inspection and test procedure both for manufacture and field activities.

(i) Control of calibration and testing of measuring testing equipment.

(j) System for Quality Audits.

(k) System for identification and appraisal of inspection status.

(l) System for authorising release of manufactured product to the Employer.

(m) System for handling, storage and delivery.

(n) System for maintenance of records, and

(o) Quality plans for manufacturing and field activities detailing out the specific quality control procedure adopted for controlling the quality characteristics relevant to each item of equipment/component.

9.03.00 GENERAL REQUIREMENTS - QUALITY ASSURANCE

9.03.01 All materials, components and equipment covered under this specification shall be procured, manufactured, erected, commissioned and tested at all the stages, as per a comprehensive Quality Assurance Programme. An indicative programme of inspection/tests to be carried out by the contractor for some of the major items is given in the respective technical specification. This is, however, not intended to form a comprehensive programme as it is the contractor's responsibility to draw up and implement such programme duly approved by the Employer. The detailed Quality Plans for manufacturing and field activities shall be drawn up by the Bidder and will be submitted to Employer for approval. Schedule of finalisation of such quality plans will be finalised before award on enclosed format No. QS-01-QAI-P-01/F3.

9.03.02 Manufacturing Quality Plan will detail out for all the components and equipment, various tests/inspection, to be carried out as per the requirements of this specification and standards mentioned therein and quality practices and procedures followed by Contractor's/ Sub-contractor's/ sub-supplier's Quality Control Organisation, the relevant

`	reference documents and standards, acceptance norms, inspection documents raised etc., during all stages of materials procurement, manufacture, assembly and final testing/performance testing. The Quality Plan shall be submitted on electronic media e.g. floppy or E-mail in addition to hard copy, for review and approval. After approval the same shall be submitted in compiled form on CD-ROM.
9.03.03	Field Quality Plans will detail out for all the equipment, the quality practices and procedures etc. to be followed by the Contractor's "Site Quality Control Organisation", during various stages of site activities starting from receipt of materials/equipment at site.
9.03.04	The Bidder shall also furnish copies of the reference documents/plant standards/acceptance norms/tests and inspection procedure etc., as referred in Quality Plans along with Quality Plans. These Quality Plans and reference documents/standards etc. will be subject to Employer's approval without which manufacturer shall not proceed. These approved documents shall form a part of the contract. In these approved Quality Plans, Employer shall identify customer hold points (CHP), i.e. test/checks which shall be carried out in presence of the Employer's Project Manager or his authorised representative and beyond which the work will not proceed without consent of Employer in writing. All deviations to this specification, approved quality plans and applicable standards must be documented and referred to Employer along with technical justification for approval and dispositioning.
9.03.05	No material shall be dispatched from the manufacturer's works before the same is accepted, subsequent to predispatch final inspection including verification of records of all previous tests/inspections by Employer's Project Manager/Authorised representative and duly authorised for dispatch by issuance of Material Despatch Clearance Certificate (MDCC).
9.03.06	All material used for equipment manufacture including casting and forging etc. shall be of tested quality as per relevant codes/standards. Details of results of the tests conducted to determine the mechanical properties; chemical analysis and details of heat treatment procedure recommended and actually followed shall be recorded on certificates and time temperature chart. Tests shall be carried out as per applicable material standards and/or agreed details.
9.03.07	The contractor shall submit to the Employer Field Welding Schedule for field welding activities in the enclosed format No.: QS-01-CQA-W-11/F1. The field welding schedule shall be submitted to the Employer along with all supporting documents, like welding procedures, heat treatment procedures, NDT procedures etc. at least ninety days before schedule start of erection work at site.

9.03.08	All welding and brazing shall be carried out as per procedure drawn and qualified in accordance with requirements of ASME Section IX/BS-4870 or other International equivalent standard acceptable to the Employer. All welding/brazing procedures shall be submitted to the Employer or its authorised representative for approval prior to carrying out the welding/brazing.
9.03.09	All brazers, welders and welding operators employed on any part of the contract either in Contractor's/sub-contractor's works or at site or elsewhere shall be qualified as per ASME Section-IX or BS-4871 or other equivalent International Standards acceptable to the Employer.
9.03.10	Welding procedure qualification & Welder qualification test results shall be furnished to the Employer for approval. However, where required by the Employer, tests shall be conducted in presence of Employer/authorised representative.
9.03.11	For all pressure parts and high pressure piping welding, the latest applicable requirements of the IBR (Indian Boiler Regulations) shall also be essentially complied with. Similarly, any other statutory requirements for the equipment/systems shall also be complied with. On all back-gauged welds MPI/LPI shall be carried before seal welding.
9.03.12	Unless otherwise proven and specifically agreed with the Employer, welding of dissimilar materials and high alloy materials shall be carried out at shop only.
9.03.13	No welding shall be carried out on cast iron components for repair.
9.03.14	All the heat treatment results shall be recorded on time temperature charts and verified with recommended regimes.
9.03.15	All non-destructive examination shall be performed in accordance with written procedures as per International Standards, The NDT operator shall be qualified as per SNT-TC-IA (of the American Society of non-destructive examination). NDT shall be recorded in a report, which includes details of methods and equipment used, result/evaluation, job data and identification of personnel employed and details of co-relation of the test report with the job. All plates of thickness above 40mm & all bar stock/Forging above 40mm dia shall be ultrasonically tested. For pressure parts, plate of thickness equal to or above 25mm shall be ultrasonically tested.
9.03.16	The Contractor shall list out all major items/ equipment/ components to be manufactured in house as well as procured from sub-contractors (BOI). All the sub-contractor proposed by the Contractor for procurement of major bought out items including castings, forging, semi-finished and finished

`	components/equipment etc., list of which shall be drawn up by the Contractor and finalised with the Employer, shall be subject to Employer's approval on enclosed format No. QS-01-QAI-P-01/F3. The contractor's proposal shall include vendor's facilities established at the respective works, the process capability, process stabilization, QC systems followed, experience list, etc. along with his own technical evaluation for identified sub-contractors enclosed and shall be submitted to the Employer for approval within the period agreed at the time of pre-awards discussion and identified in "DR" category prior to any procurement. Such vendor approval shall not relieve the contractor from any obligation, duty or responsibility under the contract.
9.03.17	For components/equipment procured by the contractors for the purpose of the contract, after obtaining the written approval of the Employer, the contractor's purchase specifications and inquiries shall call for quality plans to be submitted by the suppliers. The quality plans called for from the sub-contractor shall set out, during the various stages of manufacture and installation, the quality practices and procedures followed by the vendor's quality control organisation, the relevant reference documents/standards used, acceptance level, inspection of documentation raised, etc. Such quality plans of the successful vendors shall be finalised with the Employer and such approved Quality Plans shall form a part of the purchase order/contract between the Contractor and sub-contractor. With in three weeks of the release of the purchase orders /contracts for such bought out items /components, a copy of the same without price details but together with the detailed purchase specifications, quality plans and delivery conditions shall be furnished to the Employer on the monthly basis by the Contractor along with a report of the Purchase Order placed so far for the contract. **
9.03.18	Employer reserves the right to carry out quality audit and quality surveillance of the systems and procedures of the Contractor's or their sub-contractor's quality management and control activities. The contractor shall provide all necessary assistance to enable the Employer carry out such audit and surveillance.
9.03.19	The contractor shall carry out an inspection and testing programme during manufacture in his work and that of his sub-contractor's and at site to ensure the mechanical accuracy of components, compliance with drawings, conformance to functional and performance requirements, identity and acceptability of all materials parts and equipment. Contractor shall carry out all tests/inspection required to establish that the items/equipment conform to requirements of the specification and the relevant

codes/standards specified in the specification, in addition to carrying out tests as per the approved quality plan.

9.03.20 Quality audit/surveillance/approval of the results of the tests and inspection will not, however, prejudice the right of the Employer to reject the equipment if it does not comply with the specification when erected or does not give complete satisfaction in service and the above shall in no way limit the liabilities and responsibilities of the Contractor in ensuring complete conformance of the materials/equipment supplied to relevant specification, standard, data sheets, drawings, etc.

9.03.21 For all spares and replacement items, the quality requirements as agreed for the main equipment supply shall be applicable.

9.03.22 Repair/rectification procedures to be adopted to make the job acceptable shall be subject to the approval of the Employer/ authorised representative.

9.03.23 **Environmental Stress Screening**

All solid state electronic system / equipment / sub assembly shall be free from infant mortile components. For establishing the compliance to this requirement, the contractor / sub – contractor should meet the following.

1) The Contractor / Sub – contractor shall furnish the established procedure being followed for eliminating infant mortile components. The procedure followed by the Contractor / Sub – contractor should be substantiated along with the statistical figures to validate the procedure being followed. The necessary details as required under this clause shall be furnished at the stage of QP finalization.

Or

In case the Contractor / Sub – contractor do not have any established procedure to eliminate infant mortile components then two or 10% which ever is less, most densely populated Panels shall be tested for Elevated Temperature Cycle Test as per the following procedure.

Elevated Temperature Test Cycle

During the elevated temperature test which shall be for 48 hours, the ambient temperature shall be maintained at 50° C. The equipment shall be interconnected with devices and kept under energized conditions so as to repeatedly perform all operations it is expected to perform in actual service with load on various components being equal to those which will be experienced in actual service.
During the elevated temperature test the cubicle doors shall be closed (or shall be in the position same as they are supposed to be in the field) and

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inside temperature in the zone of highest heat dissipating components / modules shall be monitored. The temperature rise inside the cubicle should not exceed 10° C above the ambient temperature at 50° C.
In case of any failure during the test cycle, the further course of action should be mutually discussed for demonstrating the intent of the above requirement.

2) Burn in Test Cycle

The test shall be conducted on all the panels fully assembled and wired including the panels having undergone the above mentioned elevated temperature test.
The period of Burn in Test Cycle shall be 120 hrs and process shall be similar to the elevated temperature test as above except that the temperature shall be reduced to the ambient temperature prevalent at that time.
During the above tests, the process I/O and other load on the system shall be simulated by simulated inputs and in the case of control systems; the process which is to be controlled shall also be simulated. Testing of individual components or modules shall not be acceptable.
During the Burn in Test the cubicle doors shall be closed (or shall be in the position same as they are supposed to be in the field) and inside temperature in the zone of highest heat dissipating components / modules shall be monitored. The temperature rise inside the cubicle should not exceed 10° C above the ambient temperature.

The Contractor / Sub-contractor shall carry out routine test on 100% item at contractor / sub-contractor's works. The quantum of check / test for routine & acceptance test by employer shall be generally as per criteria / sampling plan defined in referred standards. Wherever standards have not been mentioned quantum of check / test for routine / acceptance test shall be as agreed during detailed engineering stage.

9.04.00 **DOCUMENTATION PACKAGE**

The Contractor shall be required to submit the QA Documentation in two hard copies and two CD ROMs, as identified in respective quality plan with tick mark.

9.04.01 Each QA Documentation shall have a project specific Cover Sheet bearing name & identification number of equipment and including an index of its contents with page control on each document.

The QA Documentation file shall be progressively completed by the Supplier's sub- supplier to allow regular reviews by all parties during the manufacturing.

The final quality document will be compiled and issued at the final assembly place of equipment before dispatch. However CD-Rom may be issued not later than three weeks.

9.04.02 Typical contents of QA Documentation is as below:-

(a) Quality Plan

(b) Material mill test reports on components as specified by the specification and approved Quality Plans.

(c) Manufacturer / works test reports/results for testing required as per applicable codes and standard referred in the specification and approved Quality Plans.

(d) Non-destructive examination results /reports including radiography interpretation reports. Sketches/drawings used for indicating the method of traceability of the radiographs to the location on the equipment.

(e) Heat Treatment Certificate/Record (Time- temperature Chart)

(f) All the accepted Non-conformance Reports (Major/Minor) / deviation, including complete technical details / repair procedure).

(g) CHP / Inspection reports duly signed by the Inspector of the Employer and Contractor for the agreed Customer Hold Points.

(h) Certificate of Conformance (COC) wherever applicable.

(i) MDCC

9.04.03 Similarly, the contractor shall be required to submit two sets (two hard copies and two CD ROMs), containing QA Documentation pertaining to field activities as per Approved Field Quality Plans and other agreed manuals/ procedures, prior to commissioning of individual system.

9.04.04 Before dispatch / commissioning of any equipment, the Supplier shall make sure that the corresponding quality document or in the case of protracted

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phased deliveries, the applicable section of the quality document file is completed. The supplier will then notify the Inspector regarding the readiness of the quality document (or applicable section) for review.

(a) If the result of the review carried out by the Inspector is satisfactory, the Inspector shall stamp the quality document (or applicable section) for release.

(b) If the quality document is unsatisfactory, the Supplier shall endeavor to correct the incompleteness, thus allowing to finalize the quality document (or applicable section) by time compatible with the requirements as per contract documents. When it is done, the quality document (or applicable section) is stamped by the Inspector.

(c) If a decision is made dispatch, whereas all outstanding actions cannot be readily cleared for the release of the quality document by that time. The supplier shall immediately, upon shipment of the equipment, send a copy of the quality document Review Status signed by the Supplier Representative to the Inspector and notify of the committed date for the completion of all outstanding actions & submission. The Inspector shall stamp the quality document for applicable section when it is effectively completed. The submission of QA documentation package shall not be later than 3 weeks after the dispatch of equipment.

9.04.05 TRANSMISSION OF QA DOCUMENTATION

On release of QA Documentation by Inspector, one set of quality document shall be forwarded to Corporate Quality Assurance Department and other set to respective Project Site of Employer.

For the particular case of phased deliveries, the complete quality document to the Employer shall be issued not later than 3 weeks after the date of the last delivery of equipment.

9.05.00 Project Manager's Supervision

9.05.01 To eliminate delays and avoid disputes and litigation, it is agreed between the parties to the Contract that all matters and questions shall be referred to the Project Manager and without prejudice to the provisions of 'Arbitration' clause in Section GCC of Vol.I, the Contractor shall proceed to comply with the Project Manager's decision.

9.05.02 The work shall be performed under the supervision of the Project Manager. The scope of the duties of the Project Manager pursuant to the Contract, will include but not be limited to the following:

(a) Interpretation of all the terms and conditions of these documents and specifications:

(b) Review and interpretation of all the Contractor's drawing, engineering data, etc:

(c) Witness or his authorised representative to witness tests and trials either at the manufacturer's works or at site, or at any place where work is performed under the contract :

(d) Inspect, accept or reject any equipment, material and work under the contract :

(e) Issue certificate of acceptance and/or progressive payment and final payment certificates

(f) Review and suggest modifications and improvement in completion schedules from time to time, and

(g) Supervise Quality Assurance Programme implementation at all stages of the works.

9.06.00 INSPECTION, TESTING AND INSPECTION CERTIFICATES

9.06.01 The word 'Inspector' shall mean the Project Manager and/or his authorised representative and/or an outside inspection agency acting on behalf of the Employer to inspect and examine the materials and workmanship of the works during its manufacture or erection.

9.06.02 The Project Manager or his duly authorised representative and/or an outside inspection agency acting on behalf of the Employer shall have access at all reasonable times to inspect and examine the materials and workmanship of the works during its manufacture or erection and if part of the works is being manufactured or assembled on other premises or works, the Contractor shall obtain for the Project Manager and for his duly authorised representative permission to inspect as if the works were manufactured or assembled on the Contractor's own premises or works.

9.06.03 The Contractor shall give the Project Manager/Inspector fifteen (15) days written notice of any material being ready for testing. Such tests shall be to the Contractor's account except for the expenses of the Inspector's. The Project Manager/Inspector, unless the witnessing of the tests is virtually waived and confirmed in writing, will attend such tests within fifteen (15) days of the date on which the equipment is noticed as being ready for test/inspection failing which the contractor may proceed with test which shall be deemed to have been made in the inspector's presence and he

	shall forthwith forward to the inspector duly certified copies of test reports in two (2) copies.
9.06.04	The Project Manager or Inspector shall within fifteen (15) days from the date of inspection as defined herein give notice in writing to the Contractor, or any objection to any drawings and all or any equipment and workmanship which is in his opinion not in accordance with the contract. The Contractor shall give due consideration to such objections and shall either make modifications that may be necessary to meet the said objections or shall inform in writing to the Project Manager/Inspector giving reasons therein, that no modifications are necessary to comply with the contract.
9.06.05	When the factory tests have been completed at the Contractor's or sub-contractor's works, the Project Manager /Inspector shall issue a certificate to this effect fifteen (15) days after completion of tests but if the tests are not witnessed by the Project Manager /Inspectors, the certificate shall be issued within fifteen (15) days of the receipt of the Contractor's test certificate by the Project Manager /Inspector. Project Manager /Inspector to issue such a certificate shall not prevent the Contractor from proceeding with the works. The completion of these tests or the issue of the certificates shall not bind the Employer to accept the equipment should it, on further tests after erection be found not to comply with the contract.
9.06.06	In all cases where the contract provides for tests whether at the premises or works of the Contractor or any sub-contractor, the Contractor, except where otherwise specified shall provide free of charge such items as labour, material, electricity, fuel, water, stores, apparatus and instruments as may be reasonably demanded by the Project Manager /Inspector or his authorised representatives to carry out effectively such tests on the equipment in accordance with the Contractor and shall give facilities to the Project Manager/Inspector or to his authorised representative to accomplish testing.
9.06.07	The inspection by Project Manager / Inspector and issue of Inspection Certificate thereon shall in no way limit the liabilities and responsibilities of the Contractor in respect of the agreed Quality Assurance Programme forming a part of the contract.
9.06.08	To facilitate advance planning of inspection in addition to giving inspection notice as specified at clause no 9.05.03- of this chapter, the Contractor shall furnish quarterly inspection programme indicating schedule dates of inspection at Customer Hold Point and final inspection stages. Updated quarterly inspection plans will be made for each three consecutive months and shall be furnished before beginning of each calendar month.

9.06.09	All inspection, measuring and test equipment used by contractor shall be calibrated periodically depending on its use and criticality of the test/measurement to be done. The Contractor shall maintain all the relevant records of periodic calibration and instrument identification, and shall produce the same for inspection by NTPC. Wherever asked specifically, the contractor shall re-calibrate the measuring/test equipment in the presence of Project Manager / Inspector.
9.07.00	**ASSOCIATED DOCUMENT FOR QUALITY ASSURANCE PROGRAMME:**
9.07.01	List of items requiring quality plan and sub supplier approval. Format No.:QS-01-QAI-P-01/F3-R0.
9.07.02	Manufacturing Quality Plan Format No.: QS-01-QAI-P-09/F1-R1
9.07.03	Field Quality Plan Format No.: QS-01-QAI-P-09/F2-R1.

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QUALITY ASSURANCE AND INSPECTION FOR CIVIL WORKS

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QUALITY ASSURANCE AND INSPECTION FOR CIVIL WORKS

1. INTRODUCTION

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 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 at every stage of execution of work at site, to suit the site conditions by the contractor at no extra cost to the owner.

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 NTPC. NTPC 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 NTPC 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 NTPC for approval/ acceptance and further shall ensure their availability well before the start of the concern activity.

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3. LABORATORY AND FIELD TESTING

The field laboratory for QA and QC activities shall be constructed and set-up by the contractor in line with the indicative field QA&QC laboratory set-up enclosed at Annexure-I. The Laboratory building shall be constructed and installed with the adequate facilities to meet the requirement of envisaged test setup. Temperature and humidity controls shall be available wherever necessary during testing of samples. The quality plan shall identify the testing equipments/ instrument, which the contractor shall deploy and equip the field quality laboratory for meeting the field quality plan requirements. The contractor shall furnish a comprehensive list of testing equipments/ instrument required to meet the planned/scheduled tests for the execution of works for NTPC acceptance/ approval. The contractor shall mobilize the requisite laboratory equipment and QA&QC manpower at least 15 days prior to the planned test activity as per the schedule of tests.

All equipments and instruments in the field shall be calibrated before the commencement of tests and then at regular intervals, as per the manufacturer's recommendation and as directed by the NTPC. The calibration certificates shall specify the fitness of the equipments and instruments within the limit of tolerance for use. Contractor shall arrange for calibration of equipments and instruments by an NABL / NPL accredited agency and the calibration report shall be submitted to NTPC.

The tests which cannot be carried out in the field laboratory shall be done at a laboratory of repute. This includes selected 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 thereafter these shall be sent to the concerned laboratory through the covering letter signed by NTPC engineer. The test report along with the recommendations shall be obtained from the laboratories without delay and submitted to NTPC.

Based on the schedule of work agreed with the engineer-in-charge and the approved FQP, the contractor shall prepare a schedule of tests and submit them to the engineer-in-charge and organize to carry out the tests as scheduled / agreed.

4. SAMPLING AND TESTING OF CONSTRUCTION MATERIALS

The method of sampling for testing of construction 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 of the

Engineer. All testing shall be done in the presence of the engineer or his authorized representative in a NABL accredited / Govt. Laboratory acceptable to NTPC. 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 thereafter these shall be sent to the concerned laboratory through the covering letter signed by NTPC engineer. The test report along with the recommendations shall be obtained from the laboratories without delay and submitted to NTPC.

5. PURCHASE AND SERVICE

All structural steel shall be procured from main steel producers like SAIL, TISCO, RINL, Essar Steel, Ispat Industries, JSW Steel, Lloyds Steel Industries, Jindal Steel & Power and Sunflag Steel & Iron Co., Bhandara [only for rounds (15-105 mm), flats (45-120 mm width & 4.75-28 mm thick), hex rods (15.5-42 mm) and wire rods (5.5-38 mm)]. 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 cleared by corporate quality assurance of NTPC for which 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., Confirmation that the process control and manufacturing of steel sections by re-rollers shall be same as that of main steel producers, that billets for re-rolling will be sourced from main steel producers only shall be furnished with regards to re-roller.

For Module Mounting Structures, sources of steel other than those specified under this Clause may also be used subject to the condition that they otherwise meet the requirements of the Technical Specifications / Bid Documents.

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 main Contractor.

Reinforcement steel shall be procured from main steel producers like SAIL, TISCO, RINL, Essar Steel, Ispat Industries, JSW Steel, Lloyds Steel Industries, Jindal Steel & Power and Jai Balaji Industries Ltd, Durgapur (for 8-40mm reinforcement steel) and mill test certificates (TC) is to be obtained and submitted to NTPC for co-relation.

The other conditions are covered in the chapter 'GTR'.

6. FIELD QUALITY PLAN

Well before the start of the work, the contractor shall prepare and submit the Field Quality Plans (FQP) on the format No. QS-01-QAI-P-09/F2-R1, and obtain approval of NTPC, which shall detail out for all the works, equipments, 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 for all the items / activities covered in the contract / schedule of items required, right from material procurement to completion of the work at site. An Indicative Field Quality Plan for civil works is enclosed at Annexure – II (Indicative FQP for civil works).

7. GENERAL QA REQUIREMENTS

The contractor shall ensure that the works, BOIs and services under the scope of contract whether manufactured or performed within contractor's works or at his sub-contractor's premises or at the NTPC's site or at any other place of work are in accordance with the NTPC technical specification, applicable standards / codes, approved drawings / data sheets / quality plans and BOQ. All the works, BOIs and services shall be carried out as per the best prevalent engineering practices and to the directions of the Engineer.

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ANNEXURE - I

TYPICAL QA/QC LAB EQUIPMENT

S.No	Equipment	Approximate Nos.
1.	Cube Moulds for cement testing	12
2.	Sieve shaker	1
3.	Sieves for sand, coarse & fine aggregate	1 set for each
4.	Sieves for coarse aggregate	1 set
5.	Slump testing equipment	6 sets
6.	Oven	2
7.	Physical balance	1
8.	Thermometer	4
9.	Burret	2
10.	Measuring cylinders	9
11.	Measuring flasks	3
12.	Compression testing machine	1 set
13.	Cube moulds for Concrete	18
14.	Mechanical weighing machine	1 (100 kg capacity)
15.	Drum Type Concrete Mixer (for trial mixes)	1
16.	Proctor Testing Equipment	1 set

Note :

1. The equipments listed above are indicative and required to be mobilised as minimum requirement. Additional equipment if any, required for successful completion of work shall be provided /arranged by the contractor.
2. All test reports/ inspection reports have to be computerized and maintained on LAN with an access to the owner
3. Based on the schedule (L2/L3 Network), Quality control & Quality Assurance work plan shall be finalized by the contractor and the same shall be submitted to the engineer-in-charge for acceptance/approval. The Finalized work plan shall be maintained on the computer to be accessed by the owner for database and day to day monitoring.

FQP FOR CIVIL WORKS

INDICATIVE FIELD QUALITY PLAN

ITEM : CIVIL WORK	QP NO. : 1
SUB-SYSTEM : CIVIL AND STRUCTURAL STEEL WORKS	REV. NO .: 1
	DATE :
	PAGE : Page 1 of 11
PROJECT:	SOLAR PV PROJECT
PACKAGE:	
CONTRACT NO.	XXXX-YYY
MAIN CONTRACTOR	

Sl. No	Activity and operation	Characteristics / instruments		Class of check	Type of Check	Quantum Of check	Reference Document / Acceptance Norms	Format of Record	D*	Remarks
1	2	3		4	5	6	7 / 8	9	D*	10
1	GENERAL REQUIREMENTS									
A	Availability of QA& QC manpower and laboratory		-	A	Physical	Once prior to start of work and thereof monthly	Tech Specs and Const. Drawings	SR	√	
B	Sampling for testing of buliding materials, concrete mix design etc.		As agreed / required	A	Physical	As specified in FQP for various materials	Tech Specs and Const. Drawings	SR/TR	√	Test report along with the recommendations from specialist agency to be submitted to NTPC.
C	Submission of schedule of tests to be done monthly / quaterly		-	A	Physical	Once prior to start of work and thereof monthly	Tech Specs and Const. Drawings	SR	√	
D	Stacking and storage of construction materials and components at site		As per IS:4082	A	Physical	Random	Tech Specs and Const. Drawings and IS: 4082	SR	√	
2	EXCAVATION AND FILLING IN FOUNDATION WORKS									
	Excavations-									
2.1		Nature, type of soil/rock before and during excavations	As agreed / required	C	Visual	Random in eah shift	Tech Specs and Const. Drawings	SR		
2.2		Initial ground level before start of excavations	As agreed / required	C	Measurement	100%	Tech Specs and Const. Drawings	SR	√	
2.3		Final shape and Dimensions of excavations	As agreed / required	C	Measurement	100%	Tech Specs and Const. Drawings	SR		
2.4		Final excavation lelvels	As agreed / required	B	Measuement	100%	Tech Specs and Const. Drawings	SR	√	
2.5		Side slope of final excavation	As agreed / required	B	Measurement	Random in each shift	Tech Specs and Const. Drawings	SR		
	Fill/ Backfill -									
2.6	Standard proctor Test	Optimum moisture content and max. dry density before fill	As per IS: 2720, Proctor needle apparatus,etc.	B	Physical	One in every 2000 cum for each type and source of fill materials	IS 2720 (Pt.VII), Tech Specs and Const. Drawings	SR/TR	√	
2.70	Moisture content	Moisture content of fill before compaction	As per IS: 2720, balance, oven, rapid moisture meter, etc.	B	Physical	One in every 2000 cum for each type and source of fill materials	IS 2720 (Pt.II), Tech Specs and Const. Drawings	SR/TR	√	
2.8	Degree Of Compaction Of Fill / Backfill									
i		Dry density by core cutter method ---- OR---- Dry density in place by sand displacement method	As per IS: 2720/compaction test (core cutter), balance, rapid moisture meter etc.	A	Physical	One sample for every 2000 SQM area for each compacted layer.	IS 2720 (Pt. XXIX), Tech Specs and Const. Drawings OR IS 2720 (Pt. XXVIII), Tech Specs and Const. Drawings	SR/TR	√	
3.0	MATERIALS									
3.1	CEMENT									
		Retesting of cement	as per IS:4031	A	Testing	At Random	As per relevant IS Codes	TR	√	Each consignment of cement shall be duly correlated with manufactureres TC.
3.2	Coarse Aggregate	Moisture content	as per IS:2386	B	Physical	Once for each stack of 100 Cu.M. or part there of	IS : 456 IS : 383/Tech Spec	SR/LB	√	during monsoon when this has to be done every day before start of concreting
ii		Specific gravity, water absorption	IS:2386	A	Physical	Once for each source & for every change of source	IS: 2386 Part-III, IS:456, IS:383/Tech Spec	SR/LB/ TR	√	

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INDICATIVE FIELD QUALITY PLAN

			ITEM : CIVIL WORK	QP NO. :		1	PROJECT:	SOLAR PV PROJECT					
				REV. NO. :		1	PACKAGE:						
			SUB-SYSTEM : CIVIL AND STRUCTURAL STEEL WORKS	DATE :			CONTRACT NO.	XXXX-YYY					
				PAGE :	Page 2 of 11		MAIN CONTRACTOR						
Sl. No	Activity and operation	Characteristics / instruments		Class of check	Type of Check	Quantum Of check	Reference Document	Acceptance Norms	Format of Record		Remarks		
1	2	3		4	5	6	7	8	9	D*	10		
iii		Sieve analysis, flakiness index, elongation index,	IS:2386	B	Physical	One per 100 cum., or part thereof	IS: 2386 Part-I, Spec	IS:383/Tech	SR/LB	√			
iv		Deleterious materials (coal & lignite, clay lumps, material finer than 75 micron sieve, soft fragment, shale)	IS:2386	A	Physical	Once per source/ on every change of source	IS: 2386 Part-II, Spec	IS:383/Tech	SR/LB/ TR	√			
v		Soundness	IS:2386	A	Physical	-do-	IS: 2386 Part-V, IS:383		SR/LB/ TR	√			
vi		Crushing value abrasion value and impact value	IS:2386	A	Physical	-do-	IS:383, IS-2386 Part IV/Tech Spec.		SR/LB/ TR	√			
3.3	Fine Aggregate												
i		Moisture content, water absorption	balance , oven, rapid moisture meter etc	B	Physical	To be done every day before start of work	IS: 2386 Part-III	IS:383	SR/LB/T R	√			
ii		Deleterious materials (coal & lignite, clay lumps, material finer than 75 micron sieve, soft fragment, shale)	IS:2386	A	Physical	Once per source& for on every change of source	IS: 2386 Part-II, IS:383		SR/LB/T R	√			
iii		All other tests similar to coarse aggregates as mentioned above.					IS-2386, IS-383		SR/LB/T R	√	except test for flankiness index,elongation index, abrasion value, impact value		
3.4	Water												
i		Complete tests as per IS:456	Buret, conical flask, pipette etc	B	Testing	One for each source	IS:3025 part 22 and 23 (for test procedure), IS:456(for acceptance criteria)		SR/LB/T R	√			
3.5	CONCRETE												
i		Crushing strength (works Tests cubes)	IS:516	A	Physical	One set of 6 cubes per 50 CuM or part thereof for each grade of concrete per shift whichever is earlier.	IS:516, IS:456, NTPC Tech. Spec.		SR/LB/ TR	√	Min. of 6 cubes for each mix, 3 specimen shall be tested at 7 days remaining 3 shall be for 28 days comp. Strength.		
ii		Workability - slump test	IS:1199	B	Physical	At the time of concrete pouring at site every two hrs	IS:456/NTPC Tech. Spec.		SR/LB/T R	√			
3.5.1	Admixtures for Concrete	Type of admixture	As per IS:9103	B	Review of MTC	For each lot received at site	Designed mix and IS:9103		MTC	√	Admixture of appd. Brand and tested quality shall be used (each lot of admixture will included with brochure in which the type of admixture and its properties shall be clearly indicated)		
3.6	Concrete conveying, placing& compaction												
i		mixing of concrete shall be done in a approved mixer such as to produce a homogenous mix				To be calibrated at the time of starting and subsequently once in three months, and shall conform to IS:4925	Review of calibration chart/ Certificate, IS 4926			√			
ii		Arrangement for transportation & placement of concrete.	As required	C	Visual	100%	Before clearance for concreting		Inspecti on Report	√			
iii		Handling and Transportation of concrete	As required	C	Physical	100%	As per construction/erection methodology (to be approved one week prior to start of		SR				
iv		Placement of concrete	Visual	B	Physical	100%	As per construction/erection methodology and tech specs / No segregation		SR	√			
v		Compacting	As required	C	Physical	At Random	IS:456		SR	√			
vi		Curing	As required	C	Physical	At Random	Period of curing as per IS 456 (use gunny bags / curing compound)		SR	√			
3.7	TEST/CHECK ON RCC STRUCTURE IN HARDENDED CONDITIONS												
i		Dimensional check on finished structures & Dimensional tolerances	As required	B	Measurement	Approved Drawing	As per IS:456/ tech. Specification.		SR/LB	√			

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INDICATIVE FIELD QUALITY PLAN

		ITEM : CIVIL WORK		QP NO. :		1	PROJECT:	SOLAR PV PROJECT			
				REV. NO. :		1	PACKAGE:				
		SUB-SYSTEM : CIVIL AND STRUCTURAL STEEL WORKS		DATE :			CONTRACT NO.	XXXX-YYY			
				PAGE :		Page 3 of 11	MAIN CONTRACTOR				
Sl. No	Activity and operation	Characteristics / Instruments		Class of check	Type of Check	Quantum Of check	Reference Document	Acceptance Norms	Format of Record		Remarks
1	2	3		4	5	6	7	8	9	D*	10
ii		Water Tightness Test of liquid retaining structure/ tanks	As required	B	Test	100%	IS 3370/ Tech. Specification		SR/LB	√	
3.8	REINFORCEMENT STEEL										
i		Physical and Chemical Properties for each lot as per relevant IS codes	As required/ agreed	A	Review of MTC	Each batch of delivery	IS : 1786, IS 432, IS 1566, Tech Specs and Const. Drawings		MTC	√	Applicable if steel is procured by Contractor
ii		Freedom from cracks, surface flaws, Lamination	As agreed / required	C	Visual	Random in each shift	IS: 1852, IS 432, IS 1786, Tech Specs and Const. Drawings		SR		To be checked at site. Steel collected from source should be free from excessive rust. To be stored as per Technical Specs
3.9	PLACEMENT OF REINFORCEMENT STEEL										
i		Bar bending schedule with necessary lap, Spacers & Chairs	As agreed / required	B	Visual & Measurement	Random in each shift	Approved Drawings, Tech Specs and Const. Drawings, IS 2502		SR	√	
ii		Bending of bars, cutting tolerance	As agreed / required	C	Visual & Measurement	Random in each shift	Approved Drawings, Tech Specs and Const. Drawings, IS 2502		SR	√	
iii		Acceptance - Cover, spacing of bars, spacers and chairs after the reinforcement cage is put inside the formwork	As agreed / required	B	Visual & Measurement	Random in each shift	Approved Drawings, Tech Specs and Const. Drawings		SR	√	
3.10	STAGING AND FORMS										
i		Materials and accessories	As agreed / required	C	Visual	Once before start of work	As per relevant IS, Tech Specs and Const. Drawings		SR		
ii		Soundness of staging, shuttering and scaffolding including application of mould oil / release agent	As agreed / required	C	Visual	Once before start of work	As per manufacturer's spec and as per 3696,4014, 4990, Tech Specs and Const Drawings		SR		
iii		Acceptance of formwork before start of concreting		B	Physical / visual	Before start of each concreting	As per provisions and tolerances, Tech Specs and Const. Drawings		SR	√	
3.11	DAMP PROOF COURSE						Tech Specs and Const. Drawings				
i		Material - Hot bitumen and water proofing materials etc	As agreed / required	B	Review of MTC	Each batch of delivery at site	Tech Specs and Const. Drawings, IS 702		SR	√	
ii		Acceptance of damp proof course	As agreed / required	B	Acceptance	100%	Tech Specs and Const. Drawings		SR		
3.12	GROUTING										
i		Material	As agreed / required	B	Review of MTC	Each batch of delivery	Tech Specs and Const. Drawings		SR	√	
		Type of mix - fluid mix, plastic mix, stiff mix etc.	As agreed / required	C	Physical	Prior to start of work	Tech Specs and Const. Drawings		SR	√	
ii		Mixing, placement, application and grout pressure	As agreed / required	C	Physical	Random in each shift	Tech Specs and Const. Drawings		SR		
iii		Compressive strength	As agreed / required	C	Physical	Random in each shift	Tech Specs and Const. Drawings		SR	√	
iv		Acceptance of the grouts	As agreed / required	B	Physical	Each grout section	Tech Specs and Const. Drawings		SR		
4.00	BRICK MASONARY										
4.1	Test on Bricks										
		Dimensions , shape, compressive strength, water absorption, warpage, efflorescence	As agreed / required	B	Measurement/ Physical Test	As per relevant IS Code/ One Sample for 20,000 nos. or part thereof	IS: 1077, IS 13757, IS 12894 / Tech Specs and const. Drawings		Inspection Report	√	Efflorescence shall be checked at each source
4.2	Masonry construction	Workmanship, verticality and alignment	As agreed / required	B	Visual/ Physical	100%	IS 2212, IS 1905., Tech Specs and Const. Drawings		SR/LB		
5.00	FINISHING AND ALLIED WORKS										
5.1	PLASTERING - WORKMANSHIP										

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INDICATIVE FIELD QUALITY PLAN

		ITEM : CIVIL WORK		QP NO. :		1	PROJECT:	SOLAR PV PROJECT			
		SUB-SYSTEM : CIVIL AND STRUCTURAL STEEL WORKS		REV. NO .:		1	PACKAGE:				
				DATE :			CONTRACT NO.	XXXX-YYY			
				PAGE :		Page 4 of 11	MAIN CONTRACTOR				
Sl. No	Activity and operation	Characteristics / instruments		Class of check	Type of Check	Quantum Of check	Reference Document	Acceptance Norms	Format of Record		Remarks
1	2	3		4	5	6	7	8	9	D*	10
i		Curing	As agreed / required	C	Physical	100%	Tech specifications, construction drawings and agreed methodology		SR		
ii		Thickness and finishing of plaster, grooves etc	As agreed / required	B	Visual/ Measurement	Random in each shift	Tech Specs and Const. Drawings		SR/LB		
iii		Truness of plastering system	As agreed / required	B	Visual/ Physical	Random in each shift	Tech Specs and Const. Drawings		SR		
5.2	STONE GRIT PLASTER/ GRANULAR TEXTURED COAT FINISH										
i		Material	As agreed / required	B	Review of MTC	For each lot received at site	Tech Specs and Const. Drawings		SR	√	
ii		Thickness, finishing and grooves etc	As agreed / required	C	Visual/ Measurement	Random in each shift	Tech Specs and Const. Drawings		SR	√	
6.00	SHEETING AND OTHER WORKS										
6.1	PAINTING SYSTEM - CONCRETE WORKS AND PLASTERED MASONARY SURFACES										
i	Materials and accessories- Oil Bound, Acrylic Emulsion, Chemical Resistant, Oil Resistant Paint etc.	Shade, type from brand and manufacturer as approved by NTPC EIC	As agreed / required	B	Review of MTC	Each batch of delivery	Tech Specs and Const. Drawings		SR/MTC	√	
ii	Surface prepration	As required	As agreed / required	C	Physical /visual	Random in each shift	Tech Specs and Const. Drawings		SR		
iii	Acceptance of painted surfaces	As required	As agreed / required	B	Physical	Each surface at random	Tech Specs and Const. Drawings		SR		
6.1.1	PAINTING SYSTEM - STEEL WORKS (OTHER THAN STRUCTURAL STEEL WORKS)										
i		Paining Materials and accessories	-	B	Review of MTC	Each batch of delivery	Tech Specs and Const. Drawings		SR/MTC	√	
ii		Surface prepration	As agreed / required	C	Physical /visual	Each Erection Mark	Tech Specs and Const. Drawings, Relevant code/ standards		SR	√	
iii		Primer Thickness	Elcometer	C	Measurement	Each Erection Mark	Tech Specs and Const. Drawings		SR	√	
iv		DFT of paint	Elcometer	C	Measurement	Each Erection Mark	Tech Specs and Const. Drawings		SR	√	
v		Acceptance of painted surfaces	Elcometer	B	Visual and measurement	Each Erection Mark	Tech Specs and Const. Drawings		SR		
6.2	INSULATION WORKS										
i	Material	Insulation material, galvanised wire net, aluminium foil, fasteners	As agreed / required	B	Review of MTC	For each lot received at site	Tech Specs and Const. Drawings		SR / LB	√	
ii		Acceptance of each type of installation	As agreed / required	B	Visual/ Physical	Each installation	Tech Specs and Const. Drawings		SR/LB		
7.00	DOORS , WINDOWS VENTILATORS & GRILL										
7.1	Fire proof doors										
i		Source of supply	As agreed / required	A	Review of purchase order (unpriced copy) / drawings of suppliers / certificate of CBRI	For each source	Tech Specs and Const. Drawings		SR	√	Procured from Approved parties as per relevant IS/Tech, The door drawing proposed for supply should have been tested and approved by CBRI Roorkee for the similar dimensions for minimum 2 hours fire rating.
ii		Receipt inspection	As agreed / required	B	Visual/ Physical/ Review of MTC	For each lot received at site	Tech Specs and Const. Drawings		SR	√	
iii		Finishing and acceptance	As agreed / required	B	Visual / physical	Random	Tech Specs and Const. Drawings		SR		
7.2	False Ceiling										
i		Materials (gypsum glass, glass fibre membrane, fibre board acoustical tiles etc)	As agreed / required	B	Review of MTC	For each lot received at site	Tech Specs and Const. Drawings		SR	√	Compare MTC with technical specification and requirement
ii		Installation finishing and acceptance	As agreed / required	B	Visual / physical	Random	Tech Specs and Const. Drawings		SR		
7.3	WATER PROOFING										

INDICATIVE FIELD QUALITY PLAN

		ITEM : CIVIL WORK		QP NO. :		1	PROJECT:	SOLAR PV PROJECT			
		SUB-SYSTEM : CIVIL AND STRUCTURAL STEEL WORKS		REV. NO .:		1	PACKAGE:				
				DATE :			CONTRACT NO.	XXXX-YYY			
				PAGE :		Page 5 of 11	MAIN CONTRACTOR				
Sl. No	Activity and operation	Characteristics / instruments		Class of check	Type of Check	Quantum Of check	Reference Document	Acceptance Norms	Format of Record		Remarks
1	2	3		4	5	6	7	8	9	D*	10
		Methodology for the application of water proofing system	As required	B	Review	for each type of treatment	Tech Specs and Const. Drawings		SR	√	
7.7.1	**General Requirement- Water Proofing**										
i	Polyurethene based coating, polyester scrim cloth, extruded HD dimpled polyurethene	Material	As agreed / required	B	Review of MTC	For each lot received at site	Tech Specs /Const. Drawings		SR	√	MTC shall contain all the parameters specified in the technical specifications
ii		Acceptance of water proofing work	As agreed / required	B	Physical	100%	Tech Specs and Const. Drawings				
7.7.2	**Roof / Basement Treatment**										
i	Graded under bed	Levels / slopes	As required	C	Physical	100%	Tech Specs and Const. Drawings				
ii	Elastomaric coatings	Material- Primer coat, finishing coat	As required	B	Review of MTC	Each lot of delivery	Tech Specs and Const. Drawings		SR	√	
iii	Wearing course	Materials - PCC, chicken wire mesh, elastomeric sealant	As required	B	Review of MTC	Each lot of delivery	Tech Specs and Const. Drawings		SR	√	
iv		Acceptance of water proofing work	As agreed / required	B	Physical	100%	Tech Specs and Const. Drawings				
7.8	**Fencing and Gates**										
i	PVC coated chain link fencing, Welded wire mesh (IS 1566), Reinforced barbed tape galvanised (IS 2629) etc.	Materials	As agreed / required	B	Review of MTC	Each batch of delivery	Tech Specs and Const. Drawings		SR/MTC	√	MTC shall contain all the parameters specified in the technical specifications / relevant IS Codes
ii		Acceptance of the installation	As agreed / required	B	Physical / measurements	Each installation	Tech Specs and Const. Drawings		SR		
7.9	**FLOOR FINISHES AND ALIED WORKS**										
7.9.1	**Cement Concrete Flooring**										
i		Glass/ PVC strips in joints	As agreed / required	C	Physical	Random in each shift	Tech Specs and Const. Drawings		SR		
ii		Finishing and acceptance	As agreed / required	B	Physical	100%	Tech Specs and Const. Drawings		SR		
7.9.2	**Tiles**										
i	**Ceramic, vitrified, glass mosaic, acid alkali resistant, heavy duty cement concrete tiles**	Materials	As agreed / required	B	Review of MTC	Each lot of delivery	Tech Specs and Const. Drawings		SR	√	MTC shall contain all the parameters specified in the technical specifications / relevant IS Codes
ii		Finishing and acceptance	As agreed / required	B	Physical	100%	Tech Specs and Const. Drawings		SR		
7.9.3	**Interlocking Blocks**										
i		Materials	As agreed / required	B	Review of MTC	Each lot of delivery	Tech Specs and Const. Drawings		SR	√	
ii		Finishing and acceptance	As agreed / required	B	Physical	100%	Tech Specs and Const. Drawings		SR		
7.9.4	**Kota Stone, Granite and Marble**										
i		Quality, texture, thickness, colour for each lot of delivery from approved source	As agreed / required	C	Physical	Each batch of delivery	Tech Specs and Const. Drawings		SR	√	
ii		Finishing and acceptance	As agreed / required	B	Physical	100%	Tech Specs and Const. Drawings		SR		
7.10.6	**Acid / alkali and oil resistant high built seamless epoxy based resin and treatment**										
i	Material	Bricks, vitreous tiles, mortar, sealing, paints, coatings, sheets, fillers etc	As agreed / required	B	Review of MTC	Each batch of delivery	Tech Specs and Const. Drawings		SR	√	Experienced workers under supervisors recommended/ appointed by manufacturer to be deployed
ii		Surface preparation	As agreed / required	C	Physical	Random in each shift	Tech Specs and Const. Drawings, IS				
iii		Finishing and acceptance	As agreed / required	B	Physical	100%	Tech Specs and Const. Drawings		SR		

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Sl. No	Activity and operation	Characteristics / instruments		Class of check	Type of Check	Quantum Of check	Reference Document	Acceptance Norms	Format of Record		Remarks
1	2	3		4	5	6	7	8	9	D*	10
8.0	WATER SUPPLY / SANITORY INSTALLATIONS										
8.1	Water supply fittings and fixtures										
i	Materials	GI/ MS pipes and fittings	As agreed / required	B	Review of MTC	Each lot of delivery as per Specifications	Tech Specs and Const. Drawings		SR	√	
ii	Disinfection	Before use	As agreed / required	C	Physical	Each installation	Tech Specs and Const. Drawings		SR		
iii	Hydraulic test	Before use / leakage	As agreed / required	B	Physical	Each installation	Tech specs and const drawings		SR	√	
iv		Acceptance and working	As agreed / required	A	Acceptance	Random	Tech Specs and Const. Drawings		SR		
8.2	Sand cast iron / cast iron pipes										
i	Material	SCI / CI pipes and fittings / joints	As agreed / required	B	Review of MTC	Each lot of delivery as per Specifications	Tech Specs and Const. Drawings		SR	√	
ii		Acceptance and leakage	As agreed / required	B	Physical	Random	Tech Specs and Const. Drawings		SR		
8.3	Sanitary fittings and fixtures										
i	Material	Sanitory items and fixtures i.e. water closets, urinals, wash basins, sinks, mirrors, shelves, towel rail, soap containers, geyser, water cooler, etc, water supply / sanitation pipes, manhole cover and frames etc	As agreed / required	B	Physical	Each lot of delivery as per Specifications	Tech Specs and Const. Drawings		SR	√	
ii		Acceptance of installations of all sanitory items and fixtures	As agreed / required	B	Acceptance	100%	Tech Specs and Const. Drawings		SR		
8.4	RCC Pipes										
i	Material	RCC pipes	As agreed / required	B	Review of MTC	Each lot of delivery as per Specifications	Tech Specs and Const. Drawings /IS 458		SR	√	
ii		Acceptance and leakage	As agreed / required	B	Physical	Random	Tech Specs and Const. Drawings		SR		
8.5	Water Storage Tanks										
i	Material	Over head / loft type	As agreed / required	B	Physical	Each lot of delivery as per Specifications	Tech Specs and Const. Drawings		SR	√	
ii		Aceptance and leakage	As agreed / required	B	Acceptance	Random	Tech Specs and Const. Drawings		SR		
9.0	SPECIAL ITEMS										
9.1	Earthing Mat (Grounding System)										
i	Material	Earthing mat	As agreed / required	B	Physical	Each lot of delivery as per Specifications	As per relevant IS and Tech. Specs / Manufacturer's, IS 3043		SR/MTC	√	
ii		Weld sizes & length	Visual/Tape	B	Visual/ Measurement	100%	Tech Specs and Const. Drawings				NTPC approved electrodes shall be used
iii		D P test	DP test Kit	B	Physical	10% at random of the offered lot	Tech Specs and Const. Drawings		TR	√	
iv		Earth test	Earthing test kit	A	Physical	100%	Tech Specs and Const. Drawings,		SR	√	
10.00	STRUCTURAL STEEL MATERIAL (For Site Fabrication)										
i	Procured by contractor	Structural steel procured from NTPC approved sources- Mechanical (YS, UTS, Elg, UT if specified),,and Chemical properties (CE as per IS)		A	Review	For each batch of each section delivered at site	Technical Specification and Construction Drawings, IS 2062, 8500		SR	√	Correlated MTC shall be verified.
10.1	PRE-WELDING REQUIREMENTS										
i		Welding Procedure Specification * (WPS*)	-	A	Review	Each Welding Process	Technical Specification and Construction Drawings, ASME-IX/ AWS D 1.1		WPS	√	*To be approved by CQA
ii		PQR and Welder's Qualification	-	A	Physical	Each welder	PQR/ WQR, AWS-D1.1/ASME-IX,		TR	√	
iii		Welding consumables	-	B	Physical	Random in each shift	Approved WPS, Latest NTPC		SR	√	

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10.2	FIT-UP										
i		Marking and Cutting	Tape, ruler etc	B	Visual & Measurement	Each plate/ Section	Technical Specification and Construction Drawings/ Approved cutting plan		SR		
ii		Match markings for trial assembled components	-	B	Physical	Each fit-up	Technical Specification and Construction Drawings		SR		
iii		Weld Fit Up- Edge Preparation/ Gap/ Alignment	Tape, ruler etc	B	Physical	Each fit-up	Technical Specification and Construction Drawings, IS 7215		SR	√	If required suitable stiffners shall be provided to prevent deflection.
10.3	PRE HEATING (wherever applicable)										
i		Pre-Heating Temperature	Thermal chalk	B	Measurement	Each pre-heating	Technical Specification and Construction Drawings, Approved WPS		SR	√	
ii		Post Weld Heat Treatment (PWHT), if required	Thermo couple with time temperature recorder	A	Time & Temperature	Each PWHT	Technical Specification and Construction Drawings, Approved WPS		SR	√	
10.4	WELDING REQUIREMENTS										
i		Sequence of welding	-	B	Physical	Random in each shift	Technical Specification and Construction Drawings, Agreed scheme		SR		
ii		Removal/ grinding of temporary attachments	-	B	Measurement	All cleats/ attachments	Technical Specification and Construction Drawings, Approved Drg.		SR		
iii		Completeness after welding- Dimensions/ distortion	Weld gauge	B	Visual	Each structure component	Technical Specification and Construction Drawings, IS 822		SR	√	
iv		Completeness of welding (each butt & fillet weld)		B	Visual	Each structure component	Technical Specification and Construction Drawings, Approved Drg.		SR	√	
10.50	NON DESTRUCTIVE AND DESTRUCTIVE TESTING										
10.5.1	FILLET WELDS										
i		size and visual examination	As required/ agreed	B	Visual/ Measurement	100%	As per technical specifications and construction drawings, IS 822, AWS D 1.1		SR		As per requirement of NTPC Engineer
ii		Dye Penetration Test	As required/ agreed	B	Physical	5% of Weld length with min. 300mm at each loaction	As per technical specifications and construction drawings, IS 822, AWS D 1.1		SR		
10.5.2	BUTT WELDS										
i		Visual examination	As required/ agreed	B	Visual	Random in each shift	As per technical specifications and construction drawings, IS 822, AWS D 1.1		SR		As per requirement of NTPC Engineer
ii		DPT	As required/ agreed	B	Physical	100% on all butt welds after back gouging on root run and 10% on	As per technical specifications and construction drawings, IS 822, AWS D 1.1		IR		All butt welds to be back gouged before DPT
iii		Radiography Test	As required/ agreed	A	Physical	10%	As per technical specifications and construction drawings, IS 822, AWS D 1.1		IR	√	Wherever RT is not feasible UT to be carried out. In case of failure of any welds in SPOT/RT or UT the % of retesting shall be doubled at that particular loaction. Acceptance criteria of NDT on welds shall be as per AWS D1.1.
10.60	FOUNDATION CHECKS										
i		Dimensions and levels- Shape, lines (including diagonal checks)	Theodolite, Tape etc	B	Physical/ Measurement	Each Foundation	Tech Specs and Const. Drawings		SR	√	
ii		Foundation Bolts and Embedments- Verticality, Levels, pitch distance	Theodolite, Tape, Piano wires etc	B	Physical/ Measurement	Each Foundation	Tech Specs and Const. Drawings		SR	√	
10.70	PAINTING SYSTEM										
i		Paining Materials and accessories	-	A	Review of MTC	Each batch of delivery	Tech Specs and Const. Drawings		SR/MTC	√	Mfr.'s T.C. shall be correlated with the consignment received.
ii		Submission of painting methodology	-	B	For Review of painting system	Before start of painting work	Tech Specs and Const. Drawings				
iii		Surface prepration	As agreed / required	B	Physical /visual	Each Erection Mark	Tech Specs and Const. Drawings,		SR	√	

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1	2	3		4	5	6	7	8	9	D*	10
iv		Primer Thickness	Elcometer	B	Measurement	Each Erection Mark	Tech Specs and Const. Drawings		SR	√	
v		DFT of paint	Elcometer	B	Measurement	Each Erection Mark	Tech Specs and Const. Drawings		SR	√	
vi		Acceptance of painted surfaces	Elcometer	B	Visual and measurement	Each Erection Mark	Tech Specs and Const. Drawings		SR		
10.80	PRE-ASSEMBLY CHECKS										
i		Punch Erection marks and match marks on members	-	B	Visual/ Physical	Each structural member	Tech Specs and Const. Drawings				Markings for - Assembly designation, Part number, Weight. Any other important
ii		Pre-assembly as per match mark	-	B	Visual/ Physical	Each structural member	Tech Specs and Const. Drawings				
iii		Camber, sweep and total length after trial assembly of structure.	Theodolite, Tape, plumb, piano wires etc	B	Visual/ Physical	Each structural member	Tech Specs and Const. Drawings		SR	√	
iv		Control assembly check at shop	Theodolite, Tape, plumb, piano wires etc	B	Visual/ Physical	Every first and tenth set of identical structure	Tech Specs and Const. Drawings				
V		Completion of primer & intermediate coat of paint		B	Visual / Physical	Random	Tech Specs and Const. Drawings		SR		
10.90	ERECTION CHECKS										
i		Alignment, slopes, level, tolerances of erected member	Theodolite, Tape, plumb, piano wires etc	B	Measurement	Each structural member	Tech Specs and Const. Drawings		SR	√	
ii		Tightening of bolts/ Torque including foundation bolts with lock nuts	Wrench/ Torque wrench if specified	B	Visual/ Physical	Each structural member	Tech Specs and Const. Drawings		SR	√	
iii		Completion of all erection fillet & butt welds		B	Visual	Each structural member	Tech Specs and Const. Drawings		SR	√	
iv		Acceptance of erected structure	Theodolite, Tape, plumb, piano wires etc	B	Visual/ Physical	Each erected structure	Tech Specs and Const. Drawings, IS 7215 and IS 12843		SR	√	
10.10	PERMANENT BOLTS AND NUTS AND WASHERS										
i		Material- Permanent mild steel Bolts, mild steel Nuts, High strength structural Bolts, Washers-Dimensions, properties, Class, storage along with MTC	Screw gauge, Vernier, Tape etc.	A	Physical and MTC Review	Once for each lot of delivery	Tech Specs and Const. Drawings		SR/MTC	√	
ii		Contact surfaces before bolting	-	B	Physical	Random before asembly for bolting	Tech Specs and Const. Drawings, IS 4000		SR		
iii		Inspection of the assembled bolts	-	B	Physical	Randomly in each shift for assembeled bolts	Tech Specs and Const. Drawings, IS 4000		SR		
iv		Tensioning	As agreed / required	B	Physical	Randomly during snug tight test and after full tensinoning	Tech Specs and Const. Drawings, IS 4000		SR	√	
v		Acceptance of installed bolts	-	B	Physical	Each bolt	Tech Specs and Const. Drawings		SR		
11.0	ROAD WORKS										
11.1	Construction of Sub-Grade and earthen/hard soulders										
i		Standard proctor Test	As per IS: 2720	B	Physical	One in every 2000 cum for each type and source of fill materials	As per Tech Specs and Const. Drawings,Section 900 of MORTH specification, IS 2720 (Pt.VII)		SR/TR	√	In cutting or existing levelled ground - quantum of check shall be one per 1000 SQM
ii		Moisture content of fill before compaction	As per IS: 2720	B	Physical	One in every 2000 cum for each type and source of fill materials	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification, IS 2720 (Pt.II)		SR/TR		In cutting or existing levelled ground - quantum of check shall be one per 1000 SQM
iii		Dry density by core cutter method ---- OR---- Dry density in place by sand displacement method	As per IS: 2720	A	Physical	One in every 500 SQM area for each compacted layer.	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification, IS 2720 (Pt. XXIX)/ IS 2720 (Pt. XXVIII),		SR/TR	√	Both for embankment and cut formation quantum of check - One in every 1000 SQM area for each compacted layer.
iv		Lines, grade and cross section	As required / agreed	B	Physical	One in every 500 SQM area	As per Tech Specs and Const. Drawings		SR		Template, straight edge
11.2	Water Bound Macadam (Non-Bituminous) for base course and sub-base course										

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i		Aggregate Impact value	Agrregate Impact value Test Apparatus	B	Physical	One test per 200 cum of Test aggregate	As perTech Specs and Const. Drawings, Section 900 of MORTH specification,		SR	√	
ii		Grading	Set of IS Sieves	B	Physical	One test per 100 cum of aggregate	As perTech Specs and Const. Drawings, Section 900 of MORTH specification,		SR		
iii		Flakiness index and elongation index	Flakiness test gauge	B	Physical	One test per 200cun of agregate	As perTech Specs and Const. Drawings, Section 900 of MORTH specification,		SR		
iv		Atterberg Limits of binding material	Atterberg limits determination	B	Physical	One test per 25 cum of binding material	As perTech Specs and Const. Drawings, Section 900 of MORTH specification,		SR	√	
v		Atterberg Limits of portion of agreggate passing 425 micron sieve	Atterberg limits determination	B	Physical	One test per 100cum of aggregate	As perTech Specs and Const. Drawings, Section 900 of MORTH specification,		SR	√	
vi		Camber, surface, slope	As required / agreed	B	Physical	One in every 500 SQM area	As per Tech Specs and Const. Drawings		SR		Template, straight edge
11.3	**Bituminous Macadam for base and binder course**										
i		Quality of binder	Penetrometre with St. needle	B	Physical	No. of samples per Lot & tests as per IS:73, IS:217, IS:8887 as applicable	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification, IS 73		SR	√	
ii		Aggregate Impact Value / Los angeles abrasion value	Aggregate Impact ValueTest apparatus	A	Physical	Once per source	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification		SR	√	
iii		Flakiness Index and elongation index of aggregates	Flakiness test gauge	B	Physical	One test per 50 cum of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification		SR		
iv		Stripping value of aggregate (Immersion tray test)	As required / agreed	B	Physical	Initialy one set of 3 representative specimen per source, and on every change of source.	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification		SR		
v		Water sensitivity of mix	As required / agreed	B	Physical	Initialy one set of 3 representative specimen per source, and on every change of source.	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification		SR	√	
vi		Grading of aggregates	Set of Sieves	B	Physical	Two test per day per plant both on individual constituents and mixed aggregate from dryer	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification		SR		
vii		Water absorption of aggregate	As required / agreed			Initially one set of 3 representative specimen per source, and on every change of source.	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification		SR		
viii		Soundness (Magnesium and Sodium Sulphate)	As required as per IS:2386	A	Physical	Once per source by each method and on every change of source	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification		SR	√	
ix		Percentage of fractured faces	As required / agreed	B	Physical	When gravel is used one test per 50cum of aggregates	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification		SR		
x		Binder content and aggregate grading	Bitumen extractor	A	Physical	Periodic, subject to a min of two tests per day per plant	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification		SR	√	
xi		Control of Temperature of binder and aggregate for mixing and of the mix at the time of laying and rolling	Thermometer	B	Physical	At regular close intervals	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification		SR		

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1	2	3	4	5	6	7	8	9	D*	10			
xii		Rate of spread of mixed materials	B	Physical	Regular control through checks of layer thickness	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification		SR					
		As required / agreed											
xiii		Density of compacted Layer	A	Physical	One test per 250 sqm of area	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification		SR	√				
		As required / agreed											
11.4	Bituminous Surfacing - Open graded premix carpet and Seal coat												
i		Quality of binder	A	Physical	No. of samples per Lot & tests as per IS:73, IS:217, IS:8887 as applicable	IS:73,Tech Specs and Const. Drawings, Section 900 of MORTH specification		SR	√				
		Penetrometre with St. needle											
ii		Aggregate Impact Value / Los angeles abrasion value	B	Physical	One test per 50 cum of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification		SR	√				
		Aggregate Impact Value/Test apparatus											
iii		Flakiness Index and elongation indexof aggregates	B	Physical	One test per 50 cum of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification		SR					
		Flakiness test gauge											
iv		Stripping value of aggregate (Immersion tray test)	B	Physical	Initialy one set of 3 representative specimen per source, and on every change of source	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification		SR					
		As required / agreed											
v		Water absorption test	B	Physical	Initialy one set of 3 representative specimen per source, and on every change of source	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification		SR	√				
vi		Water sensitivity of mix	B	Physical	Initialy one set of 3 representative specimen per source, and on every change of source	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification		SR	√				
		As required / agreed											
vii		Grading of aggregates	B	Physical	One test per 25 cum of aggregates	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification		SR					
		Set of Sieves											
viii		Soundness (Magnesium and Sodium Sulphate)	A	Physical	Once per source by each method and on every change of source	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification		SR	√				
		As required as per IS:2386											
ix		Polished stone value	B	Physical	As required	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification		SR					
		As required as per BS:812(Part 114)											
x		Temperature of binder at application	B	Physical	At regular close intervals	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification		SR					
		Thermometer											
xi		Binder content	A	Physical	One test per 500 cum& not less than two tests per day	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification		SR	√				
		Bitumen extractor											
xii		Rate of spread of materials	B	Physical	One test per 500 cum and not less than 2 tests per day	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification		SR					
		As required / agreed											
xiii		Percentage of fractured faces	B	Physical	When gravel is used one test per 50cum of aggregates	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification		SR	√				
		Bitumen extractor											
11.5	Tack Coat/ Prime coat/ fog coat												
i		Quality of binder	A	Physical	No. of samples per Lot & tests as per IS:73, IS:217, IS:8887 as	IS:73,Tech Specs and Const. Drawings, Section 900 of MORTH specification		SR	√				
		Penetrometre with Standard needle											
ii		Temperature of binder at application	B	Physical	At regular close intervals	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification		SR					
		Thermometer											
iii		Rate of spread of binder	B	Physical	One test per 500 cum and not less than 2 tests per day	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification		SR					
		As required / agreed											

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11.6	RCC Pavements	Concrete - Material, Mix design, Trial Mixes, Production, Transportation, Placement, Compaction, Curing, Test on green concrete, Test on hardened concrete etc.	As required / agreed	-	-	Refer FQP for concrete Works	Refer FQP for concrete Works, , Tech Specs and Const. Drawings, IRC & MORTH		-	-	FQP for Concrete Works shall be application for all concrete works
11.7	Alignment, Level, Surface regularity and rectification										
i		Horizontal alignment, Surface levels and Surface regularity	As required / agreed	B	Physical	As per section 900 of MOSRTH specification	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification		SR		
ii		Rectification	As required / agreed	B	Physical	Each rectification	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification		SR	√	

Manufacturer/ Sub supplier	Main-supplier	Legend to be used: Class # : A = Critical, B=Major, C=Minor[redacted]TR, MTC, LB Categorization Witnessing & Accepting (As per NTPC QA&I[redacted]m) Category 'A' FQA Engineer in association with Executing E[redacted]r, Category 'B' Executing Engineer, Category 'C' Executing Engineer ,SR = Site Register , TR= Test Report[redacted] = Manufacturer's Test Certificate	For NTPC USE			
Signature		This document shall be read in conjunction with NTPC Tech. Sp[redacted]tions, BOQ, Drawings		REVIEWED BY	APPROVED BY	APPROVAL SEAL

MF . LOGO	MANUFACTU E NAME AND ADDRESS	**MANUFACTURING QUALITY PLAN**		PROJECT : PACKAGE : CONTRACT NO. : MAIN-SUPPLIER:
		ITEM : SUB-SYSTEM:	QP NO.: REV.NO.: DATE: PA E: . OF .	

SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
					M	C / N					M	C	N	
1.	2.	3.	4.	5.	6.		7.	8.	9.	D*	** 10.			11.

MANUFACTURER/ SUB-SUPPLIER	MAIN-SUPPLIER
SIGNATURE	

LEGEND: * RECORDS, INDENTIFIED WITH "TICK" ( ) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.
** **M:** MANUFACTURER/SUB-SUPPLIER **C:** MAIN SUPPLIER, **N:** NTPC
P: PERFORM **W:** WITNESS AND **V:** VERIFICATION. AS APPROPRIATE,
CHP: NTPC SHALL IDENTIFY IN COLUM "N" AS 'W"

FOR NTPC USE

DOC. NO.:		EV CAT ..
REVIEWED BY	APPROVED BY	APPROVAL SEAL

UPPLIE LOGO	UPPLIE NAME AN ADDRESS	FIELD QUALITY PLAN		PROJECT :
		ITEM :	QP NO.:	PACKAGE :
		SUB-SYSTEM:	REV. NO.:	CONTRACT NO. :
			DATE:	MAIN-SUPPLIER:
			PA E: . OF .	

SL. NO	ACTIVITY AND OPERATION	CHARACTERISTICS / INSTRUMENTS	CLASS OF CHECK #	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	D*	REMARKS
1.	2.	3.	4.	5.	6.	7.	8.	9.		10.

MANUFACTURER/ SUB-SUPPLIER	MAIN-SUPPLIER
SIGNATURE	

LEGEND: * RECORDS, INDENTIFIED WITH "TICK" ( ) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.
LEGEND TO BE USED: CLASS # : A = CRITICAL, B=MAJOR, C=MINOR;
'A SHALL BE WITNESSED BY NTPC FQA, **'** SHALL BE WITNESSED BY NTPC ERECTION / CONSTRUCTION DEPTT. AND **'C** SHALL BE WITNESSED BY MAIN SUPPLIER (A & B CHECK SHALL BE NTPC CHP STAGE)

FOR NTPC USE

DOC. NO.:		EV
REVIEWED BY	APPROVED BY	APPROVAL SEAL

ENDORSEMENT SHEET FOR QP

REFERENCE / *STANDARD* / FIELD QUALITY PLAN (RQP / SQP/*RFQP/SFQP*)

TO BE FILLED IN BY SUPPLIER AT TIME OF SUBMISSION		**To be filled in by NTPC**
PROJECT NAME		***REVIEW & ENDORSEMENT BY NTPC*** **PROJECT SPECIFIC QP NUMBER ALLOTTED** **QP NO.:** **REV. NO.: DATE:** ** The **RQP/SQP/RFQP/SFQP** once endorsed for a particular contract shall remain valid even though the original QP may have expired or revised, unless / otherwise mutually agreed with the supplier. ①
CONTRACT NO.:		
MAIN SUPPLIER		
MANUFACTURER WORKS & ADDRESS	**M/S**	
ITEM /EQUIPMENT / SYSTEM/ SUB-SYSTEM DETAILS i.e. MODEL TYPE / SIZE /RATING etc.		
APPROVED QP NO.: RQP/SQP/RFQP/SFQP	**0000-999-QV - - REV. NO.: DATED**:**	
Confirmation by Main Supplier (TICK WHICHEVER APPLICABLE)		*(TICK APPLICABLE)*
I. That the item/ component is identical to that considered for QP approval. **OR.**		**The QP is endorsed for this project without any change**
II. That there are minor changes in the item/ component with respect to that considered for QP approval, however the same do not affect the contents of QP. **OR**		
III. That there are minor changes in the item/ component with respect to that considered for QP approval, however the same affect the QP slightly, as indicated below / in attached sheet.		**The QP is endorsed for this project with changes as indicated.**
.		***DISTRIBUTION OF ENDORSEMENT OF*** **A) RQP/SQP:** ***1. MAIN SUPPLIER (WITH A COPY OF QP)*** ***2. MANUFACTURER*** ***3. RIO*** ***4. CQA-SPL*** ***5. CQA-O/C*** **B) RFQP/SFQP:** ***1. MAIN SUPPLIER (with a copy of QP)*** ***2. MANUFACTURER*** ***3. NTPC FQA (with a copy of QP)*** ***4. NTPC Erection (with a copy of QP)*** ***5. CQA-SPL*** ***6. CQA-O/C***
SIGN.: (Main Supplier) DATE	***SIGN.: (Manufacturer) DATE:***	**NTPC (Reviewed /Approved by/ Date & Seal)**

Logo Of Supplier / Sub-Supplier / Manufacturer (If possible)	**FROM: SUPPLIER : (ON WHOM NTPC PLACED LOI / ORDER)** M/s:---------- **Address**---------- Contact Person: ---------- Ph:(O): ----------Fax:---------- Ph(R):- ---------- Mobile: ---------- **e**-mail:-------- ----------	**INSPECTION CALL FOR NTPC INSPECTION** **(FOR SUBMISSION BY SUPPLIER/ SUB-SUPPLIER)**	**TO:** **REGIONAL INSPECTION OFFICE** ---------- **NTPC LTD.**---------- Contact Person: ---------- Ph:(O): ----------Fax:---------- ---------- Mobile: ---------- **e**-mail: ----------

PROJECT NAME: ----------

PACKAGE NAME: ----------

NTPC CONTRACT NO/ PO NO: ----------

PROPOSED DATE OF INSPACTION: ----------

NO. OF DAYS REQUIRED: ----------

WEEKLY OFF DAY (OF MANUFACTURER)..----------

SUB-SUPPLIER (If Applicable)
M/s:---------- ---------- **Address** ----------
Contact Person: ----------**Ph:(O):** ---------- **Fax:**---------
Mobile: ---------- **e-mail:** ----------

MANUFACTURER (Place of Inspection)
M/s ----------
Address ----------
Contact Person: ---------- ***Ph:(O):*** ----------***Fax:***--------
Mobile: ---------- ***Ph(R):*** ---------- ***e-mail:*** ----------

SL. NO	BBU NO.	ITEM DESCRIPTION / TESTS	QUANTITY				Insp. Cat (*)	REFERENCE DOCUMENT	REMARKS/ UNDERTAKING
			As in BBU	Already supplied	Offered	Unit			
								QP No. Drg/Data sheet No.	1. Material internally inspected, in line with NTPC QP and found satisfactory. 2 All Reference Documents including latest revisions of NTPC approved QP /Drawing / BBU in original are available and shall be made available during inspection. 3 All stage inspection requirements if applicable have been cleared and relevant CHP's are available. 4 **(Applicable for bought out items)** Inspection by Main supplier is completed and material is cleared. OR Joint inspection along with Main supplier proposed. 5. Type test Approval from NTPC Engg.: Obtained / Pending / Not available. 6. Material shall not be Despatched without Despatch Clearance from NTPC **SIGNATURE& DATE:**---------- **NAME & DESIGNNATION:**---------- **ORGANIZATION:**----------

Insp. Cat (*): ***Enter*** **0** – For Stage Inspection. **1** – For Final Physical Inspection. **2** – For Review of MTC's based on QP **3** – For Non-QP cases based on COC.

MAIN-SUPPLIER'S LOGO

(NAME & ADDRESS OF THE MAIN SUPPLIER)

M/S.....
.....

Ref. No. : ..... Date: .....

CERTIFICATE OF CONFORMANCE

Contract Name & Project : _____
Contract No./P.O. No. : _____
Sub Supplier's Name : _____

Sl. No.	Description of item/ Equipment	Specification Size/Type/ Rating	Make	NTPC DRG. NO. / GFR. DRG. NO.	Qty Offered	Bal. Qty	BBU Ref.	Identification Mark

It is hereby confirmed that above mentioned component/item/equipment was/were manufactured and tested in accordance with drawings/data sheets as referred above and found acceptable.

Signature :
Name :
Design :

Note:

1. Wherever a deviations accepted by the contractor relevant details to be enclosed with the Certificate of Conformance.
2. For Mandatory and Recommended Spares, the contractor shall furnish a 100%. Interchangeability with original equipment along with Certificate of Conformance.

BHARAT HEAVY ELECTRICALS LIMITED
PROJECT ENGINEERING & SYSTEMS DIVISION

PROJECT: - PEB for 1 x 50MW Solar PV Project – Mandsaur, M.P

ANNEXURE-6

PREBID QUERIES FORMAT					
Sl. No.	**Bidding document Reference**			**Subject**	**Bidder's Query**
	Part No/ Volume	**Page No**	**Clause No**		

BHARAT HEAVY ELECTRICALS LIMITED
PROJECT ENGINEERING & SYSTEMS DIVISION
RCPURAM, HYD-32

PY 60051
Rev No. 00

ANNEXURE-7

DEVIATION FROM SPECIFICATION

If the proposal submitted has got any deviation from the technical stipulations in the bidding document, the Bidder shall tabulate below the full particulars of such deviations and shall sign below. Additional sheets may be enclosed, if necessary. Deviation is to be furnished with mention of specific clause numbers. Technical and commercial deviations to scope of supply and services, shall be indicated separately. Bidders shall bring put only those deviations which are impractical to meet (or) not advisable

Sl.No.	CLAUSE NO.	DESCRIPTION AS PER SPECIFICATION	DEVIATION BY BIDDER

We confirm that all the deviations/exceptions to the Technical Specification PY51084, Job Specification and enclosures including reference documents attached are listed in this Annexure only. No other deviations or exceptions even if mentioned elsewhere shall be considered for any technical/ commercial evaluation or for ordering.

Signature of Bidder's
Authorized representative .with date.....

Date .....

BHARAT HEAVY ELECTRICALS LIMITED
PROJECT ENGINEERING AND SYSTEMS DIVISION

ANNEXURE-8

PRICE BID FORMAT													
RFQ No._____ Dt. _____ Due Date(Tech Bid): _____													
S.No	Short Text	Floor area of each PEB (sq.m.) 'A'	UNIT RATE per sq.m. (Rs.) 'B'	Qty 'C'	Unit	TOTAL RATE (UNIT RATE* QTY) (Rs.) 'D=A x B x C'	Taxes					Total (incl. of taxes)
							ED %	CST %	VAT%	Service Tax%	Others	
	SUPPLY											
1	**PY9760051010**: Supply of one set of structural materials such as columns, rafters, beams, purlins, steel sheets, insulation etc. all required for construction of PEB inverter room as per clause 9.1.1 of BHEL spec PY60051. (Note: 1 set is for one inverter room)											
a.	Type-1	107.575		4	SET					NA		
b.	Type-2	116.025		6	SET					NA		
2	**PY9760051028**:Supply of one set of architectural items such as doors, windows, rolling shutters etc all required for PEB inverter rooms as per clause 9.1.2 of BHEL spec PY60051. (Note: 1 set is for one inverter room)											
a.	Type-1	107.575		4	SET							
b.	Type-2	116.025		6	SET							
3	**PY9760051036**:Supply of one set of structural materials such as columns, rafters, beams, purlins, steel sheets, insulation etc all required for construction of PEB security room as per clause 9.1.1 of BHEL spec PY60051	4		1	SET					NA		
4	**PY9760051044**: Supply of one set of architectural items such as doors, windows etc all required for PEB security room as per clause 9.1.2 of BHEL spec PY60051	4		1	SET					NA		
5	Supply of electrical services as per clause 9.6.0 of BHEL spec PY60051	NA	NA	1	SET					NA		
	ERECTION & COMMISSIONING											
6	**PY9860051054**: E&C: Erection of one set of structural materials all required for PEB inverter room as per clause 9.1.3 of BHEL spec PY60051. (Note: 1 set is for one inverter room)											
a.	Type-1	107.575		4	SET		NA	NA	NA			
b.	Type-2	116.025		6	SET		NA	NA	NA			
7	**PY9860051062**: E&C: Erection of one set of architectural items all required for PEB inverter room as per clause 9.1.4 of BHEL spec PY60051. (Note: 1 set is for one inverter room)											
a.	Type-1	107.575		4	SET		NA	NA	NA			
b.	Type-2	116.025		6	SET		NA	NA	NA			
8	**PY9860051070**: E&C: Erection of one set of structural materials all required for PEB security room as per clause 9.1.3 of BHEL spec PY60051	4		1	SET		NA	NA	NA			

BHARAT HEAVY ELECTRICALS LIMITED
PROJECT ENGINEERING AND SYSTEMS DIVISION

PRICE BID FORMAT

RFQ No._____ Dt. _____ Due Date(Tech Bid): _____

S.No	Short Text	Floor area of each PEB (sq.m.) 'A'	UNIT RATE per sq.m. (Rs.) 'B'	Qty 'C'	Unit	TOTAL RATE (UNIT RATE* QTY) (Rs.) 'D=A x B x C'	Taxes					Total (incl. of taxes)
							ED %	CST %	VAT%	Service Tax%	Others	
9	**PY9860051089**: E&C: Erection of one set of architectural items all required for PEB security room as per clause 9.1.4 of BHEL spec PY60051	4		1	SET		NA	NA	NA			
10	E&C for Electrical Services as per clause 9.6.0 of BHEL spec PY60051	NA	NA	1	SET		NA	NA	NA			
	FREIGHT CHARGE											
11	Freight Charge including Service Tax on Freight	LUMPSUM										
	INSURANCE											
12	Insurance	LUMPSUM										
									Grand Total (in Rs.)			

NOTE:

1 Offer will be evaluated on the overall L1 basis for the sizes (floor area) indicated under column 'A' .

2 Column 'A'(Floor Area of each PEB) may change ± 10%, which will be finalised during detailed engineering. Floor Area is 'L'x 'W' as indicated in the drawing no. PY-LE-3-M086-2037-01 - Indicative invertor room layout (refer Annexure no. 2 of Cl. 21.0.0)

3 The payment for the above items mentioned shall be on actual size 'L'x'W' of PEB, finalized during detailed engineering using the unit rate quoted under column 'B'

4 The quoted prices shall be on “free on road” basis to project site: NTPC, MP

5 Please indicate taxes : ED, VAT/CST, Service Tax,Other Taxes clearly applicable as on date.

6 Use this format for compliance(reproducing on your letter head is acceptable).

7 * ED shall not be considered as the project is under MNRE approval. Hence all inclusive rate for Supply is to be quoted without ED for Sl No.1-4. However, the percentage of taxes considered against each item may pls be indicated in the column of Taxes for the purpose of availing Tax Credit.

8 Bidder to quote strictly as per BHEL's NIT requirements.

9 Bidder to note that this is a LUMP SUM Turn-Key Order. Any additional claim after placement of order will not be entertained under any circumstances.

10 Successful vendor shall submit the billing break up for supply & E&C for approval and implementation

11 Successful vendor shall provide bom along with make model, test certificate, caliberation report & qty of each item shall be furnished to BHEL/NTPC.

PART-G GENERAL TECHNICAL REQUIREMENTS

1.00.00 INTRODUCTION

This part covers technical requirements which will form an integral part of the Contract. The following provisions shall supplement all the detailed technical requirements brought out in the Technical Specifications and the Technical Data Sheets.

2.00.00 BRAND NAME

Whenever a material or article is specified or described by the name of a particular brand, manufacturer or vendor, the specific item mentioned shall be understood to be indicative of the function and quality desired, and not restrictive; other manufacturer's products may be considered provided sufficient information is furnished to enable the Employer to determine that the products proposed are equivalent to those named.

3.00.00 BASE OFFER & ALTERNATE PROPOSALS

The Bidder's proposal shall be based upon the use of equipment and material complying fully with the requirements specified herein. It is recognized that the Contractor may have standardized on the use of certain components, materials, processes or procedures different than those specified herein. Alternate proposals offering similar equipment based on the manufacturer's standard practice may also be considered, provided the base offer is in line with technical specifications and such proposals meet the specified design standards and performance requirement and are acceptable to the Employer. Sufficient amount of information for justifying such proposals shall be furnished to Employer along with the bid to enable the Employer to determine the acceptability of these proposals.

4.00.00 COMPLETENESS OF FACILITIES

4.01.00 Bidders may note that this is a contract inclusive of the scope as indicated elsewhere in the specification. Each of the plant shall be engineered and designed in accordance with the specification requirement. All engineering and associated services are required to ensure that a completely engineered plant is provided.

4.02.00 All equipment furnished by the Contractor shall be complete in every respect, with all mountings, fittings, fixtures and standard accessories normally provided with such equipment and/or those needed for erection, completion and safe operation & maintenance of the equipment and for the safety of the operating personnel, as required by applicable codes, though they may not have been specifically detailed in the respective specifications, unless included in the list of exclusions.

All similar standard components/ parts of similar standard equipment provided, shall be interchangeable with one another.

5.00.00 CODES & STANDARDS

5.01.00 In addition to the codes and standards specifically mentioned in the relevant technical specifications for the equipment / plant / system, all equipment parts, systems and works covered under this specification shall comply with all currently applicable statutory regulations and safety codes of the Republic of India as well as of the locality where they will be installed, including the following**:**

(a) Bureau of Indian Standards (BIS)

(b) Indian electricity act

(c) Indian electricity rules

(d) Indian Explosives Act

(e) Indian Factories Act and State Factories Act

(f) Indian Boiler Regulations (IBR)

(g) Regulations of the Central Pollution Control Board, India

(h) Regulations of the Ministry of Environment & Forest (MoEF),Government of India

(i) Pollution Control Regulations of Department of Environment, Government of India

(j) State Pollution Control Board.

(k) Rules for Electrical installation by Tariff Advisory Committee (TAC).

(l) Any other statutory codes / standards / regulations, as may be applicable.

5.02.00 Unless covered otherwise by Indian codes & standards and in case nothing to the contrary is specifically mentioned elsewhere in the specifications, the latest editions (as applicable as on date of bid opening), of the codes and standards given below shall also apply:

(a) Japanese Industrial Standards (JIS)

(b) American National Standards Institute (ANSI)

(c) American Society of Testing and Materials (ASTM)

(d) American Society of Mechanical Engineers (ASME)

(e) American Petroleum Institute (API)

(f) Standards of the Hydraulic Institute, U.S.A.

(g) International Organization for Standardization (ISO)

(h) Tubular Exchanger Manufacturer's Association (TEMA)

(i) American Welding Society (AWS)

(j) National Electrical Manufacturers Association (NEMA)

(k) National Fire Protection Association (NFPA)

(l) International Electro-Technical Commission (IEC)

(m) Expansion Joint Manufacturers Association (EJMA)

(n) Heat Exchange Institute (HEI)

5.03.00 Other International/ National standards such as DIN, VDI, BS, GOST etc. shall also be accepted for only material codes and manufacturing standards, subject to the Employer's approval, for which the Bidder shall furnish, alongwith the offer, adequate information to justify that these standards are equivalent or superior to the standards mentioned above. In all such cases the Bidder shall furnish specifically the variations and deviations from the standards mentioned elsewhere in the specification together with the complete word to word translation of the standard that is normally not published in English.

5.04.00 As regards highly standardized equipment National /International standards such as JIS, DIN, VDI, ISO, SEL, SEW, VDE, IEC & VGB shall also be considered as far as applicable for Design, Manufacturing and Testing of the respective equipment. In addition, these standards shall be referred for the design of machine foundations, wherever specifically mentioned in the specifications. However, for those of the above equipment not covered by these National / International standards, established and proven standards of manufacturers shall also be considered.

5.05.00 In the event of any conflict between the codes and standards referred to in the above clauses and the requirement of this specification, the requirement of Technical Specification shall govern.

5.06.00 Two (2) English language copies of all-national and international codes and/or standards which are not available with NTPC and same is used in the design of the plant, equipment, civil and structural works shall be provided by the Contractor to the Employer within two calendar months from the date of the Notification of Award.

5.07.00 In case of any change in codes, standards & regulations between the date of bid opening and the date when vendors proceed with fabrication, the Employer shall have the option to incorporate the changed requirements or to retain the original standard. It shall be the responsibility of the Contractor

	to bring to the notice of the Employer such changes and advise Employer of the resulting effect.
6.00.00	**EQUIPMENT FUNCTIONAL GUARANTEE**
6.01.00	The functional guarantees of the equipment under the scope of the Contract is given elsewhere in the technical specification. These guarantees shall supplement the general functional guarantee provisions covered under General Conditions of Contract.
6.02.00	Liquidated damages for shortfall in meeting functional guarantee(s) during the performance guarantee tests shall be assessed and recovered from the Contractor as specified elsewhere in this specification.
7.00.00	**DESIGN OF FACILITIES/ MAINTENANCE & AVAILABILITY CONSIDERATIONS**
7.01.00	**Design of Facilities**
	All the design procedures, systems and components proposed shall have already been adequately developed and shall have demonstrated good reliability under similar conditions elsewhere.
	The Contractor shall be responsible for the selection and design of appropriate equipment to provide the best co-ordinated performance of the entire system. The basic requirements are detailed out in various clauses of the Technical Specifications. The design of various components, assemblies and subassemblies shall be done so that it facilitates easy field assembly and dismantling. All the rotating components shall be so selected that the natural frequency of the complete unit is not critical or close to the operating range of the unit.
7.02.00	**Maintenance and Availability Considerations**
	Equipment/facilities offered shall be designed for high availability, low maintenance and ease of maintenance. The Bidder shall specifically state the design features incorporated to achieve high degree of reliability/ availability and ease of maintenance. The Bidder shall also furnish details of availability records in the reference plants stated in his experience list.
7.03.00	**Bidder shall state in his offer the various maintenance intervals, spare parts and man-hour requirement during such operation. The intervals for each type of maintenance namely the minor and major overhauls shall be specified in terms of fired hours, clearly defining the spare parts and man-hour requirement for each stage.**
	Lifting devices i.e. hoists and chain pulley jacks, etc. shall be provided by the contractor for handling of any equipment or any of its part having weight in excess of 500 kgs during erection and maintenance activities.

Lifting devices like lifting tackles, slings, etc. to be connected to hook of the hoist / crane shall be provided by the contractor for lifting the equipment and accessories covered under the specification.

8.00.00 DOCUMENTS, DATA AND DRAWINGS TO BE FURNISHED BY CONTRACTOR

8.01.00 Bidders may note that this is a contract inclusive of the scope as indicated elsewhere in the specification. Each of the plant and equipment shall be fully integrated, engineered and designed to perform in accordance with the technical specification. All engineering and technical services required ensuring a completely engineered plant shall be provided in respect of mechanical, electrical, control & instrumentation, civil & structural works as per the scope.

8.02.00 The Contractor shall furnish engineering data/drgs. for entire equipment covered under this specification in accordance with the schedule of information as specified in Technical Specification and Data sheets.. This documentation shall include but not be limited to the following :

8.02.01 **INSTRUCTION MANUALS**

The Contractor shall submit to the Employer, draft Instruction Manuals for all the equipment covered under the Contract by the end of one year from the date of his acceptance of the Letter of Award. The Instruction manuals shall contain full details required for erection, commissioning, operation and maintenance of each equipment. The manual shall be specifically compiled for this project. After finalization and approval of the Employer the Instruction Manuals shall be submitted. The Contract shall not be considered to be completed for purposes of taking over until the final Instructions manuals have been supplied to the Employer. The Instruction Manuals shall comprise of the following.

(a) Erection & Commissioning Manuals/Checklists

The erection & Commissioning Manuals/Checklists shall be submitted atleast three (3) months prior to the commencement of erection activities of particular equipment/system. The erection manual should contain the following as a minimum.

a) Erection strategy.

b) Sequence of erection.

c) Erection instructions.

d) Critical checks and permissible deviation/tolerances.

e) List of tool, tackles, heavy equipment like cranes, dozers, etc.

f) Bill of Materials

g) Procedure for erection.

h) General safety procedures to followed during erection/installation.

i) Procedure for initial checking after erection.

j) Procedure for testing and acceptance norms.

k) Procedure / Check list for pre-commissioning activities.

l) Procedure / Check list for commissioning of the system.

m) Safety precautions to be followed in electrical supply distribution during erection

(b) Operation & Maintenance Manuals

i. The operating and maintenance instructions together with drawings (other than shop drawings) of the equipment, as completed, shall be in sufficient detail to enable the Employer to operate, maintain, dismantle, reassemble and adjust all parts of the equipment. They shall give a step by step procedure for all operations likely to be carried out during the life of the plant / equipment including, operation, maintenance, dismantling and repair including periodical activities such as chemical cleaning of the generator. Each manual shall also include a complete set of drawings together with performance/rating curves of the equipment and test certificates wherever applicable. The contract shall not be considered to be completed for purposes for taking over until these manuals have been supplied to the Employer.

ii. If after the commissioning and initial operation of the plant, the manuals require any modification / additions / changes, the same shall be incorporated and the updated final instruction manuals shall be submitted to the Employer for records.

iii. A separate section of the manual shall be for each size/ type of equipment and shall contain a detailed description of construction and operation, together with all relevant pamphlets and drawings.

iv. The manuals shall include the following :

a) List of spare parts along with their drawing and catalogues and procedure for ordering spares.

b) Lubrication Schedule including charts showing lubrication checking, testing and replacement procedure to be carried daily, weekly, monthly & at longer intervals to ensure trouble free operation.

c) Where applicable, fault location charts shall be included to facilitate finding the cause of mal-operation or break down.

v. Detailed specifications for all the consumables including lubricant oils, greases, chemicals etc. system/equipment/assembly/sub-assembly - wise required for the complete plant.

vi. On completion of erection, a complete list of bearings / equipment giving their location, and identification marks etc. shall also be furnished to the Employer indicating lubrication method for each type/category of bearing.

8.02.02 **Project Completion Report**

The Contractor shall submit a Project Completion Report at the time of handing over the plant. After final acceptance of individual equipment /system by the Employer, the Contractor will update all original drawings and documents for the equipment/ system to "as built" conditions and submit.

8.03.00 ENGINEERING INFORMATION SUBMISSION SCHEDULE

Prior to the award of Contract, a Detailed Engineering Information Submission Schedule shall be tied up with the Employer. For this, the bidder shall furnish a detailed list of engineering information alongwith the proposed submission schedule. This list would be a comprehensive one including all engineering data / drawings / information for all bought out items and manufactured items. The information shall be categorised into the following parts.

a) Information that shall be submitted for the approval of the Employer before proceeding further, and

b) Information that would be submitted for Employer's information only.

The Engineering Information Schedule shall be updated month-wise.

The schedule should allow adequate time for proper review and incorporation of changes/ modifications, if any, to meet the contract without affecting the equipment delivery schedule and overall project schedule. The early submission of drawings and data is as important as the manufacture and delivery of equipment and hardware and this shall be duly considered while determining the overall performance and progress.

8.04.00 ENGINEERING PROGRESS AND EXCEPTION REPORT

Report giving the status of each engineering information including

(a) A list of drawings/engineering information which remains unapproved for more than four (4) weeks after the date of first submission

(b) Drawings which were not submitted as per agreed schedule.

The draft format for this report shall be furnished to the Employer within four (4) weeks of the award of the contract, which shall then be discussed and finalised with the Employer.

8.05.00 TECHNICAL CO-ORDINATION MEETING

- The Contractor shall organize and attend at least one monthly progress Meetings with the Employer/Employer's representatives during the period of Contract at mutually agreed venues for review of progress & resolving technical clarifications, if any. The Contractor shall attend such meetings at his own cost and fully co-operate with such persons and agencies involved during the discussions.
- The Contractor shall ensure availability of the concerned experts / consultants/ personnel who are empowered to take necessary decisions during these meetings. The Contractor shall be equipped with necessary tools and facilities so that, if required, the drawings/documents can be resubmitted after incorporating necessary changes and approved during the meeting itself.
- The Contractor shall furnish monthly progress report to the Employer detailing out the progress achieved on all erection activities as compared to the schedules. This shall be supplemented by printed colour photographs and video in VCD/DVD indicating various stages of erection and the progress of the work done at Site. The report shall also indicate the reasons for the variance between the

scheduled and actual progress and the action proposed for corrective measures, wherever necessary.

8.06.00 DESIGN IMPROVEMENTS

The Employer or the Contractor may propose changes in the specification of the equipment or quality thereof and if the parties agree upon any such changes the specification shall be modified accordingly.

If any such agreed upon change is such that it affects the price and schedule of completion, the parties shall agree in writing as to the extent of any changing the price and/or schedule of completion before the Contractor proceeds with the change. Following such agreement, the provision thereof, shall be deemed to have been amended accordingly.

8.07.00 EQUIPMENT BASES

A cast iron or welded steel base plate shall be provided for all rotating equipment which is to be installed on a concrete base, unless otherwise specifically agreed to by the Employer. Each base plate which support the unit and its drive assembly, shall be of a neat design with pads for anchoring the units, shall have a raised lip all around, and shall have threaded drain connections.

8.08.00 PROTECTIVE GUARDS

Suitable guards shall be provided for protection of personnel on all exposed rotating and/or moving machine parts. All such guards shall be designed for easy installation and removal for maintenance purpose.

8.09.00 LUBRICANTS, SERVO FLUIDS AND CHEMICALS

The Bidder's scope includes all the first fill and one year's topping, requirements of consumables such as oils, lubricants including grease, servo fluids, gases and essential chemicals etc. Consumption of all these consumables during the initial operation and final filling after the initial operation shall also be included in the scope of the Bidder.

8.09.01 As far as possible lubricants marketed by reputed companies shall be used. The variety of lubricants shall be kept to a minimum possible.

Detailed specifications for the lubricating oil, grease, gases, servo fluids, control fluids, chemicals etc. required for the complete plant covered herein shall be furnished. On completion of erection, a complete list of bearings/ equipment giving their location and identification marks shall be furnished to the Employer along with lubrication requirements.

8.09.02	**Lubrication** Equipment shall be lubricated by systems designed for continuous operation. Lubricant level indicators shall be furnished and marked to indicate proper levels under both standstill and operating conditions.
8.10.00	**Material of Construction** All materials used for the construction of the equipment shall be new and shall be in accordance with the requirements of this specification. Materials utilized for various components shall be those which have established themselves for use in such applications.
8.11.00	**RATING PLATES, NAME PLATES & LABELS**
8.11.01	Each main and auxiliary item of plant including instruments shall have permanently attached to it in a conspicuous position, a rating plate of non-corrosive material upon which shall be engraved manufacturer's name, equipment, type or serial number together with details of the ratings, service conditions under which the item of plant in question has been designed to operate, and such diagram plates as may be required by the Employer.
8.11.02	Such nameplates or labels shall be of white non-hygroscopic material with engraved black lettering or alternately, in the case of indoor circuit breakers, starters, etc. of transparent plastic material with suitably coloured lettering engraved on the back. The name plates shall be suitably fixed on both front and rear sides.
8.11.03	Hanger/ support numbers shall be marked on all pipe supports, anchors, hangers, snubbers and restraint assemblies. Each constant and variable spring support shall also have stamped upon it the designed hot and cold load which it is intended to support. Suitable scale shall also be provided to indicate load on support/hanger.
8.11.04	Nameplates shall be as per best practices of the industry
8.11.05	All such plates, instruction plates, etc. shall be bilingual with Hindi inscription first, followed by English. Alternatively, two separate plates one with Hindi and the other with English inscriptions may be provided.
8.11.06	All segregated phases of conductors or bus ducts, indoor or outdoor, shall be provided with coloured phase plates to clearly identify the phase of the system
8.12.00	**TOOLS AND TACKLES** The Contractor shall supply with the equipment one complete set of all special tools and tackles and other instruments required for the erection, assembly, disassembly and proper maintenance of the plant and equipment and systems (including software). These special tools will also

include special material handling equipment, jigs and fixtures for maintenance and calibration / readjustment, checking and measurement aids etc. A list of such tools and tackles shall be submitted by the Bidder alongwith the offer.

The price of each tool / tackle shall be deemed to have been included in the total bid price. These tools and tackles shall be separately packed and sent to site. The Contractor shall also ensure that these tools and tackles are not used by him during erection, commissioning and initial operation. For this period the Contractor should bring his own tools and tackles. All the tools and tackles shall be of reputed make acceptable to the Employer.

8.13.00 Welding

If the manufacturer has special requirements relating to the welding procedures for welds at the terminals of the equipment to be per formed by others the requirements shall be submitted to the Employer in advance of commencement of erection work.

8.14.00 COLOUR CODE FOR ALL EQUIPMENTS/ PIPINGS/ PIPE SERVICES

All equipment/ piping/ pipe services are to be painted by the Contractor in accordance with Employer's standard colour coding scheme, which will be furnished to the Contractor during detailed engineering stage.

8.15.00 PROTECTION AND PRESERVATIVE SHOP COATING

8.16.00 PROTECTION

All coated surfaces shall be protected against abrasion, impact, discoloration and any other damages. All exposed threaded portions shall be suitably protected with either metallic or a nonmetallic protection device. All ends of all valves and pipings and conduit equipment connections shall be properly sealed with suitable devices to protect them from damage. The parts which are likely to get rusted, due to exposure to weather, should also be properly treated and protected in a suitable manner. All primers/paints/coatings shall take into account the hot humid, corrosive & alkaline, subsoil or overground environment as the case may be.

8.17.00 Preservative Shop Coating

All exposed metallic surfaces subject to corrosion shall be protected by shop application of suitable coatings. All surfaces which will not be easily accessible after the shop assembly, shall be treated beforehand and protected for the life of the equipment. All surfaces shall be thoroughly cleaned of all mill scales, oxides and other coatings and prepared in the shop. The surfaces that are to be finish-painted after installation or require corrosion protection until installation, shall be shop painted with at least two coats of primer.

Transformers and other electrical equipment if included shall be shop finished with one or more coats of primer and two coats of high grade resistance enamel. The finished colors shall be as per manufacturer's standards, to be selected and specified by the Employer at a later date.

Shop primer for all steel surfaces which will be exposed to operating temperature below 95 degrees Celsius shall be selected by the Contractor after obtaining specific approval of the Employer regarding the quality of primer proposed to be applied. Special high temperature primer shall be used on surfaces exposed to temperature higher than 95 degrees Celsius and such primer shall also be subject to the approval of the Employer.

All other steel surfaces which are not to be painted shall be coated with suitable rust preventive compound subject to the approval of the Employer.

All piping shall be cleaned after shop assembly by shot blasting or other means approved by the Employer. Lube oil piping or carbon steel shall be pickled.

Painting for Civil structures shall be done as per relevant part of technical specification

9.00.00 QUALITY ASSURANCE PROGRAMME

9.01.00 The Contractor shall adopt suitable quality assurance programme to ensure that the equipment and services under the scope of contract whether manufactured or performed within the Contractor's works or at his sub-contractor's premises or at the Employer's site or at any other place of work are in accordance with the specifications. Such programmes shall be outlined by the Contractor and shall be finally accepted by the Employer/authorised representative after discussions before the award of the contract. The QA programme shall be generally in line with IS/ISO-9001.A quality assurance programme of the contractor shall generally cover the following:

9.02.00 His organisation structure for the management and implementation of the proposed quality assurance programme

(a) Quality System Manual

(b) Design Control System

(c) Documentation and Data Control System

(d) Qualification data for bidder's key personnel.

(e) The procedure for purchase of materials, parts, components and selection of sub-contractor's services including vendor analysis,

source inspection, incoming raw-material inspection, verification of materials purchased etc.

(f) System for shop manufacturing and site erection controls including process, fabrication and assembly.

(g) Control of non-conforming items and system for corrective actions and resolution of deviations.

(h) Inspection and test procedure both for manufacture and field activities.

(i) Control of calibration and testing of measuring testing equipment.

(j) System for Quality Audits.

(k) System for identification and appraisal of inspection status.

(l) System for authorising release of manufactured product to the Employer.

(m) System for handling, storage and delivery.

(n) System for maintenance of records, and

(o) Quality plans for manufacturing and field activities detailing out the specific quality control procedure adopted for controlling the quality characteristics relevant to each item of equipment/component.

9.03.00 GENERAL REQUIREMENTS - QUALITY ASSURANCE

9.03.01 All materials, components and equipment covered under this specification shall be procured, manufactured, erected, commissioned and tested at all the stages, as per a comprehensive Quality Assurance Programme. An indicative programme of inspection/tests to be carried out by the contractor for some of the major items is given in the respective technical specification. This is, however, not intended to form a comprehensive programme as it is the contractor's responsibility to draw up and implement such programme duly approved by the Employer. The detailed Quality Plans for manufacturing and field activities shall be drawn up by the Bidder and will be submitted to Employer for approval. Schedule of finalisation of such quality plans will be finalised before award on enclosed format No. QS-01-QAI-P-01/F3.

9.03.02 Manufacturing Quality Plan will detail out for all the components and equipment, various tests/inspection, to be carried out as per the requirements of this specification and standards mentioned therein and quality practices and procedures followed by Contractor's/ Sub-contractor's/ sub-supplier's Quality Control Organisation, the relevant

`	reference documents and standards, acceptance norms, inspection documents raised etc., during all stages of materials procurement, manufacture, assembly and final testing/performance testing. The Quality Plan shall be submitted on electronic media e.g. floppy or E-mail in addition to hard copy, for review and approval. After approval the same shall be submitted in compiled form on CD-ROM.
9.03.03	Field Quality Plans will detail out for all the equipment, the quality practices and procedures etc. to be followed by the Contractor's "Site Quality Control Organisation", during various stages of site activities starting from receipt of materials/equipment at site.
9.03.04	The Bidder shall also furnish copies of the reference documents/plant standards/acceptance norms/tests and inspection procedure etc., as referred in Quality Plans along with Quality Plans. These Quality Plans and reference documents/standards etc. will be subject to Employer's approval without which manufacturer shall not proceed. These approved documents shall form a part of the contract. In these approved Quality Plans, Employer shall identify customer hold points (CHP), i.e. test/checks which shall be carried out in presence of the Employer's Project Manager or his authorised representative and beyond which the work will not proceed without consent of Employer in writing. All deviations to this specification, approved quality plans and applicable standards must be documented and referred to Employer along with technical justification for approval and dispositioning.
9.03.05	No material shall be dispatched from the manufacturer's works before the same is accepted, subsequent to predispatch final inspection including verification of records of all previous tests/inspections by Employer's Project Manager/Authorised representative and duly authorised for dispatch by issuance of Material Despatch Clearance Certificate (MDCC).
9.03.06	All material used for equipment manufacture including casting and forging etc. shall be of tested quality as per relevant codes/standards. Details of results of the tests conducted to determine the mechanical properties; chemical analysis and details of heat treatment procedure recommended and actually followed shall be recorded on certificates and time temperature chart. Tests shall be carried out as per applicable material standards and/or agreed details.
9.03.07	The contractor shall submit to the Employer Field Welding Schedule for field welding activities in the enclosed format No.: QS-01-CQA-W-11/F1. The field welding schedule shall be submitted to the Employer along with all supporting documents, like welding procedures, heat treatment procedures, NDT procedures etc. at least ninety days before schedule start of erection work at site.

9.03.08	All welding and brazing shall be carried out as per procedure drawn and qualified in accordance with requirements of ASME Section IX/BS-4870 or other International equivalent standard acceptable to the Employer. All welding/brazing procedures shall be submitted to the Employer or its authorised representative for approval prior to carrying out the welding/brazing.
9.03.09	All brazers, welders and welding operators employed on any part of the contract either in Contractor's/sub-contractor's works or at site or elsewhere shall be qualified as per ASME Section-IX or BS-4871 or other equivalent International Standards acceptable to the Employer.
9.03.10	Welding procedure qualification & Welder qualification test results shall be furnished to the Employer for approval. However, where required by the Employer, tests shall be conducted in presence of Employer/authorised representative.
9.03.11	For all pressure parts and high pressure piping welding, the latest applicable requirements of the IBR (Indian Boiler Regulations) shall also be essentially complied with. Similarly, any other statutory requirements for the equipment/systems shall also be complied with. On all back-gauged welds MPI/LPI shall be carried before seal welding.
9.03.12	Unless otherwise proven and specifically agreed with the Employer, welding of dissimilar materials and high alloy materials shall be carried out at shop only.
9.03.13	No welding shall be carried out on cast iron components for repair.
9.03.14	All the heat treatment results shall be recorded on time temperature charts and verified with recommended regimes.
9.03.15	All non-destructive examination shall be performed in accordance with written procedures as per International Standards, The NDT operator shall be qualified as per SNT-TC-IA (of the American Society of non-destructive examination). NDT shall be recorded in a report, which includes details of methods and equipment used, result/evaluation, job data and identification of personnel employed and details of co-relation of the test report with the job. All plates of thickness above 40mm & all bar stock/Forging above 40mm dia shall be ultrasonically tested. For pressure parts, plate of thickness equal to or above 25mm shall be ultrasonically tested.
9.03.16	The Contractor shall list out all major items/ equipment/ components to be manufactured in house as well as procured from sub-contractors (BOI). All the sub-contractor proposed by the Contractor for procurement of major bought out items including castings, forging, semi-finished and finished

`	components/equipment etc., list of which shall be drawn up by the Contractor and finalised with the Employer, shall be subject to Employer's approval on enclosed format No. QS-01-QAI-P-01/F3. The contractor's proposal shall include vendor's facilities established at the respective works, the process capability, process stabilization, QC systems followed, experience list, etc. along with his own technical evaluation for identified sub-contractors enclosed and shall be submitted to the Employer for approval within the period agreed at the time of pre-awards discussion and identified in "DR" category prior to any procurement. Such vendor approval shall not relieve the contractor from any obligation, duty or responsibility under the contract.
9.03.17	For components/equipment procured by the contractors for the purpose of the contract, after obtaining the written approval of the Employer, the contractor's purchase specifications and inquiries shall call for quality plans to be submitted by the suppliers. The quality plans called for from the sub-contractor shall set out, during the various stages of manufacture and installation, the quality practices and procedures followed by the vendor's quality control organisation, the relevant reference documents/standards used, acceptance level, inspection of documentation raised, etc. Such quality plans of the successful vendors shall be finalised with the Employer and such approved Quality Plans shall form a part of the purchase order/contract between the Contractor and sub-contractor. With in three weeks of the release of the purchase orders /contracts for such bought out items /components, a copy of the same without price details but together with the detailed purchase specifications, quality plans and delivery conditions shall be furnished to the Employer on the monthly basis by the Contractor along with a report of the Purchase Order placed so far for the contract. **
9.03.18	Employer reserves the right to carry out quality audit and quality surveillance of the systems and procedures of the Contractor's or their sub-contractor's quality management and control activities. The contractor shall provide all necessary assistance to enable the Employer carry out such audit and surveillance.
9.03.19	The contractor shall carry out an inspection and testing programme during manufacture in his work and that of his sub-contractor's and at site to ensure the mechanical accuracy of components, compliance with drawings, conformance to functional and performance requirements, identity and acceptability of all materials parts and equipment. Contractor shall carry out all tests/inspection required to establish that the items/equipment conform to requirements of the specification and the relevant

codes/standards specified in the specification, in addition to carrying out tests as per the approved quality plan.

9.03.20 Quality audit/surveillance/approval of the results of the tests and inspection will not, however, prejudice the right of the Employer to reject the equipment if it does not comply with the specification when erected or does not give complete satisfaction in service and the above shall in no way limit the liabilities and responsibilities of the Contractor in ensuring complete conformance of the materials/equipment supplied to relevant specification, standard, data sheets, drawings, etc.

9.03.21 For all spares and replacement items, the quality requirements as agreed for the main equipment supply shall be applicable.

9.03.22 Repair/rectification procedures to be adopted to make the job acceptable shall be subject to the approval of the Employer/ authorised representative.

9.03.23 **Environmental Stress Screening**

All solid state electronic system / equipment / sub assembly shall be free from infant mortile components. For establishing the compliance to this requirement, the contractor / sub – contractor should meet the following.

1) The Contractor / Sub – contractor shall furnish the established procedure being followed for eliminating infant mortile components. The procedure followed by the Contractor / Sub – contractor should be substantiated along with the statistical figures to validate the procedure being followed. The necessary details as required under this clause shall be furnished at the stage of QP finalization.

Or

In case the Contractor / Sub – contractor do not have any established procedure to eliminate infant mortile components then two or 10% which ever is less, most densely populated Panels shall be tested for Elevated Temperature Cycle Test as per the following procedure.

Elevated Temperature Test Cycle

During the elevated temperature test which shall be for 48 hours, the ambient temperature shall be maintained at 50° C. The equipment shall be interconnected with devices and kept under energized conditions so as to repeatedly perform all operations it is expected to perform in actual service with load on various components being equal to those which will be experienced in actual service.
During the elevated temperature test the cubicle doors shall be closed (or shall be in the position same as they are supposed to be in the field) and

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inside temperature in the zone of highest heat dissipating components / modules shall be monitored. The temperature rise inside the cubicle should not exceed 10° C above the ambient temperature at 50° C.
In case of any failure during the test cycle, the further course of action should be mutually discussed for demonstrating the intent of the above requirement.

2) Burn in Test Cycle

The test shall be conducted on all the panels fully assembled and wired including the panels having undergone the above mentioned elevated temperature test.
The period of Burn in Test Cycle shall be 120 hrs and process shall be similar to the elevated temperature test as above except that the temperature shall be reduced to the ambient temperature prevalent at that time.
During the above tests, the process I/O and other load on the system shall be simulated by simulated inputs and in the case of control systems; the process which is to be controlled shall also be simulated. Testing of individual components or modules shall not be acceptable.
During the Burn in Test the cubicle doors shall be closed (or shall be in the position same as they are supposed to be in the field) and inside temperature in the zone of highest heat dissipating components / modules shall be monitored. The temperature rise inside the cubicle should not exceed 10° C above the ambient temperature.

The Contractor / Sub-contractor shall carry out routine test on 100% item at contractor / sub-contractor's works. The quantum of check / test for routine & acceptance test by employer shall be generally as per criteria / sampling plan defined in referred standards. Wherever standards have not been mentioned quantum of check / test for routine / acceptance test shall be as agreed during detailed engineering stage.

9.04.00 **DOCUMENTATION PACKAGE**

The Contractor shall be required to submit the QA Documentation in two hard copies and two CD ROMs, as identified in respective quality plan with tick mark.

9.04.01 Each QA Documentation shall have a project specific Cover Sheet bearing name & identification number of equipment and including an index of its contents with page control on each document.

The QA Documentation file shall be progressively completed by the Supplier's sub- supplier to allow regular reviews by all parties during the manufacturing.

The final quality document will be compiled and issued at the final assembly place of equipment before dispatch. However CD-Rom may be issued not later than three weeks.

9.04.02 Typical contents of QA Documentation is as below:-

(a) Quality Plan

(b) Material mill test reports on components as specified by the specification and approved Quality Plans.

(c) Manufacturer / works test reports/results for testing required as per applicable codes and standard referred in the specification and approved Quality Plans.

(d) Non-destructive examination results /reports including radiography interpretation reports. Sketches/drawings used for indicating the method of traceability of the radiographs to the location on the equipment.

(e) Heat Treatment Certificate/Record (Time- temperature Chart)

(f) All the accepted Non-conformance Reports (Major/Minor) / deviation, including complete technical details / repair procedure).

(g) CHP / Inspection reports duly signed by the Inspector of the Employer and Contractor for the agreed Customer Hold Points.

(h) Certificate of Conformance (COC) wherever applicable.

(i) MDCC

9.04.03 Similarly, the contractor shall be required to submit two sets (two hard copies and two CD ROMs), containing QA Documentation pertaining to field activities as per Approved Field Quality Plans and other agreed manuals/ procedures, prior to commissioning of individual system.

9.04.04 Before dispatch / commissioning of any equipment, the Supplier shall make sure that the corresponding quality document or in the case of protracted

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phased deliveries, the applicable section of the quality document file is completed. The supplier will then notify the Inspector regarding the readiness of the quality document (or applicable section) for review.

(a) If the result of the review carried out by the Inspector is satisfactory, the Inspector shall stamp the quality document (or applicable section) for release.

(b) If the quality document is unsatisfactory, the Supplier shall endeavor to correct the incompleteness, thus allowing to finalize the quality document (or applicable section) by time compatible with the requirements as per contract documents. When it is done, the quality document (or applicable section) is stamped by the Inspector.

(c) If a decision is made dispatch, whereas all outstanding actions cannot be readily cleared for the release of the quality document by that time. The supplier shall immediately, upon shipment of the equipment, send a copy of the quality document Review Status signed by the Supplier Representative to the Inspector and notify of the committed date for the completion of all outstanding actions & submission. The Inspector shall stamp the quality document for applicable section when it is effectively completed. The submission of QA documentation package shall not be later than 3 weeks after the dispatch of equipment.

9.04.05 TRANSMISSION OF QA DOCUMENTATION

On release of QA Documentation by Inspector, one set of quality document shall be forwarded to Corporate Quality Assurance Department and other set to respective Project Site of Employer.

For the particular case of phased deliveries, the complete quality document to the Employer shall be issued not later than 3 weeks after the date of the last delivery of equipment.

9.05.00 Project Manager's Supervision

9.05.01 To eliminate delays and avoid disputes and litigation, it is agreed between the parties to the Contract that all matters and questions shall be referred to the Project Manager and without prejudice to the provisions of 'Arbitration' clause in Section GCC of Vol.I, the Contractor shall proceed to comply with the Project Manager's decision.

9.05.02 The work shall be performed under the supervision of the Project Manager. The scope of the duties of the Project Manager pursuant to the Contract, will include but not be limited to the following:

(a) Interpretation of all the terms and conditions of these documents and specifications:

(b) Review and interpretation of all the Contractor's drawing, engineering data, etc:

(c) Witness or his authorised representative to witness tests and trials either at the manufacturer's works or at site, or at any place where work is performed under the contract :

(d) Inspect, accept or reject any equipment, material and work under the contract :

(e) Issue certificate of acceptance and/or progressive payment and final payment certificates

(f) Review and suggest modifications and improvement in completion schedules from time to time, and

(g) Supervise Quality Assurance Programme implementation at all stages of the works.

9.06.00 INSPECTION, TESTING AND INSPECTION CERTIFICATES

9.06.01 The word 'Inspector' shall mean the Project Manager and/or his authorised representative and/or an outside inspection agency acting on behalf of the Employer to inspect and examine the materials and workmanship of the works during its manufacture or erection.

9.06.02 The Project Manager or his duly authorised representative and/or an outside inspection agency acting on behalf of the Employer shall have access at all reasonable times to inspect and examine the materials and workmanship of the works during its manufacture or erection and if part of the works is being manufactured or assembled on other premises or works, the Contractor shall obtain for the Project Manager and for his duly authorised representative permission to inspect as if the works were manufactured or assembled on the Contractor's own premises or works.

9.06.03 The Contractor shall give the Project Manager/Inspector fifteen (15) days written notice of any material being ready for testing. Such tests shall be to the Contractor's account except for the expenses of the Inspector's. The Project Manager/Inspector, unless the witnessing of the tests is virtually waived and confirmed in writing, will attend such tests within fifteen (15) days of the date on which the equipment is noticed as being ready for test/inspection failing which the contractor may proceed with test which shall be deemed to have been made in the inspector's presence and he

	shall forthwith forward to the inspector duly certified copies of test reports in two (2) copies.
9.06.04	The Project Manager or Inspector shall within fifteen (15) days from the date of inspection as defined herein give notice in writing to the Contractor, or any objection to any drawings and all or any equipment and workmanship which is in his opinion not in accordance with the contract. The Contractor shall give due consideration to such objections and shall either make modifications that may be necessary to meet the said objections or shall inform in writing to the Project Manager/Inspector giving reasons therein, that no modifications are necessary to comply with the contract.
9.06.05	When the factory tests have been completed at the Contractor's or sub-contractor's works, the Project Manager /Inspector shall issue a certificate to this effect fifteen (15) days after completion of tests but if the tests are not witnessed by the Project Manager /Inspectors, the certificate shall be issued within fifteen (15) days of the receipt of the Contractor's test certificate by the Project Manager /Inspector. Project Manager /Inspector to issue such a certificate shall not prevent the Contractor from proceeding with the works. The completion of these tests or the issue of the certificates shall not bind the Employer to accept the equipment should it, on further tests after erection be found not to comply with the contract.
9.06.06	In all cases where the contract provides for tests whether at the premises or works of the Contractor or any sub-contractor, the Contractor, except where otherwise specified shall provide free of charge such items as labour, material, electricity, fuel, water, stores, apparatus and instruments as may be reasonably demanded by the Project Manager /Inspector or his authorised representatives to carry out effectively such tests on the equipment in accordance with the Contractor and shall give facilities to the Project Manager/Inspector or to his authorised representative to accomplish testing.
9.06.07	The inspection by Project Manager / Inspector and issue of Inspection Certificate thereon shall in no way limit the liabilities and responsibilities of the Contractor in respect of the agreed Quality Assurance Programme forming a part of the contract.
9.06.08	To facilitate advance planning of inspection in addition to giving inspection notice as specified at clause no 9.05.03- of this chapter, the Contractor shall furnish quarterly inspection programme indicating schedule dates of inspection at Customer Hold Point and final inspection stages. Updated quarterly inspection plans will be made for each three consecutive months and shall be furnished before beginning of each calendar month.

9.06.09	All inspection, measuring and test equipment used by contractor shall be calibrated periodically depending on its use and criticality of the test/measurement to be done. The Contractor shall maintain all the relevant records of periodic calibration and instrument identification, and shall produce the same for inspection by NTPC. Wherever asked specifically, the contractor shall re-calibrate the measuring/test equipment in the presence of Project Manager / Inspector.
9.07.00	**ASSOCIATED DOCUMENT FOR QUALITY ASSURANCE PROGRAMME:**
9.07.01	List of items requiring quality plan and sub supplier approval. Format No.:QS-01-QAI-P-01/F3-R0.
9.07.02	Manufacturing Quality Plan Format No.: QS-01-QAI-P-09/F1-R1
9.07.03	Field Quality Plan Format No.: QS-01-QAI-P-09/F2-R1.
10.00.00	**PRE-COMMISSIONING AND COMMISSIONING FACILITIES** The Contractor upon completion of installation of equipments and systems, shall conduct pre-commissioning and commissioning activities, to make the equipment/systems ready for safe, reliable and efficient operation on sustained basis. During commissioning the Contractor shall carry out system checking and reliability trials on various parts of the facilities. All pre-commissioning/commissioning activities considered essential for such readiness of the equipment/systems including those mutually agreed and included in the Contractor's quality assurance programme as well as those indicated in clauses elsewhere in the technical specifications shall be performed by the contractor. The pre-commissioning and commissioning activities of the equipment/systems furnished and installed by the contractor shall be the responsibility of the Contractor. The Contractor shall provide, in addition, temporary instrumentation and other measuring devices, test instruments, calibrating devices etc. and labour required for successful performance of these operations. If it is anticipated that the above test may prolong for a long time, the Contractor's workmen required for the above test shall always be present at site during such operations.
10.01.00	**All erection & commissioning checks shall be as per manufacturer's manual on mutually agreed terms.** (a) As soon as the facilities or part thereof has been completed operationally and structurally and before start-up, each item of the equipment and systems forming part of facilities shall be thoroughly cleaned and then inspected jointly by the Employer and the

Contractor for correctness of and completeness of facility or part thereof and acceptability for initial pre-commissioning tests, commissioning and start-up at Site. The list of pre-commissioning tests to be performed shall be as mutually agreed and included in the Contractor's quality assurance programme as well as those included elsewhere in the Technical Specifications.

(b) The Contractor's pre-commissioning/ commissioning/start-up engineers, specially identified as far as possible, shall be responsible for carrying out all the pre-commissioning tests at Site. On completion of inspection, checking and after the pre-commissioning tests are satisfactorily over, the commissioning of the complete facilities shall be commenced during which period the complete facilities, equipments shall be operated integral with sub-systems and supporting equipment as a complete plant.

(c) The time consumed in the inspection and checking of the units shall be considered as a part of the erection and installation period.

(d) The check outs during the pre - commissioning period should be programmed to follow the construction completion schedule. Each equipment/system, as it is completed in construction and turned over for commissioning (start-up), should be checked out and cleaned. The checking and inspection of individual systems should then follow a prescribed commissioning documentation [SCL (Standard Check List) / TS (Testing Schedule) / CS (Commissioning Schedule)] to be furnished by the manufacturer/supplier.

(e) The Contractor shall conduct vibration testing to determine the 'base line' of performance of all plant rotating equipment. These tests shall be conducted when the equipment is running at the base load, peak load as well as lowest sustained operating condition as far as practicable.

11.00.00 SAFETY ASPECTS DURING CONSTRUCTION AND ERECTION

In addition to the requirements given in Erection Conditions of Contract (ECC) the following shall also cover:

(a) Working platforms should be fenced and shall have means of access.

(b) Ladders in accordance with Employer's safety rules for construction and erection shall be used. Rungs shall not be welded on columns. All the stairs shall be provided with handrails immediately after its erection.

12.00.00 PACKAGING AND TRANSPORTATION

All the equipment shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at Site till the time of erection. While packing all the materials, the limitation from the point of view of the sizes of railway wagons available in India should be taken account of. The Contractor shall be responsible for any loss or damage during transportation, handling and storage due to improper packing. The Employer's Inspector shall have right to insist for completion of works in shops before dispatch of materials for transportation.

13.00.00 **ELECTRICAL ENCLOSURE**

All electrical equipment and devices, including insulation, heating and ventilation devices shall be designed for ambient temperature and a maximum relative humidity as specified elsewhere in the specification.

14.00.00 **INSTRUMENTATION AND CONTROL**

All instrumentation and control systems/ equipment/ devices/ components, furnished under this contract shall be in accordance with the requirements stated herein, unless otherwise specified in the detailed specifications.

14.01.00 All instrument scales and charts shall be calibrated and printed in metric units and shall have linear graduation. The ranges shall be selected to have the normal reading at 75% of full scale.

All scales and charts shall be calibrated and printed in Metric Units

14.02.00 All instruments and control devices provided on panels shall be of miniaturized design, suitable for modular flush mounting on panels with front draw out facility and flexible plug-in connection at rear.

14.03.00 All electronic modules shall have gold plated connector fingers and further all input and output modules shall be short circuit proof. These shall also be tropicalised & components shall be of industrial grade or better.

15.00.00 **ELECTRICAL NOISE CONTROL**

The equipment furnished by the Contractor shall incorporate necessary techniques to eliminate measurement and control problems caused by electrical noise. Areas in Contractor's equipment which are vulnerable to electrical noise shall be hardened to eliminate possible problems. Any additional equipment, services required for effectively eliminating the noise problems shall be included in the proposal. The equipment shall be protected against ESD as per IEC-801- 2. Radio Frequency interference (RFI) and Electro Magnetic Interference (EMI) protection against hardware damage and control system mal-operations/errors shall be provided for all systems.

16.00.00 **ELECTRONIC MODULE/COMPONENT DETAILS**

The Bidder shall have to furnish all technical details including circuit diagrams, specifications of components, etc., in respect of each and every electronic card/module as employed on the various solid state as well as

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microprocessor based systems and equipment including conventional instruments, peripherals etc.

It is mandatory for the Bidder to identify clearly the custom built ICs used in the package. The Bidder shall also furnish the details of any equivalents of the same.

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Annexure-1 of GTR

S. N.	Description Of Documents	No of Prints (Sets)	NO. OF CD-ROMs /Floppy
1.	Drawings for Initial Submission (Either "FOR APPROVAL" or "FOR INFORMATION Category) and re-submissions after review by NTPC (including Data sheets/ Calculations, all Equipment/instrument schedule, BOM etc)	8	1 Soft Copy (through 2 sets of Floppy or 1 no of CD-Rom or through E-Mail)
2.	Final Approved Drawings (Cat-I & Cat – IV Approved) (As referred in Sl no: 1 above)	3	4 CD- Roms
3.	Documents / Drawings "AS BUILT "	3	4 CD- Roms
4.	Type test reports (Intial)	8	1 Soft Copy (through 2 sets of Floppy or 1 no of CD-Rom or through E-Mail)
5	Type test reports (Final)	1	2 CD-Roms
6.	Piping / Equipment Analysis (Transient) etc, Model study reports (Draft) Including the input/ output data etc.	8	1 Soft Copy (through 2 sets of Floppy or 1 no of CD-Rom or through E-Mail)
7.	Piping / Equipment Analysis (Transient) etc, Model study reports (Final Approved) Including the input/ output data etc.	2	4 CD-Roms
8	Erection manual "Draft "	4 sets	1 CD ROMS
8	Erection manual "Final "	4 sets	1 CD ROMS
9	Operation & Maintenance manual "DRAFT"	4 sets	2 CD ROMS
10	Operation & Maintenance manual "FINAL"	4 sets	4 CD ROMS

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Annexure-1 of GTR

S. N.	Description Of Documents	No of Prints (Sets)	NO. OF CD-ROMs /Floppy
11	Commissioning Procedure (If applicable) (DRAFT)	4 sets	1 CD ROMS
12.	Commissioning Procedure (If applicable) (FINAL)	4 sets	1 CD ROMS
13	Performance and Guarantee test Procedure (Draft)	8	1 Soft Copy (through 2 sets of Floppy or 1 no of CD-Rom or through E-Mail)
14.	Performance and Guarantee test Procedure (Final)	8	1 Soft Copy (2 Floppy or 1 no of CD-Rom or through E-Mail)
16	Progress Reports	8	3 FLOPPIES
16	Project completion report	3 Sets	3CD ROMS
17	QA programme including Organisation for implementation and QA system manual (with revision-servicing)	1	1 CD-ROM
18	Vendor details in respect of proposed vendors including contractor's evaluation report.	1	1 CD –ROM
19	Manufacturing QPs, Field QPs, Field welding schedules and their reference documents like test procedures, WPS, POR etc.		
	i) For review/comment -	3	1 set of soft copy
	(ii) For final approval 1 set floppies	4	1 CD ROM

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Annexure-1 of GTR

S. N.	Description Of Documents	No of Prints (Sets)	NO. OF CD-ROMs /Floppy
20	Welding Manual, Heat Treatment Manuals, Storage & preservation manuals		
	Draft	4 sets	
	Final	4 sets	2 CD ROMS
21	Monthly Vendor Approval /QP approval status	2 sets	1 FLOPPY
22	QA Documentation Package for items / equipment manufactured and dispatched to site	2 Sets	2 CD ROMS
23	QA Documentation Package for field activities on equipment / systems at site	2 Sets	2 CD ROMS

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PART-H
ERECTION CONDITIONS OF CONTRACT

ERECTION CONDITIONS OF CONTRACT

1.00.00 GENERAL

1.01.00 The following provisions shall supplement the conditions already contained in the other parts of these specifications and documents and shall govern that portion of the work of this contract which is to be performed at site. The erection requirements and procedures not specified in these documents shall be in accordance with the recommendations of the equipment manufacturer, or as mutually agreed to between the Employer and the Contractor prior to commencement of erection work.

1.02.00 The Contractor upon signing of the Contract shall, in addition to a Project Co-ordinator, nominate another responsible officer as his representative at Site suitably designated for the purpose of overall responsibility and co-ordination of the Works to be performed at Site. Such a person shall function from the Site office of the Contractor during the pendency of Con-tract.

2.00.00 CODE REQUIREMENTS

The erection requirements and procedures to be followed during the installation of the equipment shall be in accordance with the relevant Government of India Rules & Codes, accepted good practices in the industry and shall fulfill all statutory requirements.

3.00.00 ELECTRICAL SAFETY REGULATIONS

The contractor shall ensure that entire electrical installation work is executed by adopting applicable statutory safety regulations and best practices in the industry. The Contractor shall employ the necessary number of qualified, full time electricians to maintain his temporary electrical installation.

4.00.00 INSPECTION AND TESTING INSPECTION CERTIFICATES

The provisions of the clause entitled Inspection and Testing in the Technical Specification, shall also be applicable to the erection portion of the Works. The Employer shall have the right to re-inspect any equipment though previously inspected and approved by him at the Contractor's works, before and after the same are erected at Site. If by the above inspection, the Employer rejects any equipment, the Contractor shall make good for such rejections either by replacement or modification/ repairs as may be necessary to the satisfaction of the Employer. Such replacements will also

include the replacements or re-execution of such of those works of other Contractors and/or agencies, which might have got damaged or affected by the replacements or re-work done to the Contractor's work.

5.00.00 CONTRACTOR'S SITE OFFICE ESTABLISHMENT

The Contractor shall establish an Office at the Site and keep posted an authorised representative for the purpose of the Contract. Any written order or instruction of the Employer or his duly authorised representative shall be communicated to the said authorised resident representative of the Contractor and the same shall be deemed to have been communicated to the Contractor at his legal address

6.00.00 CONTRACTOR'S FIELD OPERATION

The Contractor shall keep the Employer informed in advance regarding his field activity plans and schedules for carrying out each part of the works. Any review of such plan or schedule or method of work by the Employer shall not relieve the Contractor of any of his responsibilities towards the field activities. Such reviews shall also not be considered as an assumption of any risk or liability by the Employer or any of his representatives and no claim of the Contractor will be entertained because of the failure or inefficiency of any such plan or schedule or method of work reviewed. The Contractor shall be solely responsible for the safety, adequacy and efficiency of plant and equipment and his erection methods.

The Contractor shall have the complete responsibility for the conditions of the Work-Site including the safety of all persons employed by him or his Sub-Contractor and all the properties under his custody during the performance of the work. This requirement shall apply continuously till the completion of the Contract and shall not be limited to normal working hours. The construction review by the Employer is not intended to include review of Contractor's safety measures in, on or near the Work-Site, and their adequacy or otherwise.

7.00.00 PROTECTION OF WORK

The Contractor shall have total responsibility for protecting his works till it is finally taken over by the Employer. No claim will be entertained by the Employer or the representative of the Employer for any damage or loss to the Contractor's works and the Contractor shall be responsible for complete restoration of the damaged works to original conditions to comply with the specification and drawings. Should any such damage to the Contractor's Works occur because of any other agency/individual not being under his

supervision or control, the Contractor shall make his claim directly with the party concerned. The Contractor shall not cause any delay in the repair of such damaged Works because of any delay in the resolution of such disputes. The Contractor shall proceed to repair the Work immediately and no cause thereof will be assigned pending resolution of such disputes.

8.00.00 FACILITIES TO BE PROVIDED BY THE CONTRACTOR

Contractor's site office Establishment

The Contractor shall establish a site office at the site and keep posted an authorized representative for the purpose of the contract, pursuant to GCC.

Tools, tackles and scaffoldings

The Contractor shall provide all the construction equipments, tools, tackles and scaffoldings required for pre-assembly, installation, testing, commissioning and conducting Guarantee tests of the equipments covered under the Contract. The Contractor shall arrange machinery & equipment such as Dozer, Hydra, Cranes, Trailer, etc. wherever required for the purpose of fabrication, erection and commissioning.

Testing Equipment and Facilities:

The contractor shall provide the necessary testing, equipment and facilities.

Testing of construction material at the site:

Contractor shall make arrangements for the testing of construction material at the site wherever required, under the scope of services of the contract.

First-aid

The Contractor shall provide necessary first-aid facilities for all his employees, representatives and workmen working at the Site. Enough number of Contractor's personnel shall be trained in administering first-aid.

Water

Contractor shall make all arrangements himself for the supply of construction water as well as potable water for labour and other personnel at the worksite/colony.

9.00.00 FIRE PROTECTION

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The work procedures that are to be used during the erection shall be those which minimise fire hazards to the extent practicable. Combustible materials, combustible waste and rubbish shall be collected and removed from the Site regularly. Fuels, oils and volatile or flammable materials shall be stored away from the construction and equipment and materials storage areas in safe containers. Untreated canvas, paper, plastic or other flammable flexible materials shall not at all be used at Site for any other purpose unless otherwise specified. If any such materials are received with the equipment at the Site, the same shall be removed and replaced with acceptable material before moving into the construction or storage area.

All materials used for storage or for handling of materials shall be of water proof and flame resistant type. All the other materials such as working drawings, plans etc. which are combustible but are essential for the works to be executed shall be protected against combustion resulting from welding sparks, cutting flames and other similar fire sources.

All the Contractor's supervisory personnel and sufficient number of workers shall be trained for fire-fighting and shall be assigned specific fire protection duties. Enough of such trained personnel must be available at the Site during the entire period of the Contract.

The Contractor shall provide suitable quantity & type fire protection equipment for the warehouses, office, temporary structures etc.

10.00.00 SECURITY

The Contractor shall have total responsibility for all equipment and materials in his custody stores, loose, semi-assembled and/or erected by him at Site. The Contractor shall make suitable security arrangements including employment of security personnel to ensure the protection of all materials, equipment and works from theft, fire, pilferage and any other damages and loss.

11.00.00 PACKAGING AND TRANSPORTATION

All the equipments shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at Site till the time of erection. While packing all the materials, the limitation from the point of view of the sizes of railway wagons available in India should be taken account of. The Contractor shall be responsible for any loss or damage during transportation, handling and storage due to improper packing. The Contractor shall ascertain the availability of Railway wagon

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sizes from the Indian Railways or any other agency concerned in India well before effecting dispatch of equipment. Before dispatch it shall be ensured that complete processing and manufacturing of the components is carried out at shop, only restricted by transport limitation, in order to ensure that site works like grinding, welding, cutting & preassembly to bare minimum. The Employer's Inspector shall have right to insist for completion of works in shops before dispatch of materials for transportation.

12.00.00 CRATING

All equipment and materials shall be suitably coated, wrapped, or covered and boxed or crated for moist humid tropical shipment and to prevent damage or deterioration during handling and storage at the site.

Equipment shall be packed with suitable desiccants, sealed in water proof vapour-proof wrapping and packed in lumber of plywood enclosures, suitably braced, tied and skidded. Lumber enclosures shall be solid, not slatted.

Desiccants shall be either silica gel or calcium sulphate, sufficiently ground to provide the required surface area and activated prior to placing in the packaging. Calcium sulphate desiccants shall be of a chemical nature to absorb moisture. In any case, the desiccant shall not be of a type that will absorb enough moisture to go into solution. Desiccants shall be packed in porous containers, strong enough to withstand handling encountered during normal shipment. Enough desiccant shall be used for the volumes enclosed in wrapping.

Packaging or shipping units shall be designed within the limitations of unloading facilities and the equipment which will be used for transport. Complications involved with ocean shipment and the limitations of ports, railways and roads shall be considered. It shall be the Contractor's responsibility to investigate these limitations and to provide suitable packaging to permit safe handling during transit and at the job site.

Electrical equipment, control and instrumentation shall be protected against moisture and water damage. All external gasket surfaces and flange faces, couplings, motor pump shafts, bearing and like items shall be thoroughly cleaned and coated with rust preventive compound as specified above and protected with suitable wood, metal or other substantial type covering to ensure their full protection.

Equipment having antifriction or sleeve bearings shall be protected by weather tight enclosures.

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Coated surfaces shall be protected against impact, abrasion, discolouration and other damage. Surfaces which are damaged shall be repaired.

All exposed threaded parts shall be greased and protected with metallic or other substantial type protectors. All female threaded openings shall be closed with forged steel plugs. All pipings, tubing, and conduit equipment and other equipment openings shall be sealed with metallic or other rough usage covers and tapped to seal the interior of the equipment piping, tubing, or conduit.

Provisions shall be made to ensure that water does not enter any equipment during shipment or in storage at the plant site.

Returnable containers and special shipping devices shall be returned by the manufacturer's field representative at the Contractor's expense.

While packaging the material, care shall be taken for the limitation from the point of view of availability of railway wagon sizes in India.

13.00.00 MATERIALS HANDLING AND STORAGE

All the equipments furnished under the Contract and arriving at Site shall be promptly received, unloaded and transported and stored in the storage spaces by the Contractor.

Contractor shall be solely responsible for any shortages or damage in transit, handling and / or in storage and erection of the equipment at Site. Any demurrage, wharfage and other such charges claimed by the transporters, railways etc. shall be to the account of the Contractor.

The equipment stored shall be properly protected to prevent damage either to the equipment or to the floor where they are stored. The equipment from the store shall be moved to the actual location at the appropriate time so as to avoid damage of such equipment at Site.

All electrical panels, controls gear, motors and such other devices shall be properly dried by heating before they are installed and energised. Motor bearings, slip rings, commutators and other exposed parts shall be protected against moisture ingress and corrosion during storage and periodically inspected. Heavy rotating parts in assembled conditions shall be periodically rotated to prevent corrosion due to prolonged storage.

All the electrical equipment such as motors, etc. shall be periodically tested for insulation resistance from the date of receipt till the date of commissioning

and a record of such measured insulation values maintained by the Contractor. Such records shall be open for inspection by the Employer.

The Contractor shall ensure that all the packing materials and protection devices used for the various equipments during transit and storage are removed before the equipment are installed.

The consumables and other supplies likely to deteriorate due to storage must be thoroughly protected and stored in a suitable manner to prevent damage or deterioration in quality by storage.
All the materials stored in the open or dusty location must be covered with suitable weatherproof and flameproof covering material wherever applicable.

14.00.00 CONSTRUCTION MANAGEMENT

Contractor shall be responsible for performance of his works in accordance with the specified construction schedule. If at any time, the Contractor is falling behind the schedule, he shall take necessary action to make good for such delays by increasing his work force or by working overtime or otherwise accelerate the progress of the work to comply with the schedule and shall communicate such actions in writing to the Employer, satisfying that his action will compensate for the delay. The Contractor shall not be allowed any extra compensation for such action.

The Employer shall however not be responsible for provision of additional labour and/or materials or supply or any other services to the Contractor.

15.00.00 FIELD OFFICE RECORDS

The Contractor shall maintain at his Site Office up-to- date copies of all drawings, specifications and other Contract Documents and any other supplementary data complete with all the latest revisions thereto. The Contractor shall also maintain in addition the continuous record of all changes to the above Contract Documents, drawings, specifications, supplementary data, etc. effected at the field and on completion of his total assignment under the Contract shall incorporate all such changes on the drawings and other Engineering data to indicate as installed conditions of the equipment furnished and erected under the Contract. Such drawings and Engineering data shall be available for inspection & review to the Employer.

16.00.00 PROTECTION OF PROPERTY AND CONTRACTOR'S LIABILITY

The Contractor shall be responsible for any damage resulting from his operations. He shall also be responsible for protection of all persons

including members of public and employees of the Employer and his own employees and all public and private property including structures, building, other plants and equipments and utilities either above or below the ground.

The Contractor will ensure provision of necessary safety equipment such as barriers, sign - boards, warning lights and alarms, etc. to provide adequate protection to persons and property.

17.00.00 PAINTING

All exposed metal parts of the equipment including pipings, structure railings, etc. wherever applicable, after installation unless otherwise surface protected, shall be first painted in accordance with relevant codes & standards, after throughly cleaning all such parts of all dirt, rust, scales, greases, oils and other foreign materials by wire brushing, scraping or sand blasting.

18.00.00 UNFAVOURABLE WORKING CONDITIONS

The Contractor shall confine all his field operations to those works which can be performed without subjecting the equipment and materials to adverse effects during inclement weather conditions, like monsoon, storms, etc. and during other unfavourable construction conditions. No field activities shall be performed by the Contractor under conditions which might adversely affect the quality and efficiency thereof, unless special precautions or measures are taken by the Contractor in a proper and satisfactory manner in the performance of such Works and with the concurrence of the Employer. Such unfavourable construction conditions will in no way relieve the Contractor of his responsibility to perform the Works as per the schedule.

19.00.00 PROTECTION OF MONUMENTS AND REFERENCE POINTS

The Contractor shall ensure that any finds such as relic, antiquity, coins, fossils, etc. which he may come across during the course of performance of his Works either during excavation or elsewhere, are properly protected and handed over to the Employer.

20.00.00 FOUNDATION DRESSING & GROUTING FOR EQUIPMENT/ EQUIPMENT BASES

The surfaces of foundations shall be dressed to bring the top surface of the foundations to the required level, prior to placement of equipment/equipment bases on the foundations.

All the equipment/ equipment bases shall be grouted and finished as per these specifications unless otherwise recommended by the equipment manufacturer.

The concrete foundation surfaces shall be properly prepared by chipping, grinding as required to bring the top of such foundation to the required level, to provide the necessary roughness for bondage and to assure enough bearing strength.

20.01.00 GROUT

The grout shall be high strength grout having a minimum characteristic compressive strength of 60 N/mm^2 at 28 days. The grout shall be chloride - free, cement based, free flowing, non-metallic grout.
The Grout shall have good flowability even at very low water/ grout powder ratio.
The Grout shall have characteristics of controlled expansion to be able to occupy its original volume to fill the voids and to compensate for shrinkage.
Grout shall be of pre-mix variety so that only water needs to be added before use.
The mixing of the Grout shall conform to the recommendations of the manufacturer of the Grout.

20.02.00 PLACING OF GROUT

After the base has been prepared, its alignment and level has been checked and approved and before actually placing the grout, a low dam shall be set around the base at a distance that will permit pouring and manipulation of the grout. The height of such dam shall be at least 25mm above the bottom of the base. Suitable size and number of chains shall be introduced under the base before placing the grout, so that such chains can be moved back & forth to push the grout into every part of the space under the base.

The grout shall be poured either through grout holes if provided or shall be poured at one side or at two adjacent sides to make the grout move in a solid mass under the base and out in the opposite side. Pouring shall be continued until the entire space below the base is thoroughly filled and the grout stands at least 25 mm higher all around than the bottom of the base. Enough care should be taken to avoid any air or water pockets beneath the bases.

In addition to the above, recommendations of Grout manufacturer shall also be followed.

20.03.00 FINISHING OF THE EDGES OF THE GROUT

The poured grout should be allowed to stand undisturbed until it is well set. Immediately thereafter, the dam shall be removed and grout which extends beyond the edges of the structural or equipment base plates shall be cut off, flushed and removed. The edges of the grout shall then be pointed and finished with 1:2 cement mortar pressed firmly to bond with the body of the grout and smoothened with a tool to present a smooth vertical surface. The work shall be done in a clean and scientific manner and the adjacent floor spaces, exposed edges of the foundations, and structural steel and equipment base plates shall be thoroughly cleaned of any spillage of the grout.

21.00.00 SHAFT ALIGNMENTS

All the shafts of rotating equipment shall be properly aligned to those of the matching equipments to as perfect accuracy as practicable. The equipment shall be free from excessive vibration so as to avoid overheating of bearings or other conditions which may tend to shorten the life of the equipment. The vibration level of rotating equipments measured at bearing housing shall conform to VDI 2056. All bearings, shafts and other rotating parts shall be thoroughly cleaned and suitably lubricated before starting.

22.00.00 **DOWELLING**

All the motors and other equipment shall be suitably doweled after alignment of shafts with tapered machined dowels as per the direction of the Employer.

23.00.00 CABLING

All cables shall be supported by conduits or cable tray run in air or in cable channels. These shall be installed in exposed runs parallel or perpendicular to dominant surfaces with right angle turn made of symmetrical bends or fittings. When cables are run on cable trays, they shall be clamped at a minimum intervals of 2000mm.

Each cable, whether power or control, shall be provided with a metallic or plastic tag of an approved type, bearing a cable reference number indicated in the cable and conduit list (prepared by the Contractor), at every 5 meter run or part thereof and at both ends of the cable adjacent to the terminations. Cable routing is to be done in such a way that cables are accessible for any maintenance and for easy identification.

Sharp bending and kinking of cables shall be avoided. Installation of other cables like high voltage, coaxial, screened, compensating, mineral insulated shall be in accordance with the cable manufacturer's recommendations. Wherever cables cross roads and water, oil, sewage or gaslines, special care should be taken for the protection of the cables in designing the cable channels.

In each cable run some extra length shall be kept at a suitable point to enable one or two straight through joints to be made, should the cable develop fault at a later date.

Control cable terminations shall be made in accordance with wiring diagrams, using identifying codes subject to the Employer's approval. Multicore control cable jackets shall be removed as required to train and terminate the conductors. The cable jacket shall be left on the cable, as far as possible, to the point of the first conductor branch. The insulated conductors from which the jacket is removed shall be neatly twined in bundles and terminated. The bundles shall be firmly but not tightly tied utilising plastic or nylon ties or specifically treated fungus protected cord made for this purpose. Control cable conductor insulation shall be securely and evenly cut.

The connectors for control cables shall be covered with a transparent insulating sleeve so as to prevent accidental contact with ground or adjacent terminals and shall preferably terminate in Elmex terminals and washers. The insulating sleeve shall be fire resistant and shall be long enough to over pass the conductor insulation. All control cables shall be fanned out and connection made to terminal blocks and test equipment for proper operation before cables are corded together.

24.00.00 EQUIPMENT INSTALLATION

24.01.00 General Requirements

The Contractor shall furnish all construction materials, tools and equipment and shall perform all work required for complete installation of all control and instrument equipment furnished under this specification.

Contractor shall prepare detailed installation drawings for each equipment furnished under this specification. Installation of all equipment/systems furnished by this specification shall be as per installation drawings.

Erection procedures not specified herein shall be in accordance with the recommendations of the equipment manufacturers. The procedures shall be acceptable to the Employer.

The Contractor shall coordinate his work with other suppliers where their instruments and devices are to be installed under specifications.

24.02.00 Installation Materials

All materials required for installation, testing and commissioning of the equipment shall be furnished by the Contractor.

24.03.00 Regulatory Requirements

All installation procedures shall confirm with the accepted good engineering practice and with all applicable governmental laws, regulations and codes.

24.04.00 Cleaning

All equipment shall be cleaned of all sand, dirt and other foreign materials immediately after removal from storage and before the equipment is installed.

24.05.00 Installation of Field Mounted Instruments/Devices and Non-free Standing Equipment

The installation drawings for all field mounted equipment/instrument/devices furnished under this specification shall meet the requirements of this specification, applicable codes and standards and recommendations of manufacturers of instruments/devices. In addition to above relevant Portion as specified elsewhere in technical specification may be referred.

Field mounted instruments and accessories shall be bracket or sub panel mounted on the nearest suitable firm steel work or masonry. The brackets, stands, supports and other miscellaneous hardware required for mounting instruments and accessories such as receiver gauge, air set, valve manifold, purge-meter etc. shall be furnished and installed. No field mounted instruments shall be installed such that it depends for support or rigidity on the impulse piping or on electrical connection to it.

All free standing instrumentation cabinets and panels shall be located within the construction tolerances of +/- 3 mm of the location dimensions indicated on the plant arrangement drawings.

Non-free standing local enclosures and cabinets shall be mounted in accessible locations on columns, walls, or stands. Bracket and stands shall be fabricated as required to install the local enclosures and cabinets in a workman like manner. Rough edges and welds on all fabricated supports shall be ground smooth. The supports shall be finished with two coats of primer and two coats of paint as specified in this part.

24.06.00 Defects

All defects in erection shall be corrected to the satisfaction of the Employer and the Project Manager. The dismantling and reassembly of Contractor furnished equipment to remove defective parts, replace parts, or make adjustments shall be included as a part of the work under these specifications.

The removal of control and instrument equipment in order to allow bench calibration, if required, and the re-installation of the said equipment after calibration shall also be included as a part of the work under these specifications.

24.07.00 Equipment Protection

All equipment to be erected under these specifications shall be protected from damage of any kind from the time of contract award until commissioning of each unit.

The equipment shall be protected during storage as described herein.

Equipment shall be protected from weld spatter during construction.

Suitable guards shall be provided for protection of personnel on all exposed rotating or moving machine parts. All such guards with necessary spares and accessories shall be designed for easy removal and maintenance.

Equipment having glass components such as gauges, or equipment having other easily breakable components, shall be protected during the construction period with plywood enclosures or other suitable means. Broken, stolen, or lost components shall be replaced by the Contractor.

Machine finished surfaces, polished surfaces, or other bare metal surfaces which are not to be painted, such as machinery shafts and couplings shall be provided temporary protection during storage and constructional periods by a coating of a suitable non- drying, oily type, rust preventive compound.

25.00.00 DEVIATIONS DISPOSITIONING:

Any deviation to the contract and employer approved documents shall be properly recorded in the format prescribed by NTPC. All the deviations shall be bought to the knowledge of employer's representative for suitable dispositioning.

26.00.00 STATUTORY REQUIREMENTS

In addition to the local laws and regulations, the Contractor shall also comply with the Minimum Wages Act and the Payment of Wages Act (both of the Government of India) and the rules made there under in respect of its labour and the labour of its sub-contractors currently employed on or connected with the contract.

All registration and statutory inspection fees, if any, in respect of his work pursuant to this Contract shall be to the account of the Contractor. However, any registration, statutory inspection fees lawfully payable under the provisions of any statutory laws and its amendments from time to time during erection in respect of the plant equipment ultimately to be owned by the Employer, shall be to the account of the Employer. Should any such inspection or registration need to be re-arranged due to the fault of the Contractor or his Sub-Contractor, the additional fees for such inspection and/or registration shall be borne by the Contractor.

27.00.00 EMPLOYMENT OF LABOUR

In addition to all local laws and regulations pertaining to the employment of labour to be complied with by the Contractor pursuant to GCC, the Contractor will be expected to employ on the work only his regular skilled employees with experience of the particular work. No female labour shall be employed after darkness. No person below the age of eighteen years shall be employed.

All travelling expenses including provisions of all necessary transport to and from Site, lodging allowances and other payments to the Contractor's employees shall be the sole responsibility of the Contractor.

In case the Employer becomes liable to pay any wages or dues to the labour or any Government agency under any of the provisions of the Minimum Wages Act, Workmen Compensation Act, Contact Labour Regulation Abolition Act or any other law due to act of omission of the Contractor, the Employer may make such payments and shall recover the same from the Contractor's Bills.

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28.00.00 WORK & SAFETY REGULATIONS

The Contractor shall ensure proper safety of all the workmen, materials, plant and equipments belonging to him or to Employer or to others, working at the Site. The Contractor shall also be responsible for provision of all safety notices and safety equipment required both by the relevant legislation and the Employer as he may deem necessary.

28.01.00 Where it is necessary to provide and/or store petroleum products or petroleum mixtures and explosives, the contractor shall be responsible for carrying-out such provision and/or storage in accordance with the rules and regulations laid down in petroleum act 1934, explosives act, 1948, and petroleum and carbide of calcium manual published by the chief inspector of explosives of india. All such storage shall have prior approval of the employer. In case, any approvals are necessary from the chief inspector (explosives) or any statutory authorities, the contractor shall be responsible for obtaining the same.

Where explosives are to be used, the same shall be used under the direct control and supervision of an expert, experienced, qualified and competent person strictly in accordance with the Code of Practices/Rules framed under Indian Explosives Act pertaining to handling, storage and use of explosives.

28.02.00 All equipment used in construction and erection by Contractor shall meet Indian/International Standards and where such standards do not exist, the Contractor shall ensure these to be absolutely safe. All construction and erection equipments shall be strictly operated and maintained by the Contractor in accordance with statutory safety regulations. Periodical Examinations and all tests for all lifting/ hoisting equipment & tackles shall be carried-out in accordance with the relevant provisions of Factories Act 1948, Indian Electricity Act 1910 and associated Laws/Rules in force from time to time.

28.03.00 The Contractor shall provide suitable safety equipment of prescribed standard to all employees and workmen according to the need, as may be directed by Employer who will also have right to examine these safety equipments to determine their suitability, reliability, acceptability and adaptability.

(a) Working platforms should be fenced and shall have means of access.

(b) Ladders in accordance with stautory safety rules for construction and erection shall be used. Rungs shall not be welded on columns. All the stairs shall be provided with handrails immediately after its erection.

The Contractor shall provide safe working conditions to all workmen and employees at the Site including safe means of access, railings, stairs, ladders, scaffoldings etc. The scaffoldings shall be erected under the control and supervision of an experienced and competent person. For erection, good and standard quality of material only shall be used by the Contractor.

28.04.00 The Contractor employing more than 250 workmen whether temporary, casual, probationer, regular or permanent or on contract, shall employ atleast one full time officer exclusively as Safety Officer to supervise safety aspects of the equipments and workmen, who will co- ordinate with the Employer Safety Officer. In case of work being carried out through sub-Contractors, the Sub-Contractor's workmen/employees will also be considered as the Contractor's employees/workmen for the above purpose.

In case any accident occurs during the construction/ erection or other associated activities undertaken by the Contractor thereby causing any minor or major or fatal injury to his employees due to any reason, what-soever, it shall be the responsibility of the Contractor to promptly inform the same to the Employer and also to all the authorities envisaged under the applicable laws.

The Contractor shall follow and comply with relevant provisions of applicable laws pertaining to the safety of workmen, employees plant and equipment as may be prescribed from time to time without any demur, protest or contest or reservation.

If the Contractor does not take all safety precautions and/or fails to comply with the Safety Rules as prescribed by the Employer or under the applicable law for the safety of the equipment and plant and for the safety of personnel and the Contractor does not prevent hazardous conditions which cause injury to his own employees or employees of other Contractors, or the Employer's employees or any other person who are at Site or adjacent thereto, the Contractor shall be responsible for payment of compensation to Employer as per the following schedule:-

1	Fatal injury or accident. These are causing death applicable	Rs. 1,00,000/- per person
2	Major injuries or accident	Rs. 20,000/- per personfor death/ causing 25% or more injury to any

		permanent disablement to person workmen or employees whosoever

Permanent disablement shall have same meaning as indicated in Workmen's Compensation Act. The compensation mentioned above shall be in addition to the compensation payable to the workmen/employees under the relevant provisions of the Workmen's Compensation Act and rules framed thereunder or any other applicable laws as applicable from time to time. In case the Employer is made to pay such Compensation then the Contractor is liable to reimburse the Employer such amount in addition to the compensation indicated above.

If the Contractor observes all the Safety Rules and Codes, Statutory Laws and Rules during the currency of Contract awarded by the Employer and no accident occurs then the Employer may consider the performance of the Contractor and award suitable "ACCIDENT FREE SAFETY MERITORIOUS AWARD" as per scheme as may be announced separately from time to time.

29.00.00 INSURANCE

In addition to the conditions covered under the Clause entitled "Insurance" in Section General Conditions of Contract (GCC), the following provisions will also apply to the portion of works to be done beyond the Contractor's own or his Sub-Contractor's manufacturing Works and all statutory obligations shall be fulfilled.

29.01.00 WORKMEN'S COMPENSATION INSURANCE

This insurance shall protect the Contractor against all claims applicable under the Workmen's Compensation Act, 1948 (Government of India). This policy shall also cover the Contractor against claims for injury, disability disease or death of his or his Sub-Contractor's employees, which for any reason are not covered under the Workmen's Compensation Act, 1948. The liabilities shall not be less than the following:

Workmen's Compensation - As per Statutory Provisions

Employee's Liability - As per Statutory Provisions

29.02.00 COMPREHENSIVE AUTOMOBILE INSURANCE

This insurance shall be in such a form to protect the Contractor against all claims for injuries, disability, disease and death to members of public including the Employer's men and damage to

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the property of other arising from the use of motor vehicles during on or off the Site operations, irrespective of the Ownership of such vehicles. The liability covered shall be as herein indicated:

Fatal Injury	:	Rs.100,000 each person
	:	Rs.200,000 each occurrence
Property Damage	:	Rs.100,000 each occurrence

29.03.00 COMPREHENSIVE GENERAL LIABILITY INSURANCE

The insurance shall protect the Contractor against all claims arising from injuries, disabilities, disease or death of members of public or damage to property of others, due to any act or omission on the part of the Contractor, his agents, his employees, his representatives and Sub-Contractors or from riots, strikes and civil commotion. This insurance shall also cover all the liabilities of the Contractor arising out of the Clause entitled "Defence of Suits" in Section General Conditions of Contract (GCC).

The hazards to be covered will pertain to all the Works and areas where the Contractor, his Sub-Contractors, his agents and his employees have to perform work pursuant to the Contract.

	PROJECT: **DEVELOPMENT OF 250 MW (5 BLOCKS OF 50 MW EACH) SOLAR PHOTO VOLTAIC PROJECT(S) IN MADHYA PRADESH**	LIST OF ITEMS REQUIRING QUALITY PLAN AND SUB- SUPPLIER APPROVAL				NTPC DOC NO	
	PACKAGE: SOLAR					REV. NO.	0
	MAIN SUPPLIER:	SUB SYSTEM: CIVIL WORKS				DATE	
SR. NO.	ITEM	QAP/ INSP. CAT	QAP NO.	PROPOSED SUB SUPPLIER	PLACE OF MANUFACTURING	APPROVAL STATUS / CATEGORY	REMARKS
1.	**CEMENT**	III	-	CCI	-	N	
				GUJARAT AMBUJA	-	N	
				JK LAXMI	-	N	
				JAYPEE	-	N	
				GRASIM	-	N	
				BIRLA	-	N	
				LAFARGE	-	N	
				ACC	-	N	
				SHREE	-	N	
				INDIA CEMENT	-	N	
				PENNA CEMENT	-	N	
				MADRAS CEMENT	-	N	
				PRISM	-	N	
				ULTRATECH	-	N	
				ORIENT	-	N	
				MANCHERIAL	-	N	
				JSW	-	N	
				ANDHRA CEMENT	-	N	
				PARASHAKTI	-	N	
				SAGAR	-	N	
				MAIHAR	-	N	
				BHARTHI CEMENT	-	N	
				CHETTINAD CEMENT	-	N	
				KONARK	-	N	
				MANIKGARH	-	N	
2.	**CONSTRUCTION CHEMICALS -**	III	-	SIKA INDIA LTD	-	N	

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	ADMIXTURES, PLASTISIZERS, RETARDERS WATER PROOFING COMPOUNDS GROUTS			CICO TECHONOLOGIES LTD	-	N	
				FOSROC CHEMICALS (I) PVT LTD	-	N	
				BASF	-	N	
3.	**FALSE CEILING - GLASS REINFORCED GYPSUM SYSTEM, MINERAL FIBRE BOARD SYSTEM, PREPAINTED COIL COATED STEEL SYSTEM**	III	-	SAINT GOBAIN	NEW DELHI	N	
				HUNTER DOUGLOUS	MUMBAI	N	
				TIGER STEEL	PUNE/MUMBAI	N	
				INTERARCH	NOIDA	N	
				LLOYD INSULATION	-	N	
				MG INDUSTRIES	FARIDABAD	N	
				ARM STRONG	NEW DELHI	N	
4.	**PAINT AND PAINTING SYSTEM**	III	-	BERGER	-	N	
				SHALIMAR PAINTS	-	N	
				JENSON AND NICHOLSON	-	N	
				KANSAI NEROLAC	-	N	
				AKZO NOBEL	-	N	
				ASIAN PAINTS	-	N	
5.	**GI PIPES**	III	-	BIS APPROVED SOURCES HAVING VALID BIS LICENCE	-		
6.	**BITUMEN ASPHALT**	III	-	ALL GOVERNMENT REFIINARIES	-		
7.	**PLASTIC/ PVC PIPES**	III	-	BIS APPROVED SOURCES HAVING VALID BIS LICENCE	-		
8.	**BITUMEN IMPREGNATED FIBER BOARD JOINT FILLER**	III	-	BIS APPROVED SOURCES HAVING VALID BIS LICENCE	-		

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	, BITUMEN SEALING COMPOUND						
9.	**CERAMIC / VITRIFIED TILES**	III	-	KAJARIA	-	N	
				SOMANY	-	N	
				SPARTEK INDIA	-	N	
				NITCO	-	N	
				ORIENT BELL	-	N	
				MARBITO		N	
				RESTILE	-	N	
				JOHNSON	-	N	
10.	**PARTICLE BOARDS, PLYWOOD, MDF**	III	-	NOVAPAN	-	N	
				ECOBOARD	-	N	
				BHUTAN BOARD	-	N	
				KITPLY	-	N	
				CENTURY	-	N	
				GREEN PLY	-	N	
				DUROPLY	-	N	
				MERINO	-	N	
11.	**ALUMINUM SECTIONS**	III	-	HINDALCO	-	N	
				ALOM EXTRUSIONS LTD	-	N	
				BALCO (VEDANTA)	-	N	
				NALCO	-	N	
				JINDAL	-	N	
12.	**HIGH SOLID CONTENT LIQUID**	III	-	STP	-	N	

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	APPLIED URETHANE BASED ELASTOMERIC MEMBRANE FOR WATER PROOFING			IWL INDIA LTD	-	N	
				CIPY POLYURETHANES	SHIRWAL	N	
				LLOYDS	-	N	
				CICO TECHONOLOGIES LTD	-	N	
				MK PETRO	-	N	
13.	**SANITARY ITEMS**	III		PARRYWARE	-	N	
				HINDWARE	-	N	
				SEABIRD	-	N	
				ORIENT	-	N	
				HINDUSTAN	-	N	
				CERA	-	N	
14.	**CP BRASS TAP AND OTHER SANITARY FITTINGS**	III	-	GEM	-	N	
				PARKO	-	N	
				JAQUAR	-	N	
				MARC	-	N	
15.	**POLYTHENE WATER STORAGE TANKS**	III	-	BIS APPROVED SOURCES HAVING VALID BIS LICENCE	-		
16.	**MINERAL WOOL FOR THERMAL INSULATION**	III		ROCKWOOL INDIA LTD.	HYDERABAD	A	
				ROCKWOOL INDUSTRIES	BHILAI	A	
				LAPINUS	MALANPUR (MP)	A	
				MINWOOL	RAJANANDGAON	A	
				LLOYD INSULATION	BHILAI	A	
				GOENKA ROCKWOOL (I) PVT	RAIPUR	A	

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				LTD			
				SHREERAM EQUITECH PVT LTD	DURG	A	
				U.P. TWIGA	BULENDSHAHAR	A	
17.	**CI PIPES**	III	-	BIS APPROVED SOURCES HAVING VALID BIS LICENCE			
18.	**MODULE MOUNTING STRUCTURES (MMS)**	III		MAIN CONTRACTOR'S APPROVED SOURCES			
19.	**GALAVANISED STEEL STRUCTURES FOR TRANSMISION LINE**	I		L&T	PITAMPUR	A	
				NAMPA STEEL	HOWRAH	A	
				UNITECH POWER TRANSMISSION LTD.	NAGPUR	A	
				L&T	PONDICHERRY	A	
				ASSOCIATED POWER STRUCTURES	VADODARA	A	
				GOOD LUCK STEEL TUBES	SIKANDRABAD	A	
				R.S. INFRAPROJECTS PVT. LTD	SURAJPUR	A	
				ADVANCE STEEL TUBE	SAHIBABAD	A	
				RICHARDSON & CRUDDAS (1972) LTD	NAGPUR	A	
20.	**GALVANISED STEEL STRUCTURE (LATTICE & PIPE)**	I		GOOD LUCK STEEL TUBES	SIKANDRABAD	A	
				RICHARDSON & CRUDDAS (1972) LTD	NAGPUR	A	
				L&T	PONDICHERY	A	
				L&T	PITAMPUR	A	
				NAMPA STEEL	HOWRAH	A	

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				R.S. INFRAPROJECTS PVT. LTD	SURAJPUR	A	
				PIONEER FABRICATOR	MEERUT	A*	*Galvanising to be done by M/s Vinayak Transco Ltd, Modinagar
				VIJAY TRANSMIISION P. LTD	RAIPUR	A	
				UNIQUE STRUCTURES & TOWERS LTD.	RAIPUR	A	
				VATCO ELEC-POWER PVT. LTD. ,	NAVIMUMBAI	A	GALVANISING AT SIGMA GALVANISER NAVI MUMBAI
				R.S. INFRAPROJECTS PVT. LTD	GHAZIABAD	A	
				ADVANCE STEEL TUBE ,	SAHIBABAD	A	
				SANGAM STRUCTURES LTD.	ALLAHABAD	A	
				NEW MODERN TECHNOMECH	MAYURBHANJ (OR)	A	
				UNITECH POWER TRANSMISSION LTD.	NAGPUR	A	
				ASSOCIATED POWER STRUCTURES	VADODARA	A	
21.	**FOUNDATION BOLT**	III		MAIN CONTRACTOR'S APPROVED SOURCES			

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LEGENDS:

1. SYSTEM SUPPLIER/SUB-SUPPLIER APPROVAL STATUS CATEGORY (SHALL BE FILLED BY NTPC)

A – For these items proposed vendor is acceptable to NTPC. To be indicated with letter "A" in the list along with the condition of approval, if any.

DR – For these items "Details required" for NTPC review. To be identified with letter "DR" in the list.

'N' NOTED – For these items vendors are approved by Main Supplier and accepted by NTPC without specific vendor approval from NTPC. To be identified with 'NOTED.'

2. QP/INSPN CATEGORY:

CAT-I : For these items the Quality Plans are approved by NTPC and the final acceptance will be on physical inspection witness by NTPC.

CAT-II : For these items the Quality Plans approved by NTPC. However no physical inspection shall be done by NTPC. The final acceptance by NTPC shall be on the basis review of documents as per approved quality plan.

CAT-III : For these items Main Supplier approves the Quality Plans.

UNITS/ WORKS : Place of manufacturing Place of Main Supplier of multi units/works.

NOTE 1: For the items placed in CAT-III for Civil Works, the review and final acceptance shall be done by NTPC-EIC/ FQA on the basis of MTC / certificate of conformance in line with Indicative FQP / Technical Specifications.

NOTE 2:

i) This list has been compiled based on the names of suppliers / sub vendors proposed by the Bidders / Main Contractors to NTPC for various Corporate Civil packages awarded in the past based on respective Technical Specifications / Bill of Quantities / Tender Documents. This list is not exhaustive. Listed sub-suppliers may or may not have supplied the material to NTPC in the past.

ii) The purpose of this list is not to limit the sub vendors but to provide general guidance to the prospective Bidders / Main Contractors. However this list is indicative in nature and may undergo revision for future packages based on the performance feedback received from NTPC sites / other agencies about the supplier / sub vendors / supplied material. Moreover listed suppliers may or may not be able to supply the material as per current Tech Specifications / Bill of Quantities / Tender Documents for the present package. Bidder is required to enquire before finalizing the suppliers / sub vendors for the present contract to meet provisions of the current Tech Specs / BOQ / Tender Documents. Moreover some of these listed sub-suppliers might have stopped manufacturing the identified items. It is also possible that some of the listed manufacturers/suppliers do not exist now. Bidder to make necessary enquiry before submitting bids. Bidders / Contractors are free to propose names of suppliers / sub vendors for various items as per their procurement policy to NTPC for considering supplies for the present Contract.