

# सेंट्रल कोलफिल्डस लिमिटेड Central Coalfields Limited

(A subsidiary of Coal India Limited)



Bidding Document FOR

Development of 20MW Solar PV Project at Central Coalfields Limited (CCL) CHP/CPP Piparwar, Jharkhand

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## SECTION- I e-TENDER NOTICE







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सेंट्रलकोलफील्ड्सलिमिटेड (कोलइंडियाकीअनुषंगीइकाई) दरभंगाहाउसरांची- 834 029

CENTRAL COALFIELDS LIMITED (A Subsidiary of Coal India Limited) E&M DEPARTMENT DARBHANGA HOUSE, RANCHI 834 029

दूरभाष/Phone : 0651-2360788, 0651-2365500

Mob.: 8987784113 वेबसाइट/Website : https://www.centralcoalfields.in Email Id- gmenm.ccl@coalindia.in

NIT No.: GM(E&M)/NIT/Solar/19/3004

Dated:04.12.2019

#### e-TENDER NOTICE

1. Digitally signed and encrypted e-Tenders are invited under Two Part system on the website <a href="https://coalindiatenders.nic.in">https://coalindiatenders.nic.in</a> from the reputed and experienced contractors for the following work:

Description of work	Location	Estimated Value (Rs.)	Earnest Money (Rs )	Period of Completi on (in Days)
DEVELOPMENT OF 20 MW SOLAR PV	CHP/CPP	80.31 Crore	50,00,000/-	270 Days
PROJECT AT CENTRAL COALFIELDS	PIPARW	(Including GST and		
LIMITED (CCL) CHP/CPP PIPARWAR,	AR,	O&M cost for 5		
JHARKHAND	JHARKH	Year) for 46.75 MU		
	AND	Maximum		
		generation		

Note: The bid documents will be available on the website(s) <u>www.centralcoalfields.in</u> & CPP Portal <u>eprocure.gov.in</u> and can be downloaded by the bidder up to the bid submission end date. There is no Application Fee.

#### 2.0 BRIEF SCOPE OF WORK

Design, Engineering, Manufacturing, Supply, Packing and Forwarding, Transportation, Unloading, Storage, Installation and Commissioning of grid connected 20MW Ground Mounted Solar PV Project at CCL CHP/CPP Piparwar, Jharkhand.

The broad scope of work under this package shall include Civil Structural and architectural works related to but not limited to the following areas, System, Structures / Substructures, Buildings and Facilities:

- i. Design, engineering, manufacturing, supply, packing and forwarding, transportation, unloading storage, installation, testing and commissioning of Solar Photo Voltaic Plant based on Open category PV modules and cells.
- ii. Site levelling & Grading and clearing/removal of vegetation.
- iii. Providing power supply and water supply for construction purposes.
- iv. Construction of Central Monitoring and Control Station (CMCS) with switchgear room, with all electrical fitting and furniture, security cabin etc.
- v. Construction of Inverter room/Pre Engineered Building (PEB) as per bidder's proposal.
- vi. SCADA system for remote monitoring and including control of Inverters with all hardware & software.
- vii. Design, construction and fabrication of Module Mounting Structures and its Foundations.
- viii. Design and construction of Internal Roads and Pathways as per Bidder's proposed General Layout.
- ix. Design and construction of Drainage system as per General Layout and Topography.
- x. Construction of Prestressed precast Boundary wall / Fencing and Main gate as per approved design.
- xi. Design and construction of a Module Washing System. Water supply arrangement for washing including supply and installation of Module Washing System.
- xii. Construction of Store Room.
- xiii. Design and construction of Sewerage System for any facility/ Room /building.
- xiv. Cable laying works
- xv. All associated electrical and civil works required for interfacing with grid (i.e. breakers, isolators, panels, protection system, cables/ overhead line).
- xvi. Construction of Overhead 33kV double circuit line and integration with CCL existing outdoor 33kV Central Switching Station (CSS), Piparwar Area including construction of two numbers of new 33kV Bay at CSS with all required control and protection system.
- xvii. Civil Foundation for all electrical items/33KV Systems.
- xviii. Metering system as per specifications.
- xix. Comprehensive Operation & maintenance of SPV Plant along with all electrical equipments, consumables and spare parts for a period of 5 (Five) years from the date of successful completion of trial run.
- xx. Comprehensive AMC of Inverter, SCADA & tracker system (if applicable) for 5 years beyond comprehensive operation & maintenance period.
- xxi. Supply of Mandatory spares.
- xxii. Any other works and services to make the system complete.

#### 3.0 Time Schedule of Tender

SL No	Particulars	Date Time		
1	Tender e-Publication date			
2	Document download start date			
3	Document download end date			
4	Date of Pre-Bid meeting	As mentioned in the portal		
5	Bid submission start date			
6	Bid submission end date		and pertur	
7	Start date for seeking clarification on-line			
8	Last date for seeking clarification on-line			
9	Date of opening of tender [Cover I (Technical bid)			
	&Cover II (Price bid)]			
10	Start date of Reverse Auction	On date of op	pening of bid	

#### 4.0 Deposit of EMD:

4.1 Bidders will have to make the payment of EMD through ONLINE mode only.

In ONLINE mode, the bidder can make payment of EMD either through net- banking from designated Bank/s or through RTGS / NEFT from any schedule Bank. In case of payment through Net- banking, the money will be immediately transferred to CIL/ Subsidiary's designated account. In case of payment through NEFT/ RTGS, the bidder will have to make payment as per the Challans generated by the system on e- Procurement Portal (<u>www.coalindiatenders.nic.in</u>) and will have to furnish online Unique Transaction Reference (UTR) Number before submission of bid. Bidder will be allowed to submit his/her bid only when the EMD successfully received in CIL/ Subsidiary's designated account and the information flows from Bank to the e- procurement system.

4.2The qualification in the bid will also be subject to the receipt and acceptance of EMD within the scheduled date and time as mentioned in the NIT.

- 5.0 **Pre-bid Meeting:** The pre-bid meeting shall be held in the office of Tender Inviting Authority on the scheduled date & time, if specified online. Non-attendance of pre-bid meeting will not be a cause for disqualification of the bidder and it shall be presumed that the bidder does not require any clarification. The purpose of the pre-bid meeting will be to clarify issues.
- 6.0 **Seeking online clarification by bidder:** The bidder may seek clarification online within the specified period. The identity of the bidder will not be disclosed by the system. The department will clarify as far as possible the relevant queries of bidders. The clarification given by the department will be visible to all the bidders intending to participate in the tender.

#### 7.0 Eligibility Criteria:-

#### A. TECHNICAL CRITERIA

7.1 The Bidder should have designed, supplied, erected/ supervised erection and commissioned/ supervised commissioning of Solar Photo Voltaic (SPV) based grid connected power plant(s) of cumulative installed capacity of 16 MWp or higher, out of which at least one plant should have been of 10 MWp or higher capacity. The reference plant of 10MWp or higher capacity must have been in successful operation for at least six (6) months prior to the date of techno-commercial bid opening.

#### OR

7.2 The Bidder should be a developer of Solar Photo Voltaic (SPV) based grid connected power plant(s) of cumulative installed capacity of 16 MWp or higher, out of which at least one plant should have been of 10 MWp or higher capacity. The reference plant of 10MWp or higher capacity must have been in successful operation for at least six (6) months prior to the date of techno-commercial bid opening.

#### OR

7.3 (a) The Bidder should have executed in the last ten (10) years an industrial project either as developer or as EPC Contractor in the area of power/ steel/ oil and gas/ petro-chemical/ fertilizer/cement/coal mining including coal handling plant and/ or any other process industry, of a value of INR73 Crore (Indian Rupees Seventy Three Crore only) or more in a single project or single work respectively and the same should be in successful operation for at least one (1) year prior to the date of techno-commercial bid opening.

(b) The Bidder should have executed at least one (1) Electrical Sub-station of 33 kV or above voltage level, consisting of equipment such as 33kV or above voltage level circuit breakers and Power transformer, either as developer or as EPC Contractor which should be in successful operation for at least one (1) year prior to the date of techno-commercial bid opening.

The works referred to at clause 7.3 (a) & 7.3 (b) can be in same or different projects.

The Intending bidder must have in its name of having successfully completed works as required at Clause 7.1 /7.2/7.3 (a) & (b) above. Experience for those works only shall be considered for evaluation purposes, which match eligibility requirement stipulated above, on or before the last day of month previous to one in which tender has been invited(publication date of NIT). The experience of incomplete/ongoing works as on last date of eligibility period will not be considered for evaluation. If the referred work includes construction as well as maintenance after construction, the experience of such work may be considered as 'acceptable' if the construction part is completed as on the last date of 'eligibility period', even if maintenance work is ongoing, and the certificate issued clearly stipulates the same .

In case the bidder is not a prime contractor, but a sub-contractor, the bidder's experience as sub-contractor will be taken into account, against suitable document that the contract in support of qualification is a sub-contract in compliance with the provision of such sub-contracts in the original contract awarded to prime contractor. The document may be issued by owner/Govt. department on behalf of the owner.

**Joint Venture shall be allowed for participation in the bid.** In order for joint venture to qualify, each of its partners must meet the minimum criteria listed for an individual Bidder for the component of the contract they are designated to perform. Failure to comply with this requirement will result in rejection of the Joint Venture's Bid.

A firm can be a partner in only one joint venture; multiple bids submitted by joint ventures having the same firm as partner will be rejected.

#### Notes for clause 7.A

a. The reference SPV based grid-connected power plant of 10MWp or above capacity should be at a single location developed by Bidder for itself or any other client.

- b. SPV based Roof-top/Floating solar power projects, which are grid connected, shall also be considered eligible for QR purposes.
- c. Projects executed by Bidder's group company, Holding Company or Subsidiary Company shall also be considered as Bidder's experience for meeting the QR, provided Bidder is an Indian company registered in India.
- d. Bidder shall submit certificate of successful completion and operation from the Owner.
- e. In case the award for the reference works has been received by the Bidder directly from either owner of plant or any other intermediary organization, a certificate from such owner of plant or the intermediary organization shall be required to be furnished by the Bidder along with its techno-commercial bid in support of its claim of meeting requirement stipulated above. Certificate from owner of the plant shall also be furnished by the Bidder for successful operation of the reference plant.
- f. In case of developer as bidder in clause 7.2 or 7.3, the documentary evidence (certified by Chartered Accountant) for value of executed reference work must be submitted by the Bidder.
- g. Developer means an entity who has either executed or got executed the work/ project as owner of industrial projects.
- h. The execution of industrial project as EPC Contractor under Clause No. 7.3 means, such EPC Contractor is responsible for all the activities i.e. Design/Engineering, Procurement, Construction and Commissioning of a project/work.
- i. The portion of work related to power transformer such as supply and or installation mentioned at cl. No. 7.3(b) can either be done by EPC contractor by themselves or by the owner.

#### For Clause No 7.1

#### Data to be furnished by the bidders online:

Bidder has to confirm YES/NO in technical parameters sheet having experience as per clause 7.1 above.

#### **Technical Evaluation by the System:**

The System will evaluate "Yes" as eligible and "No" as not eligible.

#### Scanned Copy of documents to be uploaded by the bidders

Copies of authentic Purchase Orders Completion Certificate from client, Agreements in support of details/data along with Annexure - XII.

In case of Sub- Contractor, suitable document as per provision of eligibility, if applicable.

Work- Order, BOQ and/or TDS may be sought during clarification or along with deficient documents.

#### For Clause No 7.2

#### Data to be furnished by the bidders online:

Bidder has to confirm YES/NO in technical parameters sheet having experience as per clause 7.2 above.

#### **Technical Evaluation by the System:**

The System will evaluate "Yes" as eligible and "No" as not eligible.

#### Scanned Copy of documents to be uploaded by the bidders

Copies of authentic Purchase Orders Completion Certificate from client, Agreements in support of details/data along with Annexure - XIII.

The documentary evidence (certified by Chartered Accountant) for value of executed work in support of reference work.

Work- Order, BOQ and/or TDS may be sought during clarification or along with deficient documents.

#### For Clause No 7.3

#### Data to be furnished by the bidders online:

Bidder has to confirm YES/NO in technical parameters sheet having experience as per clause 7.3 (a) & (b) above.

#### **Technical Evaluation by the System:**

The System will evaluate "Yes" as eligible and "No" as not eligible.

#### Scanned Copy of documents to be uploaded by the bidders

Copies of authentic Purchase Orders Completion Certificate from client, Agreements in support of details/data along with Annexure - XIV.

In case of Sub- Contractor, suitable document as per provision of eligibility, if applicable.

In case the Project executed by Developer the documentary evidence (certified by Chartered Accountant) for value of executed work in support of reference work.

Work- Order, BOQ and/or TDS may be sought during clarification or along with deficient documents.

#### **B** FINANCIAL TURNOVER:

Average annual financial turnover during the last 3(three) years, ending 31<sup>st</sup> March the previous financial year should be at least 30% of the estimated cost put to tender.

(The "Previous Financial Year" shall be computed with respect to the e- Publication date.)

#### Data to be furnished by the bidders:

- i) Annual turnover of each of the last 3 (three) years ending 31<sup>st</sup> March of the previous financial year.
- ii) Name of the Chartered Accountant issuing the Profit & Loss Account or the Turnover Certificate.
- iii) Membership number of the Chartered Accountant.
- iv) In case the bidder is a Joint Venture, the Turnover of the individual partners will be added together for each financial year and is to be furnished as turnover of the bidder for that particular financial year.

#### Technical Evaluation by the System:

- i) The system will calculate the 30% of the estimated value (ECV) as required average turnover of the bidder.
- ii) The system shall calculate the average of the financial turnover of 3 years furnished by the bidder adding 5% for each completed year ( total number of days/ 365) after the end of the respective Financial Year ( i.e. 31<sup>st</sup> March ) till the last date of the month previous to the one in which the e- tender has been invited.

- iii) The average shall be compared with the minimum requirement to ascertain the eligibility status of the bidder.
- iv) If any bidder does not submit the Turnover value for any of the 3 years, the system will not disqualify the bidder and instead shall consider all 3 years for computing the average assuming a value of 'zero' for the year for which no information has been furnished by the bidder.

#### Scanned copy of documents to be uploaded by the bidders (Confirmatory documents)

Turnover certificate issued by a practicing Chartered Accountant having membership of Institute of Chartered Accountants of India containing information as furnished by the bidder. Turnover certificate issued by CA should bear UDIN No.

#### **C** Working Capital

The bidder must produce the evidence of adequacy of a minimum working capital, 20% of the estimated cost of the work.

#### Data to be furnished by the bidders on line :

- i.) Date of issue of certificate by bank
- ii.) Name of bank
- iii.) Address of the bank
- iv.) Value of access to credit issued by bank in the name of the bidder.

#### Scanned copy of documents to be uploaded by the bidders (Confirmatory documents)

The intending bidder must submit Banker's certificate from any Scheduled Bank regarding availability of access to credit (issued within 3 months prior to the end date of submission of bid), to meet the requirement of Working capital.

Note:

- a) In case the bidder is a Joint Venture, the Working Capital of the individual partners of the JV will be added together and is to be furnished as the Working Capital of the bidder.
- b) In case of JV, if Working Capital of all the partners are not submitted the system will not disqualify the JV and instead shall consider assuming a value of zero for partner/partners who has/have not submitted the Working capital certificate.

#### **D PERMANENT ACCOUNT NUMBER:**

The bidder should possess a Permanent Account Number (PAN) issued by Income tax Department.

#### Data to be furnished by the bidders online:

Confirmation in the form of YES/NO regarding possessing PAN

#### **Technical Evaluation by the System:**

The System will evaluate "Yes" as eligible and "No" as not eligible.

#### Scanned copy of documents to be uploaded by the bidders (Confirmatory documents)

PAN card of the bidder.

(In case JV, all the partner should submit PAN)

[In case the work is awarded to JV, the PAN, in the name of JV, is to be submitted before execution of Agreement]

#### E. GOODS AND SERVICES TAX (NOT APPLICABLE FOR EXEMPTED SERVICES) :

The bidder should possess GST Registration Certificate and submit GSTIN (Goods and Services Tax Identification Number).

In respect of the above eligibility criteria the bidders are required to furnish the following information on-line:

Confirmation in the form of YES/NO regarding possessing of GST Registration Certificate (with GSTIN)

#### <u>Scanned copy of documents to be uploaded by the bidders in support of information/ declaration furnished</u> <u>online by the bidder against eligibility criteria as confirmatory document</u>

GST Registration Certificate (i.e GST identification number) issued by appropriate authority

Note: In case of Joint Venture (JV), each partner of JV should possess GST Registration Certificate (with GSTIN) OR JV itself should possess GST Registration Certificate (with GSTIN).

[In case the work is awarded to JV, the GST Registration Certificate (with GSTIN), in the name of JV, is to be submitted before execution of Agreement]

#### F.VALID ELECTRICAL LICENSE:

The bidder or his authorized representative (In whose guidance work will be executed) should submit valid Electrical Contractor's License issued by Electrical Licensing Board/Authority of any Indian State/UT, in accordance with IE Rule-45 within -30 days of issue of letter of acceptance.

For this bidder has to agree at Point no 11 of undertaking as per the format enclosed as Annexure II to submit Valid Electrical Contractor's License of the bidder itself or his authorized representative (In whose guidance work will be executed) issued by Electrical Licensing Board/ Authority of any Indian State/ UT, in accordance with IE Rule- 45 within 30 days of issue of letter of acceptance.

#### Data to be furnished by the bidders:

Confirmation in the form of YES/NO to submit Valid Electrical License within 30 days of issue of letter of acceptance.

#### Technical Evaluation by the System:

The System will evaluate "Yes" as eligible and "No" as not eligible.

#### G. BIDDER'S QUALIFICATIONS

The documentary evidence of the Bidder's Qualifications to perform the contract, shall establish to the Employer's satisfaction that the Bidder has the financial, technical, production, procurement, shipping, installation and other capacities and capabilities necessary to perform the contract and meets the experience.

The Bidder shall provide satisfactory evidence that he and/or, where applicable, his collaborator/associate:

- (i) is a manufacturer/supplier, who regularly manufactures equipment of the type specified and/or undertakes the type of work specified and has adequate technical knowledge and relevant experience for the works covered in the Bidding Documents.
- (ii)does not anticipate a change in ownership during the proposed period of execution of work (If such a change is anticipated, the scope and effect thereof shall be defined).
- (iii) has adequate Design, Plant and Manufacturing and/or Fabrication Capability and Capacity available to perform the work properly and expeditiously within the time period specified. The evidence shall specifically cover, with written details, the installed manufacturing and/or fabrication capacities and present commitments (excluding those anticipated under this specification). If the present commitments are such that the installed capacity results in an inadequacy of manufacturing and/or fabrication capacities to meet the requirements appropriate to the works cover in his bid, then the details of alternative arrangements to be organized by the Bidder and/or his collaborator/associate for this purpose and which shall meet the Employer's approval, shall also be furnished.
- (iv) has an established Project Management Organization covering the areas related to engineering of equipment/systems, interface engineering, procurement of equipments and the necessary field services required for successful construction, testing and commissioning of all the power plant equipments and systems covered in the scope of work for this package and as required by the Bidding Documents.
- (v) has established Quality Assurance Systems and Organization Designed to achieve high levels of equipment/system reliability, both during his manufacturing and/or fabrication and field installation activities.
- (vi) a company formed by the merger of two or more companies or divisions of such companies engaged in supply and installation of power generation equipments can also participate provided the constituent companies or divisions before merger individually or jointly meet the stipulated qualification requirements fully.

#### Scanned Copy of documents to be uploaded by the bidders

As per Annexure XV, bidder is required to upload a write up of all the points mentioned in this annexure in his own format along with all the relevant documents and the same should be enclosed as annexures numbered as XVA, XVB ... and so on. For further detailed technical evaluation, the bidder is also required to upload filled annexures XVI to XXII which are enclosed as:

- 1. Annexure XV : Details of Manufacturing and Testing Capacities
- 2. Annexure XVI: Details of Manufacturing Capacities & Plant Loading
- 3. Annexure XVII: Present Order Book Position
- 4. Annexure XVIII: Past Performance Data
- 5. Annexure XIX: Data regarding Key Construction Personnel
- 6. Annexure XX : Manpower Loading Data
- 7. Annexure XXI: Detail regarding Project Management Organization
- 8. Annexure XXII : Declaration by the Bidder who did not manufacture or otherwise produce and/or install plant and equipment of Solar Project

Note : The Bidder shall enclose relevant documents in support of the details/data provided in above Annexures

Notwithstanding anything stated above, the Employer reserves the right to undertake a Physical Assessment of the capacity and capabilities including financial capacity and capability of the Bidder / his Collaborator(s)/ Associate(s)/subsidiary(ies) /Group Company(ies) to perform the Contract, should the circumstances warrant such assessment in the overall interest of the Employer. The Physical Assessment shall include but not be limited the assessment the to of office/facilities/banker's/reference works by the Employer. A negative determination of such assessment of capacity and capabilities may result in the rejection of the Bid.

The above right to undertake the Physical Assessment shall be applicable for the qualifying requirements as stipulated in the bid document.

In case Bidder is permitted to offer to supply and/or install plant and equipment under the contract that the Bidder did not manufacture or otherwise produce and/or install, the Bidder shall (i) have the financial and other capabilities necessary to perform the contract; (ii) have been duly authorized by the manufacturer or producer of the related plant and equipment or component to supply and/or install that item in the Employer's country; (iii) be responsible for ensuring that the manufacturer or producer of the related item meets the minimum criteria listed for that item.

#### H. Eligibility and Conformity of the Facilities

Documentary evidence establishing that the facilities offered by the Bidder in its bid are eligible and conform to the Bidding Documents.

The documentary evidence of the eligibility of the facilities shall consist of a statement on the country of origin of the plant and equipment offered, which shall be confirmed by a certificate of origin issued at the time of shipment.

#### Scanned Copy of documents to be uploaded by the bidders

The documentary evidence of the conformity of the facilities to the Bidding Documents may be in the form of literature, drawing and data, and shall include:

- (i) a detailed description of the essential technical and performance characteristics of the facilities;
- (ii) a list giving full particulars, including available sources, of all spare parts, special tools, etc. necessary for the proper and continuing functioning of the facilities following completion of facilities in accordance with provisions of contract; and
- (iii) a commentary on the Employer's Technical Specifications and adequate evidence demonstrating the substantial responsiveness of the facilities to those specifications. Bidders shall note that standards for workmanship, materials and equipment designated by the Employer in the Bidding Documents are intended to be descriptive (establishing standards of quality and performance) only and not restrictive. The Bidder may substitute alternative standards, brand names and/or catalog numbers in its bid, provided that it demonstrates to the Employer's satisfaction that the substitutions are substantially equivalent or superior to the standards designated in the Technical Specifications.

### 1. ERECTION TOOLS AND PLANT AND SAFETY EQUIPMENTS & SAFETY PERSONAL PROTECTIVE EQUIPMENTS

List of Erection Tools and Plant and Safety Equipments & Safety Personal Protective Equipments which the bidder proposes to bring to site in case the contract is awarded to him.

#### Scanned Copy of documents to be uploaded by the bidders

Details as per format at Annexure XXIII.

#### J. QUALITY ASSURANCE PROGRAMME

Details regarding the overall Quality Management & Procedures which the bidder proposes to follow during various phases of execution of the contract.

#### Scanned Copy of documents to be uploaded by the bidders

Details as per format at Annexure XXIV.

#### K. MILESTONE SCHEDULE

Time for completion of facilities under the Package is as per details given in the Clause No 3 of Special conditions of the Contract of the Bidding Documents. Further, bidder is also to provide comprehensive Operation and Maintenance (O&M) of Solar Photo Voltaic Plant for a period of **Five (05)** years from the date of successful completion of Trial Run.

The Bidder shall also be required to submit a brief integrated PERT Network (L2 Schedule) matching the above work schedule. The Master Network shall inter-alia; include the major activities listed below for each of the systems listed above showing their interrelationship and duration so as to meet the schedule dates mentioned at Clause No 3 of Special conditions of the Contract of the Bidding Documents

Activities to be incorporated in Master Network to be submitted with bid:

- 1. Ordering on sub-vendor(s) (wherever applicable)
- 2. Start of Engineering
- 3. Completion of Engineering
- 4. Start of Manufacturing/ Fabrication
- 5. Completion of Manufacturing/ Fabrication
- 6. Readiness and Completion of Type Test
- 7. Commencement of Dispatch
- 8. Completion of Dispatch
- 9. Start of Erection
- 10. Commissioning of the System
- 11. Completion of the Facilities.

The Master Network and the Key Milestone Dates will be discussed with the successful bidder, if required, and agreed upon before the issue of Notification of Award as per tender schedule. Engineering Drawing and Data Submission Schedule shall also be discussed and finalised before the issue of Notification of Award.

After the Notification of Award, the contractor shall plan the sequence of work of Manufacture, Supply and Erection to meet the above stated dates of Successful Completion of Facilities and shall ensure all work, Manufacture, Shop Testing, Inspection and Shipment of the equipment in accordance with the required construction/erection sequence.

#### Scanned Copy of documents to be uploaded by the bidders

Details regarding the timing & sequence of all Key Activities/Important milestones necessary for successful completion of the contract, as per Employer's format enclosed as Annexure XXV.

#### L. GENERAL ESSENTIAL REQUIREMENTS:

In order to qualify in the tender the bidders have to accept the following conditions:

- i. All the Terms and Condition of the NIT and Tender Document Unconditionally on line in the form of User Portal Agreement.
- ii. To upload online the scanned copy of documents, as specified in the NIT for evaluation by Tender Committee as per the checklist given in the NIT.

#### Data to be furnished by Bidder on-line:

Confirmation in the form of Agree/Disagree for accepting user portal agreement

Confirmation in the form of Agree/Disagree.

#### **Technical evaluation by the System:**

System will capture data in the format from the bidder and will decide the eligibility for (i) & (ii) above.

#### Scanned copy of documents to be uploaded by bidders (CONFIRMATORY DOCUMENT) :

#### To be taken as per Checklist

#### 8.0 CHECK LIST OF DOCUMENTS TO BE UPLOADED BY THE BIDDERS

Sl. No.	Submission of Documents related to Eligibility Criteria	Information to be furnished by the bidder online.	Scanned copy of documents, to be uploaded by bidder in support of information/ declaration furnished online by the bidder against Eligibility Criteria as Confirmatory Document
1	Letter of Bid	Confirmation in the form of YES/NO regarding submission of information.	Letter of Bid as per Performa on bidder's letter head.
3	Work Experience : 7.1. The Bidder should have designed, supplied, erected/ supervised erection and commissioned/ supervised commissioning of Solar Photo Voltaic (SPV) based grid connected power plant(s) of cumulative installed capacity of 16 MWp or higher, out of which at least one plant should have been of 10 MWp or higher capacity. The reference plant of 10MWp or higher capacity must have been in successful operation for at least six (6) months prior to the date of techno-	Confirmation in the form of YES/NO for Clause no. 7.1 or 7.2 or 7.3 regarding submission of information.	For Clause 7.1:Copies of authentic Purchase Orders Completion Certificate from client, Agreements in support of details/data along with Annexure XII.In case of Sub- Contractor, suitable document as per provision of eligibility, if applicable.Work- Order, BOQ and/or TDS may be sought during clarification or along with deficient documents.For Clause 7.2:

OROrders, Certificate from Clients, Agreements in support of details/data along with Annexure XIII.7.2. The Bidder should be a developer of Solar Photo Voltate (SPV) based grid connected power plant(s) of cumulative installed capacity of 16 MWp or higher capacity. The reference plant of 10 MWp or higher capacity must have been in successful operation for at least six (6) months prior to the date of techno- commercial bid opening.The documentary evidence (certified by Chartered Accountant) for value of executed work in support of reference plant of 10 MWp or higher capacity must have been in successful operation for at least six (6) months prior to the date of techno- commercial bid opening.Copies of Authentic Purchase Orders, Certificate from Clients, Agreements in support of queries along with Annexure XIV. In case of Sub-Contractor, suitable document as per provision of eligibility, if applicable.7.3. (a) The Bidder should have executed in the last ten (10) years an industrial project either as developer or as EPC Contractor in the area of power/ steel/ oil and gas/ petro-chemical/ fertilizer/cement/coal mining including coal handling plant and / or any other process industry, of a value of INR 73 Crore (Indian RupcesSeventy Three coroeonly) or more in a single project or single work respectively and the same should be in successful operation for at least one (1) Electrical Sub-station of 33 kV or above voltage level, circuit breakers and Power such as 33kV or above voltage level circuit breakers and Powerb) The Bidder should have executed at least one (1) Electrical Sub-station of 33 kV or above voltage level, circuit breakers and Powerconsisting of equipment such	(	commercial bid opening.	Copies of Authentic Purchase
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<ul> <li>connected power plant(s)</li> <li>of cumulative installed</li> <li>capacity of 16 MWp or</li> <li>higher, out of which at</li> <li>least sit (6) months prior to</li> <li>the date of techno-</li> <li>commercial bid opening.</li> <li>OR</li> <li>7.3. (a) The Bidder should</li> <li>have executed in the last</li> <li>ten (10) years an industrial</li> <li>project either as developer</li> <li>or as EPC Contractor in the</li> <li>area of power/ steel/ oil</li> <li>and gas/ petro-chemical/</li> <li>fertilizer/cement/coal</li> <li>mining including coal</li> <li>handling plant and/ or any</li> <li>othe date of techno-</li> <li>commercial bid opening.</li> </ul>	· ·	Voltaic (SPV) based grid	
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<ul> <li>least six (6) months prior to the date of technocommercial bid opening.</li> <li>OR</li> <li>7.3. (a) The Bidder should have executed in the last ten (10) years an industrial project either as developer or as EPC Contractor in the area of power/ steel/ oil and gas/ petro-chemical/ fertilizer/cement/coal mining including coal handling plant and/ or any other process industry, of a value of INR 73 Crore (Indian RupeesSeventy) Three coreonly or more in a single project or single work respectively and the same should be in successful operation for at least one (1) year prior to the date of technocommercial bid opening.</li> <li>b) The Bidder should have executed at least one (1) Electrical Sub-station of 33 kV or above voltage level, consisting of equipment such as 33kV or above voltage level, circuit breakers and Power</li> </ul>		successful operation for at	Orders, Certificate from Clients,
<ul> <li>the date of techno- commercial bid opening.</li> <li>OR</li> <li>7.3. (a) The Bidder should have executed in the last ten (10) years an industrial project either as developer or as EPC Contractor in the area of power/ steel/ oil and gas/ petro-chemical/ fertilizer/cement/coal mining including coal handling plant and/ or any other process industry, of a value of INR 73 Crore (Indian RupeesSeventy Three croreonly) or more in a single project or single work respectively and the same should be in successful operation for at least one (1) year prior to the date of techno- commercial bid opening.</li> <li>b) The Bidder should have executed at least one (1) Electrical Sub-station of 33 kV or above voltage level, consisting of equipment such as 33kV or above voltage level circuit breakers and Power</li> </ul>	1	east six $(6)$ months prior to	Agreements in support of queries
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OR         7.3. (a) The Bidder should have executed in the last ten (10) years an industrial project either as developer or as EPC Contractor in the area of power/ steel/ oil and gas/ petro-chemical/ fertilizer/cement/coal mining including coal handling plant and/ or any other process industry, of a value of INR 73 Crore (Indian RupeesSeventy Three eroreonly) or more in a single project or single work respectively and the same should be in successful operation for at least one (1) year prior to the date of techno- commercial bid opening.       b) The Bidder should have executed at least one (1) Electrical Sub-station of 33 kV or above voltage level, consisting of equipment such as 33kV or above voltage level circuit breakers and Power       document as per provision of eligibility, if applicable.		commercial bid opening	In case of Sub- Contractor, suitable
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<ul> <li>area of power/ steel/ oil</li> <li>and gas/ petro-chemical/ fertilizer/cement/coal</li> <li>mining including coal</li> <li>handling plant and/ or any</li> <li>other process industry, of a</li> <li>value of INR 73 Crore</li> <li>(Indian RupeesSeventy</li> <li>Three croreonly) or more</li> <li>in a single project or single</li> <li>work respectively and the</li> <li>same should be in</li> <li>successful operation for at</li> <li>least one (1) year prior to</li> <li>the date of techno-</li> <li>commercial bid opening.</li> </ul> b) The Bidder should have <ul> <li>executed at least one (1)</li> <li>Electrical Sub-station of 33</li> <li>kV or above voltage level,</li> <li>consisting of equipment</li> <li>such as 33kV or above</li> <li>voltage level circuit</li> <li>breakers and Power</li> </ul>		or as EPC Contractor in the	executed work in support of
<ul> <li>and gas' petro-chemical/ fertilizer/cement/coal</li> <li>mining including coal</li> <li>handling plant and/ or any</li> <li>other process industry, of a</li> <li>value of INR 73 Crore</li> <li>(Indian RupeesSeventy</li> <li>Three croreonly) or more</li> <li>in a single project or single</li> <li>work respectively and the</li> <li>same should be in</li> <li>successful operation for at</li> <li>least one (1) year prior to</li> <li>the date of techno-</li> <li>commercial bid opening.</li> </ul> b) The Bidder should have <ul> <li>executed at least one (1)</li> <li>Electrical Sub-station of 33</li> <li>kV or above voltage level,</li> <li>consisting of equipment</li> <li>such as 33kV or above</li> <li>voltage level circuit</li> <li>breakers and Power</li> </ul>	2	area of power/ steel/ oil	reference work.
fertilizer/cement/coal mining including coal handling plant and/ or any other process industry, of a value of <b>INR 73 Crore</b> (Indian RupeesSeventy Three croreonly) or more in a single project or single work respectively and the same should be in successful operation for at least one (1) year prior to the date of techno- commercial bid opening. b) The Bidder should have executed at least one (1) Electrical Sub-station of 33 kV or above voltage level, consisting of equipment such as 33kV or above voltage level circuit breakers and Power	2	and gas/ petro-chemical/	
<ul> <li>mining including coal handling plant and/ or any other process industry, of a value of INR 73 Crore (Indian RupeesSeventy Three croreonly) or more in a single project or single work respectively and the same should be in successful operation for at least one (1) year prior to the date of techno- commercial bid opening.</li> <li>b) The Bidder should have executed at least one (1) Electrical Sub-station of 33 kV or above voltage level, consisting of equipment such as 33kV or above voltage level circuit breakers and Power</li> </ul>	f	fertilizer/cement/coal	
<ul> <li>handling plant and/ or any other process industry, of a value of INR 73 Crore (Indian RupeesSeventy Three croreonly) or more in a single project or single work respectively and the same should be in successful operation for at least one (1) year prior to the date of techno-commercial bid opening.</li> <li>b) The Bidder should have executed at least one (1) Electrical Sub-station of 33 kV or above voltage level, consisting of equipment such as 33kV or above tricit breakers and Power</li> </ul>	r	mining including coal	
other process industry, of a value of INR 73 Crore (Indian RupeesSeventy Three croreonly) or more in a single project or single work respectively and the same should be in successful operation for at least one (1) year prior to the date of techno-commercial bid opening.         b) The Bidder should have executed at least one (1) Electrical Sub-station of 33 kV or above voltage level, consisting of equipment such as 33kV or above voltage level circuit breakers and Power transformer either as	ł	handling plant and/ or any	
<ul> <li>value of INR 73 Crore (Indian RupeesSeventy Three croreonly) or more in a single project or single work respectively and the same should be in successful operation for at least one (1) year prior to the date of techno- commercial bid opening.</li> <li>b) The Bidder should have executed at least one (1) Electrical Sub-station of 33 kV or above voltage level, consisting of equipment such as 33kV or above voltage level circuit breakers and Power transformer either as</li> </ul>		other process industry, of a	
<ul> <li>(Indian RupeesSeventy Three croreonly) or more in a single project or single work respectively and the same should be in successful operation for at least one (1) year prior to the date of techno- commercial bid opening.</li> <li>b) The Bidder should have executed at least one (1) Electrical Sub-station of 33 kV or above voltage level, consisting of equipment such as 33kV or above voltage level circuit breakers and Power transformer either as</li> </ul>	v	value of INR 73 Crore	
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<ul> <li>in a single project or single work respectively and the same should be in successful operation for at least one (1) year prior to the date of techno- commercial bid opening.</li> <li>b) The Bidder should have executed at least one (1) Electrical Sub-station of 33 kV or above voltage level, consisting of equipment such as 33kV or above voltage level circuit breakers and Power transformer either as</li> </ul>	-	Three croreonly) or more	
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<ul> <li>successful operation for at least one (1) year prior to the date of techno-commercial bid opening.</li> <li>b) The Bidder should have executed at least one (1) Electrical Sub-station of 33 kV or above voltage level, consisting of equipment such as 33kV or above voltage level circuit breakers and Power transformer either as</li> </ul>	5	same should be in	
<ul> <li>least one (1) year prior to the date of techno- commercial bid opening.</li> <li>b) The Bidder should have executed at least one (1) Electrical Sub-station of 33 kV or above voltage level, consisting of equipment such as 33kV or above voltage level circuit breakers and Power transformer either as</li> </ul>	S	successful operation for at	
<ul> <li>the date of techno- commercial bid opening.</li> <li>b) The Bidder should have executed at least one (1) Electrical Sub-station of 33 kV or above voltage level, consisting of equipment such as 33kV or above voltage level circuit breakers and Power transformer either as</li> </ul>	1	east one (1) year prior to	
commercial bid opening.         b) The Bidder should have executed at least one (1) Electrical Sub-station of 33 kV or above voltage level, consisting of equipment such as 33kV or above voltage level circuit breakers and Power transformer either as	t	the date of techno-	
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Electrical Sub-station of 33 kV or above voltage level, consisting of equipment such as 33kV or above voltage level circuit breakers and Power transformer either as	e	executed at least one (1)	
kV or above voltage level, consisting of equipment such as 33kV or above voltage level circuit breakers and Power transformer either as	1	Electrical Sub-station of 33	
consisting of equipment such as 33kV or above voltage level circuit breakers and Power transformer either as	1	kV or above voltage level,	
such as 33kV or above voltage level circuit breakers and Power transformer either as	0	consisting of equipment	
voltage level circuit breakers and Power transformer either as	S	such as 33kV or above	
breakers and Power transformer either as	V	voltage level circuit	
transformer either as	ł	breakers and Power	
	t	transformer, either as	

	developer or as EPC Contractor which should be in successful operation for at least one (1) year prior to the date of techno- commercial bid opening. The works referred to at clause 7.3 (a) & 7.3 (b) can be in same or different projects.		
4.	Financial Turnover: Average annual financial turnover during the last 3 (three) years ending 31st March of the previous financial year should be at least 30% of the estimated cost. The "previous financial year" shall be computed with respect to the e- Publication date of NIT.	<ol> <li>Annual financial turnover during the last 3 (three) years ending 31<sup>st</sup> March of the previous financial year.</li> <li>Name of the Chartered Accountant issuing the Profit &amp; Loss A/c or the Turnover certificate.</li> <li>Membership number of the Chartered Accountant.</li> </ol>	<ul> <li>Financial Turnover certificate for the last 3 (three) financial years issued by a Practicing Chartered Accountant having membership number with Institute of Chartered Accountants of India. Turnover certificate issued by CA should bear UDIN No.</li> <li>(In case of JV, turnover Certificate of each individual partner of JV)</li> </ul>
5.	Working Capital The bidder must produce the evidence of adequacy of a minimum working capital, 20% of the estimated cost of the work.	<ul> <li>i.) Date of issue of certificate by bank</li> <li>ii.) Name of bank</li> <li>iii.) Address of the bank</li> <li>iv.) Value of access to credit issued by bank in the name of the bidder.</li> </ul>	Banker's certificate from any Scheduled Bank regarding availability of access to credit (issued within 3 months prior to the end date of submission of bid), to meet the requirement of Working capital.
6.	Goods and Services Tax	Confirmation in the form of YES/NO regarding possessing of GST Registration Certificate (with GSTIN)	GST Registration Certificate with GSTIN Note : In case of JV, GST Registration Certificate with GSTIN of each partner of JV OR of JV itself. [In case the work is awarded to JV, the GST Registration Certificate (with GSTIN), in the name of JV, is to be submitted before execution of Agreement]
7.	Legal Status of the Bidder :	Confirmation in the form of YES/ NO for possessing the supporting documents	<ul> <li>Any one of the following document:</li> <li>1. Affidavit or any other document to prove proprietorship/ Individual status of the bidder</li> <li>2. Partnership deed containing</li> </ul>

			<ul> <li>name of partners</li> <li>3. Memorandum &amp; Articles of association with certificate of incorporation containing name of the bidder</li> <li>4. Joint Venture Agreement containing names of the partners and the lead partner, Power of attorney to the Lead Partner and share of each partner.</li> </ul>
8.	Valid Permanent Account Number (PAN)	Confirmation in the form of YES/ NO for possessing the supporting document.	Pan card issued by the Income Tax department, Government of India. (In case of JV, PAN card for each individual partner) [In case the work is awarded to JV, the PAN, in the name of JV, is to be submitted before execution of Agreement]
9.	Valid Digital Signature Certificate	Confirmation in the form of YES/ NO for possessing the supporting document.	If the bidder himself is the DSC holder bidding on-line then no document is required. However, if DSC holder is bidding on behalf of the bidder, then Power of attorney or any sort of legally acceptable document for the authority to bid on behalf of the bidder.
10.	<b>Undertaking</b> in support of the authenticity of submitted information and documents and other commitments & Consent for Arbitration Clause	Confirmation in the form of YES/NO regarding submission of information	<ul> <li>a) A commitment is to be uploaded in the form of undertaking on company's letter head as per the format given in the bid document as per Annexure II . Undertaking is about the genuineness of information furnished online, authenticity of scanned copy of documents uploaded and about other commitments.</li> <li>In case of JV, undertaking shall be signed by all the partners.</li> <li>b).WRITTEN CONSENT FOR ARBITRATION CLAUSE in the prescribed format (Annexure- XXVIII) : (Applicable for Partnership Firm &amp; Joint Venture only)</li> </ul>

11.	BIDDER'S	Confirmation in the form of	As per Annexure XV, bidder is
	QUALIFICATION	YES/NO regarding submission of	required to upload a write up of all
	The Bidder shall provide	information.	the points mentioned in this
	satisfactory evidence that		annexure in his own format along
	he and/or, where		with all the relevant documents
	applicable, his		and the same should be enclosed
	collaborator/associate:		as annexures numbered as XVA,
	i. is a		XVB and so on. For further
	manufacturer/supplier		detailed technical evaluation, the
	, who regularly		bidder is also required to upload
	manufactures		filled annexures XVI to XXII
	equipment of the type		which are as under.
	specified and/or		1. Annexure XV :
	undertakes the type of		Details of
	work specified and		Manufacturing and Testing
	has adequate technical		Capacities
	knowledge and		2 Annexure XVI
	relevant experience		Details of
	for the works covered		Manufacturing Canacities
	in the Bidding		& Plant Loading
	Documents.		2 Appayura VVII
	ii. does not anticipate a		5. Alliexule AVII
	change in ownership		Deals Desition
	during the proposed		A nnovuro VVI II
	period of execution of		4. Alliexule AVI II .
	work (If such a		Past Performance Data
	change is anticipated,		5. Annexure XIX :
	the scope and effect		Data regarding Key
	thereof shall be		Construction Personnel
	defined).		6. Annexure XX :
	iii. has adequate Design,		Manpower Loading
	Plant and		Data
	Manufacturing and/or		7. Annexure XXI
	Fabrication Capability		Detail regarding Project
	and Capacity		Management Organization
	available to perform		8. Annexure XXII :
	the work properly		Declaration by the
	and expeditiously		Bidder who did not
	within the time period		manufacture or otherwise
	specified. The		produce and/or install plant
	specifically cover		and equipment of Solar
	with written details		Project.
	the installed		Note : The Bidder shall enclose
	manufacturing and/or		relevant documents in support of
	fabrication capacities		the details/data provided in
	and present		above Annexures.
	commitments		
	(excluding those		
	anticipated under this		
	specification). If the		

Г			
		present commitments	
		are such that the	
		installed capacity	
		results in an	
		inadaguagu af	
		inadequacy of	
		manufacturing and/or	
		fabrication capacities	
		to meet the	
		requirements	
		appropriate to the	
		works cover in his	
		hid then the details of	
		alternative	
		organized by the	
		Bidder and/or his	
		collaborator/associate	
		for this purpose and	
		which shall meet the	
		Employer's approval,	
		shall also be	
		furnished.	
	iv	has an established	
	17.	Project Management	
		Organization acuaring	
		the areas related to	
		engineering of	
		equipment/systems,	
		interface engineering,	
		procurement of	
		equipments and the	
		necessary field	
		services required for	
		successful	
		construction testing	
		and commissioning	
		of all the power plant	
		or an the power plant	
		equipments and	
		systems covered in	
		the scope of work for	
		this package and as	
		required by the	
		Bidding Documents.	
	v.	has established	
		Quality Assurance	
		Systems and	
		Organization	
		Designed to achieve	
		high levels of	
		equinment/system	
		raliability bath	
- 1			

	during his		
	manufacturing and/or		
	fabrication and field		
	installation activities.		
	v1. a company formed by		
	the merger of two or		
	more companies or		
	divisions of such		
	companies engaged in		
	supply and		
	installation of power		
	generation		
	equipments can also		
	participate provided		
	the constituent		
	companies or		
	divisions before		
	merger individually or		
	Jointly meet the		
	gualification		
	qualification		
12	Fligibility and	Confirmation in the form of	The documentary evidence of the
12.	Conformity of the	VFS/NO regarding submission	conformity of the facilities to the
	Facilities	of information	Bidding Documents may be in the
	I definites		form of literature, drawing and
	Documentary evidence		data, and shall include:
	establishing that the		
	facilities offered by the		(i) a detailed description of the
	Bidder in its bid are		essential technical and
	eligible and conform to the		performance characteristics of
	Bidding Documents.		the facilities;
			(ii) list giving full particulars,
	The documentary evidence		including available sources, of
	of the eligibility of the		all spare parts, special tools, etc.
	facilities shall consist of a		necessary for the proper and
	statement on the country of		continuing functioning of the
	origin of the plant and		facilities following completion
	equipment offered, which		of facilities in accordance with
	shall be confirmed by a		provisions of contract; and a
	certificate of origin issued		commentary on the Employer's
	at the time of shipment.		adequate evidence
			demonstrating the substantial
			responsiveness of the facilities
			to those specifications. Bidders
			shall note that standards for
			workmanship, materials and
			equipment designated by the
			Employer in the Bidding
			Documents are intended to be
			descriptive (establishing

			standards of quality and performance) only and not restrictive. The Bidder may substitute alternative standards, brand names and/or catalog numbers in its bid, provided that it demonstrates to the Employer's satisfaction that the substitutions are substantially equivalent or superior to the standards designated in the Technical Specifications
13	ERECTION TOOLS AND PLANT AND SAFETY EQUIPMENTS & SAFETY PERSONAL PROTECTIVE EQUIPMENTS List of Erection Tools and Plant and Safety Equipments & Safety Personal Protective Equipments which the bidder proposes to bring to site in case the contract is	Confirmation in the form of YES/NO regarding submission of information	As per Annexure XXIII.
14	QUALITY ASSURANCE PROGRAMME Details regarding the overall Quality Management & Procedures which the bidder proposes to follow during various phases of execution of the contract.	Confirmation in the form of YES/NO regarding submission of information	As per Annexure XXIV.
15	MILESTONE SCHEDULE Time for completion of facilities under the Package is as per details given in Clause 3 of SCC of the bidding document. Further, bidder is also to provide comprehensive Operation and Maintenance (O&M) of Solar Photo Voltaic Plant for a period of Five (05) years from the date of		Details regarding the timing & sequence of all Key Activities/Important milestones necessary for successful completion of the contract, as per Employer's format enclosed at Annexure XXV.

	Trial Run.	
	The Bidder shall also be	
	required to submit a brief	
	integrated PERT Network	
	(1.2 Schedule) matching	
	(L2 Schedule) matching	
	The Master Network schedule.	
	inter alia: include the	
	miler-alla, include the	
	halow for each of the	
	below for each of the	
	systems listed above their	
	interrelationship and	
	duration so as to meet the	
	schedule dates mentioned	
	at Clause 3 of SCC	
	at Clause 5 01 SCC.	
	A ativitias to be	
	Activities to be	
	Network to be submitted	
	with hid:	
	with bld.	
	1 Ordening on such	
	1. Ordering on sub-	
	vendor(s) (wherever	
	applicable)	
	2. Start of Engineering	
	3. Completion of	
	A Start of Manufacturin a/	
	4. Start of Manufacturing/	
	Fabrication 5. Completion of	
	5. Completion of Manufacturing/ Enhrication	
	6 Deadiness and	
	Completion of Type Test	
	7 Commencement of	
	Dispatch	
	8 Completion of Dispatch	
	9 Start of Freetion	
	10 Commissioning of the	
	System	
	11 Completion of the	
	Facilities	
	r uennies.	
Ŀ.	The Master Network and the	
	Key Milestone Dates will	
	be discussed with the	
	successful bidder, if	
	required, and agreed upon	
	before the issue of	
	Notification of Award as	
	per tender schedule.	

	finalised before the issue of Notification of Award.			
	After the Notification of Award, the contractor shall			
	plan the sequence of work of Manufacture Supply			
	and Erection to meet the			
	above stated dates of Successful Completion of			
	Facilities and shall ensure			
	Shop Testing, Inspection			
	and Shipment of the			
	with the required			
	construction/erection sequence.			
16	Provision of Public		Undertaking for compliance of	
	Procurement (Preference to		Make in India Policy of	
	Make in India), Order		Government of India (Annexure	
	201 /-Revision dt. 20/5/2010		XXVII ).	
	29/3/2019.			
17	Any other document to support the qualification information as submitted by the bidder online.			
Note: Only one file in .pdf format can be uploaded against each eligibility criteria. Any additional/ other relevant documents to support the information/declaration furnished by bidder online against eligibility criteria may also be attached by the bidder in the same file to be uploaded against respective eligibility criteria				

#### 9.0 Submission of Bid:

In order to submit the Bid, the bidders have to get themselves registered online on the e-Procurement portal of CIL/Subsidiary (https://coalindiatenders.nic.in) with valid Digital Signature Certificate (DSC) issued from any agency authorized by Controller of Certifying Authority (CCA), Govt. of India and which can be traced up to the chain of trust to the Root Certificate of CCA. The online Registration of the Bidders on the portal will be free of cost and one time activity only. The registration should be in the name of bidder, whereas DSC holder may be either bidder himself or his duly authorized person. The bidder is one whose name will appear as bidder in the e-Procurement Portal.

- **9.1**The bidders will submit their bid ONLINEon the website <u>https://coalindiatenders.nic.in</u>. No OFFLINE bid shall be accepted.
- **9.2**The bidders have to accept unconditionally the **on-line User Portal Agreement** which contains the acceptance of all the Terms and Conditions of NIT including General and Special Terms & Conditions, Integrity Pact and other conditions, if any, along with online undertaking in support of the authenticity of the declarations regarding the fact, figures, information and documents furnished by the Bidder online in order to become an eligible bidder.

No conditional bid shall be allowed/ accepted. This **User Portal Agreement** will be a part of the NIT/ Contract Agreement.

- **9.3** In the undertaking given by bidder online, there will be provision for penal action, if any information/declaration furnished online by the bidder against eligibility criteria is found to be wrong at any stage which changes the eligibility status of the bidder.
- **9.4** The qualification in the bid will be subject to the receipt and acceptance of the EMD within schedule date and time as mentioned in the NIT.
- **a.** The bidder will have to make the payment of EMD through ONLINE mode only.
- **b.** In Online mode the bidder can make payment of EMD either through net-banking from designated Bank/s or through NEFT/RTGS from any scheduled Bank. In case of payment through net-banking the money will be immediately transferred to CIL/Subsidiary's designated Account. In case of payment through NEFT/RTGS the bidder will have to make payment as per the Challan generated by system on e-Procurement portal and will have to furnish online the UTR Numbers before submission of bid. Bidder will be allowed to submit his/her bid only when the EMD is successfully received in CIL/Subsidiary account and the information flows from Bank to e-Procurement system.
- **c.** For online submission of tender the bidders will have to upload "Letter of Bid", all the confirmatory documents as prescribed in the NIT in Cover-I and only "Price-bid" in Cover-II.
- **9.5** The information will be provided by the bidder by filling up the relevant data through a form in an objective and structured manner. The software will use the information provided by the bidders to evaluate the technical bids automatically.
- **9.6** For online submission of tender, the bidders will have to upload "Letter of Bid", all the confirmatory documents as prescribed in the NIT/ GTE at the appropriate places.
  - 9.6.1 Letter of Bid: The format of Letter of Bid (as given in the NIT) will be downloaded by the bidder and will be printed on bidder's letterhead and the scanned copy of the same will be uploaded during bid submission in cover- I. This will be the covering letter of the bidder for submitted bid. The content of the "The Letter of Bid" uploaded by the bidder must be same as per format downloaded from the website and it should not contain any other information.

The Letter of Bid will be signed by the DSC holder submitting bid online and it does not require any physical signature. However, if the Letter of Bid (LOB) bears the physical signature in addition to the digital signature of the DSC holder, it will be accepted without questioning the identity of the person signing the letter of bid.

**9.6.2** Technical Parameter Sheet (TPS) : The Technical Parameter Sheet containing the qualification criteria and technical specification parameters will be in Excel format (password protected) and will be uploaded during tender creation. This will be downloaded by the bidder and he will furnish all the required information on this Excel file. Thereafter, the bidder will upload the same Excel file during online bid submission. The Technical Parameter Sheet which is incomplete and not submitted as per instruction given above will be rejected.

- 9.6.3 Confirmatory documents: All the confirmatory documents as enlisted in the NIT in support of ONLINE information submitted by the bidder are to be uploaded in cover I by the bidder while submitting his/ her bid.
- 9.7
- 9.7.1 **Price- Bid:** -The price bid containing the "Bill of Quantity" in .xls format will be downloaded by the bidder and he will quote rates for all the items on this Excel file. Thereafter, the bidder will upload the same Excel file during bid submission in cover- II. The price- bid will be in Item Rate or Percentage Rate BOQ format and the bidder will have to quote for all the tendered items and the L-1 will be decided on overall quoted value (i.e. Cost to Company). The price- bids of the tenderers will have no conditions. The price- bid which is incomplete and not submitted as per instructions given above will be rejected.

In the Price Bid, Bidders shall give the required details and a breakdown of their prices as follows:

- (a) Plant and Equipment (including Type Test Charges) and Mandatory Spares to be supplied from within the Employer's country (Schedule No. 1) shall be quoted on EXW (Ex-Factory, Ex-Works, Ex-Warehouse or Off-the-Shelf, as applicable) basis and shall be inclusive of all costs as well as taxes, duties and levies paid or payable on components and raw materials incorporated or to be incorporated in the facilities. Rate of the GST of each item shall be quoted by the bidder.
- (b) Local Transportation, Inland Transit Insurance, and other local costs incidental to delivery of the Plant and Equipment including Mandatory Spares shall be quoted in Schedule-2. Rate of the GST of each item shall be quoted by the bidder.
- (c) Installation Services including Erection and Civil & Allied Works (as applicable) shall be quoted separately (Schedule No. 3) and shall include rates or prices for all labor, contractor's equipment, temporary works, materials, consumables and all matters and things of whatsoever nature, charges for insurance covers other than inland transit Insurance including operations and maintenance services, the provision of operations and maintenance manuals, training of employer's personnel, etc., and other services, as identified in the Bidding Documents, as necessary for the proper execution of the Installation Services. Rate of the GST of each item shall be quoted by the bidder.

Bidders shall quote their O&M charges as minimum 1.5% for Five (05) years of their Total Quoted Price excluding O&M Charges.

Bidders are advised to price their bids in such a manner that Installation Price Component of the bid price (excluding Civil/Structural works price) should not be less than 15% and should not be more than 20% of the Ex-works Price of Main Equipment.

In case the Installation Price is below the minimum percentage specified above, the amount by which it is lower shall be retained proportionately from the Ex-Works component of Contract price while releasing payments due on receipt of equipment, and no interest shall be payable on the retained amount. The aforesaid retained amount shall be paid on pro-rata basis upon completion of installation of the respective equipment and its certification by the Engineer- in-Charge.

Bidders are advised to price their bids in such a manner that the Civil Works Price Component of the bid price (including Site Fabricated Structural works price) should not be less than 6% and should not be more than 16% of the total of Ex-works Price of Main Equipment.

In case the Civil Works Price (including Site Fabricated Structural Works Price) is more than 16% of the Ex-works Price of Main Equipment, the amount by which it is higher shall be retained while releasing progressive payments due on completion of civil works (including Site Fabricated Structural works), and no interest shall be payable on the retained amount. The aforesaid retained amount shall be paid along with payment due on completion of Trial Operation/ Completion of Facilities.

(d) Recommended Spare parts shall be quoted separately in Schedule-4 on EXW (Ex-Factory, Ex-Works, Ex-Warehouse or Off-the-Shelf, as applicable) basis and shall be inclusive of all costs as well as taxes, duties and levies paid or payable on components and raw materials incorporated. Local Transportation Charges including Inland Transit Insurance etc., for recommended spares shall also be quoted in Schedule-4 and shall not be included in Schedule No. 2 by the bidder. Schedule 4 will not be the part of price bid for evaluation.

- (e) Plant and Equipment (including Type Test Charges) and Mandatory Spares to be supplied from within the Employer's country (Schedule No. 1) shall be quoted on EXW (Ex-Factory, Ex-Works, Ex-Warehouse or Off-the-Shelf, as applicable) basis and shall be inclusive of all costs as well as taxes, duties and levies paid or payable on components and raw materials incorporated or to be incorporated in the facilities.
- (f) The itemwise rate quoted by bidder shall be inclusive of all taxes, duties & levies but excluding GST & GST Compensation Cess, if applicable. The payment of GST & GST Compensation Cess by service availer (i.e. CIL/Subsidiary) to bidder/contractor(If GST payable by bidder/contractor) would be made only on latter submitting a Bill/invoice in accordance with the provision of relevant GST Act and the rules made thereunder and after online filling of valid return on GST portal. Payment of GST & GST Compensation Cess is responsibility of contractor.

However in case contractor is GST unregistered bidder/dealer in compliance with GST rules, the bidder/dealer shall not charge any GST and/or GST compensation Cess on the bill/invoice. In such case, applicable GST will be deposited by CIL/Subsidiary directly to concerned authorities.

Input tax credit is to be availed by CIL/Subsidiary as per rule.

If CIL/Subsidiary fails to claim Input Tax Credit (ITC) on eligible inputs and Capital Goods or the ITC claimed is disallowed due to failure on the part of supplier/vendor of goods and services in incorporating the tax invoice issued to CIL/Subsidiary in its relevant returns under GST, payment of CGST & SGST or IGST, GST (Compensation to State) Cess shown in tax invoice to the tax authorities, issue of proper tax invoice or any other reason whatsoever, the applicable taxes & cess paid based on such Tax invoice shall be recovered from the current bills or any other dues of the supplier/vendor along with interest, if any.

All duties, taxes (excluding Goods and Services Tax (GST) only) and other levies, royalty, building and construction workers cess (as applicable in states) payable by the bidder/Contractor under the Contract, or for any other cause as applicable on the last date of submission of Bid, shall be included in the rates, prices and the total Bid Price submitted by the Bidder.

Applicable GST either payable by bidder or by company under reverse charge mechanism shall be computed by system in BOQ sheet as per predefined logic.

All investments, operating expenses, incidentals, overheads, leads, lifts, carriages, tools and plants etc. as may be attendant upon execution and completion of works shall also be included in the rates, prices and total Bid price submitted by the bidder.

However, such duties, taxes, levies etc. which is notified after the last date of submission of Bid and/or any increase over the rate existing on the last date of submission of Bid shall be reimbursed by the company on production of documentary evidence in support of payment actually made to the concerned authorities.

Similarly if there is any decrease in such duties, taxes and levies the same shall become recoverable from the contractor. The details of such duties, taxes and other levies along with rates shall be declared by the bidder.

The above bid price covers all the Contractor's obligations mentioned in or to be reasonably inferred from the Bidding Documents in respect of the design, manufacture, including procurement and subcontracting (if any), delivery, construction [including, Structural Steel Works Civil & Allied Works etc.], installation, commissioning, completion of

the facilities and conductance of Guarantee tests for the facilities including supply of mandatory spares (if any), operation and maintenance. This includes all requirements under the Contractor's responsibilities for testing, precommissioning and commissioning of the facilities, conducting Guarantee tests and, where so required by the bidding documents, the acquisition of all permits, approvals and licenses, etc.; the operation, maintenance and training services and such other items and services as may be specified in the bidding documents, all in accordance with the requirements of the General Conditions of Contract and Technical Specifications.

The bidder has to declare the Guaranteed Annual Generation in MU in Price Bid.

The declared Annual Generation shall be fixed during entire bidding process including Reverse Auction (RA) for the respective bidder as quoted in the price bid. The system will calculate the total bid price per MU (including Taxes & Duties) as per the predefined formula in the BOQ which will be considered for determination of L1 bidder.

Minimum value of Quoted Annual Generation (G) for 20 MW plant shall be 43.64 MU and limiting value of Quoted Annual Generation (G3) for 20 MW plant shall be 46.75 MU.

In case the successful Bidder, to whom the work is awarded, has quoted the Annual Generation (G) more than 45 MU, he shall provide security in the form of Bank Guarantee for meeting the Quoted Annual Generation Target. The Rate of Bank Guarantee per MU for the portion of Quoted Annual Generation in excess of 45 MU shall be INR 3.67 Crore per MU (INR Three Crore Sixty Seven Lakhs per Million Unit) as detailed in Clause No 2 of SCC of the bid document.

#### The system will not allow to quote annual generation less than 43.64MU and more than 46.75 MU.

Bidder has to Declare Monthwise Generation from one MWp Fixed/Seasonal Tilt or Automatic East-West Tracking based Solar PV Project in price bid.

The bidder is required to give the confirmation in the technical parameter sheet(TPS) about the declaration that the ratings, capacities and performance figures of the equipments furnished by bidder under the package are guaranteed. The bidder has to further declare that in the event of any deficiencies in meeting the guaranteed figures as specified in Technical Specifications as established after conducting the guarantee tests, the employer at their discretion accept the equipment / system after levying the Liquidated Damages as specified in Technical Specifications or reject the equipment/ system and recover payments already made or get the defects repaired by any other agency and recover the cost of repair from the bidder.

9.7.2 If there is any change in the contents of Letter of Bid uploaded by bidder as compared to the format of Letter of Bid uploaded by the department with NIT document, then the bid will be rejected. However inclusion of any additional redundant information by the Bidder in the submitted Letter of Bid (LOB), which does not contradict the content and spirit of original format of LOB uploaded by department will not be a cause of rejection of his/her bid.

10. It is the bidder's responsibility to comply with the system requirement i.e. hardware, software and internet connectivity at bidder's premises to access the e-tender portal. Under no circumstances, CIL/Subsidiary shall be liable to the bidders for any direct/indirect loss or damage incurred by them arising out of incorrect use of the e-tender system or internet connectivity failures.

#### 11. Modification and Withdrawal of Bid:

Modification of the submitted bid shall be allowed on-line only before the deadline of submission of tender and the bidder may modify and resubmit the bid on-line as many times as he may wish.

Bidders may withdraw their bids online within the end date of bid submission and their EMD will be refunded. However, if the bidder once withdraws his bid, he will not be able to resubmit the bid in that particular tender. For withdrawal of bid after the end date of bid submission, the bidder will have to make a request in writing to the Tender Inviting Authority. Withdrawal of bid will be allowed till issue of work- order/ LOA with the following provisions:

- 1. The EMD will be forfeited; and
- 2. The bidder will be debarred for 1 (One) year from participating in tenders in CIL/ CCL.
- The price bid of all the eligible bidders including this bidder will be opened and action will follow as under:
- 1. If the bidder withdrawing his bid is other than the L-1 bidder, the tender process will go on; and
- 2. If the bidder withdrawing his bid is the L-1 bidder, then re- tender will be done.

#### **Offline Withdrawal of Bids:**

A partner of bidder(in case of JV and partnership firms) whose DSC is registered on the e-Procurement portal can access the portal for online withdrawal but when there is a split in the business relationship, the partners whose DSC is not registered on the portal do not have the option of online withdrawal of bid. Hence such partners may opt to use offline method of withdrawal of his/her offer (or express his disassociation from the bidder organization).

**12. Tender Status:** It will be the bidder's responsibility to check the status of their Bid online regularly, after the opening of bid till award of contract. Additionally, information shall also be sent by system generated e-mail and SMS at nodal points (Date of bid opening, Requisition for Clarification on Confirmatory document from L-1 bidder, award of work etc.). No separate communication will be required in this regard. Non-receipt of e-mail and SMS will not be accepted as a reason of non-submission of Confirmatory documents within prescribed time. This will be specifically mentioned in the NIT. The Tender Status will be in public domain and anyone visiting the site can view it by identifying the tender.

#### **13.** Automatic Evaluation (Technical):

- 1. The e-Procurement System will evaluate the Technical bids automatically on the basis of relevant data provided by bidder through a form in an objective and structured manner while submitting bid. If the parameter given by bidder in objective and structured manner does not confirm to required eligibility criteria as specified in the tender document then the bid will be automatically rejected by the system. The system will automatically upload the technical opening summary and technical evaluation summary.
- 2. Acceptance of Bidder in a general form of online declaration will be recognized and accepted as the certification regarding authenticity of all the information and documents furnished by them online and acceptance of all terms and conditions of the bid document, since such acceptance by Bidder with Digital Signature Certificate is legally tenable.

#### 14. Opening of Tender

#### 14.1 Opening of Bid:

Tenders (Cover- I and Cover- II) will be decrypted and opened online by "Bid Openers" with their digital signature certificates on the prescheduled date &time of Tender Opening.

- Tenders: In case of tenders, after opening of the bids, comparative statement showing the bidders will be generated.
- **Tender- cum- Auction:** In this case, after opening of the bids, the system will display the lowest rate quoted by bidder (L-1). The auction (reverse) will be created for the tender after opening of the bid.
- **14.2** Extension of Tender submission date in case of number of bids received are less than three, initially by two days and thereafter by five days will be done automatically by the system.

This extension will be also applicable in case of receipt of zero bid.

**14.3** If the date of opening of bids (scheduled as per NIT/ extended automatically) falls on a holiday, the bids will be opened on the next working day.

#### 15. Reverse Auction (Applicable for the work of estimated value 1 Crore and more) :

- i) Reverse Auction will start on the pre-scheduled date and time as mentioned in the NIT (Ref.Clause No.3).
- ii) There will be no participation fees for e-Reverse auction.
- iii) H1 bid will be eliminated during price bid opening, if more than three techno-commercially acceptable bids are available as per the evaluation done by system and such bidder will not be allowed participate in reverse auction. If two or three bidders have quoted same H1 land cost(i.e. Cost to company ), the bidder(s) who submitted/ Frozen the bid later, shall be rejected and will not be allowed to participate in reverse auction.
- iv) System displays L1 cost to company price automatically in auction creation form and allows TIA to edit the value as 'start bid' price.

For the time being L1 Price or [approved estimated/justified price + 10% + applicable GST including GST Compensation Cess, if any, taking into consideration Input tax credit, if applicable] whichever is lower will be the start bid price. If the L-1 price is higher than the Start Bid Price (as above) and the RAP is not triggered within the scheduled time, the cases will be retendered.

- v) The L1 price / start bid price is cost to the company price on which the auction will be initiated. At the end of reverse auction, the L1 bidder has to submit break up of prices conforming to the lowest landed rate quoted by him in the reverse auction.
- vi) The bidder(s) who have participated in the reverse auction has to upload the Breakup of cost to company Prices in the confirmatory documents. The detailed Break-up of offered cost to company price, uploaded by the bidder shall be considered and order, if placed, shall be with the same break-up of prices. The bidder(s) after reverse auction will be responsible to ensure that the cost to company rate as per the breakup of prices provided by him after the reverse auction and the cost to company rate offered by him in the reverse auction is exactly same. The bidder will not be allowed to increase the rate of any item while submitting the breakup. While giving the break up, the bidder will have to consider same rate of taxes and duties as quoted while submitting the e price bid. In case the bidder(s) fail(s) to submit the break-up of cost to company price within stipulated period or the break up given by bidder does not match with total offered price, the Company will be at liberty to place order by proportionately reducing the item rates on basis of the breakup of the e-price bid submitted by the bidder along with the initial offer and the same will be binding on the bidder. In case of works and services tenders, the reverse auction will be conducted on composite cost to company price.
- vii) The decrement value will be 0.5 % of the start bid price with minimum of Rs.1/-, as the system does not have a provision of taking amounts less than Rs.1/- as decrement value. The reduction shall have to be made as per decrement value or in multiple thereof. The maximum **seal** percentage will be fixed as 2 % of start bid price/ last quoted price during reverse auction, whichever is lower.

In order to have ease of submission of reverse auction bid by the bidders, it is suggested that decrement value may be rounded off to nearest value as under:

- (a) For decrement values up to Rs.10/-, rounding off may be made to nearest rupee.
- (b) For decrement values from Rs.11/- to Rs.100/-, rounding off may be made to nearest 10.
- (c) For decrement value from Rs.101/- to Rs.1,000/-, rounding off may be made to nearest 100.
- (d) For decrement value from Rs.1,001/- to Rs.10,000/-, rounding off may be made to nearest 1000. and so on .....

- viii) Initial period of reverse auction will be two hours. There will be auto extensions of time every time by ten minutes in case of any reduction recorded in the last ten minutes. The reverse auction will come to a close only when there is no further reduction recorded in the last ten minutes slot.
- ix) System protects bid and bidder information till auction gets over and displays current L1 price to the bidder in auction hall.
- x) System provides bidder details along with bid documents at the end of reverse auction process.
- xi) The log details of the entire reverse auction process will be generated by the system once the process of reverse auction is completed.
- xii) If a bidder does not submit his bid in the Reverse Auction, the price quoted by him in the price bid shall be considered as the valid price of that bidder. The status of the bidder (L1, L2 etc) shall be evaluated considering either the bid price submitted in Reverse auction or the Price quoted in the price bid, whichever is lower.
- xiii) Since, reverse auction is a sequel to e-tender, the process of finalizing the tender upon completion of reverse auction will be same as the tender process without reverse auction.
- xiv)The bid history shall reflect only the landed price. The landed price shall also not be same for two bidders even if any bidder makes such an attempt.
- xv) Only the chronologically last bid submitted by the bidder till the end of the auction shall be considered as the valid price bid of that bidder. Any bid submitted earlier by the bidder prior to submission of his last bid will not be considered as the valid price bid.
- xvi) Server time shall be the basis of Start time & Closing time for bidding and shall be binding for all. This would be visible to all concerned.
- xvii) On expiry of the closing of the auction, the bid history showing all the last valid bids offered along with name of the bidders shall be published. All bidders shall have the facility to see and get a print of the same for their record.
- xviii) All electronic bids submitted during the reverse auction process shall be legally binding on the bidder. The chronologically last bid submitted by the bidder till the end of the auction will be considered as the valid price bid offered by that bidder and acceptance of the same by CIL will form a binding contract between CIL and the bidder for entering into a contract.
- xix) Conditional discounts shall not be considered. If a bidder offers a discount unilaterally after submission of bid, the discount shall not be considered for evaluation of offers but shall be availed if order is placed on such tenderer.
- xx) If the lowest price received during reverse auction is unreasonable or it is unacceptable on ground of being too high or too low compared with estimated price, the management reserves right to seek justification of the price from lowest bidder. If the price is not considered reasonable, management may not accept such bid and go for another tender process.
- xxi) In case of disruption of service at the service provider's end while the RAP is online, due to any technical snag or otherwise attributable to the system failure at the server end, the RAP process will start all over again. In such a situation, the last recorded lowest price of prematurely ended RAP, will be the 'Start Bid' price for the restarted RAP. The prices quoted in the prematurely ended RAP will be binding on all the bidders for consideration, if the restarted RAP does not trigger within the stipulated time. A provision to this effect should be made in the NIT.

Disruption and restarting of RAP shall be intimated to all the bidders through system/SMS/e-mail through e procurement portal. All the time stipulations of normal RAP will be applicable to the restarted RAP.

#### 16. Tender/ Tender –cum- Auction evaluation

A. After opening of price- bid ( after finishing reverse auction in case of Tender- cum- Auction), the documents submitted by the L-1 bidder in cover- I as enlisted in the NIT will be downloaded by the Evaluator and shall be put up to Tender Committee. The Tender Committee will examine the uploaded documents against the information/ declarations furnished by the L-1 bidder online. If it confirms to all the information/ declarations furnished by the bidder online and do not change the eligibility status of the bidder, then bidder will be considered eligible for award of work.

- B. In case the Tender Committee finds that there is some deficiency in the uploaded documents by the bidder then the same will be specified online by the Evaluator clearly indicating the omissions/ shortcomings in the uploaded documents and indicating start date and end date allowing 07 (Seven) days (07X 24 hours) time for online resubmission by the bidder. The L-1 bidder will get this information on their personalized dashboard under "Upload confirmatory document" link. Additionally, information shall also be sent by the system generated email and SMS, but it will be the bidder's responsibility to check the updated status/ information on their personalized dashboard regularly after opening of bid. No separate communication will be required in this regard. Non- receipt of thee- mail and SMS will not be accepted as a reason for non- submission of documents within the prescribed time. The bidder will upload the scanned copy of all those specified documents in support of the information/ declarations furnished by them online within the specified period of 07(Seven) days. If the bidder fails to submit the specified document/s in the 07(Seven) days, 05 (Five) more days (05 X24 hours) of time will be given by the Evaluator clearly indicating the omissions/ shortcomings in the uploaded documents indicating start date and end date for online submission of such document/s.
- C. The tender will be evaluated on the basis of documents uploaded by the L-1 bidder online. The L-1 bidder is not required to submit hard copy of any document through offline mode. Any document submitted offline will not be given any cognizance in evaluation of tender.
- D. In case the L-1 bidder submits requisite documents online as per NIT, the bidder will be considered eligible for award of Contract.
- E. In case the L-1 bidder fails to submit requisite documents online as per NIT or if any of the information/ declarations furnished by the L-1 bidder is found to be wrong by the Tender Committee during evaluation of scanned documents uploaded by the bidder, which changes the eligibility status of the bidder, then the bid shall be rejected and EMD of L-1 will be forfeited.
- F. In case the L-1 bidder is found technically eligible but rejection is due to high rate quoted by him/ her, then the tender shall be cancelled and retendered.
- G. In case the L-1 bidder is rejected due to non- compliance of confirmatory documents then the L-2 bidder will become L-1 bidder and confirmatory documents of this bidder shall be evaluated by the Tender Committee and the process shall be followed as mentioned in clause numbers A to E above.
- H. The process as mentioned at clause number G shall be repeated till the work is either awarded or all the eligible bidders are exhausted.
- I. In case none of the bidders comply the technical requirements, then re- tender will be done (with the same or different quantity, as per instant requirement).
- J. It is the responsibility of Bidders to upload legible/ clearly readable scanned copy of all the required documents mentioned above.
- 17. Bid Validity: The validity of bids shall be not less than 180(one hundred Eighty) days from the final end date of submission of bid.

#### **18.** EMD Refund:

- a. If EMD is paid by the bidder in online mode (Direct Debit/NEFT/RTGS) then the EMD of rejected bidders will be refunded at any stage directly to the account from where it had been received (except the cases where EMD is to be forfeited).
- b. No claim from the bidders will be entertained for non-receipt of the refund in any account other than the one from where the money is received.
- c. If the refund of EMD is not received by the bidder in the account from which the EMD has been made due to any technical reason then it will be paid through conventional system of e-payment. For this purpose, if required, Tender Inviting Authority will obtain the Mandate Form from the Bidder.
- d. In case the tender is cancelled then EMD of all the participating bidders will be refunded unless it is forfeited by the department.

- e. If the bidder withdraws his/her bid online (i.e. before the end date of submission of tender) then his/her EMD will be refunded automatically after the opening of tender.
- f. The EMD of successful bidder (on Award of Contract) will be retained by CCL and will be adjusted to Performance Security Deposit.
- **19.** The Company reserves the right to postpone the date of receipt and opening of tenders or tocancel the tenders without assigning any reason whatsoever.
- 20. This Tender Notice shall be deemed to be part of the Contract Agreement.
- **21.** The Company does not bind itself to accept the lowest bid and reserves the right to reject any or all the bid without assigning any reasons whatsoever and also to split up the work between two or moretenderers or accept the tender in part and not in its entirety, at its sole discretion.
- 22. Any addendum/corrigendum/date extension etc in respect of this tender shall be issued on our website <u>https://coalindiatenders.nic.in</u> only. No separate notification shall be issued in the press. Bidders are therefore requested to visit our website regularly to keep themselves updated.

#### 23. Integrity Pact: Applicable for estimated bid value above Rupees 200 lakhs.

Bidders are required to submit the pre contract integrity pact duly signed and witnessed as per enclosed format along with the bid Part-I. This will be signed by the authorized signatory of the bidder (s) with name, designation and seal of the company. Bidders who do not sign the pact shall be disqualified from participation in the Bid process.

Name, address and contact Number of the Independent External Monitor nominated for this tender:-

Sl. No.	Name	Address	Email Id
1.	Shri Devendra Kumar Pathak, IPS(Retd.)	L/G4, Amrapali Sapphire, Sector-45, Noida(U.P.)	pathak56515@gmail.com
2.	Shri Srinivasan Rangarajan, IRSME	C-1, Railnagar N, Podanur, Coimbatore-641023	ramasalperi@gmail.com

General Manager (E&M)/HOD CCL, Ranchi

### <u>SECTION – II</u> INSTRUCTIONS TO BIDDER

#### **INSTRUCTIONS TO BIDDERS**

#### **1. SCOPE OF BIDDER**

- 1.1 The Central Coalfields Limited (referred to as Employer in these documents) invites bids for the works as mentioned in the Bid Notice. The Bidders should submit Bids for all the works mentioned in the Notice.
- 1.2 The successful Bidder will be expected to complete the Work(s) by the Intended Completion periodspecified in the Bid document/Notice.

#### 2. ELIGIBLE BIDDERS

- 2.1 The Invitation for Bid is open to all Bidders including an individual, proprietorship firm, partnership firm, company registered under Companies Act, any legal entity or joint ventures. The bidders shall be eligible to participate only if they fulfill the qualifying/eligibility criteria specified in e-tender Notice and at Clause 3.
- 2.2 Joint Venture:- Two or three companies/ contractors may jointly undertake contract/contracts. Each entity will be jointly and severally responsible for completing the task as per the contract (**applicable for bids with estimated cost above Rs. 5 crores**).

#### Joint Venture details :

Name of all partners of a joint venture(not more than 3):

- 1. Lead partner
- 2. Partner
- 3. Partner

Joint Venture must comply the following requirements :

i) Minimum qualification requirements for Joint Venture

- a) The qualifying criteria &parameter e.g. experience of the individual partners of the J.V will be as deliberated under Clause 7.A of e-tender notice towards fulfillment of qualification criteria related to experience.
- b) The qualifying criteria parameter e.g. financial resources (Turnover and Working Capital ) of the individual partners of the J.V. will be added together for the relevant period and the total criteria should not be less than as deliberated under Clause 7.B& C of the e-tender notice towards fulfillment of qualification criteria related to financial turnover.
- ii) The formation of joint venture or change in the Joint Venture character/ partners after submission of the bid and any change in the bidding regarding Joint Venture will not be permitted.
- iii) The bid, and in case of a successful bid, the agreement, shall be signed so as to legally bind all partners jointly and severally and any bid shall be submitted with a copy of the Joint Venture Agreement providing the joint and several liabilities with respect to the contract.
- iv) The pre-qualification of a Joint Venture does not necessarily pre-qualify any of its partners individually or as a partner in any other Joint Venture or association. In case of dissolution of a Joint Venture, each one of the constituent firms may pre-qualify if they meet all the pre-qualification requirements, subject to written approval of the employer.
- v) The bid submission must include documentary evidence to the relationship between Joint Venture partners in the form of JV Agreement to legally bind all partners jointly and severally for the proposed agreement which should set out the principles for the constitution, operation, responsibilities regarding work and financial arrangements, participation

#### **INSTRUCTIONS TO BIDDERS**

(percentage share in the total) and liabilities (joint and several) in respect of eachand all of the firms in the Joint Venture. Such JV Agreement must evidence the commitment of the parties to bid for the facilities applied for (if prequalified) and to execute the contract for the facilities if their bid is successful.

- vi) One of the partners shall be nominated as 'In-charge' of the contract and shall be designated as Lead Partner. This authorization shall be evidenced by submitting with the bid a Power of Attorney signed by legally authorized signatories of all the partners.
- vii) The JV Agreement must provide that the Lead Partner shall be authorized to incur liabilities and receive instructions for and on behalf of any and all partners of the Joint Venture and the entire execution of the contract shall be done with active participation of the Lead Partner.
- viii) The contract agreement should be signed by each Joint Venture Partners. Subsequent declarations/letters/documents shall be signed by lead partner authorized to sign on behalf of the JV or authorized signatory on behalf of JV.
- ix) The bid should be signed by all the partners of the Joint Venture.
- x) An entity can be a partner in only one Joint Venture. Bid submitted by Joint Venture including the same entity as partner will be rejected.

xi) The JV agreement may specify the share of each individual partner for the purpose of execution of this contract. This is required to fulfill eligibility and also for the purpose of apportioning the value of the contract to that extent to individual partner for subsequent submission in other bids if he intends to do so for the purpose of the qualification in that Bid.

- xii) The earnest money / bids security can be submitted by the Joint Venture or one or more partners of the Joint Venture.
- xiii) The JV agreement must specifically state that it is valid for the project for which bidding is done. If JV breaks up midway before award of work and during bid validity period bid will be rejected.If JV breaks up midway before award of work and during bid validity/after award of work/during pendency of contract, in addition to normal penalties as per provision of bid document, all the partners of the JV shall be debarred from participating in future bids for a minimum period of 12 months.
- xiv) JV agreement shall be registered in accordance with law so as to be legally valid and binding on the members before making any payment.

xv) JV shall open a Bank Account in the name of JV and all payments due to the JV shall be credited by employer to that account only. <u>To facilitate statutory deductions all statutory documents like PAN/GSTIN, etc. in the name of the Joint</u> Venture shall be submitted by JV before making any payment.

- 2.3 The bidders shall have Digital Signature Certificate (DSC) issued from any agency authorized by Controller of Certifying Authority (CCA), Govt. of India and which can be traced up to the chain of trust to the Root certificate of CCA.
- 2.4 The bidders have to accept unconditionally the online user portal agreement which contains the acceptance of all the Terms and Conditions of NIT and ITB, including General and Special Terms & Conditions, technical specifications, other conditions, if any, along with on-line undertaking in support of the authenticity of the declarations regarding the facts, figures, information and documents furnished by the bidder on-line in order to become an eligible bidder.
- 2.5 The Company reserves its right to allow Public Enterprises purchase preference facility as admissible under prevailing policy.
- 2.6 No sub-letting of the work as a whole by the contractor is permissible. Prior permission is required to be taken from the principle employer for engagement of sub-contractors in part work/piece rated work.
The Contract Agreement will specify major items of supply or services for which the contractor proposes to engage subcontractor/sub-vendor. The contractor may from time to time propose any addition or deletion from any such list and will submit proposals in this regard to the Engineer-in–Charge / Designated Officer in charge for approval well in advance so as not to impede the progress of work. Such approval of the Engineer-in-Charge/ Designated Officer in Charge will not relieve the contractor from any of his obligations, duties and responsibilities under the contract.

# 3. QUALIFICATION OF THE BIDDER

- 3.1 In the event that pre-qualification of potential bidders has been undertaken, only bids from pre-qualified bidders will be considered for award of contract.
- 3.2 If the employer has not undertaken pre-qualification of potential bidders, all bidders shall fulfill the eligibility/ qualifying criteria as detailed at clause 6&7 of e-tender Notice. Such details shall be submitted as deliberated at e-tender Notice.
- 3.3 If the bidder is subsidiary of a company, the experience and resources of the holding company or its other subsidiaries will not be taken into account. However, if the bidder is a holding company, the experience and resources of its wholly owned subsidiaries will be taken into consideration.
- 3.4 Even though the bidders meet the above eligibility/qualifying criteria, they are subject to be disqualified if they have:
  - a. Made misleading or false representations in the forms, statements and attachments submitted in proof of the qualification requirements; and/or
  - b. Record of poor performance such as abandoning the works, not properly completing the contract, inordinate delays in completion, or financial failures etc.

# 4. ONE BID PER BIDDER

4.1 Each Bidder shall submit only one Bid, either individually, or as a partner in a partnership firm or a partner in a Joint Venture or a Public Ltd./Private Ltd. company or any legal entity. A Bidder who submits or participates in more than one Bid (other than as a subcontractor or in cases of alternatives that have been permitted or requested) will cause all the proposals with the Bidder's participation to be disqualified.

# 5. COST OF BIDDING

5.1 The Bidder shall bear all costs associated with the preparation and submission of his Bid, and the Employer will in no case be responsible or liable for those costs.

# 6. SITE VISIT

- 6.1 The Bidder, at the Bidder's own responsibility, cost and risk, is encouraged to visit and examine the Site of Works and its surroundings, approach road, soil condition, investigation report, existing works, if any, connected to the tendered work, drawings connected to the work, if / as available and obtain all information that may be necessary for preparing the Bid and entering into a contract for execution of the Works. The costs of visiting the Site shall be at the Bidder's own expense.
- 6.2 It shall be deemed that the Bidder has visited the site/area and got fully acquainted with the working conditions and other prevalent conditions and fluctuations thereto whether he actually visits the site/area or not and has taken all the factors into account while quoting his rates.
- 6.3 The bidder is expected, before quoting his rate, to go through the requirement of materials / workmanship, specification,

requirements and conditions of contract.

6.4 The bidder, in preparing the bid, shall rely on the site investigation report referred to in the bid document (if available), supplemented by any information available to the bidder.

# 7.CONTENT OF BIDDING DOCUMENTS

- 7.1 The set of bidding documents comprises the documents (all or as available/applicable)listed below:
  - i) e-Tender Notice,
  - ii) Instructions to Bidders,
  - iii) Letter of Bid,
  - iv) Undertaking,

v) Conditions of Contract(General Terms & Conditions of Contract , Special Conditions of Contract, Erection Conditions of Contract, Safety codes, etc.),

- vi) Technical Specifications
- vii) Integrity Pact, if applicable;
- viii) Various Forms of Securities ,form of Article of Agreement,
- ix) Bill of Quantities.
- x) e-tender user portal agreement.

# 8. CLARIFICATION OF BIDDING DOCUMENTS

- 8.1 A prospective bidder requiring any interpretation or clarification of bidding document may seek clarification online or during pre-bid meeting (if any). The clarifications may be asked from the next day of e-Publication of NIT. The last date for seeking clarification will be as specified online. The department will clarify as far as possible only relevant queries. The clarifications given by department will be visible to all the bidders intending to participate in bid.
- 9. AMENDMENT OF BIDDING DOCUMENTS (BE DELETED FOR NORMAL WORKS, APPLICABLE FOR SPECIALISED WORK)
- 9.1 Before the deadline for submission of Bids, the Employer may modify the bidding documents by issuing addenda.
- 9.2 Any addendum thus issued shall be a part of the bidding document and shall be displayed in the website. The bidder shall upload the same during bid submission.
- 9.3 To give prospective Bidders reasonable time in which to take an addendum into account in preparing their Bids, the Employer shall extend, as necessary, the deadline for submission of Bids, in accordance with Sub-clause 15.2 below.

# **10.LANGUAGE OF BID**

10.1 All documents relating to the Bid shall be in the English language.

# **11.BID PRICES**

- 11.1 The bidder shall closely study specification in detail and scope of work which govern the rates for which he is quoting. The Bidders shall offer for the whole Works as described in Sub-Clause 1.1, based on the Bill of Quantities. Based on priced bill of quantities submitted by the Bidder, the Employer reserves the right to allot whole or part of the work at their discretion and no claims, whatsoever, shall be entertained in this regard.
- 11.2 The price bid containing the bill of quantity will be excel format and will be downloaded by the bidder and he will quote the rates for all items/heads/sub-heads on this excel file as detailed at clause 8.6.4 of the e-tender notice.

11.3 All duties, taxes (excluding Goods and Services Tax (GST) & GST Compensation Cess (if applicable) only) and other levies, royalty, building and construction workers cess (as applicable in States) payable <u>by the bidder/Contractor</u> under the Contract, or for any other cause as applicable on the last date of submission of Bid, shall be included in the rates, prices and the total Bid Price submitted by the Bidder. <u>Applicable GST either payable by bidder or by company under reverse change mechanism shall be computed by system in BOQ sheet as per predefined logic.</u>

All investments, operating expenses, incidentals, overheads, leads, lifts, carriages, tools and plants etc. as may be attendant upon execution and completion of works shall also be included in the rates, prices and total Bid price submitted by the bidder.

However, such duties, taxes, levies etc. which is notified after the last date of submission of Bid and/or any increase over the rate existing on the last date of submission of Bid shall be reimbursed by the company on production of documentary evidence in support of payment actually made to the concerned authorities.

Similarly if there is any decrease in such duties, taxes and levies the same shall become recoverable from the contractor. The details of such duties, taxes and other levies along with rates shall be declared by the bidder.

The item wise rate quoted by bidder shall be inclusive of all taxes, duties & levies but excluding GST & GST Compensation Cess, if applicable. The payment of GST and GST Compensation Cess by service availer (i.e. CIL/Subsidiary) to bidder/contractor (if GST payable by bidder/contractor) would be made only on the latter submitting a Bill/invoice in accordance with the provision of relevant GST Act and the rules made there under and after online filing of valid return on GST portal. Payment of GST & GST Compensation Cess is responsibility of the service provider/contractor.

However, in case bidder/contractor is GST unregistered bidder/dealer in compliance with GST rules, the bidder/dealer shall not charge any GST and/or GST Compensation Cess on the bill/invoice. In such case, applicable GST will be deposited by CIL/Subsidiary directly to concerned authorities.

Input tax credit is to be availed by CIL/Subsidiary as per rule.

If CIL/Subsidiary fails to claim Input Tax Credit(ITC) on eligible Inputs, input services and Capital Goods or the ITC claimed is disallowed due to failure on the part of supplier/vendor of goods and services in incorporating the tax invoice issued to CIL/Subsidiary in its relevant returns under GST, payment of CGST & SGST or IGST, GST (Compensation to State) Cess shown in tax invoice to the tax authorities, issue of proper tax invoice or any other reason whatsoever, the applicable taxes & cess paid based on such Tax invoice shall be recovered from the current bills or any other dues of the supplier/vendor along with interest, if any.

11.4 The rates and prices quoted by the Bidder shall be fixed for the duration of the contract and shall not be subject to variations on any account except to the extent variations allowed as per the conditions of the contract of the bidding document.

# **12.CURRENCIES OF BID AND PAYMENT**

The unit rates and prices shall be quoted by the Bidder entirely in Indian Rupees.

# **13. BID VALIDITY**

13.1 Bid shall remain valid for a period not less than 180 (One hundred Eighty) days from the final end date of submission of bid. A bid valid for a shorter period shall be rejected by the Employer.

13.2 In exceptional circumstances, prior to expiry of the original time limit, the Employer may request that the bidder(s) extend

the period of validity for a specified additional period. The request and the bidder's response shall be in writing. A bidder may refuse the request without forfeiting his bid security. A bidder agreeing to the request will not be required or permitted to modify his bid but will be required to extend the validity of his bid security for the period of extension, and in compliance with Clause 14 in all respects.

# 14. BID SECURITY/EARNEST MONEY DEPOSIT

- 14.1 The Bidder shall furnish, as part of his bid, a Bid Security/Earnest Money of the amount as shown in e-tender Notice and in the form as deliberated at Clause 3 of e-tender Notice.
- 14.2. Any Bid not accompanied by an acceptable Bid Security/ EMD shall be summarily rejected by the employer as non-responsive.
- 14.3 If EMD is paid by the bidder in online mode (Direct Debit/NEFT/RTGS) then the EMD of rejected bidders will be refunded at any stage directly to the account from where it had been received (except the cases where EMD is to be forfeited).
- 14.4The bid security/EMD of the successful bidder (Submitted through Net banking or NEFT/RTGS) may be retained and adjusted with performance security / security deposit, at bidder's option.
- 14.5 The Bid Security/ EMD deposited with the Employer will not carry any interest.

# **15. DEADLINE FOR SUBMISSION OF BIDS**

- 15.1. Bids shall be submitted on line on the web site <u>www.coalindiatenders.nic.in</u> within the date and time specified in the e-tender notice.
- 15.2. The employer may extend the deadline for submission of bids by issuing a corrigendum in accordance with provisions of e-tender notice/ITB, in which case all rights and obligations of the employer and the bidders previously subject to the original deadline will then be subject to the new deadline.

# 16. SIGNING AND SUBMISSION OF BID

16.1 Letter of bid will be digitally signed by DSC holder submitting bid online and it does not require any physical signature. However, if the Contractor's bid bears the physical signature in addition to the digital signature of DSC holder, it will be accepted without questioning the identity of person singing the bid.

16.2 Submission of bid shall be as detailed at clause **9** of e-tender notice.

# **17. MODIFICATION AND WITHDRAWAL OF BIDS**

- 17.1Modification of the submitted bid shall be allowed online only before the deadline of submission of tender and the bidder may modify and resubmit the bid online as many times as he may wish.
- 17.2Bidders may withdraw their bids online within the end date of bid submission and their EMD will be refunded. However, if the bidder once withdraws his bid, he will not be able to resubmit the bid in that particular tender.
- 17.3 For withdrawal of bid after the end date of bid submission, the bidder will have to make a request in writing to the Tender Inviting Authority. Withdrawal of bid may be allowed till issue of work order/LOA with the following provision of penal

action:

1. The EMD will be forfeited; and

2. The bidder will be debarred for 1(One) year from participating in tenders in CIL/Subsidiary.

The Price-bid of all eligible bidders including this bidder will be opened and action will follow as under:

i). If the bidder withdrawing his bid is other than L 1, the tender process shall go on.

ii). If the bidder withdrawing his bid is L-1, then re-tender will be done.

Note: In case of above, a letter will be issued to the bidder by Tender Inviting Authority with the approval of Tender Accepting Authority (in case Board is Tender Accepting Authority then with the approval of CMD), stating that the EMD of bidder is forfeited, and this bidder is debarred for one year from participating in tenders in CIL/Subsidiary. This letter will be circulated to all Areas and CIL/Subsidiary HQ. and the updated list will be maintained by all Tender Inviting Authority/Evaluators.

Penal action against clauses above will be enforced from the date of issue of such order.

17.4 Standard Operative Procedure (SOP) for managing the cases of Withdrawal of Bids in e-Procurement System of CIL/Subsidiary

# I. The Mode of Withdrawal:

# A. Online Withdrawal of Bids:

- a. The system of online withdrawal is available on the portal up to end date of bid submission, where any bidder can withdraw his/her bid which will attract no penal action from department side.
- b. The system of online withdrawal beyond end date of bid submission and till award of contract is also available but not fully functional and under development stage. Once it is developed and implemented only online withdrawal shall be considered except for some exceptional cases as mentioned in clause below.

# **B.** Offline Withdrawal of Bids :

- a. A partner of bidder(in case of JV and partnership firms) whose DSC is registered on the e-Procurement portal can access the portal for online withdrawal but when there is a split in the business relationship, the partners whose DSC is not registered on the portal do not have the option of online withdrawal of bid. Hence such partners may opt to use offline method of withdrawal of his/her offer (or express his disassociation from the bidder organization).
- b. Till a fully functional system of online withdrawal of bid (beyond end date of bid submission and till award of contract) is not developed and implemented, offline withdrawal shall also be considered.

# II. Acceptance of withdrawal by Tender Committee:

- **A.** Every case of withdrawal under Clause I-(A) (b) and Clause I-(B) shall be put up to Tender Committee for deliberation and further course of action.
- **B.** The Tender Committee shall apply its due diligence to decide:
  - **a**. Whether the request for withdrawal of offer has been received from right source and authentic. For this purpose a letter is to be sent by registered post/speed post to the bidder on the address as given by him in the enrollment page of e-Procurement portal, allowing 10 days' time to confirm the withdrawal. If the bidder does not confirm the withdrawal within the stipulated period then it should be construed that there is no withdrawal of bid. In case the withdrawal/disassociation from the firm (Joint Venture or Partnership firm) has been submitted by any other partner then also the confirmation has to be sought from the bidder and if bidder wants to deny the withdrawal/disassociation from the firm then the bidder shall be required to furnish a legally acceptable document signed by all the partners of the firm to substantiate his claim.
  - b. Whether the withdrawal is due to the reason other than to support any mala fide intention of any participating bidder such as participating or supporting a cartel formation etc.
  - c. If the mala fide intentions in the withdrawal are apprehended then the tender should be cancelled apart from other

penal action as per e-Procurement Manual for works and services of CIL and other guidelines/manuals of CIL.

- d. If no mala fide intentions in the withdrawal are apprehended then the penal action in line with the prescriptions of the e-Procurement Manual for works and services of CIL will be applicable.
- e. The Tender Committee may also obtain the opinion of legal department in order to ascertain the legal course of action in case of Clause II-(B)(b) and II-(B)(c) above.
- **17.5 Tender Status:** It will be the bidder's responsibility to check the status of their Bid online regularly, after the opening of bid till award of contract. Additionally, information shall also be sent by system generated e-mail and SMS at nodal points (Date of bid opening, Requisition for Clarification on Confirmatory document from L-1 bidder, award of work etc.). No separate communication will be required in this regard. Non-receipt of e-mail and SMS will not be accepted as a reason of non-submission of Confirmatory documents within prescribed time. This will be specifically mentioned in the NIT. The Tender Status will be in public domain and anyone visiting the site can view it by identifying the tender.

# **18.** Automatic Evaluation (Technical):

- 18.1The e-Procurement System will evaluate the Technical bids automatically on the basis of relevant data provided by bidder through a form in an objective and structured manner while submitting bid. If the parameter given by bidder in objective and structured manner does not confirm to required eligibility criteria as specified in the tender document then the bid will be automatically rejected by the system. The system will automatically upload the technical opening summary and technical evaluation summary.
- 18.2Acceptance of Bidder in a general form of online declaration will be recognized and accepted as the certification regarding authenticity of all the information and documents furnished by them online and acceptance of all terms and conditions of the bid document, since such acceptance by Bidder with Digital Signature Certificate is legally tenable.

# 19. BID OPENING 19.1 Opening of Bid:

Tenders (Cover- I and Cover- II) will be decrypted and opened online by "Bid Openers" with their digital signature certificates on the prescheduled date &time of Tender Opening.

Tenders: In case of tenders, after opening of the bids, comparative statement showing the bidders will be generated.

- **Tender- cum- Auction:** In this case, after opening of the bids, the system will display the lowest rate quoted by bidder (L-1). The auction (reverse) will be created for the tender after opening of the bid.
- 19.2 Extension of Tender submission date in case of number of bids received are less than three, initially by two days and thereafter by five days will be done automatically by the system.

This extension will be also applicable in case of receipt of zero bid.

19.3 If the date of opening of bids (scheduled as per NIT/ extended automatically) falls on a holiday, the bids will be opened on the next working day.

# 20. Tender/ Tender –cum- Auction evaluation

**A.** After opening of price- bid ( after finishing reverse auction in case of Tender- cum- Auction), the documents submitted by the bidders in cover- I as enlisted in the NIT will be downloaded by the Evaluator and shall be put up to Tender Committee. The Tender Committee will examine the uploaded documents against the information/ declarations furnished by the L-1 bidder online. If it confirms to all the information/ declarations furnished by the bidder online and

do not change the eligibility status of the bidder, then bidder will be considered eligible for award of work.

- **B.** In case the Tender Committee finds that there is some deficiency in the uploaded documents by the bidder then the same will be specified online by the Evaluator clearly indicating the omissions/ shortcomings in the uploaded documents and indicating start date and end date allowing 07 (Seven) days (7X 24 hours) time for online re- submission by the bidder. The L-1 bidder will get this information on their personalized dashboard under "Upload confirmatory document" link. Additionally, information shall also be sent by the system generated e- mail and SMS, but it will be the bidder's responsibility to check the updated status/ information on their personalized dashboard regularly after opening of bid. No separate communication will be required in this regard. Non- receipt of thee- mail and SMS will not be accepted as a reason for non- submission of documents within the prescribed time. The bidder will upload the scanned copy of all those specified documents in support of the information/ declarations furnished by them online within the specified period of 7 (Seven) days. If the bidder fails to submit the specified document/s in the 07 (Seven) days, 05 (Five) more days (05X 24 hours) of time will be given by the Evaluator clearly indicating the omissions/ shortcomings in the uploaded documents indicating start date and end date for online submission of such document/s.
- **C.** The tender will be evaluated on the basis of documents uploaded by the L-1 bidder online. The L-1 bidder is not required to submit hard copy of any document through offline mode. Any document submitted offline will not be given any cognizance in evaluation of tender.
- **D.** In case the L-1 bidder submits requisite documents online as per NIT, the bidder will be considered eligible for award of Contract.
- **E.** In case the L-1 bidder fails to submit requisite documents online as per NIT or if any of the information/ declarations furnished by the L-1 bidder is found to be wrong by the Tender Committee during evaluation of scanned documents uploaded by the bidder, which changes the eligibility status of the bidder, then the bid shall be rejected and EMD of L-1 will be forfeited.
- **F.** In case the L-1 bidder is found technically eligible but rejection is due to high rate quoted by him/ her, then the tender shall be cancelled and retendered.
- **G.** In case the L-1 bidder is rejected due to non- compliance of confirmatory documents then the L-2 bidder will become L-1 bidder and confirmatory documents of this bidder shall be evaluated by the Tender Committee and the process shall be followed as mentioned in clause numbers A to E above.
- **H.** The process as mentioned at clause numberG shall be repeated till the work is either awarded or all the eligible bidders are exhausted.
- **I.** In case none of the bidders comply the technical requirements, then re- tender will be done (with the same or different quantity, as per instant requirement).
- J. It is the responsibility of Bidders to upload legible/ clearly readable scanned copy of all the required documents mentioned above.

# 21. EVALUATION AND COMPARISON OF BIDS.

- 21.1 Evaluation and comparison of Bids will be done by System on-line. This online evaluation will be validated by CIL/ Subsidiary at each stage as deliberated at clause 13 and 14of e-tender notice. The bidder shall also comply with system requirement as at clause 9 of e-tender notice. Bid evaluation shall be done after taking into consideration overall quoted price by the bidder and effect of Goods and ServicesTax (GST), GST Compensation Cessetc. as applicable. L1 will be decided based on cost to the company.
- 21.2If the Bid of the successful L-1 bidder is seriously unbalanced in relation to the Company's estimate of the cost of work to be performed under the contract, the Employer may require the Bidder to produce detailed price analysis for any or all items of the Bill of Quantities, to demonstrate the internal consistency of those prices with the methods and schedule proposed.

After evaluation of the price analysis, the company may require that the amount of the performance security/security deposit is increased at the expense of the successful bidder to a level sufficient to protect the company against financial loss in the event of default on the part of the successful bidder under the contract.

Additional performance security shall be applicable if the bid price is below 15% of the justified price, finalized by the

owner. The amount of such additional performance security shall be the difference between 85% of the owner's justified price and quoted price.

Justified price shall be finalized by the owner on the basis of prevalent market rate of materials and labour analyzed as per standard analysis of rate of CPWD/ NBO, and shall be binding on the bidder.

Such additional performance security shall be applicable for Item-rate and Percentage Tenders.

Such additional performance security shall be furnished by bidder along with normal performance security as per Cl. No. 4 of GTC. Failure to submit such additional performance security may result into termination of the contract.

# 22.AWARD CRITERIA

Subject to Clause 23, the Employer will award the Contract to the Bidder whose Bid has been determined to be substantially responsive to the Bidding documents and who has offered the lowest evaluated acceptable Bid Price, provided that such Bidder has been determined to be:

a. Eligible in accordance with the provisions of Clause 2; and

b. Qualified in accordance with the provisions of Clause 3.

# 23.EMPLOYER'S RIGHT TO ACCEPT ANY BID, NEGOTIATE AND TO REJECT ANY OR ALL BIDS

Notwithstanding Clause 22, the Employer reserves the right to accept, negotiate or reject any Bid, and to cancel the bidding process and reject all Bids, at any time prior to the award of Contract, without thereby incurring any liability to the affected Bidder or Bidders or any obligation to inform the affected Bidder or Bidders of the grounds for the Employer's action.

# 24.NOTIFICATION OF AWARD AND SIGNING OF AGREEMENT

- 24.1 The Bidder, whoseBid has been accepted, will be notified of the award by the Employer prior to expiration of the Bid validity period by e-mail and confirmed by registered letter. This letter (hereinafter and in the Conditions of Contract called the "Letter of Acceptance") will state the sum that the Employer will pay the Contractor in consideration of the execution and completion of the Works by the Contractor as prescribed by the Contract (hereinafter and in the Contract called "the Contract Price").
- 24.2 The notification of award will constitute the formation of the Contract.

The works should be completed as per period specified in the NIT from expiry of 30(thirty) days from the issue of letter of acceptance issued by department or within 7 days of handing over of the site or handing over of reasonable number of working drawings to the contractor or the period of mobilization allowed in the work order for starting the work in special circumstances whichever is latest.

24.3 The Agreement will incorporate all agreements between the Employer and the successful Bidder, work programme etc. within 60(Sixty ) days following the notification of award along with the letter of Acceptance and / or Work Order issued by department.

In case of failure to enter in to agreement within specified period or extended period on the written-request of the bidder, if any, the department will take action as per clause 2 of special conditions of contract.

24.4 In the bidding process, the cause of rejection of Bid of any bidder should be intimated to non-qualified bidder after the award of the work to the successful one and the Security / Earnest Money shall be refunded to unsuccessful bidders as per provision of Cl. 14.3.

- 24.5 The contractor shall enter into and execute contract agreement in the prescribed form. The cost of the stamp papers for the contract agreement shall be borne by the contractor. Two sets of contract document/agreements shall be prepared and signed by both the parties One of the sets shall be stamped "Original" and the other "Duplicate". The duplicate copy will be supplied to the contractor free of cost and the original is to be retained by the company. For additional copy, cost to be charged.
- All additional copies should be certified by the Engineer-in-Charge.

The contractor shall keep copy of these documents on the site/place of work in proper manner so that these are available for inspection at all reasonable times by the Engineer-in-charge, his representatives or any other officials authorized by the company for the purpose.

The contract document shall not be used by the contractor for any purpose other than this contract and the contractor shall ensure that all persons employed for this contract strictly adhere to this and maintain secrecy, as required of such documents.

## 25 .PERFORMANCE SECURITY/SECURITY DEPOSIT

For details refer Cl. 2 of Special Conditions of Contract

# 26. **EMPLOYMENT OF LABOUR**

26.1. Contractors are to employ, to the extent possible (as per policy decision of the company valid from time to time), local project affected people and pay wages not less than the minimum wages as per Minimum Wages Act or such other legislations or award of the minimum wage fixed by respective State Govt. or Central Govt. as may be in force. Payment of arrears to the contract workers on account of revision of minimum wages w.e.f. 1st April & 1st October of each year shall be the responsibility of the contractor.

Payment of Provident Fund for the workmen employed by him for the work as per the Laws prevailing under provision of CMPF and allied scheme valid from time to time shall be the responsibility of bidder. Bidder shall also submit statutory returns.

- 26.2. The bidder shall comply with statutory requirements of various acts including Child Labour (Prohibition & Regulation) Act, 1986 as mended from time to time and all rules, regulations and schemes framed thereunder from time to time in addition to other applicable labour laws.
  - 26.3. The payment to the contractor's labourers has to be made through Bank only.
  - 26.4. Bonus is to be paid to the contract workers engaged by the Contractors as per the provisions of Payment of Bonus Act, 1965.
  - 26.5. The contractors shall register themselves on the Contract Labour Payment Management Portal (CLPMP) of CIL within 30 days of issue of work order and will have to enter and update periodically the following details in the portal :
    - i) Work Order details
    - ii) Contractor workers details and Wages payment details in respect of each Work Order.
- **27.** An Amount of 1% (one percent) of the work value payable to the contractors will be deducted from all Bills towards the worker's welfare under Building and other Construction Worker's Welfare Cess Rules'1998 and Building and other Construction Worker's Welfare Cess Act'1996 (As applicable in the States).
- **28.** The provisions of Public Procurement (Preference to Make in India) Order 2017 will have to be complied with by the contractor where ever applicable.

# 29.LEGAL JURISDICTION

Matter relating to any dispute or difference arising out of this bid and subsequent contract awarded based on the bid shall be subject to the jurisdiction of local court only where the subject work is to be executed.

**30. Integrity Pact** (applicable for bids with estimated cost exceeding Rs. 2 Crores).

Bidders are required to submit the pre contract integrity pact duly signed and witnessed as per enclosed format along with the bid Part-I. This will be signed by the authorized signatory of the bidder (s) with name, designation and seal of the company. Bidders who do not sign the pact shall be disqualified from participation in the Bid process.

#### **31.** Change in the Constitution of Contracting Agency.

Prior approval in writing of the Company shall be obtained, before any change is made in the constitution of the contracting agency, otherwise it will treated as a breach of contract.

## 32. Miscellaneous.

32.1 The bidders should fill the bid document properly and carefully. They should avoid quoting absurd rates.

32.2 Throughout the bidding documents, the terms 'bid' and 'tender' and their derivatives are synonymous.

33. Instruction to Bidder shall be a part of contract agreement.

# Section-3 CONDITIONS OF CONTRACT

## SUB-SECTION-3.1

# GENERAL TERMS AND CONDITIONS OF CONTRACT

#### **1. DEFINITIONS :-**

- i. The word "Company" or "Employer" or "Owner" or "Purchaser" wherever occurs in the conditions, means the Central Coalfields Limited, represented at the headquarters of the Company or his authorized representative or any other officer specially deputed for the purpose.
- ii. The word "Principal Employer" or "Engineer" wherever occurs, means the authorized representative or any other officer specially deputed by the Company for the purpose of contract.
- iii. The word "Contractor"/"Contractors" or "Manufacturer" wherever occurs means the successful Bidder/Bidders who has/have deposited the necessary Earnest Money and has/have been given written intimation about the acceptance of tender and shall include legal representative of such individual or persons composing a firm or a company or the successors and permitted assignees of such individual, firm or company, as the case may be.
- iv. "The Site" shall mean the site of the contract work including land and any building and erections thereon and any other land allotted by the company for contractor's use in the performance of the contract.
- v. The term "sub-contractor", as employed herein, includes those having a direct contract with
- contractor either on piece rate, items rate, time rate or on any other basis and it includes one who furnishes work to a special design according to the plans or specifications of this work but does not include one who merely supplied materials.
- vi. "Consulting Engineer"/"Consultant" shall mean any firm or person duly appointed as such from time to time by the owner.
- vii. 'Accepting authority' shall mean the management of the company and includes an authorized representative of the company or any other person or body of persons empowered in this behalf by the company.
- viii. A 'Day 'shall mean a day of 24 hours from midnight to midnight.
- ix. Engineer-in-charge/Designated Officer-in-charge who is of an appropriate seniority will be

responsible for supervising and administering the contract, certifying payment due to the contractor, valuing variations to the contract, awarding extension of time and valuing compensation events. Engineer-in-charge/Designated Officer-in-charge may further appoint his representatives i.e. another person/ Project Manager or any other competent person and notify to the contractor who is directly responsible for supervising the work being executed at the site, on his behalf under the Delegation of Powers of the company.

However, overall responsibility, as far as the contract is concerned will be that of the Engineer-in-charge/Designated Officer-in-charge.

- x. The 'contract' shall mean the notice inviting tender, the tender as accepted by the company and the formal agreement executed between the company and the contractor together with the documents referred to therein including conditions of contract, special conditions, if any, specifications, designs& drawings including those to be submitted during progress of work, scope of work, billing schedule/schedule of quantities with rates and amounts.
- xi. The 'works' shall mean and include the furnishing of equipment, labor, and the services in accordance with the contract or parts thereof as the case may be and shall also include all extra or additional, altered or substituted works or any work of emergent nature, which in the opinion of the Engineer-in-charge, become necessary during the progress of the works to obviate any risk or accident or failure or become necessary for security.
- xii. "Specification" shall mean the technical specifications forming a part of the contract and such other schedules and drawings as may be mutually agreed upon.
- xiii.'Contract price' shall mean the total sum for which tender is accepted by the company.
- xiv.'Written notice' shall mean a notice or communication in writing and shall be deemed to have been duly served if delivered in person to the individual or to a member of the firm or to an office of the Corporation/Company for whom it is intended, or if delivered at or sent by registered mail to the last business address known to him who gives the notice.
- xv. "Letter of Acceptance" of the tender shall mean the official notice issued by the company notifying the contractor that his tender has been accepted.
- xvi. "Date of Contract" shall mean the date on which both the parties have signed the contract agreement.

- xvii. "Manufacturer's Works' or Contractor's Works" shall mean the place of work used by the Manufacturer, the Contractor, their collaborators or sub-contractors for the performance of the works.
- xviii. "Inspector" shall mean the Owner or any person nominated by the Owner from time, to inspect the equipment stores or Works under the contract and/or the duly authorized representative of the owner.
- xix. When the words "Approved", "Subject to Approval", "Satisfactory", "Equal to", "Proper", "Requested", "As directed", "Where directed", "When directed", "Determined by", "Accepted", "Permitted", or words and phrases of like import are used, the approval, judgment, direction etc. is understood to be function of the Owner/Engineer-in-Charge.
- xx. "Test of Completion" shall mean such tests as prescribed in the contract to be performed by the contractor before the Works is taken over by the Owner.
- xxi. "Start-up" shall mean the time period required to bring the equipment covered under the Contract from an inactive condition, when construction is essentially complete, to the state ready for trial operation. The start-up period shall include preliminary inspection and check out of equipment and supporting sub-systems; initial operation of the complete equipment covered under the Contract to obtain necessary pre-trial operation data, perform calibration and corrective action; shut down inspection and adjustment prior to the trial operation period.
- xxii. "Initial operation" shall mean the first integral operation of the complete equipment covered under the contract with sub-systems and supporting equipment in service.
- xxiii. "Trial Operation", "Reliability Test", Trial Run", "Complete Test" shall mean the extended period of time after the "Start-up" period. During this trial operation period the unit shall be operated over the full load range. The length of Trial Operation shall be as determined by the Engineer, unless otherwise specified elsewhere in the Contract.
- xxiv."Performance and Guarantee Tests" shall mean all operation checks and tests required to determine and demonstrate capacity, efficiency, and operating characteristics as specified in the contract document.
- xxv. "Commercial Operation" shall mean the condition of operation in which the complete equipment covered under the contract is officially declared by the owner to be available for continuous operation at different loads up to and including rated capacity. Such declaration by the owner however, shall not relieve or prejudice any of the contractor's obligation under this contract.
- xxvi."Final Acceptance" shall mean the owner's written acceptance of the works performed under the contract, after successful completion of performance and guarantee tests.
- xxvii. "Guarantee Period/Maintenance Period" shall mean the period during which the contractor shall remain liable for repair or replacement of any defective part of the works performed under the contract.
- xxviii. "Drawings"/"Plans" shall mean all :
- (a) drawings furnished by the owner/consultant as a basis for proposals,

(b) supplementary drawings furnished by the Owner/Consultant to clarify and to define in greater detail the intent of the contract,

(c) Drawings submitted by the contractor with his proposal provided such drawings are acceptable to the Owner/Consultant,

(d) Drawings furnished by the Owner/Consultant to the Contractor during the progress of the work, and

(e) Engineering data and drawings submitted by the Contractor during the progress of the work provided such drawings are acceptable to the Engineer,

xxix. "Codes" shall mean the following, including the latest amendments, and/or replacements, if any :

(a) Standards of Bureau of Indian Standards relevant to the works under the contract and their specifications.

(b) Other Internationally approved Standards and/or rules and regulations touching the subject matter of the contract.

- (i) A.S.M.E. Test codes.
- (ii) A.I.E.E. Test codes.
- (iii) American Society of Materials Testing Codes.
- (iv) Indian Electricity Act and Rules and Regulations made there under.
- (v) Indian Explosive Act and Rules and Regulations made there under.
- (vi) Indian Petroleum Act and Rules and Regulations made there under.
- (vii) Indian Mines Act and Rules and Regulations made there under.

(c) Any other laws, rules, regulations and Acts applicable in the country with respect to labour, safety, compensation, insurance etc.

- xxx Words importing singular only shall also include the plural and vice-versa where the context so requires.
- xxxi Words importing "Person" shall include firms, companies, corporations, and associations or bodies of individuals, whether incorporated or not.
- xxxii Terms and expressions, not defined herein, shall have the same meaning as are assigned to them in the Indian Sale of Goods Act, failing that in the Indian Contract Act, and failing that in the General Clauses Act.
- xxxiiiCommissioning" the plant/project shall mean completion in all respects of construction rendering the plan/project ready for performance test and commercial operation as per xxv.
- xxxiv Government Approvals" shall mean all permits, licenses, authorizations, consents, clearances, decrees, waivers, privileges, approvals from and filing with government instrumentalities necessary for the development, construction and operation of the plant/project.
- xxxv "Month" shall mean a calendar month according to the Gregorian calendar.

xxxvi "Bank Guarantee" shall mean the Bank Guarantee to be provided by ..... to.....

- xxxvii "Prime contractor "shall mean the contractor who has a contract with the owner of the project or job and has the full responsibility of its completion.
- xxxviii "Turnkey contract" shall mean a contract in which the contractor takes the entire responsibility of detailed site investigation, planning, design, material procurement, installation, construction and commissioning of the total project i.e. takes the responsibility from concept to commissioning.

#### 2. CONTRACT DOCUMENTS:

The following documents shall constitute the contract documents:

- i) Articles of Agreement,
- ii) Notice Inviting Tender,
- iii) Letter of Acceptance of Tender indicating deviations, if any, from the conditions of contract incorporated in the Tender document issued to the bidder and/or the Bid submitted by the bidder,
- iv) Conditions of Contract(General Terms & Conditions of Contract, Special Conditions of Contract, Erection Conditions of Contract, Safety codes, etc.) forming part of the Agreement.
- v) Specifications, where it is part of Tender Documents,
- vi) Scope of works/Bills of quantities/schedule of works/quantities and
- vii) Contract Drawings/finalized work programme.

## DISCREPANCIES IN CONTRACT DOCUMENTS & ADJUSTMENTS THEREOF

- (i). The documents forming part of the contract are to be treated as mutually explanatory of one another and in case of discrepancy between schedule of quantity, the specifications and/or drawing, the following order of preference shall be observed;
  - a)Description in Bill of Quantities of work.
  - b)Particular specification and special conditions, if any
  - c) Drawings.
  - d)General specifications.
  - e)BIS Specifications.
- (ii). In the event of varying or conflicting provision in any of the document(s) forming part of the contract, the Accepting Authority's decision/clarification shall hold good with regard to the intention of the document or contract as the case may be.
- (iii). Any error in description, quantity or rate in Bill of Quantities or any omission there from, shall not vitiate the contract or release the contractor from discharging his obligations under the contract including execution of work according to the Drawings and Specifications forming part of the particular contract document.
- 2.1 After acceptance of tender the Contractor shall be deemed to have carefully examined all Contract Documents to his satisfaction. If he shall have any doubt as to the meaning of any portion of the Contract Documents, he shall

before signing the Contract, set forth the particulars thereof, and submit them to the Owner in writing in order that such doubt may be removed. The Owner will provide such clarifications as may be necessary in writing to the Contractor. Any information otherwise obtained from the Owner or the Engineer shall not in any way relieve the Contractor of his responsibility to fulfill his obligations under the Contract.

- 2.2 The Contractor shall enter into a Contract Agreement with the Owner within 60 (sixty) days from the date of 'Acceptance of Tender' or within such extended time as may be granted by the owner. The performance Bank Guarantee for the proper fulfillment of the contract shall be furnished by the contractor in the prescribed form within Thirty (30) days of 'Acceptance of tender'. The performance Guarantee shall be as per terms prescribed in clause 2 of Special Condition of Contract of of this tender.
- 2.3 The owner, after the issue of the letter of Acceptance of Tender, will send one copy of the final agreement to the contractor for his scrutiny and approval.
- 2.4 The agreement, unless otherwise agreed to, shall be signed within 60 days of the issue of the letter of Acceptance of tender, at the office of the owner on a date and time to be mutually agreed. The contractor shall provide for signing of the contract, performance guarantee in copies as required, appropriate power of attorney and other requisite materials. In case it is agreed mutually that the contract is to be signed beyond the stipulated time, the bid guarantee submitted with the tender will have to be extended accordingly.
- 2.5 The agreement will be signed in six originals and the contractor shall be provide d with one signed original and the rest will be retained by the owner. None of these documents shall be used by the contractor for any purpose other than this contract and the contractor shall ensure that all persons employed for this contract strictly adhere to this and maintain secrecy, as required of such documents.
- 2.6 The contractor shall provide free of cost to the owner all the engineering data, drawings and descriptive materials submitted with the bid, in at least six (6) copies to form a part of the contract immediately after issue of letter of acceptance.
- 2.7 Subsequent to signing of the contract, the contractor at his own cost shall provide the owner with at least six (6)true copies of agreement within thirty (30) days after the signing of the contract.
- 2.8 The contract shall be considered as having come into force from the date of the letter of acceptance of tender issued by the owner.
- 2.9 The laws applicable to this contract shall be the laws in force in India. The courts of Ranchi shall have exclusive jurisdiction in all matters arising under this contract.

# **3.0 CONTRACT PERFORMANCE GUARANTEE/SECURITY DEPOSIT ( Replaced by Clause No 2 ) Of Special Conditions of Contract)**

#### **3.1 Security Deposit shall consist of two parts;**

a) Performance Security to be submitted at award of work and

b) Retention Money to be recovered from running bills. The security deposit shall bear no interest.

3.1.1 Performance Security should be 5% of contract amount and should be submitted by the successful bidder within 30 days of issue of LOA in any of the form given below after which bid security/earnest money will be refunded to the contractor.

- a Bank Guarantee in the form given in the bid document from any schedule bank acceptable to the owner. Bank Guarantee issued by outstation bank shall be operative at its local branch at Ranchi (Jharkhand)

- Govt. Securities, FDR (Scheduled Bank) or any other form of deposit stipulated by the owner and duly pledged in favour of owner.

- Demand Draft drawn in favour of Central Coalfields Ltd. on any Scheduled Bank payable at its Branch at Ranchi.

The Earnest Money/ Bid Security deposited shall be discharged when the Bidder has signed the agreement and furnished the required performance security/1<sup>st</sup> part of security deposit.

The bid Security deposited may be adjusted against the performance security (1<sup>st</sup> part of security deposit) at bidder's option.

- 3.1.2 If performance security is provided by the successful bidder in the form of bank guarantee it shall be issued either -
  - (a)at Bidder's option by a Scheduled Bank as per provisions of Cl.3.1.1. The BG shall contain complete postal address, telephone number, fax number and email address of both out station bank issuing the BG as well as its local operating branch.
  - (b)by a foreign bank located in India and acceptable to the employer.

NOTE:

-The Bank Guarantee (BG) issued by the issuing Bank on behalf of contractor in favour of "Central Coalfields Limited" shall be in paper form as well as issued under "Structured Financial Messaging System (SFMS)".

The details of beneficiary for issue of Bank Guarantee (BG) under SFMS platform is furnished below:

	Name	<b>Central Coalfields Limited</b>
	Area	*
Name of beneficiary and	Bank A/C no. of beneficiary	<del>10106155123</del>
details	Customer ID/CIF no of	<del>80288731402</del>
	<del>beneficiary</del>	
	Department	E&M
	Beneficiary's Bank	State Bank of India
Beneficiary's Bank, Branch	Branch and Adress	SME Branch, Doranda,
and Address		<del>ranchi - 834002</del>
	SFMS Code/ IFSC Code	SBIN0009620
	In case of Foreign BG Swift	SBININBB387
	Code	

Failure of the successful bidder to comply with the requirement as above shall constitute sufficient ground for cancellation of the award of work and forfeiture of the bid security/ earnest money.

In addition to the above penal measures, the bidder will not be allowed to participate in the re-tendering process. The bidder may also be debarred from participating in future tenders in the subsidiary for a minimum period of 12 Months.

3.1.3 Retention Money should be deducted at 5% from running bills. Total of performance security and Retention Money should not exceed 10% of contract amount or lesser sum indicated in the bid document. Retention Money may be released against equivalent Bank Guarantee only for values above Rs. 25.0 lakhs

3.2 The Guarantee amount shall be payable to the Employer without any condition whatsoever.

**3.3**Performance Security/Retention Money shall be converted into Performance Guarantee on successful completion of work in accordance with contract and upon satisfactory trial operations.

Performance security/ Retention Money /security deposit submitted in the form of BG shall be valid for 90 days after the end of Guarantee period

- 3.4 The Performance Guarantee shall cover additionally the following guarantees to the Employer:
  - (a) The successful bidder guarantees the successful and satisfactory operation of the equipment furnished and erected under the contract, as per the specifications and documents,
  - (b) The successful bidder further guarantees that the equipment provided and installed by him shall be free from all defects in design, material and workmanship and shall upon written notice from the employer fully remedy free of expenses to the Employer such defects as developed under the normal use of the said equipment within the period of guarantee specified in the relevant clause of the Conditions of Contract.

**3.5** The Contract Performance Guarantee is intended to secure the performance of the entire Contract. However it is not construed as limiting the damages under clause entitled 'Equipment Performance Guarantee' in section Technical Conditions of Contract and damages stipulated in the other clauses in the bidding documents.

- **3.6** All Bank Guarantees are to be submitted in the format prescribed by the company in the bid document. Bank Guarantee shall be irrevocable and it shall be from any Scheduled Bank acceptable to the owner. The BG issued by outstation bank shall be operative at its local branch at Ranchi.
- **3.7** The Company shall be at liberty to deduct/appropriate from the Contract Performance Guarantee/Security Deposit such sums as are due and payable by the contractor to the company as may be determined in terms of the contract, and the amount appropriated from the Contract Performance Guarantee/Security Deposit shall have to be restored by Contractor subsequently.
- **3.8** The Contract Performance Guarantee will be returned to the Contractor without any interest at the end of the Guarantee Period as per provisions of the contract. Any defect/defects in the work, if detected during guarantee period shall be rectified to the satisfaction of the Engineer-in- Charge within the said guarantee period or its due extension till completion of the rectification works as required.
- **3.9** Failure of the successful Bidder to comply with the requirements of Sub-Clause 3.1 shall constitute sufficient grounds for cancellation of the award and forfeiture of the Bid Security. In addition to the above penal measures, the bidder will not be allowed to participate in the re tendering process. The bidder may also be debarred from participating in future tenders in the subsidiary for a minimum period of 12 Months.

#### 4.0 ASSIGNMENT AND SUBLETTING OF CONTRACT

- **4.1** The contractor may, after informing the engineer and getting his written approval, assign or sub-let the contract or any part thereof other than for raw materials, for minor detail or any part of the plant for which makes are identified in the contract. Suppliers of the equipment not identified in the contract or any change in the identified supplier shall be subject to approval by the engineer. The experience list of the equipment vendors under consideration by the contractor for this contract shall be furnished to the engineer for approval prior to procurement of all such items/equipments. Such assignment sub-letting shallot relieve the contractor from any obligation, duty or responsibility under the contract. Any assignment as above without prior written approval of engineer shall be void.
- **4.2** For components/equipments procured by the contractors for the purposes of the contract, after obtaining the written approval of the owner, the contractor's purchase specifications and enquiries shall call for quality plans to be submitted by the suppliers along with their proposals. The quality plans called for from the vendors shall set out, during the various stages of manufacture and installation, the quality practices and procedures followed by the vendor's quality control organization, the relevant reference documents/standards used, acceptance level, inspection documentation raised, etc. Such quality plans of the successful vendor shall be discussed and finalized in consultation with the engineer and shall form a part of the purchase order/contract between the contractor and the vendor. Within 3 weeks of the release of the same purchase order/contracts for such bought out items/ components, a copy of the same without price details but together with detailed purchase specifications, quality plans and delivery conditions shall be furnished to the engineer by the contractor.

# **5.0 PATENT RIGHTS AND ROYALTIES**

5.1 Royalties and fees for patent covering materials, articles, apparatus, devices, equipment or processes used in the works shall be deemed to have been included in the contract price. The contractor shall satisfy all demands that may be made at any time for such royalties or fees and he alone shall be liable for any damages or claims for patent infringements and shall keep the owner indemnified in that regard. The contractor shall, at his own cost and expense, defend all suits or proceedings that may be instituted for alleged infringement of any patent involved in the works, and, in case of an award of damages, the contractor shall pay for such award. In the event of any suit or other proceedings instituted against the owner, the same shall be defended at the cost and expense of the contractor who shall also satisfy/comply and decree, order or award made against the owner. But it shall be understood that no such machine, plant, work, material or thing has been used by the owner for any purpose or any manner other than that for which they have been furnished and installed by the contractor and specified under these specifications. Final payment to the contractor by the owner will not be made while any such suit or claim remains unsettled. In the event

any apparatus or equipment, or any matter thereof furnished by the contractor, is in such suit or proceedings held to constitute infringement, and its use is enjoined, the contractor shall, at his option and at his own expense, either procure for the owner, the right to continue use of said apparatus, equipment or part thereof, replace it with non-infringing apparatus or equipment or modify it, so it becomes non-infringing.

#### 6.0 TIME - THE ESSENCE OF CONTRACT( Replaced by Clause No 3 Of Special Conditions of Contract)

6.1 The time and the date of completion of the works as stipulated in the contractor's proposal and accepted by the owner without or with modifications, if any and so incorporated in the award letter shall be deemed to be the essence of the contract. The contractor shall so organise his resources and perform his work as to complete it not later than the date agreed to.

6.2 The contractor shall submit a detailed PERT network within the time frame agreed above consisting of adequate number of activities covering various key phases of the works such as design, procurement, manufacturing, shipment and field erection activities within fifteen (15) days after the date of acceptance of tender. This network shall also indicate the interface facilities to be provided by the owner and the dates by which such facilities are needed. Contractor shall discuss the network so submitted with the owner and the agreed network which may be in the form as submitted or in revised form in line with the outcome of discussions and shall form part of the contract to be signed within sixty (60) days from the date of letter of acceptance of notice of award of contract. During the performance of contract, if in the opinion of the engineer proper progress is not maintained suitable changes shall be made in the contractor's operations to ensure proper progress.

For the purpose of this detailed time and progress/ PERT chart, the works shall be deemed to have commenced on the expiry of 30 days from the issue of letter of acceptance or seven days after handing over the site of work, whichever is later.

6.3 The above PERT network shall be reviewed and periodic review reports shall be submitted by the contractor as directed by the engineer.

6.4 Subsequent to the award of the contract, the contractor shall make available to the engineer, a detailed manufacturing programme, in line with the agreed contract network. Such manufacturing programme shall be reviewed, updated and submitted to the Engineer, once every two month thereafter.

**7.0 CONTRACT PRICE:** The lump sum prices quoted by the contractor in his bid with additions and deletions as may be agreed before signing of the contract, for the entire scope of the work including furnishing and erection of equipment covered under the specifications and documents and shall be treated as the contract price.

**8.0 CHANGED QUANTITY:** The owner reserves the right to vary the quantities of items or groups of items to be ordered as specified in the accompanying technical specifications, as may be necessary, during the execution of the contract, but such variations unless otherwise specified in the accompanying technical specifications shall be limited to plus or minus twenty percent (20%) of the original quantity ordered.

**9.0 DEDUCTIONS FROM CONTRACT PRICE:** All costs, damages or expenses which the owner may have paid, for which under the contract the contractor is liable, will be claimed by the owner. All such claims shall be billed by the owner to the contractor regularly as and when they fall due. Such bills shall be supported by appropriate and certified vouchers or explanations, to enable the contractor to properly identify such claims. Such claims shall be paid by the contractor within fifteen (15) days of the receipt of the corresponding bills and if not paid by the contractor within the said period, the owner may then deduct the amount, from any moneys due or becoming due by him to the contractor under the contract or may be recovered by actions of law or otherwise, if the contractor fails to satisfy the owner of such claims.

## **10.0 CONTRACT PRICE ADJUSTMENT: (Deleted)**

- 10.1 All adjustments in the contract price shall be computed in accordance with the conditions and formulae prescribed in the relevant clauses of 'Additional Terms and Conditions of Contract', the accompanying technical specifications and further satisfying the requirements specified herein.
- 10.2 The contract price stated in the contract agreement is the base price. A certain fixed percentage of the base price as indicated in the technical specifications shall not be subject to any price adjustment. The balance percentage viz. the cost portion shall only be subject to price adjustment.
- 10.3 Price adjustment shall be applicable to the cost portion, only if changes in the cost of labour and materials (either increases or decreases) occur during the contract period, directly affecting the cost portion.
- 10.4 Variations in the cost of materials shall be determined by comparing published material indices as on the last date of submission of bid (inclusive of price part) or the revised price bid, whichever is later, with the same indices published during the manufacture at the respective cut off periods for material as specified in clause 2.0 of Additional Terms and Conditions of Contract. Variations in the cost of labour shall be determined by comparing the wages as per the Minimum Wages Act/ Rules of the State or Central Government or wages of contract workers engaged in mining activities as notified by CIL from time to time as may be in force., whichever is more, applicable to the place of work as on the last date of submission of bid (inclusive of price part) or the revised price bid, whichever is later, with the same wages as per the Minimum Wages Act/ Rules of bid (inclusive of price part) or the revised price bid, whichever is later, with the same wages as per the Minimum Wages Act/ Rules of bid (inclusive of price part) or the revised price bid, whichever is later, with the same wages as per the Minimum Wages Act/ Rules of the State or Central Government, whichever is later, with the same wages as per the Minimum Wages Act/ Rules of the State or Central Government, whichever is more, during the work/manufacture applicable to the place of work/manufacture at the respective cut off periods for labour as specified in clause 2.0 of Additional Terms and Conditions of Contract of this volume
- 10.5 The total computed variation in the contract price shall be restricted to a limiting percentage as specified in clause 2.5 of Additional Terms and Conditions of Contract of this volume.
- 10.6 The price adjustment for the erection shall be made on the value of erection work done as indicated in each billing.
- 10.7 Every three months after the award of contract, and a month prior to shipment of equipment (in the case of exfactory price component of contract price), and every month after establishing his site office (in the case of erection) the contractor shall submit to the engineer a written notice of the changes, if any, that have occurred in the specified material and labour indices during the previous reporting period containing the effective date of such change, the amount of change, the amount of contract price adjustment and documentary evidence to substantiate the price adjustment.
- 10.8 The contract price adjustment provisions detailed above, shall only be applicable if so specified in the Additional Terms and Conditions of Contract.

#### 11.0 PACKING, FORWARDING AND SHIPMENT:-

11.1 The contractor, wherever applicable, shall after proper painting, pack and crate all equipment in such a manner as to protect them from deterioration and damage during rail and road transportation to the site and storage at the site till the time of erection. The contractor shall be held responsible for all damages due to improper packing.

- 11.2 The contractor shall notify the owner of the date of each shipment from his works, and the expected date of arrival at the site for the information of the owner.
- 11.3 The contractor shall also give all shipping information concerning the weight, size and content of each packing including any other information the owner may require.
- 11.4 The following documents shall be sent by registered post to the owner within 3 days from the date of shipment, to enable the owner to make progressive payments to the contractor: the payment shall be made only after receipt and acceptance of material at site in good condition.

Application for payment in the standard format of the owner (3 copies),

Invoice (6 copies),

Packing list (6 copies),

Pre-dispatch clearance certificate, if any(3 copies),

Test certificate, wherever applicable (3 copies),

11.5 The contractor shall prepare detailed packing list of all packages and containers, bundles and loose material forming each and every consignment dispatched to site. The contractor shall further be responsible for making

all necessary arrangements for loading, unloading and other handling right from his works up to the site and also till the equipment is erected, tested and commissioned. He shall be solely responsible for proper storage and safe custody of all equipment.

**12.0 DEMURRAGE, WHARFAGE, ETC:** All demurrage, wharf age and other expenses incurred due to delayed clearance of the material or any other reason shall be to the account of the contractor.

#### **13.0 INSURANCE:-**

- 13.1 The contractor shall arrange, secure and maintain insurance as may be necessary and for all such amounts to protect his interests and the interests of the owner, against all risks as detailed herein in the joint names of the Owner and the Contractor with the condition that payments against all claims shall be payable by insurers to the owner as elaborated at clause 13.5. All premiums and other charges of the said insurance policies shall be paid by the contractor. The form and the limit of such insurance, as defined herein together with the under -writer thereof in each case shall be acceptable to the owner. However, irrespective of such acceptance, the responsibility to maintain adequate insurance coverage on comprehensive all risks basis at all time during the period of contract shall be that of the contractor alone. The contractor's failure in this regard shall not relieve him of any of his contractual responsibilities and obligations.
- 13.2 Any loss of damage to the equipment, during handling, transporting, storage and erection, till such time the plant is taken over by the owner, shall be to the account of the contractor. The contractor shall be responsible for preferring of all claims and make good for the damage or loss by way of repairs and/or replacement of the portion of the works damaged or lost. The transfer of title shall not in any way relieve the contractor of the above responsibilities during the period of the contract. The contractor shall provide the owner with a copy of all insurance policies and documents taken out by him in pursuance of the contract. Such copies of document shall be submitted to the owner immediately after such insurance coverage. The contractor shall also inform the owner in writing at least sixty (60) days in advance, regarding the expiry, cancellation and/or change in any of such documents and ensure revalidation/renewal, etc. as may be necessary well in time.
- 13.3 The risk that are to be covered under the insurance shall include, but not be limited to, the loss or damage in transit, theft, pilferage, riot, civil commotion, weather conditions, accidents of all kinds, fire, etc. The scope of such insurance shall cover the entire value of the works from time to time.
- 13.4 All costs on account of insurance liabilities covered under the contract will be on contractor's account and will be included in contract price. However, the owner may from time to time, during the pendency of the contract, ask the contractor in writing to limit the insurance coverage risks and in such a case, the parties to the contract will agree for a mutual settlement for reduction in contract price to the extent of reduced premium amounts.
- 13.5 All insurance claims, payable by the insurers, shall be paid to the Owner which shall be released to the contractor in installments as may be certified by the Engineer-in-charge for the purpose of rebuilding or replacement or repair of the works and/or goods destroyed or damaged for which payment was received from the insurers.
- 13.6 The clause entitled insurance under the section erection terms and conditions of contract of this volume, covers the additional insurance requirements for the portion of the works to be performed at the site of work.

**14.0 LIABILITY FOR ACCIDENTS AND DAMAGES:** Under the contract, the contractor shall be responsible for loss or damage to the plant until the plant is taken over in accordance with technical specification of bid document.

# **15.0 LIQUIDATED DAMAGES FOR DELAY IN COMPLETION: ( Replaced by Clause 5 of Special Conditions of Contract)**

15.1 If the contractor fails to maintain the required progress in terms of the agreed time and progress chart or to complete the work and clear the site on or before the date of completion of contract or extended date of completion, he shall without prejudice to any other right or remedy available under the law to the company on account of such breach, pay as compensation/ Liquidated Damages @ half percent (1/2%) of the contract price per week of delay. The aggregate of such compensation/ compensations shall not exceed 10 (ten) percent of the total value as shown in the contract. This will also apply to items or group of items for which separate period of completion has been specified. The amount of compensation may be adjusted or set off against any sum payable to the contractor under this or any other contract with the company.

- 15.2 The company, if satisfied, that the works can be completed by the contractor within a reasonable time after the specified time of completion, may allow further extension of time at its discretion with or without the levy of L.D. In the event of extension granted being with L.D, the company will be entitled without prejudice to any other right or remedy available in that behalf, to recover from the contractor as agreed damages equivalent to half percent of the contract value of the works for each week or part of the week subject to a ceiling of 10% of the contract price.
- 15.3 The company, if not satisfied that the works can be completed by the contractor, and in the event of failure on the part of the contractor to complete work within further extension of time allowed as aforesaid, shall be entitled, without prejudice to any other right, or remedy available in that behalf, to rescind the contract.
- 15.4 The company, if not satisfied with the progress of the contract and in the event of failure of the contractor to recoup the delays in the mutually agreed time frame, shall be entitled to terminate the contract.
- 15.5 In the event of such termination of the contract as described in clauses 15.2 or 15..3 or both, the company, shall be entitled to recover L.D. up to ten percent (10%) of the contract value and forfeit the security deposit made by the contractor besides getting the work completed by other means at the risk and cost of the contractor.
- 15.6 The company may waive the payment of compensation, depending upon merit of the case, on request received from the contractor if the entire work is completed within the date as specified in the contract or as validly extended without stipulating any penalty.

#### **16.0 CONTRACTOR'S DEFAULT:-**

16.1 If the contractor shall neglect to execute the works with the diligence and expedition or shall refuse or neglect to comply with any reasonable orders given to him, if writing by the engineer in connection with the works or shall contravene the provisions of the contract, the owner may give notice in writing to the contractor to make good the failure, neglect or contravention complained of. Should the contractor fail to comply with the notice within thirty (30) days from the date of service thereof, then and in such case the owner shall be at liberty to employ other workmen and forthwith execute such part of the works as the contractor may have neglected to do or if the owner shall think fit, it shall be lawful for him, without prejudice to any other right he may have under the contract, to take the works wholly or in part thereof and in that event the owner shall have free use of all contractor's equipment that may have been at the time on the site in connection with the works without being responsible to the contractor for fair wear and tear thereof and to the exclusion of any right of the contract by him to the contractor, or such part thereof as may be necessary, the payment of the cost of executing the said part of the works or of completing the works as the case may be. If the cost of completing the works or executing a part thereof as aforesaid shall exceed the balance due to the contractor, the contractor shall pay such excess. Such payment of excess amount shall be independent of the liquidated damages for delay which the contractor shall pay if the completion of works is delayed.

- 16.2 In addition, such action by the owner as aforesaid shall not relieve the contractor of his liability to pay liquidated damages for delay in completion of works as defined in clause 15.0 of this section
- 16.3 The termination of the contract under this clause shall not entitle the contractor to reduce the value of the performance bank guarantee nor the time thereof. The performance guarantee shall be valid for the full value and for the full period of the contract including guarantee period.
- 16.4 The bidding documents will clearly state that, if the contractor fails to complete the work and the orders cancelled, the amount due to him on account of work executed by him, if payable, shall be paid to him only after due recoveries as per the provisions of the contract and that too after alternative arrangements to complete the work has been made.

#### **17.0 FORCE MAJEURE**

- 17.1 Force majeure is herein defined as any cause which is beyond the control of the contractor or the owner as the case may be which they could not foresee or with a reasonable amount of diligence could not have foreseen and which substantially affect the performance of the contract, such as:
  - (a) Natural phenomena, including but not limited to floods, draughts, earthquakes and epidemics:
  - (b) Acts of any government, including but not limited to war, declared or undeclared, priorities, quarantines, embargoes,

Provided either party shall within fifteen (15) days from the occurrence of such a cause notify the other in writing of such causes.

17.2 (a) The successful bidder / contractor will advise, in the event of his having resort to this clause by registered letter duly certified by the local chamber of commerce or statutory authorities, the beginning and end of the clause of delay, within fifteen days of the occurrence and cessation of such Force Majeure condition. In the event of delay lasting over two months, if arising out of Force Majeure, the contract may be terminated at the discretion of the company.

(b) For delays arising out of Force Majeure, the bidder/ contractor will not claim extension incompletion date for a period exceeding the period of delay attributable to the causes of Force Majeure and neither company nor the bidder shall be liable to pay extra costs (like increase in rates, remobilization advance, idle charges for labor and machinery etc.) Provided it is mutually established that the Force Majeure conditions did actually exist.

(c) If any of the Force Majeure conditions exists in the place of operation of the bidder even at the time of submission of bid he will categorically specify them in his bid and state whether they have been taken into consideration in their quotations.

17.3 The contractor or the owner shall not be liable for delays in performing his obligations resulting from any force majeure cause as referred to and/or defined above. The date of

completion will, subject thereinafter provided, be extended by a reasonable time even though such cause may occur after contractor's performance of his obligations has been delayed for other causes.

#### **18.0 DELAYS BY OWNER OR HIS AUTHORIZED AGENT**

- 18.1 In case the contractor's performance is delayed due to any act of omission on the part of the owner or his authorized agents, then the contractor shall be given due extension of time for the completion of the works, to the extent such omission on the part of the owner has caused delay in the contractor's performance of his work. Regarding reasonableness or otherwise of the extension of time, the decision of the engineer shall be final.
- 18.2 In addition, the contractor shall be entitled to claim demonstrable and reasonable compensation if such delays have resulted in any increase in the cost of work. The owner shall examine the justification for such a request for claim, and if satisfied, the extent of compensation shall be mutually agreed depending upon the circumstances at the time of such an occurrence
- 18.3 Any delay in finalization of mutual agreement in regard to any of the contractor's claim/ compensation against any act of omission on the part of the owners or his authorized agents should not result in any work stoppage/ further delay on the part of the contractor.

#### **19.0 EXTENSION OF DATE OF COMPLETION**

- 19.1 On happening of any events causing delay as stated hereinafter, the contractor shall intimate immediately in writing the Engineer-in-charge:
  - a. due to any reasons defined as Force Majeure.
  - b. non-availability of stores which are the responsibility of the owner to supply
  - c. non -availability or breakdown of tools and plant to be made available or made available by the owner
  - d. delay on the part of the contractors or tradesmen engaged by the owner not forming part of the contract, holding up further progress of the work
  - e. non-availability of working drawings/work program in time, which are to be made available by the company during progress of the work
  - f. any other causes which, at the sole discretion of the company is beyond the control of the contractor.
- 19.2 A "Hindrance Register" shall be maintained by both the Company and the Contractor at site to record the various hindrances, as mentioned above, encountered during the course of execution.
- 19.3 The contractor may request the company in writing for extension of time within 14 days of happening of such event causing delay stating also, if practicable, the period for which extension is desired. The company may, considering the eligibility of the request, give a fair and reasonable extension of time for completion of the work. Such extension shall be communicated to the contractor in writing by the company through the Engineer-in-charge within 1 month of the date of receipt of such request. The contractor shall however use his best efforts to prevent or make good the delay by putting his endeavors constantly as may be reasonably required of him to the satisfaction of the Engineer-in-charge.

- 19.4 Provisional extension of time may also be granted by the Engineer -In-charge during the course of execution, on written request for extension of time within 15 (fifteen) days of happening of such events as stated above, reserving the company's right to impose/ waive liquidated damages at the time of granting final extension of time as per contract agreement.
- 19.5 When the period fixed for the completion of the contract is about to expire, the question of extension of the contract may be considered at the instance of the Contractor or the Company or the both. The extension will have to be by party's agreement, expressed or implied.
- 19.6 In case the Contractor does not apply for grant of extension of time within 15 (fifteen) days of hindrance occurring in execution of the work and the Company wants to continue with the work beyond the stipulated date of completion for reason of the work having been hindered, the Engineer-in-charge at his sole discretion can grant provisional extension of time even in the absence of application from the Contractor. Such extension of time granted by the Engineer-in-charge is valid provided the Contractor accepts the same either expressly or implied by his actions before and subsequent to the date of completion. Such extension of time shall be without prejudice to Company's right to levy compensation under the relevant clause of contract.

#### 20.0 TERMINATION, SUSPENSION, CANCELLATION & FORECLOSURE OF CONTRACT

- 20.1 The owner shall, in addition to other remedial steps to be taken as provided in the conditions of contract, be entitled to cancel the contract in full or in part, if the contractor
  - a. makes default in proceeding with the works with due diligence and continues to do so even after a notice in writing from the Engineer-in-charge, then on the expiry of the period as specified in the notice

or

b. commits default/breach in complying with any of the terms and conditions of the contract and does not remedy it or fails to take effective steps for the remedy to the satisfaction of the Engineer-in-charge, then on the expiry of the period as may be specified by the Engineer-in charge in a notice in writing

or

c. fails to complete the work or items of work with individual dates of completion, on or before the date/dates of completion or as extended by the company, then on the expiry of the period as may be specified by the Engineer-in-charge in a notice in writing

or

- d. shall offer or give or agree to give any person in the service of the company or to any other person on his behalf any gift or consideration of any kind as an inducement or reward for act/acts of favor in relation to the obtaining or execution of this or any other contract for the company.
  - or
- e. Shall try to obtain a contract with the company by way of offering tendering or other non-bonafide method of competitive tendering.

or

- f. transfers, sublets, assigns the entire work or any portion thereof without the prior approval in writing from the Engineer -in-charge. The Engineer-in-charge may by giving a written notice, cancel the whole contract or portion of it in default.
- 20.2 The owner shall in such an event give fifteen (15) days notice in writing to the contractor of his decision to do so.
- 20.3 The contractor upon receipt of such notice shall discontinue the work on the date and to the extent specified in the notice, make all reasonable efforts to obtain cancellation of all orders and contracts to the extent they are related to the work terminated and terms satisfactory to the owner, stop all further subcontracting or purchasing activity related to the work terminated, and assist the owner in maintenance, protection, and disposition of the works acquired under the contract by the owner.
- 20.4 The contract shall stand terminated under the following circumstances unless the owner is satisfied that the legal representatives of the individual contractor or of the proprietor of the proprietary concern and in the case of partnership the surviving partners, are capable of carrying out and completing the contract and the owner shall in any way not be liable to payment of any compensation to the estate of deceased contractor and/or to the surviving partners of the contractor's firm on account of the termination of the contract.
  - a. If the contractor being an individual in the case of proprietary concern or in the case of a partnership firm any of its partners is declared insolvent under the provisions of insolvency act for the time being inforce,

or makes any conveyance or assignment of his effects or composition or arrangement for the benefit of his creditors amounting to proceedings for liquidation or composition under any insolvency act.

- b. In the case of the contractor being a company, its affairs are under liquidation either by a resolution passed by the company or by an order of court, not being a voluntary liquidation proceedings for the purpose of amalgamation or reorganization, or a receiver or manager is appointed by the court on the application by the debenture holders of the company, if any.
- c. If the contractor shall suffer an execution being levied on his/their goods, estates and allow it to becontinued for a period of 21 days.
- d. On the death of the contractor being a proprietary concern or of any of the partners in the case of a partnership concern and the company is not satisfied that the legal representative of the deceased proprietor or the other surviving partners of the partnership concern are capable of carrying out and completing the contract. The decision of the company in this respect shall be final and binding which is to be intimated in writing to the legal representative or to the partnership concern.
- 20.5 If the contractor is an individual or a proprietary concern and the individual or the proprietor dies and if the contractor is a partnership concern and one of the partners dies, then unless the owner is satisfied that the legal representatives of the individual contractor or of the proprietor of the proprietary concern and in the case of partnership the surviving partners, are capable of carrying out and completing the contract the owner shall be entitled to cancel the contract as to its incomplete part without being in any way liable to payment of any compensation to the estate of deceased contractor and/or to the surviving partners of the contractor's firm on account of the cancellation of the contract.
- The decision of the owner that the legal representatives of the deceased contractor or surviving partners of the contractor's firm cannot carry out and complete the contract shall be final and binding on the parties. In the event of such cancellation the owner shall not hold the estate of the deceased contractor and/or the surviving partners of the estate of the deceased contractor's firm liable to damages for not completing the contract.
- 20.6 On cancellation of the contract or on termination of the contract, the Engineer-in-charge shall have powers
  - a. to take possession of the site and any materials, constructional plant, implements, stores, etc. thereon.
    - b. to carry out the incomplete work by any means at the risk of the contractor
    - c. to determine the amount to be recovered from the contractor for completing the remaining work or in the event the remaining work is not to be completed the loss/damage suffered, if any, by the company after giving credit for the value of the work executed by the contractor up to the time of termination/cancellation less on a/c payments made till date and value of contractor's materials plant, equipment, etc., taken possession of after termination/cancellation.
  - d. to recover the amount determined as above, if any, from any moneys due to the contractor or any account or under any other contract and in the event of any shortfall, the contractor shall be called upon to pay the same on demand.

The need for determination of the amount of recovery of any extra cost/expenditure or of any loss/damage suffered by the company shall not however arise in the case of termination of the contract for death/demise of the contractor as stated in 20.4(d).

20.7 Suspension of work - The company shall have power to suspend the progress of the work or any part thereof and the Engineer -in-charge may direct the contractor in writing to suspend the work, for such period and in such manner as may be specified therein, on account of any default on the part of the contractor, or for proper execution of the work for reasons other than any default on the part of the contractor, or on ground of safety of the work or part thereof. In the event of suspension for reason other than any default on the part of suspension. Any necessary and demonstrable costs incurred by the contractor as a result of such suspension of the works will be paid by the owner, provided such costs are substantiated to the satisfaction of the engineer. The owner shall not be responsible for any liabilities if suspension or delay is due to some default on the part of the contractor or his sub-contractor.

The work shall, throughout the stipulated period of contract, be carried out with all due diligence on the part of the contractor. In the event of termination or suspension of the contract, on account of default on the part of the contractor, as narrated hereinbefore, the security deposit and other dues of this work or any other work done

under this company shall be forfeited and brought under the absolute disposal of the company provided, that the amount so forfeited shall not exceed 10% of the contract value.

- 20.8 Foreclosure of contract in full or in part If at any time after acceptance of the tender, the company decides to abandon or reduce the scope of the work for any reason whatsoever the company, through it Engineer-in-charge, shall give notice in writing to that effect to the contractor. In the event of abandonment/reduction in the scope of work, the company shall be liable
  - a. to pay the contractor at the contract rates full amount for works executed and measured at site upto the date of such abandonment/reduction in the work.
  - b. to pay reasonable amount assessed and certified by the Engineer-in-charge of the expenditure incurred, if any, by the contractor on preliminary works at site. e.g. temporary access roads, temporary construction for labor and staff quarters, office accommodation, storage of materials, water storage tanks and supply for the work including supply to labor/staff quarters, office, etc.
  - c. to pay for the materials brought to site or to be delivered at site, which the contractor is legally liable to pay, for the purpose of consumption in works carried out or were to be carried out but for the foreclosure, including the cost of purchase and transportation and cost of delivery of such materials. The materials to be taken over by the company should be in good condition and the company may allow at its discretion the contractor to retain the materials in full or part if so desired by him and to be transported by the contractor from site to his place.
  - d. to take back the materials issued by the company but remaining unused, if any, in the work on the date of abandonment/reduction in the work, at the original issued price less allowance for any deterioration or damage caused while in custody of the contractor
  - e. to pay for the transportation of tools and plants of the contractor from site to contractor's place or to any other destination, whichever is less.

The contractor shall, if required by the Engineer -in-charge, furnish to him books of accounts, papers, relevant documents as may be necessary to enable the Engineer-in-charge to assess the amount payable in terms of para 20.8 (b), (c) and (e) above, the contractor shall not have any claim for compensation whatsoever either for abandonment or for reduction in the scope of work, other than those as specified above.

**21.0 NO WAIVER OF RIGHTS:** Neither the inspection by the owner or the engineer or any of their officials, employees or agents nor any order by the owner or the engineer for payment of money or any payment for or acceptance of, the whole or any part of the works by the owner or the engineer, nor any extension of time, nor any possession taken by the engineer shall operate as a waiver of any provision of the contract, or of any power here in reserved to the owner, or any right to damages herein provided, nor shall any waiver of any breach in the contract be held to be a waiver of any other or subsequent breach.

**22.0 CERTIFICATE NOT TO AFFECT RIGHT OF OWNER AND LIABILITY OF CONTRACTOR:** No interim payment certificate of the engineer, nor any sum paid on account, by the owner, nor any extension of time for execution of the works granted by the engineer shall affect or prejudice the rights of the owner against the contractor or relieve the contractor of his obligations for the due performance of the contract, or be interpreted as approval of the works done or of the equipment furnished and no certificate shall create liability for the owner to pay for alterations, amendments, variations or additional works not ordered, in writing, by the engineer or discharge the liability of the contractor for the payment of damages whether due, ascertained, or certificate nor the acceptance by him of any sum paid on account or otherwise affect of prejudice the rights of the contractor against the owner.

#### 23.0 GRAFTS AND COMMISSIONS ETC.

Any graft, commission, gift or advantage given, promised or offered by or on behalf of the contractor or his partner, agent, officers, director, employee or servant or any one of his or their behalf in relation to the obtaining or to the execution of this or any other contract with the owner, shall, in addition to any criminal liability which it may incur, subject the contractor to the cancellation of this and all other contracts and also to payment of any loss or damage to the owner resulting from any cancellation. The owner shall then be entitled to deduct the amount so payable from any moneys otherwise due to the contractor under the contract.

**24.0 LANGUAGE AND MEASURES:** All documents pertaining to the contract including specifications, schedules notices, correspondence, operating and maintenance instructions, drawings or any other writing shall be written in English language. The metric system of measurement shall be used exclusively in the contract.

**25.0 RELEASE OF INFORMATION:** The contractor shall not communicate or use in advertising, publicity, sales releases or in any other medium photographs or other reproduction of the works under this contract, or descriptions of the site, dimensions, quantity, quality or other information, concerning the works unless prior written permission has been obtained from the owner.

## **26.0 CONSTRUCTION OF THE CONTRACT**

- 26.1 Notwithstanding anything stated elsewhere in the bid documents, the contract to be entered into will be treated as a divisible supply and erection contract. The supply portion of the contract will relate to the supply of equipment and materials and the erection portion will relate to the handling at the site, storage, erection, construction, testing, commissioning etc. as defined in the bid documents. The contractor will pay the sales tax for the supply of equipment and materials in accordance with law and the same will be reimbursed by the owner as a part of the total contract price on actual. The sales tax should be included in the total bid price in the proposal and should also be indicated separately.
- 26.2 In case of divisible supply and erection contract, or where the owner hands over his equipment to the contractor for executing, then the contractor shall at the time of taking delivery of the equipment/ dispatch documents be required to execute an indemnity bond in favour of the owner in the form acceptable to the owner for keeping the equipment in safe custody and to utilize the same exclusively for the purposes of the said contract.
- 26.3 The contract shall in all respects be construed and governed accordingly to Indian Laws.
- 26.4 It is clearly understood that the total consideration for the contract (s) has been bro ken up into various components only for the convenience of payment of advance under the contract (s) and for the measurement of deviations or modifications under the contract(s).

**27.0 COMPLETION OF CONTRACT:** Unless otherwise terminated under the provisions of any other relevant clause, this contract shall be deemed to have been completed at the expiration of the guarantee period as provided for under the clause entitled 'Guarantee' in this section.

**28.0 ENFORCEMENT OF TERMS:** The failure of either party to enforce at any time of the provisions of this contract or any rights in respect thereto or to exercise any option herein provided, shall in no way be construed to be a waiver of such provisions, rights or options or in any way to affect the validity of the contract. The exercise by either party of any of its rights herein shall not preclude or prejudice either party from exercising the same or any other right it may have hereunder.

#### 29.0 ENGINEER'S DECISION:-

- 29.1 In respect of all matters which are left to the decision of the engineer including the granting or withholding of the certificates, the engineer shall, if required to do so by the contractor give in writing a decision thereon.
- 29.2 If in the opinion of the contractor, a decision made by the engineer is not in accordance with the meaning and intent of the contract, the contractor may file with the engineer within fifteen (15) days after receipt of the decision, a written objection to the decision. Failure to file an objection within the allotted time will be considered as acceptance of the engineer's decision and the decision shall become final binding.
- 29.3 The engineer's decision and the filling of the written objection thereto shall be a condition precedent to the right to any legal proceedings. It is the intent of the agreement that there shall be no delay in the execution of the works and the decision of the engineer as rendered shall be promptly observed.

**30.0 CO-OPERATION WITH OTHER CONTRACTORS AND CONSULTING ENGINEERS:** The contractor shall agree to co-operate with the owner's other contractors and consulting engineers and freely exchange with them such technical information as is necessary to obtain the most efficient and economical design and to avoid unnecessary duplication of efforts. The engineer shall be provided with three copies of all correspondence addressed by the contractor to other sub-contractors and consulting engineers in respect of such exchange of technical information.

#### 31.0 TRAINING OF OWNER'S PERSONNEL:-

- 31.1 The contractor shall undertake to train free of cost, engineering personnel selected and sent by the owner at the works of the contractor unless otherwise specified in the technical specifications. The period and the nature of training for the individual personnel shall be agreed upon mutually between the contractor and the owner. These engineering personnel shall be given special training in the shops, where the equipment will be manufactured and/or their collaborator's works and where possible, in any other plant where equipment manufactured by the contractor or his collaborator is under installation or test, to enable those personnel to become familiar with the equipment being furnished by the contractor.
- 31.2 All traveling and living expenses for the engineering personnel to be trained during the total period of training will be borne by the owner. These engineering personnel while undergoing training shall be responsible to the contractor for discipline.
- 31.3 In the event of the owner, for any reason, failing to avail of the training facilities, he shall not be entitled for any rebate whatsoever on this account.

#### 32.0 POWER TO VARY OR OMIT WORK:-

- 32.1 No alterations, amendments, omissions, suspensions or variations of the works (hereinafter referred to as 'Variation') under the contract as detailed in the contract documents, shall be made by the contractor except as directed in writing by the engineer, but the engineer shall have full power subject to the provision hereinafter contained from time to time during the execution of the contract, by notice in writing, to instruct the contractor to make such variation without prejudice to the contract. The contractor shall carry out such variation and be bound by the same conditions as far as applicable as though the said variation occurred in the contract documents. If any suggested variation would, in the opinion of the contractor, if carried out, prevent him from fulfilling any of his obligations or guarantees under the contract, he shall notify the engineer there of in writing and the engineer shall decide forthwith, whether or not the same shall be carried out and if the engineer confirm his instructions, contractor's obligations and guarantees shall be modified to such an extent as may be mutually agreed. Any agreed difference in cost occasioned by any such variation shall be added to or deducted from the contract price as the case may be.
- 32.2 In the event of the engineer requiring any variation, such reasonable and proper notice shall be given to the contractor to enable him to work his arrangements accordingly, and in cases where goods or materials are already prepared or any design, drawings of pattern made or work done requires to be altered, a reasonable and agreed sum in respect there of shall be paid to the contractor.
- 32.3 In any case in which the contractor has received instructions from the engineer as to the requirement of carrying out the altered or additional substituted work which either then or later on, will in the opinion of the contractor, involve a claim for additional payments, the contractor shall immediately and in no case later than thirty (30) days, after receipt of the instructions aforesaid and before carrying out the instructions, advise the engineer to that effect. But the engineer shall not become liable for the payment of any charges in respect of any such variations, unless the instructions for the performance of the same shall be confirmed in writing by the engineer.
- 32.4 If any variation in the works, results in reduction of contract price, the parties shall, agree, in writing, so to the extent of any change in the price, before in contractor proceeds with the change.
- 32.5 In all the above cases, in the event of a disagreement as to the reasonableness of the said sum, the decision of the engineer shall prevail.
- 32.6 Notwithstanding anything stated above in this clause, the engineer shall have the full power to instruct the contractor, in writing, during the execution of the contract, to vary to quantities of the items or groups of items. The contractor shall carry out such variations and be bound by the same conditions, as though the said variations occurred in the contract documents. However, the contract price shall be adjusted at the rates and the prices provided for the original quantities in the contract.

#### **33.0GUARANTEE/ DEFECT LIABILITY**

(Replaced by Clause No 6 Of Special conditions of Contract)

33.1 The contractor shall warrant that the equipment will be new and in accordance with the contract documents and be free from defects in material, design, manufacture and workmanship for a period of forty eight (48) calendar months commencing immediately upon the satisfactory completion of the trial operations. The contractor's liability shall be limited to the replacement of any defective parts in the equipment of his own manufacture or those of his sub-contractor (s)/ subvendor (s) or replacement of the complete equipment, under normal use and arising solely form faulty design, manufacture, materials, and/or workmanship provided always that such defective parts/ equipment are repairable at the site/ replacing the equipment as a whole without hampering the operation of the plant. Such replaced defective parts/ old equipment shall be returned to the contractor unless otherwise arranged. No repairs or replacements shall be carried out by the engineer in charge of the employer during the 48 calendar months, as the plant is under the supervision of the contractor's supervisory engineers/staff.

- 33.2 The operation of the plant will be done departmentally by the respective subsidiary companies, as per provisions of tender document. However, in this case the successful EPC contractor shall be responsible for maintaining the plant during 48 calendar months including repair, replacement of the spare parts, components, equipment etc. free of cost.
- 33.3 If the facilities or any part thereof cannot be used by reason of such defect and/or making good such defect, 48 calendar months (i.e. four years of Defect liability period (DLP) including maintenance of plant by contractor for four years, as per the provisions of tender document) of any facilities or such part, as the case may be, shall be extended by a period equal to the period during which the facilities or such part cannot be used by the employer because of aforesaid reasons.
- 33.4 In case of failure of any equipment/system in during the initial period of 48 calendar months (i.e. four years of Defect liability period (DLP) including maintenance of plant by contractor for four years, as per the provisions of tender document) the EPC contractor shall repair/replace the equipment/system etc. at his own cost.

All the equipment should be guaranteed for a minimum of 90% availability of plant during defect liability period from the date of commissioning calculated on quarterly basis. The following formula may be adopted to calculate percentage availability.

(Total shift hours- breakdown hours-maintenance hours)/Total shift hours X 100

Total shift hours=8xNo. of shifts operated in 3 or 12 months as elaborated (quarterly/annual basis) including those on scheduled holidays.

In the event that equipment fails to achieve the availability herein provided, measured over each quarter, contractor shall be liable for and pay to the employer, as penalty, a sum equal to as indicated hereunder to be adjusted against running bill/performance guarantee:

- a. 0.25% of contract price (excluding GST) for reduction in every percentage or part thereof from guaranteed availability for first 10% (i.e. from 90% to 80%), calculated on quarterly basis.
- **b.** In case the availability falls below 80%, 10% of contract price (excluding GST) shall be deducted as penalty calculated on annual basis.

However, the total penalty on account of failure in guaranteed availability shall not exceed 10% of contract price (excluding GST).

# 34.0 REPLACEMENT OF DEFECTIVE PARTS AND MATERIALS:-

**34.1** If during the progress of the works the engineer shall decide and inform in writing to the contractor, that the contractor has manufactured any plant or part of the plant unsound or imperfect or has furnished any plant inferior than the quality specified, the contractor on receiving details of such defects or deficiencies shall at his own expense within seven (7) days of his receiving the notice, or otherwise, within such time as may be reasonably necessary for making it good, proceed to alter, re-construct or remove such work and furnish fresh equipment up to the standards of the specifications. In case the contractor fails to do so, the engineer may on giving the contractor seven (7) days' notice in writing of his intentions to do so, proceed to remove the portion of the works so complained of and, at the cost of the contractor, perform all such work or furnish all such equipment provided that nothing in this clause shall be deemed to deprive the owner of or affect any rights under the contract which the owner may otherwise have in respect of such defects and deficiencies.

**34.2** The contractor's full and extreme liability under this clause shall be satisfied by the payments to the owner of the extra cost, of such replacement procured, including erection, as provided for in the contract, such extra cost being the ascertained difference between the price paid by the owner for such replacements and the contract price portion for such defective plant and repayments of any sum paid by the owner to the contractor in respect of such defective plant. Should the owner not so replace the defective plant, the contractor's extreme liability under this clause shall be limited to repayment of all sums paid by the owner under the contract for such defective plant.

**35.0 DEFENCE OF SUITS**: If any action in court is brought against the owner or engineer or an officer or agent of the owner. For the failure or neglect on the part of the contractor to perform any acts, matters, covenants or things under the contract, or for damage or injury caused by the alleged omission or negligence on the part of the contractor, his agents, representatives or his sub-contractors, workmen, suppliers or employees, the contract tor shall in all such cases indemnify and keep the owner, and the engineer and/or his representative, harmless from all losses, damages, expenses or decrees arising of such action.

**36.0 LIMITATIONS OF LIABILITIES**: The final payment by the owner in pursuance of the contract shall mean, the release of the contractor from all his liabilities under the contract. Such final payment shall be made only at the end of the guarantee period as detailed in clause 33.0 above and till such time as the contractual liabilities and responsibilities of the contractor, shall prevail. All other payments made under the contract shall be treated as on account payments.

**37.0 MARGINAL NOTES**: The marginal notes to any clause of the contract shall not affect or control the construction of such clause.

**38.0 TAXES, PERMITS & LICENCES:** The contractor shall be liable and pay all- Indian taxes, (other than Goods and Services tax and GST Compensation Cess, if applicable) duties, levies, royalties, whether local, municipal, provincial or central lawfully assessed against the owner or the contractor in pursuance of the contract. In addition, the contractor shall be responsible for payment of all Indian duties, levies and taxes lawfully assessed against the contractor for his personal income and property only. This clause shall be read in conjunction with clause 12.3 of Instruction to Bidders.

The contractor, along with his bills, shall submit proper documents in the name of the Company to enable the Company to claim Input Tax Credit under the applicable laws. The invoice shall be in compliance with the relevant rules. CIL/Subsidiary is entitled to avail Input Tax Credit on account of : CGST, SGST/UTGST, IGST and GST Compensation Cess, as applicable for indigenous product/imported products. Hence set off allowed against CGST, SGST/UTGST, IGST and GST Compensation Cess as per relevant rules/act. Contractor shall submit relevant document as desired by CIL/Subsidiary at the time of supply, along with the bills/invoice as per relevant rules for enabling subsidiary to claim Input tax credit benefit.

**39.0 PROGRESS REPORTS AND PHOTOGRAPHS:** During the various stages of the works in the pursuance of the contract, the contractor shall at his own cost submit periodic progress reports as may be reasonably required by the engineer with such materials as charts, net-works, photographs, test certificates, etc. such progress report shall be in the form and size as may be required by the engineer and shall be submitted in at least three (3) copies.

#### 40.0 LONG TERM AVAILABILITY OF SPARES:-

**40.1** The contractor shall guarantee the long term availability of spares to the owner for the full life of the equipments covered under the contract. The contractor shall guarantee that before going out of production of spare parts of the equipment covered under the contract, he shall give the owner at least twelve (12) months advance notice so that the latter may order his bulk requirement of spares, if he so desires. The same provision will also be applicable to sub-contractor. Further, in case of discontinuance of manufacture of any spares by the contractor or his sub-contractors the contractor will provide the owner two years in advance, with full manufacturing drawings, material specifications and technical information required by the owner for the purpose of manufacture of such items.

40.2 Further, in case of discontinuance of supply of spares by the contractor or his sub-contractors the contractor will provide the owner with full information for replacement of such spares with other equivalent makes, if so required by the owner.

40.3 The contractor shall provide the owner with a "directory" of his sub-contractors giving the addresses and other particulars of his sub-contractors. The owner, if he so desires, shall have the right to procure the spares directly from sub-contractors.

40.4 Notwithstanding anything stated elsewhere in the bid documents, the prices of all spares which may be procured to cover long term requirements for additional sixty (60) calendar months after Sixty(60) calendar months excluding critical equipments having Comprehensive AMC as specified in the Technical Specifications, will be generally in accordance with the mutually agreed prices.

**40.5** The contractor will indicate in advance the delivery period of the items of spares, which the owner may procure in accordance with the sub-clause 40.4. In case of emergency requirements of spares, the contractor would make every effort to expedite the manufacture and delivery of such spares on the basis of mutually agreed time schedule.

**40.6** The procedure specified in clause 40.4 and 40.5 shall apply for future procurement of items included in stand by spare list, mandatory spares lists, optional spares list and special tools, plants and equipment list, if any, specified in the bid documents.

**40.7** The Contractor shall indemnify the owner for the availability of long time spares as per the terms and conditions laid down above in clause 40.1 to clause 40.6.

**40.8** In case of equipment/ system (including manufactured domestic and overseas) the availability of spare parts for additional sixty (60) calendar months after Sixty(60) calendar months (i.e Defect Liability Period of 1 year and Comprehensive maintenance of 4 Years) excluding critical equipments having Comprehensive AMC as specified in the Technical Specifications., as per the provisions of tender document) shall have to be guaranteed by the contractor. In this regard, the contractor will have to provide, an undertaking from the respective OEMs regarding supply of spare parts and maintenance support as and when required during the said period, before signing of contract agreement and it should be made a part of contract agreement.

**41.0 PAYMENT:** The payment to the contractor for the performance of the works under the contract will be made by the owner as per the guidelines and conditions specified herein. All payment made during the contract shall be on account payments only. The final payment will be made on completion of all the works and on fulfillment by the contractor of all his liabilities under the contract.

**41.2 CURRENCY OF PAYMENT:** All payments under the contract shall be in Indian Rupees only.

- **41.3 DUE DATES FOR PAYMENT:** Owner will make progressive payment as and when the payment is due as per the terms of payment set forth in the accompanying technical specifications. Payment will become due and payable by the owner within thirty 30) days from the date of receipt of contractor's bill/invoice/debit note by the owner, provided the documents submitted are complete in all respects.
- **41.4 PAYMENT SCHEDULE:** The contractor shall prepare and submit to the engineer for approval, a break-up of the contract price. This contract price break-up shall be interlinked with the agreed detailed PERT network of the contractor setting forth his starting and completion dates for the various key phases of works prepared as per condition of this section. While preparing the PERT network, the supply of P&M Equipment shall be linked to construction of respective Civil and Structural Works. Any payment under the contract shall be made only after the contractor's price break-up is approved by the engineer. The aggregate sum of the contractor's price break-up shall be equal to the lump sum contract price

# 41.5 INTERIM PAYMENTS:-

- 41.5.1 The contractor shall submit running bill for the payment in the prescribed proforma of the owner to be supplied in due course at the time of payment.
- 41.5.2 Each such running bill shall state the amount claimed and shall set forth in detail, in the order of the payment schedule, particulars of the works including the works executed at site and of the equipment shipped/brought on to the site pursuant to the contract up to the date mentioned in the bill and for the period covered since the last preceding certificate, if any.
- 41.5.3 Every interim payment claim shall indicate the contract value of the works executed up to the date mentioned in the running bill, provided that no sum shall be included in any running bill in respect of the works that, according to the decision of the engineer, does not comply with the contract, or has been performed, at the date of certificate prematurely.

#### 41.6 TERMS OF PAYMENTS:-

#### (Replaced by Clause No 7 Of Special conditions of Contract)

**41.6.1** PAYMENT: Since the total job is on turnkey basis, any payment to the Contractor before the final payment shall be treated as provisional payment towards the total contract value. The Contractor may at intervals of not less than one month submit claims/ bills for payment on account of work done after proper scrutiny and certification of the same by the Employer. The progressive payment shall be made in respect of the following:

#### a) Design engineering

b) Civil construction including foundation and

#### buildings

c) Structural fabrication and erection

#### d) Supply of equipment

e) Machinery Erection

#### f) Trial Run and commissioning

g)After successful trial run and commissioning , the Solar Power Plant package will be under comprehensive maintenance contract from day one of its operation , the spares required if any shall be provided by the OEM/bidder free of cost as guaranteedreplacement for 1<sup>st</sup> twelve months after words the equipment package as defined on the NIT will be under extended warranty of additional three years and the employer will purchase spares and consumables for the extended three years. The bid will be decided on the total cost of 48 months basis .

All such payments shall be made by the Employer online / through Account Payee Cheque within a month from the date of the submission of claims/bills. Payment will also be governed by Clauses of 3.0 of General Terms& Conditions of Contract. Any sum due from the Contractor shall be deducted from the first or next subsequent on account of payments as the case may be, in general the following procedure of payment shall be followed:

#### 41.6.1.1 DESIGN AND ENGINEERING:-

a) 85 % payment on completion of approval of system, mechanical, electrical, civil, structural design, drawings etc. as per contract on prorate basis.

b) 7.5 % payment on Preliminary acceptance of the works after start-up and trial operation .

c) 7.5% on issue of final acceptance certificate of the works after performance and guarantee test.

#### 41.6.1.2 CIVIL/STRUCTURAL WORKS:-

a) 90 % payment on progress of work completed, duly measured and certified by the engineer.

- b) 5 % payment on preliminary acceptance of the works after start-up and trial operation .
- c) 5 % on issue of final acceptance certificate of the works after performance and guarantee test.

#### 41.6.1.3 SUPPLY OF EQUIPMENT:-

- a) 85 % payment on receipt of the equipment conforming to stipulated specifications and quality in good condition at site to be certified by the site engineer.
- b) 7.5% on preliminary acceptance of the works after start-up and trial operation .
- e) 7.5% on issue of final acceptance certificate of the works after performance and guarantee test .

#### 41.6.1.4 INSTALLATION & COMMISSIONING:-

- a) 85% progress payment based on the installation and commissioning of plant and equipment duly certified by site engineer.
- b) 7.5% payment on preliminary acceptance of the works after start-up and trial operation.

-c) 7.5% on issue of final acceptance certificate of the works after performance and guarantee test.

**41.6.1.5 FINAL BILL:** As soon as possible after completion of the works to the satisfaction of the Employer the Contractor shall forward a certified final bill. It shall be accompanied by all relevant vouchers, such as royalty elearance certificate (if any) from appropriate authorities, submission of copies of working drawings, technical documents as required documents showing therein all additions and alternations etc. in the process of execution, completion certificate for embedded and covered up works, plant handing over certificate etc. as applicable. The Contractor shall be paid full and final payment only after deduction of amounts paid against on account bill and any other amount due etc. payable by Contractor.

For extended warranty for three years, payment will be made against delivery of spares and consumables on FOR destination basis and price will remain firm till execution of contract.100% payment shall be made within 21(Twenty one) days of correct receipt and acceptance of materials or submission of bills, whichever is as later.

**42.0 SETTLEMENT OF DISPUTES:** It is incumbent upon the contractor to avoid litigation and disputes during the course of execution. However, if such disputes take place between the contractor and the department, effort shall be made first to settle the disputes at the company level.

The contractor should make request in writing to the Engineer-in-charge for settlement of such disputes/ claims within 30 (thirty) days of arising of the cause of dispute/ claim failing which no disputes/ claims of the contractor shall be entertained by the company.

Effort shall be made to resolve the dispute in two stages

In first stage dispute shall be referred to Area GM or GM/HoD(E&M). If difference still persist the dispute shall be referred to a committee constituted by the owner. The committee shall have one member of the rank of Director of the company who shall be chairman of the committee.

If differences still persist, the settlement of the dispute shall be resolved in the following manner:

Disputes relating to the commercial contracts with Central Public Sector Enterprises / Govt. Departments (except Railways, Income Tax, Customs & excise duties )/ State Public Sector Enterprises shall be referred by either party for Arbitration to the PMA (Permanent Machinery of Arbitration ) in the department of Public Enterprises.

In case of parties other than Govt. Agencies, the redressal of the dispute may be sought through Arbitration (THE ARBITRATION AND CONCILIATION ACT, 1996 as amended by AMENDMENT ACT of 2015)..

#### 42 A. Settlement of Disputes through Arbitration

If the parties fail to resolve the disputes/differences by in house mechanism, then, depending on the position of the case, either the employer/owner or the contractor shall give notice to other party to refer the matter to arbitration instead of directly approaching Court. The contractor shall, however, be entitled to invoke arbitration clause only after exhausting the remedy available under the clause 16.

In case of parties other than Govt. agencies, the redressal of disputes/differences shall be sought through Sole Arbitration as under.

#### **Sole Arbitration**

In the event of any question, dispute or difference arising under these terms & conditions or any condition contained in this contract or interpretation of the terms of, or in connection with this Contract (except as to any matter the decision of which is specially provided for by these conditions), the same shall be referred to the sole arbitration of a person, appointed to be the arbitrator by the Competent Authority of CIL / CMD of Subsidiary Company (as the case may be). The award of the arbitrator shall be final and binding on the parties of this Contract.

- a) In the event of the Arbitrator dying, neglecting or refusing to act or resigning or being unable to act for any reason, or his/her award being set aside by the court for any reason, it shall be lawful for the Competent Authority of CIL / CMD of Subsidiary Company (as the case may be) to appoint another arbitrator in place of the outgoing arbitrator in the manner aforesaid.
- b) It is further a term of this contract that no person other than the person appointed by the Competent Authority of CIL / CMD of Subsidiary Company (as the case may be) as aforesaid should act as arbitrator and that, if for any reason that is not possible, the matter is not to be referred to Arbitration at all.

Subject as aforesaid, Arbitration and Conciliation Act, 1996 as amended by Amendment Act of 2015, and the rules there under and any statutory modification thereof for the time being in force shall be deemed to apply to the Arbitration proceedings under this clause.

The venue of arbitration shall be the place from which the contract is issued.

**Applicable Law**: The contracts shall be interpreted in accordance with the laws of the Union of India. **Contracts with Partnership firm/ Joint Venture/Consortium**: The Partnership firm /Joint Venture/Consortium is required to submit written consent of all the partners to above arbitration clause at the time of submission of bid.

- **43.0** The company reserves the right to deduct/ withhold any amount towards taxes, levies, etc. and to deal with such amount in terms of the provisions of the Statute or in terms of the direction of any Statutory authority and the company shall only provide with certificate towards such deduction and shall not be responsible for any reason whatsoever.
- **44.0** <u>E-way Bill:</u> The e-way bill required in connection with supply of goods or services, if any, shall be arranged by the supplier/vendor. However, the e-way bill will be arranged by CIL/Subsidiary if the supplier/vendor is unregistered one or if provisions of the relevant Act and the rules made there under specifically states that the e-way bill is required to be issued by recipient of goods.
- **45.0** In the event of recovery of any claim towards LD Charges, Penalty, fee, fine or any other charges (Except EMD) from the supplier/vendor, the same will be recovered along with the applicable GST and the amount shall be adjusted with the payment to be made to the supplier/vendor against their bill/invoice or any other dues.

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# SUB-SECTION-3.2

# **ERECTION CONDITIONS OF CONTRACT**

#### **ERECTION CONDITIONS OF CONTRACT**

#### 1.0 GENERAL:-

1.1 The following 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 to be performed at site.

1.2 The contractor upon signing of the contract shall, in addition to a project coordinator, 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 person shall function from the site office of the contractor during the pendency of contract.

# 2.0 REGULATION OF LOCAL AUTHORITIES AND STATUTES:-

- 2.1 The contractor shall comply with all the rules and regulations of local authorities during the performance of his field activities. He shall also comply with the minimum wages act, 1948 the payment of wages act (both of the Government of India and the local State Government) and the wages notified by CIL for contract laborer from time to time and the rules made there under in respect of any employee or workman employed or engaged by him or his subcontractor.
- The contractor shall make all necessary payments of the Provident Fund for the workmen employed by him for the work as per the laws prevailing under provisions of CMPF and Allied Schemes and CMPF and Miscellaneous Provisions Act 1948 or Employees Provident Fund and Miscellaneous Provisions Act 1952 as the case may be.
- 2.2 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 the rules and regulations of the Government and any other statutory laws and its amendments from time to time during erection in respect of the plant equipment ultimately to be owned by the owner, shall be to the account of the owner. Should any such inspection or registration need to be 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.

**3.0 OWNER'S LIEN ON EQUIPMENT:** The owner shall have lien on all equipment including those of the contractor brought to the site for the purpose of erection, testing and commissioning of the plant. The owner shall continue to hold the lien on all such equipment throughout the period of contract. No material brought to the site shall be removed from the site by the contractor and/or his sub-contractors without the prior written approval of the engineer.

**4.0 INSPECTION, TESTING AND INSPECTION CERTIFICATES:** The provisions of the clause entitled inspection testing and inspection certificates under section GTC shall also be applicable to the erection portion of the works. The engineer 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 constructed and/or erected at site. If by the above inspection, the engineer rejects any work or equipment, the contractor shall make good for such rejection either by replacement or modifications/repairs as may be necessary, to the satisfaction of the engineer. Such replacement will also include the replacement 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.

# 5.0 ACCESS TO SITE AND WORKS ON SITE:-

- 5.1 Suitable access to and possession of the site shall be accorded to the contractor by the owner in reasonable time.
- 5.2 The owner shall have the necessary foundations to be provided by him ready, as per the agreed schedule for the execution of the individual phases of works.
- 5.3 The works so far as it is carried out on the owner's premises, shall be carried out at such time as the owner may approve and the owner shall give the contractor reasonable facilities for carrying out the works.
- 5.4 In the execution of the works, no persons other than the contractor or his duly appointed representative, subcontractor and workmen, shall be allowed to do work on the site, except by the special permission, in writing of the engineer or his representative.

**6.0 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. Any written order or instruction of the engineer or his duly authorized representative, shall be communicated to the said authorized resident representing the contractor and the same shall be deemed to have been communicated to the contractor at his legal address.

# 7.0 CO-OPERATION WITH OTHER CONTRACTORS:-

- 7.1 The contractor shall co-operate with all other contractors or tradesmen of the owner, who may be performing other works on behalf of the owner and the workmen who may be employed by the owner and doing work in the vicinity of the works under the contract. The contractor shall also so arrange to perform his work as to minimize, to the maximum extent possible, interference with the work of other contractors and his workmen. Any injury or damage that may be sustained in the employees of the other contractors and the owner, due to the contractor's work shall promptly be made good at his own expense. The engineer shall determine the resolution of any difference or conflict that may arise between the contractor and other contractors or between the contractor and the workmen of the owner in regard to their work. If the works of the contractor is delayed because of any acts or omissions of another contractor, the contractor shall have no claim against the owner on that account other than an extension of time for completing his works.
- 7.2 The engineer shall be notified promptly by the contractor of any defects in the other contractor's works that could affect the contractor's works. The engineer shall determine the corrective measures if any, required to rectify this situation after inspection of the works and such decisions by the engineer shall be binding on the contractor.

**8.0 DISCIPLINE OF WORKMEN:** The contractor shall adhere to the disciplinary procedure set by the engineer in respect of his employees and workmen at site. The engineer shall be at liberty to object to the presence of any representative or employees of the contractor at the site, if in the opinion of the engineer such employee has misconducted himself or be incompetent or negligent or otherwise undesirable and then the contractor shall remove such a person objected to and provide in his place a competent replacement.

# 9.0 CONTRACTOR'S FIELD OPERATION:-

9.1 The contractor shall keep the engineer 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 engineer 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 engineer or the owner 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.

9.2 The contractor shall have 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 engineer is not intended to include review of contractor's safety measures in, on or near the work-site, and their adequacy or otherwise.

# **10.0 PHOTOGRAPHS AND PROGRESS REPORT:-**

10.1 The contractor shall furnish three (3) prints each to the engineer of progress photographs of the work done at site. Photographs shall be taken as and when indicated by the engineer or his representative. Photographs shall be adequate in size and number to indicate various stages of erection. Each photograph shall contain the date , the name of the contractor and the title of the photograph.

10.2 The above photographs shall accompany the monthly progress report detailing out the progress achieved on all erection activities as compared to the schedules. 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.

# **11.0 MAN-POWER REPORT:-**
11.1 The contractor shall submit to the engineer, on the first day of every month, a man hour schedule for the month, detailing the man hours scheduled for the month, skill wise and area -wise.

11.2 The contractor shall also submit to the engineer on the first day of every month, a man power report of the previous months detailing the number of persons scheduled to have been employed and actually employed, skill-wise and areas of employment of such labour.

**12.0 PROTECTION WORK:** The contractor shall have total responsibility for protecting his works till it is finally taken over by the engineer. No claim will be entertained by the owner or the engineer for any damage or loss to the contractor's works and the contractor shall be responsible for the complete restoration of the damaged works to its original condition to comply with the specifications and drawings. Should any such damage to the contractor's works occur because of other party not under his supervision or control, the contractor shall make his claim directly with the party concerned. If dis-agreement or conflict or dispute develops between the contractor and the other party or parties concerned regarding the responsibility for damage to the contractor's works the same shall be resolved as per the provisions of the clause 7.0 above entitled cooperation with other contractors. 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 the cause thereof will be assigned pending resolution of such dispute.

# **13.0 EMPLOYMENT OF LABOUR:-**

13.1 The contractor will be expected to employ on the work only his regular skilled employees with experience of his particular work. No female labour shall be employed after darkness no persons below the age of eighteen years s hall be employed.

- 13.2 All traveling expenses including provisions of all necessary transport to and from site lodging allowances and other payments to contractor's employees shall be the sole responsibility of the contractor.
- 13.3 The hour of work on the site shall be decided by the owner and the contractor shall adhere to it. Working hours will normally be eight (8) hours per day- Monday to Saturday.
- 13.4 Contractor's employees shall wear identification badges while on work at site.
- 13.5 In case the owner becomes liable to pay any wages or dues to the labour or to any Government agency under any of the provisions of the Minimum Wages Act, Workmen compensation Act, Contract Labour Regulation Abolition Act, CMPF Act/EPF Act or any other law due to act of omission of the contractor, the owner may make such payments and shall recover the same from the contractor's bills.

# 14.0 FACILITIES TO BE PROVIDED BY THE OWNER:-

**14.1 SPACE :** The contractor shall advise the owner within thirty (30) days from the date of acceptance of the letter of award, about his exact requirement of space for his office, storage area, pre-assembly and fabrication areas, toilets, etc. The above requirement shall be reviewed by the engineer and space will be allotted to the contractor for construction of his temporary structures like office, storage sheds and other utilities etc. for his own as well as his sub-contractor's use.

**14.2 ELECTRICITY:** The contractor shall submit to the engineer within thirty (30) days from the date of acceptance of the award letter, his electrical power requirements, if any, to allow the planning of the temporary electrical distribution by the engineer. The contractor shall be provided with supply of electricity for the purposes of the contract, only at one point in the project site. The contractor shall make his own further distribution arrangement. All temporary wiring must comply with local regulations and will be subject to engineer's inspection and approval before connection to supply. Power The contractor shall be charged for the power supplied at prevalent rate of power supplied by State Electricity Board.

**14.3 WATER:** Supply of water will be made available for the construction purposes at an agreed single point within100 metres of the work site. And further distribution will be the responsibility of the contractor. The contractor shall be charged for the water supplied at work site (a) 1% of the value of civil works and shall be deducted from the contractor's running/final bills.

# **15.0 FACILITIES TO BE PROVIDED BY THE CONTRACTOR:-**

**15.1 TOOLS, TACKLES AND SCAFFOLDINGS:** The contractor shall provide all the construction equipment, tools, tackles and scaffoldings required for pre-assembly, erection, testing and commissioning of the equipment covered under the contract. He shall submit a list of all such materials to the engineer before the commencement of pre-assembly at site. These tools and tackles shall not be removed from the site without the written permission of the engineer.

**15.2 COMMUNICATION:** The owner will extend the telephone & telex facilities, if available at site, for purposes of contract. The contractor shall be charged at actual for such facilities.

# 15.3 FIRST – AID:-

- 15.3.1 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.
- 15.3.2 The owner will provide the contractor, in case of an emergency, the services of an ambulance for transportation to the nearest hospital.

# **15.4 CLEANLINESS:-**

- 15.4.1 The contractor shall be responsible for keeping the entire area allotted to him clean and free from rubbish, debris etc. during the period of contract. The contractor shall employ enough number of special personnel to thoroughly clean his work area at least once in a day. All such rubbish and scrap material shall be stacked or disposed in a place to be identified by the engineer. Material sand stores shall be so arranged to permit easy cleaning of the area in areas where equipment might drip oil and cause damage to the floor surface, a suitable protective cover of a flame resistant, oil proof sheet shall be provided to protect the floor from such damage.
- 15.4.2 Similarly the labour colony, the offices and the residential areas of the contractor's employees and workmen shall be kept clean and neat to the entire satisfaction of the engineer. Proper sanitary arrangement shall be provided by the contractor, in the work areas, office and residential areas of the contractor.

**16.0 LINES AND GRADES:** All the works shall be performed to the lines, grades and elevations indicated on the drawings. The contractor shall be responsible to locate and layout the works. Basic horizontal and vertical control points will be established and marked by the engineer at site at suitable points. These points shall be used as datum for the works under the contract. The contractor shall inform the engineer well in advance of the times and places at which he wishes to do work in the area allotted to him, so that suitable datum points may be established and checked by the engineer to enable the contractor to proceed with his works. Any work done without being properly located may be removed and/or dismantled by the engineer at contractor's expense.

# **17.0 FIRE PROTECTION:-**

17.1 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 at least once each day. 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 area or storage.

17.2 Similarly corrugated paper fabricated cartons etc. will not be permitted in the construction area either for storage or for handling of materials. All such materials used shall be water proof and flame resistant type. All the other materials such as working drawings, plants, 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.

17.3 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.

17.4 The contractor shall provide enough fire protection equipment of the types and number for the ware -houses, office, temporary structures, labour colony area etc. Access to such fire protection equipment, shall be easy and kept open at all times.

**18.0 SECURITY:** The contractor shall have total responsibility for all equipment and materials in his custody stored, 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 los s. All materials of the contractor shall enter and leave the project site only with the written permission of the engineer in the prescribed manner.

**19.0 CONTRACTOR'S AREA LIMITS:** The engineer will mark-out the boundary limits of access roads, parking spaces, storage andConstruction areas for the contractor and the contractor shall not trespass the areas not so marked out for him. The contractor shall be responsible to ensure that none of his personnel move out of the areas marked out for his operations. In case of such a need for the contractor's personnel to work out of the areas marked out for him, the same shall be done only with the written permission of the engineer.

**20.0 CONTRACTOR'S CO-OPERATION WITH THE OWNER:** In cases where the performance of the erection work by the contractor affects the operation of the system facilities of the owner, such erection work of the contractor shall be scheduled to be performed only in the manner stipulated by the engineer and the same shall be acceptable at all times to the contractor. The engineer may impose such restrictions on the facilities provided to the contractor such as electricity, water, etc. as he may think fit in the interest of the owner and the contractor shall strictly adhere etc. such restrictions and co-operate with the engineer. It will be the responsibility of the contractor to provide all necessary temporary instrumentation and other measuring devices required during start-up and operation of the equipment systems, which are erected by him. The contractor shall also be responsible for flushing and initial filling of all the oil and lubricants required for the equipment furnished and erected by him, so as to make such equipment ready for operation. The contractor shall be responsible for supplying such flushing oil and other lubricants unless otherwise specified elsewhere in these documents & specifications.

**21.0 PRE-COMMISSIONING TRIALS AND INITIAL OPERATIONS:** The pre-commissioning trials and initial operations of the equipment furnished and erected by the contractor shall be the responsibility of the contractor as detailed in relevant clauses in section GTC. The contractor shall provide, in addition, test instruments, calibrating devices, etc. and the labour required for the successful performance of these trials. 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 trials.

# 22.0 MATERIALS HANDLING AND STORAGE:-

- 22.1 All the equipment furnished under the contract and arriving at site shall be promptly received, unloaded and transported and stored in the storage spaces by the contractor.
- 22.2 Contractor shall be responsible for examining all the shipment and notify the engineer immediately or any damage, shortage, discrepancy, etc. for the purpose of engineer's information only. The contractor shall submit to the engineer every week a report detailing all the receipts during the week. However, the contractor shall be solely responsible for any shortages or damage in transit, handling and/or in storage and erection of the equipment at the site. Any demurrage, wharfage and other such charges claimed by the transporters, railways etc. shall be to the account of the contractor.
- 22.3 The contractor shall maintain an accurate and exhaustive record detailing out the list of all equipment received by him for the purpose of erection and keep such record open for the inspection of the engineer at any time.
- 22.4 All equipment shall be handled very carefully to prevent any damage or loss. No bare wire ropes, slings, etc. shall be used for unloading and/or handling of the equipment without the specific written permission of the engineer. 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.
- 22.5 All electrical panels, control gear, motors and such other devices shall be properly dried by heating before they are installed and energized. Motor bearings, slip rings, commentators 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.
- 22.6 All the electrical equipment such as motors, generators, etc. shall be tested for insulation resistance at least once in three months 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 engineer.

- 22.7 The contractor shall ensure that all the packing materials and protection devices used for the various equipment during transit and storage are removed before the equipment are installed.
- 22.8 The consumable 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.
- 22.9 All the materials stored in the open or duty location must be covered with suitable weather-proof and flameproof covering materials wherever applicable.
- 22.10If the materials belonging to the contractor are stored in areas other than those earmarked for him, the engineer will have the right to get it moved to the area earmarked for the contractor at the contractor's cost.
- 22.11The contractor shall be responsible for making suitable indoor storage facilities to store all equipment which require indoor storage. Normally, all the electrical equipment such as motors, control gear, generators, exciters and consumable like electrodes, lubricants etc. shall be stored in the closed storage space. The engineer, in addition, may direct the contractor to move certain other materials which in his opinion will require indoor storage areas which the contractor shall strictly comply with.

# 23.0 CONSTRUCTION MANAGEMENT:-

- 23.1 The field activities of the contractors working at site, will be co-ordinate by the engineer and the engineer's decision shall be final in resolving any disputes or conflicts between the contractor and other contractors and tradesmen of the owner regarding scheduling and co-ordination of work. Such decision by the engineer shall not be a cause for extra compensation or extension of time for the contractor.
- 23.2 The engineer shall hold weekly meetings of all the contractors working at site, at a time and a place to be designated by the engineer. The contractor shall attend such meetings and take notes of discussions during the meeting and the decisions of the engineer and shall strictly adhere to those decisions in performing his works. In addition to the above weekly meetings, the engineer may call for other meetings either with individual contractors or with selected number of contractors and in such a case the contractor, if called will also attend such meetings.
- 23.3 Time is the essence of the contract and the contractor shall be responsible for performance this 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 engineer, satisfying that his action will compensate for the delay. The contractor shall not be allowed any extra compensation for such action.
- 23.4 The engineer shall however not be responsible for provision of additional labour and/or materials or supply or any other services to the contractor except for the co-ordination work between various contractors as set out earlier.

**24.0 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 condition of the equipment furnished and erected under the contract. Such drawings and engineering data shall be submitted to the engineer in required number of copies. Daily work programme with progress of the previous day and deployment of labour related to work programme and attendance of workmen deployed during the previous day shall be maintained in a register. This register shall be signed by authorized representative of the contractor which will then be checked and signed by the owner's representative. Every three months this register shall be deposited to the owner which shall then be owner's property.

# 25.0 CONTRACTOR'S MATERIALS BROUGHT ON TO SITE:-

25.1 The contractor shall bring to site all equipment, parts, materials, including construction equipment, tools and tackles for the purpose of the works with intimation to the engineer. All such goods shall, from the time of their being brought vest in the owner, but may be used for the purpose of the works only and shall not on any account

be removed or taken away by the contractor without the written permission of the engineer. The contractor shall nevertheless be solely liable and responsible for any loss or destruction thereof and damage thereto.

- 25.2 The owner shall have a lien on such goods for any sum or sums which may at any time be due or owing to him by the contractor, under, in respect of or by reasons of the contract. After giving a fifteen (15)days' notice in writing of his intention to do so, the owner shall be at liberty to sell and dispose of any such goods, in such manner as he shall think fit including public auction or private treaty and to apply the proceeds in or towards the satisfaction of such sum or sums due as aforesaid.
- 25.3 After the completion of the works, the contractor shall remove from the site under the direction of the engineer the materials such as construction equipment, erection tools and tackles, scaffolding etc. with the written permission of the engineer. If the contractor fails to remove such materials, within 15 days of issue of a notice by the engineer to do so then the engineer shall have the liberty to dispose of such materials as detailed under clause 25.2 above and credit the proceeds thereto the account of the contractor.

# 26.0 PROTECTION OF PROPERTY AND CONTRACTOR'S LIABILITY:-

- 26.1 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 owner and the employees of other contractors and sub-contractors and all public and private property including structures, buildings, other plants and equipment and utilities either above or below the ground.
- 26.2 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. The contractor shall be responsible to give reasonable notice to the engineer and the owners of public or private property and utilities when such property and utilities are likely to get damaged or injured during the performance of his works and shall make all necessary arrangements with such owners, related to removal and/o replacement or protection of such property and utilities.

**27.0 PAINTING:** All exposed metal parts of the equipment including pipings, structure railing etc. wherever applicable, after installation unless otherwise surface protected, shall be first painted with at least one coat of suitable primer which matches the shop primer paint used, after thoroughly cleaning all such parts of all dirt, rust, scales, greases, oils and other foreign materials by wire brushing, scarping or sand blasting, and the same being inspected and approved by the engineer for painting. Afterwards, the above parts shall be finished with two coats of alloyed resin machinery enamel paints. The quality of the finish paint shall be as per the standards of ISI or equivalent and to be of the colour as approved by the engineer.

# 28.0 INSURANCE:-

- 28.1 In addition to the conditions covered under the clause entitled insurance in general terms and conditions of contract of this volume, the following provisions will also apply to the portion of the works to be done beyond the contractor's own or his sub-contractor's works.
- 28.2 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

Workmen's compensationAs per statutory provisionsEmployer's liabilityAs per statutory provisions

The contractor shall take full responsibility to take all precautions to prevent loss or damage to the works or part thereof for any reasons whatsoever (except for reasons which are beyond control of the contractor or act of God, e.g. flood, riots, war, earthquake etc.) and shall be at his own cost repair and make good the loss/damage to the work so that on completion, the work shall be in good order and condition and in conformity with the requirements of the contract and instructions of the Engineer-incharge if any:

a) The contractor shall at all times during the pendency of the contract indemnify the company against all claims, damages or compensation under the provisions of the Workmen's Compensation Act and shall take insurance policy covering all risk, claims, damages or compensation payable under the Workmen's Compensation Act or under any other

law relating thereto.

b) The contractor shall pay directly the ex-gratia amount of Rs.5 lakhs to the same dependent as per the terms of contract or through insurance company by availing group personal accident Insurance policy for all its workers before commencement of the contract, which shall be renewed periodically to cover the entire duration of the contract. No reimbursement shall be made on this account by CIL/subsidiaries. In order to comply with the above provisions, the contractor shall immediately on receipt of letter of acceptance/work order shall obtain group personal accident insurance in respect of the workmen engaged in mining activities to ensure such payment of Rs. 5.0 lakhs in case of death in mine accident within 30 days. A proof to such effect shall be produced to the satisfaction of the management before commencement of the work. However, the responsibility of payment of special relief/ex-gratia amount shall be exclusively with the contractor. If the contractor fails to disburse the special relief/Ex-gratia within the due date, the subsidiary concerned may make the payment to the eligible dependent as mentioned here in above. However, such amount shall be recovered from the contractor from his dues either in the same and /or other subsidiaries/CIL.

- 28.3 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 owner's men and damage to the property of others arising from the use of motor vehicles during on or off the site operations, irrespective of the owners hip of such vehicles.
- 28.4 Comprehensive General Liability Insurance
- 28.4.1 This 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. The insurance shall also cover all the liabilities of the contractor arising out of the clause entitled defense of suits under General Terms and Conditions of contracts of this volume. 1.
- 28.4.2 The hazards to be covered will pertain to all the works which and areas where the contractor, his subcontractors, his agents and his employees have to perform work pursuant to the contract.
- 28.5 The above are only illustrative list of insurance covers normally required and it will be the responsibility of the contractor to maintain all necessary insurance coverage to the extent both in time and amount to take care of all his liabilities either direct or indirect, in pursuance of the contract.

**29.0 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 unfavorable construction conditions. No field activities shall be performed by the contractor under conditions which might adversely affect quality and efficiency thereof, unless special precautions or measures are taken by the contractor in a proper and satisfactory manner in performance of such works and with concurrence of the engineer. Such unfavorable construction conditions will in no way relieve the contractor of his responsibility to perform works as per the schedule.

**30.0 PROTECTION OF MONUMENTS AND REFERENCE POINTS:** The contractor shall ensure that any finds such as relic, antiquity, coins, fossils, etc. which he might come across during the course of performance of his works either during excavation or elsewhere, are properly protected and handed over to the engineer. Similarly the contractor shall ensure that the benchmarks, reference points, etc., which are marked out either with the help of engineer or by the engineer shall not be disturbed in any way during the performance of his works. If any work is to be performed which disturb such references, the same shall be done only after these are transferred to other suitable locations under the direction of the engineer. The contractor shall provide all necessary materials and assistance for such relocation of reference points etc.

# **31.0 WORK AND SAFETY REGULATIONS:-**

31.1 The contractor shall ensure proper safety of all the workmen, materials plant and equipment belonging to him or the Company or to others, working at or near 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 engineer-in-charge as he may deem necessary.

31.2 The contractor will notify well in advance to the engineer -in-charge of his intention to bring to the site any container filled with liquid or gaseous fuel or explosive or petroleum substance or such chemicals which may involve hazards. The engineer-in-charge shall have the right to prescribe the conditions, under which such container is to be stored, handled and used during the performance of the works and the contractor shall strictly adhere to and comply with such instructions. The engineer-in-charge shall have the right at his sole discretion to inspect any such container or such construction plant/equipment for which material in the container is required to be used and if in his opinion, its use is not safe, he may forbid its 'use. No claim due to such prohibition shall be entertained by the owner. Nor the owner shall entertain any claim of the contractor towards additional safety provisions/conditions to be provided for constructed as per engineer-in-charge's instructions.

Further any such decision of engineer-in-charge shall not, in any way, absolve the contractor of his responsibilities, and in case, use of such a container or entry thereof into the site area is forbidden by engineer-in-charge, the contractor shall use alternative methods with the approval of engineer-in-charge without any cost implication to Company or extension of work schedule.

- 31.3 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 engineer -in-charge. In case, any approvals are necessary from the Chief Inspector (Explosive) or any statutory authorities, the contractor shall be responsible for obtaining the same.
- 31.4 All equipment used in construction and erection by contractor shall meet Indian, Inter –national Standards and where such standards do not exist, the contractor shall ensure these to be absolutely safe. All equipment shall be strictly operated and maintained by the contractor in accordance with manufacturer's operation manual and safety instructions and per Guidelines/Rules of the Company in this regard.
- 31.5 Periodical Examinations and all tests for all lifting/hoisting equipment and tackles shall be carried out in accordance with the relevant provisions of Factories Act 1948, Indian Electricity Act 1910 and associated Laws/Rules enforced from time to time. A register of such examinations and tests shall be properly maintained by the contractor and will be promptly produced as and when desired by engineer–incharge or by the person authorized by him.
- 31.6 The contract shall be fully responsible for the safe storage of his and his sub-contractors radio-active sources in accordance with BARC/DAE Rules and other applicable provisions. All precautionary measures stipulated by BARC/DAE in connection with use, storage and handling of such material will be taken by contractor.
- 31.7 The contractor shall provide suitable safety equipment of prescribed standard to all employee and workmen according to the need, as may be directed by engineer-in-charge who will also have right to examine these safety equipment to determine their suitability, reliability, acceptability and adaptability.
- 31.8 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 practices/rules framed under Indian Explosives Act pertaining to handling, storage and use of the explosives.
- 31.9 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, stairs, ladders etc. 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.
- 31.10The contractor shall not interfere or disturb electric fuses, wiring and other electrical equipment belonging to the owner or other contractors under any circumstances, whatsoever, unless expressly permitted in writing by the Company to handle such fuses, wiring or electrical equipment.
- 31.11Before the contractor connects any electrical appliances to any plug or socket belonging to the other contractor or owner, he shall:
  - a. satisfy the engineer that the appliances is in good working condition
  - b. inform the engineer of the maximum current rating, voltage and phases of the appliances.
  - c. Obtain permission of the engineer detailing the sockets to which the appliances may be connected.
- 31.12The engineer will not grant permission to connect until he is satisfied that:
  - a .the appliance is in good condition and is fitted with a suitable plug.
  - b. the appliance is fitted with a suitable cable having two earth conductors, one of which shall be an earthed metal sheath surrounding the cores.

- 31.13No electric cable is in use by the contractor/owner will be disturbed without prior permission. No weight of any description will be imposed on any cable and no ladder or similar equipment will rest against or attached to it.
- 31.14No repair work shall be carried out on any live equipment. The equipment shall must be declared safe by engineer-in-charge and a permit to work shall be issued by engineer-in-charge before any repair work is carried out by the contractor. While working on electric lines/equipments whether alive or dead, suitable type and sufficient quantity of tools will have to be provided by contractor to electricians/workmen/officers.
- 31.15The contractor shall employ necessary number of qualified, full time electricians/ electrical supervisors to maintain in his temporary electrical installations.
- 31.16The contractor employing more than 250 workmen whether temporary, casual, probationer, regular or permanent or on contract, shall employ at least one full time officer exclusively as safety officer to supervise safety aspects of the equipment and workmen who will co-ordinate with the project safety officer.
- In case of work being carried out through sub-contractor, the sub-contractor's workmen/employees will also be considered as the contractor's employees/workmen for above purpose. The name and address of a safety officer of contractor will be promptly informed in writing to engineer-in-charge with a copy to safety officer-in charge before he starts work or immediately after any change of the incumbent is made during currency of the contract.
- 31.17In 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, whatsoever, it shall be the responsibility of the contractor to promptly inform the same to the company's engineer-in-charge in prescribed form and also to all the authorities envisaged under the applicable laws.
- 31.18The engineer-in-charge shall have the right at his sole discretion to stop the work, if in his opinion the work is being carried out in such a way that it may cause accidents and endanger the safety of the person sand/or property, and/or equipment. In such cases, the contractor shall be informed in writing about the nature of hazards and possible injury/accident and he shall comply to remove short comings promptly. The contractor after stopping the specific work, can, if felt necessary, appeal against the order of stoppage of work to the General Manager of the project within 3 days of such stoppage of work and decision of the project G.M in this respect shall be conclusive and binding on the contractor.
- 31.19The contractor shall not be entitled for any damages/compensation for stoppage of work due to safety reasons as provided in para 31.18 above and the period of such stoppage of work will not be taken as an extension of time for completion of work and will not be the ground for waiver of levy of liquidate damages.
- 31.20The contractor shall follow and comply with all the Company safety rules relevant provisions of applicable laws pertaining to the safety of workmen, employees, plant and equipment as may be prescribed from time to time without demur, protest or content or reservation. In case of any inconformity between statutory requirement and the Company safety rules referred above, the later shall be binding on the contractor unless the statutory provisions are more stringent.
- 31.21If the contractor fails in providing safe working environment as per the Company safety rules or continues the work even after being instructed to stop work by engineer -in-charge as provided in para above(31.18), the contractor shall promptly pay to the Company, on demand i.e. by the owner compensation at the rate of Rs. 5,000/= per day or part there of till the instructions are complied with an so certified by engineer -in-charge. However in case of accident taking place causing injury to any individual, the provisions contained in para (31.22) shall also apply in addition to compensation mentioned in this para.
- 31.22If the contractor does not take all safety precautions and/or fails to comply with the safety rules as prescribed by the Company or under the applicable laws 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 Company employees or any other person who are at site or adjacent thereto, the contractor shall be responsible for payment of compensation under the relevant provisions of the workmen's compensation act and rules framed there under or any other applicable laws as applicable from time to time.

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 hereunder or any other applicable laws as applicable from time to time.

In case the owner is made to pay such compensation then the contractor is liable to reimburse the owner such amount.

**32.0 CODE REQUIREMENTS**: The erection requirements and procedures to be followed during the installation of the equipment shall be in accordance with the relevant Indian Regulations. ASME codes and accepted good engineering practice, the engineer's drawings and other applicable Indian recognized codes and the laws and regulations of the Government of India.

# 33.0 FOUNDATION DRESSING AND GROUTING:-

- 33.1 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.
- 33.2 All the equipment bases and structural steel base plates shall be grouted and finished as per these specifications unless otherwise recommended by the equipment manufacturer.
- 33.3 The concrete foundation surfaces shall be properly prepared by chipping, grinding as required to bring the type of such foundation to the required level, to provide the necessary roughness for bondage and to assure enough bearing strength. All laitance and surface film shall be removed and cleaned.

**33.4 GROUTING MIX:** The grouting mixtures shall be composed of Portland cement, sand and water. The Portland cement to be used shall conform to ISI No. 269 or equivalent, sand shall conform to ISI No.383/2386 or equivalent. The grout proportions for flat based where the grouting space does not exceed 35 mm shall be 50 Kg bag of cement to 75 Kg of sand. Only the required quantity of water shall be added so as to make the mix quaky and flowable and the mix shall not show excess water on top when it is being puddled in place. For thicker grout beds up to 65 mm, the amount of sand shall be increased to 105 Kg per bag of cement. Bases which are hollow and are to be filed full of grouting shall be filled to a level of 25 mm above the outside rim with a mortar mix in the volumetric proportions of one bag of cement and 1.5 bags sand and 1.5 part 6 mm granite gravel. An acceptable plasticizer may be added to the grout mixes in a proportion recommended by the plasticizers manufacturer. All such grouts shall be thoroughly mixed for not less than five minutes in an approved mechanical mixer and shall be used immediately after mixing.

# 33.5 PLACING OF GROUT:-

- 33.5.1 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. T he height of such dam shall be at least 25 mm 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 and forth to push the grout into every part of the space under the base.
- 33.5.2 The grout shall be poured either through grout holes if provided or shall be poured at one side or at two adjacent sides giving it a pressure head 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.

**33.6 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 out off flush and removed. The edges of the grout shall then be pointed and finished with1:2 cement mortar pressed firmly to bond with the body of the grout and smoothed with a tool to present 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

**33.7 CHECKING OF EQUIPMENT AFTER GROUTING**: After the grout is set and cured, the contractor shall check and verify the alignment of equipment, alignment of shafts of rotating machinery, the slopes of all bearing pedestals, centring of rotors with respect to their sealing bores, couplings, etc. as applicable and the like items to ensure that no displacement had taken place during grouting. The values recorded prior to grouting shall be used during such post grouting check-up and verifications. Such pre and post grout records of alignment details shall be maintained by the contractor in a manner acceptable to the engineer.

**34.0 SHAFT ALIGNMENTS:** All the shafts of rotating equipment shall be properly aligned to those of the matching equipment to as perfect accuracy as practicable. The equipment shall be free from excessive vibration so as to avoid over-heating of bearings or other conditions which may tend to shorten the life of the equipment. All bearings, shafts and other rotating parts shall be thoroughly cleaned and suitably lubricated before starting.

**35.0 DOWELING:** All the motors and other equipment shall be suitably doweled after alignment of shafts with tapered machined dowels as per the direction of the engineer.

**36.0 CHECK OUT OF CONTROL SYSTEMS / POWER SUPPLY:** After completion of wiring, cabling furnished under separate specifications and laid and terminated by the owner, the contractor shall check out the operation of all control systems for the equipment furnished and installed under these specifications and documents. The contractor shall get the drawings pertaining to the control system, power supply etc. approved from applicable agencies

**37.0 COMMISSIONING SPARES:** The contractor shall make arrangement for an adequate inventory at site of necessary commissioning spares prior to commissioning of the equipment furnished and erected so that any damage or loss during this commissioning activities necessitating the requirements of spares will not come in the way of timely completion of the works under the contract.

# 38.0 CABLING:-

- 38.1 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 interval of 2000 mm or otherwise as directed by the engineer.
- 38.2 Each cable, whether power or control, shall be provided with a metallic or plastic of an approved type, bearing a cable reference number indicated in the cable and conduit list (prepared by the contractor), at every 5 metre run or part thereof and at both ends or 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.
- 38.3 Sharp bending and kinking of cables shall be avoided. The minimum radii for PVC insulated cables1100 V grade shall be 15D, where D is the overall diameter of the cable. 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 gas lines, special care should be taken for the protection of the cables in designing the cable channels.
- 38.4 In each cable run some extra length shall be kept at a suitable point to enable one to two straight through joints to be made should the cable develop fault at a later date.
- 38.5 Control cable terminations shall be made in accordance with wiring diagrams, using identifying codes subject to engineer'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 specially treated fungus protected cord made for this purpose. Control cable conductor insulation shall be securely and evenly cut.
- 38.6 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 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.

# **39. SAFETY CODE**.

1. Suitable scaffolds should be provided for workmen for all works that cannot safely be done from the ground, or from solid construction except such short period work as can be done safely from ladders. When a ladder is used, an

extra mazdoor shall be engaged for holding the ladder and if the ladder is used for carrying materials as well suitable footholds and hand-hold shall be provided on the ladder and the ladder shall be given an inclination not steeper that  $\frac{1}{4}$  to 1 ( $\frac{1}{4}$  horizontal and 1 vertical).

- 2. Scaffolding of staging more than 3.6 m (12ft). above the ground or floor, swung or suspended from an overhead support or erected with stationary support shall have a guard rail properly attached or bolted, braced and otherwise secured at least 90 cm (3ft) high above the floor or platform of such scaffolding or staging and extending along the entire length of the outside and ends thereof with only such opening as may be necessary for the delivery of materials. Such scaffolding or staging shall be so fastened as to prevent it from swaying from the building or structure.
- 3. Working platforms, gangways and stairways should be so constructed that they should not sag unduly or unequally, and if the height of the platform or the gangway or the stairway is more than 3.6 m (12ft) above ground level, they should be closely boarded, should have adequate width and should be suitably fastened as described in (2) above.
- 4. Every opening in the floor of a building or in a working platform shall be provided with suitable means to prevent the fall of person or materials by providing suitable fencing or railing whose minimum height shall be 90 cm (3ft).
- 5. Safety means of access shall be provided to all working platforms and other working places. Every ladder shall be securely fixed. No portable single ladder shall be over 9 m (30ft) in length while the width between side rails in rung ladder shall in no case be less than 20 cm (11 ½") for ladder upto and including 3 m (10ft) in length. For longer ladders, this width should be increased at least ¼" for additional 30 cm (1ft.) of length. Uniform step spacing of not more than 30 cm shall be kept. Adequate precautions shall be taken to prevent danger from electrical equipment. No materials on any of the sites or work shall be so stacked or placed as to cause danger or inconvenience to any person or the public. The contractor shall provide all necessary fencing and lights to protect the public from accident and shall be bound to bear the expenses of defence of every suit, action or other proceedings at law that may be brought by any person for injury sustained owing to neglect of the above precautions and to pay any damages and cost which may be awarded in any such suit; action or proceedings to any such person or which may, with the consent of the contractor, be paid to compensate any claim by any such person.
- 6. Excavation and Trenching: All trenches 1.2 m (4ft) or more in depth, shall at all times be supplied with at least one ladder for each 30 m. (100 ft.) in length or fraction thereof. Ladder shall extend from bottom of the trench to at least 90 cm (3ft) above the surface of the ground. The side of the trenches which are 1.5 m (5ft) or more in depth shall be stepped back to give suitable slope or securely held by timber bracing, so as to avoid the danger of sides collapsing. The excavated materials shall not be placed within 1.5 m (5ft) of the edges of the trench or half of the depth of the trench whichever is more. Cutting shall be done from top to bottom. Under no circumstances, undermining or undercutting shall be done.
- 7. Demolition : before any demolition work is commenced and also during the progress of the work,
  - i. All roads and open areas adjacent to the work site shall either be closed or suitably protected.
  - ii. No electric cable or apparatus which is liable to be a source of danger or a cable or apparatus used by the operator shall remain electrically charged.
  - iii. All practical steps shall be taken to prevent danger to persons employed from risk of fire or explosion or flooding. No floor, roof or other part of the building shall be so overloaded with debris or materials as to render it unsafe.
- 8. All necessary personal safety equipment as considered adequate by the Engineer-in-Charge should be kept available for the use of the person employed on the site and maintained in a condition suitable for immediate use, and the contractor should take adequate steps to ensure proper use of equipment by those concerned:- The following safety equipment shall invariably be provided.

- i) Workers employed on mixing asphaltic materials, cement and lime mortars shall be provided with protective footwear and protective goggles.
- ii) Those engaged in white washing and mixing or stacking of cement bags or any material which is injurious to the eyes, shall be provided with protective goggles.
- iii) Those engaged in welding works shall be provided with welder's protective eye-shields.
- iv) Stone breaker shall be provided with protective goggles and protective clothing and seated at sufficiently safe intervals.
- v) When workers are employed in sewers and manholes, which are in active use, the contractors shall ensure that the manhole covers are opened and ventilated at least for an hour before the workers are allowed to get into the manholes, and the manholes so opened shall be cordoned off with suitable railing and provided with warming signals or boards to prevent accident to the public. In addition, the contractor shall ensure that the following safety measures are adhered to:-
- a) Entry for workers into the line shall not be allowed except under supervision of the Engineering Assistant or any other higher officer.
- b) At least 5 to 6 manholes upstream and downstream should be kept open for at least 2 to 3 hours before any man is allowed to enter into the manhole for working inside.
- c) Before entry, presence of Toxic gases should be tested by inserting wet lead acetate paper which changes colour in the presence of such gases and gives indication of their presence.
- d) Presence of Oxygen should be verified by lowering a detector lamp into the manhole. In case, no Oxygen is found inside the sewer line, workers should be sent only with Oxygen kit.
- e) Safety belt with rope should be provided to the workers. While working inside the manholes, such rope should be handled by two men standing outside to enable him to be pulled out during emergency.
- f) The area should be barricaded or condoned of by suitable means to avoid mishaps of any kind. Proper warming signs should be displayed for the safety of the public whenever cleaning works are undertaken during night or day.
- g) No smoking or open flames shall be allowed near the blocked manhole being cleaned.
- h) The malba obtained on account of cleaning of blocked manholes and sewer lines should be immediately removed to avoid accidents on account of slippery nature of the malba.
- i) Workers should not be allowed to work inside the manhole continuously. He should be given rest intermittently. The Engineer-in-Charge may decide the time up to which a worker may be allowed to work continuously inside the manhole.
- j) Gas masks with Oxygen Cylinder should be kept at site for use in emergency.
- k) Air-blowers should be used for flow of fresh air through the manholes. Whenever called for, portable air blowers are recommended for ventilating the manholes. The Motors for these shall be vapour proof and of totally enclosed type. Non sparking gas engines also could be used but they should be placed at least 2 meters away from the opening and on the leeward side protected from wind so that they will not be a source of friction on any inflammable gas that might be present.

- 1) The workers engaged for cleaning the manholes / sewers should be properly trained before allowing to work in the manhole.
- m) The workers shall be provided with Gumboots or non-sparking shoes bump helmets and gloves non sparking tools safety lights and gas masks and portable air blowers ( when necessary). They must be supplied with barrier cream for anointing the limbs before working inside the sewer lines.
- n) Workmen descending a manhole shall try each ladder stop or rung carefully before putting his full weight on it to guard against insecure fastening due to corrosion of the rung fixed to manhole well.
- o) If a man has received a physical injury, he should be brought out of the sewer immediately and adequate medical aid should be provided to him.
- p) The extents to which these precautions are to be taken depend on individual situation but the decision of the Engineer-in-Charge regarding the steps to be taken in this regard in an individual case will be final.
- vi) The Contractor shall not employ men and women below the age of 18 years on the work of painting with products containing lead in any form. Wherever men above the age of 18 are employed on the work of lead painting, the following precaution should be taken:-
- a) No paint containing lead or lead products shall be used except in the form of paste or readymade paint.
- b) Suitable face masks should be supplied for use by the workers when paint is applied in the form of spray or a surface having lead paint is dry rubbed and scrapped.
- c) Overalls shall be supplied by the contractors to the workmen and adequate facilities shall be provided to enable the working painters to wash during and on the cessation of work.
- d) Measures shall be taken, wherever practicable, to prevent danger arising out of from dust caused by dry rubbing down and scraping.
- e) Adequate facilities shall be provided to enable working painters to wash during and on cessation of work.
- f) Overall shall be worn by working painters during the whole of working period.
- g) Suitable arrangement shall be made to prevent clothing put off during working hours being spoiled by painting materials.
- 9. When the work is done near any place where there is risk of drowning, all necessary equipment should be provided and kept ready for use and all necessary steps taken for prompt rescue of any person in danger and adequate provision, should be made for prompt first aid treatment of all injuries likely to be obtained during the course of the work.
- 10. Use of hoisting machines and tackle including their attachments, anchorage and supports shall conform to the following standards or conditions:
  - i) (a) These shall be of good mechanical construction, sound materials and adequate strength and free from patent defects and shall be kept repaired and in good working order.

(b) Every rope used in hoisting or lowering materials or as a means of suspension shall be of durable quality and adequate strength, and free from patent defects.

- Every crane driver or hoisting appliance operator, shall be properly qualified and no person under the age of 21 years should be in charge of any hoisting machine including any scaffolding winch or give signals to operator.
- iii) In case of every hoisting machine and of every chain ring hook, shackle swivel and pulley block used in hoisting or as means of suspension, the safe working load shall be ascertained by adequate means. Every hoisting machine and all gear referred to above shall be plainly marked with the safe working load. In case of a hoisting machine having a variable safe working load each safe working load and the condition under which it is applicable shall be clearly indicated. No part of any machine or any gear referred to above in this paragraph shall be loaded beyond the safe working load except for the purpose of testing.
- iv) In case of departmental machines, the safe working load shall be notified by the Electrical Engineer-in-Charge. As regards contractor's machines the contractors shall notify the safe working load of the machine to the Engineer-in-Charge whenever he brings any mach8inery to site of work and get it verified by the Electrical Engineer concerned.
- 12. Motors, gearing, transmission, electric wiring and other dangerous parts of hoisting appliances should be provided with efficient safeguards. Hoisting appliances should be provided with such means as will reduce to the minimum the risk of accidental descent of the load. Adequate precautions should be taken to reduce to the minimum the risk of any part of a suspended load becoming accidentally displaced. When workers are employed on electrical installations which are already energized, insulating mats, wearing apparel, such as gloves, sleeves and boots as may be necessary should be provided. The worker should not wear any rings, watches and carry keys or other materials which are good conductors of electricity.
- 13. All scaffolds, ladders and other safety devices mentioned or described herein shall be maintained in safe condition and no scaffold, ladder or equipment shall be altered or removed while it is in use. Adequate washing facilities should be provided at or near places of work.
- 14. These safety provisions should be brought to the notice of all concerned by display on a notice board at a prominent place at work spot. The person responsible for compliance of the safety code shall be named therein by the contractor.
- 15. To ensure effective enforcement of the rules and regulations relating to safety precautions the arrangements made by the contractor shall be open to inspection by the Labour Officer or Engineer-in-Charge of the department or their representatives.
- 16. Notwithstanding the above clauses from (1) to (15), there is nothing in these to exempt the contractor from the operations of any other Act or Rule in force in the Republic of India.

# SUB-CLAUSE- 3.3

# ADDITIONAL TERMS & CONDITIONS OF CONTRACT

The following additional terms & conditions are also acceptable to the company. The tenderers are requested not to quote any additional conditions in their tender.

# 1. VARIATION IN THE TAXES, DUTIES, LEVIES ETC.

Other statutory variation due to increase in taxes, duties, levies etc. by Govt. (Central or State or Local) as of thirty (30) days prior to the date of opening of the bid or the revised price bid, whichever is later, with the taxes, duties, levies etc. during the manufacture/works/supply, as the case may be, shall be born by the owner. Similarly decrease in taxes, duties, levies etc. shall be returned/deducted to/by the owner.

# Sub Clause 3.4

# **Special Conditions of the Contract**

The following Special Conditions of Contract (SCC) shall supplement the General Conditions of Contract (GCC). Wherever there is a conflict, the provisions herein shall prevail over those in the GCC. The corresponding clause number of the GCC is indicated in parentheses

1.	Definitions in GCC	"Facilities" means the Plant and Equipment to be supplied and installed, as well as all the Installation Services to be carried out by the Contractor under the Contract.
2.	GCC 3.0	Replace the clause 3.0 of GCC by the following:
		3.0 CONTRACT PERFORMANCE GUARANTEE/SECURITY DEPOSIT
		<ul> <li>3.1</li> <li>3.1. 1 Performance Security should be 10% of contract amount and should be submitted by the successful bidder within 30 days of issue of LOA in any of the form given below after which bid security/earnest money will be refunded to the contractor.</li> <li>- a Bank Guarantee in the form given in the bid document from any schedule bank acceptable to the owner. Bank Guarantee issued by outstation bank shall be operative at its local branch at Ranchi (Jharkhand)</li> <li>- Govt. Securities, FDR (Scheduled Bank) or any other form of deposit stipulated by the owner and duly pledged in favour of owner.</li> <li>- Demand Draft drawn in favour of Central Coalfields Ltd. on any Scheduled Bank payable at its Branch at Ranchi. The Earnest Money/ Bid Security deposited shall be discharged when the Bidder has signed the agreement and furnished the required performance security/1<sup>st</sup> part of security deposit. The bid Security deposited may be adjusted against the performance security (1<sup>st</sup> part of security deposit) at bidder's option.</li> </ul>
		<ul> <li>3.1.2 If performance security is provided by the successful bidder in the form of bank guarantee it shall be issued either -</li> <li>a) at Bidder's option by a Scheduled Bank as per provisions of Cl.3.1.1. The BG shall contain complete postal address, telephone number, fax number and email address of both out station bank issuing the BG as well as its local operating branch</li> </ul>

b) by a foreign b	bank located in India and	acceptable to the employe	r.
(ii). The Bank G contractor in form as well (SFMS)".	uarantee (BG) issued by favour of "Central Coal as issued under "Structu	y the issuing Bank on be fields Limited" shall be i ired Financial Messaging	ehalf of n paper System
The details o SFMS	f beneficiary for issue platform is	of Bank Guarantee (BG furnished	) under below:
	Name	Central Coalfields Limited	
Name of beneficiary and	Area Bank A/C no. of beneficiary	HQ 10106155123	-
details	Customer ID/CIF no of beneficiary	80288731402	-
	Department Beneficiary's Bank	E&M State Bank of India	-
Beneficiary's Bank, Branch and Address	Branch and Adress	SME Branch, Doranda, ranchi - 834002	
	SFMS Code/ IFSC Code	SBIN0009620	
	In case of Foreign BG Swift Code	SBININBB387	
<ul> <li>3.2 The Guarantee amoves whatsoever.</li> <li>3.3 Performance Security successful completion of operations.</li> <li>1. Performance security beyond defect liability one year after satisfactors.</li> </ul>	ount shall be payable to urity shall be convert f work in accordance wi submitted in the for ty period. The Defect L actory trial operations.	the Employer without an ted into Performance Gu th contract and upon satis of BG shall be valid tiability period in this ca	ny condition harantee on factory trial for 90 days ase shall be
<b>3.4</b> The Performance C the Employer:	Guarantee shall cover ad	ditionally the following g	uarantees to
<ul> <li>(a) The successful the equipme specifications</li> <li>(b) The successful installed by I workmanship free of expens</li> </ul>	bidder guarantees the su ent furnished and erect s and documents, il bidder further guarant nim shall be free from and shall upon written n es to the Employer such	ted under the contract, ted under the contract, tees that the equipment p all defects in design, r notice from the employer f defects as developed unde	operation of as per the rovided and naterial and fully remedy r the normal

<ul> <li>use of the said equipment within the period of defect liability.</li> <li>3.5 The Contract Performance Guarantee is intended to secure the performance of the entire Contract. However it is not construed as limiting the damages under clause entitled 'Equipment Performance Guarantee' in section Technical Conditions of Contract and damages stipulated in the other clauses in the bidding documents.</li> <li>3.6 All Bank Guarantees are to be submitted in the format prescribed by the company in the bid document. Bank Guarantee shall be irrevocable and it shall be from any Scheduled Bank acceptable to the owner. The BG issued by outstation bank shall be operative at its local branch at Ranchi.</li> <li>3.7 The Company shall be at liberty to deduct/appropriate from the Contract Performance Guarantee/Security Deposit such sums as are due and payable by the contractor to the company as may be determined in terms of the contract, and the amount appropriated from the Contract Performance Guarantee/Security Deposit shall have to be restored by Contractor subsequently.</li> <li>3.8 The Contract Performance Guarantee will be returned to the Contractor without any interest at the end of the defect liability period. Any defect/defects in the work, if detected during defect liability period shall be rectified to the satisfaction of the Engineer-in- Charge within the said defect liability period or its due extension till completion of the rectification works as required.</li> <li>3.9 Failure of the successful Bidder to comply with the requirements of Sub- Clause 3.1 shall constitute sufficient grounds for cancellation of the award and forfeiture of the Bid Security. In addition to the above penal measures, the bidder will not be allowed to participate in the re-tendering process. The bidder may also be debarred from participating in future tenders in the subsidiary for a minimum period of 12 Months.</li> </ul>
3.10 Security against quoting Annual Generation in excess of 45MU
In case the successful Bidder, to whom the work is awarded, has quoted the Annual Generation (G) more than 45 MU, he shall provide security in the form of Bank Guarantee for meeting the Quoted Annual Generation Target. The Rate of Bank Guarantee per MU for the portion of Quoted Annual Generation in excess of <b>45 MU</b> shall be <b>INR 3.67 Crore per MU (INR Three Crore Sixty Seven Lakhs per Million Unit).</b> The Bank Guarantee (BG) issued by the issuing Bank on behalf of contractor in favour of "Central Coalfields Limited" shall be in paper form as well as issued under "Structured Financial Messaging System (SFMS)". The details of beneficiary for issue of Bank Guarantee (BG) under SFMS platform has already been furnished above. The security shall be submitted by the bidder within 30 days after the issuance of LOA/Award of the Contract and shall be valid upto 15 Months beyond the scheduled date for Completion of Facilities covered under the Package. Thus total validity of the BG shall be 24 months (9 months+12 months +3 months).
<u>3.11 Security against Overall System Performance during O&amp;M,</u> <u>Warranty and AMC Period</u>
3.11.1 The successful Bidder, to whom the work is awarded, shall provide security equal to <b>INR 3.32 Lakhs per MU</b> ( <b>INR Three Lakhs Thirty Two Thousand per MU</b> ) of Quoted Annual Generation (i.e. INR 3.32 Lakhs per MU x Annual Quoted Generation in MU) <b>for remaining Four (04) years of Comprehensive O&amp;M period</b> in the form as provided in Annexure VII The Bank Guarantee (BG)

		<ul> <li>issued by the issuing Bank on behalf of contractor in favour of "Central Coalfields Limited" shall be in paper form as well as issued under "Structured Financial Messaging System (SFMS)". The details of beneficiary for issue of Bank Guarantee (BG) under SFMS platform has already been furnished above.</li> <li>Any defect/defects in the work, if detected during Comprehensive O&amp;M period shall be rectified free of expenses to the satisfaction of the Engineer-in- Charge within the said O&amp;M period or its due extension till completion of the rectification works as required.</li> </ul>			
		The above security shall be submitted prior to return of the Contract Performance Security (CPG) under the subject package. The above Security shall be valid up to (90) days after the end of Comprehensive Operation & Maintenance (O&M) perior as specified in the Technical Specifications. The above security amount shall be payable to the Employer without any condition whatsoever.			
		CPG shall be released only after submission of the above by the Contractor.			
		The bidder will furnish the above security initially valid upto 90 days beyond Comprehensive Operation & Maintenance (O&M) period.			
		3.11.2 Beyond 5th year (from 6th year to 10th year), the bidder is required to submit a fresh BG for a further period of 5 years to cover comprehensive AMC of Inverter, SCADA & tracker system (if applicable) as per the following:			
		(a) BG amount of Rs. 1.0 Lakh/MW only in case tracker system is not offered by the bidder.			
		(b) BG amount of Rs. 1.25 Lakh/MW only in case tracker system is offered by the bidder.			
		The above Security shall be valid upto 90 days after the end of AMC period as specified in the Technical Specification.			
		The Bank Guarantee as specified at point 3.11.1 shall be released only after submission of BG as above by the Contractor.			
		The above BG will be returned to the contractor without any interest at the end of 10 years(AMC Period)			
3.	Clause 6 of	6.0 TIME - THE ESSENCE OF CONTRACT:			
	GCC	It is clearly understood and agreed that time is the essence of this Contract and shall be strictly adhered to by the Contractor. The time and the date of completion of the works as stipulated in the contractor's proposal and accepted by the owner without or with modifications, if any and so incorporated in the award letter shall be deemed to be the essence of the contract. The contractor shall so organise his resources and perform his work as to complete it not later than the date agreed to. The program of furnishing, installing, commissioning, completion of facilities and FOR site delivery of all mandatory spares, identifying the key phases in various areas of work like design, procurement, manufacture and field activities including erection works. Planning, Design & Engineering, civilworks			
		(including structural steel works) allied works etc. shall be as per master			

network submitted by the Bidder as per Annexure XXV and mutually discussed and agreed to before Notification of Award.

The Master Network shall confirm to the following schedule dates for the key milestones.

Implementation Schedule for of 20 MW as under:

S.N.	Activities/Milestone	Period in months (after completion of time as mentioned in Cl. No. 24.2 of ITB)		
		Start	Finish	
Gene	ral Works			
1.	Site Mobilization, Site office opening and Preparatory works	0.5	1	
2.	Topography & Geo Technical Investigations	0.5	1	
3.	Approval of Details Required (DR)Category Vendors	0.5	2	
4.	<ul> <li>(Solar Plant)</li> <li>Approval of Solar Plant Layout</li> <li>MMS- Structure and Foundation Design</li> <li>Data sheet- Modules, Inverters and Transformers</li> <li>Foundation drawings for Control and Inverter Rooms</li> <li>Basic Engineering &amp; Approvals (Switchyard)</li> <li>Approval of Switchyard Layout</li> <li>Approval of Structure and Foundation Design</li> </ul>	0.5	3	
5	Ordering of BOIs	1	3	
6	Detailed Engineering and Approvals	3	4	
Solar Plant Works – DC Side				
7	Civil works –Foundations for MMS	3	5	
8	Supply of Module Mounting Structures	3.5	5	
9	Installation of Module Mounting Structures	4	6	
10	Supply of SPV Modules	4.5	6.5	
11	Installation of SPV Modules	5	7	

	a 1 10 a a 11		-	
12	Supply of DC Cables	4	6	-
13	Laying of DC Cables	5	7	
Solar Plant Works – AC Side				
.4	Supply of Cables, Inverter Transformer, Inverters & other Electrical Equipments	4.5	6.5	
	Installation of Cables, Inverter Transformer, Inverters & other Electrical Equipments	5	7	
	Control Room worksCivil &Electrical works	3	6	-
17	Inverter Room works—Civil & Electrical works	3	6	
18	Fencing, Road and Drainage works and other civil works	3	7	1
19	Testing of Equipments & Readiness of SCADA	7	7.5	1
Bay &	& Switchyard Works			
20	Civil Works for Bays, Overhead Line & Switchyard	4	6	
21	Supply of Bay Equipments, Overhead Line Materials and Power Transformer	4.5	6.5	
22	Installation of Bays Equipments, Overhead Line and Power Transformer	5	7	
23	Charging of Power Transformer	7	7.5	
Com Com	nissioning, Trial Run and pletion of Facilities			
24	Commissioning	7.5	8.5	]
25	Stabilization & Trial Run	8.5	9	
26	Completion of facilities		9	

		2. Within one month of the Notification of Award, the Contractor shall submit to the Employer for his review and approval two copies (one reproducible and one print) of detailed PERT Network schedules with master network activities further exploded based on the Master Network mutually agreed by the Employer and the Contractor, showing the logic and duration of the activities covered in Contract in the following areas:			
		Engineering, procurement, manufacturing and supply, detailed engineering, procurement (including bought out items), manufacturing, dispatch, shipment, receipt at site, field activities related to erection works, commissioning and completion of facilities and O&M.			
		4.0 Further, all engineering data related to civil input, interface engineering details, requiring employer's approval/information for items in the scope of Employer are to be given within the agreed schedule but in no case later than 45 days from the date of Notification of award. For bought out items, the contractor shall furnish the engineering input data to the employer within the agreed schedule but in no case later than 45 days from the date of no case later than 45 days from the sub-vendors.			
		5.0 Detailed Manufacturing Programme			
		Detailed Manufacturing PERT Network for all the manufacturing activities at Contractor's/sub-Contractor's works shall also be furnished within 60 days of Notification of Award. The manufacturing network shall be supported by detailed procurement programme for critical bought out item/raw materials.			
		6.0 Pre-Erection Activity Programme			
		The erection network will be supported by detailed Pre-erection activity programme covering the following:			
		A) Manpower Deployment			
		B) T&P Mobilization			
		C) Detailed Site Mobilization			
4	Clause 10,	(deleted For this document) 10.0 CONTRACT PRICE ADJUSTMENT:-			
5	Clause 15 of GCC	15 Liquidated damage for delay in Completion : (A)Liquidated Damages for Delay in Commissioning shall be as under:			
		If the Contractor fails to successfully achieve commissioning of 20 MW Project within <b>8.5 months</b> from the time schedule specified in the Bidding Documents at Clause No 24.2 of ITB, the Contractor shall pay to the Employer as Liquidated Damages and not as penalty, a sum calculated at following rates.			

		A sum of INR 29,737/- per Day per MW	For each day of delay in un- commissioned portion of work in MW till commissioning of entire project of <b>20 MW</b> , subject to a maximum of 5 % (Five Percent) of the total Contract Price (value of supply, F&I, Installation Services (Erection, Commissioning), Civil & Allied works excluding O&M Price).
		(B)The liquidated damages for a stipulated under the Contract sha	delay in supply of spares beyond the dates all be as follows:
		Half percent (1/2%) of Ex-We part thereof of delay subject to Ex-Works Price of all spares in under the Contract.	orks price of undelivered spares, per week or to maximum of five percent (5%) of the total included in the scope of work of the Contractor
		(C) Maximum deduction for	or liquidated damages:
		The total amount of liquidated damag to a maximum of five percent (5%) of	es for delay under the contract will be subject the total Contract Price.
6	Clause 33.0	<b>33.0 GUARANTEE</b> 33.1 The contractor shall w accordance with the contr material, design, manufactu ( <b>60</b> ) calendar months com completion of the trial op limited to the replacement of own manufacture or those replacement of the comple solely form faulty design, provided always that such d site/ replacing the equipmen of the plant. Such replace returned to the contractor replacements shall be car employer during the 60 of supervision of the contractor	varrant that the equipment will be new and in act documents and be free from defects in ure and workmanship for a period of <b>Sixty</b> mencing immediately upon the satisfactory berations. The contractor's liability shall be of any defective parts in the equipment of his of his sub-contractor (s)/ subvendor (s) or ete equipment, under normal use and arising manufacture, materials, and/or workmanship lefective parts/ equipment are repairable at the nt as a whole without hampering the operation ed defective parts/ old equipment shall be r unless otherwise arranged. No repairs or tried out by the engineer-in-charge of the calendar months, as the plant is under the r's supervisory engineers/staff.
		33.2 The operation of the pl provisions of tender do responsible for maintain including repair, replac equipment etc. free of cos	ant will be done by the contractor as per cument. The successful contractor shall be ning the plant during 60 calendar months cement of the spare parts, components, st.

		33.3	If the facilities or any part thereof cannot be used by reason of such defect and/or making good such defect, 60 calendar months (i.e. one year of Defect liability period (DLP) and Comprehensive maintenance of plant by contractor for remaining four years of operation,, as per the provisions of tender document) of any facilities or such part, as the case may be, shall be extended by a period equal to the period during which the facilities or such part cannot be used by the employer because of aforesaid reasons.
		33.4 In c of c open etc.	case of failure of any equipment/system in during the initial period 60 calendar months from satisfactory completion of the trial rations ,the contractor shall repair/replace the equipment/system at his own cost.
7	Clause 41.6	41.6 TERMS	OF PAYMENTS:-
	of GCC	A. Sched	ule No.1: Plant and Equipment including type Test (excluding Mandatory Spares)
		In resp made:	ect of plant and equipment supplied the following payments shall be
		For Ex (exclue	-works Price component of plant and Equipment including Type Tests ding Mandatory Spares)
		(I) <b>Five P</b> Payme	<b>Percent (5 %)</b> of the total Ex-Works price component as Initial Advance ont on:
		(a) Accep Agree	otance of Notification of Award and Signing of the Contract ement.
		(b)	Submission of an unconditional Bank Guarantee covering the advance amount plus GST as applicable on the advance payment to be paid to the contractor, which shall be initially kept valid upto Ninety (90) days beyond the schedule date for Completion of the last facility covered under the Package. However, in case of delay in completion of the facilities covered under the package, the validity of this Bank Guarantee shall be extended by the period of such delay. Proforma of Bank Guarantee is enclosed in Annexure V.
		(c)	Submission of unconditional Bank Guarantees towards Contract Performance Securities as per Clause 3.1.1 of GCC(Replaced at Clause 2 of SCC)
		(d)	Submission of unconditional Bank Guarantee towards Security against Annual Quoted Generation in excess of 45 MU for 20 MW Solar PV Project as per Clause 3.10 of GCC(Replaced at Clause 2 of SCC).
		(e)	Submission of a detailed PERT Network based on the work schedule stipulated in the bid document and its approval by consultant of Employer and further agreed by Engineer In- charge.
		(II) Sixty	Percent (60%) of Ex-works price component of the Contract price for

B.	Schedule 1 and 4: Mandatory Spares and Recommended Spares (When ordered) quoted on Ex-works (India) basis
	<ul> <li>furnished by the Contractor and approved by the Engineer-in-Charge.</li> <li>(i) In case Installation Price (excluding civil/structural works price) is less than 15% of the Ex-works Price of Main Equipment, the amount by which it is lower shall be retained from the Ex-works Component of Contract Price while releasing payment due on receipt of equipment, and no interest shall be payable on the retained amount. The aforesaid retained amount shall be paid on prorate basis upon completion of installation of the respective equipment and its certification by the Consultant of the employer and further agreed by Engineer-in-Charge.</li> <li>(ii) In case the Civil Works Price (including Site Fabricated Structural works price) is less than 6% of the Ex-works Price of Main Equipment, the amount by which it is lower shall be retained proportionately from the Ex-Works component of Contract price while releasing payments due on dispatch of equipment, and no interest shall be payable on the retained amount. The aforesaid retained amount shall be paid on pro-rata basis upon completion of Civil Works including Structural works (if any) corresponding to the respective equipment and its certification by the Consultant of the employer and further agreed by Engineer-in-Charge</li> </ul>
(VI)	<b>Ten Percent (10%)</b> of Ex-works price component of the Contract price on Successful Completion of Performance Guarantee Tests of entire Solar Photo Voltaic Plant, as specified, and issuance of Operational Acceptance Certificate issued by consultant of the employer and agreed by the Engineer-in-Charge <b>Note:</b> The prorata payment will be based on the detailed price break-up
(V)	<b>Two Point Five Percent (2.5%)</b> of Ex-Works price Component of the contract price on Completion of the Facilities, as specified, and issuance of Completion Certificate by the Consultant of the employer and further agreed by Engineer-in-Charge.
(IV)	<b>Two Point Five Percent (2.5%)</b> of Ex-works price Component of the contract price on Successful Commissioning of entire Solar Photo Voltaic Plant on certification by the Consultant of the employer and further agreed by Engineer-in-Charge
	Twenty Percent (20%) of Ex-works price component of the Contract Price for each identified equipment on receipt of equipment at site on prorata basis and Physical Verification and Certification by the Consultant of the employer and further agreed by Engineer-in-Charge for the equipment received and stored at site.
	each identified equipment upon dispatch of equipment from manufacturer's works on pro-rata basis on production of invoices and satisfactory evidence of shipment which shall be original Goods Receipt or receipted GR / Rail Receipt including Material Dispatch Clearance Certificate (MDCC) issued by the consultant of Employer and further agreed by Engineer In-charge.

	The Ex-works price of spares manufactured for fabricated within the Employer's country shall be paid as under.
	(i) Seventy Five Percent (75 %) of Ex-works price component of the spares to be paid on pro-rata basis upon dispatch to site and agains invoices and shipping documents along with Insurance & Materia Dispatch Clearance Certificate (MDCC) issued by Consultant o Employer and further agreed by Engineer In-charge
	(ii) Twenty Five Percent (25 %) of Ex-works price component of the spares to be paid on pro-rata basis: on receipt and storage at site and on physical verifications by the Consultant of the employer and further agreed by Engineer-in-Charge for received and stored the spares at site.
C.	Schedule No. 2: Local Transportation
	a) All Plant and Equipment excluding Mandatory Spares
	Hundred Percent (100%) of Local Transportation charges (including inland transit insurance charges) for the plant and equipment covered in Schedule-1 shall be paid to the Contractor pro-rata to the value of the equipment received at site and on production of invoices by the Contractor. The aggregate of all such pro-rata payments shall however, not exceed the total amount identified in the Contract fo Local Transportation. However, where equipment wise local transportation charges (including inland transit insurance charges have been identified in the Contract, the payment for the same shall be made after receipt of the equipment at site, based on the charges so identified in the Contract.
	b) Mandatory Spares and Recommended Spares (if ordered)
	<b>Hundred Percent (100%)</b> of Local Transportation charges (including inland transit insurance charges) for the spares shall be paid to the Contractor pro- rata to the value of the spares received at site and on production of invoices by the Contractor. The aggregate of all such pro-rata payments shall, however, not exceed the total amoun identified in the Contract for Local Transportation. However, where item wise local transportation charges (including inland transi insurance charges) have been identified in the Contract, the payment for the same shall be made after receipt of the spares at site based on the charges so identified in the Contract.
D.	Schedule No. 3: Installation Services excluding operation and maintenance.
	The Installation Services component of the Equipment Price shall be paid as under:
(I) (A	<b>Five Percent (5%)</b> of the Installation Services Component (excluding AMC of the Contract Price will be paid to the Contractor, bearing interest at the rate of 12.20% per annum as advance payment on:
	(i) Acceptance of Notification of Award and Signing of Contract

	Agreement.
(ii)	Establishing their office at site or resources at site in preparatory to commencement of installation.
(iii)	Submission of an unconditional Bank Guarantee for an amount equivalent to one Hundred Ten Percent (110%) of the advance amount plus GST as applicable on the advance payment to be paid to the contractor, which shall be initially kept valid upto Ninety (90) days beyond the schedule date for successful 'Completion of the Facilities' under the Package. However, in case of delay in completion of the facilities covered under the package, the validity of this advance Bank Guarantee shall be extended by the period of such delay. The proforma of the Bank Guarantee is enclosed in Annexure XXVI.
(iv)	Submission of unconditional Bank Guarantees towards Contract Performance Securities as per Clause 2 of SCC.
(v)	Submission of unconditional Bank Guarantee towards Security against Annual Quoted Generation in excess of 45 MU for 20 MW Solar PV Project as per Clause 2 of SCC.
(vi)	Submission of a detailed PERT Network based on the work schedule stipulated in the bid document and its approval by the Consultant of the employer and further agreed by Engineer-in-Charge.
(I) (B) Five H Price v annum (i) (ii) (ii)	<ul> <li>Percent (5%) of the Installation Services Component of the Contract will be paid to the Contractor, bearing interest at the rate of 12.20% per as advance payment on:</li> <li>Fulfilment of conditions mentioned at Clause D(I)(A) (i), (ii), (iii), (iv), (v) &amp; (vi) above.</li> <li>) T&amp;P mobilization as identified along with PERT network for start of Erection and Certification thereof by the Consultant of the employer and further agreed by Engineer-in-Charge</li> <li>i) Submission of an unconditional Bank Guarantee for an amount equivalent to one Hundred Ten Percent (110%) of the advance amount plus GST as applicable on the advance payment to be paid to the contractor, which shall be initially kept valid upto Ninety (90) days beyond the schedule date for successful 'Completion of the Facilities' under the Package. However, in case of delay in completion of the facilities covered under the package, the validity of this Advance Bank Guarantee shall be extended by the period of such delay. The proforma of the Bank Guarantee is enclosed in Annexure XXVI.</li> </ul>
Advance Pa released afte site the Sa minimum qu I. In cas progre release agreed	ayment for Installation Services/ Works price components shall be r certification of Engineer-in-Charge that the Contractor has brought to fety equipments & Safety Personal Protective Equipments as per antity specified in the Bidding Documents. See the Contractor decides not to take advance payment, the first ssive payment for Installation services price component shall be ed after certification by the Consultant of the employer and further by Engineer-in-Charge that the contractor has brought to site the Safety

	equipments & Safety Personal Protective Equipments as per minimum
	<ul> <li>quantity specified in the Bidding Documents.</li> <li>Seventy-Five Percent (75%) of the installation Services component of contract price shall be paid on pro-rata basis on completion of installation of equipments for the quantum of work completed and for the successful completion of quality check points involved in the quantum of work billed on certification by the Consultant of the employer and further agreed by Engineer-in-Charge</li> </ul>
III	<b>Two and a Half Percent (2.5%)</b> of total Installation price of the Contract shall be paid on Successful Commissioning of entire Solar Photo Voltaic Plant on certification by the Consultant of the employer and further agreed by Engineer-in-Charge.
IV	<b>Two and a Half Percent (2.5%)</b> of total Installation price of the Contract shall be paid on Completion of the Facilities, as specified, and issuance of Completion Certificate by the Consultant of the employer and further agreed by Engineer-in-Charge.
V	• <b>Ten Percent (10%)</b> of total Installation price of the Contract shall be paid on successful completion of Performance Guarantee Tests <u>of entire Solar Photo</u> <u>Voltaic Plant</u> , as specified and issue of Operational Acceptance Certificate by the Consultant of the employer and further agreed by Engineer-in-Charge.
VI	Recovery of the interest component on the advance amount shall be made from the progressive payments released to the Contractor as per D(II) above. The amount of interest to be recovered from a particular bill shall be calculated (a) <b>12.20%</b> per annum on the value of advance corresponding to the %age of total progressive payment being released. The period for which the interest is to be calculated shall be reckoned from the date of release of the advance payment to the actual date of release of the said progressive payment or the expiry of the stipulated time frame for release of such progressive payment shall stand fully recovered on release of all the progressive payments. If the amount payable under any interim bill is not sufficient to cover all deductions to be made for interest on the advance payment and other sums deductible there from, the balance outstanding shall be recovered from the next payments immediately falling due.
	<b>Notes:</b> 1.The bidder shall furnish a detailed break-up for the Erection Price Component of the package which shall be mutually discussed and finalized with the Owner. Progressive payment for Erection will be made against monthly bills based on certification by the Consultant of the employer and further agreed by Engineer-in-Charge for the work completed.
2.	In case, the Contractor decides not to take interest bearing advance payment as on D (I), the advance payment shall be proportionately adjusted in the balance payments excluding final payments.
3.	The release of first progressive payment for Installation Services shall also be subject to submission of documentary evidence by the Contractor towards having taken the insurance policy(ies) in terms of relevant provisions of Clause 13 of GCC and Clause No 28 of Erection Conditions of Contract and acceptance of same by the Engineer-in-Charge.

In case the Installation Price (excluding Civil/Structural works price) is more than
<b>20%</b> of the Ex-works Price of Main Equipment, the amount by which it is higher shall be retained while releasing progressive payments due on installation of equipment, and no interest shall be payable on the retained amount. The aforesaid retained amount shall be paid along with payment due on completion of Trial Operation / Completion of Facilities.
E. Schedule No. 3: Civil Works and Allied Works etc.
The Civil Works Price Component of the Contract Price shall be paid as under:
<ul><li>(I)(A) Five Percent (5%) of the total Civil works Price component of the Contract Price will be paid to the Contractor, bearing interest at the rate of Twelve point Two percent (12.20%) per annum as advance payment on:</li></ul>
i) Establishing their office at site in preparatory to commencement of Civil works.
<ul> <li>ii) Submission of an unconditional Bank guarantee for an for an amount equivalent to one Hundred Ten Percent (110%) of the advance amount plus GST as applicable on the advance payment to be paid to the contractor, which shall be initially kept valid upto Ninety (90) days beyond the schedule date for successful 'Completion of all Facilities under the Package. However, in case of delay in completion of the facilities covered under the package, the validity of this advance Bank Guarantee shall be extended by the period of such delay. The proforma of the Bank Guarantee is enclosed in Annexure XXVI.</li> <li>iii) Acceptance of Notification of Award and Signing of Contract Agreement.</li> <li>iv) Submission of unconditional Bank Guarantee towards Security against Annual Quoted Generation in excess of 45 MU for 20 MW Solar PV Project as per Clause 2 of SCC.</li> </ul>
VII. Submission of a detailed PERT Network based on the work schedule stipulated in the bid document and its approval by the Consultant of the employer and further agreed by Engineer-in-Charge.
VIII. (I)(B) Five Percent (5 %) of the total Civil works Price component of the Contract Price will be paid to the Contractor, bearing interest at the rate of Twelve point Two percent (12.20%) per annum as advance payment on:
(i) Fulfilment of conditions mentioned at Clause E(I)(A) (i), (ii), (iii), (iv), (v) & (vi) above.
<ul><li>(ii) T&amp;P mobilization as identified along with PERT network for start of Civil Works and Certification thereof by the Engineer-in-Charge.</li></ul>
(iii) Submission of an unconditional Bank guarantee for an <b>amount</b> equivalent to one Hundred Ten Percent (110%) of the advance amount plus GST as applicable on the advance payment to be paid to the contractor, which shall be initially kept valid upto Ninety (90) days beyond the schedule date for successful 'Completion of all Facilities under the Package. However, in case of delay in completion of the facilities covered under the package, the validity of this advance Bank Guarantee shall be extended by the period of such delay. The

		proforma of the Bank Guarantee is enclosed in Annexure XXVI.
IX.	Advanc certifics Charge Persona Bidding	the Payment for Civil works price components shall be released after ation the Consultant of the employer and further agreed by Engineer-in- that the Contractor has brought to site the Safety Equipments & Safety al Protective Equipments as per minimum quantity specified in the g Documents.
	I. II.	In case the Contractor decides not to take advance payment, the first progressive payment for Civil works price components shall be released after certification of Engineer-in-Charge that the Contractor has brought to site the Safety Equipments & Safety Personal Protective Equipments as per minimum quantity specified in the Bidding Documents. Seventy-Five Percent (75 %) of the total Civil Works Price Component of Contract Price shall be paid progressively for the quantum of work completed/Milestones achieved and for the successful completion of quality check points involved in the quantum of the employer and further agreed by Engineer-in-Charge
Х.	subject having Clause accepta Engine	The release of first progressive payment for Civil Works shall also be to submission of documentary evidence by the Contractor towards taken the insurance policy(ies) in terms of relevant provisions of 13 of GCC and Clause No 28 of Erection Conditions of Contract and nce of same by the Consultant of the employer and further agreed by er-in-Charge.
	III.	<b>Two and a Half Percent (2.5%)</b> of Civil Works Component of contract price shall be paid on Successful Commissioning of entire Solar Photo Voltaic Plant on certification by the Consultant of the employer and further agreed by Engineer-in-Charge
	IV.	<b>Two and a Half Percent (2.5%)</b> of Civil Works Component of contract price shall be paid on Completion of the Facilities, as specified, and issuance of Completion Certificate on certification by the Consultant of the employer and further agreed by Engineer-in-Charge
	V.	<b>Ten Percent (10 %)</b> of Civil Works Component of contract price on Successful Completion Performance Guarantee Tests of entire Solar Photo Voltaic Plant, as specified and issue of Operational Acceptance Certificate by the Consultant of the employer and further agreed by
	VI.	Recovery of the interest component on the advance amount shall be made from the progressive payments released to the Contractor as per E (II) above. The amount of interest to be recovered from a particular bill shall be calculated @ 12.20% per annum on the value of advance corresponding to the %age of total progressive payment being released. The period for which the interest is to be calculated shall be reckoned from the date of release of the advance payment to the actual
		the contract, whichever is earlier. The interest on the advance payment shall stand fully recovered on release of all the progressive payments. If the amount payable under any interim bill is not sufficient to cover

	all deductions to be made for interest on the advance payment and other sums deductible there from, the balance outstanding shall be recovered from the next payments immediately falling due. <b>Note:</b>
	In case the Civil Works Price (including Site Fabricated Structural Works Price) is more than <b>16%</b> of the Ex-works Price of Main Equipment, the amount by which it is higher shall be retained while releasing progressive payments due on completion of civil works (including Site Fabricated Structural works), and no interest shall be payable on the retained amount. The aforesaid retained amount shall be paid along with payment due on completion of Trial Operation/ Completion of Facilities.
F.	Operation and Maintenance Charges
	After completion of trial run as defined in bid documents, operation and maintenance charges including all consumable, spares and equipments included in operation and maintenance charges shall be paid on pro-rata basis every three month on the certification of completion of work by Engineer-in-Charge.

# A N N E X U R E S

# FORMAT FORLETTER OF BID

# (To be uploaded by the Bidder on his Letter Head during submission of bid online)

Dear Sir,

This has reference to above referred bid. I/we have read and examined the conditions of contract, Scope of Work, technical specifications, BOQ and other documents carefully.

I /We am/are pleased to submit our bid for the above work. I/We hereby unconditionally accept the bid conditions and bid documents in its entirety for the above work and agree to abide by and fulfill all terms and conditions and specifications as contained in the bid document.

I/we here by submit all the documents as required to meet the eligibility criteria as per provision of the bid notice/document.

I/We hereby confirm that this bid complies with the Bid validity, Bid security and other documents as required by the Bidding documents.

If any information furnished by me/us towards eligibility criteria of this bid is found to be incorrect at any time, penal action as deemed fit may be taken against me/us for which I/We shall have no claim against CIL/Subsidiary.

Until a formal agreement is prepared and executed, this bid and your subsequent Letter of Acceptance/Work Order shall constitute a binding contract between us and Central coalfields ltd

Should this bid be accepted, we agree to furnish Performance Security within 30 days of issue of letter of acceptance and commence the work within 10 days of issue of letter of acceptance. In case of our failure to abide by the said provision, **Central Coalfields Limited** shall, without prejudice to any other right or remedy, be at liberty to cancel the letter of acceptance/ award and to forfeit the Earnest Money and also debar us from participating in future tenders for a minimum period 12 months.

Yours faithfully,

**Signature of Bidder** 

# PROFORMA FORUNDERTAKING

# (To be uploaded by the Bidder on his Letter Head during submission of bid online)

I / We, ....., Proprietor/Partner/Legal Attorney/Director/ Accredited Representative of M/S. ...., solemnly declare that:

- 2. Myself/Our Partners/Directors don't has/have any relative as employee of Central Coalfields Limited.

\* (If so, furnish the name, designation & place of posting of employee of CCL and name of the bidder/partners/directors, who are relative of the employee of CCL)

- 3. All information furnished by us in respect of fulfillment of eligibility criteria and qualification information of this Bid is complete, correct and true.
- 4. All copy of documents, credentials and documents submitted along with this Bid are genuine, authentic, true and valid.
- 5. I/ We hereby authorize department to seek references / clarifications from our Bankers.
- 6. We hereby undertake that we shall register and obtain license from the competent authority under the contract labour (Regulation & Abolition Act) as relevant, if applicable.
- 7. \*I/We hereby confirm that we have registration with CMPF / EPF Authorities. We shall make necessary payments as required under law.

Or

\*I/We hereby undertake that we shall take appropriate steps for registration as relevant under CMPF / EPF authorities, if applicable.We shall make necessary payments as required under law.

# \* Delete whichever is not applicable.

8. \*\* I/We have not been banned or delisted by any Govt., or Quasi Govt. Agencies or PSUs.

(In case of JV, all partners are covered)

Or

[ in case of JV, name(s) of the JV Partner(s) ]

# **\*\*** Delete whichever is not applicable.

9. If any information and document submitted is found to be false/ incorrect at any time, department may cancel my/our Bid and action as deemed fit may be taken against me/us, including termination of the contract, forfeiture of all dues including Earnest Money and banning/ delisting of our firm and all partners of the firm etc.

**10.** (a).I/We are not engaging and will not engage any child labour in any of the activities for which I/We are participating in the tender.

(b). If it is reported and proved that child labour is engaged by me/us, then I/We will be penalized 10% of the

contract value and will be blacklisted.

**11** I will submit Valid Electrical Contractor's License of me or my authorized representative (In whose guidance work will be executed) issued by Electrical Licensing Board/ Authority of any Indian State/ UT, in accordance with IE Rule- 45 within 30 days of issue of letter of acceptance.

12. I/We agree to the arbitration Clause/Provisions regarding arbitration in the bid document.

Signature of the Bidder

Dated.....

# PROFORMA FOR EXECUTION OF AGREEMENT.

(Specimen to be vetted by Legal Department))

# STAMP PAPER

# (of appropriate value as per Stamp Act)

Whereas the Company invited tenders for the work of "......" and whereas the said Contractor/ Firm submitted tender for the said work and deposited a sum of Rs...... as Earnest Money and whereas the tender of the said contract has been accepted by the Company for execution of the said work.

# NOW THIS AGREEMENT WITNESSETH AS FOLLOWS:

1) In this agreement words and expressions shall have the same meaning as are respectively assigned to them in the tender papers hereinafter referred to.

2) The following documents which are annexed to this agreement should be deemed to form and be read and construed as part of this agreement viz.

- i) Annexure-A Tender Notice (Page .. to ..)
- ii) Schedule –A General Terms & Conditions, Special Conditions and General Technical Specification (Page .... to ...) and Safety Code.
- iii) Schedule-B The probable Quantities and Amount (Page ... to ...)
- iv) Schedule-C Negotiation letters -
- iv) Schedule-D Letter of Acceptance/Work Order (Page .. to ..)
- v) Schedule-E Drawings (Page .. to ..)
3) In consideration for the payment of the sum of Rs..... (W/O Value; both in words and figures ) or such other sum as may be arrived at under the clause of the specification relating to Payment by items measurements at unit prices by the Company, the said Contractor shall, subject to the terms & condition contained herein execute and complete the work as described and to the extent of probable quantities as indicated in Schedule B with such variations by way of alteration, addition to or reduction from the said works.

4) The company has received a sum of Rs..... towards Performance Security Deposit in the form of Demand Draft / Certified Cheque/ B.G./ other form (details to be furnished).

IN WITNESS WHEREOF THE parties herein have set their hands and seals the date and year above written.

1	Partner.	Signature
2	Partner	Signature
On The	behalf of M/S	
Int	the presence of –	
1.1	Name	Signature
ddress :		
Occupation :		
Signed by Sri ( Name of Cor	on behalf of mpany) in presence of -	Signature
1.	Name :	Signature

2. Address: .

Address :

#### **ANNEXURE-IV**

## PROFORMA OF BANK GURANTEE FOR PERFORMANCE SECURITY

То

.....

.....

Re:	Bank Guarantee in respect of	Contract No,
Dated	Between	(Name of the company)
and		Name of the Contractor)

#### WHEREAS

It has been agreed that the Contractor shall furnish a Performance Security in the shape of Bank Guarantee from a Schedule bank for a sum of Rs..... as security for due compliance and performance of the terms and conditions of the said contract.

We...... (name of the Bank) having its branch/Office at..... have, at the request of the Contractor, agreed to furnish this bank Guarantee by way of performance Security.

NOW, THEREFORE, we the..... Bank (herein after called The Bank) hereby, unconditionally and irrevocably, guarantees and affirms as follows:

The Bank do hereby irrevocably guarantees and unconditionally agree with the Company that if the contractor shall in any way fail to observe or perform the terms and conditions of the said contract or shall commit any breach of its obligation there under, the Bank shall on its mere first written demand, and without any objection, demur and without any reference to the contractor, pay to the company the said sum of ..... or such portion as shall then remain due with interest without requiring the Company to have recourse to any legal remedy that may be available to it to compel the Bank to pay the sum, or failing on the company to compel such payment by the contractor.

Any such demand shall be conclusive as regards the liability of the Contractor to the company and as regards the amount payable by the Bank under this Guarantee. The Bank shall not be entitled to withhold payment on the ground that the Contractor has disputed its liability to pay or has disputed the quantum of the amount or that any arbitration proceeding or legal proceeding is pending between the company and the Contractor regarding the claim.

The Bank further agree that the Guarantee shall come into force from the date hereof and shall remain in force and effect till the period that will be taken for the performance of the said Contract which is likely to be ...... day of ..... but if the period of Contract is extended either pursuant to the provisions in the said contract or by mutual agreement between the contractor and the company, the Bank shall renew the period of the Bank Guarantee failing which it shall pay to the company the said sum of ...... or such lesser amount of the said sum of ...... as may be due to the company and as the company may demand.

This Guarantee shall remain in force until the dues of the company in respect of the said sum of ......and interest are fully satisfied and the Company certifies that the Contract has been fully carried out by the Contractor and discharged the guarantee.

The Bank further agrees with the company that the company shall have the fullest liberty without consent of the Bank and without affecting in any way the obligations hereunder to vary any of the terms and conditions of the said contract or to extend time for performance of the said contract from time to time or to postpone for any time or from time to time any of the powers exercisable by the Company against the contractor and to forebear to enforce any of the terms and conditions relating to the said Contract and the Bank shall not be relieved from its liability by reason of such failure or extension being granted to the Contractor or to any forbearance, act or omissions on the part of the company or any indulgence by the Company to the Contractor or any other matter or thing whatsoever which under the law relating to sureties would but for this provision have the effect or relieving or discharging the Guarantor.

The Bank further agrees that in case this Guarantee is required for a longer period and it is not extended by the Bank beyond the period specified above, the Bank shall pay to the company the said sum of ..... or such lesser sum as may then be deemed to the Company and as the Company may require.

\* The date of guarantee shall cover a period of minimum one year or 90 days beyond the date of completion whichever is more.

Any notice by way of request, demand or otherwise hereunder maybe sent by post/e-mail/Fax addressed to the bank branch/operative branch, which shall be deemed to be a sufficient demand notice. Bank shall effect payment thereof forthwith.

This guarantee will not be discharged due to the change in the constitution of the Bank or the Contractor.

The Bank has under its constitution power to give this Guarantee and Sri..... who has signed it on behalf of the Bank has authority to do so.

The Bank Guarantee as referred above shall be operative at our branch at..... payable at.....

The Contact details of the Bank issuing BG and the local operating Branch of the Bank at Ranchi(Jharkhand.) are as under :

Particulars	Issuing Bank	Local Operating Branch at Ranchi
Branch Code		
Postal Address		
Telephone No.		
FAX No.		
Email Id		

Signed and sealed this......day of.....at....

SIGNED, SEALED AND DELIVERED

For and on behalf of the Bank by:

(Signature)

(Name)

(Designation)

(Code number)

#### (address)

NOTE:-1. The department shall ensure extension of guarantee period in case of extension of time.

2. The Bank Guarantee issued by the issuing bank on behalf of contractor/ supplier in favour of Central Coalfields Limited shall be in paper form as well as issued under Structured Financial Messaging System(SFMS). The details of beneficiary for issue of BG under SFMS platform must contain the following information:

	Name	Central Coalfields Limited
	Area	*
Name of beneficiary and	Bank A/C no. of beneficiary	10106155123
details	Customer ID/CIF no of	80288731402
	beneficiary	
	Department	E&M
	Beneficiary's Bank	State Bank of India
Beneficiary's Bank, Branch	Branch and Adress	SME Branch, Doranda,
and Address		ranchi - 834002
	SFMS Code/ IFSC Code	SBIN0009620
	In case of Foreign BG Swift	SBININBB387
	Code	

HQ/ Name of the Area of CCL

\*

The original Bank Guarantee shall be sent by the issuing bank to concerned department/ Area by registered post(AD).

#### Annexure V

# Bank Guarantee Form for Advance Payment (Supply Ex-Works)

To, [Employer's Name & Address]

Re:	Bank Guarantee in respect of Contr	act No,
Dated	Between	(Name of the company)
and		of the Contractor)

address of We......[Name and the Bank]..... having its Head Office at..... (hereinafter referred to as the 'Bank', which expression shall, unless repugnant to the context or meaning thereof, include its successors, administrators, executors and assigns) do hereby guarantee and undertake to pay the Employer, immediately on demand any or, all monies payable by the amount plus GST]..... as aforesaid Contractor to the extent of .....[advance at anv time upto any reference to the Contractor. Any such demand made by the Employer on the Bank shall be conclusive and binding notwithstanding any difference between the Employer and the Contractor or any dispute pending before any Court, Tribunal, Arbitrator or any other authority. We agree that the guarantee herein contained shall be irrevocable and shall continue to be enforceable till the Employer discharges this guarantee.

The Employer shall have the fullest liberty without affecting in any way the liability of the Bank under this guarantee, from time to time to vary the advance or to extend the time for performance of the Contract by the Contractor. The Employer shall have the fullest liberty without affecting this guarantee, to postpone from time to time the exercise of any powers vested in them or of any right which they might have against the Contractor, and to exercise the same at any time in any manner, and either to enforce or to forbear to enforce any covenants, contained or implied, in the Contract between the Employer and the Contractor or any other course or remedy or security available to the Employer. The Bank shall not be released of its obligations under these presents by any other act or forbearance or other acts of omission or commission on the part of the Employer or any other indulgence shown by the Employer or by any other matter or thing whatsoever which under law would but for this provision, have the effect of relieving the Bank.

The Bank also agrees that the Employer at its option shall be entitled to enforce this Guarantee against the Bank as a principal debtor, in the first instance without proceeding against the Contractor and notwithstanding any security or other guarantee that the Employer may have in relation to the Contractor's liabilities.

Any notice by way of request, demand or otherwise hereunder maybe sent by post/e-mail/Fax addressed to the bank branch/operative branch, which shall be deemed to be a sufficient demand notice. Bank shall effect payment thereof forthwith.

This guarantee will not be discharged due to the change in the constitution of the Bank or the Contractor.

The Bank has under its constitution power to give this Guarantee and Sri..... who has signed it on behalf of the Bank has authority to do so.

The Bank Guarantee as referred above shall be operative at our branch at..... payable at.....

The Contact details of the Bank issuing BG and the local operating Branch of the Bank at Ranchi(Jharkhand.) are as under :

Particulars	Issuing Bank	Local Operating Branch at Ranchi
Branch Code		
Postal Address		
Telephone No.		
FAX No.		
Email Id		

Signed and sealed this.....day of.....at....

## SIGNED, SEALED AND DELIVERED

For and on behalf of the Bank by:

(Signature)

(Name)

(Designation)

(Code number)

(address)

Notes: 1. (@) This date shall be Ninety (90) days beyond the date of Completion of the last facility covered under the Package.

- 2. . The department shall ensure extension of guarantee period in case of extension of time.
- 3. The Bank Guarantee issued by the issuing bank on behalf of contractor/ supplier in favour of Central Coalfields Limited shall be in paper form as well as issued under Structured Financial Messaging System(SFMS). The details of beneficiary for issue of BG under SFMS platform must contain the following information:

	Name	Central Coalfields Limited
	Area	*
Name of beneficiary and	Bank A/C no. of beneficiary	10106155123
details	Customer ID/CIF no of	80288731402
	beneficiary	
	Department	E&M
	Beneficiary's Bank	State Bank of India
Beneficiary's Bank, Branch	Branch and Address	SME Branch, Doranda,
and Address		Ranchi - 834002
	SFMS Code/ IFSC Code	SBIN0009620
	In case of Foreign BG Swift	SBININBB387
	Code	
	·	

\* HQ/ Name of the Area of CCL

The original Bank Guarantee shall be sent by the issuing bank to concerned department/ Area by registered post(AD).

## PROFORMA BANK GUARANTEE FOR QUOTED GENRATION IN EXCESS OF 45 MU FOR 20 MW

## To, [Employer's Name & Address]

Re:	Bank Guarantee in respect of G	Contract No,
Dated	Between	(Name of the company)
and	(Na	ame of the Contractor)

unless repugnant to the context or meaning thereof include its successors, administrators and assigns) having awarded to ......[Contractor's Name]..... Registered/Head M/s with its Office at shall unless repugnant to the context or meaning thereof, include its successors, administrators, executors and assigns), a having been unequivocally accepted by the Contractor resulting in a 'Contract' bearing No. ...... dated Section - VI (Technical Specifications), at the rate of {Indian Rupees Three Crores Sixty Seven Lakhs per Million Unit {INR 3.67 Crores per MU for the generation quoted in excess of 45-MU} to the Employer.

and address of the Bank]..... Head Office having its at unless repugnant to the context or meaning thereof, include its successors, administrators, executors and assigns) do hereby guarantee and undertake to pay the Employer, on demand any and all monies payable by the Contractor to the vear)..... without any demur, reservation, contest, recourse or protest and/or without any reference to the Contractor. Any such demand made by the Employer on the Bank shall be conclusive and binding notwithstanding any difference between the Employer and Contractor or any dispute pending before any court, tribunal or any other authority. The Bank undertakes not to revoke this guarantee during its currency without, previous consent of the Employer and further agrees that the guarantee herein contained shall continue to be enforceable till the Employer discharges this guarantee.

The Employer shall have the fullest liberty without affecting in any way the liability of the Bank under this guarantee from time to time to extend the time for performance of the Contract by the Contractor. The Employer shall have the fullest liberty, without affecting this guarantee, to postpone from time to time the exercise of any powers vested in them or of any right which they might have against the Contractor, and to exercise the same at any time in any manner, and either to enforce or to forbear to enforce any covenants, contained or implied, in the Contract between the Employer and the Contractor or any other course of or remedy or security available to the Employer. The Bank shall not be released of its obligations under these presents by any exercise by the Owner of its liberty with reference to the matters aforesaid or any of them or by reason of any other acts of omission or commission on the part of the Employer or any other indulgence shown by the Owner or by any other matters or thing whatsoever which under law, would, but for this provision, have the effect of relieving the Bank.

The Bank also agrees that the Employer at its option shall be entitled to enforce this guarantee against the Bank as a principal debtor, in the first instance without proceeding against the Contractor and notwithstanding any security or other guarantee that the Employer may have in relation to the Contractor's liabilities.

Any notice by way of request, demand or otherwise hereunder maybe sent by post/e-mail/Fax addressed to the bank branch/operative branch, which shall be deemed to be a sufficient demand notice. Bank shall effect payment thereof forthwith.

This guarantee will not be discharged due to the change in the constitution of the Bank or the Contractor.

The Bank has under its constitution power to give this Guarantee and Sri..... who has signed it on behalf of the Bank has authority to do so.

The Bank Guarantee as referred above shall be operative at our branch at..... payable at.....

The Contact details of the Bank issuing BG and the local operating Branch of the Bank at Ranchi(Jharkhand.) are as under :

Particulars	Issuing Bank	Local Operating Branch at Ranchi
Branch Code		
Postal Address		
Telephone No.		
FAX No.		
Email Id		

Signed and sealed this......day of.....at.

For and on behalf of the Bank by:
(Signature)
(Name)
(Designation)
(Code number)

SIGNED SEALED AND DELIVERED

(address)

Note:

- 1. \*. This dated shall be 15 Months beyond the scheduled date for Completion of Facilities covered under the Package. Thus total validity of the BG shall be 24 months (9 months+12 months +3 months)
- 2. The department shall ensure extension of guarantee period in case of extension of time.
- 3. The Bank Guarantee issued by the issuing bank on behalf of contractor/ supplier in favour of Central Coalfields Limited shall be in paper form as well as issued under Structured Financial

Messaging System(SFMS). The details of beneficiary for issue of BG under SFMS platform must contain the following information:

	Name	<b>Central Coalfields Limited</b>
	Area	*
Name of beneficiary and	Bank A/C no. of beneficiary	10106155123
details	Customer ID/CIF no of beneficiary	80288731402
	Department	E&M
	Beneficiary's Bank	State Bank of India
Beneficiary's Bank, Branch	Branch and Address	SME Branch, Doranda,
and Address		Ranchi - 834002
	SFMS Code/ IFSC Code	SBIN0009620
	In case of Foreign BG Swift	SBININBB387
	Code	

|--|

The original Bank Guarantee shall be sent by the issuing bank to concerned department/ Area by registered post(AD).

## PROFORMA BANK GUARANTEE FOR FORM OF SECURITY AGAINST OVERALL SYSTEM PERFORMANCE DURING O&M, WARRANTY AND AMC PERIOD

To,

[Employer's Name & Address]

In consideration of the ... [Employer's Name]....., (hereinafter referred to as the 'Employer', which expression shall unless repugnant to the context or meaning thereof include its successors, administrators and assigns) having awarded ......[Contractor's Name]..... with Registered/Head Office M/s. its to at expression shall unless repugnant to the context or meaning thereof, include its successors, administrators, executors and assigns), a Contract by issue of Employer's Notification of Award No. ..... dated and the same having been unequivocally accepted by the Contractor resulting in a 'Contract' bearing No. valued at..... for ..... ..... dated ..... (Scope of Contract)..... and the Contractor having agreed to provide Guarantee against Overall System Performance for amount of INR ......@.....during O&M and Warranty Period/ for amount of INR...#..... **during AMC period** as specified in bidding document to the Employer.

The Employer shall have the fullest liberty without affecting in any way the liability of the Bank under this guarantee from time to time to extend the time for performance of the Contract by the Contractor. The Employer shall have the fullest liberty, without affecting this guarantee, to postpone from time to time the exercise of any powers vested in them or of any right which they might have against the Contractor, and to exercise the same at any time in any manner, and either to enforce or to forbear to enforce any convenants, contained or implied, in the Contract between the Employer and the Contractor or any other course of or remedy or security available to the Employer. The Bank shall not be released of its obligations under these presents by any exercise by the Owner of its liberty with reference to the matters aforesaid or any of them or by reason of any other matters or thing whatsoever which under law, would, but for this provision, have the effect of relieving the Bank.

The Bank also agrees that the Employer at its option shall be entitled to enforce this guarantee against the Bank as a principal debtor, in the first instance without proceeding against the Contractor and notwithstanding any security or other guarantee that the Employer may have in relation to the Contractor's liabilities.

Any notice by way of request, demand or otherwise hereunder maybe sent by post/e-mail/Fax addressed to the bank branch/operative branch, which shall be deemed to be a sufficient demand notice. Bank shall effect payment thereof forthwith.

This guarantee will not be discharged due to the change in the constitution of the Bank or the Contractor.

The Bank has under its constitution power to give this Guarantee and Sri..... who has signed it on behalf of the Bank has authority to do so.

The Bank Guarantee as referred above shall be operative at our branch at..... payable at.....

The Contact details of the Bank issuing BG and the local operating Branch of the Bank at Ranchi(Jharkhand.) are as under :

Particulars	Issuing Bank	Local Operating Branch at Ranchi
Branch Code		
Postal Address		
Telephone No.		
FAX No.		
Email Id		

Signed and sealed this.....day of.....at.

SIGNED, SEALED AND DELIVERED

For and on behalf of the Bank by:

- (Signature)
- (Name)
- (Designation)
- (Code number)
- (address)

#### Note

- 1. @ INR 3.32 Lakhs per MU (INR Three Lakhs Thirty Two Thousand per MU) of Quoted Annual Generation (i.e. INR 3.32 Lakhs per MU x Annual Quoted Generation in MU)
- 2. # BG amount of Rs. 1.0 Lakh/MW only in case tracker system is not offered by the bidder . or

BG amount of Rs. 1.25 Lakh/MW only in case tracker system is offered by the bidder.

- 3. \*The bidder will furnish the above security initially valid upto 90 days beyond Comprehensive Operation & Maintenance (O&M) period.
- Beyond 5th year (from 6th year to 10th year), the bidder is required to submit a fresh BG for a further period of 5 years to cover comprehensive AMC of Inverter, SCADA & tracker system (if applicable) as per the following:

- (a) BG amount of Rs. 1.0 Lakh/MW only in case tracker system is not offered by the bidder.
- (b) BG amount of Rs. 1.25 Lakh/MW only in case tracker system is offered by the bidder.

The above Security shall be valid upto 90 days after the end of AMC period as specified in the Technical Specification.

- 4. The department shall ensure extension of guarantee period in case of extension of time.
- 5. The Bank Guarantee issued by the issuing bank on behalf of contractor/ supplier in favour of Central Coalfields Limited shall be in paper form as well as issued under Structured Financial Messaging System(SFMS). The details of beneficiary for issue of BG under SFMS platform must contain the following information:

	Name	Central Coalfields Limited			
	Area	*			
Name of beneficiary and	Bank A/C no. of beneficiary	10106155123			
details	Customer ID/CIF no of	80288731402			
	beneficiary				
	Department	E&M			
	Beneficiary's Bank	State Bank of India			
Beneficiary's Bank, Branch	Branch and Address	SME Branch, Doranda,			
and Address		Ranchi - 834002			
	SFMS Code/ IFSC Code	SBIN0009620			
	In case of Foreign BG Swift	SBININBB387			
	Code				
	<u></u>				

#### \* HQ/ Name of the Area of CCL

The original Bank Guarantee shall be sent by the issuing bank to concerned department/ Area by registered post(AD).

## Annexure VIII

## PROFORMA OF JOINT VENTURE AGREEMENT

(On Non-Judicial Stamp paper of appropriate value as per provision of the Stamp Act applicable in the concerned state)

This Joint Venture agreement is made on this ......day of.....

#### AMONGST/BETWEEN

AND

#### AND

The expressions M/s ......and M/s.....and M/s .....and M/s .....shall, wherever the context admits, mean and include their respective legal representatives, successors-in-interest and assigns and shall collectively be referred to as "Joint Venture /Parties" and individually as "Joint Venture Partner/Party".

WHEREAS M/s.....and M/s....agreed to form a Joint Venture in order to join their forces to obtain best results from the combinations of their individual resources of technical and management skill, finance and equipment for the benefit of the project and in order to submit the Bid for the work of "....

. (Hereinafter referred to as "Project") under......(Name of Company(hereinafter referred to as "the principle Employer").

The Parties hereby enter into this Joint Venture Agreement (hereinafter referred to as "Joint Venture agreement") to jointly prepare and submit the Bid for the Project and in the event of securing the Project from the Employer, to execute the Project in accordance with the Contract terms and conditions, to the satisfaction of the Principal Employer.

NOW THEREFORE, the parties, in consideration of the mutual premises contained herein, agree as follows:

## 1) FORMATION AND TERMINATION OF THE JOINT VENTURE.

The parties under this Agreement have decided to form a Joint Venture to submit the Bid for the above Project and execute the Contract with the Principal Employer for the Project, if qualified and awarded.

- a) The name and style of the Joint Venture shall be "....." (hereinafter called the "Joint Venture")
- c) Neither of the parties of the Joint Venture shall be allowed to sign, pledge, sell or otherwise dispose all or part of its respective interests in the Joint Venture to any party including the existing partner of the Joint Venture.
- d) The terms of the Joint Venture shall begin as on the date first set forth above and shall terminate on the earliest of the following dates.
  - i) The Joint Venture fails to obtain qualification from the Employer.
  - ii) The Contract for the Project is not awarded to the Joint Venture.
  - iii) The Employer cancels the Project.
  - iv) The Project is completed including defects liability period to the satisfaction of the Employer and all the parties complete any and all duties, liabilities and responsibilities under or in connection with the Contract and the Joint Venture agreement.

## 2) <u>LEAD PARTNER</u>.

M/s...... shall be the Lead Partner of the Joint Venture and is In-charge for performing the contract management. M/s...... shall be attorney of the parties duly authorized to incur liabilities and receive instructions for and on behalf of any and all partners in the Joint Venture and also all the partners of the Joint Venture shall be jointly and severally liable during the bidding process and for the execution of the contract as per contract terms with the employer in accordance with the power of attorney annexed. All Joint Venture partners M/s...... nominate and authorize Shri...... (name and designation) of M/s...... to sign all letters, correspondence, papers & certificates and to submit the Pre-qualification Application / Bid documents for and on behalf of the Joint Venture.

## 3) <u>REPRESENTATIVE OF THE PARTNERS OF THE JOINT VENTURE</u>.

Each constituent party of the Joint Venture appoints the following personnel as the representative of the relevant party with full power of attorney from the Board of Directors of the concerned company, or from the partners of the entity, or from the proprietor.

JV Partner	Name	Position in the respective Company
M/s		
M/s		
M/s		

## 4) PARTICIPATION SHARE & WORK RESPONSIBILITIES.

4.1 The parties agree that their respective participation share (hereinafter called 'Participation Share') in the Joint Venture shall be as follows:

M/s	:	% (per cent)
M/s	:	% (per cent) and
M/s	:	% (per cent)

4.2 The Parties shall share the rights and obligations, risk, cost and expenses, working capitals, profits or losses or others arising out of or in relation to execution of the Project in proportion to their share of participation in the Joint Venture except as otherwise agreed.

4.3 The parties shall jointly execute the works under the Project as an integrated entity and allocate responsibilities as regards division of work between themselves by organizing the adequate resources for successful completion of the Project. However all parties shall remain jointly and severally responsible for the satisfactory execution of the Project in accordance with the Contract terms and conditions.

## 5) JOINT AND SEVERAL LIABILITIES.

All partner of Joint Venture shall be liable jointly and severally during the Pre-qualification and Bidding process; and in the event the contract is awarded, during the execution of the Contract, in accordance with Contract terms.

## 6) WORKING CAPITAL

Each party shall contribute working capital for equipment, labour and material or any expenses incurred for execution of the Project or any other investment required in connection with the execution of the project proportionate to the participation ratio.

## 7) **BID SECURITY:**

Bid Security, Performance Security and other securities shall be paid by the Joint Venture except as otherwise agreed.

## 8) <u>PERSONNEL & EQUIPMENT</u>

Team of Managers / Engineers of all the partners of the Joint Venture will form part of the core management structure and assist in execution of the project. The list of Personnel and equipment proposed to be engaged for the project by each Party will be decided by the management committee.

## 9) NON PERFORMANCE OF RESPONSIBILITY BY ANY PARTY OF JOINT VENTURE.

- a) As between themselves, each Party shall be fully responsible for the fulfillment of all obligations arising out of its scope of the work for the Project to be clarified subject to the Agreement between the Parties and shall hold harmless and indemnified against any damage arising from its default ornon-fulfillment of such obligations.
- b) If any Party fails to perform its obligations described in this Agreement during the execution of the Project and to cure such breach within the period designated by the non-defaulting party, then the other party shall have the right to take up work, the interest and responsibilities of the defaulting party at the cost of the defaulting party.
- c) Stepping into the shoes of the existing partner of Joint Venture with all the liabilities of the existing partner from the beginning of the contract with the prior approval on Northern Company.
- d) Notwithstanding demarcation or allotment of work of between/amongst Joint Venture partners, Joint Venture shall be liable for non-performance of the whole contract irrespective of their demarcation or share of work.

e) In case bid being accepted by Company, the payments under the contract shall only be made to the Joint Venture and not to the individual partners.

## 10) <u>BANK A/C</u>.

Separate Bank A/c. shall be opened in the name of the Joint Venture in a scheduled or Nationalized Bank in India asper mutual Agreement and all payments due to the Joint Venture shall be received only in that account, which shall be operated jointly by the representative of the Parties hereto. The financial obligations of the Joint Venture shall be discharged through the said Joint Venture Bank Account only and also all the payments received or paid by company to the Joint Venture shall be through that account alone.

## 11) LIMIT OF JOINT VENTURE ACTIVITIES.

The Joint Venture activities are limited to the bidding and in case of award, to the performance of the Contract for the Project according to the conditions of the Contract with the Employer.

## 12) <u>TAXES</u>.

Each Party shall be responsible for its own taxes, duties and other levies to be imposed on each party in connection with the Project. The taxes, duties and other levies imposed on the Joint Venture in connection with the Project shall be paid from the account of the Joint Venture.

## 13) EXCLUSIVITY

The Parties hereto agree and undertake that they shall not directly or indirectly either individually or with other party or parties take part in the Bid for the said Project. Each Party further guarantee to the other party hereto that this undertaking shall also apply to its subsidiaries and companies under its direct or indirect control.

## 14) MISCELLANEOUS:

a. Neither party of the Joint Venture shall assign, pledge, sell or otherwise dispose all or part of its respective interests in the Joint Venture to all third party without the Agreement of the other party in writing.

b. Subject to the above clause, the terms and conditions of this agreement shall be binding upon the parties, the Directors, Officers, Employees, Successors, Assigns and Representatives.

## 15) APPLICABLE LAW

This agreement shall be interpreted under laws and regulations of India.

IN WITNESS Whereof the Parties hereto have hereunder set their respective hands and seals the day, month, year first above written.

For .....

For.....

Signature \_\_\_\_\_ (Name & Address)

Signature \_\_\_\_\_\_(Name & Address)

(Official Seal)

(Official Seal) 125

Place
Date
Witness
Signature
(Name & Address)

## **ANNEXURE -IX**

## Pre Contract Integrity Pact

General:

This pre-bid pre-contract Agreement ( hereinafter called the Integrity Pact) is made on.....day of the month of....20....., between, on one hand, Central Coalfields Limited (hereinafter called the "BUYER" which expression shall mean and include, unless the context otherwise requires, his successors in office and assigns) of the First Part and M/s ...... (hereinafter called the "BIDDER/ Seller" which expression shall mean and include, unless the context otherwise requires, his successors and permitted assigns) of the Second Part.

WHEREAS the BUYER proposes to award, under laid down organizational procedure, Contracts

BIDDER/ Seller is willing to offer/ has offered the work and

WHEREAS the BIDER is a private company/public company/Government undertaking/ partnership./ registered export agency, constituted in accordance with the relevant law in the matter and the buyer is a PSU.

NOW, THEREFORE,

To avoid all forms of corruption by following a system that is fair, transparent and free from any influence/ prejudiced dealings prior to, during and subsequent to the currency of the contract to be entered into with a view to:-

Enabling the BUYER to obtain the desired said work at a competitive price in conformity with the defined specifications by avoiding the high cost and the distortionary impact of corruption on public procurement, and

Enabling BIDDERS to abstain from bribing or indulging in any corrupt practice in order to secure the contract by providing assurance to them that their competitor will also abstain from bribing and other corrupt practices and the BUYER will commit to prevent corruption, in any form, by its officials by following transparent procedures.

The parties hereto hereby agree to enter into this Integrity Pact and agree as follows:

Commitments of the BUYER

- 1.1 The BUYER undertakes that no official of the BUYER, connected directly or indirectly with the contract, will demand, take a promise for or accept, directly or through intermediaries, any bribe, consideration, gift reward, favour or any material or immaterial benefit or any other advantage from the BIDDER, either for themselves or for any person, organization or third party related to the contract in exchange for an advantage in the bidding process, bid evaluation, contracting implementation process related to the contract.
- 1.2 The BUYER will, during the pre-contract stage, treat all BIDDERS alike, and will provide to all BIDDERs the same information and will not provide any such information to any particular BIDDER which could afford an advantage to that particular BIDDER in comparison to other BIDDERs.
- 1.3 All the officials of the BUYER will report to the appropriate Government office any attempted or completed breaches of the above commitments as well as any substantial suspicion of such a breach.
- 2. In case any such preceding misconduct on the part of such official(s) is reported by the BIDDER to the BUYER with full and verifiable facts and the same is prima facie found to be correct by the BUYER, necessary disciplinary proceedings, or any other action as deemed fit, including criminal proceedings may be initiated by the BUYER and such a person shall be debarred from further dealing related to the contract process. In such a case while an enquiry is being conducted by the BUYER the proceedings under the contract would not be stalled.

Commitments of BIDDERs

- **3**. The BIDDER commits itself to take all measures necessary to prevent corrupt practices, unfair means and illegal activities during any stage of its bid or during any pre-contract or post contract stage in order to secure the contract or in furtherance to secure it and in particular commit itself to the following.
  - **3.1** The BIDDER will not offer, directly or through intermediaries, any bribe, gift, consideration, reward, favour, any material or immaterial benefit or other advantage, commission, fees, brokerage or inducement to any official of the BUYER, connected directly or indirectly with the bidding process, or to any person, organization or third party related to the contract in exchange for any advantage in the bidding, evaluation, contracting and implementation of the contract.
  - **3.2** The BIDDER further undertakes that it has not given. Offered or promised to give, directly or indirectly any bribe, gift, consideration, reward, favour, any material or immaterial benefit or other advantage, commission, fees, brokerage or inducement to any official of the BUYER or otherwise in procuring the Contract or forbearing to do or having done any act in relation to the obtaining or execution of the contract or any other contract with the Government for showing or forbearing to show favour or dis favour to any person in relation to the contract or any other contract with the Government.
- 3.3\* BIDDERs shall disclose the name and address of agents and representatives and Indian BIDDERs shall disclose their foreign principals or associates.
- 3.4\* BIDDERs shall disclose the payment to be made by them to agents/ brokers or any other intermediary, in connection with this bid/contract.
- 3.5\*The BIDDER further confirms and declare to the BUYER that the BIDDER is the original manufacturer/ integrator/ authorized Government sponsored export entity of the defence stores and has not engaged any individual or firm or company whether Indian or foreign to intercede, facilitate or in any way to recommend to the BUYER or any of its functionaries, whether officially or unofficially to the award of the contract to the BIDDER, not has any amount been paid, promised or intended to be paid to any such individual, firm or company in respect of any such intercession, facilitation or recommendation.
- **3.6** The BIDDER, either while presenting the bid or during pre-contract negotiations or before signing the contract, shall disclose any payments he has made, is committed to or intends to make to officials of the BUYER or their family members, agents, brokers or any other intermediaries in connection with the contract and the details of services agreed upon for such payments.
- **3.7** THE BIDDER will not collude with other parties interested in the contract to impair the transparency, fairness and progress of the bidding process, bid evaluation, contracting and implementation of the contract.
- 3.8 The BIDDER will not accept any advantage in exchange for any corrupt practice, unfair means and illegal activities.
- **3.9** The BIDDER shall not use improperly, for purposes of completion or personal gain, or pass on to others, any information provided by the BUYER as part of the business relationship, regarding plans, technical proposals and business details, including information contained in any electronic data carrier. The BIDDER also undertakes to exercise due and adequate care lest any such information is divulged.
- **3.10** The BIDDER commits to refrain from giving any complaint directly or through any other manner without supporting it with full and verifiable facts.
- **3.11** The BIDDER shall not instigate or cause to instigate any third person to commit any of the actions mentioned above.
- **3.12** If the BIDDER or any employees of the BIDDER or any person acting on behalf of the BIDDER, either directly or indirectly, is a relative of any of the officers of the BUYER, or alternatively, if any relative of an officer of the BUYER has financial interest/ stake in the BIDDER's firm, the same shall be disclosed by the BIDDER at the time of filing of tender.

The term "relative" for this purpose would be as defined in Section 6 of the Companies Act 1956.

- **3.13** The Bidder shall not lend to or borrow any money from or enter in to any monetary dealings or transactions, directly or indirectly, with any employee of the BUYER.
- 3.14 Bidder shall not approach the Courts while representing the matters to IEMs and he/ she will await their decision in the matter.
- 3.15 In case of sub-contracting, the Principal contractor shall take the responsibility of the adoption of Integrity Pact by the sub-contractor.
- 3.16 Bidders will not pass any information provided by Principal as part of business relationship to others and will not commit any offence under PC/IPC Act.
- 3.17 Bidders will disclose any transgressions with any other Company that may impinge on the anti corruption principle.
- 3.18 Bidders will not enter into any undisclosed agreement or understanding with other bidders with respect to prices, specifications, certifications, subsidiary contracts.
- 4. Previous Transgression:
- 4.1 The BIDDER declares that no previous transgression occurred in the last three years immediately before signing of this Integrity Pact, with any other company in any country in respect of any corrupt practices envisaged hereunder or with any Public Sector Enterprise in India or any Government Department in India that could justify BIDDER's exclusion from the tender process.
- **4.2** The BIDDER agrees that if it makes incorrect statement on this subject, BIDDER can be disqualified from the tender process or the contract, if already awarded, can be terminated for such reason.
  - 5. Earnest Money (Security Deposit)
  - As mentioned in the Tender Document
  - 6. Sanctions for Violations:
  - 6.1 Any breach of the aforesaid provisions by the BIDDER or any one employed by it or acting on its behalf ( whether with or without the knowledge of the BIDDER) shall entitle the BUYER to take all or any one of the following actions, wherever required.
    - (i) To immediately call off the pre contract negotiations without assigning any reason or giving any compensation to the BIDDER. However, the proceedings with the other BIDDER(s) would continue.
    - (ii) The earnest Money Deposit (in pre-contract stage) and / or Security Deposit/ Performance Bond (after the contract is signed) shall stand forfeited either fully or partly, as decided by the BUYER and the BUYER shall not be required to assign any reason therefore.
    - (iii) To immediately cancel the contract, if already signed, without giving any compensation to the BIDDER.
    - (iv) To recover all sums already paid by the BUYER, and in case of an Indian BIDDER with interest thereon at 2% higher than the prevailing Prime Lending Rate of State Bank of India, while in case of a BIDDER from a country other than India with interest thereon at 2% higher than the LIBOR. If any outstanding payment is due to the BIDDER from the BUYER in connection with any other contract for any other stores, such outstanding payment could also be utilized to recover the aforesaid sum and interest.
    - (V) To encash the advance bank guarantee and performance bond/ warranty bond, if furnished by the BIDDER, in order to recover the payments, already made by the BUYER, along with interest.
    - (vi) To cancel all or any other Contracts with the BIDDER. The BIDDER shall be liable to pay compensation for any loss or damage to the BUYER resulting from such cancellation/ rescission and the BUYER shall be entitled to deduct the amount so payable from the money(s) due to the BIDDER.

- (vii)To debar the BIDDER from participating in future bidding processes of the Government of India for a minimum period of five years, which may be further extended at the discretion of the BUYER.
- (viii) To recover all sums paid in violation of this Pact by BIDDER(s) to any middleman or agent or broker with a view to securing the contract.
- (ix) In case where irrevocable Letters of Credit have been received in respect of any contract signed by the BUYER with the BIDDER, the same shall not be opened.
- (x) Forfeiture of Performance Bond in case of a decision by the BUYER to forfeit the same without assigning any reason for imposing sanction for violation of this Pact.
- 6.2 The BUYER will be entitled to take all or any of the actions mentioned at para 6.1(i) to (x) of this Pact also on the Commission by the BIDDER or any one employed by it or acting on its behalf whether with or without the knowledge of the BIDDER), of an offence as defined in Chapter IX of the Indian Penal code, 1860 or Prevention of Corruption Act, 1988 or any other statute enacted for prevention of corruption.
- 6.3 The decision of the BUYER to the effect that a breach of the provisions of this Pact has been committed by the BIDDER shall be final and conclusive on the BIDDER. However, the BIDDER can approach the Independent Monitor(s) appointed for the purposes in this Pact.
- 7. Independent Monitors:
- 7.1 The BUYER has appointed Independent Monitors (hereinafter referred to as Monitors) for this Pact in consultation with the Central Vigilance Commission (Names and Address of the Monitors to be given).
- 7.2 The task of the Monitors shall be to review independently and objectively, whether and to what extent the parties comply with the obligations under this Pact.
- **7.3** The Monitors shall not be subject to instructions by the representatives of the parties and perform their functions neutrally and independently.
- 7.4 Both the parties accept that the Monitors have the right to access all the documents relating to the project/ procurement, including minutes of meetings.
- 7.5 As soon as the Monitor notices, or has reason to believe, a violation of this Pact, he will so inform the Authority designated by the BUYER.
- 7.6 The BIDDER(s) accepts that the Monitor has the right to access without restriction to all Project documentation of the BUYER including that provided by the BIDDER. The BIDDER will also grant the Monitor, upon his request and demonstration of a valid interest, unrestricted and unconditional access to his project documentation. The same is applicable to Subcontractors. The Monitor shall be under contractual obligation to treat the information and documents of the BIDDER/ Subcontractor(s) without confidentiality.
- 7.7 The BUYER will provide to the Monitor sufficient information about all meetings among the parties related to the Project provided such meetings could have an impact on the contractual relations between the parties. The parties will offer to the Monitor the option to participate in such meetings.
- **7.8** The Monitor will submit a written report to the designated Authority of BUYER/ Secretary in the Department/ within 8 to 10 weeks from the date of reference or intimation to him by the BUYER/ BIDDER and, should the occasion arise, submit proposals for correcting problematic situations.
- 8. Facilitation of Investigation

In case of any allegation of violation of any provisions of this Pact or payment of commission, the BUYER or its agencies shall be entitled to examine all the documents including the Books of Accounts of the BIDDER and the BIDDER shall provide necessary information and documents in English and shall extend all possible help for the purpose of such examination.

9. Law and Place of Jurisdiction

This Pact is subject to Indian Law. The place of performance and jurisdiction is the seat of the BUYER.

**10**. Other Legal Actions

The actions stipulated in this integrity Pact are without prejudice to any other legal action that may follow in accordance with the provisions of the extant law in force relating to any civil or criminal proceedings.

- 11. Validity
- 11.1 The validity of this Integrity Pact shall be from date of its signing and extend upto 5 years or the complete execution of the contract to the satisfaction of both the BUYER and the BIDDER./ Seller, including warranty period, whichever is later. In case, BIDDER is unsuccessful, this Integrity Pact shall expire after six months from the date of the signing of the contract.
- 11.2 Should one or several provisions of this Pact turn out to be invalid; the remainder of this Pact shall remain valid. In this case, the parties will strive to come to an agreement to their original intensions.
- **12**. The parties hereby sign this Integrity Pact at on

BUYER	BIDDER
Name of the Officer	CHIEF EXECUTIVE OFFICER
Designation	
Deptt./MINISTRY/PSU	
Witness	Witness
1.	1.
<ul><li>2.</li><li>* Provisions of these clauses would nee</li></ul>	2. 2. d to be amended/ deleted in line with the policy of the

\* Provisions of these clauses would need to be amended/ deleted in line with the policy of the BUYER in regard to involvement of Indian agents of foreign suppliers.

## UNDERTAKINGS TO BE furnished ON-LINE BY THE BIDDER

## USER PORTAL AGREEMENT

## e-Tender Portal User Agreement

In order to create a user account and use the e-Tender portal you must read and accept this e-Tender portal User Agreement.

## A. UNDERTAKINGS TO BE FURNISHED ONLINE BY THE BIDDER

## I DO HEREBY UNDERTAKE

1. That all the information being submitted by me/us is genuine, authentic, true and valid on the date of submission of tender and if any information is found to be false at any stage of tendering or contract period I/We will be liable to the following penal actions apart from other penal actions prescribed elsewhere in the tender document.

- a. Cancellation of my/our bid/contract(as the case may be)
- b. Forfeiture of EMD
- c. Punitive action as per tender document

2. That I/we accept all terms and condition of NIT, including General Terms and Condition and Special/Additional Terms and Condition as stated there in the tender document as available on the website.

3. That I/we accept the Integrity Pact as given in the tender document (if applicable).

4. That I/we am/are giving my/our consent for e-payment and submitting/shall submit the mandate form for e-payment in the format as prescribed in the document in case, the work is awarded to us.

5. That I/we do authorize CIL/subsidiary for seeking information/clarification from my Bankers having reference in this bid.

6. That I/we will upload original/certified photo/scanned of all the relevant documents as prescribed in the tender document in support of the information and data furnished by me/us online.

7. I/We confirm that I/We have not been banned or de-listed by any Govt. or Quasi Govt. agencies or PSUs. In case We are banned or delisted this information shall be specifically informed to the tender issuing authority.

8. That I/We accept all the undertakings as specified elsewhere in the tender document.

9. That this online agreement will be a part of my bid and if the work is awarded to me/us, this will be a part of our agreement with CIL/subsidiary Company.

## **B. TERMS AND CONDITIONS OF E-TENDER SERVICES AGREEMENT**

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You may print and download portions of material from the different areas of the website solely for your own noncommercial use provided that you agree that you shall not change or delete any copyright or proprietary materials from the site.

www.coalindiatenders.nic.in is an e-procurement portal of Coal India Limited/it's Subsidiary.

# THIS E-TENDER PORTAL AND RELATED SERVICES SUBJECT TO YOUR COMPLIANCE WITH THE USER STERMS AND CONDITIONS SET FORTH BELOW.

## PLEASE READ THE FOLLOWING INFORMATION CAREFULLY. YOU MAY NOT COMPLETE YOUR REGISTRATION AND USE THE E-TENDER PORTAL WITHOUT AGREEING TO COMPLY WITH ALL OF THE TERMS AND CONDITIONS SET FORTH BELOW.

# BY REGISTERING THE USER NAME AND PASSWORD, YOU AGREE TO ABIDE BY ALL THE TERMS AND CONDITIONS SET FORTH BELOW.

## -Bidder Registration, Password and Security

Upon successful completion of Registration online, User ID and Password will be registered. You can login, only by giving valid *User ID* and *Password* and then signing with your valid Digital Signature Certificate.

The Online registration/enrollment of bidder on the portal should be done in the name of the bidder. The person whose DSC is attached to the Registered Bidder should be **either** the bidder himself **Or**, duly authorized by the Bidder.

User ID and password are strictly personal to each Authorised User and non-transferable. The User shall ensure that its Authorised Users do not divulge or disclose their user ID or password to third parties. In the event that the Authorised User comes to know that the User ID/ Password has been/might have been divulged, disclosed or discovered by any third party, user or its authorized user shall immediately modify the password using "Change password" option. CIL/subsidiary will have no responsibility or obligation in this regard.

At the time of enrollment in the e-Tendering portal of CIL/its Subsidiaries, the Bidders should ensure that the status of DSC is active on this site. The activation of newly issued DSC may take 24 hrs or more. Hence Bidders who are obtaining new DSC should register at least 24 hrs before the submission of Bid.

By registering in this portal you forthwith assume the responsibility for maintaining the confidentiality of the Password and account, and for all activities that occur under your Password or Account. You also agree to (a) immediately notify by e-mail to **Application Administrator/Nodal officer**, of any unauthorized use of your Password or Account or any other breach of security, and (b) ensure that you log-out from your account at the end

of each session. CIL/its Subsidiaries shall not be liable for any loss or damage caused to you due to your failure to comply with the foregoing.

Registered user can modify or update some of the information in their profile as and when required at their own discretion. However some information such as "User ID" are protected against changes by Bidder after enrollment and some other information such as "Bidder Name" etc are protected against changes by Bidder after bid submission.

## Modification of software

With consent of **Project Advisory Committee**, e-procurement of CIL, the Administrator of e-Tender portal, reserves the right to modify, add, delete and/or change the contents, classification and presentation of the information on the marketplace at any time as it may in its absolute discretion find to be expedient and without giving any notice. It is the users responsibility to refer to the terms and/or any change or addition to the same while accessing the site.

Coal India Limited reserves right to interrupt/suspend the availability of the e-Tender system without any notice to the users.

## → System Requirements

It is the users responsibility to comply with the system requirements: hardware, software, Internet connectivity at user premises to access the e-Tender portal as mentioned in the home page in the link 'resources required'.

Under any circumstances, CIL shall not be liable to the Users for any direct/indirect loss incurred by them or damages caused to them arising out of the following:

(a) Incorrect use of the e-Tender System, or ;

(b) Internet Connectivity failures in respect of the equipments used by the Users or by the Internet Service Providers, or

;

(c) Inability of the Bidder to submit their bid due to any DSC related problems, hardware, software or any other factor which are personal/ special/ local to the Bidder.

## -Contents of Tender Information

Tenders shall be published by the authorized *Tender Inviting Authorities* of the respective Tendering entities of CIL/subsidiary. In case of any clarifications arising out of the tenders, the users have to contact the respective *Tender Inviting Authority*.

## -Bid Submission Acknowledgement

The User should complete all the processes and steps required for Bid submission. The successful Bid submission can be ascertained once **acknowledgement** is given by the system through **Bid Submission** number i.e. **Bid ID**, after completion of all the processes and steps. Coal India Limited/Subsidiary is not responsible for incomplete bid submission by users. Users may also note that the incomplete bids will not be saved by the system and so the same will not be available to the *Tender Inviting Authority* for processing.

The acknowledgment is the only confirmation of submission of bid, which the bidder can show as a proof of participating in the tender. Other than this acknowledgement, no proof will be considered as a confirmation to the submission of a bid. If the bidder fails to produce this acknowledgement required for verification in case of dispute, his claim for submission of bid may not be considered.

## +Upload files

The bidders have to ensure that the files being uploaded by them are free from all kinds of viruses and contain only the relevant information as stated by the Tender Inviting Authorities for the particular tender. It is not obligatory on the part of CIL/subsidiary to read each and every document uploaded by the Bidder. If any bidder / company has uploaded / attached irrelevant data, bogus or fabricated certificates towards his qualification requirements to the respective tender then their User account will be liable for termination permanently or temporarily by CIL/subsidiary without any prior notice.

#### +User Conduct

You agree that all information, data, text, software, photographs, graphics, messages or other materials ("Content"), whether publicly posted or privately transmitted, are the sole responsibility of the person from which such Content is originated. This means that you are entirely responsible for all Content that you upload, post, email or otherwise transmit via the e-Tender portal.

CIL/subsidiary does not control the Content posted via the e-Tender portal and, as such, does not guarantee the accuracy, integrity or quality of such Content. Hence under no circumstances, CIL/subsidiary is liable in any manner for any Content, including, but not limited to, for any errors or omissions in any Content, or for any loss or damage of any kind incurred as a result of the use of any Content posted, e-mailed or otherwise transmitted via the Site.

#### + Amendments to a tender published:

You agree that the CIL/ Subsidiary companies reserves the right to re-tender / cancel a tender or extend the closing date or amend the details of tender at any time by publishing corrigendum as applicable.

## -Special Admonitions For International Use:

Recognizing the global nature of the Internet, you agree to comply with all local rules regarding online content and acceptable Content. Specifically, you agree to comply with all applicable laws regarding the transmission of technical data to and from India or the country in which you reside.

## <mark>→</mark>Links

The Site may provide, links to other World Wide Web sites or resources. Because CIL/subsidiary has no control over such sites and resources, you acknowledge and agree that the CIL/Subsidiary is not responsible for the availability of such external sites or resources, and does not endorse and is not responsible or liable for any Content, advertising, products, or other materials on or available from such sites or resources. You further acknowledge and agree that the CIL/subsidiary shall not be responsible or liable, directly or indirectly, for any damage or loss caused or alleged to be caused by or in connection with use of or reliance on any such Content, Goods or Services available on or through any such site or resources.

#### Miscellaneous

This Agreement shall all be governed and construed in accordance with the laws of India & applicable to agreements made and to be performed in India. The e-Tender portal's failure to insist upon or enforce strict performance of any provision of this Agreement shall not be construed as a waiver of any provision or right. Neither the course of conduct between the parties nor trade practice shall act to modify any provision of this

Agreement. CIL/subsidiary may assign its rights and duties under this Agreement to any party at any time without notice to you. Any rights not expressly granted herein are reserved. **→Governing Law** 

Terms shall be governed by, and construed in accordance with, Indian law. The parties agree that the principal civil court of the place where the registered office of Coal India/Subsidiary company is situated shall have **non-exclusive** jurisdiction to entertain any dispute with Coal India/Subsidiary company. In case of dispute being with a regional Institute of CMPDIL, the principle Civil Court where the said regional Institute is situated shall be place of suing.

CIL/subsidiary reserves the right to initiate any legal action against those bidders violating all or any of the above mentioned terms & conditions of e-Tender services agreement.

## + Modification of terms of Agreement

CIL/its Subsidiaries reserves the right to add to or change/modify the terms of this Agreement. Changes could be made by us after the first posting to the Site and you will be deemed to have accepted any change if you continue to access the Site after that time. CIL/its Subsidiaries reserves the right to modify, suspend/cancel, or discontinue any or all services/ make modifications and alterations in any or all of the content, at any time without prior notice.

## +Policy and Security

## **General Policy**

CIL/its Subsidiaries is committed to protecting the privacy of our e-Tender site visitors. CIL/subsidiary does not collect any personal or business information unless you provide it to us voluntarily when conducting an online enrolment, bid submission etc. or any other transaction on the Site.

## Information Collected

When you choose to provide personal or business information to us to conduct an online transaction, we use it only for the purpose of conducting the specific online transaction that you requested. The information is also used for the purpose of vendor searches. For each online transaction, we require only a minimum amount of personal and business information required to process your transaction.

When you visit our portal to browse, read pages, or download information, we automatically collect and store only the following information:

- The Internet domain and IP address from which you access our portal;
- The date and time you access our portal;
- The pages you visit

This information would help us to make our site more useful to visitors and to learn about the number of visitors to our site and the types of technology our visitors use.

We do not give, share, sell or transfer any personal information to a third party unless required to do so by law. If you do not want any personal or business information to be collected, please do not submit it to us; however, without this required information we will be unable to process your online bid submission or any other on line transaction. Review, update and correction of any personal or business information can be done directly on the Site.

## **Use of Cookies**

When you choose to enter into an online transaction, we use cookies to save the information that you input while progressing through the transaction. A cookie is a very small amount of data that is sent from our server to your computer's hard drive. By enabling this feature, the cookie will remember the data entered by you and next time when you visit this site, the data stored in the cookie will be available in future.

## Security

The Site has security measures in place to protect against the loss, misuse and alteration of information under our control.

## MANDATE FORM FOR ELECTRONIC FUND TRANSFER / INTERNET BANKING PAYMENT.

1. Name of the Bidder :....

2. Address of the Bidder: .....

.....

City Pin	n Code
----------	--------

E-mail Id .....

Permanent Account Number .....

## 3. Particulars of Bank:

Bank Name							]	Bran	ch N	ame										
Branch Place				]	Branch City															
Pin Code				]	Branch Code															
MICR No.																				
(Digital Code number appearing on the MICR Band of the cheque supplied by the Bank. Please attach																				
Xerox copy of a chequ	e of	your	Ban	k foi	r ens	surin	g ao	ccura	acy of	f the	Bank	Nam	ne, B	ranc	h N	ame	an	d Co	ode	
Number.																				
RTGS CODE																				
Account Type Savings				Cu	rrent					Ca	sh C	redi	t							
Account Number(as appearing in the																				
Cheque Book.																				

4. Date from which the mandate should be effective.

I hereby declare that the particulars given above are correct and complete. If any transaction is delayed or not effected for reasons of incomplete or incorrect information. I shall not hold Company responsible. I also undertake to advise any change in the particulars of my account to facilitate updation of records for purpose of credit of amount through SBI Net / RTGS transfer/NEFT. I agree to discharge responsibility expected of me as a participant under the scheme. Any bank charges levied by the bank for such e-transfer shall be borne by us.

Place :

Date:

Signature of the Party / Authorized Signatory

Certified that particulars furnished above are correct as per our records.

Banker's Stamp Date

(Signature of the Authorized official from the Bank)

## DEVELOPMENT OF 20 MW SOLAR PV PROJECT AT CENTRAL COALFIELDS LIMITED (CCL) CHP/CPP PIPARWAR, JHARKHAND

## (Details Pertaining to Technical Qualification of the Bidder As per clause No. 7.1 of e-tender notice)

## FOR BIDDERS SEEKING QUALIFICATIONS AS PER CLAUSE 7.1 of e-tender notice

In support of Qualifying Requirements of clause No. 7.1 of e-tender notice, we confirm that we have designed, supplied, erected/ supervised erection and commissioned/ supervised commissioning of Solar Photo Voltaic (SPV) based grid connected power plant(s) of cumulative installed capacity of 16 MWp or above, out of which one plant have been of 10 MWp capacity or above.

We further confirm that one reference plant of 10 MWp or above capacity has been in successful operation for at least six (6) months prior to the date of techno-commercial bid opening:

(I) Details of SPV based grid connected power plant(s) of cumulative installed capacity of 16 MWp or above out of which one plant of 10 MWp capacity or above, as per following details:

Sl. No.	Item Description	Reference Plant 1 (10 MWp or above)	Reference Plant 2	Reference Plant	Cumulative
1.	Description of work				
2.	Name of Client with full address, Fax No. & Tel. No.				
3.	Name of the Power Plant with its location				
4.	Name and designation of the responsible person in client's organization				
5.	Contract No. and Date				
6.	Whether this is a SPV based grid connected Power Plant	YES* // NO*	YES* // NO*	YES* // NO*	YES* // NO*
7.	Capacity of the	MWp	MWp	MWp	MWp

Cumulative installed capacity of Grid connected power plant in MWp-

-	1	1	1		
	Plant				
8.	Whether scope of works included				
	(a) Design	YES* //NO*	YES* //NO*	YES* //NO*	YES* // NO*
	(b) Supply	YES* /NO*	YES* //NO*	YES* //NO*	YES* /NO*
	(c) Erected	YES* // NO*	YES* // NO*	YES* //NO*	YES* // NO*
	(d) Supervised Erection	YES* // NO*	YES* // NO*	YES* // NO*	YES* //NO*
	(e) Commissioned	YES* /NO*	YES* //NO*	YES* // NO*	YES* /NO*
	(f) Supervised Commissionin g	YES* //NO*	YES* // NO*	YES* //NO*	YES* // NO*
9.	Date of Commissioning of the above Plant				
10.	Copies of authentic Purchase Orders Completion Certificate from client, Agreements in support of details/data of Sl. No. 1 to 9 enclosed as Annex.				

Note: Continuation sheets of like size and format may be used and annexed to this Attachment if required.

# (II) Details of Reference Plant of 10 MWp or above capacity has been in successful operation for at least six (6) months prior to the date of techno-commercial bid opening, as per following :

Sl. No.	Item Description	Reference Plant
1.0	Description of work	
2.0	Name of Client with full address, Fax No. & Tel. No.	
3.0	Name of the Power Plant with its Location	
4.0	Name and Designation of the responsible person in client's organization	
5.0	Contract No. and Date	
6.0	Whether this is a SPV based grid connected Power Plant	YES* // NO*
7.0	Capacity of the Plant	MWp
8.0	Whether scope of works included	
	(a) Design	YES* //NO*
	(b) Supply	YES* //NO*
	(c) Erected	YES* //NO*
	(d) Supervised Erection	YES* //NO*
	(e) Commissioned	YES* /NO*
	(f) Supervised Commissioning	YES* //NO*
9.0	Date of Commissioning of the above Plant	
10.0	No. of months of successful operation of the above plant prior to the date of Techno- Commercial bid opening date.	
11.0	Completion Certificate from client, Copies of Authentic purchase orders, Agreements in support of data/details of Sl. No. 1 to 10 enclosed as Annex.	

Note: Continuation sheets of like size and format may be used and annexed to this Attachment if required.

## FOR BIDDER'S SEEKING QUALIFICATIONS AS PER CLAUSE 7.2 OF E-TENDER NOTICE

In support of Qualifying Requirements of clause No. 7.2 of e-tender notice, we confirm that we are a developer of Solar Photo Voltaic (SPV) based grid connected power plant(s) of cumulative installed capacity of 16 MWp or above, out of which atleast one plant have been of 10 MWp capacity or above.

We further confirm that one reference plant of 10 MWp or above capacity has been in successful operation for at least six (6) months prior to the date of Techno-Commercial bid opening:

# (I) Details of SPV based grid connected power plant(s) of cumulative installed capacity of 16 MWp or above, out of which one plant have been of 10 MWp capacity or above, as per following:

Sl.	Item Description	Reference Plant 1	Reference Plant 2	Reference Plant	Cumulative
NO		(10MWp or above)			
1	Description of work				
2	Name of Client with full address, Fax No. & Tel. No.				
3	Name of the Power Plant with its location				
'4.	Name and designation of the responsible person in client's organization				
5	Contract No. and Date				
6	Whether this is a SPV based grid connected Power Plant	YES* // NO*	YES* // NO*	YES* // NO*	YES* // NO*
7	Capacity of the Plant	MWp	MWp	MWp	MWp
8	Date of Commissioning of the above Plant				
9	Copies of Authentic Purchase Orders, Certificate from Clients, Agreements in support of details/data of Sl. No. 1 to 8 enclosed as Annex.				

Cumulative installed capacity of Grid connected power plant in MWp-

Note: Continuation sheets of like size and format may be used and annexed to this Attachment if required.

# (II) Details of reference plant of 10 MWp or above capacity has been in successful operation for at least six (6) months prior to the date of Techno- Commercial Bid opening, as per following:

Sl. No.	Item Description	Reference Plant
1.0	Description of work	

2.0	Name of Client with full address, Fax No. & Tel. No.	
3.0	Name of the Power Plant with its location	
4.0	Name and designation of the responsible person in client's organization	
5.0	Contract No. and Date	
6.0	Whether this is a SPV based grid connected Power Plant	YES* // NO*
7.0		
7.0	Capacity of the Plant	MWp
8.0	Date of Commissioning of the above Plant	MWp
7.0   8.0   9.0	Date of Commissioning of the above Plant No. of months of successful operation of the above plant prior to the date of Techno- Commercial bid opening date.	Mwp

Note: Continuation sheets of like size and format may be used and annexed to this Attachment if required.

## FOR BIDDER'S SEEKING QUALIFICATIONS AS PER CLAUSE 7.3 {(a) and (b)} OF E-TENDER NOTICE

In support of Qualifying Requirements of Clause 7.3 (a) of e-tender notice, we confirm that we have executed in the last ten (10) years an industrial project either as developer or as EPC Contractor in the area of **power\*/** steel\*/ oil and gas\*/ petro-chemical\*/ fertilizer\*/cement/\*coal mining including coal handling plant\* and/ or any other process industry\*, of a value of INR 73 Crore (Indian Rupees Seventy Three Crore only) or more in a single project or single work respectively and the same have been in successful operation for at least one (1) year prior to the date of techno-commercial bid opening. \* *Strike off whichever is not applicable* 

Sl.	Item Description	Reference Plant
No.		
1.0	Description of work	
2.0	Name of Client with full address, Fax No. & Tel. No.	
3.0	Name of the Industrial Project with its location	
4.0	Name and designation of the responsible person in client's organization	
5.0	Contract No. and Date	
6.0	Value of the Project in Crores (Rs) in a single project or work	
7.0	The Industrial Project is in the area of	
	(a) Power	YES*//NO*
	(b) Steel	YES*//NO*
	(c) Oil and Gas	YES*//NO*
	(d) Petro Chemical	YES*//NO*
	(e) Fertilizer	YES*//NO*
	(f) Cement	YES*//NO*
	(g) Coal Mining including coal handling plant	YES*//NO*
	(h) Any other process industry	YES* // NO*
8.0	Whether the Industrial Project has been executed as:	
	i) Developer	YES*//NO*
	ii) EPC	YES* // NO*
9.0	Date of Commissioning of the above Project or work	
10.0	No. of year(s) of successful operation of the above project prior to the date of Techno- Commercial bid opening date.	
11.0	Copies of Authentic Purchase Orders, Certificate from	

## **Details of Industrial Project is as per following:**
	Clients, Agreements in support of queries of Sl. No. 1 to10 enclosed as Annex.	
12.0	In case the Project executed by Developer the documentary evidence (certified by Chartered Accountant) for value of executed work enclosed at Annex in support of reference work	

Note: Continuation sheets of like size and format may be used and annexed to this Attachment if required.

In support of Qualifying Requirements of Clause 7.3(b) of e-tender notice, we confirm that we have executed at least one (1) Electrical Sub-station of 33 kV or above voltage level, consisting of equipment such as 33kV or above voltage level Circuit Breakers and Power Transformer, either as developer or as EPC Contractor which have been in successful operation for at least one (1) year prior to the date of techno-commercial bid opening.

#### **Details of Electrical Sub Station is as per following:**

Sl. No.	Item Description	Reference Plant
1.0	Description of work	
2.0	Name of Client with full address, Fax No. & Tel. No.	
3.0	Name of the Electrical Sub Station with its location	
4.0	Name and designation of the responsible person in client's organization	
5.0	Contract No. and Date	
6.0	Voltage level (s)	
7.0	Electrical Sub Station consisting of equipments of 33 KV or above: (a) Circuit Breaker (b) Power Transformers	YES* /NO*
0.0	Whather the Electrical Sub station has been avouted as	
8.0	<ul><li>i) Developer</li><li>ii) EPC</li></ul>	YES* //NO* // YES* //NO* //
9.0	Date of Commissioning of the above Electrical Sub Station	
10.0	No. of year(s) of successful operation of the above Electrical Sub Station prior to the date of Techno- Commercial bid opening date.	
11.0	Copies of Authentic Purchase Orders, Certificate from Clients, Agreements in support of queries of Sl. No. 1 to9 enclosed as Annex.	

#### Details of Design, Engineering, Manufacturing and Testing Capabilities of Bidder and/or wherever applicable, his Associate(s)/Collaborator(s)

- (1) We hereby confirm that we do not anticipate any change in ownership during proposed period of execution of work (if such a change is anticipated, the scope and effect thereof shall be defined). The relevant document for same is enclosed at Annexure XV-1 to this Annexure XV.
- (2) Furnish adequate detailed write up on

Sl. No.	Description	Details
(a)	Design and Engineering Organization and facilities/capabilities	Enclosed at Annexure XVA to this Annexure XV.
(b)	Manufacturing & Testing Organization and facilities available.	Enclosed at Annexure XVB to this Annexure XV.
(c)	Field Organization and resources for erection, testing & commissioning etc	Enclosed at Annexure XVC to this Annexure XV.
(d)	Quality Assurance Organization and capabilities for Engg., manufacturing & field installation.	Enclosed at Annexure XVD to this Annexure XV.
(e)	Established Project Management	Enclosed at Annexure XVE to this Annexure XV.
(f)	Details of Man power / Division of Company	Enclosed at Annexure XVF to this Annexure XV.

**Note:** The above Annexures from XVA to XVF shall be given as detailed write up with relevant documents by the bidder for **himself** and shall be furnished.

#### Details of Manufacturing Capacities/Plant Loading of the Bidder and Associate(s)/ Collaborator(s)/Sub-Contractors, wherever applicable

We hereby furnish below the details of our Installed Manufacturing Capacities (in KWp) and work in hand to establish spare capacity for completion of work under this Package.

SI	Item		2018-1	9		2019-20			2020-21			2021-22			2022-23	
· N o		Bidd er Shop	Coll ab rator / Asso ci te's shop	Sub Contra ctor shop	Bidd er Shop	Collabo rator/ Associa te's shop	Sub Contra ctor shop	Bidd er Shop	Collab orator/ Associ ate's shop	Sub Contra ctor shop	Bidd er Shop	Collab orator/ Associ ate's shop	Sub Contra ctor shop	Bidd er's Shop	Collabor ator/ Associat e's shop	Sub Contra ctor shop
1	Production Capacity as installed															
2	Firm orders in hand upto															
3	Balance Capacity available															
4	Orders Expected															
5	Work Load Expected for this contract															

6	Shortfall, if any								
7	Alternativ								
	e								
	Arrangem								
	entsTo								
	make up								
	For this								
	short fall								

Note: Continuation sheets of like size and format may be used as per Bidder's requirement and shall be annexed to this Attachment.

#### Present Order Book Position for Bidder and/or wherever applicable, his Associate(s)/Collaborator(s)

List of orders of last 5 years & present status.

Sl. No.	Client	Order Value	No. of Units	Date of Order	Present St	atus	% work completed Engg./ Manufacturing/	Completion Supply	n of	Completion Testing & Commission	of Erection,	Reasons for Delay (if any)
			& Unit Size		Schedule	Actual / Expected	Erection	Schedule	Actual / Expected	Schedule	Actual / Expected	-
1.												
2.												
<u> </u>												
<del>4</del> . 5												
6												
7.												
8.												
9.												
10.												
11.												
12.												
13.												
14.												
15.												
10.												
1/.												
18.												

Note: 1. The above attachment shall be filled up by the bidder for **himself** and for **major sub-contractor**, if any being proposed by the bidder in his bid.

2. Continuation sheets of like size and format may be used as per Bidder's requirement and shall be annexed to this Attachment.

#### **ANNEXURE - XVIII**

#### DEVELOPMENT OF 20 MW SOLAR PV PROJECT AT CENTRAL COALFIELDS LIMITED (CCL) CHP/CPP PIPARWAR, JHARKHAND Past Performance Data

Details of Similar Unit Supplied / Commissioned in last ten years for bidder and/or wherever applicable, his Associate(s)/Collaborator(s):

Sl. No	Client Name & Address	Order Value	No. of Units	Date of Order	Date Comple Supply	etion of	Date of 0 of Erectio	Completion n, Testing	Reasons for
			& Unit Size		Schedule	Actual	& Commis	sioning	Delay (if
							Schedule	Actual	ully)
1.									
2.									
3.									
4.									
5.									
6.									
7.									
8.									
9.									
10.									
11.									
12.									
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20.									
21.									
22.									

**Note:** 1. The above Attachment shall be filled up by the bidder for **himself**, and for **sub-contractor**, if any, being proposed by the bidder in his bid.

2. Continuation sheets of like size & format may be used if required and annexed to this Attachment.

#### Data regarding Key Construction Personnel for bidder and his Associate(s)/Collaborator(s)

The qualification and experience of key constructional personnel proposed for administration and execution of the contract at site are as follows:

Sl.	Name	Qualification	Position/Designation	Experience
No.				
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
13.				
14.				
15.				
16.				

**Note:** 1. This Attachment shall be filled by the bidder for **himself**.

2. Continuation sheets of like size & format may be used if required and annexed to this Attachment.

#### (Manpower loading data)

We declare that our manpower loading during execution of the contract will be as follows:

No. of months from the date of Notification of Award		1	2	3	4	5	6	7	8	9	10	11	12	
Labor	(Categ	gory)												
Note:	1.	The above A	Attachme	nt shall	oe filled	by the b	idder f	or <b>hi</b> i	mself					
	2.	Continuation	n sheets o	of like si	ze & foi	rmat may	be us	ed if 1	requir	ed an	d ann	exed	to th	is Attachme

3. List of category of labor will be given by the Bidder.

#### (PROJECT MANAGEMENT ORGANISATION)

Dear Sirs,

1.0 we furnish below the brief write up in support of our established Project Management Organization.

#### (DECLARATION BY THE BIDDER WHO DID NOT MANUFACTURE OR OTHERWISE PRODUCE AND/OR INSTALL PLANT AND EQUIPMENT OF SOLAR PROJECT)

#### Dear Sirs,

1.0 since we did not manufacture or otherwise produce and/or install plant and equipment of Solar Project, we furnish below the following details/ documents/ declarations in support of above:

S1. Description Details No. (i) We have financial and other Enclosed at Annexure XXII-A to this Attachment-XXII capabilities necessary to perform the Contract. (ii) We have been duly authorized by (i) Manufacturer's authorization/ consent letter etc. in the manufacturer or producer of their favor to supply of Solar Plant equipments the related plant and equipment or Enclosed at Annexure XXII-B to this Attachmentcomponent to supply and/or install XXII. that item in the Employer's (ii) Manufacturer's authorization/ consent letter etc. for country. installation of Solar Plant equipments- Enclosed at Annexure **XXII-C** To this Attachment- **XXII**.

Further, we also declare that we will be responsible for ensuring that the manufacturer or producer of the related item meets the minimum criteria listed for that item in the subject bidding documents including Technical specifications.

#### Schedule of Erection Tools & Equipment and Safety Equipments & Safety Personal Protective Equipments

A. We indicate herein below the erection tools & equipment we have in our possession and the tools & equipment we propose to bring to the Site under the Package, in case the contract is awarded to us.

Sl. No.	Type a	nd	Description	of th	e Number	the	Bidder	Number the Bidder	proposes
	Equipme	III			nas m r c	5565510	)11	to bring to the site	
1.									
2.									
3.									
4.									
5.									
6.									
7.									
8.									
9.									
10.									
11.									
12.									
13.									
14.									
15.									
16.									
17.									
18.									
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20.									
21.									
22.									
23.									
24.									
25.									
26.									
27.									

#### B. Safety Equipment & Safety Personal Protective Equipments

We hereby confirm that the quantity and type of Certain tools and plant & equipment, we will employ for construction/erection, will not be less than those listed above and agree to bring more tools & plant and equipment, if so warranted, in the opinion of the Project Manager. Our proposed construction/erection tools & plants and equipment utilization plan indicating utilization dates and time duration of all major erection and construction tools & plant and equipment placed on site is enclosed at Annexure to this attachment.

**Note :** Continuation sheets of like size and format may be used as per Bidder's requirements and shall be annexed to this Attachment.

#### Information regarding Quality Assurance Programme

We hereby provide the necessary information on Quality Assurance Programme containing the overall Quality Management and Procedures, which we propose to follow during various phases of execution of the Contract.

\_\_\_\_\_

\_\_\_\_\_

**Note:** Continuation sheets of like size and format may be used as per Bidder's requirement and shall be annexed to this Attachment.

#### **MILESTONE SCHEDULE**

We hereby confirm the acceptance to the time schedule (9 Months for completion of facilities) for the subject package as specified in the bidding documents. Further, we confirm that we shall adhere with the time schedule for the subject package as specified in the bidding documents.

Further we confirm to carry out comprehensive Operation & Maintenance (Q&M) of Solar Photo Voltaic Plant for **Five (05) years** as specified in the Technical Specifications.

# Bank Guarantee Form for Advance Payment (Installation Services/Civil& Allied works)

To,

[Employer's Name & Address]

Re: Bank Guarantee in respect of Contract No....., Dated...... Between ...... (Name of the company) and ...... (Name of the Contractor)

......[Employer's Namel In consideration of ..... (hereinafter referred to as the 'Employer', which expression shall, unless repugnant to the context or meaning thereof include its successors, administrators and assigns) having awarded to M/s ...... (Contractor's Name) ..... with its Registered/Head Office at ..... (hereinafter referred to as the 'Contractor' which expression shall unless repugnant to the context or meaning thereof, include its successors, administrators, executors and assigns), a Contract, by issue of Employer's Notification of Award No. ..... dated ..... and the same having been unequivocally accepted by the Contractor, resulting into a Contract bearing No. ..... dated ..... valued at ..... for of Contract] ..... (hereinafter called the 'Contract') and the Employer having agreed to make an interest bearing advance ('said Advance') to the Contractor amounting to ..... (in words and figures) ..... in terms of the said Contract for performance of the above Contract against Bank Guarantee to be furnished by the Contractor.

We ..... [Name and address of the Bank] ..... having its Head Office at ..... (hereinafter referred to as the 'Bank', which expression shall, unless repugnant to the context or meaning thereof, include its successors, administrators, executors and assigns) do hereby guarantee and undertake to pay the Employer, immediately on demand amount plus GST]..... as aforesaid alongwith interest @ 12.20% per annum on the advance amount released by the Employer calculated from the date of release of the said advance by the Employer to the Contractor, time at anv upto .....(#) ..... without any demur, reservation, contest, recourse or protest and / or without any reference to the Contractor. Any such demand made by the Employer on the Bank shall be conclusive and binding as to the amount and interest claimed by the Employer under this guarantee notwithstanding any difference between the Employer and the Contractor or any dispute pending before any Court, Tribunal, Arbitrator or any other authority. The Bank undertakes not to revoke this guarantee during its currency without previous consent of the Employer and further agrees that the guarantee herein contained shall be enforceable till Ninety (90) days after expiry of its validity.

The Employer shall have the fullest liberty without affecting in any way the liability of the Bank under this guarantee, from time to time to vary the advance or to extend the time for performance of the Contract by the Contractor. The Employer shall have the fullest liberty without affecting this guarantee, to postpone from time to time the exercise of any powers vested in them or of any right which they might have against the Contractor, and to exercise the same at any time in any manner, and either to enforce or to forbear to enforce any covenants, contained or implied, in the Contract between the Employer and the Contractor or any other course or remedy or security available to the Employer. The Bank shall not be released of its obligations under these presents by any exercise by the Employer of its liberty with reference to the matters aforesaid or any of them or by reason of any other act or forbearance or other acts of omission or commission on the part of the Employer or any other indulgence shown by the Employer or by any other matter or thing whatsoever which under law would but for this provision, have the effect of relieving the Bank.

The Bank also agrees that the Employer at its option shall be entitled to enforce this Guarantee against the Bank as a principal debtor, in the first instance without proceeding against the Contractor and notwithstanding any security or other guarantee that the Employer may have in relation to the Contractor's liabilities.

Any notice by way of request, demand or otherwise hereunder maybe sent by post/e-mail/Fax addressed to the bank branch/operative branch, which shall be deemed to be a sufficient demand notice. Bank shall effect payment thereof forthwith.

This guarantee will not be discharged due to the change in the constitution of the Bank or the Contractor.

The Bank has under its constitution power to give this Guarantee and Sri..... who has signed it on behalf of the Bank has authority to do so.

The Bank Guarantee as referred above shall be operative at our branch at..... payable at.....

The Contact details of the Bank issuing BG and the local operating Branch of the Bank at Ranchi(Jharkhand.) are as under :

Particulars	Issuing Bank	Local Operating Branch at Ranchi
Branch Codo		
Dialicit Coue		
Postal Address		
Telephone No.		
FAX No.		
Email Id		

Signed and sealed this.....day of.....at.....

SIGNED, SEALED AND DELIVERED

For and on behalf of the Bank by:

- (Signature)
- (Name)
- (Designation)
- (Code number)
- (address)

Notes: 1. (#) This date shall be Ninety (90) days beyond the date of Completion of the last Facilities.

2. The department shall ensure extension of guarantee period in case of extension of time.

**3.** The Bank Guarantee issued by the issuing bank on behalf of contractor/ supplier in favour of Central Coalfields Limited shall be in paper form as well as issued under Structured Financial Messaging System(SFMS). The details of beneficiary for issue of BG under SFMS platform must contain the following information:

	Name	<b>Central Coalfields Limited</b>
	Area	*
Name of beneficiary and	Bank A/C no. of beneficiary	10106155123
details	Customer ID/CIF no of beneficiary	80288731402
	Department	E&M
	Beneficiary's Bank	State Bank of India
Beneficiary's Bank, Branch	Branch and Address	SME Branch, Doranda,
and Address		Ranchi - 834002
	SFMS Code/ IFSC Code	SBIN0009620
	In case of Foreign BG Swift	SBININBB387
	Code	

*	HQ/ Name of the Area of CCL
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The original Bank Guarantee shall be sent by the issuing bank to concerned department/ Area by registered post(AD).

No. P-45021/2/2017-PP (BE-II) Government of India Ministry of Commerce and Industry Department for Promotion of Industry and Internal Trade (Public Procurement Section)

Udyog Bhawan, New Delhi Dated: 29<sup>th</sup> May, 2019

<u>To</u>

All Central Ministries/Departments/CPSUs/All concerned

#### ORDER

Subject: Public Procurement (Preference to Make in India), Order 2017 – Revision; regarding.

Department for Promotion of Industry and Internal Trade, in partial modification [Paras 3(a) and 14 modified and Para 10A added] of Order No.P-45021/2/2017-B.E.-II dated 15.6.2017 as amended by Order No.P-45021/2/2017-B.E.-II dated 28.05.2018, hereby issues the revised 'Public Procurement (Preference to Make in India), Order 2017'' with immediate effect:-

Whereas it is the policy of the Government of India to encourage 'Make in India' and promote manufacturing and production of goods and services in India with a view to enhancing income and employment, and

Whereas procurement by the Government is substantial in amount and can contribute towards this policy objective, and

Whereas local content can be increased through partnerships, cooperation with local companies, establishing production units in India or Joint Ventures (JV) with Indian suppliers, increasing the participation of local employees in services and training them,

#### Now therefore the following Order is issued :

1. This Order is issued pursuant to Rule 1/53 (iii) of the General Financial Rules 2017.

2. Definitions: For the purposes of this Order:

'Local content' means the amount of value added in India which shall, unless otherwise prescribed by the Nodal Ministry, be the total value of the item procured (excluding net domestic indirect taxes) minus the value of imported content in the item (including all customs duties) as a proportion of the total value, in percent.

'Local supplier' means a supplier or service provider whose product or service offered for procurement meets the minimum local content as prescribed under this Order or by the competent Ministries / Departments in pursuance of this order.

 $\mathcal{L}T$  means the lowest tender or lowest bid or the lowest quotation received in a tender, bidding process or other procurement solicitation as adjudged in the evaluation process as per the tender or other procurement solicitation.

*margin of purchase preference* means the maximum extent to which the price quoted by a local supplier may be above the L1 for the purpose of purchase preference.

'Nodal Ministry' means the Ministry or Department identified pursuant to this order in respect of a particular item of goods or services or works.

'Procuring entity' means a Ministry or department or attached or subordinate office of, or autonomous body controlled by, the Government of India and includes Government companies as defined in the Companies Act.

Works' means all works as per Rule 130 of GFR- 2017, and will also include 'turnkey works'.

3. Requirement of Purchase Preference : Subject to the provisions of this Order and to any specific instructions issued by the Nodal Ministry or in pursuance of this Order, purchase preference shall be given to local suppliers in all procurements undertaken by procuring entities

in the manner specified hereunder

a. In procurement of all goods, services or works in respect of which the estimated value of procurement is less than INR 50 Lakhs, only local suppliers shall be eligible to bid. However, in procurement of all goods, services or works, in respect of which the Nodal Ministry / Department has communicated that there is sufficient local capacity and local competition, only local suppliers shall be eligible to bid irrespective of purchase value.

Provided that for any particular item, the Nodal Ministry / Department may also prescribe an upper threshold limit, below which procurement shall be made only from local suppliers.

Further provided that in any particular case of procurement, if the procuring authority is of the view that the goods, services or works of required quality / specifications etc. may not be available in the country, or sufficient capacity or competition does not exist domestically. and it is necessary to undertake global competitive bidding, the procuring authority may allow the same after recording reasons. In such cases, the provisions of sub-paragraph b or c, as the case may be, shall apply;

b. In the procurements of goods or works which are not covered by paragraph 3a and which are divisible in nature, the following procedure shall be followed;

- Among all qualified bids, the lowest bid will be termed as L1. If L1 is from a local supplier, the contract for full quantity will be awarded to L1. i.
- If L1 bid is not from a local supplier, 50% of the order quantity shall be awarded to L1. Thereafter, the lowest bidder among the local suppliers, will be invited to match ü. the L1 price for the remaining 50% quantity subject to the local supplier's quoted price falling within the margin of purchase preference, and contract for that quantity shall be awarded to such local supplier subject to matching the L1 price. In case such lowest eligible local supplier fails to match the L1 price or accepts less than the offered quantity, the next higher local supplier within the margin of purchase preference shall be invited to match the L1 price for remaining quantity and so on, and contract shall be awarded accordingly. In case some quantity is still left uncovered on local suppliers, then such balance quantity may also be ordered on the L1 bidder.
- In procurements of goods or works not covered by sub-paragraph 3a and which are not divisible, and in procurement of services where the bid is evaluated on price alone, the с.

following procedure shall be followed:-Among all qualified bids, the lowest bid will be termed as L1. If L1 is from a local supplier, the contract will be awarded to L1.

- 3 -
- ii. If L1 is not from a local supplier, the lowest bidder among the local suppliers, will be invited to match the L1 price subject to local supplier's quoted price falling within the margin of purchase preference, and the contract shall be awarded to such local supplier subject to matching the L1 price.
- iii. In case such lowest eligible local supplier fails to match the L1 price, the local supplier with the next higher bid within the margin of purchase preference shall be invited to match the L1 price and so on and contract shall be awarded accordingly. In case none of the local suppliers within the margin of purchase preference matches the L1 price, then the contract may be awarded to the L1 bidder.
- 4. Exemption of small purchases: Notwithstanding anything contained in paragraph 3, procurements where the estimated value to be procured is less than Rs. 5 lakhs shall be exempt from this Order. However, it shall be ensured by procuring entities that procurement is not split for the purpose of avoiding the provisions of this Order.
- 5. **Minimum local content:** The minimum local content shall ordinarily be 50%. The Nodal Ministry may prescribe a higher or lower percentage in respect of any particular item and may also prescribe the manner of calculation of local content.
- 6. Margin of Purchase Preference: The margin of purchase preference shall be 20%.
- 7. Requirement for specification in advance: The minimum local content, the margin of purchase preference and the procedure for preference to Make in India shall be specified in the notice inviting tenders or other form of procurement solicitation and shall not be varied during a particular procurement transaction.
- 8. Government E-marketplace: In respect of procurement through the Government Emarketplace (GeM) shall, as far as possible, specifically mark the items which meet the minimum local content while registering the item for display, and shall, wherever feasible, make provision for automated comparison with purchase preference and without purchase preference and for obtaining consent of the local supplier in those cases where purchase preference is to be exercised.
- 9. Verification of local content:
  - a. The local supplier at the time of tender, bidding or solicitation shall be required to provide self-certification that the item offered meets the minimum local content and shall give details of the location(s) at which the local value addition is made.
  - b. In cases of procurement for a value in excess of Rs. 10 crores, the local supplier shall be required to provide a certificate from the statutory auditor or cost auditor of the company (in the case of companies) or from a practicing cost accountant or practicing chartered accountant (in respect of suppliers other than companies) giving the percentage of local content.
  - c. Decisions on complaints relating to implementation of this Order shall be taken by the competent authority which is enpowered to look into procurement-related complaints relating to the procuring entity.
  - d. Nodal Ministries may constitute committees with internal and external experts for independent verification of self-declarations and auditor's/ accountant's certificates on random basis and in the case of complaints.

- 4 ---

e. Nodal Ministries and procuring entities may prescribe fees for such complaints.

- f. False declarations will be in breach of the Code of Integrity under Rule 175(1)(i)(h) of the General Financial Rules for which a bidder or its successors can be debarred for up to two years as per Rule 151 (iii) of the General Financial Rules along with such other actions as may be permissible under law.
- g. A supplier who has been debarred by any procuring entity for violation of this Order shall not be eligible for preference under this Order for procurement by any other procuring entity for the duration of the debarment. The debarment for such other procuring entities shall take effect prospectively from the date on which it comes to the notice of other procurement entities, in the manner prescribed under paragraph 9h below.
- h. The Department of Expenditure shall issue suitable instructions for the effective and smooth operation of this process, so that:
  - i. The fact and duration of debarment for violation of this Order by any procuring entity are promptly brought to the notice of the Member-Convenor of the Standing Committee and the Department of Expenditure through the concerned Ministry /Department or in some other manner;
  - ii. on a periodical basis such cases are consolidated and a centralized list or decentralized lists of such suppliers with the period of debarment is maintained and displayed on website(s);
  - iii. in respect of procuring entities other than the one which has carried out the debarment, the debarment takes effect prospectively from the date of uploading on the website(s) in the such a manner that ongoing procurements are not disrupted.

### 10. Specifications in Tenders and other procurement solicitations:

- a. Every procuring entity shall ensure that the eligibility conditions in respect of previous experience fixed in any tender or solicitation do not require proof of supply in other countries or proof of exports.
  - b. Procuring entities shall endeavour to see that eligibility conditions, including on matters like turnover, production capability and financial strength do not result in unreasonable
    - exclusion of local suppliers who would otherwise be eligible, beyond what is essential for ensuring quality or creditworthiness of the supplier.
  - c. Procuring entities shall, within 2 months of the issue of this Order review all existing eligibility norms and conditions with reference to sub-paragraphs 'a' and 'b' above.
  - If a Nodal Ministry is satisfied that Indian suppliers of an item are not allowed to participate and/ or compete in procurement by any foreign government, it may, if it deems Ы appropriate, restrict or exclude bidders from that country from eligibility for procurement of that item and/ or other items relating to that Nodal Ministry. A copy of every instruction or decision taken in this regard shall be sent to the Chairman of the Standing Committee.

- 5 e. For the purpose of sub-paragraph 10 d above, a supplier or bidder shall be considered to be from a country if (i) the entity is incorporated in that country, or ii) a majority of its shareholding or effective control of the entity is exercised from that country; or (iii) more than 50% of the value of the item being supplied has been added in that country. Indian suppliers shall mean those entities which meet any of these tests with respect to India." 10A. Action for non-compliance of the Provisions of the Order: In case restrictive or discriminatory conditions against domestic suppliers are included in bid documents, an inquiry shall be conducted by the Administrative Department undertaking the procurement (including procurement by any entity under its administrative control) to fix responsibility for the same. Thereafter, appropriate action, administrative or otherwise, shall be taken against erring officials of procurement entities under relevant provisions. Intimation on all such actions shall be sent to the Standing Committee. 11. Assessment of supply base by Nodal Ministries: The Nodal Ministry shall keep in view the domestic manufacturing / supply base and assess the available capacity and the extent of local competition while identifying items and prescribing minimum local content or the manner of its calculation, with a view to avoiding cost increase from the operation of this Order. 12. Increase in minimum local content: The Nodal Ministry may annually review the local content requirements with a view to increasing them, subject to availability of sufficient local competition with adequate quality. 13. Manufacture under license/ technology collaboration agreements with phased indigenization: While notifying the minimum local content, Nodal Ministries may make special provisions for exempting suppliers from meeting the stipulated local content if the product is being manufactured in India under a license from a foreign manufacturer who holds intellectual property rights and where there is a technology collaboration agreement / transfer of technology agreement for indigenous manufacture of a product developed abroad with clear phasing of increase in local content. 14. Powers to grant exemption and to reduce minimum local content: The administrative Department undertaking the procurement (including procurement by any entity under its administrative control), with the approval of their Minister-in-charge, may by written order, for reasons to be recorded in writing. a. reduce the minimum local content below the prescribed level; or b. reduce the margin of purchase preference below 20%; or C. exempt any particular item or supplying entities or class or classes of items or procuring or supplying entities from the operation of this Order or any part of the Order A copy of every such order shall be provided to the Standing Committee and concerned Nodal Ministry / Department. The Nodal Ministry / Department concerned will continue to have the power to vary its notification on Minimum Local Content. 15. Directions to Government companies: In respect of Government companies and other procuring entities not governed by the General Financial Rules, the administrative Ministry or Department shall issue policy directions requiring compliance with this Order. .....Contd, p/6

16. Standing Committee: A standing committee is hereby constituted with the following membership

- 6 -

Secretary, Department for Promotion of Industry and Internal Trade—Chairman Secretary, Commerce-Member

Secretary, Ministry of Electronics and Information Technology-Member Joint Secretary (Public Procurement), Department of Expenditure-Member Joint Secretary (DPIIT)-Member-Convenor

The Secretary of the Department concerned with a particular item shall be a member in respect of issues relating to such item. The Chairman of the Committee may co-opt technical experts as relevant to any issue or class of issues under its consideration.

- 17. Functions of the Standing Committee: The Standing Committee shall meet as often as necessary, but not less than once in six months. The Committee
  - shall oversee the implementation of this order and issues arising therefrom, and make a. recommendations to Nodal Ministries and procuring entities.
  - b. shall annually assess and periodically monitor compliance with this Order
  - shall identify Nodal Ministries and the allocation of items among them for issue of notifications on minimum local content
  - may require furnishing of details or returns regarding compliance with this Order and d. related matters
  - may, during the annual review or otherwise, assess issues, if any, where it is felt that the manner of implementation of the order results in any restrictive practices, cartelization or e. increase in public expenditure and suggest remedial measures
  - may examine cases covered by paragraph 13 above relating to manufacture under license/ technology transfer agreements with a view to satisfying itself that adequate f. mechanisms exist for enforcement of such agreements and for attaining the underlying objective of progressive indigenization
  - g. may consider any other issue relating to this Order which may arise.
  - 18. Removal of difficulties: Ministries /Departments and the Boards of Directors of Government companies may issue such clarifications and instructions as may be necessary for the removal of any difficulties arising in the implementation of this Order.
  - 19. Ministries having existing policies: Where any Ministry or Department has its own policy for preference to local content approved by the Cabinet after 1st January 2015, such policies will prevail over the provisions of this Order. All other existing orders on preference to local content shall be reviewed by the Nodal Ministries and revised as needed to conform to this Order, within two months of the issue of this Order.
  - 20. Transitional provision: This Order shall not apply to any tender or procurement for which notice inviting tender or other form of procurement solicitation has been issued before the issue of this Order.

Hum Malonem

(Arun Mahendru Baraj) Senior Development Officer Tel: 2306 2635

#### PROFORMA FOR WRITTEN CONSENT FOR ARBITRATION CLAUSE (Applicable for Partnership Firm & Joint Venture)

We, all the Partners of M/s	(Partnership Firm/			
Joint Venture), do hereby give our written consent for acceptance of the following Arbitration Clause of the NIT for the Work				
ű	" tendered by CCL			
vide NIT No	dated and Tender Id			
······				

#### A. <u>Settlement of Disputes</u>.

It is incumbent upon the contractor to avoid litigation and disputes during the course of execution. However, if such disputes take place between the contractor and the department, effort shall be made first to settle the disputes at the company level.

The contractor should make request in writing to the Engineer-in-charge for settlement of such disputes/ claims within 30 (thirty) days of arising of the cause of dispute/ claim failing which no disputes/ claims of the contractor shall be entertained by the company.

Effort shall be made to resolve the dispute in two stages

In first stage dispute shall be referred to Area CGM/GM. If difference still persist the dispute shall be referred to a committee constituted by the owner. The committee shall have one member of the rank of Director of the company who shall be chairman of the committee.

If differences still persist, the settlement of the dispute shall be resolved in the following manner:

Disputes relating to the commercial contracts with Central Public Sector Enterprises / Govt. Departments (except Railways, Income Tax, Customs & Excise)/ State Public Sector Enterprises shall be referred by either party for Arbitration to the PMA (Permanent Machinery of Arbitration) in the department of Public Enterprises.

In case of parties other than Govt. Agencies, the redressal of the dispute may be sought through Arbitration (THE ARBITRATION AND CONCILIATION ACT, 1996 as amended by AMENDMENT ACT of 2015).

#### B. Settlement of Disputes through Arbitration

If the parties fail to resolve the disputes/differences by in house mechanism, then, depending on the position of the case, either the employer/owner or the contractor shall give notice to other party to refer the matter to arbitration instead of directly approaching Court. The contractor shall, however, be entitled to invoke arbitration clause only after exhausting the remedy available under the clause 16.

In case of parties other than Govt. agencies, the redressal of disputes/differences shall be sought through Sole Arbitration as under.

#### Sole Arbitration:

In the event of any question, dispute or difference arising under these terms & conditions or any condition contained in this contract or interpretation of the terms of, or in connection with this Contract (except as to any matter the decision of which is specially provided for by these conditions), the same shall be referred to the sole arbitration of a person, appointed to be the arbitrator by the Competent Authority of CIL / CMD of Subsidiary Company (as the case may be). The award of the arbitrator shall be final and binding on the parties of this Contract.

- (a) In the event of the Arbitrator dying, neglecting or refusing to act or resigning or being unable to act for any reason, or his/her award being set aside by the court for any reason, it shall be lawful for the Competent Authority of CIL / CMD of Subsidiary Company (as the case may be) to appoint another arbitrator in place of the outgoing arbitrator in the manner aforesaid.
- (b) It is further a term of this contract that no person other than the person appointed by the Competent Authority of CIL / CMD of Subsidiary Company (as the case may be) as aforesaid should act as arbitrator and that, if for any reason that is not possible, the matter is not to be referred to Arbitration at all.

Subject as aforesaid, Arbitration and Conciliation Act, 1996 as amended by Amendment Act of 2015, and the rules thereunder and any statutory modification thereof for the time being in force shall be deemed to apply to the Arbitration proceedings under this clause.

The venue of arbitration shall be the place from which the contract is issued or such other place as the Competent Authority of CIL/ CMD of Subsidiary Company (as the case may be) at his discretion may determine.

Applicable Law: The contracts shall be interpreted in accordance with the laws of the Union of India.

#### Signature of Partners of Partnership Firm/ Joint Venture:

1.	Name of Partner :	Signature :
2.	Name of Partner :	Signature :
3.	Name of Partner :	Signature :
4.	Name of Partner :	Signature :
5.	Name of Partner :	Signature :
6.		
7.		

Note: This CONSENT has to be signed by each Partner of Partnership Firm/ Joint Venture

# Section V Price Bid

Price bid has been enclosed in .xls format with the bid.



# सेंट्रल कोलफिल्डस लिमिटेड Central Coalfields Limited

(A subsidiary of Coal India Limited)



## SECTION – VI TECHNICAL SPECIFICATIONS FOR

Development of 20MW Solar PV Project at Central Coalfields Limited (CCL) CHP/CPP Piparwar, Jharkhand

BIDDING DOCUMENT NO: RE-CS-9296-004-9

This document is meant for the exclusive purpose of bidding against this specification and shall not be transferred, reproduced or otherwise used for purposes other than that for which it is specifically issued.

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	CHAPTER-A1				
	PROJE	ст ІІ	NFORMATION		
1.0	INTRODUCTION				
	Central Coalfields Li Corporation Ltd) is su November 1975. Centr Ratna Company since C Mines (22 Underground Darbhanga House, ranc	mited Ibsidia al Co Octobe & 40 hi,Jha	l (formerly Nationa ary of Coal India Li palfields Limited (CCL er 2007. Presently CCL O Opencast Mines). C arkhand.	I Coal Dev mited, formed ) is a Catego Lis having 62 ( CL is headqua	elopment I on 1st ry-I Mini- Operative artered at
	CCL intend to implemen land within piparwar MG	t sola R at F	r photovoltaic (SPV) po Piparwar, District Chatr	ower plant at th a (Jharkhand).	ne vacant
	The 20MW solar powe package under Domesti cell and modules.	er pro c Cor	ject shall be impleme npetitive bidding base	ented in a sin d on Open cate	igle EPC egory PV
2.0	LOCATION AND APPROACH				
	Location		Piparwar in the Chatr	a District of Jh	arkhand
	Nearest Highway		State Highway 7 Tangar Road)	(Hazaribagh	n-Tandwa-
	Nearest Commercial Air	port	Ranchi (68 kms)		
	Nearest Railway Station Ranchi (68 kms)				
	Indicative Coordinate		Latitude: 23° 44' 35" Longitude: 85° 03' 14	N , ŀ" E	
3.0	LAND AREA AVAILABI	LITY			
	Land Availability Tota Acr	al lan es.	d available for setting	g up solar pla	ant is 100
4.0	ABBREVIATION				
	Name of the project	[ ( 	Development of 20M Central Coalfields Lir Piparwar, Jharkhand.	N Solar PV I mited (CCL)	Project at CHP/CPP
	Solar Capacity		20 MW Ground Mounte	ed Solar Power	Project
	Metering Point	(	CCL 33 kV Central S	witching Static	on end as
Developmer Project at (CCL) CHP/0	nt of 20MW Solar PV Central Coalfields Limited CPP Piparwar, Jharkhand	TECH	NICAL SPECIFICATION BIDDING DOC. NO: RE- CS-9296-004-9	PART-A CHAPTER-A1	Page 1 of 3

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	shown in tender SLD.Grid Connection PointOwner's 33 kV Central Switching Station, Piparwar Area as shown in tender SLD						
5.0	TECHNOL	.OGY					
	In Solar F radiation i Cells", wh	Photo Voltaic nto electricity ich work on the	Power Generatio is achieved by us e principles of pho	n, the dir sing semic oto electric	ect conversion onductor devic effect.	of solar es "Solar	
6.0	POWER I	EVACUATION	l				
	The Bidder shall terminate the solar plant export feeders at owner's 33kV Central Switching Station (CSS), Piparwar Area as indicated in the tender drawing no. 9296-004-POE-A-006/1,2. Construction of overhead double circuit 33kV line and integration with CCL existing CSS, including construction of two numbers of new 33kV Bay for this purposes. Supply and installation of Metering Panel along with control cable shall be in bidder's scope. All associated electrical and civil works required for interfacing with grid (i.e. breakers, isolators, panels, protection system, cables/ overhead line) shall be under scope of Bidder.						
7.0	GENERA	TION GUARA	NTEE				
	The annual generation has to be quoted by the bidder in MU in the relevant section of the bid document. The bidder shall guarantee the quoted annual generation at metering point as defined in clause 4.0 of this chapter in the first year of O&M period after successful completion of trial run. The guidelines of the procedure for conducting PG Test for solar plant are detailed in Chapter E-6: Performance Guarantee (PG) Test.						
8.0		ETAILS					
	SL ITEN	1		DETAILS	5		
	01 Wate cons	er Require truction	ment during	To be ar shall pro point nea	ranged by bido wide one wate ar MGR area.	der. CCL er taping	
	02 Powe cons	er Require truction	ement during	To be arr	anged by bidd	er	
	03 MOE	F Clearance		Not Appli	icable		
	04 SPC	B Clearance		Application	on by CCL.		
				Inputs processir	for applicating to be facili	tion & tated by	
	05 MNR	E Clearance		To be fac	cilitated by bidd	ler	
		2.30.0100					
Development of 20MW Solar PV Project at Central Coalfields Limited (CCL) CHP/CPP Piparwar, Jharkhand			TECHNICAL SPECIFI BIDDING DOC. N RE- CS-9296-004	CATION O: -9	PART-A CHAPTER-A1	Page 2 of 3	

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	06 Chief Electrica	al Inspector clearance	To be fac	ilitated by bidd	er
Developmer Project at (CCL) CHP/(	t of 20MW Solar I Central Coalfields Limit PP Piparwar, Jharkhand	PV TECHNICAL SPECIF ed BIDDING DOC. N RE- CS-9296-004	ICATION IO: I-9	PART-A CHAPTER-A1	Page 3 of 3

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		CHAPTER-A2			
	SCOPE (	OF SUPPLY AND SERVI	CES		
1.0	INTENT OF SPECIFIC	ATION			
	The scope of the proposal for the Design Engineering, Supply, Construction, Erection, Testing, Commissioning including five (05) years Operation and Maintenance (O&M) works and Annual Maintenance Contract (AMC) of critical equipment for a period of 10 years of the Solar PV plant on turnkey basis completely covering the following activities and services in respect of all the equipment & works specified and covered under the specifications and read in conjunction with "Scope of Supply & services" elaborated elsewhere.				
	All equipment, materials and services whether explicitly stated or otherwise and that are necessary for the satisfactory operation of the Solar PV system and its integration as described in the specification shall be deemed to be included in the scope of work of the Contractor and shall not be limited to the following:				
	i. Basic Engineeri	ng of the plant and systems.			
	ii. Detailed desigr including civil w	n of all the equipment and orks.	d equipment s	system(s)	
	iii. Providing, Review and approval of engineering drawings, data, process Calculations, test procedures, structural design calculations, Equipment layout, Drawings/Data sheets of bought out items, Civil structural/architectural Drawings, Performance & Guarantee Test procedure etc.				
	iv. Providing Oper drawings and of	ation & Maintenance/ instru her information;	ction manuals	, as built	
	v. Providing trainir	g of Employer's personnel			
	vi. Finalization of a quality plans.	sub-vendors, manufacturing	quality plans a	and Field	
	vii. Complete manufacturing including conducting all type, routine and acceptance tests; Civil, Structural and Architectural works to the extent applicable, including construction facilities and construction power distribution.				
	viii. Packing and transportation from the manufacturer's works to the site including customs clearance & port clearance, port charges, (if any).				
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	ix. Receipt, storage, preservation and conservation of equipment at the site; Fabrication, pre-assembly, (if any), erection, testing, pre-commissioning and commissioning and putting into satisfactory operation all the equipment including successful completion of initial operation				
	x. Reliability and completion of tria	Functional guarantee t I operation;	ests after s	uccessful	
	xi. Supply of spares				
	xii. Satisfactory com	pletion of the contract.			
	xiii. Special tools an plant.	d tackles if any required t	for maintenand	ce of the	
1.1	The work to be carried accordance with the re- Technical Specifications Sections/Sub-sections of part of this volumes cor- specify herein all aspe- equipments and civil wo engineering, design and in continuous commer Employer, who will inter and shall have a right to assessment is not comp and/or applicable Indiar this specification. The materials, equipment specifically excluded) w operability and the relia- specification.	ed out as per the above equirements, conditions, ap s (Section-VI) together with of Bid Documents which sh mpletely as if bound herewire ects of design and constru- orks shall conforming all asp d workmanship and shall be rcial operation in a many pret the meaning of the spec- oreject or accept any work plete to meet the requirement of International standards r a Bidder shall be respon- and services, specified which are required to fulfill ability of the complete syst	scope shall I ppendices etc. In those stated hall be conside th. It is not the ction neverthe ects to high state capable of pener acceptable ecification and or material wh ents of this spec- mentioned else sible for prov- or otherwise the intent of the intent of	be all in given in in other ered as a intent to less, the andard of erforming to the drawings ich in his ecification ewhere in viding all (unless ensuring nder this	
1.2	Bidders are requested to carefully examine and understand the specifications and seek clarifications, if required, to ensure that they have understood the specifications. Such clarifications should be sought within the time period as stipulated in section ITB. Bidder's offer should not carry any sections like clarifications, interpretations and/or assumptions. However, if the bidder feels that, in his opinion, certain features brought out in his offer are superior to what has been specified, these may be highlighted separately.				
1.3	<b>I.3</b> Failure of any equipment to meet the specified requirements of tests carried out at works or at site shall be sufficient cause for rejection of the equipment. Rejection of any equipment will not be held as a valid reason				
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CLAUSE NO.	TECHNICAL SPECIFICATIONS				
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	for delay in completion of the works as per schedule. Contractor shall be responsible for removing all deficiencies and supplying the equipment that meet the requirement.				
1.4	Before submitting his bid, the bidder should inspect and examine the site and its surroundings and should satisfy himself as to the nature of the ground and subsoil, the quantities and nature of work, materials necessary for completion of the work and their availability, means of access to site and in general shall himself obtain all necessary information as to risks, contingencies and other circumstances which may influence or affect his offer. No consequent extra claims on any misunderstanding or otherwise shall be allowed by the Employer.				
2.0	BASIC ENGINEERING DESIGN PARAMETER OF SOLAR PV PLANT				
	a) Plant Capacity : 20 MW (MIN)				
	i) Plant capacity is cumulative capacity of Inverters.				
	ii) Inverter Transformer capacity shall not be less than the sum of				
	the connected Inverter capacity.				
	b) Minimum DC Capacity : 28 MWp (MIN)				
	c) Power Conditioning Unit (PCU):-				
	<ul> <li>(i) Capacity: The continuous combined rating of all PCUs shall not be less than plant capacity at (i) unit power factor at ambient temperature of 50°C and (ii) 0.95 power factor at 45 deg.</li> </ul>				
	<ul> <li>(ii) DC Overloading:- Maximum PCU DC overload loading shall be limited to its design PV Array Power to PCU nominal AC power ratio. Bidder needs to submit all the relevant technical document/test report from PCU manufacturer (OEM) during details engineering stage in support of declared PCU design DC overloading capacity.</li> </ul>				
	d) 33 kV Pooling Switchgear				
	(i) Bus Bar Rating of HT Switchgear: As per Single Line Diagram				
	(ii) System Fault Current Rating: As per Single Line Diagram				
	(iii) Dynamic withstand Current rating – 2.5 times of system fault				
	(iv)Spare 33 kV breaker panels with VCB, relay and all other accessories shall be provided, as per Single Line Diagram.				
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		<ul> <li>(v) DC supply shall be used for control and protection system of switchgear. In case UPS AC supply are considered for auxiliary control and protection supply for switchgear, then suitable rated AC/DC converter/power pack shall be used to meet the DC control supply requirement of switchgear panels.</li> <li>(vi) The 33kV Switchgear shall have an internal Arc Classification of IAC FLR 25kA, 1sec.</li> <li>e) Outdoor containerized solution/compact substation with inverter</li> </ul>				
	e)	Outdoor container inverter transforme acceptable. Howe switchgear and inve technical specification	ized solution/compact su er & HT switchgear as ever, technical specificati erter transformer shall be as on.	bstation with inverter sta on for inve per relevant o	inverter, ation are rter, HT chapter of	
	f)	f) Earth Pit for DC System: One number per MW				
	g)	Basic Wind Speed f	for Civil and Electrical desig	n: 39 meter/se	)C	
	h)	No. of Gates for th	e contractor plot boundar	<b>y</b> : min. 1 nos		
	i)	Metering: Bidder to provide 33kV metering panels with CT, PT, TEM meters (main and check), etc. as per tender single line diagram.				
	j)	Cable sizing criteria for HT Cable - The minimum size of cable based on 33 kV voltage level power application shall be as per protection time grading requirement subject to min. of 0.3 sec. For any cable feeder the minimum time for cable size calculation shall be the immediate one upstream breaker (towards grid) relay time setting plus 100msec.				
	k)	Licenses for Remo Concurrent viewing	te Monitoring of SCADA: 2 for all users.	2 Nos with pro	ovision of	
	<ol> <li>DC and LT Power cable voltage drop criteria: From Module to Inverter Transformer shall be limited to 3% of rated voltage. For all other LT cables, Maximum Voltage drop shall be limited to 3% of rated voltage.</li> </ol>			o Inverter other LT voltage.		
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	The detailed scope of work in accordance with this specification is elaborated below. The scope of the contractor shall be deemed to include all such items which although are not specifically mentioned in the bid documents and/or in contractor's proposal but are needed to make the system complete in all respects for its safe, reliable, efficient and trouble free operation and the same shall be furnished and erected unless otherwise specifically excluded as per Section Terminal Points & Exclusions.					
3.0	SCOPE OF W	ORK				
	Detailed design of Grid Interactive Solar PV Plant and its associated civil, electrical & mechanical auxiliary systems including preparation of foundation drawings, single line diagrams, installation drawings, electrical layouts, design calculations etc. Design memorandum and other relevant drawings and documents required for engineering of all facilities within the scope to be provided under this contract, are covered under contractor's scope of work. Ownership of packing materials (except of mandatory spares) shall be of the bidder. Hence, responsibility of removal and disposal of the packing material shall be in the scope of bidder.					
3.1	SUPPLIES &	ASSOCIATED WORKS				
	DC SIDE					
	•	Solar PV Modules				
	•	Modules Mounting Structure(MMS)	along with			
	•	DC Cables including MC4 connectors and E	OWC pipes			
	•	String Combiner Box				
	•	Power Conditioning unit				
	AC SIDE					
	•	LT Switchgear				
	•	HI Switchgear				
	•		.[			
	•	HT Cables				
	•	SCADA & Time Synchronization Equipment	t			
	•	Communication cable				
	•	Earthing System				
	•	Lightning Protection System				
	•	Plant Illumination system				
	•	Auxiliary Power Supply System				
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	<ul> <li>Battery an</li> <li>UPS</li> <li>CCTV sys</li> <li>Overhead</li> </ul>	tem 33kV double circuit line				
	33kV kV     along with     Grid inter	Solar Bays at CCL central associated equipment. facing so as to meet statu	I switching sta	ition ents		
	and compl	ly with CERC code.				
		<b>5</b> Jonitaring Station				
	Fire Detection and protection system					
	Module Washing system					
				]		
	The broad scope of work under this package shall include Civil Structural and architectural works related to but not limited to the following areas, System, Structures / Substructures, Buildings and Facilities:					
	Cutting of bushes, other vegetation. Clearing, transporting and disposal of bushes, other vegetation, roots, stubs etc.					
	Site Preparation : Si	te grading including slope p	protection, grou	und		
	preparation/ filling/ le	evelling (if required) of the lo	dentified area a	and		
	Foundation: Requis	site foundation and stru	ictures where	ver		
	required			VOI		
	MMS Structure & Fo	undation				
	Rooms: Constructio	n of Central Monitoring an	d Control Stat	ion		
	(CMCS), Inverter r	oom, security room, All	buildings are	OT		
	Cable Routing: Reg	uisite cable routing throug	h cable trench	ies/		
	trestle and/ or cable	tray, Where ever required.				
	Roads & Pathways	: Construction of Main roa	d, service roa	ads		
	and pathways	Nong the periphery of the ea	malata land			
	Store room	Along the periphery of the co				
	Switchyard civil & str	ructure works				
	Rain water harvestin	g				
	Drains: Design and o	construction of storm water of	drainage syster	n.		
	Construction of Fend	cing and Main gate as per ap	pproved design	1		
	Design and constru	ction of a Module Washin	g System. Wa	ater		
	supply arrangement	for wasning including supp	ly and installa	lion		
	or module washing a	Jystelli		]		
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	Cable trestle	Cable Routing: Requisite cable routing through cable trenches/ trestle and/ or cable tray, Where ever required.						
3.3	POWER E	POWER EVACUATION AND TELEMETRY						
3.3.1	The Bidde Central Sv drawing n circuit 33 constructio and install bidder's s interfacing cables/ ove	The Bidder shall terminate the solar plant export feeders at owner's 33kV Central Switching Station (CSS), Piparwar Area as indicated in the tender drawing no. 9296-004-POE-A-006/1,2. Construction of overhead double circuit 33kV line and integration with CCL existing CSS, including construction of two numbers of new 33kV Bay for this purposes. Supply and installation of Metering Panel along with control cable shall be in bidder's scope. All associated electrical and civil works required for interfacing with grid (i.e. breakers, isolators, panels, protection system, cables/ overhead line) shall be under scope of Bidder.						
3.3.2	Telemetry Load Disp Solar pla Communic communic other as he LDC requ (AMR), te telemetry s	<b>Telemetry System:</b> - The arrangement to transmit data required by the Load Dispatch Centre (LDC) as per extant regulatory requirement from Solar plant to NLDC/RLDC/SLDC shall be in Contractor's scope. Communication link and communication controller/Gateway used for data communication to LDC shall be redundant (one for normal operation and other as hot standby). Bidders are advised to update themselves with State LDC requirement for compliance related to Automatic Meter Reading (AMR), telemetry data, channel and procedures for engineering of telemetry solution accordingly.						
3.3.3	SCADA H	MIS /SERVEF	R EQUIPMENT:					
	SI No		Descriptio	าท		Qu	antity	
	1	Engineering	cum Operator w	ork station		01	Set	
		workstation	(EWS+OWS) (E	Desktop & M	lonitor)	0.		
	2	Operator wo Monitor)	ork station (OWS	) (Desktop &	&	01	Set	
	3	Portable (lap	otop based) EWS	S		01	No	
	4	Historian (D	esktop)			01	No	
	5	50 Inch LED	) display			01	No	
	6	Time Synchi	ronization equipr	ment		01	No	
	7	Control Des	k			02	Set	
	8	Chairs for C	ontrol Desk			04	No	
	9	Laser Printe	r			01	No	
0.0.4			<b>-</b> · · · ·					
3.3.4	No of CCIV	/ Cameras &	Type in each lo	ocation:	· ·	-		
	SI Locat	ion		Nos req	uired	Туре		
	1 Entry	Gate		2		HD –	Fixed	
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## CLAUSE NO.

## **TECHNICAL SPECIFICATIONS**

एनरीपीसी NTPC

2	Security Room	1	HD -PTZ
3	Inverter Room/Location (each)	1	HD -PTZ
4	CMCS Room entry	1	HD -Fixed
		1 Camera per kM of boundary	
5	At strategic locations on the	length	HD-Fixed
Ū	boundary	1 Camera per kM	
		of boundary	
		length	HD -PTZ

## 3.4 TENDER DRAWINGS

The list of drawings listed in Part-J of the Technical Specification shall form part of the specification and shall supplement the requirements specified in these technical specifications. These drawings are preliminary drawings for bidding purpose only and subject to changes that may be necessary during the detailed engineering keeping the basic parameters as specified. Various parameters for building and other equipment specified in the tender drawing are the minimum required & any increase in these parameters if required to meet the system requirement shall be made by the Bidder without any additional cost implication to Employer.

## 3.5 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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3.6	PAINTING					
	The bidder's scope of structures as per the painting shall include elsewhere in the Techni shall be as per standa coastal (corrosive) cond shall be furnished during	The bidder's scope of work includes painting of all equipments and structures as per the Employer's standard color coding scheme. The painting shall include required application of finish paint indicated elsewhere in the Technical Specification. The quality and finish of paints shall be as per standards of BIS or approved equivalent, suitable for coastal (corrosive) conditions of site. Employer's Color Coding scheme shall be furnished during detailed engineering stage.				
3.7	TRAINING OF EMPLOY	ERS PERSONNEL				
	The bidder shall provide 50 man-days at his work and O&M. Expenses to expenses for the person	The bidder shall provide training (free of cost) to the personnel of CCL for 50 man-days at his works and at site for erection, testing, commissioning and O&M. Expenses towards travel, lodging, and boarding and other expenses for the personnel shall be borne by CCL.				
3.8	PERFORMANCE Guara	ntee (PG) TEST				
	The performance guarantee tests shall be carried out as specified elsewhere in the Technical Specification. All special equipments, tools and tackles instruments, measuring devices required for the successful conductance of PG test shall be provided by the bidder, free of cost. All costs associated with the PG tests shall be included in bid price.					
	Bidder shall adopt module mounting arrangement with fixed/seasonal tilt/east-west tracking system or combination of any or all of the above as outlined in the specification to achieve the quoted generation.					
	The guidelines of the procedure of conductance of PG Test is included in <b>Chapter E6</b> of this document.					
3.9	OPERATION AND MAIN	ITENANCE (O&M)				
	Comprehensive O&M of the solar PV plant (s) for a period <b>of Five (5)</b> years from the date of successful completion of trial run is in the scope of the bidder.					
3.10	INPUT FOR LIQUIDITY DURING PERFORMANC	DAMAGE FOR SHORTFA CE GURRANTTEE TEST A	LL IN PERFOR	RMANCE IOD		
3.10.1	Global Solar Insolation of	f the Site				
	Month	Solar Insolation (kWhr/m2)				
	January	133.8				
Developmer Project at (CCL) CHP/(	nt of 20MW Solar PV Central Coalfields Limited CPP Piparwar, Jharkhand	TECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-9296-004-9	PART-A CHAPTER A2	Page 9 of 12		

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	February	146.9			
	March	185.1			
	April	194.2			
	May	206.2			
	June	166.3			
	July	135.4			
	August	141.7			
	September	138.5			
	October	143.4			
	November	133.4			
	December	134.1			
	Year	1859.0			
3.10.2	Tariff for determination during Performance Gua	of Liquidated Damages for arantee Test: (Rs 3.45/ kWh	r shortfall in ge ) x 10.6384	eneration	
3.10.3	Tariff for determination during O&M Period: Rs	of Liquidated Damages for 3.45/ kWh	r shortfall in g	eneration	
4.0	CODES AND STANDA	RDS			
	All works shall be carried out as per the standards/codes (IEC, IS etc) referred in the specification. All standards, specifications and codes of practice referred to shall be the latest editions including all applicable official amendments and revisions as on date of opening of bid. In case of conflict between this specification and those codes/standards referred the former shall prevail.				
	Equipments complying with other internationally accepted standards such as BS, UL, DIN, VDE etc. will also be considered, if they ensure performance and constructional features equivalent or superior to standards listed in the specification. In such case the Bidder shall clearly indicate the standards adopted, furnish a copy in the English of the latest revisions in force as on date of opening of bid and shall clearly bring out salient features for comparison.				
5.0	APPROVALS				
	The scope of the bidder includes complete design and engineering, technical coordination (including participation and arranging technical coordination meetings), finalization of drawings/ documents, submission of engineering drawing / documents and processing of their approvals by the Employer as per relevant clauses of Section VI (Technical Specifications) and other relevant clauses given elsewhere in the Technical Specifications. Further, the scope shall also include submission, in proper shape & format,				
Developmer Project at (CCL) CHP/0	nt of 20MW Solar PV Central Coalfields Limited CPP Piparwar, Jharkhand	TECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-9296-004-9	PART-A CHAPTER A2	Page 10 of 12	

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	of all types of manuals, handbooks & documents in requisite numbers to the Employer at different phases of the project as per the requirement of Employer. The contractor shall have to arrange technical coordination meetings and ensure participation					
6.0	EVALUATION CRITER	RIA				
	Bidder has to quote Pr (in Million Units-MU) fo	ice (INR) as well as Guarant r Plant Capacity.	teed Annual G	eneration		
	Annual Quoted Genera Limit (G1) and not more	ation (G) shall be not less that than Maximum Generation	an Minimum G Iimit (G3).	eneration		
	In case the successful the Annual Generation submit security in the methodology.	Bidder, to whom the work i more than Threshold Gener ne form of Bank Guarar	s awarded, ha ration (G2), bio ntee as per	is quoted Ider shall following		
	<b>BG for Annual Quote</b> (in Million INR) Where, R = Rs 3.45/kW	d Generation beyond G2 = /h	: (G-G2) x R x	: <b>10.6384</b>		
	Limiting Generation is g	given in below table.				
	<u>Table: Li</u>	miting Generation (G1, G2,	<u>G3)</u>			
	Minimum Generation Limit (G1)Threshold Generation above which bidder to submit bank guarantee (G2)Maximum Generation Limit (G3)					
	43.63 MU	45.00	46.75 MI	J		
	The evaluation criteria subject Bank guarar Procedures) - Form of	along with methodology & t ntee are indicated in Se Security.	the requiremer ection-VII (For	nts of the rms and		
7.0	TERMINAL POINT AN	D EXCLUSIONS				
	The terminal point under the scope of this assignment shall be termination to 33kV Bus at CCL existing Central Switching Station as indicated in this specification. Bidder shall furnish all relevant data required by the employer at interface points within schedule as agreed prior to award of contract.					
Developmer Project at (CCL) CHP/0	nt of 20MW Solar PV Central Coalfields Limited CPP Piparwar, Jharkhand	TECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-9296-004-9	PART-A CHAPTER A2	Page 11 of 12		

CLAUSE NO.	TECHN	CAL SPECIFICATIONS	3	त्तरीपीसी NTPC
8.0	SPARES			
	The Bidder shall include	e in his scope of supply all the	e necessary N	landatory
	spares as described els		5	
		r		
Developmen Project at ( (CCL) CHP/0	nt of 20MW Solar PV Central Coalfields Limited CPP Piparwar, Jharkhand	TECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-9296-004-9	PART-A CHAPTER A2	Page 12 of 12

CLAUSE NO.	TECHNICAL SPECIFICATIONS					
	CHAPTE	R-A3	PROVENESS			
	PROVENESS CRITERI	A				
	The Bidder or its Sub ve stipulated below:	endor is	required to meet the	e Provenness o	criteria as	
1.0	Solar PV Modules					
	<ul> <li>The Bidder / its sub-ven</li> <li>(a) and (b) below:</li> <li>a. The Bidder/ its sub-v Solar PV Modules of using any rating of n PV cells in any one fit</li> <li>b. The Bidder/ its sub- Solar PV Module buil power rating 285Wp higher, which should operation prior to the</li> </ul>	dor shal rendor s f cumula nodules nancial y -vendor lt up usi (for Cr have c date of a	I meet the requirement hould have manufa tive installed capace and any source of year. should have manufact ng indigenous and/ systalline Silicon)/10 completed at least s award of contract by	ent as stipulate ctured and sup ity of 16MWp indigenous or ufactured and or imported P\ 00Wp (for Thir ix months of si 0 NTPC to the E	d in para oplied the or higher imported supplied / Cells of n film) or uccessful Bidder.	
	Note:					
	<ul> <li>(i) The works referred to at clause 1.0 (a) &amp; 1.0 (b) can be in same or different projects.</li> <li>(ii) In case the Solar PV Module Manufacturer is not meeting the requirement as mentioned in clause 1.0(a) and or 1.0(b) above, they can utilize the credentials of its principal/holding or subsidiary company (a Solar PV module Manufacturer) for meeting these criteria(s) as stipulated in clauses 1.0(a) and (b) above</li> </ul>					
2.0	Solar Engineering Firm	n				
	Solar Engineering Firm If the Bidder (qualified under clause 1.2 (ii) or clause 1.2(iii) or clause 1.2(iv) of main QR) itself has not carried out the engineering of at least one (1) number of Solar PV Power Plant of capacity 10 MWp (minimum) which is in successful operation for the last six (6) months prior to the date of techno-commercial bid opening, the Bidder shall employ an Engineering Firm who has engineered at least one (1) number of Solar PV Power Plant of capacity 10 MWp (minimum) at single location which is in successful operation for the last six (6) months prior to the date of techno-commercial bid opening. The scope of work of engineering for the above project by the Firm shall necessarily include the following:					
Developmer Project at (CCL) CHP/(	nt of 20MW Solar PV Central Coalfields Limited CPP Piparwar, Jharkhand	TECHNIC BID RE	CAL SPECIFICATION DING DOC. NO: -CS-9296-004-9	PART-A CHAPTER-A3	Page 1 of 2	

CLAUSE NO.	TECHNIC	AL SPECIFICATIONS	5	त्तरीपीसी NTPC
	i. Selection ar a. Inverter b. PV Modules c. DC Cables ii. Finalization iii. Energy Esti	nd Sizing of: s of Plant Layout with shado mation	ow analysis	
	The Firm shall undertake proposed Solar PV Powe	at least the above scope o r Plant.	of engineering f	or the
3.0	Cable laying			
	The Bidder/ its sub-vendo contract in which it has i including 6.6 kV unearth accessories for an indu successful operation for a Techno-Commercial bid cables, LT cables, DC c kms or more.	or should have executed or installed Power cables of led or higher grade cables ustrial installation which a period of atleast two (2) y opening. The total quantit ables etc.) laid in above o	r erected atleas 1.1 kV grade s, alongwith as should have rears prior to th y of Power ca contract should	st one (1) & higher, ssociated been in he date of bles (HT d be 150
4.0	Tracking system:			
	Tracking system: The Bidder/ its sub-vendor must be manufacturer of Solar Tracking system and must have supplied for a total capacity of 1 MW. The offered tracking system should have been in successful operation for atleast six (6) months prior to the date of award of contract by CCL to the Bidder.			
Developmer Project at (CCL) CHP/0	nt of 20MW Solar PV Central Coalfields Limited CPP Piparwar, Jharkhand	FECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-9296-004-9	PART-A CHAPTER-A3	Page 2 of 2

CLAUSE NO	TECHNIC		एनरीपीसी NTPC
		PART-B	
		DC SYSTEMS	
		<u> </u>	
at Central C CHP/CPP Pipa	of 20MW Solar PV Project Coalfields Limited (CCL) arwar, Jharkhand	TECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-9296-004-9	

CLAUSE NO						एनरीपीसी NTPC
	CHAPTER-B1					
	SOLAR PHOTOVOLTAIC (SPV) MODULES					
1.0	GENERAL					
	The Solar PV module comprises of PV cell(s) connected in any combination to achieve the required module power output. PV cells directly produces DC power on receipt of solar irradiation.					
2.0	<u>Part-a: Cf</u>	RYSTALLINE	SILICON MO	DDULES (C-Si	)	
2.1	The PV cells	s in a crystal	ine silicon mo	dule shall be p	protected by	
	encapsulation between front glass and back sheet/back glass. The glass shall be made of high transmissivity and front surface shall give high					
	encapsulation gain.					
	The technic	al details of S	Solar PV Mod	ules shall be a	s given below.	
	SI. No. Description Details					
	1	Type of SPV Module Crystalline Silicon				
	2	Peak Pow Module	er rating of	Shall not be I	ess than 300W	р
	3	Module Eff	iciency	Minimum 15 Test Conditio	% at Standa ns	ard
	4	Fill Factor		0.7(Minimum	)	
2.2	CODES AN	D STANDAR	DS			
	The applica	ble codes ar	d standards a	are as mention	ed below	
		ades	Description	n		
	IEC 612	15	Crystalline	silicon terres	trial photovolta	aic
			(PV) modu	les – Design	qualification a	nd
	IEC 617	30 _ 1	type approv	/al c (P\/) i	module safe	atv
		30 - 1	qualification	n – Part 1: F	Requirements	for
			construction			
	IEC 617	30 – 2	Photovoltai	c (PV) i	module safe	ety for
Development	-6 2004WA/ 0 -1		quantication	i – Part 2: F	requirements	
at Central CHP/CPP Pip	Coalfields Lim arwar, Jharkhar	ited (CCL)	TECHNICAL SF BIDDING D RE-CS-929	PECIFICATION OC. NO: 96-004-9	PART-B CHAPTER-B1	Page 1 of 8

CLAUSE NO	TECHNICA	AL SPECIFICATIONS	(	एनरीपीम्री NTPC		
	IEC 61701 – Edition 2.0 2011-12 IEC 62804 – 1: 2015	Testing Salt mist corrosion testin (PV) modules Photovoltaic (PV) modules for the detection of degradation - Part 1: Cryst	g of photovolta s - Test metho potential-induce	aic ds ed		
2.3	TECHNICAL REQUIREM a. The temperature co-e than -0.45% per deg standards mentioned shall be accepted. Ac shall not be less than	ENTS Efficient of Power for the m C. Each and every SPV m in <b>2.2</b> above and no neg dditionally, the Module wa 5Wp. Each inverter shall us	nodule should b nodule shall con gative power to nttage band/bin se only one typ	be better nform to blerance offered e (Make		
	and Nominal rating) of b. Module shall be made module should be Pl crystalline silicon mo minimum thickness of cell module. The glass with bending less than The module shall transportation, handlin to avoid any undue loa	f module. e up of mono or poly-cryst ID resistant. The front gla odules shall be toughened f 3.2 mm (2.5mm for glass- s used shall have transmitta n 0.3% to meet the specifica not be subjected to ar ng and erection and comple ading on either side of the n	calline silicon ce ass used to m d low iron gla to-glass module ance of above 9 ations. ny point load ete care has to b nodule.	ells. The bake the ass with e) for 72 00% and during be taken		
	c. The interconnected cells shall be laminated in vacuum to withstand adverse environmental conditions. The EVA used for the modules should be of UV resistant in nature with gel content of more than 70%. The back sheet used in the crystalline silicon based modules shall be of 3 layered structure. The thickness of back sheet should be of minimum 300 microns with water vapour transmission rate less than 2.0g/m2/day (38°C at 90% RH). The Back sheet can be fluoropolymer based or of any other well proven technology details of which shall be submitted and reviewed during detailed engineering and shall be subject to Employer's approval. The backsheet shall have globally benchmarked durability properties on Moisture barrier, Tensile Strength (Machine Direction & Transverse Direction), Elongation retention and UV stability and shall be able to withstand system voltage. In case of glass-to-glass module the back glass shall have a minimum thickness of 2.5mm.					
	d. The module frame shall be made of corrosion resistant materials, preferably having aluminum anodized finish. The anodizing thickness					
Development at Central CHP/CPP Pip	Development of 20MW Solar PV Project at Central Coalfields Limited (CCL) CHP/CPP Piparwar, JharkhandTECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-9296-004-9PART-B CHAPTER-B1Page 2 of 8					

CLAUSE NO	TECHNICAL SPECIFICATIONS					
	shall be 1 suitable r damage ti	shall be 15 microns or better. In case the offered module is frameless, suitable retaining clips/clamps used for installing the modules shall not damage the glass surface in contact with the retaining clamp				
	e. Module(s)	e. Module(s) shall be provided with minimum three (03) bypass diode.				
	f. Junction b rated fitte designed Junction b	f. Junction box(es) of the module should be of high quality IP 67 or better rated fitted at the back side which should be weather proof and designed to be used with standard wiring or conduit connection. Each Junction Box shall contain Bypass Diode.				
3.0	<u>PART-B: THI</u>	N FILM MO	DULES			
3.1	In a thin film module, the cell shall be created on glass substrate and electrical connections are created in-situ. The glass substrate shall be laminated with an encapsulation to another glass. The front glass shall be made of high transmissivity and front surface shall give high encapsulation gain.					
	The technica	I details of S	Solar PV Modu	les shall be a	s given below.	
	SI. No.	Descriptio	on	Details		
	1	Type of SF	PV Module	Thin Film	loss than 110\A	1
	2	Module	rei raung or			v
	3	Module Eff	ficiency	Minimum 1 Test Conditi	5 % at Stand ons	lard
	4	Fill Factor		0.7(Minimun	n)	
3.2	CODES AND	STANDAR	DS			
	The annlicah	le codes an	d standards ar	e as mention	ad below	
		ues	Description			
Development at Central CHP/CPP Pip	of 20MW Solar F Coalfields Limit arwar, Jharkhand	PV Project ed (CCL)	TECHNICAL SPE BIDDING DO RE-CS-9296	CIFICATION C. NO: -004-9	PART-B CHAPTER-B1	Page 3 of 8

CLAUSE NO	TECHN	ICAL SPECIFICATIONS	5	नरीपीमी NTPC
	IEC 61215-1-1:201 2:2016 / IEC 61215 4:2016/ IEC 61215 3:2016 (as applical	<ul> <li>6/1- Terrestrial photovoltaid</li> <li>5-1- Design qualification and Part 1-2: Special requirements for thin-film Cadmium</li> <li>based photovoltaic (PV Special requirements for Cu (In,GA) (S,Se)<sub>2</sub> base modules. Part 1-3: Special for testing of thin-film based photovoltaic (PV Special requirements for testing of thin-film based photovoltaic (PV Special requirements for testing of thin-film based photovoltaic (PV Special requirements for testing of thin-film based photovoltaic (PV Special requirements for testing of thin-film based photovoltaic (PV Special requirements for testing of thin-film based photovoltaic (PV Special requirements for testing of thin-film based photovoltaic (PV Special requirements for testing of thin-film based photovoltaic (PV Special requirements for testing of thin-film based photovoltaic (PV Special requirements for testing of thin-film based photovoltaic (PV Special requirements for testing of thin-film based photovoltaic (PV Special requirements for testing of thin-film based photovoltaic (PV Special requirements for testing of thin-film based photovoltaic (PV Special requirements for testing of thin-film based photovoltaic (PV Special requirements for testing of thin-film based photovoltaic (PV Special requirements for testing of thin-film based photovoltaic (PV Special requirements for testing of thin-film based photovoltaic (PV Special requirements for testing of thin-film based photovoltaic (PV Special requirements for testing for testing</li></ul>	c (PV) modules nd type approva irements for test Telluride (Cd <sup>T</sup> ) modules. Part 1 or testing of thin-f ed photovoltaic (F becial requireme amorphous silic ) modules	s - al - ting Te) 1-4: film PV) ents con
	IEC 61730 – 1	Photovoltaic (PV) qualification – Part 1: construction	module saf Requirements	fety for
	IEC 61730 – 2	Photovoltaic (PV) qualification – Part 2: Testing	module saf Requirements	fety for
	IEC 61701 – Editio	701 – Edition     Salt mist corrosion testing of photovoltaic       2011 12     (D)() modules		
	IEC 62804 – 1 : 20	15 Photovoltaic (PV) modules 15 for the detection of degradation - Part 1: Cr	ules - Test metho f potential-induc vstalline silicon	ods ced
	IEC 62716:2013	Photovoltaic (PV) mc corrosion testing	odules - Ammo	onia
3.3	a. The temperature c than -0.30% per de standards mention shall be accepted.	EMENTS o-efficient of Power for the m eg C. Each and every SPV m ed in <b>3.2</b> above and no neg Additionally, the Module watt	odule should be odule shall confo gative power tole age band offered	better orm to erance d shall
	not be less than 2 and Nominal rating	.5Wp. Each inverter shall use ) of module.	e only one type	(Make
	<ul> <li>b. The module should thin film modules used shall have tra tempered. The cor not be less than 5n In case of framed sized as per the mod</li> </ul>	The module should be PID resistant. The front glass used to make the thin film modules shall be toughened low iron glass. The front glass used shall have transmittance of above 90%. The back glass shall be tempered. The combined thickness of front glass and back glass shall not be less than 5mm and individual glass thickness not less than 2mm. In case of framed modules, the front and back glass shall be suitably sized as per the module dimension.		
Development of 20MW Solar PV Project at Central Coalfields Limited (CCL) CHP/CPP Piparwar, Jharkhand			Page 4 of 8	

CLAUSE NO	TECHNICAL SPECIFICATIONS				
	<ul><li>The module shall not be subjected to any point load during transportation, handling and erection and complete care has to be taken to avoid any undue loading on the module</li><li>c. In case the offered module is frameless, suitable retaining clips/clamps used for installing the modules shall not damage the glass surface in contact with the retaining clamp.</li></ul>				
	• Clip Insulation Specification for frameless Thin Film Module- Insulation material shall be UV Resistant and designed to maintain integrity over the lifespan of the modules. Typical rubber durometers should be in the range from 45 to 75 on the Shore A scale. Volume Resistivity >= $1.0 \times 10^{14} \Omega$ -cm as per ASTM D257.				
	<ul> <li>d. The PV Modules shall also conform to PV Long Term Durability Testing like Sequential test or Thresher test etc.</li> <li>e. Junction box at the back glass of the module should be weather proof, dust proof and designed to be used with standard wiring or conduit connection. Additionally, cables coming out of the junction box shall be suitably sealed providing complete electric isolation. In case the junction box houses diode, the junction box shall be of IP 67 or better.</li> </ul>				
4.0	COMMON REQUIREMENTS FOR BOTH CRYSTALLINE SILICON (C-Si) AND THIN FILM MODULES				
	a. SPV module shall perform satisfactorily with ambient temperatures between -10°C & +60°C and shall withstand gust up to 150 Km/h on the surface of the panel.				
	b. Solar PV modules used in solar power plants/ systems must be warranted for the product Workmanship for a period of minimum 10 years. Further, they shall also be warranted for their output peak output peak watt capacity, which should not be less than 90% at the end of 10 years and 80% at the end of 25 years from the completion of the trial run.				
	c. The bidder shall provide the sample solar PV module electrical characteristics including current-voltage (I-V) performance curves and temperature coefficients of power, voltage and current.				
	d. Each PV module deployed must use a Radio Frequency identification (RFID) tag for traceability. RFID shall either be placed behind name plate sticker or behind bar code label pasted on the back glass of PV				
module and must be able to withstand harsh environmental conditionDevelopment of 20MW Solar PV Project at Central Coalfields Limited (CCL)TECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-9296-004-9PART-B CHAPTER-B1Page 5 of 8					

CLAUSE NO	TECHNICAL SPECIFICATIONS				
	<ul> <li>during the module lifetime. One number RFID reader has to be supplied by the bidder which has to be compatible to read the data from the RFID Tag &amp; download the data to Computer. All associated Software &amp; Cables are to be provided along with the RFID reader. The following information must be mentioned in the RFID used on each module.</li> <li>i. Name of the manufacturer – PV Module</li> <li>ii. Month &amp; year of the manufacture of the module</li> <li>iii. Country of origin</li> <li>iv. I-V curve for the module</li> <li>v. Wattage, Im, Vm and FF for the module</li> <li>vi. Unique Serial No. and Model No. of the module</li> <li>vii. Date and year of obtaining IEC PV module qualification certificate</li> <li>viii. Name of the test lab issuing IEC certificate</li> <li>ix. Other relevant information on traceability of solar cells and modules as per ISO 9001</li> </ul>				
	e. All the modules in the PV plant should be arranged in a way so as to minimize the mismatch losses.				
	f. Each module should have two suitably sized stranded UV resistant cables and terminated with DC plug-in connector directly. The positive (+) terminal has a male connector while the negative (-) terminal has a female connector. The connectors used for interconnecting the modules and connectors used for connecting the strings and/or to the String combiner Box, i.e. field connectors shall be of same make for better compatibility (refer Connectors). In case, 1500 V modules are used, the connecting cable shall be as per the relevant standard.				
	g. The bidder has to submit, along with the data sheet of the module, a detailed Bill of Material (BoM) elaborating on the properties, such as, thickness, material composition etc of the major components of the module which shall be same as per the type tested and approved Constructional Data Form (CDF).				
5.0					
	All individual modules shall be provided with Name Plate label at the back of module which shall provide the information given below for identification. They shall be clearly visible and shall not be hidden by equipment wiring. Type of labels and fixing of labels shall be such that they are not likely to peel off/ fall off during the life of the panel.				
Development of 20MW Solar PV Project at Central Coalfields Limited (CCL) CHP/CPP Piparwar, JharkhandTECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-9296-004-9PART-B CHAPTER-B1Page 6 of 8					

CLAUSE NO	TECHNI	CAL SPECIFICATIONS	(	एन् <b>रीपी</b> सी NTPC	
	<ol> <li>Manufacturer's Name</li> <li>Model Number, Serial Number</li> <li>Overall Dimensions (W x L x D)</li> <li>Weight (kg)</li> <li>Maximum Power (P<sub>MAX</sub>), Voltage (V<sub>MP</sub>), Current (I<sub>MP</sub>)</li> <li>Short Circuit Current (I<sub>SC</sub>), Open Circuit Voltage (V<sub>OC</sub>)</li> <li>Main System Voltage</li> <li>Relevant standards, Certification lab. name</li> <li>NTPC Logo on the top corner of each Module (Design shall be provided to successful bidder during detail engineering)</li> </ol>				
	10.Warnings, if any				
6.0	TYPE TEST				
	SPV modules must be tested and certified by any of the accredited certifying agencies according to above mentioned International Standards at clause 2.0 above and the type test reports shall be submitted for approval.				
	<b>Note:</b> 1. The Module Manufacturer, along with the Module datasheet, shall also provide the Details about the PV Cells used for the offered PV Modules. The information shall contain Cell Source, Type, and Electrical Parameters including efficiency, Size, Number of Bus bars and any other relevant information. (For Crystalline Silicon Modules)				
	2. In case the successful bidder supplies PV Modules of different make and/or model or from different agencies, the fixing holes in the frame/ location of retaining clips, their location, diameter, centre-to-centre distance between them and all other attributes related to mounting should be same, if applicable.				
	3. Bidder shall submit third-party verified PAN files for one module in each wattage bin offered and self-certified Electro- Luminescence (EL) Test reports of all the PV Modules being offered to NTPC.				
	4. In line with Office Memorandum No. 283/54/2018- Grid Solar ("Approved Models and Manufactures of Solar Photovoltaic Modules Order, 2019),				
Development at Central CHP/CPP Pip	of 20MW Solar PV Project Coalfields Limited (CCL) arwar, Jharkhand	TECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-9296-004-9	PART-B CHAPTER-B1	Page 7 of 8	

CLAUSE NO	TECHNI	CAL SPECIFICATIONS	(	एनरीपीमी NTPC	
	dated 2nd January 2019, the bidder shall source modules complying to the relevant clause				
	Quote " In order to allow a smooth transition, such projects where the bids have not been finalized before the issuance of this order, will be permitted to procure outside the ALMM List -1 till 31st March 2020. In case of procurement from within India, the date of procurement shall mean the date of dispatch while in case of procurement from outside India, the date of procurement shall mean the date of filing of bill of entry within Indian customs"				
	Unquote				
	For detailed information, bidder to refer Office Memorandum No. 283/54/2018-Grid Solar issued by MNRE				
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		CHAPTER-B2				
	MODULE M	OUNTING STRUCTURE	E (MMS)			
1.0	GENERAL					
	The PV modules shall Mounting Structures (I design, which can with pressure.	be mounted on metallic str MMS) having adequate str nstand the load of the mod	ructures called ength and app dules and desig	Module propriate gn wind		
2.0	CODES AND STANDA	RDS				
	The applicable codes and standards are as mentioned below.					
	1 IS 875: Part 1 & 2	Code of practice for the design loads for buildings and structures-				
	2 IS 875: Part 3	Code of practice for the design loads for buildings and structures-Wind Loads				
	3 IS 800: 2007	Code of practice for use of structural steel in general building construction				
	4 IS 4759	Hot-dip zinc coatings on structural steel and other allied products				
	5 IS 1868	Anodic Coatings on Aluminium and its Alloys				
3.0	<ul> <li><b>TECHNICAL REQUIREMENTS</b></li> <li>a) Modules shall be mounted on non-corrosive support structures. The Bidder can provide any of the following types of mounting arrangement</li> <li>Fixed Tilt</li> <li>Seasonal Tilt- Mounting arrangement shall have provision to adjust it at two or three angular positions. The angular difference between two consecutive tilt positions shall not be less than 5 degrees.</li> <li>Automatic motor powered Realtime East-West tracking</li> <li>The Bidder can also provide, the combination of the two arrangement. However, all modules corresponding to any inverter shall have the similar type of arrangements.</li> </ul>					
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	b) Mounting structures shall be designed to withstand the extreme weather conditions in the area. The site design wind speed factors k1, k2, k3 and k4 shall conform to IS 875 (Part-3): 2015 for the design of MMS.					
	<ul> <li>c) The structural mater</li> <li>Design Criteria for</li> <li>elsewhere in this spo</li> </ul>	ial, corrosion protection and Module Mounting Structu ecification.	design, shall b res (MMS) de	e as per escribed		
	d) The proposed fou geotechnical investi	ndation system for MMS gation report.	shall be as	per the		
	<ul> <li>e) The design philoso foundation system s the commencement</li> </ul>	philosophy and the calculations for the MMS and the ystem shall be submitted for prior approval of NTPC before cement of construction.				
	f) Further details relation for the characteristic for the character	ils related to structures and foundations have been the chapter on civil works of this specifications.				
	<ul> <li>g) In case, String Com Mounting structures during the designed mounting the SCB bidder.</li> </ul>	String Combiner Box (SCB) shall be mounted on the Module g structures, bidder to take into consideration the load of SCB ne designed of MMS. Further suitable supporting members for g the SCB on the MMS shall also be within the scope of the				
	<ul> <li>h) Suitable provision o the Module Mountin be provided using th used for lifting the mechanized arrange</li> </ul>	Suitable provision of a mechanized arrangement for seasonal tilting of the Module Mounting Structure shall also be provided. The same may be provided using the jacks placed below the MMS at few locations and used for lifting the MMS. The Bidder may also propose alternate mechanized arrangement subject to NTPC approval.				
	<ul> <li>All bolts of module mounting structure and its foundation shall be immediately tightened upon erection to ensure that no damage happens to the MMS and panels due to heavy winds arising during the erection period.</li> </ul>					
4.0	TRACKING SYSTEM (	F APPLICABLE)				
4.01	TECHNICAL REQUIRE	MENTS				
	a) Only single axis Ea	ast-West realtime tracking sh	all be acceptab	le.		
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	<ul> <li>b) All modules asso connected to a cor c) Each of the tra inclinometers mou</li> <li>d) In case of failure position. Bidder s feature for meeting</li> <li>e) The Vendor can utilization of land. A to protect actuato dust and UV rays.</li> <li>f) The material of the must last to its full corrosion protection Part-D.</li> <li>g) All control and aut good performance centigrade.</li> <li>h) Tracker shall be protection, auto communication wi of sending alarms abnormal operatio</li> <li>i) Suitable redundant provided for fail-s also desirable for not be accepted for various redundant</li> </ul>	ciated with a specific track mmon inverter. cking units should have nted on the structure. of supply, the arrays shou hall supply a tracking med the requirement. provide the backtracking A suitable arrangement/bellow r assembly from extreme ou e tracker should be corrosion lifespan of 25 years. Minimu on shall be as per this spe omation hardware shall be or in ambient air temperature e equipped with safety fe high wind stow and sha th monitoring console/station is to the monitoring station ns of the tracking systems. Icy in sensing and auxiliary afe stowing of trackers. Re the safe operation of trackers by shall be finalized at the time	ing system sh a redundant uld return to th hanism with an arrangement f ws shall be pro- utdoor harsh co n resistant enor m coating thick cification menti f industrial grad range of (-) 5 eatures like, I have uninto n. It should be in case of fa power supply dundancy in co ers. VRLA batte Detail of the sch e of detail engir	ould be (2 nos) ne stow n inbuilt for best visioned ondition, ugh and ness for oned in le with a to 60° ightning errupted capable ailure or shall be ontrol is ery shall neering.		
4.02	a) Module mounting	ARRANGEMENT - TRACKII	NG SYSTEM	and the		
	extreme weather conditions in the area. The site design wind speed factors k1, k2, k3 and k4 and pressure coefficient shall conform to IS 875 (Part-3): 2015 or as per a Wind Tunnel Study from a reputed national/international facility, for the design of MMS.					
	If the Bidder is going for wind tunnel test for the design and analysis of complete MMS and solar tracking system following has to be ensured.					
Development at Central CHP/CPP Pip	i. It must be done from an institute of reputed (IITs in India).Development of 20MW Solar PV Project at Central Coalfields Limited (CCL) CHP/CPP Piparwar, JharkhandTECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-9296-004-9PART-B CHAPTER-B2Page 3 of 5					

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	<ul> <li>ii. If the test is done to must be vetted by an iii. Bidders must ensur tunnel test simulation vetting shall be con issue of LOA.</li> <li>iv. Test results and des v. The design shall be if asked to do so.</li> <li>vi. Refer appendix-D1 for the design shall be if a start of the design shall be if a sta</li></ul>	test is done by any reputed international facility the test results be vetted by any of the IITs in India. It is must ensure that offered tracker has proven design with wind I test simulating actual site conditions. The design, analysis and its g shall be completed within two months from the actual date of of LOA. Tesults and design must comply with Indian codes lesign shall be shown in STAAD pro for further checking of NTPC ed to do so. Tappendix-D1 for site-specific design parameters.					
	<ul> <li>b) The structural mater Design Criteria for elsewhere in this spectrum of the system shall be solved and the structure shall element method use load and wind load study done from a Analysis to be done per IS codes.</li> <li>f) The Structure must rotation of the frame g) All nuts and bolts connection and oth according to the comparison of the comparison of the solved and the solved</li></ul>	rial, corrosion protection and r Module Mounting Structu- becification. he calculations for the MM submitted for prior approval construction and shall be bas lated to structures and for hapter on civil works of these be designed and analyzed in sing software (STAAD pro), as per IS: 875 (Part 1& 3) reputed national/internation e as per appropriate load com st be provided with limit st e. shall be of SS type for er structural bolts shall be of nnection design requirement.	design, shall b ures (MMS) de S and the fou I of NTPC be sed on the soil r oundations hav specifications. In accordance w with considerir or as per Winc hal facility resp binations prefe witches to cor a module to s f grade HDG 5.	e as per escribed undation fore the report. e been ith finite og Dead Tunnel ectively. rably as atrol the structure 6 or 8.8			
4.03	<ul> <li>BEARING <ul> <li>a) The bearing should be type tested for operation cycles which solar plant will go through in its life of 25 years.</li> <li>b) Preferably there should not be any lubrication in the bearing, but if there is any, then it should be maintenance free. No cleaning should be needed.</li> <li>c) The bearing should also be resistant to dust, water and any other external parameters.</li> </ul> </li> </ul>						
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4.04	MOTOR AND ACTUATOR					
4.05	<ul> <li>a) The motor should be IP 65 or better and it should be powered by reliable supply to drive the link through gear or hydraulic/electric actuator.</li> <li>b) The temperature rises in the motor during operation specified in IS12802: 1989 should not be more than approximately 10°C.</li> <li>c) The location and moisture or fumes shall not seriously interfere with the operation of the motor.</li> <li>d) The severity of vibration for the motors shall be within the limits specified in IS 12075: 1987.</li> </ul>					
4.00	a) Trackers should have an industrial grade system for its automatic					
	control and operations. For all outdoor controllers, it should be housed					
	<ul> <li>in IP-65 enclosure.</li> <li>b) Battery back-up should be provided for Controller and motor for at least 15 minutes with power pack cum UPS. Alternatively, the bidder can provide backup power from the UPS of inverter room or CMCS room.</li> <li>c) The controller must be enabled with a feature of stowing during bigh</li> </ul>					
	<ul> <li>c) The controller must be enabled with a feature of stowing dufing high-speed winds.</li> <li>d) The Real Time Clock (PTC) of the trackers shall have a facility to be</li> </ul>					
	time synchronized with SCADA on Network Time Protocol (NTP).					
	e) A suitable communication link between the controller and tracker SCADA system shall be arranged. The software for communication and analysis shall be provided by the tracker supplier. Tracker SCADA shall be interfaced with solar SCADA on an open protocol such as MODBUS.					
Decela						
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CLAUSE NO	TECHNI	CAL SPECIFICATIONS	(	एन् <b>टीपी</b> सी NTPC		
	CHAPTI	ER-B3: DC CABLES				
	The DC Cables in a sola i. Interconnecti ii. From SPV Mo iii. From SMU up	ar PV plant are used in the fo ng SPV modules odules up to SCB o to the Inverter.	llowing areas			
1.0	DC CABLES (Interconnecting SPV MODULES and from SPV Modules TO SCB)					
	Cables used for inter-connecting SPV modules as well as Modules to SMU's shall conform to the requirements of <b>EN 50618:2014</b> applicable for DC cable for photovoltaic system.					
	This shall be applicab	le for both 1000V and 1500	V modules.			
	These cables shall also meet the fire resistance requirement as per the above standard and shall be electron beam cured.					
	All cables except module cable used for (+) ve and (–) ve shall have distinct color identification.					
	In addition to manufacturer's identification on cables as per <b>EN50618</b> , following marking shall also be provided over outer sheath.					
	<ul> <li>a. Cable size and voltage grade</li> <li>b. Word 'FRNC' at every 5 meters</li> <li>c. Sequential marking of length of the cable in meters at every one meter.</li> </ul>					
	The Printing shall be progressive, automatic, in line and marking shall be legible and indelible.					
	Type test, routine, acceptance tests requirements for these cables shall be as per <b>EN50618:2014</b> . <b>All test charges</b> shall be deemed to be included in the cable price. Sampling for acceptance tests will be as per IS 7098.					
	A maximum of 8 Cables (4 Circuits) shall be laid in one HDPE Pipe for DC Cable from Module to string monitoring box (if applicable). The fill factor of the pipe should not be more than 40%.					
	However, in case of necessity to lay more than 8 cables (4 circuits) in one pipe, the same shall be allowed during detailed engineering and as per the derating factors recommended by the cable manufacturer. Fill factor criterion is still to be maintained.					
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	Bidder to ensure that th two pipes, in which DC like bell mouth.	here is no gap and proper pa cable is laid, using proper m	acking at the jur ethod and acce	nction of ssories,		
2.0	DC CABLES (STRING COMBINER BOX TO INVERTER)					
	Cables used between grade. In case bidder shall be provided. The /copper conductor, XLF Armoured /Unarmoured 7098. These cables sh codes specified at relev	SCB's and Inverters shall b offers 1500V DC system 3. se Power cables shall have PE insulated, PVC inner-sho d, FRLS PVC outer sheat all confirm to the requireme rant Chapter	e of min. 1.5 ( 3 kV (E) grade compacted Al eathed (as app ned conforming nts of the stan	<v (dc)<br="">e cables uminum licable), g to IS: dards &amp;</v>		
3.0	DC CABLES SIZING CI	RITERIA				
	As per relevant clause i	n Chapter A-2				
4.0	CABLE DRUM					
	For details refer clause 10.0 of Chapter -LT Cables.					
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	CHAPTER-B4						
	STRING COMBINER BOX						
1.0	GENERAL						
	String Combiner Box (SCB) is used in multi-string photovoltaic systems to combine the individual strings electrically and connect them to the Inverters. It shall have protection devices to protect the PV modules from current/voltage surges. Nos. of input to each SCB shall be decided during detail engineering based on the approved Single Line Diagram (SLD) submitted by contractor.						
	Vendor to note that DC system of both 1000 V and 1500 Volt rating is accepted based on solar string/array design offered by contractor. Accordingly, component/assembly shall comply with 1000/1500 V rating as applicable.						
	Voltage rating of the se as per system requirem V Application shall ha operation in Solar plant	elected component shall be ent during detail engineering ve already been type test with 1500 V DC system.	1000V or 1500\ g. SMB offered f ed and in satis	V (Min.) or 1500 sfactory			
2.0	CODES AND STANDAR	RDS		_			
	Codes	Description Fire Resistant/ fl:	ammability for	~			
		Enclosure					
	UL 746C	UV Resistant for Encl	osure				
	IEC 62262/EN 50 <sup>-</sup>	102 Mechanical Impact	Resistance for	~			
	IS 2147/IEC 60529	Degrees of protection	on provided by	,			
		enclosures (IP Code)		_			
	IEC 62208	Enclosure for low vol	tage Switchgear				
	Vendor shall submit the suitable Test Certificate/Report from accredited lab(s) indicating compliance of mentioned codes and standard if asked for the offered component or assembly.						
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3.0	GENERAL REQUIREM	ENT		
4.0	<ul> <li>SCB shall be equipped</li> <li>i. DC Disconnector Inverter for main this chapter.</li> <li>ii. All component in temperature range</li> <li>iii. Fuse in each S provided to preving case of norecommendation preferably be termination of the protection voltages as pereassociated items for the protection</li> <li>v. Surge Protection</li> <li>v. The common case of the protection</li> <li>v. Surge Protection</li> <li>v. Surge Protection</li> <li>v. Vendor shall er</li> <li>separate compares the protection</li> <li>d. Separate compares the protection</li> <li>d. Separate compares the protection of point of the protection of the protection.</li> </ul>	(but not limited to) with the fer r /Breaker to disconnect the tenance purpose as per speci- n the SCB shall be suitable ge of 0-65 Deg C. SCB input (both positive a ent the reverse short circuit egative string fuse is r of inverter manufacturer minated with field connector of a Devices for protection agai r specification given in set is like cable glands, lugs, ver and completeness of the sys of lection bus bars should b nd shall be suitably sized to thing limits. Insure adequate clearance of en positive bus and negative tive and Negative section dscape orientation) on the e rtment for negative section a sitive and negative string inp ON DEVICES (SPD) FOR P <sup>1</sup> consist of three Metal Oxide hall be connected from positi apability of the SPD shall be per IEC 61643-12 and shall ring fault and failure of MOV system. SPD shall have the ent arising from internal and red due to possible DC arcin sconnector, the SPD shall be per lice of the server shall be shall be per lice of the server shall be shall be per shall be sh	ollowing. e PV strings fi cification ment le for operation nd negative) s current flow. H not required r, string cabl with SCB. nst surge curre parate clause nts and items i stem shall be pre- be made up of b limit temperat with suitable in the shall be pre- be ind positive secure to shall be or ither side of secure and positive secure to shall be pre- to shall	rom the ioned in n within shall be owever, as per e shall ents and . Other required rovided zinc/tin cure rise nsulated n same ientated parator. ction for erred. NV) type e bus to a t 8/20 MCOV Il safely ector to In order due to uish the ntact for
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CLAUSE NO	TECHNICAL SPECIFICATIONS					
5.0	STRING FUSES					
	In order to provide protection to all cables and modules, string fuses shall be provided with strings. String fuses shall be of gPV category and dedicated to solar applications and conform to IEC 60269-6 or UL-2579 standards and fuse base shall comply with IEC 60269-1. String fuses should be so designed that it should protect the modules from reverse current overload. Fuses or Isolation Link shall be mounted in pull out type fuse holders. Fuse holders shall be suitable for DIN rail mounting. PCB mounted fuses are not acceptable. Fuse rating for single and combined input (limited to two) shall be 15 A and 30 A respectively suitable for 1000/1500 Volt for crystalline module. For Thin film modules, fuse rating shall be decided during detail engineering. In case of negative grounded system, requirement of string fuses as well as inverter input fuses on negative side shall be decided based on the recommendation of Inverter (PCU) manufacturer.					
6.0	SCB ENCLOSURE					
	SCB Enclosure shall satisfy the following requirement.					
	The enclosure shall be made of fire retardant material with self- extinguishing property and free from Halogen, UV Protected. Material of the enclosure shall be made of GRP/FRP/Polycarbonate.					
	i. Degree of protection for enclosure shall be at least IP 65. All the part shall be corrosion resistant and enclosure surface shall be free from crazing, blistering, wrinkling, color blots/striations. There should not be any mending or repair of surface. The SCB if mounted on the floater shall confirm to IP-67.					
	ii. The mechanical impact resistance of enclosure shall be IK 07 or better.					
	iii. The size of the enclosure and general arrangement of the component shall be designed in such a way that the temperature rise of at any point of enclosure shall not rise more than 12 deg C above the ambient temp of 50 deg C. The components mounted inside the SCB shall have higher temperature withstand capability and shall continuously operate under such conditions.					
	iv. Complete assembled SCB shall be subject to heat run type test to be witnessed by owner after manufacturing. In case it is found that the temperature rise is beyond the acceptable limits, bidder shall					
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		redesign the ass temp. rise is with	embly and perform the test fi in acceptable limit.	ree of cost to ve	erify that		
	V.	In each SCB 5 % rounded off to ne PV strings.	% spare terminals along with ext higher integer shall be p	cable glands a provided to con	and fuse nect the		
	vi.	All terminals bloc continuously to c	cks shall be rated for min 10 arry maximum expected curr	000V/1500 V ar ent.	nd rated		
	vii.	In case, SCB is p to be protected fr on top of SCB ex and dimensions mm of ground cle maintenance. All shall be galvanize	is proposed to be mounted on structure in open, it has ed from top, suitable canopy/rain shed shall be provided B extending minimum 50mm from all four sides. Design ons of SCB structure must be such that minimum 600 d clearance is available below SCB at site for repair and . All the erection hardware and mounting accessories anized steel.				
	viii.	All internal wiring with voltage ration internal wiring shaccessible and blocks. Wire terr type of tinned of insulation. Insulater terminations. Eng correspond with each wire. Ferrul the wire is discor	nal wiring shall be carried out with stranded copper wires tage rating mentioned elsewhere in the specification. A wiring shall be securely supported, neatly arranged, readily ble and connected to component terminals and terminal Wire terminations shall be made with solder less crimping tinned copper lugs which firmly grip the conductor and on. Insulated sleeves shall be provided at all the wire ions. Engraved core identification plastic ferrules marked to ond with the wiring diagram shall be fitted at both ends o re. Ferrules shall fit tightly on wires and shall not fall off when is disconnected from terminal blocks.				
	ix.	If metallic hinge i of SS 304 and s captive screws s Screw shall be conducting prote hinge/screw/faste	is being used with enclosure cover, it shall be made shall be rust proof. Enclosure shall be provided with so that it screw don't fall off when cover is opened. a made of corrosion free material. Suitable non- tection cover shall be provided for any metallic tener to avoid contact with live part of the assembly.				
	Х.	Mounting plate in made of FRP/GR	nside the SCB for mounting/fi RP or equivalent non-conduct	xing of devices ing material.	shall be		
7.0	DC O	N-LOAD ISOLATC	DR				
	Solar Vdc	PV on-load Isolat	tor shall be suitable for mini e, with minimum 250Vdc p	mum 1000Vdc er pole breaki	or 1500 ng. Any		
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	multipolar device achieving this configuration with Shorting links will not be acceptable.					
	Air Insulation distance distance shall be higher to carry the nominal c without any de-ration in necessarily contain rein arc-extinguishing syster Silver plated. The So indication and will have current.	shall be higher than 25 r r than 50 mm. The PV Isolate urrent till Min. ambient tem hside the String Junction bo forced break chamber, with m for the PV arc. Isolator to blar PV Isolators need to a to comply with IEC 60947	mm and the c ors shall be typ perature of 60 ox. Switching p an integrated n cerminals nee have a positiv -3 and PV-2 fo	reepage e tested Deg C art shall nagnetic ed to be e break r critical		
8.0	TYPE TEST					
	Vendor shall submit the National A	following Type Test/ Produc ccredited lab for approval.	t Certification fr	om any		
	<ul> <li>a. Temperature rise test on complete assembled Box as per acceptable limit mentioned in relevant clause.</li> <li>b. Type test for enclosure as per code and standard mentioned in relevant clause.</li> <li>c. Thermal ageing at 70 Deg C for 96 hours as per IEC 60068-2</li> <li>d. HV Test</li> </ul>					
9.0	DC PLUG-IN CONNECTORS FOR FIELD CABLING					
	GENERAL REQUIREMENT					
	Field connectors are electrical connectors/coupler used for connecting solar panels and also strings of panels to String combiners box. Cable connector to be used for connecting SPV modules and String monitoring boxes shall be in accordance with IEC 62852: 2014.					
	Connector shall be of plug and socket design to be plugged together by hand but can be separated again using a tool only. Contractor shall ensure that field connectors to be mated shall always be of same make and model or shall be tested Inter-compatible as per clause no.6.3.11 of IEC 62852: 2014 for offered make(s).					
	Mating of connectors of different makes/model shall not be acceptable if not tested for inter-compatibility by any accredited lab.					
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	TECHNICAL REQUIRE	MENTS				
	Rated Current, IEC (8	35°C) 30 A (4 mm², 6 mm²), 40 /	A (10 mm²)			
	Rated Voltage	Min1000/1500 Volts as pe	er system			
		requirement				
	Connector Design	Snap-In locking Type				
	Protection Degree	IP68 (Mated)				
	Ambient Temperature	e (-) 40° C to (+) 85° C				
	Protection/Safety Cla	ss Class II				
	Contact material	Cu				
	Contact surface mate	erial Silver/Tin				
	Contact resistance for	r <u>&lt;</u> 0.5 milli-ohms				
	plug connecter					
	Stripping length	10 mm				
	Inflammability class	UL 94-V0				
	Insulating Material	PPE / PPO/Polyamide				
	Pollution degree	3				
	Certification UL/TUV/CSA/EAC or Equivalent					
	Pollution degree       3         Certification       UL/TUV/CSA/EAC or Equivalent         TYPE TEST FOR DC PLUG-IN CONNECTORS         a.       Protection Degree (IP)         b.       Operating Temperature         c.       Inflammability         d.       Pollution Degree         e.       Voltage Withstand (Rated Voltage/Test Voltage)         l.       Product Certification					
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	CHAPTER- B5: POWER CONDITIONING UNIT The Power Conditioning Unit (PCU) is Solar Inverter designed to convert solar PV DC power to 3-phase AC power and fed into utility grid. The PCU shall consist of solid state electronic switch along with all associated control & protection, filtering, measuring instruments and data logging devices. The PCU shall have maximum power point tracker (MPPT) for operating the inverter at its maximum power point. The PCU output shall always follow the grid voltage & frequency by sensing the grid voltage and phase and the PCU shall always remain synchronized with the grid. The PCU shall use only self-commutated device which shall be adequately rated. The continuous combined rating of all PCUs shall be as per Chapter A-2.						
1.0	CODES AND STAND	ARDS					
	The PCU shall confor IEC standard is not shall be referred to a	rm to all applicable IEC stand available, IS/ any applicab s best practice.	ard. Where an le internationa	applicable I standard			
	Codes	Description					
	IEC-61683	Energy efficiency requirements	;				
	IEC 61000	Emission/ Immunity requirement	nt				
	IEEE 519	Recommended Practices ar	nd Requiremen	ts for			
		Harmonic Control in Electrical I	Power Systems.				
	IEC 60068	Environmental Testing					
	IEC 62116	Testing procedure—Islanding	prevention me	asures			
		not power conditioners use	a in gria-con	nected			
	IFC 62109-1 & 2	Safety of power converters for	or use in photo	voltaic			
		power systems		voltaio			
	EN 50530	Overall efficiency of grid co	onnected photo	voltaic			
		inverters	nation alout con				
	BDEW 2008	to Medium voltage network	rating plant con	nected			
	IEEE 1547	Standard for interconnecting	distributed res	ources			
		with electrical power systems.					
	IEC 60529	Ingress protection test					
	Grid Connectivity	Relevant CEA Regulations (	amended and r	/HVR1			
		from time to time.		eviseu			
Developmer at Central CHP/CPP Pi	Image: Development of 20MW Solar PV Project at Central Coalfields Limited (CCL) CHP/CPP Piparwar, Jharkhand     TECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-9296-004-9     PART-B     Page 1 of 9						

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2.0	GENERAL REQUIREMENTS OF PCU				
	Applicable both for Central and String Inverter				
	a. The minimum euro e The bidder shall s conditions i.e. 25% which shall be confi	The minimum euro efficiency of the PCU as per IEC 61683 shall be 97%. The bidder shall specify the conversion efficiency at following load conditions i.e. 25%, 50%, 75% and 100% during detail engineering, which shall be confirmed by type test reports. The PCU shall remain connected to the grid as per Central Electricity Authority Technical (standards for connectivity to the grid) regulation 2007 with all latest amendments and its components shall be designed accordingly. In case auxiliary supply of PCU is met internally, then it should have sufficient power backup to meet the LVRT requirement. Bidder needs to submit the detail auxiliary supply arrangement for PCU during detail engineering stage.			
	b. The PCU shall rem Authority Technical 2007 with all latest accordingly.				
	c. In case auxiliary su sufficient power bac submit the detail a engineering stage.				
	<ul> <li>d. The PCU shall be capable of operating in the frequency range of 47.5 Hz to 52 Hz and shall be able to deliver rated output in the frequency range of 49.5 Hz to 50.5 Hz.</li> <li>e. The monitoring/measurement of DC inputs (for central inverter) and AC output shall be done using transducers/instruments having sensor accuracy of 01 class or better.</li> <li>f. Internal Surge Protection Device (SPD) shall be provided in the PCU on DC and AC side. It shall consist of Metal Oxide Varister (MOV) type arrestors. The discharge capability of the SPD shall be at least 12.5kA at 8/20 micro second wave as per IEC 61643-12.</li> <li>g. The PCU shall be capable of supplying reactive power as per grid requirement (manual intervention through SCADA) during solar generation hours.</li> <li>h. The PCU shall have protection against any sustained fault in the feeder line and against lightning discharge in the feeder line.</li> </ul>				
	i. The Contractor shall ensure by carrying out all necessary studies that the PCU will not excite any resonant conditions in the system that may result in the islanded operation of PV plant and loss of generation. In case there is excitation of any resonant condition in the system during PV plant operation that may result in the islanding/tripping of the PV plant and affect the power transfer, it shall be the responsibility of				
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	contractor to rectify the design and carryout required modification in the equipment of his supply.				
	j. The PCU must be self-managing and stable in operation.				
	k. In case of grid failure, the PCU shall be re-synchronized with grid after revival of power supply. Bidder to furnish the time taken by PCU to be re synchronized after restoration of grid supply during detailed engineering.				
	I. The PCU shall inc feature to protect it PCU component fa operating range du features shall not a PCU to be operate Faults due to malf failure, shall be clea	lude appropriate self-prote self and the PV array from ailure or from parameters e to internal or external ca llow signals from the PCU d in a manner which may functioning within the PCU red by the PCU protective d	ctive and self damage in th beyond the P uses. The self front panel to be unsafe or l, including co evices.	-diagnostic e event of CU's safe f-protective cause the damaging. mmutation	
	m. PCU shall have active power limit control, reactive power and power factor control feature. Plant operator shall be able to provide (manual intervention) Active power, reactive power and power factor control/limit set point through SCADA HMI and local control display unit (or Laptop computer). PCU shall be provided with remote start and stop facility from SCADA HMI. All required hardware and software required for this purpose shall be provided by Bidder.				
	<ul> <li>n. PCU shall have necessary limiters in build in the controller so as to ensure safe operation of the PCU within the designed operational parameters.</li> </ul>				
	<ul> <li>o. PCU shall have thermal overloading protection to prevent failure of switching devices (i.e. IGBT) and other components of Inverter. PCU controller shall automatically regulate/limit the power output in order to reduce the PCU cabinet and switching devices temperature. Bidder to submit the PCU power vs ambient temperature curve during details engineering stage. PCU shall be able to provide inverter inside cabinet and IGBT's (switching device) temperature (in soft analog value) to SCADA system for remote monitoring, storing and report generation purpose.</li> </ul>				
	p. PCU shall have the following feature,				
	i. AC & DC ov ii. Synchroniza	ercurrent protection. tion loss protection.			
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	<ul> <li>iii. Over temperature protection.</li> <li>iv. DC &amp; AC under and over voltage protection.</li> <li>v. Under &amp; over frequency protection.</li> <li>vi. Cooling system failure protection</li> <li>vii. PV array ground fault monitoring &amp; detection</li> <li>viii. PV array insulation monitoring</li> <li>ix. LVRT</li> <li>x. Anti-islanding protection</li> <li>xi. Grid monitoring</li> </ul>						
	<ul> <li>q. PCU shall be provided with Mobile user interface facility for monitoring status of inverters. The system should give message alert in case any inverter is tripped due to any fault. An inverter event list is stored with important messages highlighted to enable the user to keep track of inverter status at all times for better O&amp;M and highest yield from the PV plant. In case PCU does not have this facility, then Bidder can provide the same facility through plant SCADA system. All required hardware and software including Mobile App required for this purpose shall be provided by Bidder.</li> <li>r. PCU shall meet the following technical parameter</li> </ul>						
	Nominal output	t voltage	50Hz				
	Continuous frequency range	operating	47.5 Hz to 52 H	Z			
	Continuous ope voltage range	rating AC	± 10% rated AC	voltage			
	Operating power fa	ictor range	Operating powe shall be 0.9 Lea	er factor (adjusta id to 0.9 Lag.	ible)		
	Maximum input DC	voltage	1000V or 1500V requirement.	✓ as per applica	ation		
	Current THD value	1	< 4% at nomina	lload			
		temperature	95 % non-cond	ensina			
	Maximum Noise	level (at 1	75 dBA for indo	or type PCU			
	meter distance)						
	DC Injection		<0.5 % at rated	current			
	Flicker		As per IEC6100	10			
	EARTHING OF INVER	RTERS					
	The PCU shall be ea	rthed as ner	manufacturer	recommendation	on, Durina		
	detail engineering th	ne Bidder r	needs to subn	nit the details	s earthing		
	arrangement of PCU	and syste	m earth pit re	equirement du	ring detail		
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	engineering stage. The detail specification for panel earthing for safety has been mentioned elsewhere in this specification				
	OPERATING MODES OF PCU				
	a. Low Power Mode: The PCU shall be able to wake-up automatically when PV array open circuit voltage value is equal/more than preset value in the PCU program. Once its start generation the PCU shall automatically enter maximum power mode after achieving threshold parameters.				
	b. Maximum Power Point Tracking (MPPT): In order to maximized the energy collection from solar PV array, the PCU shall have inbuilt maximum power point tracker (MPPT) controller and MPPT shall be able operate the PV array at its maximum power point by adjusting output voltage of PV array system according to atmospheric condition. PCU MPPT controller shall ensure that it operate the PV array system at its global maximum power point. The PCU shall operate within its MPPT operating input DC voltage range (window). The PCU MPPT operating DC voltage range shall be large enough so that it shall be able to satisfactorily operate the PV modules exposed to the maximum ambient temperature of 50°C. In case the solar PV array operating maximum power point voltage fall below (or above) the PCU MPPT operating voltage range, then the PCU controller shall automatically adjust the PCU input voltage so that PCU shall not enter into sleep mode. If the PV array output power fall below the PCU minimum preset power value, then PCU shall automatically switched to sleep mode.				
	<ul> <li>c. Sleep Mode: PCU shall automatically go into sleep mode when the output voltage of PV array and/or output power of the inverter falls below a specified limit. During sleep mode, the inverter shall disconnect from grid. Inverter shall continuously monitor the output of the PV array and automatically start when the DC voltage rises above a pre-defined level. During evening and night (non solar generation hours) the PCU shall be in sleep mode in order to minimize the internal power loss. Maximum loss in sleep mode shall be less than 0.05% of PCU rated power.</li> <li>d. Standby Mode: In standby mode the PCU DC &amp; AC contactor are open, inverter is powered on condition and waiting for start command.</li> </ul>				
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3.0	CENTRAL INVERTER					
	<ul> <li>i. PCS must have p Breakers/MCCB's. shall be a part of design and configu</li> </ul>	<ol> <li>PCS must have provision to be isolated from grid through Air Circuit Breakers/MCCB's. The ACBs/MCCBs as required can be provided as shall be a part of PCU/its Modules or separately based on standard design and configuration of PCU manufacturer.</li> </ol>				
	ii. PCU shall have su array from inverte end) in incoming D requirement (at inv shall be as per inv terminals with fuse the future use. D based on standard case MCCB are p PCU panel) shall b	uitable rated DC isolator/cor r. Suitable rated fuse shall OC cable from each string co verter end) in the negative s verter manufactures recomme verter manufactures recomme verter manufactures recomme verter manufactures recomme verter and factorial of the verter manufactures recomme verter and for the negative s verter and for the n	ntactor for isola be provided of mbiner box (S ide of incoming nendation. One lder shall be p ble in place of of PCU manuf MCCB (moun	ation of PV (at inverter CB). Fuse g DC cable e set spare rovided for of DC fuse facturer. In ted in side		
	<ul> <li>iii. String Monitoring f transducer at inco (SCB) for PV arra used for this purp PCU shall be abl calculated DC pow SCADA system for case PCU does n calculation within facility in SCADA s</li> </ul>	iii. String Monitoring facility: PCU shall be provided with current monitoring transducer at incoming DC cables from each string combiner box (SCB) for PV array zone monitoring purpose. The current transducers used for this purpose shall have accuracy of 01 class or better. The PCU shall be able to provide the measured DC current value and calculated DC power and energy value of incoming SCB DC cable to SCADA system for remote monitoring, storing and report generation. In case PCU does not have the facility/capability for power and energy calculation within its controller, then Bidder can provide the same facility in SCADA system.				
	iv. The PCU should be designed for parallel operation through galvanic isolation. Solid state electronic devices shall be protected to ensure smooth functioning as well as ensure long life of the inverter. Parallel operated PCU system are also accepted subjected to recommendation of PCU manufacturer. In such case, PCU design shall also ensure that no abnormal interaction shall take place among the PCU unit during any grid operating condition which may result in outages.					
v. Local Display unit for viewing important parameters, configuration and troubleshooting purpose shall be provided. Display shall include al important parameter such as DC input voltage, DC input current, AC output voltage, AC output current, AC output power, frequency etc Inverter shall also be provided with required software along with accessories (2 sets) for interface with Laptop PC for viewing configuration, troubleshooting purpose.						
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	vi. PCU shall have suitable communication card (Modbus/Ethernet) for networking and SCADA integration. Communication port shall be preferably TCP/IP protocol. PCU shall include all important measured & internal calculated analog values and alarm & trip signals for remote monitoring, storing and report generation purpose in SCADA system. Details list of above such parameters shall be provided along with their Modbus address during detail engineering stage.				
	vii. In case of modular design of PCU is offered, the Contractor shall ensure that no abnormal interaction shall take place among the various PCU modules during any grid operating condition which may result in outages. The PCU controller offered by the Contactor shall be such as to ensure stability, reliability and a good dynamic performance. The Bidder shall indicate the control scheme adopted for modular PCU and its merits and the test which will check its performance.				
	Bidder may offer liquid cooling system subject to NTPC approval. In case Liquid cooled inverters are offered, Bidder to ensure that coolant is used in closed cycle. Complete inverter along with cooling system shall be of proven design.				
	ix. The Inverter shall have suitable arrangement for negative grounding of solar PV array system and the ground current shall be limited to safe limit. Ground current shall be measured continuously and alarm shall be generated in case ground current reaches to predefined set value. Inverter shall trip in case ground current more than safe operating limit.				
	<ul> <li>x. Inverter shall have emergency stop push button for tripping of inverter with complete AC electric isolation.</li> </ul>				
	INDOOR CENTRAL INVERTER				
	a. The PCU enclosure protection class shall be IP 20 or better protection.				
	b. COOLING AND VENTILATION: Ventilation shall be designed such that the temperature rise of the inverter rooms doesn't exceed 3°C above ambient. The air velocity through the filter shall be taken at max 1.5 m/sec and the filter shall be chosen accordingly to pass the required intake air through the filter to remove heat from the inverter room. the inverter room. All exhaust and fresh air fans shall be provided with thermostat control				
	c. To prevent the maximum permissible temperature in the inverter room from being exceeded because of internal heat emission of inverters and				
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	other auxiliaries in the inverter room, the inverter room in the PV plant shall be adequately ventilated. The Ventilation plant capacity and air quality of inverter room shall be as per inverter and other auxiliary's system manufacturer's recommendations. Filter banks at the air inlet of the inverter room shall be provided to prevent dust ingress. Bidder shall furnish peak power consumption of cooling system (cooling fans, pumps etc.) of the PCU along with the data sheet.					
	OUTDOOR CENTRAL INVERTER					
	a. Outdoor PCU (including containerized solution) with metallic enclosure are acceptable. The enclosure must be suitable to withstand the harsh environmental conditions for complete life of plant.					
	b. The PCU enclosure protection class shall be IP 54 or better protection.					
	<ul> <li>c. Bidder to submit temperature endurance test report of complete assembly during detail engineering stage.</li> </ul>					
	d. For Outdoor PCU (without containerized solution) the complete assembly should be placed inside a shed made of structural steel section preferably tubular/hollow section and color coated metal sheets for roof with BMT 0.5 mm and at least 60cm projection in all side. For containerized solution separate shed is not required, however, the container shall have projection of at least 60cm wherever an opening in the inverter door exposes the inverter component to outside environment. Structural steel and paints for shed shall be as per ISO 12944-5.					
	Alternatively, Bidder can also provide integrated protection to the inverter enclosure through suitable other arrangement (s) subjected to NTPC approval					
4.0	STRING INVERTER					
	<ol> <li>The string inverter enclosure protection class shall be IP 65 or better protection.</li> </ol>					
	<li>ii. The string inverter, if installed on ground should be placed inside a canopy shed with at least 15 cm in all direction.</li>					
	iii. String inverter shall have suitable communication port (RS485/TCP- IP/PLCC) for SCADA integration. All necessary hardware, software and accessories used for communication with SCADA (including Data logger if supplied) at both the ends shall be provided by the bidder.					
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	iv. String inverter sha system. Any spec provided for local a	II have monitoring capability cial software if required for and remote monitoring and r	r and reporting r this purpose eport generatio	to SCADA s shall be on.		
	v. Anti-PID device cable/device shall of PV string is not PID device shall be	along with all hardwar be provided in case provisi available in string inverter. e integrated with SCADA sys	re and com on of negative Data logger us stem.	munication grounding ed in Anti-		
	vi. DC fuse requireme string manufacture during detail engin	ent for PV string at string inverse er/system requirement and eering stage.	verter end shal same shall b	l be as per e finalized		
	vii. Provision for MCB/MCCB/Isolat manufacturer prac	AC electrical isolation or) inside string shall be tice.	device ( as per strin	such as g inverter		
	viii. Local Display unit troubleshooting p manufacture prac requirement for Switchgear).	for viewing important parar urpose shall be provided tice. LT Junction box, swit string inverter system as	meters, configu as per strin chboard and s per chapter	iration and g inverter switchgear C-1 (LT		
5.0	TYPE TESTING					
	Applicable both for Central and String Inverter					
	During detailed engineering, the contractor shall submit all the type test reports including temperature rise test and surge withstand test carried out within last ten years from the date of techno-commercial bid opening for Owner's approval. 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 last ten years from the date of techno-commercial bid opening, 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.					
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## PART-C

## AC SYSTEMS

Development of 20MW Solar PV Project at Central Coalfields Limited (CCL) CHP/CPP Piparwar, Jharkhand

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CLAUSE NO		TECHNICAL SPECIFICATIONS					
	СН	CHAPTER- C1 : LT SWITCHGEAR					
1.0	CODES A	CODES AND STANDARDS					
	The design, r applicable IE( be carried o applicable IE standard shall and codes of official amend As a minimun	The design, materials, and method of LT switchgear shall conform to the applicable IEC standard. All equipment shall be installed and all work shall be carried out in accordance with relevant IEC standards. Where an applicable IEC standard is not available, IS/ any applicable international standard shall be referred to as best practice. All standards, specifications and codes of practice shall be the latest editions including all applicable official amendments and revisions. As a minimum requirement, the following standards shall be complied with:					
	IS	Details					
	IEC 60947/ IS13947	Low-voltage switchgear and control gear					
	IS 2705	IS 2705 Current Transformers					
	IS 3043	Code of p	practice for earthi	ng.			
	IS 3072	Code of practice for installation and maintenance of Switchgear					
	IS 3156	Voltage T	ransformers				
	IS 3202	Code of practice for climate proofing of electrical equipment.					
	IS 3231	Electrical	relays for power	system prot	ection.		
	IS 13703 / IEC 60269	HRC Carl	tridge fuses				
	IS 10118 (4 parts)	Code of p of switchg	practice for selec	tion, installat gear.	tion and mainte	enance	
	IEC 60255	Electrical	Relays				
2.0	TECHNICAL PARAMETERS						
	A. POWER SUPPLY (AC SYSTEM)						
	(I) Voltage 415V <u>+</u> 10%, 3 Phase, 4 wire, Neutral Solidly Earthed						
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	(ii)	Frequency	50 Hz +/- 5	%		
	(iii)	Minimum system fault level	As per sy (for 1 sec)	stem fault cur	rent	
	(iv)	Short time rating for bus bars, ckt. breakers, current transformers and swgr. Assembly.	As per sy (for 1 sec)	stem fault cur	rent	
	(v)	Maximum ambient air	50 deg. C			
		Temperature				
	BUS BA	RS				
	(vi) Continuous current rating As Per Requirement at 50°C ambient:					
	(vii)	Temperature Rise allowed above ambient	re Rise 40°C for plain joints 55°C for solution of the second sec			
	B. MCC	B. MCCB				
	(i)	Rated voltage 415V				
	(ii)	Rated Insulation Level	ation Level 690V			
	(iii)	Rated ultimate and service SC breaking capacity(As per system requirement)	d As per system fault current (for 1 sec)			
	(iv)	Rated making capacity	2.1 times of System fault current			
	(V)	Utilization category	A			
	C. DIGI		1			
	(i)	Accuracy class	0.5			
	(ii) MFM shall be provided at LT incomer feeder. MFM shall have suitable communication port for integration with SCADA system.				all th	
	D. CUR	RENT TRANSFORMERS				
	(i)	Туре	Cast Resin I	Bar Primary		
	(ii)	Voltage class and frequency	650V, 50HZ			
	(iii)	CT Secondary Current	1 A			
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				1		
	(iv)	Class of ins	ulation	E or better		
	(v)	Accuracy cl	ass & burden			
		a) For Prote	ection	5P20, 5VA		
		b) For Mete	ring	Class 1.0, 5	VA (min)	
	(vi)	Instrument Factor for m	Security netering CT	5		
	E. VOL	TAGE TRAN	ISFORMERS			
	(i)	Туре		Cast Resin		
	(ii)	Voltage Ratio         415 / 110V for line PT           415/\dot 3 / 110/\dot 3V for Bus PT				
	(iii)	Method of	Method of Construction Vee Vee			
	(iv)	Accuracy Class 0.5				
	(v)	Rated Volta	d Voltage factor 1.1 continuous, 1.5 for 30 sec		1 continuous, 1.5 for 30 sec.	
	(vi)	vi) Class of insulation E or better				
	(vii)	One min frequency voltage	nute power withstand	r 2.5 KV		
	F. HRC	FUSES		·		
	(i)	Voltage Cla	SS	650 Volts		
	(ii)	Rupturing c	apacity	80kA (RMS)	for AC circuits	
	G. CON	ITACTORS				
	(i)	Туре		Air break ele	ectro magnetic	
	(ii)	Utilising Ca	tegory	AC3 of IS/ reversible A for reversible	IEC 60947 for C4 of IS/IEC 60 e drives	non )947
	H. SWG	R. CUBICLE	CONSTRUCTIO	NAL REQUIR	EMENTS	
	(i)	Colour finis	h			
		Exterior	RAL9002 (Main body) RAL 5012 (Extreme end covers The paint thickness shall no be less than 50 microns		ers) not	
		Cable entry				
	(ii)	Power Cab	les	Bottom		
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	Control Cal	bles	Bottom		
	The quantities/Nos. of th requirements. 5% spare board/switchgear having breaker panels are require	e Feeders /MCC e with minimum more than 5 M ed.	B shall be so 01 No. to ICCB. Howev	o as to meet the be provided ver, no spare A	e system on each Air circuit
3.0	DETAILS OF INDOOR	DISTRIBUTION	BOARDS		
	Applicable for Auxilian distribution board of r	ary Power Sup ating upto & in-	oply system cluding 400	n and String A.	Inverter
3.1	Switchboards shall be standing type.	of metal encl	osed, indoo	r, floor-mounte	ed, free-
3.2	All switchboard frames a suitable mild steel stru sheet steel of thickness sheet steel of thickness rolled sheet steel of wherever necessary. T cold-rolled sheet steel a	and load bearing ctural sections s 2.0 mm. Fram s 1.6 mm. Door thickness 1.6 he gland plate t and 4.0 mm for n	g members s or pressed a les shall be 's and cover mm. Stiffen hickness sha on-magnetic	hall be fabricat and shaped co enclosed in co s shall also be ers shall be j all be 3.0 mm material.	ed using old-rolled old-rolled e of cold provided for hot /
3.3	All panel edges and cover / door edges shall be reinforced against distortion by rolling, bending or by the addition of welded reinforcement members. The top covers of the panels should be designed such that they do not permanently bulge/ bend by the weight of maintenance personnel working on it				
3.4	The switchboards shall be of bolted design. The complete structures shall be rigid, self-supporting, and free from flaws, twists and bends. All cut outs shall be true in shape and devoid of sharp edges.				
3.5	All switchboards shall be of dust-proof and vermin-proof construction and shall be provided with a degree of protection of IP: 5X as per IS/IEC 60947. All cutouts shall be provided with EPDM / Neoprene gaskets. Feeder Pillar with IP 55 enclosure protection meeting the technical requirement is also acceptable.				
3.6	All switchboards shall b	e of uniform heig	ght not excee	ding 2450 mm.	
3.7	Switchboards shall be sections, along with all down the base frame to	supplied with bancessary mound the foundation /	ase frames n nting hardwa steel insert	nade of structu are required for plates.	ral steel welding
3.8	All equipment and components shall be neatly arranged and shall be easily accessible for operation and maintenance. Replacement /Maintenance of				
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	individual equipment/ constrained is a set of the set o	omponent shall be possible to ments/components.	without switchir	ng off or	
3.9	Each switchboard shall plate. For all single co material. The gland plat protection.	be provided with undrilled, fre cables, gland plate shate shate shate shate shate shate be provided with gas	removable typ all be of non-r ket to ensure e	be gland nagnetic nclosure	
3.10	The minimum clearance earth for the entire bus clearance between "two be at least ten (10) mm these clearances, insu However, for busbars the even when the busbars busbars up to switch / bolted to minimize the circuits. All busbars an aluminium alloy / coppe	ce in air between phases and between phases and sbars shall be 25mm. For all other components, the ro live parts", "a live part and an earthed part", shall in throughout. Wherever it is not possible to maintain ulation shall be provided by sleeving or barriers. the clearances specified above should be maintained is are sleeved or insulated. All connections from the / fuses/MCCB shall be fully insulated and securely e risk of phase to phase and phase to earth short ind jumper connections shall be of high conductivity er of adequate size.			
3.11	All switchboards shall I Entire busbar system s shall be compliant to L having fire retardant pro	s shall be provided with three phase and neutral busbars. stem shall be insulated with PVC sleeves. Busbar sleeves ant to UL224 (Extruded insulating tubing), CE/UL certified, dant properties and working temperature of 105°C.			
3.12	The cross-section of the switchboard section ar withstand the stresses busbar short circuit stre	of the busbars shall be uniform throughout the length of n and shall be adequately supported and braced to ses due to the specified short circuit currents. Neutral strength shall be same as main busbars.			
3.13	All busbars shall be combustible, track-resis equivalent type polyest shall be provided for ea is provided, anti-trackin Insulator and barriers of accepted. The busbar in	bars shall be adequately supported by non-hygroscopic, non- tible, track-resistant and high strength sheet molded compound or ent type polyester fiber glass molded insulator. Separate supports provided for each phase and neutral busbar. If a common support ded, anti-tracking barriers shall be provided between the supports. or and barriers of inflammable material such as Hylam shall not be ed. The busbar insulators shall be supported on the main structure			
3.14	All busbar joints shall be provided with high tensile steel bolts, belleville / spring washers and nuts, so as to ensure good contacts at the joints. Non-silver plated busbar joints shall be thoroughly cleaned at the jointed locations and suitable contact grease shall be applied just before making a joint. All bolts shall be tightened by torque spanner to the recommended value. The overlap of the busbars at each joint surface shall be such that the length of overlap shall be equal to or greater than the width of the busbar. All copper to aluminium joints shall be provided with suitable bimetallic washers.				
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3 15	All busbars shall be colour coded as per IS: 375					
3.16	Wherever the busbars be suitable for tempera operating conditions.	Wherever the busbars are painted with black Matt paint, the same should be suitable for temperature encountered in the switchboard under normal operating conditions				
3.17	The Bidder shall furnish sizes for specified curre	n calculations establishing th nt ratings.	e adequacy of	bus bar		
3.18	Panel space heaters s tapped from incomer, b circuit to space-heater s link of suitable rating. tapped from the space b	Panel space heaters shall be provided and the supply for this shall be tapped from incomer, before the isolating switch/circuit breaker. Incoming circuit to space-heater shall have an isolating switch, HRC fuse and neutral link of suitable rating. Panel illumination and plug-socket shall also be tapped from the space heater supply.				
3.19	A galvanized steel / Copper / Aluminium earth bus shall be provided at the bottom of each panel and shall extend throughout the length of each switchboard. It shall be welded / bolted to the framework of each panel and breaker earthing contact bar. Vertical earth bus shall be provided in each vertical section which shall in turn be bolted / welded to main horizontal earth bus.					
3.20	The earth bus shall ha short circuit and short allowable temperature r	ve sufficient cross section to time fault current to earth ise.	o carry the mo without exceed	mentary ding the		
3.21	All non-current carrying metal work of the switchboard shall be effectively bonded to the earth bus. Electrical conductivity of the whole switchgear enclosure framework and truck shall be maintained even after painting.					
3.22	All metallic cases of relays, instruments and other panel-mounted equipment shall be connected to earth by independent stranded copper wires of size not less than 2.5 sq. mm. All the equipment mounted on the door shall be earthed through flexible wire/braids. Insulation color code of earthing wires shall be green. Earthing wires shall be connected to terminals with suitable clamp connectors, soldering is not acceptable. Looping of earth connections, which would result in loss of earth connections to other devices, when a device is removed, is not acceptable. However, looping of earth connections between equipment to provide					
3.23	VT and CT secondary neutral point earthing shall be at one place only, i.e. on the terminal block. Such earthing shall be made through links so that earthing of one secondary circuit shall be removed without disturbing the earthing of other circuit					
3.24	All hinged doors having potential carrying equipment mounted on it shall be earthed by flexible wire/ braid. For doors not having potential carrying					
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	equipment mounted on pins of proven design r earth continuity at site a	equipment mounted on it, earth continuity through scraping hinges/ hinge pins of proven design may also acceptable. The Contractor shall establish earth continuity at site also.				
3.25	All switchboards shall terminals, ready to rece	be supplied completely wir ive external cables.	red internally u	upto the		
3.26	All auxiliary wiring sha stranded copper conduc size shall be 1.5 mm2 ( CT and space heater cir	all be carried out with 650 ctor, colour coded, PVC insumin.) for control circuit wiring rcuits.	DV grade, sing Ilated wires. Co I and 2.5 mm2 (	Jle core onductor (min) for		
3.27	Extra flexible wires shall parts such as hinged do doors shall be properly	Il be used for wiring to devico pors. The wire bunches from sleeved or taped.	es mounted on the panel insic	moving le to the		
3.28	All wiring shall be prop and securely connected	erly supported, neatly arrand to equipment terminals and	ged, readily ac terminal blocks	cessible		
3.29	All internal wiring termin tinned copper lugs which method. Similar lugs sh component wiring. Insu parts of lugs to the exten type terminal shall also	All internal wiring terminations shall be made with solderless crimping type tinned copper lugs which shall firmly grip the conductor or an equally secure method. Similar lugs shall also be provided at both ends of component to component wiring. Insulating sleeves shall be provided over the exposed parts of lugs to the extent possible. Screw-less (spring loaded) / cage clamp type terminal shall also be provided with lugs				
3.30	Printed single tube ferru shall be fitted at both shall be in accordance v circuit wiring.	Printed single tube ferrules marked to correspond with panel wiring diagram shall be fitted at both ends of each wire. The wire identification marking shall be in accordance with IS: 375. Red Ferrules should be provided on trip circuit wiring.				
3.31	Cable termination arran duty, 1.1 kV grade, stra armoured / unarmoured terminating accessories etc., shall be provided b	gement for power cables sha anded aluminium conductor, d and PVC sheathed cables such as supporting clamps a by the contractor, to suit the fi	all be suitable for PVC/ XLPE in and brackets, h nal cable sizes.	or heavy Isulated, ry cable ardware		
3.32	All power cable termina shall be of tinned copp 8309. All lugs shall be ir	als shall be of stud type and per solderless crimping ring nsulated/ sleeved.	d the power ca type conformin	ble lugs ig to IS:		
3.33	All Switchgears, MCCs, push-button stations ε identification plates.	All Switchgears, MCCs, Distribution Boards, Fuse boards, all feeders, local push-button stations etc. shall be provided with prominent, engraved identification plates.				
3.34	All name plates shall be of non-rusting metal or 3-ply Lamicoid, with white engraved lettering on black background. Inscription & lettering sizes shall be subject to Employer's approval.					
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3.35	Caution name plate "Ca where the terminals are remote end.	Caution name plate "Caution Live Terminals" shall be provided at all points where the terminals are likely to remain live and isolation is possible only at remote end.					
3.36	The gaskets, wherever with good ageing, com for panel applications.	The gaskets, wherever specified, shall be of good quality EPDM / neoprene with good ageing, compression and oil resistance characteristics suitable for panel applications.					
3.37	The bidder shall, ensur load current at site amb duties without excee standards / specification no case shall be less the	shall, ensure that the equipment offered will carry the required t at site ambient conditions specified and perform the operating thout exceeding the permissible temperature as per indian specification. Continuous current rating at 50 deg C ambient in all be less than 90% of the normal rating specified.					
3.38	ON/OFF status and pro available) be provided for	ON/OFF status and protection trip status of incomers and bus coupler (if available) be provided for SCADA system.					
3.39	Suitable changeover a incomers and bus coupled	nd interlocking arrangement er.	shall be prov	ided for			
3.40	It shall be the responsibility of the contractor to fully coordinate the overload and short circuit breakers/fuses with the upstream and downstream circuit breakers / fuses, to provide satisfactory discrimination. Further the various equipment supplied shall meet the requirements of type ii class of co- ordination as per IS: 8544						
3.41	All sheet steel work shall be pretreated, in tanks, in accordance with is: 6005. Degreasing shall be done by alkaline cleaning. Rust and scales shall be removed by pickling with acid. After pickling, the parts shall be washed in running water. Then these shall be rinsed in slightly alkaline hot water and dried. The phosphate coating shall be "class-c" as specified in is: 6005. The phosphated surfaces shall be rinsed and passivated. After passivation, electrostatic powder coating shall be used. Powder should meet requirements of is 13871 (powder costing specification). Finishing paint shade for complete panels excluding end covers shall be RAL9002 & RAL5012 for extreme end covers of all boards, unless required otherwise						
4.0	МССВ						
	<ul> <li>a. MCCB shall be fixed type module, air break type, having trip free mechanism with quick make and quick break type contacts. MCCB shall have current limiting feature. MCCB of identical ratings shall be physically and electrically interchangeable. MCCB shall be provided with 1 NO and 1NC auxiliary contacts.</li> <li>b. MCCB shall have inbuilt front adjustable releases (overload &amp; short circuit) and shall have adjustable earth fault protection unit also. The</li> </ul>						
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	<ul> <li>protection settings shall have suitable range to achieve the required time &amp; current settings. LED indications shall also be provided for faults, MCCB status (on/off etc).</li> <li>C. MCCB terminals shall be shrouded and designed to receive cable lugs for cable sizes relevant to circuit rating. Extended cable terminal arrangement for higher size cable may also be offered. ON and OFF position of the operating handle of MCCB shall be displayed and the rotary operating handle shall be mounted on the door of the compartment housing MCCB. The compartment door shall be interlocked mechanically with the MCCB, such that the door can not be opened unless the MCCB is in OFF position. Means shall be provided for defeating this interlock at any time. MCCB shall be provided with padlocking facility to enable the operating mechanism to be padlocked. The MCCBs being offered shall have common/interchangeable accessories for all ratings like aux. switch, shunt trip, alarm switch etc. The MCCBs shall have the current discrimination up to full short circuit capacity and shall be selected as per manufacturer's discrimination table.</li> </ul>							
5.0	FUSES							
5.1	All fuses shall be of HR be accepted. Fuses for breaking capacity at 4 capacity at 240V DC.	All fuses shall be of HRC cartridge fuse link type. Screw type fuses shall not be accepted. Fuses for AC circuits shall be rated for 80kA rms (prospective) breaking capacity at 415V AC and for DC circuits, 20kA rms breaking capacity at 240V DC						
5.2	Fuse shall have visible provided between individed between individ	e operation indicators. Insul dual power fuses.	ating barriers	shall be				
5.3	Fuse shall be mounted fuse bases. Wherever i shall be directly mounte insulated fuse pulling ha	on insulated fuse carriers, t is not possible to mount f d on plug-in type of bases. In andles shall be supplied with	which are mou uses on carrier n such cases or each switchboa	inted on rs, fuses ne set of ard.				
5.4	The Neutral links shall b on fuse bases.	be mounted on fuse carriers	which shall be r	nounted				
6.0	INDOOR LT SWITCHG	EAR FOR STRING INVERT	ER					
6.1	<ul> <li>In addition to the above clauses (relevant), the following shall also be applicable for switchgear ratings more than 400A</li> <li>6.1 All switchboards shall be divided into distinct vertical sections (panels), each comprising of the following compartments</li> </ul>							
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CLAUSE NO	<ul> <li>(a) BUSBAR COMPARTMENT:- A completely enclosed bus bar compartment shall be provided for the horizontal and vertical busbars. Bolted covers shall be provided for access to horizontal and vertical busbars and all joints for repair and maintenance, which shall be feasible without disturbing any feeder compartment. Auxiliary and power busbars shall be in separate compartments.</li> <li>(b) SWITCHGEAR / FEEDER COMPARTMENT:- All equipment associated with an feeder of rating above 400A shall be housed in a separate compartment of the vertical section. ACB shall be provided for feeders of rating 1000A and above. The design of the vertical section for such an arrangement shall ensure ease of termination of power cables of size &amp; quantity as per system requirement. The compartment shall be sheet steel enclosed on all sides with the withdrawable units in position or removed. Insulating sheet at rear of the compartment is also acceptable. The front of the compartment shall be provided with the hinged single leaf door with captive screws for positive closure.</li> <li>(c) CABLE COMPARTMENT/CABLE ALLEY:- A full-height vertical cable alley of minimum 250mm width shall be provided for power and</li> </ul>				
6.2	<ul> <li>(c) CABLE COMPARTMENT/CABLE ALLEY:- A full-height vertical cable alley of minimum 250mm width shall be provided for power and control cables. Cable alley shall have no exposed live parts and shall have no communication with busbar compartment. Cable terminations located in cable alley of capacity more than 400 A shall be designed to meet the Form IVb and for less than 400A A shall be designed to meet the Form 3b (as per IEC 61439) for safety purpose. Wherever cable alleys are not provided for distribution boards, segregated cable boxes for individual feeders shall be provided at the rear for direct termination of cables. For circuit breaker external cable connections, a separately enclosed cable compartment shall also be acceptable. The contractor shall furnish suitable plugs to cover the cable openings in the partition between feeder compartment and cable alley. Cable alley door shall be hinged.</li> <li>(d) CONTROL COMPARTMENT:- A separate compartment shall be provided for relays and other control devices associated with a circuit breaker.</li> </ul>				
	However, the busbar chambers having a degree of protection of IP: 42 are also acceptable where continuous busbar rating is 1600A and above. Provision shall be made in all compartments for providing IP: 5X degree of protection, when circuit - breaker or module trolley has been removed. All cutouts shall be provided with EPDM / Neoprene gaskets.				
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6.3	Provision of louvers of louvers backed with me where continuous busba	n switchboards would not b stal screen are acceptable of ar rating is 1600 A and above	e preferred. ⊢ n the busbar ch ₂.	lowever, nambers		
6.4	Sheet steel barriers sha running to the full hei busbar compartment. E the panel sections to av	all be provided between two a ght of the switchboard, exe PDM / Neoprene gasket sha oid ingress of dust into panel	adjacent vertica cept for the he Ill be provided l s.	Il panels orizontal between		
6.5	The minimum clearance earth for the entire bu shall be 25mm. All be conductivity aluminum a	The minimum clearance in air between phases and between phases and earth for the entire busbars. and bus-link connections at circuit-breaker shall be 25mm. All busbars and jumper connections shall be of high conductivity aluminum alloy / copper of adequate size.				
6.6	After isolation of power safely carryout maintena circuit live. Necessary purpose. Wherever tw vertical section insulatin cable compartment to circuit when working on	After isolation of power and control circuit connections it shall be possible to safely carryout maintenance in a compartment with the busbar and adjacent circuit live. Necessary shrouding arrangement shall be provided for this purpose. Wherever two breaker compartments are provided in the same vertical section insulating barriers and shrouds shall be provided in the rear cable compartment to avoid accidental touch with the live parts of one circuit when working on the other circuit				
6.7	All switchgear (circuit-l covers shall be provide by 90 deg or more.	preaker) panels shall be of d with "DANGER" labels. All	single-front ty panel doors sh	pe. The all open		
6.8	All circuit-breaker modules shall be of fully draw out type having distinct 'Service' and 'Test' positions. Suitable arrangement with cradle / rollers, guides along with tool / lever operated racking in / out mechanism shall be provided for smooth and effortless movement of the chassis					
6.9	All switchboards shall be provided with three phase and neutral busbars. Two separate sets of vertical busbars shall be provided in each panel of double front DBs. Interleaving arrangement for busbars shall be adopted for switchboards with a rating of more than 1600A. Entire busbar system shall be insulated with PVC sleeves. Busbar sleeves shall be compliant to UL224 (Extruded insulating tubing), CE/UL certified, having fire retardant					
6.10	ON and OFF position of the operating handle of MCCB shall be displayed and the rotary operating handle shall be mounted on the door of the compartment housing MCCB. The compartment door shall be interlocked mechanically with the MCCB, such that the door cannot be opened unless the MCCB is in OFF position. Means shall be provided for defeating this interlock at any time. MCCB shall be provided with padlocking facility to enable the operating mechanism to be padlocked.					
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6.11	The module identification feeder designation. For identification labels shal	The module identification plate shall clearly give the feeder number and feeder designation. For single front switchboards, similar panel and board identification labels shall be provided at the rear switchgear also.					
6.12	Temperature raise test temperature rise of the including all power dra current along the full run joints and 40 deg C win temperature of 50 de parts/external enclosure not exceed 20deg. C. shall not exceed 10deg Temperature rise for th current.	of LT switchgear of rating more than 400A:- The horizontal and vertical busbars and main bus links aw out contacts when carrying 90% of the rated is shall in no case exceed 55 deg C with silver plated th all other types of joints over an outside ambient eg C. The temperature rise of the accessible es expected to be touched in normal operation shall The temperature rise of manual operating means . C for metallic & 15 deg. C for insulating material. e busbars shall be carried out at 90% of the rated					
6.13	The carriage and breaker frame shall get earthed while being inserted in the panel and positive earthing of the breaker frame shall be maintained in all positions, i.e. SERVICE & ISOLATED, as well as throughout the intermediate travel						
6.14	Electrically controlled of control supply.	circuit breaker boards shall	be provided	with DC			
7.0	CIRCUIT BREAKERS						
7.1	Circuit breakers shall be shall have fault making Parameters". The circu continuous current ratin provision of cooling fan	e three pole, air break, horizo and breaking capacities as uit breakers which meet sp ng and fault making / break s or special device shall not l	ontal draw out ty specified in "T ecified param king capacity o be acceptable.	ype, and echnical leters of nly after			
7.2	Circuit breakers along with its operating mechanism shall be provided with suitable arrangement for easy withdrawal. Suitable guides shall be provided to minimize misalignment of the breaker						
7.3	There shall be "SERVICE", "TEST" and "FULLY WITHDRAWN" positions for the breakers. In "Test" position the circuit breaker shall be capable of being tested for operation without energising the power circuits i.e. the power contacts shall be disconnected, while the control circuits shall remain undisturbed. Locking facilities shall be provided so as to prevent movement of the circuit breaker from the "SERVICE", "TEST" or "FULLLY WITHDRAWN" position. Circuit Breaker rack-in and rack-out from Service to Test, Test to Isolated position, or vice-versa shall be possible only in the compartment door closed condition.						
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7.4	Separate limit switches, provided in both "SEF contacts shall be rated Amp at 240 V AC and 1	es, each having required numbers of contacts shall be ERVICE" and "TEST" position of the breaker. All ed for making, continuously carrying and breaking 10 1 Amp (Inductive) at 240 V DC respectively.				
7.5	Suitable mechanical inc show "OPEN", "CLOSE positions.	dications shall be provided o ", "SERVICE ", "TEST" AND	n all circuit bre ) "SPRING CH	akers to ARGED"		
7.6	Main poles of the circu way that the maximum during closing shall not	it breakers shall operate sir difference between the instar exceed half a cycle of rated f	multaneously in nts of contacts f requency.	such a touching		
7.7	Movement of a circuit shall not be possible un closed circuit breaker sh offered circuit breaker tr it shall be ensured tha drawout contact at the even with the breaker ca	a circuit breaker between "SERVICE" and "TEST" position ossible unless it is in open position. Attempted withdrawal of a breaker shall preferably not trip the circuit breaker. In case the breaker trips on attempted withdrawal as a standard interlock, nsured that sufficient contact exists between the fixed and act at the time of breaker trip so that no arcing takes place breaker carrying its full rated current				
7.8	Closing of a circuit brea position, "TEST" positio	aker shall not be possible un n or in "FULLY WITHDRAWI	lless it is in "SE N" position.	ERVICE"		
7.9	Circuit-breaker cubicles shall be provided with safety shutters operated automatically by the movement of the circuit breaker carriage, to cover the stationary isolated contacts when the breaker is withdrawn. It shall however be possible to open the shutters intentionally against pressure for testing					
7.10	Breaker of particular rat a different rating.	ting shall be prevented from	insertion in a c	ubicle of		
7.11	Circuit breakers shall to devices, as per requirer	be provided with coded key nents.	/ electrical inte	erlocking		
7.12	Circuit breaker shall be feature, even if mechan	e provided with anti-pumpin ical anti-pumping feature is p	g feature and provided.	trip free		
7.13	Mechanical tripping shall be possible by means of front mounted Red "trip" push-button. In case of electrically operated breakers these push buttons shall be shrouded to prevent accidental operation.					
7.14	Complete shrouding / segregation shall be provided between incoming and outgoing bus links of breakers. In case of bus coupler breaker panels the busbar connection to and from the breaker terminals shall be segregated such that each connection can be approached and maintained independently with the other bus section live. Dummy panels if required to achieve the above feature shall be included in the Bidder's scope of supply.					
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7.15	Circuit breaker open/clostatus and all other im monitoring.	ose shall be possible from S portant signal status shall b	SCADA and op e provided for	en/close SCADA	
7.16	Power operated mech suitable for operation o should satisfactorily op nominal control supply o	anism shall be provided won DC Control supply. In caterate with voltage variation voltage. Motor insulation shal	/ith a Universa se of DC supp between 85% t I be class "E" o	al motor ly motor to 110% r better.	
7.17	The motor shall be such charging the closing spr	n that it requires not more tha ing at minimum available cor	an 30 Seconds htrol voltage.	for fully	
7.18	Once the closing sprin circuit breaker, it shall a	igs are discharged, after or utomatically initiate rechargir	ne closing oper ng of the spring.	ration of	
7.19	The mechanism shall be such that as long as power is available to the motor, a continuous sequence of closing and opening operations shall be possible. After failure of power supply at least one open-close-open operation shall be possible.				
7.20	Provision shall be made for emergency manual charging and as soon as this manual charging handle is coupled, the motor shall automatically get mechanically decoupled.				
7.21	All circuit breakers shall be provided with closing and trip coils. The closing coil shall operate correctly at all values of voltage between 85% to 110% nominal control supply voltage. The trip coil shall operate satisfactorily at all values of voltage between 70% to 110% nominal control supply voltage.				
7.22	Provision for mechanical closing of the breaker only in "Test" and "WITHDRAWN" positions shall be made. Alternately, the mechanical closing facility shall be normally made inaccessible; accessibility being rendered only after deliberate removal of shrouds				
7.23	The ACB Panel door shall not be possible to open in breaker closed condition. Further, the racking mechanism shall be accessible only after opening the breaker panel door.				
7.24	Telescopic trolley or suitable arrangement shall be provided for maintenance of circuit-breaker module in a cubicle at each location. The trolley shall be such that the top most breaker module can be withdrawn on the trolley and can be lowered for maintenance purpose. The telescopic trolley shall be such that all type, size and rating of breaker can be withdrawn /inserted of particular switchgear.				
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7.25	Electri	cal Parameter of	Circuit Breaker			
	1)	Туре		Air break stored ene	spring char	ged
	2) Operating duty O-3 MIN-OC-3 MIN-OC					
	3)	Symmetrical in	terrupting	As per sys one sec)	tem fault curre	nt (for
	4)	Short circuit rat	ing	2.1 time current	es of System (peak)	fault
	5)	Short Circuit Br	reaking current	<b>A</b>		
		a) AC Comp	Donent	As per s	ec)	urrent
		b) DC Com	ponent	As per IS:	13947	
	6)	Short time with	stand	As per sys	tem fault currer	nt
8.0	AC JU	NCTION BOXES	(for use with s	tring inverte	ers)	
8.1	Separa connec protec voltage 5%, ar	ate AC Junction ction. Protection tion. All compone e (with + 10% var nbient temperatur	box shall be u class for AC jur nts of junction b riation) of string i re 50 deg. C and	sed for strir nction box s ox shall be s nverter, grid system fau	ng inverters A0 hall be IP 54 o suitable for rate I frequency of 5 It current for 1	C output or better od output 50 Hz +/- sec.
8.2 AC junction box shall be of metal enclosed type. All frames and load bearing members shall be fabricated using suitable mild steel structural sections or pressed and shaped cold-rolled sheet steel of thickness 2.0 mm. Frames shall be enclosed in cold-rolled sheet steel of thickness 1.6 mm. Doors and covers shall also be of cold rolled sheet steel of thickness 1.6 mm. Stiffeners shall be provided wherever necessary. The gland plate thickness shall be 3.0 mm for hot / cold-rolled sheet steel and 4.0 mm for non-magnetic material. The minimum clearance in air between phases and between phases and earth shall be at least twenty five (25) mm throughout. Wherever it is not possible to maintain these clearances, insulation shall be						
8.3	All pov shall b 8309.	wer cable termina be of tinned copp All lugs shall be ir	als shall be of s per solderless cr nsulated/ sleeved	tud type and imping ring 1.	d the power ca type conformir	ible lugs ig to IS:
8.4	EPDM panels	/ Neoprene gas	sket shall be us	ed to preve	ent ingress of o	dust into
8.5	8.5 All non-current carrying metal work of the junction box shall be effectively connected to the system earth bus.					
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CLAUSE NO	TECHNI	CAL SPECIFICATIONS		एनरीपीसी NTPC				
8.6	Finishing paint shade f RAL9002 & RAL5012 fo otherwise by the Emplo microns.	Finishing paint shade for complete panels excluding end covers shall be RAL9002 & RAL5012 for extreme end covers of all boards, unless required otherwise by the Employer. The paint thickness shall not be less than 50 microns.						
9.0	TEMPERATURE-RISE than 400A)	(For LT Switch-gear ha	aving capacit	y more				
	The temperature rise of the horizontal and vertical busbars and main bus links including all power draw out contacts when carrying 90% of the rated current along the full run shall in no case exceed 55 deg C with silver plated joints and 40 deg C with all other types of joints over an outside ambient temperature of 50 deg C. The temperature rise of the accessible parts/external enclosures expected to be touched in normal operation shall not exceed 20deg. C. The temperature rise of manual operating means shall not exceed 10deg. C for metallic & 15 deg. C for insulating material. Temperature rise for the busbars shall be carried out at 90% of the rated current.							
10.0	DERATING OF COMPO	DNENTS						
	current. DERATING OF COMPONENTS The Bidder shall, ensure that the equipment offered will carry the required load current at site ambient conditions specified and perform the operating duties without exceeding the permissible temperature as per Indian Standards / Specification. Continuous current rating at 50 deg C ambient in no case shall be less than 90% of the normal rating specified. The Bidder shall indicate clearly the derating factors if any employed for each component and furnish the basis for arriving at these derating factors duly considering the specified current ratings and amb. temperature of 50 deg C.							
Development at Central CHP/CPP Pip	of 20MW Solar PV Project Coalfields Limited (CCL) arwar, Jharkhand	TECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-9296-004-9	PART-C CHAPTER-C1	Page 16 of 16				

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		СНАРТ	ER-C2: HT SWITCHGE	AR		
1.0	CODE	S AND STANDA	RDS			
	All standards, specification and codes of practices referred to herein shall be the latest editions including all applicable official amendments and revisions as on date of opening of Techno commercial bid. In case of conflict between this specification and those (IS Codes, Standards etc.) referred to herein, the former shall prevail. All work shall be carried out as per the following standards and codes.					
	SI	IS Code	Name Of Equipment			
	a)	IS: 722	AC electricity meters.			
	b)	IS: 996	Single phase small AC and u motors.	iniversal electrica	al	
	C)	IS: 1248	Direct Acting indicating analo	gue electrical		
	-1)		measuring instruments and Accessories.			
	(a)	IS/IEC: 60947	Degree of protection provided by enclosures for low voltage switchgear and control gear			
	e)	IS: 2544	Porcelain post insulators for systems with nominal voltages greater than 1000 Volts			
	f)	IS: 2705	Current transformers.			
	g)	IS: 3156	Voltage Transformers			
	h)	IS: 6005	Code of practice for phospha steel.	iting of iron and		
	i)	IS: 5082	Specification for wrought alu aluminium alloy bars, rods, tu for electrical purposes.	minium and ubes and selection	ons	
	i)	IEC: 61850	Communication Standard for	Numerical relay	s	
	k)	IEC: 61131-3	Automation Standard for Nur	nerical relays		
	l)	IS: 9046	AC contactors for voltages a upto and including 11000 Vo	bove 1000 volts a Its.	and	
	m)	IS: 13703	Low voltage fuses			
	n)	IS: 9385	HV fuses			
	0)	IS: 9431	Specification for indoor post material for system with non than 1000 volts upto and incl	insulators of orga ninal voltages gre uding 300 kV	anic eater	
	p)	IS: 9921	A.C. disconnectors (isolators switches for voltages above	) and Earthing 1000 V		
	(q)	IS: 11353	Guide for uniform system of marking and identification of conductors and apparatus terminals			
	r)	IS: 13118	3: 13118 Specification for high voltage AC circuit breakers.			
	s)	IEC: 60099-4	Metal oxide surge arrestor without gap for AC system			
	t)	IS/IEC: 62271-	High voltage alternating curre	<del>ent circuit brea</del> ke	rs.	
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CLAUSE NO						एलरीपीमी NTPC
	u) V) W)	100 IS/IEC: 62271- 200 IEC: 60947-7-1 IS :513 (2008)	High voltage met control gear. Terminal blocks f Cold Rolled Low	al enclose or copper Carbon S	d switchgear and conductors teel Sheets and S	trips
2.0	TECH	NICAL PARAME	TERS			
	A. S	SYSTEM PARAME	ETERS			
	a)	Nominal System	voltage		33kV	
	b)	Highest System	voltage		36kV	
	C)	Rated Frequenc	у		50Hz	
	d)	Number of phase	es/ poles		Three	
	e)	System neutral e	earthing		Solidly Earthed	1
	f)	One minute pow voltage	er frequency with	nstand		
		- for Type tests	70kV			
		- for Routine test	ts		70kV	
	g)	1.2/50 microsect voltage	ond Impulse with	stand	170kV (peak)	
	h)	Minimum system	n fault level		As per SLD	
	i)	Short time rating breakers, curren switchgear asse	for bus bars, circ t transformers an mbly.	cuit Id	As per SLD for (1) sec.	one
	j)	Dynamic withstand rating2.5 times of system fault current				
	k)	- Space heaters 240 V AC single phase with neutra solidly earthed				e itral
	I)	Maximum ambient air 50 deg. C				
	m)	Internal Arc testing As Specified in chapter-A2				
	B. E	BUS BARS				
	a)	Continuous curre 50 <sup>0</sup> C ambient:	ent rating at	As Per I	Requirement	
			_			

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		Temper Rise allowed above	10	$^{0}$ C for plain joints 55 <sup>0</sup> C for	or.
	b)	ambient	Si	Iver plated joints	
	C. SWGR. CUBICLE CONSTRUCTIONAL REQUIREMENTS				
	a)	Colour finish			
		Exterior		RAL9002 (Main body) RAL 5012 (Extreme en covers)	d
	b)	Cable entry			
		Power Cables		Bottom	
		Control Cables		Bottom	
	c)	Earthing conductor		Galvanized steel strip	
	d)	Service Continuity of swgrs ( PM)	(LSC2B-	as per IS/IEC 62271- 200	
	D.	CIRCUIT BREAKERS			
	a)	a) The circuit breakers current rating shall be selected from the load current at an ambient of 50 deg. C.			
		Short circuit breaker Current			
	b)	a) A.C. component	A a	As per system fault currer as shown in tender SLD	nt
		b) D.C. component	A G	As per IS: 13118 or IEC- 52271	
	c)	Short Circuit making current	2	2.5 times of system fault current (peak)	
	d)	Operating Duty	(	D-3 min-CO-3 min-CO	
	e)	Total break time	1	Not more than 4 cycles	
	f)	Total make time	1	Not more than 5 cycles	
	g)	Operating Mechanism	N c t	Notor wound spring charged stored energy ype as per IEC-62271	
	E.	CURRENT TRANSFORME	R		
	a)	Secondary Current	1A		
	b)	Class of Insulation	Class E	or better	

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CLAUSE NO		TECHNICAL SF	PECIF		ोपीमी 'PC
	c)	Rated output of each		Adequate for the relays and devices connected, but not less than five (5) VA.	
	d)	Accuracy class			
		Protection		5P20	
		Measurement		0.5 class / as per tender SLD	
	e)	Instrument Security Fac for Measurement CTs	ctor	5	
	f)	CT Ratio		CT ratio shall be finalized during details engineering stage. Minimum CT primary side current shall be 110% of rated current.	
	F.	VOLTAGE TRANSFO	RME	RS	
	a)	Rated Voltage Factor	1.2 8 H	continuous for all VTs, and 1.9 for ours for star connected VTs.	
	b)	Class of insulation	Cla	ss E or better	
	c)	0.5 Class. VA requirement shall be application requirement.Other parametersSuitable damping resistor and additional open delta core with load resistor shall be provided in all VT's prevent damage on account of Ferr Resonance conditions		Class. VA requirement shall be lication requirement. able damping resistor and itional open delta core with loading stor shall be provided in all VT's to vent damage on account of Ferro- onance conditions	
	G. [				
	a)	Accuracy Class		0.5 or better	
	b)	Digital MFM shall be provided for VCB panels as shown in SLD.			
3.0	SWIT	CHGEAR PANEL			
3.1	The switchgear boards shall have a single front, single tier, fully compartmentalized, metal enclosed construction complying with clause No. 3.102 of IEC 62271-200, comprising of a row of free standing floor mounted panels. Each circuit shall have a separate vertical panel with distinct compartments for circuit breaker truck, cable termination, main busbars and auxiliary control devices. The adjacent panels shall be completely separated by steel / Aluzinc sheets except in bus bar compartments where insulated				

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<ul> <li>barriers shall be provided to segregate adjacent panels. The Service Class Continuity of Switchgears shall be LSC 2B-PM (as per IS/ IEC 622771-200). However, manufacturer's standard switchgear designs without inter panel barriers in busbar compartment may also be considered.</li> <li>3.2 The circuit breakers and bus VTs shall be mounted on withdrawable trucks which shall roll out horizontally from service position to isolated position. For complete withdrawal from the panel, the truck shall rollout on the elscopic rails. In case the later arrangement is offered, suitable trolley shall be provided by the Bidder for withdrawal and insertion of the truck from and into the panel. Testing of the breaker shall be possible in isolated position by keeping the control plug connected.</li> <li>3.3 The trucks shall have distinct SERVICE and ISOLATED positions. It shall be possible to close the breaker compartment door in isolated position also, so that the switchgear retains its specified degree of protection. Circuit Breaker rack-in and rack-out from Service to Test, Test to Isolated position will be preferred, standard designs of reputed switchgear manufacturers where the truck front serves as the compartment door closed condition While switchboard designs of reputed switchgear of protection in the Isolated position. In case the latter arrangement is offered, the Bidder shall explain how this sealing is achieved and shall include blanking covers one for each size of panel per switchboard in his total Techno commercial bid price.</li> <li>3.4 The switchgear assembly shall be dust, moisture, rodent and vermin proof, with the truck in any position SERVICE, ISOLATED or removed, and all doors and covers closed. All doors, removable covers and glass windows shall have gaskets all round with synthetic rubber or neoprene gaskets.</li> <li>3.5 The control / relay compartments shall have degree of protection not less then IP 5X in accordance with IS/IEC 60947. However, remaining compartments can have a degree of protecti</li></ul>	CLAUSE NO	TECHNICAL SPECIFICATIONS
<ul> <li>3.2 The circuit breakers and bus VTs shall be mounted on withdrawable trucks which shall roll out horizontally from service position to isolated position. For complete withdrawal from the panel, the truck shall rollout on the floor or shall roll out on telescopic rails. In case the later arrangement is offered, suitable trolley shall be provided by the Bidder for withdrawal and insertion of the truck from and into the panel. Testing of the breaker shall be possible in isolated position by keeping the control plug connected.</li> <li>3.3 The trucks shall have distinct SERVICE and ISOLATED positions. It shall be possible to close the breaker compartment door in isolated position, or vice-versa shall be possible only in the compartment door closed condition. While switchboard designs with doors for breaker compartments would be preferred, standard designs of reputed switchgear manufacturers where the truck front serves as the compartment cover may also be considered provided the breaker compartment cover may also be considered provided the breaker compartment is offered, the Bidder shall explain how this sealing is achieved and shall include blanking covers one for each size of panel per switchboard in his total Techno commercial bid price.</li> <li>3.4 The switchgear assembly shall be dust, moisture, rodent and vermin proof, with the truck in any position SERVICE, ISOLATED or removed, and all doors and covers closed. All doors, removable covers and glass windows shall have gaskets all round with synthetic rubber or neoprene gaskets.</li> <li>3.5 The control / relay compartments shall have degree of protection not less them IP 5X in accordance with IS/IEC 60947. However, remaining compartments can have a degree of protection of IP 4X. All louvers, if provided, shall have very fine brass or Gl mesh screen. Tight fitting gourmet / gaskets are to be provided at all openings in relay compartment. Numerical Relays shall be fully Flush mounted on the switchgear panels at a suitable height.</li> <li>3.6 The Swit</li></ul>		barriers shall be provided to segregate adjacent panels. The Service Class Continuity of Switchgears shall be LSC 2B-PM (as per IS/ IEC 622771-200). However, manufacturer's standard switchgear designs without inter panel barriers in busbar compartment may also be considered.
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	reduce the degree of protection of panels under normal working conditions. To demonstrate that the pressure relief device operates satisfactorily the Contractor shall submit a type test report in line with IEC 62271-200 Annex – A for each high voltage chamber. Wherever louvers are provided, the construction of louvers should be such that the IAC requirements are satisfied. Further, viewing glass windows shall have the same strength as the enclosure against Internal Arc.
3.7	Enclosure shall be constructed with rolled steel / Aluzinc sections. The doors and covers shall be constructed from cold rolled steel sheets of 2.0 mm or higher thickness. Gland plates shall be 2.5 mm thick made out of hot rolled or cold rolled steel sheets and for non-magnetic material it shall be 3.0 mm.
3.8	The switchgear shall be cooled by natural air flow.
3.9	Total height of the switchgear panels shall not exceed 2600mm. The height of switches, pushbuttons and other hand operated devices shall not exceed 1800mm and shall not be less than 700mm.
3.10	Necessary guide channels shall be provided in the breaker compartments for proper alignment of plug and socket contacts when truck is being moved to SERVICE position. A crank or lever arrangement shall preferably be provided for smooth and positive movement of truck between Service and Isolated positions.
3.11	Safety shutters complying with IEC 62271-200 shall be provided to cover up the fixed high voltage contacts on busbar and cable sides when the truck is moved to ISOLATED position. The shutters shall move automatically, through a linkage with the movement of the truck. Preferably it shall however, be possible to open the shutters of busbar side and cable side individually against spring pressure for testing purpose after defeating the interlock with truck movement deliberately. In case, insulating shutters are provided, these shall meet the requirements of IEC 62271-200 and necessary tests as per IEC 62271-200 Clause 5.103.3.3 shall be carried out. A clearly visible warning label "Isolate elsewhere before earthing" shall be provided on the shutters of incoming and tie connections which could be energized from other end.
3.12	Switchgear construction shall have a bushing or other sealing arrangement between the circuit breaker compartment and the busbar / cable compartments, so that there is no air communication around the isolating contacts in the shutter area with the truck in service position.
3.13	The breaker and the auxiliary compartments provided on the front side shall have strong hinged doors. Busbar and cabling compartments provided on the rear side shall have separate bolted covers with self retaining bolts for easy maintenance and safety. Breaker compartment doors shall be provided with single-shot latch type handle and shall have locking facility. Suitable interlock shall be provided, which will ensure that breaker is OFF before

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	opening the back doors. Suitable interlock shall be provided to prevent opening of any compartment doors which has any of the MV equipment, in case the supply is ON.
3.14	In the Service position, the truck shall be so secured that it is not displaced by short circuit forces. Busbars, jumpers and other components of the switchgear shall also be properly supported to withstand all possible short circuit forces corresponding to the short circuit rating specified.
3.15	Suitable base frames made out of steel channels shall be supplied along with necessary anchor bolts and other hardware, for mounting of the switchgear panels. These shall be dispatched in advance so that they may be installed and leveled when the flooring is being done, welding of base frame to the insert plates as per approved installation drawings shall be in Bidder's scope.
3.16	Alternatively, Outdoor HT switchgear can be offered. The outdoor switchgear shall have minimum IP 55 or better protection. The bidder shall submit the relevant details of the switchgear including the datasheets, drawings and applicable type test reports during the detailed engineering for Employers approval. Internal Arc requirement shall be same as indoor type switchgear.
4.0	
4.1	The circuit breakers shall be of Vacuum type.
4.2	They shall comprise of three separate, identical single pole interrupting units, operated through a common shaft by a sturdy operating mechanism.
4.3	Circuit breaker shall be restrike free, stored energy operated and trip free type. Motor wound closing spring charging shall only be acceptable. An anti- pumping relay shall be provided for each breaker, even if it has built-in mechanical anti-pumping features. An arrangement of two breakers in parallel to meet a specified current rating shall not be acceptable.
4.4	During closing, main poles shall not rebound objectionably and mechanism shall not require adjustments. Necessary dampers shall be provided to withstand the impact at the end of opening stroke.
4.5	Plug and socket isolating Contacts for main power circuit shall be silver plated, of self-aligning type, of robust design and capable of withstanding the specified short circuit currents. They shall preferably be shrouded with an insulating material. Plug and socket contacts for auxiliary circuits shall also be silver plated, sturdy and of self-aligning type having a high degree of reliability. Thickness of silver plating shall not be less than 10 microns.
4.6	All working part of the mechanism shall be of corrosion resisting material. Bearings which require greasing shall be equipped with pressure type grease fittings. Bearing pins, bolts, nuts and other parts shall be adequately secured and locked to prevent loosening or change in adjustment due to repeated operation of the breaker and the mechanism.
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4.7	The operating mechanism shall be such that failure of any auxiliary spring shall not prevent tripping and shall not lead to closing or tripping of circuit breaker. Failure of any auxiliary spring shall also not cause damage to the circuit breaker or endanger the operator.
4.8	Mechanical indicators shall be provided on the breaker trucks to indicate OPEN / CLOSED conditions of the circuit breaker, and CHARGED / DISCHARGED conditions of the closing spring. An operation counter shall also be provided. These shall be visible without opening the breaker compartment door.
4.9	The rated control supply voltage shall be as mentioned elsewhere under Technical parameters. The closing coil and spring charging motor shall operate satisfactorily at all values of control supply voltage between 85% to 110% rated DC voltage. The shunt trip coil shall operate satisfactorily under all operating conditions of the circuit breaker upto its rated short circuit breaking current at all values of control supply voltage between 70% to 110% of rated DC voltage. The trip coil shall be so designed that it does not get energized when its healthiness is monitored by two indicating lamps (Red) and one trip coil supervision relay.
4.10	The time taken for charging of closing spring shall not exceed 30 seconds. The spring charging shall take place automatically preferably after a closing operation. Breaker operation shall be independent of the spring charging motor which shall only charge the closing spring. Opening spring shall get charged automatically during closing operation. As long as power supply is available to the charging motor a continuous sequence of closing and opening operations shall be possible. One open-close- open operation of the circuit breaker shall be possible after failure of power supply to the motor. Spring charging motors shall be capable of starting and charging the closing spring twice in quick succession without exceeding acceptable winding temperature when the control supply voltage is anywhere between 85% to 110% rated DC voltage. The initial temperature shall be as prevalent in the switchgear panel during full load operation with 50 deg. C ambient air temperature. The motor shall be provided with short circuit protection.
4.11	Motor windings shall be provided with class E insulation or better. The insulation shall be given tropical and fungicidal treatment for successful operation of the motor in a hot, humid and tropical climate.
4.12	Circuit breaker shall be provided with inter pole barriers of insulating materials. The use of inflammable materials like Hylam shall not be acceptable.
5.0	CONTROLS AND INTERLOCKS
5.1	Rotary type Control switches shall be provided in each switchgear panel. The circuit breaker will normally be controlled from remote control panels through

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	closing and shunt trip coils. The control switch and local control console of the relay flush mounted on the switchgear would normally be used only for testing of circuit breaker in isolated position, and for tripping it in an emergency. The closing and opening of the breaker shall also be possible from the Laptop through front serial port of the relay to facilitate commissioning activities.
5.2	The basic control scheme shall be developed in the numerical relay using programmable (soft) logics.
5.3	Facilities shall be provided for mechanical tripping of the breaker and for manual charging of the stored energy mechanism for a complete duty cycle, in an emergency.
5.4	Each panel shall have two separate limit switches, one for the Service position and the other for isolated position.
5.5	Auxiliary Contacts of breaker may be mounted in the fixed portion or in the withdrawable truck as per the standard practice of the manufacturer, and shall be directly operated by the breaker operating mechanism.
5.6	Auxiliary contacts mounted in the fixed portion shall not be operable by the operating mechanism, once the truck is withdrawn from the service position, but remain in the position corresponding to breaker open position. Auxiliary contacts mounted on the truck portion, and dedicated for Employer's use shall be wired out in series with a contact denoting breaker service position. With truck withdrawn, the auxiliary contacts shall be operable by hand for testing. There shall be at least 2 NO and 2 NC breaker/contactor original Auxiliary contacts made available for the of the Employer's use.
5.7	The contacts of all limit switches and all breaker auxiliary contacts located on truck portion and fixed portion shall be silver plated, rated to make, carry and break 1.0A 240V DC (Inductive) / 10A 240V AC. Contacts of control plug and socket shall be capable of carrying the above current continuously.
5.8	Movement of truck between SERVICE and ISOLATED positions shall be mechanically prevented when the breaker is closed. An attempt to withdraw a closed breaker shall not trip it.
5.9	Closing of the breaker shall be possible only when truck is either in ISOLATED or in SERVICE position and shall not be possible when truck is in between. Further, closing shall be possible only when the auxiliary circuits to breaker truck have been connected up, and closing spring is fully charged.
5.10	It shall be possible to easily insert breaker of one typical rating into any one of the panels meant for same rating but at the same time shall be prevented from inserting it into panels meant for a different type or rating.
5.11	Indications shall be provided in the relay console flush mounted on the panel front as brought out in the specification elsewhere. It shall be possible to

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	easily make out whether the truck in SERVICE OR ISOLATED POSITION even when the compartment door is closed.
5.12	Reverse blocking and Inter tripping shall be implemented in switchgear boards level. Detailed scheme for the same shall be finalized during detailed engineering stage.
6.0	NUMERICAL RELAYS AND NETWORKING
6.1	Circuit breaker feeders (with protection function as shown in SLD) shall be provided with communicable numerical relays (IED, i.e. Intelligent Electronic Device) complying with IEC-61850, having protection, control, and monitoring features. These relays shall be networked and suitably interfaced with the Solar SCADA system for dynamic SLD display, status monitoring, measurements, event / alarm displays, reports, etc. The relays shall be flush mounted on panel front with connections from the inside. These numerical relays shall be of types as proven for the application and shall be subject to Employer's approval. Numerical relays shall have appropriate setting ranges, accuracy, resetting ratio and other characteristics to provide required sensitivity.
6.2	The numerical relay shall be capable of measuring and storing values of a wide range of quantities, events, faults and disturbance recordings. The alarm / status of each of protection function and trip operation shall be communicated to Solar SCADA. The numerical relays shall have built in feature / hardware interface to provide such inputs to Solar SCADA / for analog / digital values.
6.3	All relays shall be rated for control supply voltage as mentioned elsewhere under parameters and shall be capable of satisfactory continuous operation between 80-120% of the rated voltage. Making, carrying and breaking current ratings of their contacts shall be adequate for the circuits in which they are used. Contacts for breaker close and trip commands shall be so rated as to be used directly used in the closing and tripping circuits of breaker without the need of any interposing / master trip relays. Threshold voltage for binary inputs shall be suitably selected to ensure avoidance of mal operation due to stray voltages and typically shall be more than 70% of the rated control supply voltage.
6.4	One minute power frequency withstand test voltage for all numerical relays shall at least be 2kV (rms).
6.5	Failure of a control supply and de-energization of a relay shall not initiate any circuit breaker operation.
6.6	Disturbance Record waveforms, event records & alarms shall be stored in Non-volatile memory and failure of control supply shall not result in deletion of any of these data.

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6.7	All numerical relays shall have freely programmable optically isolated binary inputs (BI) and potential free binary output (BO) contacts as per the requirement of control schematics. The quantities of such input / outputs shall be finalized during detailed engineering.
6.8	All the numerical relays shall have communications on two ports, local front port communication to laptop and rear port on IEC 61850 to communicate with the interface equipment for connectivity with the Solar SCADA. Laptop provided with SCADA shall be used to facilitate numerical relay configuration, DR and event/fault records downloading from relay locally. Latest version of hardware and Software for interfacing the numerical relays with laptop shall be provided. At least two sets of communication cable for Laptop to relay communication shall be provided.
6.9	All the numerical relays shall have adequate processor memory for implementing the programmable scheme logic required for the realization of the protection / control schemes, in addition to the built in protection algorithms. Numerical relays shall have inrush detection feature for blocking of user selectable protection functions.
6.10	Numerical relays shall have feature of current measurement. Relay shall be able to provide the same in soft to solar SCADA system.
6.11	Relays shall have event recording feature, recording of abnormalities and operating parameters with time stamping.
6.12	Master trip (86) and non-86 trips shall be software configurable to output contacts and no separate master trip relay shall be used.
6.13	Numerical relays used at main pooling switchgear shall have provision of both current and voltage inputs. Number of CT inputs for numerical relays at all switchgear panels shall be as per actual protections requirement but not less than 4 sets, 3 nos. for phase fault & 1 no. for earth fault. Relays shall be suitable for CT secondary current of 1A. All 33kV feeders shall be provided with non-directional EF and OC protection. Numerical relays used at main pooling switchgear shall have voltage protection and measurement feature.
6.14	Relay setting shall be based on time grading principle with minimum 100mSec shall be the grading margin. Least time setting at inverter transformer feeder and shall be increased towards the evacuation point (towards grid). Relay time setting shall be minimum 100 ms. However, relay current and time setting including time grading margin shall be as per Bidder offered system (with minimum as per above) considering smooth plant operation and proper protection integration/coordination with grid. Bidder can use same relay time setting for tie feeder panels between two switchgears. Relay setting of solar plant feeders shall be done in coordination with grid supply feeder relay setting. Any special/other protections, control interlocks etc as per requirement shall be provided by the Bidder. Details shall be finalized during detailed engineering stage.

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6.15	For relay setting calculation grid side shall be taken upstream and inverter side shall be taken downstream. For any switchgear outgoing feeder shall be towards grid and incoming feeders shall be towards inverter to be considered.
6.16	All CT & VT terminals on the relays shall be of fixed type suitable for connection of ring-type lugs to avoid any hazard due to loose connection leading to CT open-circuit. In no circumstances Plug In type connectors shall be used for CT / VT connections.
6.17	All numerical relay shall have key pad / keys to allow relay settings from relay front. All hand reset relays shall have reset button on the relay front. Relay to be self or hand reset shall be software selectable. Manual resetting shall be possible from remote.
6.18	Relays shall have self-diagnostic feature with self-check for power failure, programmable routines, memory and main CPU failures and a separate output contact for indication of any failure.
6.19	Relays shall have at least two sets or groups of two different sets of adaptable settings. Relays shall have multiple IEC / ANSI programmable characteristics.
6.20	Design of the relay must be immune to any kind of electromagnetic interference. Vendor shall submit all related type test reports for the offered model along with the offer.
6.21	All cards / hardware of numerical relays shall be suitable for operation in Harsh Environmental conditions with respect to high temperature, humidity & dust.
6.22	Relay shall be immune to capacitance effect due to long length of connected control cables. Any external hardware, if required for avoiding mal operation of the relay due to cable capacitance shall be included as a standard feature.
6.23	All I/Os shall have galvanic isolation. Analog inputs shall be protected against switching surges, harmonics etc.
6.24	Numerical relays shall have two level password protections, one for read only and other for authorization for modifying the setting etc.
6.25	Numerical relays shall have feature for Time synchronization through the SCADA System / networking. The resolution of time synchronization shall be +/- 1.0 millisecond or better throughout the entire system.
6.26	Relays shall be suitable to accept DC supplies with range of 70 % to 120 % of rated voltage.
6.27	Disturbance Record waveforms, event records & alarms shall be stored in Non-volatile memory and failure of control supply shall not result in deletion of any of these data.
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6.28	Bidder to depute relay OEM protection engineer at NTPC EOC office for finalization of relay setting and configuration during detail engineering stage. All numerical protection relay configuration and setting shall be done as per approved setting and configuration at switchgear manufacturer work by relay OEM or his authorized representative. All numerical relay testing and logic/interlock checking during commissioning stage at site shall be done under the supervision of Relay OEM or his authorized representative.
7.0	OTHER PROTECTIONS AND CONTROL FUNCTIONS IN THE RELAYS
7.1	Trip circuit supervision shall be provided for all feeders to monitor the circuit breaker trip circuit both in pre-trip and post trip conditions.
7.2	Schematics requiring auxiliary relays / timers for protection function shall be a part of numerical relay. The number of auxiliary relay and timer function for protection function shall be as required. Timer functions shall be programmable for on/off delays.
7.3	The numerical relay shall be able to provide supervisory functions such as trip circuit monitoring, circuit breaker state monitoring, PT and CT supervisions and recording facilities with Post fault analysis.
7.4	The numerical processor shall be capable of measuring and storing values of a wide range of quantities, all events, faults and disturbance recordings with a time stamping using the internal real time clock. Battery backup for real time clock in the event of power supply failure shall be provided.
7.5	At least 200 time tagged events / records shall be stored with time stamping. Details of at least 5 previous faults including the type of protection operated, operating time, all currents & voltages and time of fault.
7.6	Diagnostics Automatic testing, power on diagnostics with continuous monitoring to ensure high degree of reliability shall be provided. The results of the self-reset functions shall be stored in battery back memory. Test features such as examination of input quantities, status of digital inputs and relay outputs shall be shall be available on the user interface.
7.7	The alarm/status of each individual protection function and trip operation shall be communicated to solar SCADA.
7.8	Sequence of events shall have 1 ms resolution at device level.
7.9	Measurement accuracy shall be 1 % for RMS Current and voltage.
8.0	BUSBARS AND INSULATORS
8.1	All Busbar and jumper connections shall be of high conductivity aluminium alloy. They shall be adequately supported on insulators to withstand electrical and mechanical stresses due to specified short circuit currents.

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8.2	Busbar cross-section shall be uniform throughout the length of switchgear. Busbars and other high voltage connection shall be sufficiently corona free at maximum working voltage.
8.3	Contact surfaces at all joints shall be silver plated or properly cleaned and non-oxide grease applied to ensure an efficient and trouble free connection. All bolted joints shall have necessary plain and spring washers. All connection hardware shall have high corrosion resistance. Bimetallic connectors or any other technically proven method shall be used for aluminum to copper connections.
8.4	Busbar insulators shall be of arc and track resistant, high strength, non- hygroscopic, non-combustible type and shall be suitable to withstand stresses due to over-voltages, and short circuit current. Busbar shall be supported on the insulators such that the conductor expansion and contraction are allowed without straining the insulators. In case of organic insulator partial discharge shall be limited to 100pico coulomb at rated
	voltage x 1.1 / $\sqrt{3}$ . Use of insulators and barriers of in-flammable material such as Hylam shall not be accepted.
8.5	Successful Bidder shall furnish calculation establishing adequacy of busbar sizes for the specified continuous and short time current ratings.
8.6	All busbars shall be color coded.
8.7	The temperature of the busbar and all other equipment, when carrying the rated current continuously shall be limited as per the stipulations of relevant Indian Standards, duly considering the specified ambient temperature (50 deg. C). The temperature rise of the horizontal and vertical busbars when carrying the rated current shall in no case exceed 55 deg. C for silver plated joints and 40 deg. C for all other type of joints. The temperature rise at the switchgear terminals intended for external cable termination shall not exceed 40 deg. C. Further the switchgear parts handled by the operator shall not exceed a rise of 5 deg. C .The temperature rise of the accessible parts / external enclosure expected to be touched in normal operation shall not exceed 20 deg.C.
9.0	EARTHING AND EARTHING DEVICES
9.1	A copper / galvanized steel earthing bus shall be provided at the bottom and shall extend throughout the length of each switch board. It shall be bolted/ welded to the framework of each panel and each breaker earthing contact bar.
9.2	A copper / galvanized steel earthing bus shall be provided at the bottom and shall extend throughout the length of each switch board. It shall be bolted/ welded to the framework of each panel and each breaker earthing contact bar.

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9.3	The earth bus shall have sufficient cross section to carry the momentary short-circuit and short time fault currents to earth as indicated under switchgear parameters without exceeding the allowable temperature rise.
9.4	Suitable arrangement shall be provided at each end of the earth bus for bolting to Employer's earthing conductors. All joint splices to the earth bus shall be made through at least two bolts and taps by proper lug and bolt connection.
9.5	All non-current carrying metal work of the switchboard shall be effectively bonded to the earth bus. Electrical continuity of the whole switchgear enclosure frame work and the truck shall be maintained even after painting.
9.6	The truck and breaker frame shall get earthed while the truck is being inserted in the panel and positive earthing of the truck and breaker frame shall be maintained in all positions i.e. SERVICE and ISOLATED as well as throughout the intermediate travel. The truck shall also get and remain earthed when the control plug is connected irrespective of its position.
9.7	All metallic cases of relays, instruments and other panel mounted equipment shall be connected to earth by independent stranded copper wires of size not less than 2.5 sq. mm. Insulation colour code of earthing wires shall be green. Earthing wires shall be connected to terminals with suitable clamp connectors and soldering shall not be acceptable. Looping of earth connections which would result in loss of earth connection to other devices, when a device is removed is not acceptable. However, looping of earth connections between equipment to provide alternative paths of earth bus is acceptable.
9.8	VT and CT secondary neutral point earthing shall be at one place only on the terminal block. Such earthing shall be made through links so that earthing of one secondary circuit may be removed without disturbing the earthing of other circuits.
9.9	Separate earthing trucks shall be provided by the Contractor for maintenance work. These trucks shall be suitable for earthing the switchgear busbars as well as outgoing / incoming cables or busducts. The trucks shall have a interlock to prevent earthing of any live connection.
9.10	As an alternative to separate earthing trucks the Bidder may also offer built- in earthing facilities for the busbars and outgoing / incoming connections, in case such facilities are available in their standard proven switchgear design. The inbuilt earthing switches shall have provision for short circuiting and earthing a circuit intended to be earthed. These switches shall be quick make type, independent of the action of the operator and shall be operable from the front of the switchgear panel. These switches shall have facility for padlocking in the earthed condition.
9.11	Interlocks shall be provided to prevent :

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	<ul> <li>Closing of the earthing switch if the associated circuit breaker truck is in Service position.</li> </ul>						
	<ul> <li>Insertion of the breaker truck to Service position if earthing switch is in closed position.</li> </ul>						
	c) Closing of the earth switch on a live connection.						
	<ul> <li>d) Energizing an earthed Section: Complete details of arrangement offered shall be provided during detailed engineering, describing the safety features and interlocks.</li> </ul>						
9.12	The earthing device (truck / switch) shall have the short circuit withstand capability equal to that of associated switchgear panel.						
	All hinged doors shall be earthed through flexible earthing braid						
10.0	PAINTING						
	All sheet steel work shall be pretreated, in tanks, in accordance with IS: 6005. Degreasing shall be done by alkaline cleaning. Rust and scales shall be removed by pickling with acid. After pickling, the parts shall be washed in running water. Then these shall be rinsed in slightly alkaline hot water and dried. The phosphate coating shall be "Class-C" as specified in IS: 6005. The phosphated surfaces shall be rinsed and passivated. After passivation, Electrostatic Powder Coating shall be used. Powder should meet requirements of IS 13871 (Powder costing specification). Finishing paint shade for complete panels excluding end covers shall be RAL9002 & RAL5012 for extreme end covers of all boards, unless required otherwise by the Employer. The paint thickness shall not be less than 50 microns. Finished parts shall be suitably packed and wrapped with protective covering to protect the finished surfaces from scratches, grease, dirt and oil spots during testing, transportation, handling and erection.						
11.0	INSTRUMENT TRANSFORMERS						
11.1	All current and voltage transformers shall be completely encapsulated cast resin insulated type, suitable for continuous operation at the ambient temperature prevailing inside the switchgear enclosure, when the switchboard is operating at its rated load and the outside ambient temperature is 50 deg. C. The class of insulation shall be E or better.						
11.2	All instrument transformers shall withstand the power frequency and impulse test voltage specified for the switchgear assembly. The current transformer shall further have the dynamic and short time ratings at least equal to those specified for the associated switchgear and shall safely withstand the thermal and mechanical stress produced by maximum fault currents specified when mounted inside the switchgear for circuit breaker modules.						
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11.3	The parameters of instrument transformers specified in this specification are tentative and shall be finalized by the Employer in due course duly considering the actual burden of various relays and other devices finally selected. In case the Bidder finds that the specified ratings are not adequate for the relays and other devices offered by him, he shall offer instrument transformer of adequate ratings and shall bring out this fact clearly in his Techno commercial bid.
11.4	All instrument transformers shall have clear indelible polarity markings. All secondary terminals shall be wired to separate terminals on an accessible terminal block.
11.5	Current transformers may be multi or single core and shall be located in the cable termination compartment. All voltage transformers shall be single phase type.
11.6	All voltage transformers shall have suitable current limiting fuses on both primary and secondary sides. Primary fuses shall be mounted on the withdrawable portion. Replacement of the primary fuses shall be possible with VT truck in isolated position. The secondary fuses shall be mounted on the fixed portion and the fuse replacement shall be possible without drawing out the VT truck from service position.
11.7	All voltage transformers shall be designed and manufactured for 0.8 Tesla operating point on B-H curve. VT shall be fully insulated type (i.e. double pole construction and neutral side fully insulated to rated BIL). VT shall be manufactured without any joint in secondary winding.
12.0	SURGE ARRESTOR
	The surge arrestors shall be provided as per tender SLD/ as per system requirement and shall be of metal oxide, gapless type generally in accordance with IEC 60099-4 and suitable for indoor duty. These shall be mounted within the switchgear cubicle between line and earth, preferably in the cable compartment. Surge arrestor selected shall be suitable for offered system and rating shall be in such a way that the value of steep fronted switching over voltage generated at the switchgear terminals shall be limited to the requirements of switchgear.
13.0	CONTROL SUPPLY AND SPACE HEATER SUPPLY
13.1	Each switchboard shall be provided at least two (02) Nos of control supply feeders.
13.2	In case two DC sources are provided, then suitable rated blocking diodes in both circuit has to be provided. Alternately Bidder can provide source selection switch.

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13.3	One suitable rated 240V single phase AC supply feeder per switchboard / Switchboard section for space heater supply. Bidder shall provide necessary switch and fuse to receive, isolate and distribute to each panel.							
13.4	Each sub circuit shall have separate fuses. Fuse size shall be determined so as to achieve selective clearance between main circuit and sub circuit in case of fault. Potential circuits for protection and metering shall also be protected by separate fuse.							
13.5	All fuses shall be of link type conforming to IS: 13703 / 9385 mounted on suitable fuse bases. Fuses shall have operation indicators for indicating blown fuse condition. Fuse carrier base shall have imprints of the fuse rating and voltage. All accessible live connection to fuse bases shall be adequately shrouded.							
13.6	All DC circuits shall be fused on both poles. Single phase AC circuits shall have fuses on line and link on neutral.							
13.7	DC and AC supply monitoring relay shall be provided and alarm shall be generated in SCADA system in case of failure of supply.							
14.0	SPACE HEATER							
14.1	Each switchgear panel shall be equipped with thermostatically controlled space heater(s), suitably located in breaker and cable compartments to prevent condensation within the enclosure. The space heater shall be connected to 240V single phase AC auxiliary supply available in the switchgear, through switches and fuses provided separately for each panel.							
14.2	A 240V single phase 50 Hz AC plug point shall be provided in the interior of each cubicle with ON-OFF switch for connection of hand lamp.							
15.0	TERMINAL BLOCKS							
15.1	Terminal blocks shall be 650V grade, 10Amps rated, made up of unbreakable polyamide 6.6 grade. The terminals shall be screw type or screw-less (spring loaded) / cage clamp type with lugs. Marking on terminal strips shall correspond to the terminal numbering in wiring diagrams. All metal parts shall be of non-ferrous material. In case of screw type terminals the screw shall be captive, preferably with screw locking design.							
15.2	Terminal blocks for CT and VT secondary leads shall be of stud type, made up of unbreakable polyamide 6.6 grade. They shall be provided with links to facilitate testing, isolation star / delta formation and earthing. Terminal blocks for CT secondary shall have the short circuiting facility. The terminals for remote ammeter connection etc. shall also be disconnecting type only. All metal parts shall be of non-ferrous material. Screws shall be captive.							
15.3	At least 10% spare terminals for external connections shall be provided on each panel and these spare terminals shall be uniformly distributed on all							
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	terminal blocks. Space for adding another 10% spare terminals shall also be available in each panel.
15.4	There shall be minimum clearances of 250 mm between the terminal blocks and the cable gland plate and 150 mm between two rows of terminal blocks.
15.5	All panel wring for external connections shall terminate on separate terminal blocks which shall be suitable for connecting two (2) stranded copper conductors of 2.5 sq. mm on each side, or alternatively, the terminal blocks shall have the possibility of double shorting space to facilitate looping.
16.0	SWITCHGEAR WIRING
16.1	All Switchgear panels shall be supplied completely wired internally upto the terminal block ready to receive Employer's external cabling. All inter cubicle wiring and connections between panels of same switchboard including all bus wiring for AC and DC supplies shall be provided / done by the Contractor.
16.2	All internal wiring shall be carried out with 650 V grade, single core, 1.5 sq. mm. stranded copper wires having minimum of seven strands per conductor and color coded, PVC insulation. CT circuits shall be wired with 2.5 sq. mm. wires which otherwise are similar to the above. Extra flexible wires shall be used for wiring between fixed and moving parts such as hinged doors.
16.3	All wiring shall be properly supported neatly arranged, readily accessible and securely connected to equipment, terminals and terminal blocks. Wiring troughs or gutters be used for this purpose.
16.4	Internal wire terminals shall be made with solderless crimping type tinned copper lugs which shall firmly grip the conductor. Insulation sleeves shall be provided over the exposed parts of lugs.
16.5	Printed single tube ferrules marked to correspond with panel wiring diagram shall be fitted at both ends of each wire. The wire identification marking shall be in accordance with IS: 375. Red Ferrules should be provided on trip circuit wiring.
16.6	Interconnection to adjacent panels shall be brought out to a separate set of terminal blocks located near the slots or holes, meant for the interconnecting wires. Arrangement shall permit neat layout and easy interconnections to adjacent panels at site and wires for this purpose shall be provided by Contractor looped and bunched properly inside the panels.
16.7	Contractor shall be fully responsible for the completeness and correctness of the internal wiring and for the proper functioning of the connected equipment.
16.8	The Contractor shall provide the necessary clamps wiring troughs etc. for all wiring in side the switchgear enclosed including the Employer's power and control cables.

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17.0	POWER CABLE TERMINATION						
17.1	Cable termination compartment shall receive the stranded Aluminium conductor, XLPE insulated, shielded, armored / unarmored, PVC jacketed, single core / three core, unearthed / earthed grade power cable(s).						
17.2	A minimum clearance of about 600 mm shall be kept between the cable lug bottom ends and gland plates for stress cone formation for XLPE cables. Interphase clearance in the cable termination compartment shall be adequate to meet electrical and mechanical requirement besides facilitating easy connections and disconnection of cables. Dimensional drawing of cable connection compartment showing the location of lug, glands, CTs, gland plates etc. and the electrical clearances available shall be submitted for Employer's approval during detail engineering.						
17.3	Cable termination comp cables of sizes as inc undrilled gland plates. nonmagnetic material. ( intimated later	artment shall have pro licated during detaile For all single core c Cable entry shall be fr	ovision d engii ables g om boti	for termination neering with re land plates sh tom. Any chang	of power emovable nall be of ge will be		
18.0	NAME PLATES AND L	ABELS					
18.1	Each switch board shall have a name plate for its identification. All enclosure mounted equipment shall be provided with individual engraved name plates for clear equipment identification. All panels shall be identified on front as well as backside by large engraved name plates giving the distinct feeder description along with panel numbers. Back side name plates shall be fixed in panel frame and not on the rear removable cover						
18.2	Name plate shall be engraved letterings, on subjected to Employer's	of non-rusting metal black background. In: approval.	or 3-µ scriptio	bly lamicoid w ns and lettering	vith white g shall be		
18.3	Suitable stenciled paint mark shall be provided for identification of all equipment, located inside the enclosure, as well as for door mounted equipment, from the back side in addition to plastic sticker labels, if provided. These labels shall be located directly by the side of the respective equipment, shall be clearly visible and shall not be hidden by equipment wiring. Labels shall have device number as mentioned in wiring drawings. Type of labels and fixing of labels shall be such that they are not likely to peel off / fall off during prolonged use.						
19.0	MODULE DESCRIPTIO	N (Typical)					
	SI No Panel Type	Application		Applicability			
	1 DB	Transformer Feeder	Transf	ormer Feeder			
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		2	DC	Incomer Feeder	Incomer Feeder	
		3	DD	Bus Coupler Feeder	Bus Coupler Panel f MV Boards	for
		4	DE-IC	Tie Feeder	Tie Incomer Panel	
		5	DE-OG	Tie Feeder	Tie Outgoing Panel	
		6	G	Bus PT	Bus PT Panel	
		7	ICOG	Standalone Transformer feeder	Standalone panel w both incoming & outgoing cables	ith
20.0	т	EST				
20.1	Т	YPE TE	STS			
	a b tl c	Ill the fo id oper equipme ne test(s or should A) R b s	llowing type tening. These rent similar to the similar tent sin similar tent	ests carried out not ea reports should be fo ose proposed to be su been either conducte itnessed by a client.	rlier ten years from the r the test conducted upplied under this conducted d at an independent l d out on circuit breaker and current rating sl	/ circuit hall be
		i) S p	hort circuit du anel offered al	uty test on circuit bre ong with CTs , bushing	eaker, mounted insid g and seperators	le the
	į	ii) S p	hort time with anel offered to	nstand test on circuit gether with CTs, bush	t breaker, mounted ings and separators.	inside
	į	iii) P p	ower frequent	cy withstand test on	breaker mounted ir	ו side
	<ul> <li>iv) Lightning impulse withstand test on breaker mounted in side panel.</li> <li>v) Temperature rise test on breaker and panel together. For this test, the test set up shall include three panels with breakers, the test breaker and panel being placed in the centre.</li> </ul>					ו side
						or this rs, the
		T ca th co	he adjacent p apacity. Altern ne sides, whic onfiguration	anels shall also be lo atively the test panel r h will be adjoining to	aded to their rated c nay be suitably insula other panels in actua	urrent ited at al site
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	vi)	Internal Arc Test as per IEC 62271-200						
	vii)	Measurement of resistance of main circuit.						
	viii)	Mechanical operation test.						
	B)	Short circuit withstand test of earthing device (t	ruck / switch	).				
	C)	Testing to observe compliance to degree of p checked for each switch board enclosure and busb routine inspection shall be as under.	protection, sh par chambers	all be during				
		IP -4X: It shall not be possible to insert a one (1 into the enclosure from any direction, without usi	) mm. dia ste ng force.	el wire				
		IP-5X: It shall not be possible to insert a the under gaskets and through enclosure joints.	nin sheet of	paper				
	<ul> <li>Hc co the sp un pa rep</li> <li>All sta inc</li> <li>Th ref</li> <li>be Ch sh</li> <li>D) Ty Nume review</li> </ul>	wever if the contractor is not able to submit re- nducted not earlier than ten years prior to the date case of type test report(s) are not found ecification requirements, the contractor shall of der this contract free of at no additional cost to the rty lab or in presence of client/owners represen- borts for approval. acceptance and routine tests as per the spe andards shall be carried out. Charges for these cluded in the equipment price. e type test reports once approved for any proje- ference. For subsequent projects of NTPC, an e- furnished by the manufacturer confirming sim- nange". Minor changes if any shall be highlighte eet. ope test reports for the following tests on the mode erical relays, Ethernet switches shall be submitte w	port of the ty te of bid ope d to be me conduct all s ne owner eith ntative and s cification an shall be dee cts shall be endorsement illarity and " ed on the end lel of the d for employ	ype test(s) ening, or in eeting the such tests her at third submit the d relevant med to be treated as treated as the sheet will No design dorsement				
	SI.	TEST ITEMS	Standard					
	i)	Dimensions of structure and visual inspection	IEC 60297- 101	-3-				
	ii)	Functional requirements:	Relevant					
		- Steady-state simulation	IEC 60255	-100				
		Product safety requirements	IEC 60255	-27				
		(including the dielectric tests and thermal short time rating)						
	iv)	EMC requirements:						
		– Emission	IEC 60255	-26				
		– Immunity						
<b></b>				-T				

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CLAUSE NO						
	v) vi) vii)	Energizing quar – Burden – Change of aux Contact perform Communication	itities: kiliary energizing quantity ance requirements	N/A IEC 60255- N/A IEC 61850	11	
	viii)	Climatic environ – Cold – Dry heat – Change of ten – Damp heat	mental requirements:	IEC 60068-2 IEC 60068-2 IEC 60068-2 IEC 60068-2 IEC 60068-2 IEC 60068-2	2-14, 2-1, 2-2, 2-78, 2-30, 27	
	ix)	Mechanical requ – Vibration – Bump – Seismic	uirements: – Shock	IEC 60255-2 IEC 60255-2 IEC 60255-2	21-1, 21-2, 21-3	
20.2	Two (2) protected soft copies on CD-ROM of the approved test results shall be furnished with the equipment. These shall include complete reports and results of the routine tests and type tests (if the latter is carried out) on equipment. If the type tests are not conducted, the CDs shall contain copies of the results of type tests carried out on identical equipment earlier. <b>ROUTINE TESTS</b> All acceptance and routine tests as per the specification and relevant					
	for these shall be deemed to be included in the equipment price An indicative lists of tests / checks is mentioned as QA chapter on HT switchgear. However, the manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents.					
20.3	COMMISSIONING CHECKS / TESTS After installation of panels, power and Control wiring and connections, Contractor shall perform commissioning checks as listed below to verify proper operation of switchgear / panels and correctness of all equipment in all respects. In addition the Contractor shall carry out all other checks and tests recommended by the manufacturers.					
	(a) C	Check name plate	details according to specifica	ation.		
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CLAUSE NO	TECHNICAL SPECIFICATIONS
	<ul> <li>(b) Check for physical damage</li> <li>(c) Check tightness of all bolts, clamps and connecting terminals</li> <li>(d) Check earth connections.</li> <li>(e) Check cleanliness of insulators and bushings</li> <li>(f) Check heaters are provided</li> <li>(g) H.V. test on complete switchboard with CT &amp; breaker in position.</li> <li>(h) Check all moving parts are properly lubricated.</li> <li>(i) Check for alignment of busbars with the insulators to ensure alignment and fitness of insulators.</li> <li>(j) Check for interchange ability of breakers.</li> <li>(k) Check continuity and IR value of space heater.</li> <li>(l) Check alignment of trucks for free movement.</li> <li>(b) Check control wiring for correctness of connections, continuity and IR values.</li> <li>(e) Manual operation of breakers completely assembled.</li> <li>(f) Power closing / opening operation, manually and electrically at extreme condition of control supply voltage.</li> <li>(g) Closing and tripping time.</li> <li>(h) Trip free and anti-pumping operation.</li> <li>(i) R values, resistance and minimum pick up voltage of coils.</li> <li>(j) Simultaneous closing of all the three phases.</li> <li>(k) Check son spring charging motor, correct operation of limit switches and time of charging</li> <li>(m) All functional checks.</li> </ul>

CLAUSE NO	TECHNICAL SPECIFICATIONS
	<ul> <li>Voltage Transformers <ul> <li>(a) Insulation resistance test.</li> <li>(b) Ratio test on all cores.</li> <li>(c) Polarity test.</li> <li>(d) Line connections as per connection diagram.</li> </ul> </li> </ul>
	<ul> <li>Cubicle Wiring <ul> <li>(a) Check all switch developments.</li> <li>(b) It should be made sure that the wiring is as per relevant drawings. All interconnections between panels shall similarly be checked.</li> <li>(c) All the wires shall be checked for IR value.</li> <li>(d) Functional checking of all control circuit e.g. closing, tripping interlock, supervision and alarm circuit including proper functioning of component / equipment.</li> <li>(e) Check terminations and connections.</li> <li>(f) Wire ducting</li> </ul></li></ul>
21.0	SPECIFICATION FOR 33KV RING MAIN UNIT (If applicable)
21.1	33kV RING MAIN UNIT
	Each Ring Main Unit shall have all the following major components in addition to the other items required for satisfactory performance of equipment:
	<ul> <li>a. Painted MS enclosure with steel base frame for Ring Main Unit suitable for outdoor installation.</li> <li>b. 33 KV Ring Main Units, Non-extensible type along with requisite number of electrically operated breakers and manually operated Load break switches and earth switches as per Single line Diagram</li> <li>c. Control protection and metering requirements as per system requirement and single line Diagram</li> <li>d. Internal cabling for connections between the equipments of Ring Main Unit, lighting &amp; earthing system along with required hardware, gaskets, gland plates etc as required.</li> </ul>
21.2	Technical requirements for RMU
	CODES AND STANDARDS: IS: 13118, IEC: 62271-200
	The equipment shall have the following features:

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	1. E				
		Nominal system voltage	33 KV		
		Highest system voltage	36 KV		
	iii	Rated insulation level			
		I) Impulse with stand	170 KV(Peak)		
		voltage with 1.2 / 50 Micro	70 (() ( (D) (0))		
		second wave	70 KV (RMS)		
		frequency with stand			
		voltago			
	iv	Pated short circuit breaking	As por system fault		
	IV	capacity at specified site	AS per system laut		
		conditions (Minimum)	<b>Chapter A-2)</b> with %age of DC		
			component as per IEC-62271-		
			100 corresponding to minimum		
			operating time with operating		
			conditions specified.		
	V	Rated short circuit making	2.5 Times of system fault current.		
		current (Minimum)	-		
	vi	Rated short time withstand	As per system fault current		
		capacity (Minimum)			
	Vii	Rated operating duty cycle	O-3 minute-CO-3 minute – CO		
	Viii	Maximum temperature rise	As per IEC : 62271-100		
		over and ambient			
	2 0				
	<b>2.</b> K	DMLL Configuration	Two Nos Load brook switches		
	1	RIVIO Configuration	(IBS) and transformer circuit		
			hreaker as her system		
			requirement		
	ii	Extensibility	Non extensible type		
	iii	Load break switch. Circuit	All shall be fixed (Non draw out)		
		breaker& earth switch in	type		
		RMU panel			
	iv	Insulation medium for panel/	SF6 gas or Dry air in sealed		
		bus bar	metallic tank		
	v	Breakers & load break	SF6 gas or Vacuum type (with		
		switches	disconnector & earth switch)		
	vi	Internal Arc classified FLR	As per system fault current.		
	3. R	MU CONSTRUCTIONAL FEA	TURES		
	i	RMU Panel type	Metal enclosed panel		
			construction		
	ii	Service Location	Outdoor		
	iii	Mounting	Free Standing		

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	iv	Overall enclosur	e protection	IP54 minimum	for MV Switch	gear	
				Compartments	s, Vermin proof		
	V	Doors		Front access w	vith anti-theft hi	nge	
	vi	Covers		Bolted for r	ear access,	with	
				handles. All th	e accessible b	olts /	
				screws shall	be vandal p	root.	
				One set of red	quired Special	toois	
					i be in the scor		
	vii	Construction		Supply.	1 2 mm	thick	
	VII	Construction			I Z IIIII Stainloss (	Stool	
					vitable for out	door	
				application		.0001	
	viii	Rase frame mad	e of steel	Raised frame	of 300 mm beig	ht	
	VIII	for RMU		Taiseu Irame		jiit	
	ix	Lifting lugs		Four numbers			
	Х	Cable entry		Bottom			
	xi	Bus bar continuo	ous rated	As per system	requirement.		
		current at designed 50					
	deg.C ambient temp		emperature				
	xii	Bus bar short tin	ne	As per system fault current			
		withstand capac	ty	(Minimum)			
	xiii	Maximum tempe	rature rise	In line with Tal	ble 3 of IEC694		
		above reference	ambient 50				
	viv	Earth bus bar		Aluminum siz	ed for rated	fault	
	XIV	Earth bus bai		duty for 1 sec		lault	
	XV	Cooling arrange	ment	By natural air	(without fan)		
	xvi	Panel internal w	iring	Stranded flexit	ole color coded		
				PVC insulated	copper wire 1.	5 sq	
		_		mm.(min.), 11	00 volt grade		
	XVII	Gasket	<del></del>	Neoprene rubi	per		
	XVIII	Marshalling term	inal blocks	s 1.5 Sq mm, Nylon 66 material,			
				screw type + 2	10% spare in ea	ich	
	xix	Padlock facility		Required for a	Il earth switche	<u>s &amp;</u>	
				all		50	
				handles			
	XX	Explosion vents		To ensure	operator's sa	afety,	
				design should	ensure that ga	ses /	
				flames gener	ated during	flash	
				over / blast	in any of	the	
				compartment,	must not come	e out	
				from the from	IT OF RMU. C		
					of the DMU of		
I							
Development	of 20M	W Solar PV	TECHNICAL SE	PECIFICATION		Dette	
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			withstand Internal arc test for the indicated system fault current.
	4. R ch	amber)	ng live parts (RMU SF6 gas
	i	Enclosure	Stainless steel enclosure, IP67 class
	ii	SF6 gas pressure low alarm	To be given
	iii	Provision for SF6 gas filling	To be given (For 'sealed for life' design of RMU, this is not applicable)
	iv	Provision for SF6 gas pressure measurement	Manometer with non-return valve indication
	V	Arc interruption method for SF6 breaker / Load break switch	Puffer type / rotating arc type
	vi	Potential free contacts for SF6 gas 1NO +1NC pressure low	1NO +1NC
	vii	Electrical Bushing	Bushing should be suitable for replacement at site.
	5. L	OAD BREAK SWITCH (LOAD	BREAK ISOLATOR)
	i	Туре	Three poles operated simultaneously by a common shaft
	ii	Arc interruption in dielectric medium	SF6 or vacuum
	iii	Operating mechanism for close/ open	Manual.
	iv	Continuous current rating of LBS at design ambient temperature of 50 deg C	100 Amps minimum or as per system requirement
	6. C	IRCUIT BREAKER	
	i	Туре	Three poles operated simultaneously by a common shaft
	ii	Arc interruption in dielectric medium	SF6 or vacuum
	iii	Operating mechanism	Electrically Operated
	iv	Emergency trip / open push button	On panel Front
	V	Continuous current rating of Breaker at design ambient temp of 50 deg.C	100 Amps minimum or as per system requirement
	vi	Short time withstand capacity	As per system fault current

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	vii	Breaker status auxiliary contact	2NO + 2NC wired to terminal block		
	viii	Current transformer Ratio	Suggestive rating: 100/1 A or as per requirement		
			Other ratings as per		
			manufacturer's standard may		
			also be adopted. Sufficient space		
			horizontal & vertical directions for		
			mounting of CT's. Additionally,		
			some CAUTION marking (by		
			avoid CT's installation above the		
			screen of cable (i.e. earth		
			potential point.)		
	ix	CT accuracy class	Protection : 5P20		
	x	Potential Transformer (PT)	33000/ \sqrt{3}/110/ \sqrt{3}		
		ratio and Accuracy Class	Accuracy class : 0.5 suitable for		
			converter duty application as		
			specification		
	xi	Protections	Numerical relay as per requirements mentioned		
			elsewhere in the specification.		
			In addition to above Transformer		
			protections like OTI, WTI, Ruchholz and Prossure Poliof		
			Valve (PRV) operated shall be		
			suitably integrated in the		
			protection circuit. Any AC/DC		
			auxiliary supply requirement for		
			requirement mentioned		
			elsewhere in the specification.		
	xii	Relay aux contacts for	1NO+1NC Potential free wired to		
	xiii	Shunt trip (for door limit	To be wired to terminal blocks		
		switch of enclosure or			
		transformer) as per the			
	7 6		1		
	i i		Three poles operated		
		.,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	simultaneously by a common shaft		
	ii	Switching in dielectric	Dry air in sealed medium or SF6		

CLAUSE NO	TECHNICAL SPECIFICATIONS				
		medium			
	iii	Operating mechanism for Close/Open	Manual		
	iv	Short time withstand capacity	As per system fault current		
	v	Aux contacts	1NO+1NC free wired to TB		
	vi	LBS Earth Switch close /	Potential free contacts wired to		
		open	terminal block.		
	vii	CB Earth Switch close	Potential free contacts wired to		
	8 IN		terminal block.		
	i	Cable charge status indication for all Load Break Switches & Circuit Breaker	Circuit breaker capacitor type voltage indicators with LED on all the phases (Shall be clearly visible in day light)		
	ii	Spring charge status indication	On front for breaker		
	iii	Earth switch closed indication (For Each LBS)	front		
	iv	Load break switch ON/OFF indication	Green for OFF / Red for ON		
	V	Circuit breaker ON/OFF indication	Green for OFF / Red for ON		
	vi	Cable Fault Direction	Cable fault passage indicator.		
	vii	CB close / open	Potential free contacts wired to terminal block.		
	viii	Protection relay operated	Potential free contacts wired to terminal block.		
	ix	SF6 gas pressure low	Potential free contacts wired to terminal block.		
	9. R	<b>MU OPERATIONAL INTERLO</b>	СК		
	i	Interlock type	Mechanical		
	ii	Load break switch & respective earth switch	Only one in 'close' condition at a time		
	iii	Circuit breaker & respective earth switch	Only one in 'close' condition at a time		
	iv	Prevent the removal of respective cable covers if load break switch or circuit breaker is 'ON'	Electrical / Mechanical		
	V	Prevent the closure of load break switch or circuit breaker if respective cable cover is open	Electrical / Mechanical		
	vi	Cable test plug for LBS/CB accessible only if Earth	Mechanical		

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	switch connected to earth         10. MIMIC DIAGRAM, LABEL AND FINISH         i       On panel front with description of function & direction of operation of handles/buttons				
	II III	Operating instruction chart and Do's & Don'ts to be displayed on left / front side of panel enclosure on Al Sheet, duly affixed on panel.			
	iv	Name plate on panel front	Fixing by rivet only		
	v	Material	Anodized aluminum 16SWG	/ SS	
	vi	Background	Satin Silver	<u> </u>	
		Lottors diagram & bordor			
	VII	Letters, diagrafit & border	Black		
	viii	Process	Etching		
	ix Name plate details Month & year of manufacture, equipment type, input & output rating, purchaser name & order Number, guarantee period.				
	×       Labels for meters & indications       Anodized aluminum with white character on black background OR 3 Ply lamicoid.				
	xi	Danger plate on front & rear side	Anodized aluminum with v letters on red background	white	
	xii Painting surface Shot blasting or chemical 7 tar preparation Process		tank		
	xiii	Painting external finish	Powder coated epoxy poly base grade A, shade - RAL 7	ester 7032	
	xiv	Painting internal finish	Powder coated epoxy poly base grade A, shade - white	ester	
21.3	TESTS	S OF RMU			
	33 kV Switchgear/Ring Mains Unit shall be of type tested design. Durin detailed engineering, the contractor shall submit for Owner's approval the reports of all the type tests carried out 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 an the test(s) should have been either conducted at an independent laborator or should have been witnessed by a client.				
	Howe condu of typ require at no client/	ever if the contractor is not all cted within last ten years from be test report(s) are not fo ements, the contractor shall co additional cost to the owner el owners representative and sub	ble to submit report of the type the date of bid opening, or in und to be meeting the spe onduct all such tests under this other at third party lab or in pre- mit the reports for approval.	pe test(s) the case ecification s contract esence of	

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	All acceptance and restandards shall be care included in the equipmet         (a) The type test report reference. For subs furnished by the matching with the rest matching of the rest of th	CAL SPECIFICATIONS	ecification and shall be deem jects shall be tr ndorsement she and "No design of dorsement sheet.	relevant hed to be eated as et will be Change".
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SE NO			
Cł	HAPTER- C3 (A): IN	VERTER TRANSFORM	ER
1.0 TECHN	ICAL REQUIRMENTS (C	DIL FILLED TRANSFORMER	2)
Sr. No.	TRANSFORMER	INVERTER TRANSFORM	ER
i)	VA Rating & Quantity	As per system requireme SLD*	nt and
ii)	Voltage Ratio (KV)	As per system requireme SLD*	nt and
iii)	Duty, Service & Application	Continuous Solar I application and converte (Outdoor)	nverter r duty
iv)	Winding	AS per SLD*/system require	ement
<b>v</b> )	Frequency	50 Hz	
vi)	Nos. of Phase	THREE	
vii)	Vector Group & Neutral earthing	As per system requireme SLD*	nt and
viii)	Cooling	ONAN	
ix)	Tap Changer	As per system requireme SLD*	nt and
<b>x</b> )	Impedance at75 <sup>0</sup> C	0010 +/- 5% (11111.)	
^)	a) Principal Tap	As per system requireme	nt and
	h) Other Tans	SID* & as ner I	nverter
		manufacturer recommendat	ion
xi)	Permissible Temperatu	ure rise	
,	over an ambient of 50	deg C	
	(irrespective of tap)	C .	
	a) Top Oil	50 deg.C	
	b) Winding	55 deg.C	
xii)	SC withstand time (thermal)	2 sec.	
xiii)	Fault Level & Bushing CT	As per system requireme SLD*	nt and
xiv)	Termination	As per system requireme SLD*	nt and
xv)	Bushing rating,	As per relevant IS/IEC	
	Insulation class	(However Inverter Transformer LV	
	(Winding & bushing)	side winding & bushing ins	sulation
		class shall be of at least 3	3.6 kV)
	Nieles Is al	Creepage distance : 25 mm	/KV
	INOISE IEVEI	AS PER NEMA IR-1	
ent of 20MW Solar I Coalfields Lim	PV Project TECHNICAL S hited (CCL) BIDDING	PECIFICATIONPART-CDOC. NO:CHAPTER-C3	Pag

CLAUSE NO		TECHNI	CAL SPECIF	ICATIONS		एन् <b>टीपी</b> सी NTPC
	xvii)	Loading (	Capability	Continuous of MVA on any variation of transformer sl being loaded	operation at tap with vo +/-10%, hall be capab in accordance	rated Itage also le of with
	xviii)	Flux dens	ity	Not to exceed tap position w variation from w to the tap. Tr withstand follo conditions due and frequency a) 110% for co b) 125% for at c) 140% for at Bidder shall f char. up to 150	1.9 Wb/sq.m. a with +/-10% vo voltage correspo ansformer shall owing over fi to combined vo fluctuations: ontinuous rating least one minu least five secor furnish over fl 0%	t any bltage nding also luxing bltage te. nds. uxing
	xix)	Air Cleara	ance	As per CBIP		
	<ul> <li>Inverter Transformer shall have copper/Aluminum Shield winding between LV &amp; HV windings. Each LV winding must be capable of handling non-sinusoidal voltage with voltage gradient as per relevant applicable standards and Inverter manufacturer recommendation. Also each shield winding shall be taken out to tank with two separate connection from shield to bushing with proper support with 2 nos. 3.6 kV shield bushings and same shall be brought down along with support insulator from tank &amp; copper flat up to the bottom of the tank for independent grounding.</li> <li>If Inverter transformer is provided indoor, it shall be necessarily dry type. Oil filled Transformer shall not be used in location where there is immediate possibility of oil seepage/leakage/spillage into nearby marine waterbody or mixing with marine water in oil pit of transformers.</li> <li>Harmonic Factor as per Inverter manufacturer recommendation must be taken into account while designing the transformer. The extra no load loss due to voltage harmonics and load and stray load loss due to current harmonics (as applicable) and must be taken into consideration in transformer design. In addition, the dc bias</li> </ul>					
Development at Central CHP/CPP Pip	of 20MW Solar Coalfields Lim arwar, Jharkhan	PV Project ited (CCL) id	TECHNICAL S BIDDING RE-CS-9	DECIFICATION DOC. NO: 296-004-9	PART-C CHAPTER-C3 (A)	Page 2 of 17

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	component of ( accounted for its	component of 0.5% of rated Inverter output current is to baccounted for its effect on the transformer design.					
	<ul> <li>The adverse efference</li> <li>and solar generation</li> <li>suitable design (and solar generation)</li> </ul>	ect on life of transformer due ation loading cycle must be as applicable).	e to cloud inter compensated	mittency through			
	<ul> <li>The thermal des temperature dep accordance with not limit Inverter of</li> </ul>	• The thermal design of Inverter Transformer needs to consider the temperature dependent performance of the Inverter. It is to in accordance with Inverter output and under worst condition it should not limit Inverter output.					
	• The multi-winding transformer needs to be designed for long term operating conditions with asymmetrical load on LV side i.e., in case three winding design, the transformer needs to operate reliable with only one Inverter supplying power to only one LV winding.						
	<ul> <li>For multi winding transformer, it is recommended to have close coupling and equal impedances on each of LV winding to HV winding and to have high enough impedance (8% min. based on one LV winding rating) between two LV windings in order to decouple these windings.</li> </ul>						
	<ul> <li>In case of inverte type tested desig</li> </ul>	In case of inverter transformer, it shall be proven and of successfully type tested design					
	<ul> <li>Contacts from Inverter transformer fittings/protection devices shall be wired for tripping of Inverter transformer Circuit Breaker. Detailed scheme regarding same shall be finalized during detailed engineering.</li> </ul>						
	<ul> <li>Cumulative kVA total rated kVA ca</li> </ul>	rating of inverter transforme apacity of respective Inverter	r shall not be le s.	ess than			
2.0	CODES AND STANDAF	RDS					
	Transformers	IS:2026. IS:6600. IEC:600	76				
	Bushings	IS:2099, IEC:60137.IS 334	17 ,IS 12676				
	Insulating oil	IEC 60296	,				
	Bushing CTs	IS:2705, IEC 60185					
	Indian Electricity Act 20	003, BEE Guideline & CEA r	notifications				
2.1	General Construction						
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	Transformer shall be constructed in accordance to IS: 2026 and IS: 3639 or equivalent to any other international standard. Transformer shall be complete & functional in all respect and shall be in scope of supplier. The other important construction particulars shall be as below.						
	a. The Transformer tank and cover shall be fabricated from high grade low carbon plate steel of tested quality. The tank and the cover shall be of welded construction and there should be provision for lifting by crane.						
	<ul> <li>A double float type Buchholz relay conforming to IS: 3637 shall be provided.</li> </ul>						
	<ul> <li>c. Suitable Inspection hole(s) with welded flange(s) and bolted cover(s shall be provided on the tank cover. The inspection hole(s) shall be a sufficient size to afford easy access to the lower ends of th bushings, terminals etc.</li> <li>d. All bolted connections to the tank shall be fitted with suitable oil-tigh gaskets which shall give satisfactory service under the operatin conditions for complete life of the transformer if not opened for maintenance at site</li> </ul>						
	e. The transformer shall be provided with conventional single compartment conservator. The top of the conservator shall be connected to the atmosphere through indicating type cobalt free silica gel breather (in transparent enclosure). Silica gel shall be isolated from atmosphere by an oil seal						
	<li>f. Transformer shall have adequate capacity Conservator tank to accommodate oil preservation system and volumetric expansion of total transformer oil.</li>						
	g. Transformer shall have Oil Temperature Indicator and Winding temperature Indicator with accuracy class of +/-2 deg.						
	h. Radiators shall be detachable type, mounted on the tank with shut off valve at each point of connection to the tank, lifts, along with drain plug/valve at the bottom and air release plug at the top.						
	<ul> <li>M. Box shall be of sheet steel, dust and vermin proof provided with proper lighting and thermostatically controlled space heaters. The degree of protection shall be IP 55. Marshalling Box of all transformers shall be preferably Tank Mounted. One dummy terminal block in between each trip wire terminal shall be provided. At least 20% spare terminals shall be provided on each panel. The gasket used shall be of neoprene rubber. Also Marshalling Box, shall be at least 450 mm above ground level and wiring scheme (TB details)</li> </ul>						
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	shall be engra and the same s	shall be engraved in a stainless steel plate with viewable font size and the same shall be fixed inside the Marshalling Box door.				
2.2	Windings					
	<ul> <li>a) The Bidder sha dust proof &amp; cor</li> <li>b) The conductors from scales &amp; b</li> <li>c) All windings of t</li> <li>d) Tapping shall b the transformer</li> </ul>	<ul> <li>a) The Bidder shall ensure that windings of all transformers are made in dust proof &amp; conditioned atmosphere.</li> <li>b) The conductors shall be of electrolytic grade copper/Aluminum free from scales &amp; burrs.</li> <li>c) All windings of the transformers shall have uniform insulation.</li> <li>d) Tapping shall be so arranged as to preserve the magnetic balance of the transformer at all voltage ratio.</li> </ul>				
2.3	Core					
	<ul> <li>a) The core shall grain oriented s or better.</li> <li>b) Core isolation le</li> <li>c) Adequate lifting be lifted.</li> </ul>	<ul> <li>a) The core shall be constructed from non-ageing, cold rolled, super grain oriented silicon steel laminations equivalent to M4 grade steels or better.</li> <li>b) Core isolation level shall be 2 kV (rms.) for 1 minute in air.</li> <li>c) Adequate lifting lugs will be provided to enable the core &amp; windings to be lifted.</li> </ul>				
2.4	Insulating oil					
	No inhibitors shall be used in the transformer oil. The oil supplied with transformers shall be new and previously unused and must conform to following while tested at supplier's premises and shall have following parameters.					
	S.No. Property		Permissib	le values		
	1. Kinematic	Viscosity, mm²/s	≤ 12 at 40	° C		
			≤ 1800.0 at (-)30 ° C			
	2. Flash Poin	t, ° C	≥ 140° C			
	3. Pour point	°C	≤ (-)40 ° C	≤ (-)40 ° C		
	4. Appearanc	ë	Clear , fre	e from sedimer d matter	it and	
	5. Density kg	/dm <sup>3</sup> at 20 ° C	≤ 0.895			
	6. Interfacial	Tension N/m at 25° C	≥ 0.04			
	7. Neutralisat	ion value, mgKOH/g	≤ 0.01			
	8. Corrosive	sulphur	Non Corro	sive		
	9. Water cont	ent mg/kg	$\leq$ 30 in bul	k supply		
			$\leq$ 40 in dru	m supply		
	10. Anti-oxidar		Not detect	able		
		Stability				
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	S.No.	Property		Permissib	Permissible values				
		-Neutralizatio	on value, mgKOH/g	≤ 1.2	≤ 1.2				
	10	-Sludge, %	by mass	≤ 0.8					
	12.	Breakdown vo	bitage						
		After treatmen	After treatment kV			≥ 30 > 70			
	13	Dissination fac	ctor at 90° C	< 0.005	≥ 70 < 0.005				
	10.	And 40 Hz to	60 Hz	_ 0.000	≥ 0.005				
	14.	PCA content		≤1%					
	15.	Impulse withs	and Level, kVp	≥ 145					
	16.	Gassing tende	ency at 50 Hz afte	r ≤ 5					
		120 min, mm	³/min						
	Subseq	uently oil samp	oles shall be draw	n at:					
	Sr.	Parameters	Before filling in	Prior	to	Applicabili	ty		
	No.		main tank &	energizatio	n				
			tested for	for followi	ng				
				acceptance	œ				
				norms:					
	i)	BDV	60 kV (min)	60 kV (min)		Applicable f	for all		
	ii)	Moisture	10 ppm (max.)	10 ppm (ma	x.)	Transforme	rs.		
		content							
2.5	<b>Bushin</b> a) B	<b>gs</b> Bushing below	v 52 kV shall b	oe oil comn	nunic	cating type	e with		
	р	orcelain insula	itor.						
	b) N	lo arcing horns	s to be provided o	n the bushing	gs.				
	c) Ir	nverter Transfo	ormer LV bushing	palms shall b	be si	lver/tin plat	.ed.		
2.6	Bushin	g CTs							
	Shall be of adequate rating for protection (differential and others if any) as required, WTI etc. All CTs (except WTI) shall be mounted in the turret of bushings, mounting inside the tank is not permitted. All CT terminals shall be provided as fixed type terminals on the M. Box to avoid any hazard due to loose connection leading to CT opening. In no circumstances Plug In type connectors shall be used for CT.						iny) as irret of Box to In no		
2.7	Valves								
	All valves up to and including 50 mm shall be of gun metal or of cast steel. Larger valves may be of gun metal or may have cast iron bodies.								
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	Sampling & drain v	Sampling & drain valves should have zero leakage rate.					
2.8	Gaskets						
	a)Gasket shall be cork gasket.	fitte	d with weather proof, hot	: oil	resista	int, rubl	perized
	b)If gasket is com over compressio	<ul> <li>b) If gasket is compressible, metallic stops shall be provided to prevent over compression.</li> </ul>					
	c) The gaskets shall not deteriorate during the life of transformer if not opened for maintenance at site. All joints flanged or welded associated with oil shall be such that no oil leakage or sweating occurs during the life of transformer. The quality of these joints is considered established, only if the joints do not exhibit any oil leakage or sweating for a continuous period of at least 3 months during the guarantee period. In case any sweating / leakage is observed, contractor shall rectify the same & establish for a further period of 3 months of the same. If it is not established during the guaranteed period, the guaranteed period shall be extended until the performance is established						
2.9	PAINTING						
	PARTS NAME	TYF	PE OF PAINT	NC CC	).OF )ATS	TOTA DFT	L
	Inside of tank	Oil	& heat resistant fully	Or	ne	Atleas	t 30
	and accessories	glos	sy white	со	at	micror	n
	(except M Box)			-			
	External surface	Che	mical resistant epoxy	Or	ne	Atleas	t 100
	of transformer		c phosphate primer, MIO	CO	at	micror	ו
	including M Box	inte	rmediate paint followed	ca	GI		
	(except	by p	oolyurethane finish paint				
	radiators)	(RA	L 5012 Blue)	-		A (1	
	External Radiator surface	Anti	corrosive primary paint		/0 ate	Atleas	t 100
		glos (RA	ssy outer finish paint L 5012 Blue)	ea	ch	micro	1
	Internal	Hot	oil proof, low viscosity				
	Radiator surface	varr	hing with transformer oil				
	Internal surface	Che	mical resistant epoxy	Тм	/0	Not	less
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	PARTS NAME	TYPE OF PAINT	NO.OF COATS	TOTAL DFT		
	of M Box	zinc phosphate primer followed by chemical and heat resistant epoxy enamel white paint	coats each	than 100 micron		
2.10	Neutral Earthing	Arrangement				
	Neutral earthing shall be done as per system requirement and SLD. In case of solidly earthed neutral of Transformers, it shall be brought through insulated support from tank to the ground level at a convenient point with 2 nos. copper flat, for connection to ground network (as applicable).Neutral of Transformer if not used should be taken out through bushing and covered by insulating cap.					
2.11	Cable boxes & applicable 3.3 kV	disconnecting chamber ( and above & for Inverter Tra	Disconneo Insformer	cting chamber both side)		
Development	<ul> <li>Cable boxes &amp; disconnecting chamber (Disconnecting chamber applicable 3.3 kV and above &amp; for Inverter Transformer both side)</li> <li>(a) HV Cable boxes shall be of phase segregated air insulated type &amp; shall be of sufficient size to accommodate Employer's cable &amp; termination. Phase segregation shall be achieved by insulating barriers (for 3.3 kV and above side)</li> <li>(b) Cable boxes shall have bus bars / suitable terminal connectors of adequate size &amp; bolt holes to receive cable lugs. The degree of protection of cable boxes shall be IP 55.</li> <li>(c) A suitable removable gland plate of non-magnetic material drilled as per the Employer's instruction shall also be provided in the cable box</li> <li>(d) The support from base for the cable box (for 3.3 kV and above side) shall be of galvanized iron</li> <li>(e) The contractor shall provide earthing terminals on the cable box, to suit Employer's GI flat.</li> <li>(f) The minimum length provided for terminating 33 kV, 11KV &amp; 3.3 KV XLPE cable shall be 1000 mm (for 33 kV) 650 mm (for 3.3 kV and 11 kV) from cable gland plate to the cable lug) for the cable boxes, for 433V side suitable length shall be provided (shall be discussed during detail engineering). The final cable size, number &amp; length of terminating XLPE cable shall be furnished during detailed engineering.</li> <li>(g) Cable boxes shall be designed such that it shall be possible to move away the transformer without disturbing the cable terminations, leaving the cable boxes shall have removable top cover (for transformer above 100 KVA) &amp; ample clearance shall be provided to enable either</li> </ul>					
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	transformer or each cable to be subjected separately to high voltage test.
2.12	FITTINGS
2.12	<ul> <li>FITTINGS</li> <li>Following fittings shall be provided with Transformers covered under this sub section.</li> <li>a) -Conservator for main tank shall be provided with MOG with low oil level alarm contact, drain valve &amp; indicating type free Cobalt free breather with transparent enclosure (maximum height 1400 mm above ground level) etc.</li> <li>b) - Buchholz relay, double float type with alarm and trip contacts, along with suitable gas collecting arrangement.</li> <li>c) - For Inverter transformer and transformers with rating 2 MVA &amp; above, shall be provided with minimum two numbers of spring operated PRD (with trip contacts) with suitable discharge arrangement for oil shall be provided.</li> <li>d) OTI &amp; WTI shall be 150 mm dial type with alarm and trip contacts with max. reading pointer &amp; resetting device (maximum height 1500 mm above ground level). For Inverter Transformers, WTI shall be provided at least for all LV windings.</li> <li>e) Top &amp; bottom filter valves with threaded male adapters, bottom sampling valve, drain valve/sludge removal valve at the bottom most point of the tank.</li> <li>f) Air release plug, bushing with metal parts &amp; gaskets, terminal connectors on bushings (as applicable).</li> <li>g) Prismatic/toughened glass oil gauge for transformers.</li> <li>h) Bi-directional wheel/skids, M.Box, OCTC, Bushing CTs (as applicable), Insulating Oil, Cooling equipment.</li> <li>i) Cover lifting eyes, transformer lifting lugs, jacking pads, towing holes and core and winding lifting lugs, inspection cover, Bilingual R&amp;D Plate, Terminal marking plates, two nos. earthing terminals</li> </ul>
	j) Bolts & nuts (exposed to atmosphere) shall be galvanized steel/SS.
	k) Rain hoods to be provided on Buchholz, MOG & PRD. Entry points of wires shall be suitably sealed.
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	The fittings listed above are only indicative and other fittings, which generally are required for satisfactory operation of the transformers are deemed to be included.							
3.0	DRY TYP	DRY TYPE INVERTER TRANSFORMER						
	Sr. No.	PARAMETEI	RS	INVERTER TR	ANSFORMER			
	i)	Туре		Epoxy cast resin/resin e	encapsulated			
	ii)	Duty, Service Application	8	Continuous Solar Inverter application and converter duty				
	iii)	MVA & Voltag ratio	ge					
	iv)	Vector group	)					
	v)	Termination a Bushing CT	&	As per system requirement and SLD.				
	vi)	Fault Level & Earthing	•					
	vii)	Tap changer type & range		As per system requirement and SLD. OCTC +/-5% (min.) As per system requirement and SLD & as per Inverter manufacturer recommendation.				
	viii)	Impedance						
	ix)	Number of phases		Three (3)				
	x)	Type of cooli	ng	AN Transformer shall be provided with suitable ventilation system to ensure the temperature rise limits under most severe condition while in service however all tests and performance guarantee shall correspond to air natural (AN) cooling. G, As per relevant IS/IEC (However Inverter Transformer LV side winding & bushing insulation class shall be of at least 3.6 kV) 90 deg.C. (class F) 115 deg.C. (class H)				
	xi)	Bushing ratin Insulation cla (Winding & bushing)	ng, ass					
	xii)	Maximum Temperature ris winding over 50 deg. C ambient. (by resistance method) with Ai	se of ) ir					
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		Natural (AN) cooling.		]		
	xiii)	SC withstan time (therma	al) 2 sec	-		
	xiv)	Noise Level	Not to exceed values specified in NEMA TR-			
	xv)	PD Level (m Allowable)	<b>ax.</b> 10 pc	-		
	xvi)	Loading Capability	Continuous operation at rated KVA on any tap with voltage variation of +/-10% corresponding to the voltage of the tap as well as in accordance with IEC60076- 12/IS: 6600.			
	xvii)	Flux Density	Not to exceed 1.9 Wb/sq.m. at any tap position with +/-10% voltage variation from voltage corresponding to the tap. Transformer shall also withstand following over fluxing conditions due combined voltage and frequency fluctuations: a) 110% for continuous rating. b) 125% for at least one minute. c) 140% for at least five seconds.			
3.1	CODES A	AND STANDA	RDS			
	Dry type	transformers	IS: 11171, IEC 60076-11			
	Indian El notificatio	ectricity Act 20 on & CEA guide	03 and Indian Electricity Rules, BEE			
3.2	DESIGN	AND CONSTF	RUCTIONAL FEATURES			
3.2.1	The core shall be constructed from high grade non-ageing cold rolled grain oriented silicon steel laminations of M4 grade or better quality. The insulation of core to clamp-plates shall be able to withstand a power frequency voltage of 2 kV (rms) for one (1) minute.					
3.2.2	3.2.2 The transformers shall be housed in a metal protective housing, having a degree of protection of IP-23.In case it is placed outdoor, IP for enclosure shall be minimum IP-42 or higher. Enclosure shall be of a tested quality sheet steel of minimum thickness 2mm & shall also accommodate cable					
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	terminations. The hous possible to open the do be provided with lifting l bi-directional skids with enclosure or bi-directio arrangement.	ing door shall be interlocked or only when transformer is lugs and other hardware for f pre-drilled holes shall be pr onal rollers shall be provide	I such that it sh off. The enclosu floor mounting. ovided integral d with suitable	nould be ure shall Suitable with the locking			
3.2.3	Winding conductor shal shall be of class F ins insulated.	Winding conductor shall be electrolytic grade Copper/ Aluminum. Windings shall be of class F insulation or better. All windings are to be uniformly insulated.					
3.2.4	Transformer HV bushin epoxy type. Bushing sh ambient temperature ir area shall be of non-ma	Transformer HV bushings and LV bushings can be either solid porcelain or epoxy type. Bushing shall be suitable for satisfactory operation in the high ambient temperature inside Bus Duct enclosure (if applicable). LV flange area shall be of non-magnetic material.					
3.2.5	Bushing CTs shall be p REF protection, WTI, et	Bushing CTs shall be provided in the LV neutral side of adequate rating for REF protection, WTI, etc (as applicable).					
3.2.6	For Marshalling Box the sheet steel used shall be at least 1.6 mm thick cold rolled. The box shall be tank mounted type. The degree of protection shall be IP-54 in accordance with IS-13947. Wiring Scheme shall be engraved in a stainless steel plate with viewable font size and the same shall be fixed inside the Marshalling Box door.						
3.2.7	Inside the Marshalling Box door. Transformer shall be provided with suitable ventilation system to ensure the temperature rise limits under most severe condition while in service however all tests and performance shall correspond to air natural cooling.						
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3.3	PAINTING					
	The inside of enclosure and accessories (except M. Box) shall be painted with two coats of fully glossy white colour with total DFT of 25 to 60 microns. The external paint colour of transformer & accessories shall be blue corresponding to RAL 5012. The external surface of transformer & accessories shall have two coats of chemical resistant epoxy zinc phosphate primer and two coats of polyurethane finish paint with total DFT of 80 to 150 microns. The internal surface of M.Box shall have two coats of chemical resistant epoxy zinc phosphate primer and two coats of chemical finish paint with total DFT of 80 to 150 microns. The internal surface of M.Box shall have two coats of chemical resistant epoxy zinc phosphate primer and two coats of chemical finish paint with total DFT of 80 to 150 microns.					
3.4	FITTING					
	Winding temperature indicator (WTI)	Shall be Platinum resistance detector in each limb. Single Indicating meter mand display of temperature of class of Indicating meter shal and it shall have least count of no. 4-20 mA signal shall be monitoring of winding Temper	e type temper ay be provided all limbs. Accu l be +/- 1% or to of 0.1 °C or bet provided for re rature.	ature d for uracy better ter. 1 emote		
	RTD/Thermistors	1 No. PT-RTD shall be embedded in each limb with alarm and trip contacts for remote annunciation. Additional 1 No. thermistor/RTD shall be embedded in each limb				
	Fittings which are generally required for satisfactory operation of the transformers are deemed to be included, in the scope of supply of the Contractor.					
4.0	TESTS AND INSPECT	ION				
	In case the bidder/contractor has conducted type test(s) within last ten years, he may submit the type test reports to the owner for waiver of conductance of such type test(s). These reports should be for the tests conducted on the equipment similar to those proposed to be supplied under this contract and test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. In case the Bidder is not able to submit report of the type test(s) conducted within last ten years from the date LOA by NTPC, or in case the type test					
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	report(s) are not found Bidder shall conduct a to the Employer and su	report(s) are not found to be meeting the specification requirements, the Bidder shall conduct all such tests under this contract at no additional cost to the Employer and submit the reports for approval						
	<u>Short Circuit Test</u> :- In case short circuit test has not been conducted or the test report not meeting the specification requirement for the offered transformer manufacturer, Bidder /Sub-vendor shall establish" Ability to withstand the dynamic effects of short circuit "for the offered transformer as per latest IEC 60076-5.The ability to withstand the dynamic effects of short circuit can be established either by performing actual short circuit test or by method of calculation with reference to short circuit tested reference transformer as per IEC-60076-5/Annexure-A&B. Bidder shall choose any one the two options mentioned below;							
	<u>Option-1</u> :- Performing actual short circuit test as Type Test. In order to meet project schedule, Bidder/Sub vendor shall take suitable steps quite in advance to ensure successful conduction of short circuit test within three months time from date of LOA failing which the offered make of the transformer shall not be considered.							
	<u>Option-2</u> : By theoretical evaluation of the ability to withstand dynamic effect of short circuit based on 'Calculation and Design and Manufacture Consideration'. In this regard the guidelines given in Annexure-A with applicable tables of the IEC 60076-5 is to be followed. <u>The reference transformer chosen shall be of same application, winding configuration, conductor current density and as per Annexure-B of latest IEC-60076-5. Necessary Design document and reference test reports related to theoretical comparative evaluation must be submitted by</u>							
	S.N. ROUTINE TES	TS						
	1. All routine test 60076.	shall be carried out in accorda	ance with IEC	$\checkmark$				
	2. Measurement of IEC 60076-1)	of Voltage Ratio & phase displac	ement (as per					
	3. Measurement	of winding resistance on all the	e taps (as per					
	4. Vector group a	nd Polarity Check (as per IEC 60	076-1)					
	5. Magnetic Balar	ice and Magnetising Current Tes	st					
	6. Measurement of	of no load current with 415 V, 50	Hz AC supply					
	7. Measurement of	of no load losses and current at	90%, 100% &					
	110% of rated	voltage (as per IEC 60076-1)		v				
	8. Load Loss &	Short Circuit Impedance Mea	asurement on	$\checkmark$				
		eme raps						
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	S.N.   ROUTINE TESTS							
	9	IR measuremen	t (As per IEC 60076-1)					
	10.	Measurement	of capacitance & tan delta	to determine				
	11.	Separate Source						
	12.	Induced overvo	vithstand(IVW)					
	13.	Repeat no load						
	14.	Oil leakage test						
	15	Jacking test foll		N				
	16	Marshalling Box/Cable box: It shall not be possible to insert a			•			
	10.	thin sheet of paper under gaskets and through enclosure joints.						
	17. IR measurement on wiring of Marshalling Box.							
	S. N.							
	1.Lightning impulse(Full and chopped wave) test on windings(as per IEC 60076-3) (Not applicable for LV)2.Short circuit test (special test) as per IEC 60076-5 (if applicable).				$\checkmark$			
	3.	Temperature R losses as per conducted on o temp. rise test. on IEC: 60567) (based on IEC:	nperature Rise test at a tap corresponding to maximum ses as per IEC 60076. Gas Chromatography shall be ducted on oil sample taken before & immediately after ip. rise test. Gas analysis shall be as per IS: 9434 (based IEC: 60567), results will be interpreted as per IS: 10593 sed on IEC: 60599).					
	4. Measurement of harmonics of no load current (special test)							
	5.	Measurement ( (special test)	nent of acoustic noise level as per NEMA TR-1					
	6. Tank Vacuum & Pressure Test (as per CBIP norms)							
<ul> <li>(#) <u>NOTE:-</u> <ul> <li>i) All the type and special tests shall be conducted after performing Short Circuit Test. If Tank Vacuum &amp; Pressure Test is to be carried out then it shall be conducted before SC test.</li> <li>ii) Inverter Transformer LV winding Di-electric tests (except for lightning impulse test for LV winding) shall be carried out corresponding to levels (as per IEC 60076) for 3.6 kV class.</li> </ul> </li> </ul>								
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	iii) All Type tests should be done as per Employer's approved procedure.								
4.1	Leakage test on assembled Oil filled Transformer (ROUTINE TEST)								
	All tank & oil filled compartment shall be tested for oil tightness by being completely filled with oil of viscosity not greater than that of specified oil at the ambient temperature & applying pressure equal to the normal pressure plus 35 KN/sq. m measured at the base of the tank. The pressure shall be maintained for a period of not less than 6 hours during which time no sweating shall occur. Bidder can perform this test at site depending upon urgency subjected to NTPC approval.								
	Suitable Fire Fighting a applicable as per Tariff Firewall & soak pit as 10028 / IS 1646) shall b wall or 355 mm thick f However for all oil fille distance of 1.0 meter (r be provided for each p Electricity Authority (Th Plants and Electrical Lin	rrangements for Transformers shall be provided if Advisory Committee (TAC)/statutory requirements. applicable (as per statuary requirement/TAC/IS be provided of minimum 230 mm thickness of RCC fire resisting brick wall subject to NTPC approval. d outdoor a pit shall be provided all around at a min.) from transformer outer edge, a sump pit shall bit. Transformer efficiency shall be as per Central echnical Standards for Construction of Electrical mes) regulation, 2010.							
4.2	Routine / Type Tests (Dry Type Transformers)								
	Transformer shall be short circuit tested after conducting the routin Rest of the type tests shall be conducted after successful short testing.								
	All routine tests in accordance with IS: 11171 shall be carried transformer.								
	And All Type tests should be done as per Employer's approved procedure.								
Routine / Type Tests (Dry Type Transformers)									
	a.) Measurement of winding Resistance for each tap				Routine				
	b.) Measurement of v	sition.	Routine						
	c.) Vector group and	Routine							
	d.) Measurement of i impedance & load	Routine							
	taps	Deutin							
	e.)   Measurement of I	Routine							
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	F								
	current at rated fr 110% rated voltage	equency and 90%, 100% and ge.	b						
	f) Measurement of i	nsulation resistance	Routi	ne					
	g) Measurement of a	capacitance and tan delta	Routi	ne					
	h) Dielectric Tests								
	PF/Separate so	ource AC withstand voltage te	est. Routi	ne					
	2 Chopped wave ) windings(as pe	e lightning impulse voltage tes r IEC 60076-3) (Not applical	st on Type ble for						
	<sup>3</sup> Induced over v	oltage withstand test	Routi	ne					
	i) Partial discharge	measurement	Routi	ne					
	j) Measurement of i	ron loss & IR (repeat after ind	duced Routi	ne					
	k) Short Circuit test	as per IEC (if applicable)	Туре						
	I) Noise Level Meas	surement	Туре						
	o) Temperature rise	test as per IEC (HV & LV wir	nding) Type						
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CLAUSE NO								
	CI	HAPTER- C	3 (B): Al	JXILLARY TR	ANSFORME	R		
1.0	TECHNIC	AL REQUIRM	ENTS (OIL	FILLED TRANS	FORMER)			
	Sr. No.	DESCRIPTI	ON	AUXILIARY (AT)	TRANSFOR	MER		
	i)	VA Rating &	Quantity	As per system SLD*	requirement ar	nd /or		
	ii)	Voltage Rati	o (KV)	As per system r SLD*	equirement an	d / or		
	iii)	Duty, Se Application	ervice &	Continuous app	lication (Outdo	or)		
	iv)	Winding		TWO				
	v)	Frequency		50 Hz				
	vi)	Nos. of Phas	se	THREE				
	vii)	Vector Grou Neutral earth	p & ning	As per system SLD*	requirement ar	nd /or		
	viii)	Cooling		ONAN				
	ix)	Tap Change	r	As per system SLD*	requirement ar	nd /or		
		Impedance at75°C						
	x)	b) Other Taps		As per system SLD*.	requirement ar	nd /or		
		Permissible Temperature rise over an ambient of 50 deg C						
	xi)	(irrespective of tap)		25 dag C				
	,	a) Top Oil		35 deg.C				
		b) winding	g and times	40 deg.C				
	xii)	(thermal)	and time	2 sec. As per system requirement and SLD*				
	xiii)	Fault Level	& Bushing					
	xiv)	Termination		As per systen SLD*	n requirement	and		
	xv)	Bushing Insulation (Winding & t	rating, class oushing)	As per relevant Creepage dista	IS/IEC nce : 35 mm/k\	/		
	xvi)	Noise level	•	AS PER NEMA	TR-1			
	xvii)	Loading Cap	Loading Capability		Continuous operation at rated MVA on any tap with voltage variation of +/-10%, also transformer shall be capable of being loaded in			
				accordance with	h IS: 6600.			
Development of 20MW Solar PV Project at Central Coalfields Limited (CCL) CHP/CPP Piparwar, Jharkhand			TECHNICAL BIDDING RE-CS-	SPECIFICATION DOC. NO: 9296-004-9	PART-C CHAPTER-C3(B)	Page 1 of 10		

CLAUSE NO	TECHNICAL SPECIFICATIONS							
	xviii)	lux density		Not to exceed 1. position with +/- from voltage cor Transformer sl following over f to combined vo fluctuations: a) 110% for cor b) 125% for at c) 140% for at l Bidder shall f char. up to 150	9 Wb/sq.m. at ar 10% voltage var responding to the hall also with luxing conditions ltage and frequ ntinuous rating. least one minute least five secon furnish over flu	ny tap iation e tap. stand s due uency e. ds. uxing		
	xix) A	ir Clearand	e	As per CBIP				
	<u>Note (comm</u>	on for Oil	filled and d	ry type transfor	rmer):			
2.0	<ul> <li>Auxiliary transformers shall be suitable for 3 phase, 4 wire system with additional LVN bushing for equipment earthing.</li> <li>Auxiliary Transformer can be either Oil filled or Dry Type (refer relevant specification. If auxiliary transformer is provided indoor, it shall be necessarily dry type. Oil filled Transformer shall not be used in location where there is immediate possibility of oil seepage/leakage/spillage into nearby marine waterbody or mixing with marine water in oil pit of transformers.</li> <li>Further Auxiliary transformer must be capable of handling Non-Sinusoidal Voltage with voltage gradient as per PCU (power conditioning unit) manufacturer's recommendation if it is connected from Inverter LT side.</li> </ul>							
	Transformer	rs	IS:2026. I	S:6600				
	Bushings		IS:2099,IS	6 3347				
	Insulating oi	il	IEC 6029	3				
	Bushing CT	S	IS:2705					
	Indian Electi	ricity Act 20	003, BEE G	uideline & CEA	notifications			
2.1	General Construction Transformer shall be constructed in accordance to IS: 2026 and IS: 3639 or equivalent to any other international standard. Transformer shall be complete & functional in all respect and shall be in scope of supplier.							
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CLAUSE NO									
	The other important con a. The Transformer ta low carbon plate ste be of welded constr crane.	<ul> <li>The other important construction particulars shall be as below.</li> <li>a. The Transformer tank and cover shall be fabricated from high grade low carbon plate steel of tested quality. The tank and the cover shall be of welded construction and there should be provision for lifting by crane.</li> </ul>							
	b. A double float type Buchholz relay conforming to IS: 3637 shall be provided.								
	c. Suitable Inspection shall be provided or sufficient size to a bushings, terminals	Suitable Inspection hole(s) with welded flange(s) and bolted cover(s) shall be provided on the tank cover. The inspection hole(s) shall be of sufficient size to afford easy access to the lower ends of the bushings, terminals etc.							
	d. All bolted connections to the tank shall be fitted with suitable oil-tight gaskets which shall give satisfactory service under the operating conditions for complete life of the transformer if not opened for maintenance at site								
	e. The transformer compartment conse connected to the atr gel breather (in tra from atmosphere by	e. The transformer shall be provided with conventional single compartment conservator. The top of the conservator shall be connected to the atmosphere through indicating type cobalt free silica gel breather (in transparent enclosure). Silica gel shall be isolated from atmosphere by an oil seal.							
	<ul> <li>f. Transformer shall accommodate oil p total transformer oil.</li> </ul>	Transformer shall have adequate capacity Conservator tank to accommodate oil preservation system and volumetric expansion of total transformer oil.							
	g. Transformer shall temperature Indicate with accuracy class	g. Transformer shall have Oil Temperature Indicator and Winding temperature Indicator (WTI applicable for transformer above 50 KVA) with accuracy class of +/-2 deg.							
	h. For Transformers al mounted on the tanl the tank, lifts, alor release plug at the t	bove 100KVA, radiators sha k with shut off valve at each ng with drain plug/valve at cop.	ll be detachable point of connec the bottom a	e type, tion to nd air					
	<ul> <li>i. M. Box shall be of sheet steel, dust and vermin proof provided with proper lighting and thermostatically controlled space heaters. The degree of protection shall be IP 55. Marshalling Box of all transformers shall be preferably Tank Mounted. One dummy terminal block in between each trip wire terminal shall be provided. At least 20% spare terminals shall be provided on each panel. The gasket used shall be of neoprene rubber. Also Marshalling Box, shall be at least 450 mm above ground level (for transformer above 100 KVA). For transformer above 100 KVA, wiring scheme (TB details) shall be engraved in a stainless steel plate with viewable font size and the same shall be fixed inside the Marshalling Box door.</li> </ul>								
I     I       Development of 20MW Solar PV Project at Central Coalfields Limited (CCL) CHP/CPP Piparwar, Jharkhand     TECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-9296-004-9     PART-C CHAPTER-C3(B)     Page 3 of 10									

CLAUSE NO		TECHNI		TIONS		एनरीपीमी NTPC			
2.2	Windin	Windings							
	a) The dust b) The & bu c) All v d) Tap the t	<ul> <li>a) The bidder shall ensure that windings of all transformers are made in dust proof &amp; conditioned atmosphere.</li> <li>b) The conductors shall be of electrolytic grade copper free from scales &amp; burrs.</li> <li>c) All windings of the transformers shall have uniform insulation.</li> <li>d) Tapping shall be so arranged as to preserve the magnetic balance of the transformer at all voltage ratio.</li> </ul>							
2.3	Core								
	a) The grain or b b) Core c) Ade be li	<ul> <li>a) The core shall be constructed from non-ageing, cold rolled, super grain oriented silicon steel laminations equivalent to M4 grade steels or better.</li> <li>b) Core isolation level shall be 2 kV (rms.) for 1 minute in air.</li> <li>c) Adequate lifting lugs will be provided to enable the core &amp; windings to be lifted.</li> </ul>							
2.4	Insulat	ina oil							
	transfor followin parame	g while tested ters.	new and previous at supplier's pre	ly unused mises and	and must conf shall have fol	orm to llowing			
	S.No.	Property		Permissib					
	1.	Kinematic Visco	osity, mm²/s	$\leq$ 12 at 40 ° C					
	2	Flach Daint ° C	<u> </u>	≤ 1800.0 at (-)30 ° C					
	2.	Pour point ° C	,	≥ 140° C					
	4.	Appearance		Clear , free from sediment and suspended matter					
	5.	Density kg/dm <sup>3</sup>	at 20 ° C	≤ 0.895					
	6.	Interfacial Tens	ion N/m at 25° C	≥ 0.04					
	7.	Neutralisation v	alue, mgKOH/g	≤ 0.01					
	8.	Corrosive sulph	iur	Non Corro	sive				
	9.	Water content r	ng/kg	$\leq$ 30 in bul	k supply				
	10	Anti-oxidants ad	ditives	≤ 40 in aru Not detect	ini suppiy able				
	11.	Oxidation Stabi -Neutralization -Sludge, % b	Anti-oxidants additives     Not detectable       Oxidation Stability     -Neutralization value, mgKOH/g       -Sludge % by mass     ≤ 1.2						
	12.	Breakdown volt	age						
		1 	-	۰ 					
Development of 20MW Solar PV Project at Central Coalfields Limited (CCL) CHP/CPP Piparwar, JharkhandTECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-9296-004-9PART-C CHAPTER-C3(B)Page 4 of 10									

CLAUSE NO								
	S.No	<ul> <li>Property</li> <li>As delivered, k</li> <li>After treatment</li> </ul>	V ., kV	Permissible           ≥ 30           ≥ 70	Permissible values ≥ 30 > 70			
	13. 14. 15. 16.	13.       Dissipation factor, at 90° C       ≤         And 40 Hz to 60 Hz       ≤         14.       PCA content       ≤         15.       Impulse withstand Level, kVp       ≥         16.       Gassing tendency at 50 Hz after       ≤         120 min       mm³/min			≤ 0.005 ≤1% ≥ 145 ≤ 5			
	Subse Sr. No.	equently oil samp	les shall be draw Before filling in main tank & tested for	n at: Prior to energization for following properties & acceptance norms:	o Applicabili	ity		
	i) ii)	BDV Moisture content	60 kV (min) 10 ppm (max.)	60 kV (min) 10 ppm (max.)	Applicable all Transforme	for ers.		
2.5	<ul> <li>Bushings</li> <li>a) Bushing below 52 kV shall be oil communicating type with porcelain insulator.</li> <li>b) No arcing horns to be provided on the bushings</li> </ul>							
2.6	Bushi Shall applic be mo permit All CT avoid circun	ing CTs be of adequate able for transform punted in the tur tted. terminals shall b any hazard due nstances Plug In t	rating for prote ner above 50 KV rret of bushings, re provided as fix to loose connec type connectors	ction as requi 'A) etc. All CTs mounting ins ed type termina tion leading to shall be used fo	red, WTI (W s (except WT ide the tank als on the M. CT opening or CT.	/TI CT I) shall is not Box to . In no		
2.7	Valve	S						
	All valves up to and including 50 mm shall be of gun metal or of cast steel. Larger valves may be of gun metal or may have cast iron bodies. Sampling & drain valves should have zero leakage rate.							
2.8	Gaske	ets						
Development at Central CHP/CPP Pip	I       Development of 20MW Solar PV Project at Central Coalfields Limited (CCL) CHP/CPP Piparwar, Jharkhand     TECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-9296-004-9     PART-C CHAPTER-C3(B)     Page 5 of 10							

CLAUSE NO	TECHNICAL SPECIFICATIONS							
2.9	<ul> <li>a) Gasket shall be fitted with weather proof, hot oil resistant, rubberized cork gasket.</li> <li>b) If gasket is compressible, metallic stops shall be provided to prevent over compression.</li> <li>c) The gaskets shall not deteriorate during the life of transformer if not opened for maintenance at site. All joints flanged or welded associated with oil shall be such that no oil leakage or sweating occurs during the life of transformer. The quality of these joints is considered established, only if the joints do not exhibit any oil leakage or sweating for a continuous period of at least 3 months during the guarantee period. In case any sweating / leakage is observed, contractor shall rectify the same &amp; established during the guaranteed period shall be extended until the performance is established.</li> </ul>							
	PARTS NAME     TYPE OF PAINT     NO.OF     TOTAL DFT       COATS							
	Inside of tank and accessories (except M Box)	Oil gloss	& heat resistant fully sy white	One coat	Atleast micron	30		
	External surface of transformer and accessories including M Box (except	Cher zinc (Mica inter by p (RAL	mical resistant epoxy phosphate primer, MIO aceious iron oxide) as mediate paint followed olyurethane finish paint 5012 Blue)	One coat each	Atleast	100		
	radiators) External Radiator surface	Antic follov gloss (RAL	corrosive primary paint wed by high quality full sy outer finish paint 5012 Blue)	Two coats each	Atleast micron	100		
	Internal Radiator surface	Hot varni flush	oil proof, low viscosity ish and subsequent ing with transformer oil					
	Internal surface of M Box	is al surfaceChemical resistant epoxyTwoNotless3oxzincphosphateprimercoatsthan100followedbychemicalandeachmicron						
Development of 20MW Solar PV Project at Central Coalfields Limited (CCL) CHP/CPP Piparwar, Jharkhand TECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-9296-004-9 PART-C BIDDING DOC. NO: RE-CS-9296-004-9						Page 6 of 10		

PARTS NAME       TYPE OF PAINT       NO.OF       TOTAL DFT         Image: COATS       Image: COATS       Image: COATS       Image: COATS         Image: COATS       Image: COATS       Image	CLAUSE NO									
PARTS NAME         TYPE OF PAINT         NO.OF         TOTAL DFT           OATS         heat resistant epoxy enamel         Image: Control of the contro										
2.10       Neutral Earthing Arrangement         Neutral earthing shall be done as per system requirement and SLD. In case of solidly earthed neutral of Transformers, it shall be brought through insulated support from tank to the ground level at a convenient point with 2 nos. copper flat, for connection to ground network (as applicable). Neutral of Transformer if not used should be taken out through bushing and covered by insulating cap.         2.11       Cable boxes & disconnecting chamber (Disconnecting chamber applicable 3.3 kV and above)         (a) HV Cable boxes shall be of phase segregated air insulated type & shall be of sufficient size to accommodate Employer's cable & termination. Phase segregation shall be achieved by insulating barriers (for 3.3 kV and above side)         (b) Cable boxes shall be use bus bars / suitable terminal connectors of adequate size & bolt holes to receive cable lugs. The degree of protection of cable boxes shall be of non-magnetic material drilled as per the Employer's instruction shall also be provided in the cable box.         (c) The support from base for the cable box (for 3.3 kV and above side) shall be of galvanized iron       (e) The contractor shall provide earthing terminals on the cable box, to suit Employer's Gl flat.         (f) The minimum length provided for terminating 33 kV, 11KV & 3.3 KV XLPE cable shall be 1000 mm (for 33 kV) 650 mm (for 3.3 kV and 11 kV) form cable galned plate to the cable lug) for the cable boxes, for 433V vide suitable length shall be forsised during detailed engineering.         (g) Cable boxes shall be turnished during detailed engineering.       (g) Cable boxes shall be turnished busing the cable box (for 4.33 kV and 11 kV) from cable gland plate to the cable lug) for the cable boxes, for		PARTS NAME	TYP	E OF PAINT	NO.OF COATS	TOTAL	DFT			
<ul> <li>2.10 Neutral Earthing Arrangement</li> <li>Neutral earthing shall be done as per system requirement and SLD. In case of solidly earthed neutral of Transformers, it shall be brought through insulated support from tank to the ground level at a convenient point with 2 nos. copper flat, for connection to ground network (as applicable). Neutral of Transformer if not used should be taken out through bushing and covered by insulating cap.</li> <li>2.11 Cable boxes &amp; disconnecting chamber (Disconnecting chamber applicable 3.3 kV and above)</li> <li>(a) HV Cable boxes shall be of phase segregated air insulated type &amp; shall be of sufficient size to accommodate Employer's cable &amp; termination. Phase segregation shall be achieved by insulating barriers (for 3.3 kV and above side)</li> <li>(b) Cable boxes shall have bus bars / suitable terminal connectors of adequate size &amp; bolt holes to receive cable lugs. The degree of protection of cable boxes shall per 55.</li> <li>(c) A suitable removable gland plate of non-magnetic material drilled as per the Employer's instruction shall also be provided in the cable box (d) The support from base for the cable box (for 3.3 kV and above side) shall be of galvanized iron</li> <li>(e) The contractor shall provide arthing terminals on the cable box, to suit Employer's Gl flat.</li> <li>(f) The minimum length provided for terminating 33 kV, 11KV &amp; 3.3 KV XLPE cable shall be 1000 mm (for 33 kV) 650 mm (for 3.3 kV and 11 kV) from cable gland plate to the cable lug) for the cable boxes, for 433V side suitable length shall be provided (shall be possible to move away the transformer without disturbing the cable terminations, leaving the cable box on external supports (as applicable).</li> <li>(h) Cable boxes shall have removable top cover (for transformer above 100 KVA) &amp; ample clearance shall be provided to enable either transformer or each cable to be subjected separately to high voltage test.</li> </ul>			heat white	resistant epoxy enamel e paint						
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		<ul> <li>applicable 3.3 kV and above)</li> <li>(a) HV Cable boxes shall be of phase segregated air insulated type &amp; shall be of sufficient size to accommodate Employer's cable &amp; termination. Phase segregation shall be achieved by insulating barriers (for 3.3 kV and above side)</li> <li>(b) Cable boxes shall have bus bars / suitable terminal connectors of adequate size &amp; bolt holes to receive cable lugs. The degree of protection of cable boxes shall be IP 55.</li> <li>(c) A suitable removable gland plate of non-magnetic material drilled as per the Employer's instruction shall also be provided in the cable box</li> <li>(d) The support from base for the cable box (for 3.3 kV and above side) shall be of galvanized iron</li> <li>(e) The contractor shall provide earthing terminals on the cable box, to suit Employer's GI flat.</li> <li>(f) The minimum length provided for terminating 33 kV, 11KV &amp; 3.3 KV XLPE cable shall be 1000 mm (for 33 kV) 650 mm (for 3.3 kV and 11 kV) from cable gland plate to the cable lug) for the cable boxes, for 433V side suitable length shall be provided (shall be discussed during detail engineering). The final cable size, number &amp; length of terminating XLPE cable shall be furnished during detailed engineering.</li> <li>(g) Cable boxes shall be designed such that it shall be possible to move away the transformer without disturbing the cable terminations, leaving the cable box on external supports (as applicable).</li> <li>(h) Cable boxes shall have removable top cover (for transformer above 100 KVA) &amp; ample clearance shall be provided to enable either transformer or each cable to be subjected separately to high voltage test</li> </ul>								
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CLAUSE NO	TECHNICAL SPECIFICATIONS									
2.12	FITTINGS									
	Following fittings shall be provided with Transformers covered under this sub section.									
	a) -Conservator for main tank (transformer above 100 KVA shall be provided with MOG with low oil level alarm contact), drain valve & indicating type free Cobalt free breather with transparent enclosure (maximum height 1400 mm above ground level) etc.									
	<ul> <li>b) - Buchholz relay, double float type with alarm and trip contacts, along with suitable gas collecting arrangement (Gas collecting arrangement applicable for transformer above 100 KVA).</li> </ul>									
	c) - For Auxiliary transformers below 2 MVA, diaphragm type explosion vent shall be provided.									
	<ul> <li>d) OTI &amp; WTI shall be 150 mm dial type with alarm (WTI only for transformer above 50 kVA) and trip contacts with max. reading pointer &amp; resetting device (maximum height 1500 mm above ground level).</li> </ul>									
	e) For transformer above 100 KVA: Top & bottom filter valves with threaded male adapters, bottom sampling valve, and drain valve/sludge removal valve at the bottom most point of the tank. For Transformer upto 100 KVA: common drain cum sampling cum bottom filter cum sludge									
	<ul> <li>f) Air release plug, bushing with metal parts &amp; gaskets, terminal connectors on bushings (as applicable).</li> </ul>									
	<ul> <li>g) Prismatic/toughened glass oil gauge for transformers.</li> <li>h) Bi-directional wheel/skids, M.Box, OCTC, Bushing CTs (as applicable), Insulating Oil, Cooling equipment.</li> </ul>									
	<ul> <li>i) Cover lifting eyes, transformer lifting lugs, jacking pads(jacking pad applicable for transformer above 100 KVA), towing holes and core and winding lifting lugs, inspection cover, Bilingual R&amp;D Plate, Terminal marking plates, two nos. earthing terminals etc.</li> </ul>									
	j) Bolts & nuts (exposed to atmosphere) shall be galvanized steel/SS.									
	<ul> <li>k) Rain hoods to be provided on Buchholz, MOG &amp; PRD. Entry points of wires shall be suitably sealed.</li> </ul>									
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CLAUSE NO										
	The fittings listed above are only indicative and other fittings, which generally are required for satisfactory operation of the transformers are deemed to be included.									
2.13	Tests and Inspection									
	S.N.	ROUTINE TEST	S							
	1.	All routine test s	All routine test shall be carried out in accordance with IEC $1000000000000000000000000000000000000$							
	2.	Measurement of	Voltage Ratio & phase displacement							
	3.	Measurement of IEC 60076-1)	leasurement of winding resistance on all the taps (as per , EC 60076-1)							
	4.	Vector group and	d Polarity Check							
	5.	Magnetic Balanc	e and Magnetising Current Test							
	6.	Measurement of	no load current with 415 V, 50 Hz AC	supply						
	7.	Measurement of 110% of rated vo	no load losses and current at 90%, 1 bitage	100% &	$\checkmark$					
	8.	Load Loss & S principal & Extre	Load Loss & Short Circuit Impedance Measurement on $$							
	9.	IR measurement	R measurement (As per IEC 60076-1)							
	10.	Separate Sourc test.	Separate Source Voltage Withstand Test /Applied voltage $$							
	11.	Induced overvol test.	Induced overvoltage test/Induced voltage withstand (IVW) $$							
	12.	Repeat no loac electrical test	current/loss & IR after completion	n of all	$\checkmark$					
	13.	Oil leakage test with radiators (as	on completely assembled transforme s per relevant clause of this sub section	er along on)	$\checkmark$					
	14.	Marshalling Box/ thin sheet of pa joints.	Cable box: It shall not be possible to aper under gaskets and through en	insert a closure	$\checkmark$					
	15.	IR measurement	on wiring of Marshalling Box.							
	S.N.	TYPE TESTS#		·						
	1.	Temperature Ris losses as per IS	se test at a tap corresponding to ma 2026.	aximum	$\checkmark$					
	2.	Tank Vacuum &	Pressure Test (as per CBIP norms)							
2.14	Leakag	e test on assen	nbled Oil filled Transformer (ROU		EST)					
All tank & oil filled compartment shall be tested for oil tightness by being completely filled with oil of viscosity not greater than that of specified oil at the ambient temperature & applying pressure equal to the normal pressure										
Development of 20MW Solar PV Project at Central Coalfields Limited (CCL) CHP/CPP Piparwar, Jharkhand     TECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-9296-004-9     PART-C CHAPTER-C3(B)     Page 9 of 10										

CLAUSE NO	TECHNI	CAL SPECIFICATIONS	(	एन् <b>टीपी</b> मी NTPC						
	plus 35 KN/sq. m meas maintained for a perio sweating shall occur. B urgency subjected to N	plus 35 KN/sq. m measured at the base of the tank. The pressure shall be maintained for a period of not less than 6 hours during which time no sweating shall occur. Bidder can perform this test at site depending upon urgency subjected to NTPC approval.								
2.15	Fire Fighting	Fire Fighting								
	Fire Fighting arrange applicable as per Tariff Firewall & soak pit as 10028 / IS 1646) shall b wall or 355 mm thick f However for all outdoo transformer outer edg Transformer efficiency (Technical Standards f Lines) regulation, 2010.	ements for Transformers Advisory Committee (TAC)/s applicable (as per statuar be provided of minimum 230 fire resisting brick wall subje or transformer at a distance e. A sump pit shall be p shall be as per Centra for Construction of Electrical	shall be prov statutory require ry requirement/ mm thickness ect to NTPC ap of 1.0 m (min rovided for ea I Electricity A I Plants and El	ided if ements. TAC/IS of RCC oproval. a.) from ach pit. uthority lectrical						
3.0	DRY TYPE AUXILIARY	TRANSFORMERS:								
	Dry Type Transformer shall be constructed in accordance to IS: 2026, IS: 11171 or equivalent to any other international standard, Indian Electricity Act 2003, BEE Guideline & CEA notifications. Transformer rating and all related technical parameters including tap changer (if applicable) shall be as per system requirement/SLD and relevant standards. Transformer shall be suitable for continuous indoor duty application. Transformer shall be complete & functional in all respect. The other important construction particulars shall be as below.									
	<ul> <li>a) The transformers shall be housed in a metal protective housing, having a degree of protection of IP-23. The enclosure shall be provided with suitable hardware (as required).</li> <li>b) The conductors shall be of electrolytic grade copper free from scales &amp; burrs.</li> <li>c) Dry Type Transformer windings shall be of class F insulation or better. Cooling shall be AN.</li> <li>d) The core shall be constructed from non-ageing, cold rolled, grain existence of a standard elibert of the standard el</li></ul>									
	The fittings/accessories including protection/monitoring device (temperature scanner) generally required for satisfactory operation of the transformer, are to be provided									
Development at Central CHP/CPP Pip	I     Development of 20MW Solar PV Project at Central Coalfields Limited (CCL) CHP/CPP Piparwar, Jharkhand     TECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-9296-004-9     PART-C CHAPTER-C3(B)     Page 10 of 10									

CLAUSE NO	TECHNICAL SPECIFICATIONS							
	CHAPTER-C4 : LT CABLES							
1.0	LT	POWER & CONTROL CAB	LES					
	LT Power & control ca /PVC insulated confor voltages less than equa	bles shall be of minimum 11 ming to IS 1554 / IS 7098 al to 415 V.	00 volts grade (Part-I) for util	XLPE ization				
	For cable connecting c and interconnecting tre such a manner so that Sufficient space for cat	For cable connecting central inverter and inverter transformer, no. of runs and interconnecting trench, bus bar terminations, lugs shall be provided in such a manner so that no overheating of contacts & terminals encountered. Sufficient space for cabling & termination shall be kept.						
	All standards, specifications and codes of practice referred to herein shall be the latest editions including all applicable official amendments and revisions as on date of opening of bid. In case of conflict between this specification and those (IS codes, standards, etc.) referred to herein, the former shall prevail. All the cables shall conform to the requirements of the following standards and codes:							
	IS :1554 - I PV	/C insulated (heavy duty) e orking voltages upto and inclue	lectric cables f ding 1100V.	for				
	IS : 3961 Re	commended current ratings f	or cables					
	IS : 3975 Lo an	w carbon galvanised steel wi d tapes for armouring of cable	res, formed wir	es				
	IS : 5831 PV	C insulation and sheath of ele	ectrical cables.					
	IS:7098 (Part -I) Cr sh inc	oss linked polyethylene eathed cables for working v cluding 1100V.	insulated PV oltages upto a	/C nd				
	IS:8130 Co	nductors for insulated elect xible cords.	trical cables a	nd				
	IS : 10418 Sp	ecification for drums for elect	ric cables.					
	IS : 10810 Me	ethods of tests for cables.						
	ASTM-D -2843 Sta the	andard test method for densi burning or decomposition of	ty of smoke fro plastics.	om				
	IEC-754 (Part-I) Te	sts on gases evolved durin	g combustion	of				
	IEC-332 Tests on electric cables under fire conditions. Part-3: Tests on bunched wires or cables (Category-B).							
	I X -							
Development at Central CHP/CPP Pip	of 20MW Solar PV Project Coalfields Limited (CCL) arwar, Jharkhand	TECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-9296-004-9	PART-C CHAPTER-C4	Page 1 of 8				

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2.0	LT POWER CABLES				
	The cables shall be suit and underground (burie	able for layir d) installatio	ng on racks, in di n with chances c	ucts, trenches, of flooding by w	conduits ater.
	All cables shall be flar withstand all mechanica steady state and transi this specification. If cables are to be laid u code.	All cables shall be flame retardant, low smoke (FRLS) type designed to withstand all mechanical, electrical and thermal stresses developed under steady state and transient operating conditions as specified elsewhere in his specification. f cables are to be laid underground, laying shall be as per latest relevant IS code.			
	Copper/aluminium conductor used in power cables shall have tensile strength as per relevant standards. Conductors shall be stranded.				
	XLPE insulation shall be suitable for a continuous conductor temperature of 90 deg. C and short circuit conductor temperature of 250 deg C.				
	PVC insulation shall be suitable for continuous conductor temperature of 70 deg C and short circuit conductor temperature of 160 deg. C.				
	The cable cores shall be laid up with fillers between the cores wherever necessary. It shall not stick to insulation and inner sheath. All the cables, other than single core cables, shall have distinct extruded PVC inner sheath of black colour as per IS: 5831. Single core cables shall have no Inner sheath as per IS: 7098 Part-I				vherever e cables, /C inner have no
	For single core armoured cables, armouring shall be of copper/aluminium wires/ formed wires. For multicore armoured cables, armouring shall be of galvanised steel as follows:				uminium all be of
	Calculated nominal of cable under arm	dia. our	Size and Type	of armour	
	Upto 13 mm		1.4mm dia GS	wire	
	Above 13 & upto 25	ōmm	0.8 mm thick ( 1.6 mm dia GS	GS formed wire	e /
	Above 25 & upto 40 mm 0.8mm thick GS formed wire / 2.0mm dia GS wire				e /
	Above 40 & upto 55mm 1.4 mm thick GS formed wire /2.5mm dia GS wire				
	Above 55 & upto 70 mm 1.4mm thick GS formed wire / 3.15mm dia GS wire				
	Above 70mm		1.4 mm thick (	GS formed wire	e /
Development of 20MW Solar PV Project at Central Coalfields Limited (CCL) CHP/CPP Piparwar, Jharkhand		TECHNICAL S BIDDING RE-CS-S	SPECIFICATION DOC. NO: 296-004-9	PART-C CHAPTER-C4	Page 2 of 8



	4.0 mm dia GS wire				
	The aluminium used for armouring shall be of H4 grade as per IS: 8130 with maximum resistivity of 0.028264 ohm mm <sup>2</sup> per meter at 20 deg C. The sizes of aluminium armouring shall be same as indicated above for galvanized steel.				
	The gap between armour wires / formed wires shall not exceed one armour wire / formed wire space and there shall be no cross over / over-riding of armour wire / formed wire. The minimum area of coverage of armouring shall be 90%. The breaking load of armour joint shall not be less than 95% of that of armour wire / formed wire. Zinc rich paint shall be applied on armour joint surface of GS wire / formed wire.				
	Outer sheath shall be of PVC as per IS: 5831 & black in colour for power cables. In addition to meeting all the requirements of Indian standards referred to, outer sheath of all the cables shall have the following FRLS properties.				
	(a.) Oxygen index of min. 29 (as per IS 10810 Part-58).				
	(b.) Acid gas emission of max. 20% (as per IEC-754-I).				
	(c.) Smoke density rating shall not be more than 60 % (as per ASTMD-2843).				
	Cores of the cables shall be identified by colouring of insulation. Following colour scheme shall be adopted:				
	1 core - Red, Black, Yellow or Blue				
	2 core - Red & Black				
	3 core - Red, Yellow & Blue				
	4 core - Red, Yellow, Blue and Black				
	For reduced neutral conductors (in case of power cable), the core shall be black.				
	In addition to manufacturer's identification on cables as per IS, following marking shall also be provided over outer sheath.				
	<ul> <li>(a.) Cable size and voltage grade - To be embossed</li> <li>(b.) Word 'FRLS' at every 5 metre - To be embossed</li> <li>(c.) Sequential marking of length of the cable in metres at every one metre -To be embossed / printed</li> <li>The embossing shall be progressive, automatic, in line and marking shall be legible and indelible.</li> </ul>				
Development of 20MW Solar PV Project at Central Coalfields Limited (CCL) CHP/CPP Piparwar, Jharkhand RE-CS-9296-004-9 PART-C RE-CS-9296-004-9					

CLAUSE NO	TECHNIC	AL SPECIFICATIONS		एन्टीपीसी NTPC
	All cables shall meet the IEC 332 Part-3.	e fire resistance requiremen	it as per Categ	ory-B of
	Allowable tolerances on maximum, over the decla	the overall diameter of the o ared value in the technical d	ables shall be ata sheets.	+\-2 mm
	Repaired cables shall n are not acceptable.	ot be accepted. Pimples, fis	sh eye, blow h	oles etc.
3.0	CABLE SELECTION & SIZING			
	Cables shall be sized based on the following considerations:			
	<ul> <li>(a) Rated current</li> <li>(b) The Maximut</li> <li>chapter A 2.</li> <li>(c) Short circuit</li> <li>i) Fault</li> <li>ii) Tint</li> </ul>	nt of the equipment um Overall Voltage Drop: As withstand capability t current- As per system faul ne-As per protection time subject to minimum of 0.5	s per relevant o t current. grading requ 5 sec.	elause in uirement
	This will depend on the feeder type. For a fuse protected circuit, cable should be sized to withstand the let out energy of the fuse. For breaker controlled feeder, cable shall be capable of withstanding the system fault current level for total breaker tripping time inclusive of relay pickup time.			
4.0	DERATING FACTORS			
	De rating factors for following shall be consid	various conditions of instant lered while selecting the cab	allations incluc le sizes:	ling the
	<ul> <li>a) Variation in ambient temperature for cables laid in air</li> <li>b) Grouping of cables</li> <li>c) Variation in ground temperature and soil resistivity for buried cables.</li> </ul>			or buried
	Cable lengths shall be considered in such ways that straight through cable joints are avoided.			gh cable
	Cables shall be armoured type if laid in switchyard area or directly buried. All LT power cables of sizes more than 120 sq.mm. shall be XLPE insulated.			
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CLAUSE NO	TECHNIC	CAL SPECIFICATIO	NS		एन्टीपीसी NTPC	
5.0	CONSTRUCTIONAL FI	CONSTRUCTIONAL FEATURES FOR LT POWER CABLES				
	1.1 KV grade XLPE pow conductor, XLPE insula unarmoured, PVC oute which are directly buried	wer cables shall have ted, PVC inner-shea er-sheathed conform d shall be armoured.	e compa athed (as ing to IS	cted aluminium applicable), ar 3:7098. (Part-I)	/ copper moured/ . Cables	
	1.1KV grade PVC pow (compacted type for si sheathed (as applicat conforming to IS:1554 (	ver cables shall hav zes above 10 sq.m ole) armoured/ una Part-I).	ve alumi m), PV0 rmoured	nium/copper co C Insulated, P\ , PVC outer-s	onductor /C inner heathed	
6.0	TESTS					
	Indicative list of tests/ch Quality Assurance & enclosed at relevant se	necks, Routine and A Inspection table of ction.	Acceptan LT pow	ce tests shall b er and contro	e as per I cables	
	All acceptance and ro standards shall be carr included in the equipme All cables to be supplied	utine tests as per ied out. Charges fo ent price. d shall be of type tes	the spe or these ted desig	cification and shall be deeme gn.	relevant ed to be	
	During detailed engin approval the reports of from the date of bid conducted on the equip this contract and the independent laboratory	ingineering, the contractor shall submit for Owner's ts of all the type tests carried out within last ten years bid opening. These reports should be for the test equipment similar to those proposed to be supplied under the test(s) should have been either conducted at an atory 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 last ten years from the date of bid opening, 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.			e test(s) he case dification contract sence of		
	The type test reports once approved for any projects shall be treated as reference. For subsequent projects of NTPC, an endorsement sheet will be furnished by the manufacturer confirming similarity and "No design Change". Minor changes if any shall be highlighted on the endorsement sheet.					
	The reports for following	g type tests shall be	furnished	d:		
	Conductor1.Resistance test	st				
Development of 20MW Solar PV TECHNIC Project at Central Coalfields Limited BID (CCL) CHP/CPP Piparwar, Jharkhand RE		TECHNICAL SPECIFICA BIDDING DOC. NO: RE-CS-9296-004-9	ATION	PART-C CHAPTER-C4	Page 5 of 8	

CLAUSE NO	TECHNI	CAL SPECIFICATIONS	(	एनरीपीमी NTPC	
CLAUSE NO	NO         TECHNICAL SPECIFICATIONS           SI         Type Test         Remarks           For Armour Wires / Formed Wires         2.           Measurement of Dimensions         3.           Tensile Test         4.           Resistance test         5.           Wrapping test         6.           Torsion test         For GS round           7.         Elongation test         For GS wires only.           8(a)         Mass& uniformity of Zinc Coating For GS wires only.         8(b)           8(b)         Adhesion test         For GS wires only.           8(b)         Adhesion test         For GS wires only.           8(b)         Adhesion test         For GS wires only.           9.         Test for thickness         0.           10.         Tensile strength and elongation test before ageing and after ageing         11.           11.         Ageing in air oven         12.           12.         Shrinkage test         For XLPE ins           13.         Hot set test         For PVC oute           15.         Loss of mass test         For PVC oute           16.         Hot deformation test         For PVC oute           17.         Heat shock test         For PVC oute		ks S round wires on S wire only S wires/formed v S wires/formed v S wires/formed v PE insulation on PE insulation on C outer sheath of C	vires wires wires ly ly ly only only. only. only. only. only.	
	<ul> <li>20. Smoke density to</li> <li>21. Acid gas genera</li> <li>22 Flammability tes</li> <li>Part-3 (Category)</li> <li>23 Insulation resist</li> </ul>	est For PV tion test For PV t as per IEC-332 For cor (-B) ance test (Volume	<u>C outer sheath of C outer she</u>	only only nly	
7.0	24 High voltage tes	s S			
	The cables shall be sui and under ground (buri	table for laying on racks, in d ed) installation with chances	ucts, trenches, of flooding by wa	conduits ater.	
	All cables shall be flame retardant, low smoke (FRLS) type designed to withstand all mechanical, electrical and thermal stresses developed under steady state and transient operating conditions as specified elsewhere in this specification. Conductor of control cables shall be made of stranded, plain annealed copper.				
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CLAUSE NO	TECHNI	CAL SPECIFICATIONS		एन्दीपीसी NTPC	
	Outer sheath shall be of PVC as per IS: 5831 &grey in colour for control cables. In addition to meeting all the requirements of Indian standards referred to, outer sheath of all the cables shall have the following FRLS properties.				
	(a.) Oxygen index of m	nin. 29 (as per IS 10810 Part-	·58).		
	(b.) Acid gas emission of max. 20% (as per IEC-754-I).				
	(c.) Smoke density rating shall not be more than 60 % (as per ASTMI 2843).			ASTMD-	
	Cores of the cables shall be identified by colouring of insulation. Followin colour scheme shall be adopted:			ollowing	
	1 core - Red, Blac	k, Yellow or Blue			
	2 core - Red & Bla	ick			
	3 core - Red, Yello	ow & Blue			
	4 core - Red, Yello	ow, Blue and Black			
	for control cables hav done by numbering the 1 in the inner layer (e. from 1 to 10). The numl outer surfaces of the c which shall contrast with all the cores shall be gr The numbers shall be consecutive numbers k number is a single nur number consists of two other and a dash place consecutive numbers shall	ing more than 5 cores, core insulation of cores sequentia g. say for 10 core cable, co per shall be printed in Hindu- ores. All the numbers shall in the colour of insulation. The ey only. The numerals shall be repeated at regular into peing inverted in relation to meral, a dash shall be place o numerals, these shall be d ed below the lower numeral. hall not exceed 50 mm.	ally, starting by ore numbering Arabic numeral be of the same colour of insul be legible and in ervals along the each other. We d underneath isposed one be the spacing l	shall be number shall be s on the colour, ation for ndelible. ne core, 'hen the it. If the elow the petween	
	In addition to manufac marking shall also be p	turer's identification on cable rovided over outer sheath.	es as per IS, f	ollowing	
	(a.) Cable size	and voltage grade - To be en	nbossed		
	(b.) Word 'FRLS	S' at every 5 metre - To be er	nbossed		
	(c.) Sequential one metre -	marking of length of the ca To be embossed / printed	ble in metres	at every	
	The embossing shall b be legible and indelible.	e progressive, automatic, in	line and marki	ng shall	
	All cables shall meet th IEC 332 Part-3.	ne fire resistance requiremer	nt as per Categ	ory-B of	
Development Project at C (CCL) CHP/CI	of 20MW Solar PV entral Coalfields Limited PP Piparwar, Jharkhand	TECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-9296-004-9	PART-C CHAPTER-C4	Page 7 of 8	

CLAUSE NO	TECHN	CAL SPECIF	CATIONS		एनरीपीमी NTPC	
	Repaired cables shall not be accepted. Pimples, fish eye, blow holes etc. are not acceptable.					
8.0	CABLE SELECTION 8	CABLE SELECTION & SIZING				
	Control cables shall be (a) The minimum cond (b) The minimum nu follows: No. of cable	sized based of luctor cross-s mber of spare cores in Mir cor	on the following ection shall be e cores in cor . No. of sp es	) considerations 1.5 sq.mm. htrol cables sha	: Il be as	
	5C	1				
	7C-120 14C &	above 3				
9.0		EATURES FO	OR LT CONTR	OL CABLES		
	1.1 KV Grade Control Cables shall have stranded copper conductor and shall be multicore PVC or XLPE insulated, PVC inner sheathed, armoured / unarmoured, FRLS PVC outer sheathed conforming to IS: 1554. (Part-I).					
10.0	CABLE DRUMS					
	<ul> <li>(a) Cables shall be supplied in non-returnable wooden or steel drums of heavy construction. The surface of the drum and the outer most cable layer shall be covered with water proof cover. Both the ends of the cables shall be properly sealed with heat shrinkable PVC/ rubber caps secured by 'U' nails so as to eliminate ingress of water during transportation, storage and erection. However, For Single core cables upto 6 Sq. mm size, supplier can do alternative packaging of whole Drum/Spool to eliminate ingress of water during transportation, storage and erection. Wood preservative anti-termite treatment shall be applied to the entire drum. Wooden drums shall comply with IS: 10418.</li> <li>(b) Each drum shall carry manufacturer's name, purchaser's name, address and contract number, item number and type, size and length of cable and net gross weight stenciled on both sides of the drum. A tag containing same information shall be attached to the leading end of the cable. An arrow and suitable accompanying wording shall be marked</li> </ul>					
	rolled.					
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CLAUSE NO	TECHN	ICAL SPECIFICATIONS		एनरीपीमी NTPC	
	CHAPTI	ER-C5: HT CABLES			
10					
1.0	CODES & STANDARL	5			
	All standards, specificate be the latest editions revisions as on date of specification and those former shall prevail. A the following standards	ations and codes of practice r including all applicable offi- of opening of bid. In case of e (IS : codes, standards, etc.) Il the cables shall conform t s and codes:	referred to here cial amendmer f conflict betwe referred to here o the requirem	in shall hts and en this ein, the ents of	
	IS:7098 Cross linked polyethylene insulated PVC sheathed cable for (Part -II) working voltage from 3.3 KV upto & including 33 KV.				
	IS : 3961 Recomm	ended current ratings for cab	les		
	IS : 3975 Low Carl for armouring of cables	IS : 3975 Low Carbon Galvanized steel wires, formed wires and tape for armouring of cables.			
	IS:4905 Methods	Methods for random sampling.			
	IS : 5831 PVC insu	insulation and sheath of electrical cables.			
	IS: 8130 Conductors for insulated electrical cables and flexible cords.				
	IS : 10418 Specifica	tion for drums for electric cat	oles.		
	IS: 10810 Methods	of tests for cables.			
	ASTM-D -2843 Standa burnin	FM-D -2843 Standard test method for density of smoke from the burning or decomposition of plastics.			
	ASTM-D-2863 Standa concer plastic	Indard method for measuring the minimum oxygen ncentration to support candle like combustion of stics.			
	IEC-754 (Part-I) Test on gases evolved during combustion of electric cables.				
	IEEE-383 Standard	for type test of Class IE Elec	tric Cables.		
	IEC -332 Tests on	Electric cables under fire cor	nditions.		
	Part-3 : Tests on	bunched wires or cables (cat	tegory -B)		
2.0	TECHNICAL REQUIRI	EMENTS			
	The cables shall be suitable for laying on racks, in ducts, trenches, conduits and underground (buried) installation with chances of flooding by water.				
	Cables shall be flame retardant, low smoke (FRLS) type designed to withstand all mechanical, electrical and thermal stresses develop under				
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CLAUSE NO		TECHN		IONS		एलरीपीसी NTPC
	steady sta this speci	ate and trans fication.	ient operating conc	ditions as	specified elsew	here in
	Copper/al strength a	uminium cor as per relevar	nductor used in po nt standards. Condu	ower cabl uctors sha	es shall have Il be multi stran	tensile ded.
	XLPE insulation shall be suitable for continuous conductor temperature of 90 deg. C and short circuit conductor temperature of 250 deg C. For single-core armoured cables, the armouring may constitute the metallic part of insulation screening					
	The cable cores shall be laid up with fillers between the cores wherever necessary. It shall not stick to insulation and inner sheath. All the cables, other than single core cables, shall have distinct extruded PVC inner sheath of black colour as per IS: 5831. In case of single core cables where there are both metallic screening and armouring, there shall be extruded inner sheath between them.					
	For single core armoured cables, armouring shall be of aluminum wires/formed wires. For multi core armoured cables armouring shall be of galvanized steel as follows:					ıminum ıll be of
	SI	Calculated cable under	nominal dia of armour	Size and	Type of armour	
	i)	Upto 13 mn	n	1.4mm di	a GS wire	
	ii)	Above 13 u	pto 25mm	0.8 mm th	nick GS formed w	/ire /
	iii)	Above 25 u	pto 40 mm	0.8mm th 2.0 mm d	ick GS formed w ia GS wire	ire /
	iv)	Above 40 u	pto 55mm	1.4 mm th	nick GS formed w	/ire/
	V)	Above 55 u	pto 70 mm	1.4mm th	ick GS formed w	ire /
			-	3.15mm c	dia GS wire	
	VI)	Above 70m	m	1.4 mm tr 4.0 mm d	ia GS wire	/ire /
	The aluminium used for armouring shall be of H4 grade as per IS:8130 with maximum resistivity of 0.028264 ohm-sq. mm/ mtr. at 20 deg.C. The types and sizes of aluminium armouring shall be same as indicated for galvanised steel. The gap between armour wires / formed wire shall not exceed one armour wire / formed wire space and there shall be no cross over / overriding of armour wire / formed wire. The minimum area of coverage of armouring shall be 90%. The breaking load of armour joint shall not be					S:8130 C. The ited for ed one / over- rage of not be
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	less than 95% of that applied on armour joir	less than 95% of that of armour wire / formed wire. Zinc rich paint shall be applied on armour joint surface of GS wires/formed wires.				
	Distinct extruded PV0 be provided for the ca a) For all b) For sin being use	C inner sheath of black colou bles as follows: multicore cables. Igle core armoured cables, w d as metallic screen	r as per IS:583 here armouring	a1 shall g is not		
	Outer sheath shall be the requirements of I cables shall have the	Outer sheath shall be of PVC black in colour. In addition to meeting al the requirements of Indian standards referred to, outer sheath of all the cables shall have the following FRLS properties.				
	(a) Oxygen (b) Acid gas (c) Smoke Smoke I	index of min. 29 (to ASTMD 2 s emission of max. 20% (to IEC density rating shall not be m Density Test as per ASTMD-25	863) C-754-I). nore than 60% 843.	during		
	Cores of the cables of unto 3 cores shall be identified by colouring of insulation or by providing coloured tapes helically over the cores with Red, Yellow & Blue colours.					
	In addition to manufacturer's identification on cables as per IS, following marking shall also be provided over outer sheath:			llowing		
	(a) Cable si (b) Word 'F (c) Screen current a	Cable size and voltage grade - To be embossed Word 'FRLS' at every 5 metre - To be embossed Screen Fault currentKA for Sec. (Value of current & time shall be indicated)				
	(d) Sequent one met	ial marking of length of the ca re.  -To be embossed / printed	ble in metres a I	t every		
	The embossing / printing shall be progressive, automatic, in line and marking shall be legible and indelible.			ne and		
	All cables shall meet the fire resistance requirement as per IEEE - 383 with cable installations made in accordance with 'Flammability Test' and as per Category-B of IEC 332 Part -3.					
	Allowable tolerances mm maximum over th	on the overall diameter of the declared value in the technic	e cables shall l cal data sheets	be +\-2		
	In plant repairs to the cables shall not be accepted. Pimples, fish eye, blow holes etc. are not acceptable.					
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	The cross-sectional area of the metallic screen strip/tape shall be considered in design calculations.				
	The eccentricity shall be calculated as				
	tmax -tmin x 100 t max				
	and the ovality shall be calculated as				
	dmax -dmin x 100 d max				
	Where t-max/t-min is the maximum/minimum thickness of insulation and d-max/d-min is the maximum / minimum diameter of the core.				
	The eccentricity of the core shall not exceed 10% and ovality not to exceed 2%				
	Cable selection& sizing				
	HT cables shall be sized based on the following considerations:				
	<ul> <li>a) Rated current of the equipment</li> <li>b) Maximum Fault duration current as per relevant clause in Chapter A- 2.</li> </ul>				
	De rating Factors				
	<b>De rating</b> factors for various conditions of installations including the following shall be considered while selecting the cable sizes:				
	<ul> <li>a) Variation in ambient temperature for cables laid in air</li> <li>b) Grouping of cables</li> <li>c) Variation in ground temperature and soil resistivity for buried cables.</li> </ul>				
	Cable lengths shall be considered in such a way that straight through cable joints are avoided. Cables shall be armoured type if laid directly buried.				
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3.0	CONSTRUCTIONAL F	EATURES OF 11 KV AND A	ABOVE GRADI	E	
	Cables shall conform to stranded, compacted metallic screened suita outer sheathed. The co of extruded semicond the XLPE insulation in to obtain continuously shall be "dry curing / ga	o IS: 7098 Part - II. These ca circular, aluminium conduct able for carrying the system ea onductor screen and insulation ucting compound and shall a single operation of triple ex y smooth interfaces. Method as curing".	ables shall have tors, XLPE ins arth fault currer in screen shall be applied alou xtrusion proces I of curing for	e mutli- sulated, nt, PVC both be ng with s so as cables	
	The metallic screen minimum overlap of 20 armouring shall constit	of each core shall consist of copper tape with 0%. However for single core armoured cables, the ute the metallic part of the screening.			
4.0	CABLE DRUMS	CABLE DRUMS			
	Cables shall be supp heavy construction. The layer shall be covered shall be properly sealed by 'U' nails so as to storage and erection. applied to the entire dr	lied in non-returnable wooden or steel drums of the surface of the drum and the outer most cable with water proof cover. Both the ends of the cables ed with heat shrinkable PVC/ rubber caps secured eliminate ingress of water during transportation, Wood preservative anti-termite treatment shall be um. Wooden drums shall comply with IS: 10418.			
	Each drum shall carry and contract number, i net gross weight stend same information shall arrow and suitable acc the reel indicating the o	ry manufacturer's name, purchaser's name, address item number and type, size and length of cable and ncilled on both sides of the drum. A tag containing all be attached to the leading end of the cable. An ccompanying wording shall be marked on one end of e direction in which it should be rolled.			
	The standard length the single core cables and shall be subjected to drum length. The Emp with shorter lengths. Constandard length (not length (not length), For each size supplied drum lengths, and the payment shall supplied within this lime.	ndard length for HT power cables shall be 1000 meter for all bre cables and 750 meters for 3 core cables. The length per drum subjected to a maximum tolerance of +/- 5% of the standard ngth. The Employer shall have the option of rejecting cable drum rter lengths. One drum length of each cable size can be of non a length (not less than 250 meter) so as to match the ordered For each size, the variance of total quantity, adding all the drum lengths, from the ordered quantity, shall not exceed +/-2% payment shall be made based on the actual cable length within this limit.			
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5.0	TYPE, RO	TYPE, ROUTINE AND ACCEPTANCE TESTS				
	All equipn detailed en reports of within last be for the be supplie conducted by a client	Il equipments to be supplied shall be of type tested design. During etailed engineering, the contractor shall submit for Owner's approval the eports of all the type tests as listed in this specification and carried out <i>i</i> thin last ten years from the date of bid opening. These reports should e for the test conducted on the equipment similar to those proposed to e supplied under this contract and the test(s) should have been either onducted at an independent laboratory or should have been witnessed y a client.				
	All accept standards included ir	acceptance and routine tests as per the specification and relevant andards shall be carried out. Charges for these shall be deemed to be cluded in the equipment price				
	The type test reports once approved for any projects shall be treated as reference. For subsequent projects of NTPC, an endorsement sheet will be furnished by the manufacturer confirming similarity and "No design Change". Minor changes if any shall be highlighted on the endorsement sheet.					
	All types and sizes of cables being supplied shall be subjected to type tests, routine tests and acceptance tests as specified below and according to relevant standards. The following type tests shall be carried out at no extra cost to NTPC, if the relevant reports are not available, on one cable of each size and/or design of HT Cables. Size of the cable shall be decided by the employer during detailed engineering.					
	S. No	-	Fype Test		Remarks	
			Condu	ctor		
	1.	Resistance	e test			
			For Armour Wires	/ Forme	ed Wires	
	2.	Measureme	ent of Dimensions			
	3.		st v toot	For C	2 wiroo	
	4.	Torsion tes	1 IESI †	FOI G	S round wires o	nly
	6	Wrapping	test	10100	5 Touria Wires o	iny
	7	Resistance	a test			
	8(a)	Mass & un	iformity of Zinc	For G	Swires/formed	wires
		Coating te	ests	only		WIIC3
	8(b)	Adhesion test For GS wires/formed				
				wires of	only	
			For XLPE insulation	n & PV	C Sheath	
	9.	Test for thic	ckness			
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	S. No		Type Test		Remarks		
	10.	Tensile stre	ength and				
		elongation	test before ageing				
		and after a	geing				
	11.	Ageing in a	ir oven				
	12.	Shrinkage	test			_	
	13.	Hot set tes	t	For XL	PE insulation o	only	
	14.	Water abs	sorption test	For XL	PE insulation o	only	
	15.	Loss of ma	ss test	For PV	C outer sheath	only.	
	16.	Hot deform	ation test	For PV	C outer sheath	only.	
	17.	Heat shock		For PV	C outer sheath	only	
	18.	I nermai sta	ability test	For PV	C outer sheath	oniy	
	19.	Oxygen Inc			C outer sheat	n only	
	20.	Smoke den	ISITY TEST	FORPV	C outer sheath	only	
	21.	Acia gas ge		FOIPV	C Outer sheath		
		Part 3 (Cat	ammability test as per IEC-332 For completed cable only				
	23	rail-3 (Calegoly -D)					
	23.	High voltage test					
	25 *	Partial disc	harge test				
	26 *	Bending te	st				
	27 *	Dielectric p	ower factor test				
		a) As a f	function of voltage				
		b) As a f	unction of temperatur	e			
	28.*	Heating cy	cle test	-			
	29.*	Impulse wit	thstand test				
	* Not on allo	- 	10.01/V and a schlas				
	Indicative li	ist of tests/ Assurance	checks, Routine and & Inspection table of	d Accep H.T. Ca	tance tests sh ables enclosed	all be a with th	as IIS
	chapter						
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		CHAPTER-C6				
		STALLATION METHODO	LOGY			
1.0	CODES & STANDAR	DS				
	All standards, specific be the latest editions revisions as on date specification and thos former shall prevail. standards/ codes as a	All standards, specifications and codes of practice referred to herein shall be the latest editions including all applicable official amendments and revisions as on date of opening of bid. In case of conflict between this specification and those (IS codes, standards, etc.) referred to herein, the former shall prevail. All work shall be carried out as per the following standards/ codes as applicable.				
	IS:513	Cold rolled low carbon steel s	heets and strip	S.		
	IS:802	Code of practice for the use of Structural Steel in Overhead Transmission Line Towers.				
	IS:1079	Hot Rolled carbon steel sheet	t & strips			
	IS:1239	Mild steel tubes, tubulars and other wrought steel flttings				
	IS:1255	Code of practice for installation power cables upto and include	on and mainter ing 33 KV ratine	nance of g		
	IS:1367 Part-13	Technical supply conditions fasteners. (Hot dip galvanized fasteners).	s for threade d coatings on f	d Steel threaded		
	IS:2147	Degree of protection provided voltage switchgear and control	d by enclosure: ol gear	s for low		
	IS:2309	Code of Practice for the pro allied structures against lightr	ntection of build	ding and		
	IS:2629	Recommended practice for iron & steel	hot dip galvar	nising of		
	IS:2633	Method for testing uniformit coated articles.	ty of coating	on zinc		
	IS:3043	Code of practice for Earthing				
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	IS:3063	Fasteners single coil recta	angular sectior	spring		
	IS:6745	washers. Methods for determination o on zinc coated iron & steel ar	f mass of zinc ticles.	coating		
	IS:8308	Compression type tubular i aluminium conductors of insu	n- line conneo lated cables	ctors for		
	IS:8309	Compression type tubular aluminium conductors of insu	r terminal er lated cables.	nds for		
	IS:9537	Conduits for electrical installa	tion.			
	IS:9595	Metal - arc welding of manganese steels - recomme	carbon and endations.	carbon		
	IS:13573	573 Joints and terminations for polymeric cables for working voltages from 6.6kv upto and including 33kv performance requirements and type tests.				
	BS:476 Fire tests on building materials and structures					
	IEEE:80	IEEE guide for safety in AC s	ubstation groun	ding		
	IEEE:142	Grounding of Industrial & com	nmercial power	systems		
	DIN 46267 (Part-II)	Non tension proof compression conductors.	on joints for Al	uminium		
	DIN 46329	Cable lugs for compression ,for Aluminium conductors	connections, ri	ng type		
	VDE 0278	Tests on cable terminations joints	s and straight	through		
	BS:6121	Specification for mechanic elastomers and plastic insulat	al Cable gla ted cables.	nds for		
		Indian Electricity Act.				
		Indian Electricity Rules.				
	Equipment complying IEC, BS, DIN, USA, V	with other internationally acce /DE, NEMA etc. will also be co	pted standards	such as y ensure		
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	performance and constructional features equivalent or superior to standards listed above. In such a case, the Bidder shall clearly indicate the standard(s) adopted, furnish a copy in English of the latest revision of the standards along with copies of all official amendments and revisions in force as on date of opening of bid and shall clearly bring out the salient features for comparison.				
2.0	DESIGN AND CONSTR	RUCTIONAL FEATURE			
	Inter Plant Cabling				
	Interplant cabling for r trays/buried/duct banks sand and provided w armoured	main routes shall be laid ir . In case of Duct banks, pull ith a PCC covering. All b	n Cable trench I-pits shall be fi puried cables s	es/cable lled with shall be	
	Cable Sizing Conditions All cables shall be suitably derated as per the laying conditions for carrying the required load current and fault current. For derating, the ambient temperature for directly buried cables shall be taken as 35° C and 45° C for cables laid in air.				
	All XLPE cables shall be rated at 90° C conductor temperature for AC Voltage drop calculation and 80° C for DC Voltage calculation. However, for Voltage drop calculation in DC Cable, actual conductor temperature as per loading can be used.				
	Trenches				
	PCC flooring of built up sump pits and sump pu	trenches shall be sloped for mps.	effective drain	age with	
	General				
	The cable slits to be us be sand filled & covered	sed for motor/equipment pov d with PCC after cabling.	wer/control sup	ply shall	
	Sizing criteria, derating factors for the cables shall be met as per respective chapters. However for the power cables, the minimum conductor size shall be 6 sq.mm. for aluminium conductor and 2.5 sq.mm. for copper conductor cable.				
	Conscious exceptions special conditions but s to:	to the above guidelines m suitable measures should be	ay be accepte taken at such	d under location	
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	<ul> <li>Meet all safety requirements</li> <li>Safeguard against fire hazards, mechanical damage, flooding of water, oil accumulation, electrical faults/interferences, etc</li> </ul>				
3.0	EQUIPMENT DESCRIF	TION			
	Cable trays, Fittings 8	Accessories			
	Cable trays shall be matching fittings (like etc.) accessories (like nuts, washers, G.I. stra type for power & contro	ladder/perforated type as s brackets, elbows, bends, re side coupler plates, etc. an p, hook etc.) as required. Ca l cables and perforated for in	pecified compl educers, tees, d hardware (lik able tray shall b strumentation c	ete with crosses, ke bolts, e ladder ables.	
	Cable trays, fittings and accessories shall be fabricated out of rolled mild steel sheets free from flaws such as laminations, rolling marks, pitting etc. These (including hardware) shall be hot dip galvanized as per relevant IS.				
	Cable trays shall have standard lengths of 2. fabrication of cable tray coupler plates shall be	standard width of 150 mm, 3 5 metre. Thickness of mild ys and fittings shall be 2 mm 3 mm.	300 mm & 600 steel sheets i n. The thickness	mm and used for s of side	
	Cable troughs shall be cable route. These sha thickness 2 mm and sh shall be standard width	e required for branching out all be U-shaped, fabricated all be hot dip galvanised as p of 50 mm & 75 mm with dep	few cables fro of mild steel s per relevant IS. th of 25 mm	om main heets of Troughs	
	Support System for Cable Trays				
	Cable tray support sys "Unistrut make".	tem shall be pre-fabricated	similar or equiv	valent to	
	Support system for cable trays shall essentially comprise of the two components i.e. main support channel and cantilever arms. The main support channel shall be of two types : (i) C1:- having provision of supporting cable trays on one side and (ii) C2:-having provision of supporting cable trays on both sides. The support system shall be the type described hereunder:				
	a. Cable supporting steel work for cable racks/cables shall comprise of various channel sections, cantilever arms, various brackets, clamps, floor plates, all hardwares such as lock washers, hexagon nuts, hexagon head bolt, support hooks, stud nuts, hexagon head screw, channel nut, channel nut with springs, fixing studs, etc.				
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	b. The system shall be designed such that it allows easy assembly at site by using bolting. All cable supporting steel work, hardwares fitings and accessories shall be prefabricated factory galvanised.						
	c. The main support and cantilever arms shall be fixed at site using necessary brackets, clamps, fittings, bolts, nuts and other hardware etc. to form various arrangements required to support the cable trays. Welding of the components shall not be allowed. However, welding of the bracket (to which the main support channel is bolted) to the overhead beams, structural steel, insert plates or reinforcement bars will be permitted. Any cutting or welding of the galvansied surface shall be brushed and red lead primer, oil primer & aluminium paint shall be applied						
	d. All steel components, accessories, fittings and hardware shall be hot dip galvanised after completing welding, cutting, drill ing and other machining operation.						
	e. Support system shall be able to withstand						
	<ul> <li>weight of the cable trays</li> <li>weight of the cables (75 Kg/Metre run of each cable tray)</li> <li>Concentrated load of 75 Kg between every support span.</li> <li>Factor of safety of minimum 1.5 shall be considered.</li> </ul>						
	Pipes, Fittings & Acce	ssories					
	Pipes offered shall be complete with fittings and accessories (like tees, elbows, bends, check nuts, bushings, reducers, enlargers, coupling caps, nipples etc.) The size of the pipe shall be selected on the basis of maximum 40% fill criteria						
	GI Pipes shall be of me	dium duty as per IS:1239					
	Duct banks shall be Hig each size, subject to mi	gh Density PE pipes encased nimum one) with suitable wa	d in PCC (10% ter-proof manhe	spare of oles.			
	Hume pipes shall be NF	P3 type as per IS 458					
	Junction Boxes						
	Junction Boxes with IP:55 degree of protection, shall comprise of a case with hinged door constructed from cold rolled sheet steel of thickness 2mm. Top of the boxes shall be arranged to slope towards rear of the box. Gland plate shall be 3mm thick sheet steel with neoprene/synthetic rubber						
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	dip galvanised as per columns, structures ef screws M8 earthing stu	dip galvanised as per relevant IS, and suitable for mounting on wall, columns, structures etc. The boxes shall include brackets, bolts, nuts, screws M8 earthing stud etc. required for installation.				
	Terminal blocks shall unbreakable polyamide screw-less (spring load strips shall correspond metal parts shall be of r the screw shall be c terminal blocks shall be stranded copper cond wiring shall be of minim	rminal blocks shall be 1100V grade, 10Amps rated, made up of breakable polyamide 6.6 grade. The terminals shall be screw type or rew-less (spring loaded) / cage clamp type with lugs. Marking on terminal ips shall correspond to the terminal numbering in wiring diagrams. All etal parts shall be of non-ferrous material. In case of screw type terminals e screw shall be captive, preferably with screw locking design. All minal blocks shall be suitable for terminating on each side two (2) nos. anded copper conductors of size upto 2.5 sq mm each. All internal ring shall be of minimum 1.5 sq. mm cu. Conductor PVC wire.				
	Terminations & Straight Through Joints					
	Termination and jointing kits for 33kV, 11kV, 6.6 kV and 3.3 kV grade XLPE insulated cables shall be of proven design and make which have already been extensively used and type tested. Termination kits and jointing kits shall be pre-moulded type, taped type or heat shrinkable type. 33kV, 11kV and 6.6 kV grade joints and terminations shall be type tested as per IS:13573. 3.3kV grade joints and terminations shall be type tested as per VDE0278. Critical components used in cable accessories shall be of tested and proven quality as per relevant product specification/ESI specification. Kit contents shall be supplied from the same source as were used for type testing. The kit shall be complete with the aluminium solderless crimping type cable lugs & ferrule as per DIN standard.					
	Straight through joint a fault level for the syster	nd termination shall be capa n.	ble of withstan	ding the		
	1.1KV grade Straight T	hrough Joint shall be of prove	en design.			
	Cable glands					
	Cable shall be terminated using double compression type cable glands. Cable glands shall conform to BS:6121 and be of robust construction capable of clamping cable and cable armour (for armoured cables) firmly without injury to insulation. Cable glands shall be made of heavy duty brass machine finished and nickel chrome plated. Thickness of plating shall not be less than 10 micron. All washers and hardware shall also be made of brass with nickel chrome plating Rubber components shall be of neoprene or better synthetic material and of tested quality. Cable glands shall be suitable for the sizes of cable supplied/erected.					
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	Cable lugs/ferrules	Cable lugs/ferrules				
	Cable lugs/ferrules for crimping type suitable lugs and ferrules for co lugs for control cables s the type of terminals p shall conform to relevan	power cables shall be tin for aluminium compacted co ontrol cables shall be tinned shall be provided with insulati rovided on the equipments. Int standard	ned copper so onductor cables copper type. Thing sleeve and s Cable lugs and	olderless s. Cable he cable shall suit d ferrule		
	Trefoil clamps					
	<ul> <li>Trefoil clamps for single core cables shall be pressure die cast aluminum or fibre glass or nylon and shall include necessary fixing accessories like G.I. nuts, bolts, washers, etc. Trefoil clamps shall have adequate mechanical strength to withstand the forces generated by the peak value of maximum system short circuit current.</li> <li>Cable Clamps &amp; Straps</li> <li>The cable clamps required to clamp multicore cables on vertical run shall be made up of Aluminium strip of 25x3 mm size. For clamping the multicore cables, self-locking, de-interlocking type nylon clamps/straps shall be used. The clamps/straps shall have sufficient strength and shall not get affected by direct exposure to sun rays and outdoor environment</li> </ul>					
	Receptacles					
Receptacles Receptacles boxes shall be fabricated out of MS sheet of 2mm thicknes and hot dipped gavanised or of die-cast aluminium alloy of thickness r less than 2.5 mm. The boxes shall be provided with two nos. earthin terminals, gasket to achieve IP55 degree of protection, terminal blocks of loop-in loop-out for cable of specified sizes, mounting brackets suitable for surface mounting on wall/column/structure, gland plate etc. The ON-OI switch shall be rotary type heavy duty, double break,AC23 catego suitable for AC supply. Plug and Socket shall be shrouded Die-ca aluminium. Socket shall be provided with lid safety cover. Robu mechanical interlock shall be provided such that the switch can be put C 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 th switch is in OFF position. Wiring shall be carried out with 1100 V gra PVC insulated stranded aluminium/copper wire of adequate size. T Terminal blocks shall be of 1100 V grade. The Terminal blocks shall be 1100 V grade made up of unbreakable polymide 6.6 grade with adequate current rating and size. The welding receptacles shall be provided w inbuilt ELCB rated for suitable mA sensitivity.				hickness hess not earthing locks for table for ON-OFF category, Die-cast Robust e put ON hy when then the V grade ze. The hall be of idequate ded with		
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	Galvanising					
	Galvanising of steel co , IS4759 & IS:2633. smooth, continuous and	mponents and accessories s Additionally galvanising sh d free from acid spots.	hall conform to nall be uniforn	IS:2629 n, clean		
	The amount of zinc dep washers shall be as pe portion of components shall have the required	oosit over threaded portion of er IS:1367 . The removal of shall be carefully done to e zinc coating on them as spec	bolts, nuts, scr extra zinc on t ensure that the cified	rews and threaded threads		
	Welding					
	The welding shall be on procedures and welder with IS:9595	welding shall be carried out in accordance with IS:9595. All welding edures and welders qualification shall also be followed strictly in line IS:9595				
4.0	INSTALLATION					
	<ul> <li>Cable tray and Support System Installation</li> <li>Cables shall run in cable trays mounted horizontally or vertically on cable tray support system which in turn shall be supported from floor, ceiling, overhead structures, trestles, pipe racks, trenches or other building structures.</li> <li>Horizontally running cable trays shall be clamped by bolting to cantilever arms and vertically running cable trays shall be bolted to main support channel by suitable bracket/clamps on both top and bottom side rails at an interval of 2000 mm in general. For vertical cable risers/shafts cable trays shall be supported at an interval of 1000mm in general. Fixing of cable trays to cantilever arms or main support channel by welding shall not be accepted. Cable tray installation shall generally be carried out as per the approved guidelines/ drawings. Vendor shall design the support system along with tray. spacing etc in line with relevant standard.</li> </ul>					
	The cantilever arms sha minimum vertical spaci	all be positioned on the main ng of 300 mm unless otherwi	support chann se indicated.	el with a		
	The contractor shall fix the brackets/ clamps/ insert plates using anchor fasteners. Minimum size of anchor fasteners shall be M 8 X 50 and material shall be stainless steel grade 316 or better. Anchor fastener shall be fixed as recommended by manufacturer and as approved by site engineer. For brick wall suitable anchor fasteners shall be used as per the					
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	recommendations of manufacturer. Make of anchor fasteners subject to QA approval.					
	All cable way sections way layout drawings a where there is a branch of letter shall be not identification shall be painted/stenciled with in	shall have identification, deand nd painted/stenciled at each h connection to another cabl less than 75 mm. For long ainted at every 10 meter. Ris dentification numbers at every	signations as p end of cable e way. Minimur g lengths of tr ers shall additio y floor.	er cable way and m height ays, the onally be		
	In certain cases it ma supports and other no trays, supports and acc trays, supports and acc shall be neat in appear in the dimensions. The one coat of oil primer fo	certain cases it may be necessary to site fabricate portions of trays, upports and other non standard bends where the normal prefabricated ays, supports and accessories may not be suitable. Fabricated sections of ays, supports and accessories to make the installation complete at site nall be neat in appearance and shall match with the prefabricated sections the dimensions. They shall be applied with one coat of red lead primer, ne coat of oil primer followed by two finishing coats of aluminium paint.				
	Conduits/Pipes/Ducts Installation					
	The Contractor shall ensure for properly embedding conduit pipe sleeves wherever necessary for cabling work. All openings in the floor/ roof/ wall/ cable tunnel/ cable trenches made for conduit installation shall be sealed and made water proof by the Contractor <b>either with any proven fire</b> <b>sealing system rated for one hour or</b> Modular multi-diameter cable sealing system consisting of frames, blocks, Compression wedge and its accessories. The Cable sealing system should have been tested for fire insulation for min. 1 hr as per BS 476 and shall also provide water sealing. System shall be anti- rodent and anti- termite					
	GI pull wire of adequate Metallic conduit runs required for junction bo	e size shall be laid in all cond at termination shall have tw xes etc.	duits before ins vo lock nuts v	tallation. vherever		
	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 spacing between the supports as given below, unless specified otherwise.					
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	Conduit /pipe size (dia	a). Spacing			
	Upto 40 mm	1 M			
	50 mm	2.0 M			
	65-85 mm	2.5 M			
	100 mm and above	3.0 M			
	For bending of conduits, bending machine shall be arranged at site by the contractor to facilitate cold bending. The bends formed shall be smooth.				
	Junction Boxes Installation				
	Junction boxes shall be mounted at a height of 1200mm above floor level or as specified in the drawings and shall be adequately supported/mounted on masonry wall by means of anchor fasteners/ expandable bolts or shall be mounted on an angle, plate or other structural supports fixed to floor, wall, ceiling or equipment foundations.				
	Cable Installation				
	Cable installation shall standards.	be carried out as per IS:12	255 and other a	oplicable	
	For Cable unloading, <sub>I</sub> general :	pulling etc following guideli	nes shall be fol	lowed in	
	• Cable drums shall be unloaded, handled and stored in an approved manner on hard and well drained surface so that they may not sink. In no case shall be drum be stored flat i.e. with flange horizontal. Rolling of drums shall be avoided as far as possible. For short distances, the drums may be rolled provided they are rolled slowly and in proper direction as marked on the drum. In absence of any indication, the drums may be rolled in the same direction as it was rolled during taking up the cables. For unreeling the cable, the drum shall be mounted on suitable jacks or on cable wheels and shall be rolled slowly so that cable comes out over the drum and not from below. All possible care shall be taken during unreeling and laying to avoid damage due to twist, kink or sharp bends. Cable ends shall be provided with sealed plastic caps to prevent damage and ingress of moisture.				
	While laying cable, g     to avoid cable touc	ground rollers shall be used hing ground. The cables s	at every 2 mete <u>hall be pu</u> shed	r interval over_the	
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	rollers by a gang o shall not be pulled arrangements. Pu recommended by o each run shall be joints. Care should damage to cables. I repaired or changeo	of people positioned in betwo from the end without havin illing tension shall not cable manufacturer. Selection so planned so as to avoid be taken while laying the f any particular cable is dama to the satisfaction of Project	een the rollers g intermediate exceed the on of cable dr using straight cables so as aged, the same Manager.	Cables pushing values rums for through to avoid shall be	
	Cables shall be laid on cable trays strictly in line with cable schedule				
	Power and control cables shall be laid on separate tiers in line with approved guidelines/drawings. The laying of different voltage grade cables shall be on different tiers according to the voltage grade of the cables. In horizontal tray stacks, H.T. cables shall be laid on topmost tier and cables of subsequent lower voltage grades on lower tiers of trays. Single core cable in trefoil formation shall be laid with a distance of four times the diameter of cable between trefoil center lines and clamped at every two meter. All multi core cables shall be laid in touching formation. Power and control cables shall be secured fixed to trays/support with self-locking type nylon cable straps with de-interlocking facilities. For horizontal trays arrangements, multi core power cables and control cables shall be secured at every five meter interval. For vertical tray arrangement, individual multi core power cables and control cables shall be secured at every five meter interval. For vertical tray arrangement, individual multi core power cables and control cables shall be secured at every five meter interval. For vertical tray arrangement, individual multi core power cables and control cables shall be secured at every one meter by nylon cable strap. After completion of cable laying work in the particular vertical tray, all the control cables shall be binded to trays/supports by aluminium strips at every five meter interval and at every bend.				
	Bending radii for cable and IS: 1255.	s shall be as per manufactu	irer's recomme	ndations	
	Where cables cross ro HDPE pipe.	ads/rail tracks, the cables sha	all be laid in hu	me pipe/	
	No joints shall be allowed in trip circuits, protection circuits and CT/PT circuits. Also joints in critical equipment in main plant area shall not be permitted. Vendor shall identify and accordingly procure the cable drum length.				
	In each cable run some extra length shall be kept at suitable point to enable one LT/two HT straight through joints to made, should the cable develop fault at a later stage. Control cable termination inside equipment enclosure shall have sufficient lengths so that shifting of termination in terminal blocks can be done without requiring any splicing.				
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	Wherever few cables a be used.	re branching out from main t	runk route troug	ghs shall
	Wind loading shall be o wherever required.	considered for designing sup	port as well Ca	ble trays
	Where there is a considerable risk of steam, hot oil or mechanical damage cable routes shall be protected by barriers or enclosures.			damage
	The installation work shall be carried out in a neat workman like manner & areas of work shall be cleaned of all scraps, water, etc. after the completion of work in each area every day. Contractor shall replace RCC/Steel trench covers after the Installation work in that particular area is completed or when further work is not likely to be taken up for some time.			anner & mpletion el trench leted or
	Separation			
	At least 300mm clearance shall be provided between:			
	<ul> <li>HT power &amp; LT power cables,</li> <li>LT power &amp; LT control/instrumentation cables,</li> </ul>			
	Minimum number of spare cores required to be left for interconnection in control cables shall be as follows:			ection in
	No. of cores in ca	ble No. of spare core	es	
	2C,3C	NIL		
	5C	1		
	7C-10C	2		
	14C and above Directly Buried Cables	3 5		
	• Cable trenches shall be constructed for directly buried cables. Construction of cable trench for cables shall include excavation, preparation of sieved sand bedding, riddled soil cover, supply and installation of brick or concrete protective covers, back filling and compacting, supply and installation of route markers and joint markers. Laying of cables and providing protective covering shall be as per IS:1255.			
	<ul> <li>RCC cable route a required. The voltage be engraved on the</li> </ul>	nd RCC joint markers shall ge grade of the higher voltage marker. Location of underge	be provided v ge cables in ro round cable joi	vherever ute shall nts shall
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	be indicated with o Joint". The marker spaced at an interv They shall be loca crossings. Top of o accumulation of wat	ed with cable marker with an additional inscription "Cable marker shall project 150 mm above ground and shall be an interval of 30 meters and at every change in direction. be located on both sides of road crossings and drain Top of cable marker/joint marker shall be sloped to avoid on of water/dust on marker.			
	Cable tags shall be pro the equipment enclosur duct/conduit entry, and tags shall also be pro- control and relay pane through a gland plate. cables and control cabl number punched on it two turns of 20 SWG Contractor may also pr with cable number heat	Cable tags shall be provided on all cables at each end (just before entering the equipment enclosure), on both sides of a wall or floor crossing, on each duct/conduit entry, and at every 20 meters in cable tray/trench runs. Cable tags shall also be provided inside the switchgear, motor control centers, control and relay panels etc. where a number of cables enter together through a gland plate. Cable tag shall be of rectangular shape for power cables and control cables. Cable tag shall be of 2 mm thick aluminum with number punched on it and securely attached to the cable by not less than two turns of 20 SWG GI wire conforming to IS:280. Alternatively, the Contractor may also provide cable tags made of nylon, cable marking ties with cable number heat stamped on the cable tags			
	While crossing the floors, unarmoured cables shall be protected in conduits upto a height of 500 mm from floor level if not laid in tray.				
	Cable Terminations & Connections				
	The termination and connection of cables shall be done strictly in accordance with cable termination kit manufacturer" instructions, drawings and/or as directed by Project Manager. Cable jointer shall be qualified to carryout satisfactory cable jointing/termination. Contractor shall furnish for review documentary evidence/experience reports of the jointers to be deployed at site. Work shall include all clamps, fittings etc. and clamping, fitting, fixing, plumbing, soldering, drilling, cutting, taping, preparation of cable end, crimping of lug, insulated sleeving over control cable lugs, heat shrinking (where applicable) connecting to cable terminal shorting and grounding as				
required to complete the job to the satisfaction of the Project Manager. The equipment will be generally provided with undrilled gland plates for cables/conduit entry. The Contractor shall be responsible for punching of gland plates, painting and touching up. Holes shall not be made by gas cutting. The holes shall be true in shape. All cable entry points shall be sealed and made vermin and dust proof. Unused openings shall be effectively sealed by 2mm thick aluminium sheets.				jer. lates for ching of by gas shall be shall be	
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	Control cable cores en panels shall be neatly nylon cable ties with de	tering control panel/switchge bunched, clamped and tied interlocking facility to keep th	ear/MCC/misce I with self-lock nem in position	llaneous ing type
	All the cores of the cor by providing ferrules indelible, printed single number and TB numbe the core. Spare cores s along with cable numbe	ntrol cable to be terminated s at either end of the core, e tube ferrule and shall incl er as per the drawings. The fe shall have similar ferrules wit ers and coiled up after end se	shall have iden each ferrule ude the compl errule shall fit ti h suffix sp1, sp aling.	tification shall be ete wire ghtly on 52,etc
	All cable terminations s reliable connections.	hall be appropriately tightene	ed to ensure see	cure and
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	СНА	PTER-C7: SCADA		
1.0	GENERAL			
1.1	Contractor shall provide auxiliaries and associan reliable operation of en	de complete SCADA syster ted equipment and cables fo tire plant and its auxiliary sys	n with all acc or the safe, effic tems.	essories, cient and
1.2	Bidder shall include in his proposal all the Hardware, Software, Panels, Power Supply, HMI, Laser Printer, Gateway, Networking equipment and associated Cable etc. needed for the completeness even if the same are not specifically appearing in this specifications.			
1.3	SCADA System shall h	ave the provision to perform	the following fu	nctions:
	i) Remote control	of all the HT Breakers either	in hard or soft s	signal.
	ii) Remote contro requirement me	I of Inverter active and r ntioned in respective chapter	eactive power	as per
	iii) SCADA shall also be able to acquire, display and store real time data, status and alarm signal from following equipment included but not limited to as required or offered under the scope of this specification:			real time uded but e of this
	a) All the H <sup>-</sup> b) Incomer a c) Power co d) UPS and respectiv e) Weather	F Switchgear/RMU equipmen and bus coupler breaker of L onditioning unit (PCU) I Battery charger as per rec e chapter Monitoring Equipment	ts T Panel. quirement men	tioned in
	f) TEM/AB time sync	F/MFM meter, numerical relay chronization unit and transform	y, fire alarm pai mer.	nel, GPS
	g) SCADA H	Hardware, Accessories and C	communication	link
	h) Any othe	r equipment required as per s	specification	
	iv) Display of status of major equipment in Single Line/Mimic Diagram. Mimic Diagram colour shall comply to IS 11954: Guide for colour coding of electrical mimic diagrams			
	v) Display and stor	rage of derived/calculated/inte	egrated values	
	vi) Generate, store SCADA shall ha	e and retrieve user configutive facility to generate report	arable periodic in MS Excel file	reports. type.
	vii) Remote monito using popular	ring of essential parameter web browser without req	s of plant on uirement of a	the web additional
Development at Central CHP/CPP Pip	software. Same of 20MW Solar PV Project Coalfields Limited (CCL) arwar, Jharkhand	Shall be authorised with use TECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-9296-004-9	r Id and passwo PART-C CHAPTER-C7	Ord USING Page 1 of 23

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	standard modem be changed by transferring data NTPC Site for O	<ul> <li>User ID and password fo</li> <li>SCADA Administrator. Ir</li> <li>to web shall be taken by Co</li> <li>M period.</li> </ul>	r remote view on ternet connect ontractor in the	can only tion for name of
	Please refer Ch Remote monitori	napter- A2 for Nos. of Weing, Nos. of OWS/EWS/Histor	eb Client Licer rian with location	nses for on.
	viii)Performing self-r	nonitoring and diagnostic fun	ctions	
1.4	The contractor shall p synchronized with the (RTC) with time synchro SCADA shall be synch with GPS Clock. The elsewhere in the specifi	provide at least one GPS SCADA system. All devices pnization facility which are co ronized with GPS Clock thro technical details of GPS cation	clock, which s having real-tin ommunicating w ugh SCADA or have been s	shall be ne clock rith plant directly specified
1.5	Type of signal from e specification of the eq approved during detail e	equipment (Hard wired or uipment mentioned in the r engineering.	Soft) shall be respective chap	as per oter and
1.6	SCADA shall provide r 61724 standard. In case codes, standards, etc.)	eal time performance monite of conflict between this spe referred to herein, the former	oring according cification and th shall prevail.	to IEC nose (IS
1.7	The control system shall provide safe operation under all plant disturbances and on component failure so that under no condition the safety of plant, personnel or equipment is affected. Control system shall be designed to prevent abnormal swings due to loss of Control System power supply, failure of any Control System component, open circuit/short circuit. On any of these failures the controlled equipment/parameter shall either remain in last position before failure or shall come to fully open/close or on/off state as required for the safety of plant/personnel/equipment and as finalized during detailed engineering. System shall be designed such that there will be no upset when power is restored. These operation shall be demonstrated by vendor during Factory Accepted Test (FAT) in the			
1.8	Contractor shall provide load requirement in SC/ module, Ethernet switch area shall be suitable t minimum.	a Package/Split AC of suital ADA Main control/CMCS room nes and network accessories for operating in ambient ten	ble capacity dea m. All the powe for non-air cor nperature of 50	cided by r supply iditioned Deg C
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2.0	SCADA CONTROLLER	SYSTEM:		
2.1	The SCADA at Main co per specification given Room, PLC/ IO modules	ontrol /CMCS room shall be hereunder. For other loca s/RTUs are acceptable.	of PLC/DCS b tions such as	ased as Inverter
	Main control /CMCS ro	om SCADA shall have the	following feat	ure:
	<ul> <li>Facility for impler and annunciation</li> </ul>	<ul> <li>Facility for implementation of all logic functions for control, protection and annunciation of the equipment and systems.</li> </ul>		
	<ul> <li>ii) Main control /C processors (main operation and o processor, there the hot standby operation automa processor shall b disturbance what system shall reve of the processor shall b processor.</li> <li>iii) The memory shall</li> </ul>	MCS room SCADA shall n processing unit and mem- ne as hot standby. In case shall be an appropriate ala processor shall take over atically. The transfer from ma- be totally bump less and sha soever. In the event of both ert to fail safe mode. It shall be rs as master and other as e updated in line with the char of the field expandable. The	be provided v ories), one for e of failure of rm and simulta er the complet in processor to all not cause a processors fai be possible to k standby. The anges made in	vith two normal working aneously te plant standby ny plant ling, the eep any standby working
	be sufficient for the for at least 20 <sup>o</sup> sequences and o memories like EF buffer battery ba lithium or Ni-Cd t	The memory shall be field expandable. The memory capacity shall be sufficient for the complete system operation and have a capability or at least 20% expansion in future. Programmed operating sequences and criteria shall be stored in nonvolatile semiconductor memories like EPROM. All dynamic memories shall be provided with buffer battery backup for at least 360 hours. The batteries shall be ithium or Ni-Cd type.		
	iv) A forcing facility and outputs, tim testing requireme during operation	shall be provided for changi ers and flags to facilitate f ents. It shall be possible to of the program.	ing the states of fault finding ar display the sig	of inputs nd other nal flow
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3.0	DATA COMMUNICATIO	N SYSTEM (DCS)		
	The Data Communication Bus with hot back-up. C bus, I/O bus etc shall be be non-redundant.	on System shall include a ro Other applicable bus system e redundant except for back	edundant Main s like cubicle b plane buses wl	System us, local hich can
	The DCS shall have the	following minimum features:		
	<ul> <li>Redundant comm the communicatio PLCs and betwee</li> </ul>	nunication controllers shall on between I/O Modules (inc on PLCs and operator work s	be provided to cluding remote station.	handle I/O) and
	ii) The design shall shall ensure that no more than a s shall automatically of any station/mod loss of any co station/module.	The design shall be such as to minimize interruption of signals. It shall ensure that a single failure anywhere in the media shall cause to more than a single message to be disrupted and that message shall automatically be retransmitted. Any failure or physical removal of any station/module connected to the system bus shall not result in the pass of any communication function to and from any other station/module.		
	iii) If the system bus employ redundan facility	stem bus requires a master bus controller philosophy, it shal redundant master bus controller with automatic switchover		
	iv) Built-in diagnosti Communication e provided at all le changeover to th completely bum alarmed/logged.	agnostics shall be provided for easy fault detection ation error detection and correction facility (ECC) shall be t all levels of communication. Failure of one bus an r to the standby system bus shall be automatic ar bump less and the same shall be suitab aged.		etection. shall be ous and atic and suitably
	<ul> <li>v) The design and ir environmental cor</li> </ul>	nstallation of the system buinditions as applicable.	s shall take car	re of the
	vi) Data transmitting the system in tern shall be available	speed shall be sufficient to ns of displays, control etc. p for future expansion	meet the respo lus 25% spare	onses of capacity
	vii) Cat 6 UTP or fiber	r optic cables shall be emplo	oyed.	
	viii)The Contractor s system like comm	shall furnish details regardi nunication protocol, bus utiliz	ng the commu ation calculatio	inication ns etc.
	ix) Contractor shall setup Gigabit Ethernet based Plant Local Area Netowrk (LAN) to connect to different communication nodes at Inverter /Switchgear location etc. with redundant backbone using ring or better topology. Each Modbus cable shall be provided with Surge protection device at SCADA Panel End. Specification of OFC and Modbus cable has been given elsewhere in this specification.			al Area odes at le using ded with of OFC ation.
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4.0	HUMAN MACHINE INT	ERFACE SYSTEM (HMIS)		
	i) HMIS configured with open archite	around latest state-of-the a cture supporting OPC /TCP/	rt servers/Work P protocols, etc	stations c.
	ii) The SCADA sha OPC-DA 2.05a s All data should b	II be OPC version 2.05a com server as per the specifications of the specification of the spec	pliant and impl on of OPC Fou C server.	ement a ndation.
	iii) For communicat SCADA system <b>NTPC on OPC</b> furnished during	ing the generation data o shall be interfaced/ connec <b>Protocol.</b> The details of NT the detailed engineering.	f plant in NT sted with <b>PI se</b> PC PI server	PC, the erver of shall be
	iv) Graphical Interfa perform control, equipment's conr	ce Unit (GIU) / Operator wo monitoring and operation (a nected with SCADA system.	ork station (OW as applicable) f	/S) shall or plant
	v) Engineering work both for controlle EWS as program System.	workstation (EWS) shall work as a programming station troller and SCADA. It shall be possible to use same gramming station and the Human Machine Interface		
	vi) SCADA System shall be able to operating condit failure/hardware	A System shall be provided with redundant OWS. Operato e able to access all control/information related data under al ng conditions including a single processor and compute hardware failure at CMCS in the HMIS.		
	vii) In addition to a dedicated portab	desktop based EWS, ven le <b>(laptop)</b> based EWS.	dor shall also	provide
	viii)All frequently ca shall be assigned the convenience operator function	y called important functions including major displays gned to dedicated function keys on a soft keyboard for nce of the operator for quick access to displays & other tions.		displays oard for & other
	ix) The mimic shall l control, monitor a	be configured on the HMI an and operate the plant from the	d it shall be po e same.	ssible to
	x) The SCADA System shall have ability to perform operator functions for each OWS / GIU as a minimum, include Control System operation (A/M selection, raise/lower, set point/bias change, on/off, open/close operation, mode/device selection, bypassing criteria, sequence auto, start/stop selection, drive auto selection, local- remote/other multi-position selection etc.); alarm acknowledge; call all kind of displays, logs, summaries, calculation results, etc.; printing of logs & reports; retrieval of historical data; and any other functions			unctions System e, on/off, criteria, n, local- dge; call printing unctions
Development Project at C (CCL) CHP/CI	of 20MW Solar PV entral Coalfields Limited PP Piparwar, Jharkhand	TECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-9296-004-9	PART-C CHAPTER-C7	Page 5 of 23

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	required for smo as finalized durin	required for smooth operation, control & management of information as finalized during detailed engineering.			
	xi) The display select display can be Navigation from efficiently throug defined on the di such targets.	<ul> <li>xi) The display selection process shall be optimized so that the desired display can be selected with the minimum no. of operations. Navigation from one display to any other should be possible efficiently through paging soft keys as well as through targets defined on the displays. There should be no limitation on number of such targets.</li> <li>xii) The display selection process shall be optimized so that the desired display can be selected with the minimum no. of operations. Navigation from one display to any other should be possible efficiently through paging soft keys as well as through targets display can be selected with the minimum no. of operations. Navigation from one display to any other should be possible efficiently through paging soft keys as well as through targets defined on the displays. There should be no limitation on number of such targets.</li> </ul>			
	xii) The display select display can be Navigation from efficiently throug defined on the di such targets.				
	xiii)The system shall certain functions password contro use of these func fields shall be on contain various Employer during no. of users in a by the programm	xiii)The system shall have built-in safety features that will allow/disallow certain functions and entry fields within a function to be under password control to protect against inadvertent and unauthorized use of these functions. Assignment of allowable functions and entry fields shall be on the basis of user profile. The system security shall contain various user levels with specific rights as finalized by the Employer during detailed engineering. However, no. of user levels, no. of users in a level and rights for each level shall be changeable by the programmer (Administrator).			
	xiv)Wherever Graphical Interface Unit is envisaged, it shall meet the minimum functional requirements of monitoring, operating & controlling the process and displaying information related to process locally. GIU shall be provided with TFT active matrix or LED display and keypad for operation. GIU shall be ruggedly designed to withstand hard environments like high temperature, shock and vibration			neet the ating & process display gned to ock and	
	xv) In addition to G provided at SCAI	GUI Display, <b>one 50 Inch</b> DA Room.	LED display	shall be	
	xvi)Bidder has to provide suitable hardware DMZ network firewall to restrict unauthorized access to HMI/ SCADA system. Details specification of hardware firewall is provided elsewhere in the specification.				
	xvii) SCADA shall h and statistical d	ave facility to provide real ti ata through SMS and e-mails	me reporting o S.	f alarms	
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	xviii) Programming of programming of interface and shall	of the PLC Processor/co HMIS shall be user friend not require knowledge of an	ontroller as v ly with graphic y specialized la	well as cal user nguage.		
	xix) The programmin data base, mimic be possible throu	ng of HMIS (like development and modification of es, logs / reports, HSR functionalities etc.) shall also igh user-friendly menus etc. functionalities shall be password protected to avoid dification. <b>CTIONALITIES</b> PLC Processor/controller as well as programming of				
	xx) All programming unauthorized mo					
5.0	PROGRAMMING FUNC	CTIONALITIES				
	Programming of the PLC Processor/controller as well as programming of HMIS shall be user friendly with graphical user interface and shall not require knowledge of any specialized language. For example, the programming of PLC shall use either of the following:					
	<ul> <li>Flow-chart or block logic representing the instructions graphically</li> <li>Ladder diagrams</li> </ul>					
	The programming of HMIS (like development and modification of data base, mimics, logs / reports, HSR functionalities etc.) shall also be possible through user-friendly menus etc.					
	All programming functionalities shall be password protected to avoid unauthorized modification.					
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6.0	SOFTWARE REQUIRE	REQUIREMENT		
	i) All necessary softwork operator station disprequirement shall be languages as far a documentation and Employer to carry out	ware required for implement plays / logs, storage & retriev e provided. The programs s s possible. The contractor program listing so that ut modification at a later date	tation of contr val and other fu shall include hi shall provide s it is possible	ol logic, inctional gh level sufficient for the
	<li>ii) The Contractor sha meeting the intent specification.</li>	e Contractor shall provide all software required by the system f eting the intent and functional/parametric requirements of the ecification.		stem for of the
	<li>iii) Industry standard op to ensure openness</li>	standard operating system like WINDOWS (latest version) etc e openness and connectivity with other system in industry.		
	iv) SCADA system sha minimum:	stem shall include the following standard protocols as a		
	a) Modbus (TCF	a) Modbus (TCP/IP, RTU, ASCII).		
	b) Sub Station F	b) Sub Station Protocol (IEC-61850 and IEC 60870 -5-101/104).		
	Any other protocol on which the offered equipment (by Contractor) we communicate with SCADA			ctor) will
	<ul> <li>v) The system shall ha user interface.</li> </ul>	The system shall have user friendly programming language & graphic user interface. All system related software including Real Time Operating System, File management software, screen editor, database management software, On line diagnostics/debug software, peripheral drivers software and atest versions of standard PC-based software, Antivirus software and atest WINDOWS based packages (MS Word, Excel and PowerPoint) etc. and any other standard language offered shall be furnished as a minimum		
	vi) All system related so management softwa On line diagnostics latest versions of st latest WINDOWS b etc. and any other minimum.			
	vii) All application software for SCADA system functioning like input scanning, acquisition, conditioning processing, control and communication and software for operator interface of monitors, displays, trends, curves, bar charts etc. Historical storage and retrieval utility, and alarm functions shall be provided.			e input ol and nonitors, retrieval
	viii) The Contractor shall provide software locks and passwords to Employer's engineers at site for all operating & application software so that Employer's engineers can take backup of these software and are able to do modifications at site			ords to ware so and are
	ix) The Contractor sha used in Contractor's	all provide software license s System. The software lice	for all softwar nses shall be p	re being provided
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	<ul> <li>for the project (e.g. organization or site license) and shall not be hardware/machine-specific. That is, if any hardware/machine is upgraded or changed, the same license shall hold good and it shall not be necessary for Employer to seek a new license/renew license due to up gradation/change of hardware/machine in Contractor's System at site. All licenses shall be valid for the continuous service life of the plant.</li> <li>x) All the SCADA Software with license Key shall be handed over to NTPC on the DVD/CD media. All the hardware and software shall be licensed to NTPC.</li> </ul>				
7.0	PARAMETRIC REQUIREMENTS				
	The control system shall be designed such that under worst case loadi conditions the response time shall not be worse than the following:-	ng			
	<ul> <li>i) On/Off Command:- The response time for screen update after t execution of the control command from the time the command issued shall be one second (excluding the drive actuation time).</li> </ul>	he is			
	ii) Adjustment Command:- 0.5 to 1 second.				
	iii) On screen Updating and All Control related displays:- 1 second.				
	iv) Bar Chart displays, Plant Mimic displays, Group review displays, X-T Plot Displays and Plant Summary Displays :- 1 to 2 seconds.				
	<ul> <li>v) All the Analog data shall be scanned at the resolution of 1(one) second and refreshed on screen however, recording of data shall be as finalized during detail engineering.</li> </ul>				
8.0	INPUT/OUTPUT MODULES				
	<ul> <li>The SCADA system should be designed according to the location the input/output cabinets as specified.</li> </ul>	of			
	<ul> <li>ii) Input Output modules, as required in the Control System for all type of field input signals (4-20 mA, non-changeover/change over type of contact inputs etc.) and outputs from the control system (non changeover/change over type of contact, output signals for energizing interface relays at suitable DC voltage as decided during detail engineering, 4-20 mA output etc.) are to be provided by the Contractor</li> </ul>				
	<ul> <li>iii) Electrical isolation of 1.5kV with optical couplers between the plant input/output and controller shall be provided on the I/O cards. The isolation shall ensure that any inadvertent voltage or voltage spikes (as may be encountered in a plant of this nature) shall not damage or mal-operate the internal processing equipment.</li> </ul>				
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	iv) The Input/output stages. The indications on the status.	iv) The Input/output system shall facilitate modular expansion in fixed stages. The individual input/output cards shall incorporate indications on the module front panels for displaying individual signal status.				
	<ul> <li>v) Individually fused be provided. Al indicator.</li> </ul>	d output circuits with the blow I input/output points shall b	wer fuse indica e provided wit	tor shall h status		
	vi) The I/O Module	shall have the following featu	res:			
	a) Power supply	monitoring.				
	b) Contact boun	ce filtering.				
	c) Optical isola internal circui	tion between input and oເ ts	utput signals v	with the		
	d) In case of p outputs shall fail-safe mode	d) In case of power supply failure or hardware fault, the critical outputs shall be automatically switched to the fail-safe mode. The fail-safe mode shall be finalized during detailed engineering.				
	vii) Binary Output modules shall be rated to switch ON/OFF coupling relays of approx. 3 VA. Analog output modules shall be able to drive a load impedance of 500 Ohms minimum.					
	viii)In case of loss c unit, the I/O shal be finalized durin	viii)In case of loss of I/O communication link with the main processing unit, the I/O shall be able to go to predetermined fail safe mode (to be finalized during detailed engineering) with proper annunciation.				
	ix) Requirement of Input, Analog Ou link at Inverter a the Input/output approval during o	ix) Requirement of Nos. of channel in each type of Module (Analog Input, Analog Output, Binary Input, Binary Output, RTD) and Modbus link at Inverter and main control room shall be calculated based on the Input/output signal list to be submitted by the contractor for approval during detail engineering.				
9.0	SYSTEM SPARE CAP	ACITY				
	Over and above the equipment and accessories required to meet the fully implemented system as per specification requirements, Control System shall have spare capacity and necessary hardware/ equipment/ accessories to meet following requirement for future expansion at site:					
	i) 10 % spare channels in input/output modules fully wired up to cabinets TB.					
	<ul> <li>Wired-in "usable" space for 10% modules in each of the system cabinets for mounting electronic modules wired up to corresponding spare terminals in system cabinets.</li> </ul>					
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	iii) Empty slots between individual modules/group of modules, kept ease in maintenance or for heat dissipation requirement as standard practice of Contractor shall not be considered as wired "usable" space for I/O modules.				
	iv) Terminal assemblie the I/O modules sh space.	es (if any in the offered sys all be provided for above	tem), correspo mentioned 10	nding to % blank	
	<ul> <li>v) Each processor / control</li> <li>to implement acceleration implemented logic/</li> <li>have spare capace</li> <li>outputs of each type</li> <li>over and above implemented above implemented above</li> </ul>	ontroller shall have 20% sp dditional function blocks loops. Further, each proc sity to handle minimum 2 be including above specifie plemented capacity. Each ntrollers shall also have sa ontroller.	pare functional of s, over and cessor / control 20% additional ed spare requir n of the corres ame spare cap	capacity above ler shall inputs/ ements, ponding acity as	
	vi) The Data commun the additions mention	ication system shall have oned above.	the capacity to	handle	
	vii) Ten (10) percent s wired in cabinets terminal blocks of c	pare relays of each type a TB. All contacts of relays abinets.	nd rating mour shall be termir	nted and nated in	
	viii)The spare capacity throughout all cubio mentioned additi controller/processo site. Further, thes response time / d specification.	as specified above shall b cles. The system design s ions shall not requ r/ peripheral drivers in th se additions shall not d uty cycle, etc. from those	be uniformly dis hall ensure that ire any ac e system deliveteriorate the stipulated un	stributed at above dditional vered at system der this	
10.0	OPERATOR INTERFACE	DISPLAYS/LOGS/REPO	RTS		
	<ul> <li>i) Suitable Operator</li> <li>operation &amp; monit</li> <li>finalized during details</li> </ul>	Interface Displays/Logs oring shall be provided. ailed Engineering stage.	s/Reports for The details s	control shall be	
	ii) Minimum quantities	shall be as follows:-			
	Various displays of displays or mimic, to operator guidance up/shutdown messes of displays and the and as finalized du quantities as given	on the OWS shall as a m par chart displays, X-Y & X message displays, group age displays, system statu e exact functionality shall b ring detailed engineering s in subsequent clauses. Fo	ninimum incluc -T plot (trend) o displays, plat s displays etc. e on as require subject to the n or X-T & X-Y p	le P&ID displays, nt start- Number ed basis ninimum lots, the	
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	facility of providing a background grid on operator request shall be variable with adequate no. of divisions in both co-ordinates. The minimum quantity of major types of displays per unit shall be as follows:					shall be all be as
	SI	Display		Minimum Qty for Plant capacity of 50 MW or Less	Additional 0 for each 10 or part abov 50 MW	Qty MW ve
	a)	a) Control displays (group/sub-group/ sequence/loop)		(On as reqd. basis subject to 100 minimum)	(On as i basis subjec 100 minimun	reqd. ct to n)
	b)	P&ID/ mimic dis	play	25	5	
	c)	X-Y Plot (with superimposed operating curves + using user selectable stored data)		25+25	5+5	
	d)	Group displays		30	5	
	e)	Operator guidance message		20	NIL	
	f)	System status & other diagnostic display		on as required basis	on a required basis	S
11 0	The assignment for the above will be done by the contractor as per the requirement of operation of contractor's system as well as for maintenance. The balance displays shall be left as spare for future modification/addition.					per the tenance. ddition.
11.0	<ul> <li>i) The HSRS shall collect, store and process system data from MMIPIS data base. The data shall be saved online on hard disk and automatically transferred to non-erasable long term storage media once in every 30 Days periodically for long term storage. Provision shall be made to notify the operator when hard disk is certain percentage full.</li> </ul>					
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	<li>ii) The data to be stored in the above system shall include alarm and event list, periodic plant data, selected logs/reports.</li>					
	iii) The system shall provide user-friendly operator functions to retrieve the data from historical storage. It shall be possible to retrieve the selected data on OWS in form of trend/report by specifying date, time & period. Further, suitable index files/directories shall also be provided to facilitate the same.					
	iv) In addition to above, the system shall also have facility to store & retrieve important plant data for a very long duration on portable external long term storage media. Bidder shall provide two numbers of portable external hard drive of 2TB each.					
	<ul> <li>v) For long term plant performance analysis, the following plant data as a minimum with time stamping and interval as indicated in below table but not limited to shall be stored daily on historian.</li> </ul>					
	<u>Important plant</u> <u>on Historian</u>	data for a very long duratio	on (plant life) S	Storage		
	SI Doromotor		Time Int	orvol		
	1 Weather Monitoria Global Horizonta Irradiance and Ambient Temp, Rain Fall and Rel	1 (One) Mi ed ee, on,	nute			
	2 Calculated Daily Global Inclined In Insolation.	2 Calculated Daily Global Horizontal Insolation, Global Inclined Insolation and Diffuse Horizontal				
	3       Power Conditioning Unit (PCUs):-       1 (C         DC Voltage, DC Power, DC Current, SMB/SMU       1 (C         Current (PCU end), AC Active & Reactive       Power, Power factor, AC Current & Voltage,         Energy, Inverter room       temp, Inverter Cabinet			nute		
	6 MFM, Energy me Active & Reactiv and Voltage	a:- 1 (One) Mi ent	inute			
	7 Export feeder/s E Active & Reacti export, Curren Frequency.	<ul> <li>7 Export feeder/s Energy Meter Data:-</li> <li>Active &amp; Reactive Power, Energy import and export, Current and Voltage and Grid Frequency</li> </ul>				
	8 Daily energy export from each Inverter			nty purs		
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	9 Total sum of Inve	daily energy export from erter	all 24 (Twenty Four) Hours		
12.0	SCADA PANEL/CABI	NET/CONTROL DESK/FURN	IITURE		
	i) The SCADA cat	inets shall be IP-22 protection	n class.		
	<ul> <li>ii) The Contractor in these cabine above the cabine conditioning fail shall ensure tha ambient and is even under the remote I/O cal required by the maximum feasil system operation provided in eaco mesh shall be p</li> </ul>	shall ensure that the packagin ts is not excessive and about inet temperature during not ure, is prevented by careful of the temperature rise is limit well within the safe limits for worst condition and specific binets. Ventilation blowers equipment design and shall ble extent. If blowers are re- on, dual blowers with blower ch cabinet with proper. Suit rovided on the cabinet.	ng density of equipment ormal temperature rise, rmal operation or air- design. The Contractor red to 10 deg. C above or system components cation requirements for shall be furnished as be sound proof to the equired for satisfactory failure alarm shall be able louvers with wire		
	iii) The cabinets sh and rear access the cables for M	all be designed for front acce to wiring and shall be desig ain control room.	ess to system modules ned for bottom entry of		
	iv) The cabinets shall be totally enclosed, free standing type and shall be constructed with minimum 2 mm thick steel plate frame and 1.6 mm thick CRCA steel sheet or as per supplier's standard practice for similar applications, preferred height of the cabinet shall not higher than 2200 mm. The cabinets shall be equipped with full height front and rear doors. The floor mounting arrangement for other cabinets shall be as required by the Employer and shall be furnished by the Contractor during detailed engineering. Wall mounted cabinet is acceptable for Inverter room/sub-pooling switchgear				
	<ul> <li>v) Cabinet doors shall be hinged and shall have turned back edges and additional braking where required ensuring rigidity. Hinges shall be of concealed type. Door latches shall be of three-point type to assure tight closing. Detachable lifting eyes or angles shall be furnished at the top of each separately shipped section and all necessary provisions shall be made to facilitate handling without damage. Front and rear doors shall be provided with locking arrangements with a master key for all cabinets. If width of a cabinet is more than 800 mm, double doors shall be provided.</li> </ul>				
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	<ul> <li>vi) Two spray coats of inhibitive epoxy primer-surface shall be applied to all exterior and interior surfaces. A minimum of 2 spray coats of final finish colour shall be applied to all surfaces. The final finished thickness of paint film on steel shall not be less than 65-75 micro for sheet thickness of 2 mm and 50 microns for sheet thickness of 1.6 mm. The Preferable finish colors for exterior and interior surfaces shall conform to following shades:</li> </ul>				
	a) Exterior:-7 b) Interior:-S Paint films which be As an alternative single textured p thickness require	As per RAL 9002 (End pane same as above show sags, checks or other acceptable. e, single coat of anodic dip powder coating with epoxy ment is also acceptable	l sides RAL 501 imperfections s coat primer alc polyester mee	2), shall not ong with ting the	
	vii) Control desk shall be free standing table top type with doors at the back and shall be constructed of 2 mm thick CRCA steel plates. A 19 mm thick wooden top shall be provided on the desk to keep the monitors at top and computers inside. Control desk shall consist of vertical, horizontal and base supports with their coverings for work surface, keyboard trays, mouse pads, monitor shelf and concealed cable and wire way management, perforated trays with covers in both horizontal and vertical directions. ASCII Keyboard shall be				
	viii) Contractor shall or UPS AC) and the load requiren remain in service module failure. S power supply fail	provide the two power supported one raw supply feeder of superts of SCADA panel/cabination in case of single power supported by the generation of the second statement of the	oly feeders (DC itable rating to et/control desk. ply failure/powe ierated in case	C supply cater all System or supply of any	
	ix) The cabling / wi etc. shall be aest	ring between OWS & CPU's	S, power supply ed from view.	y cables	
	x) Chairs – Industry standard revolving chairs with wheels and with provision for adjustment of height (hydraulically/gas lift) shall be provided for the operators and other personnel in control room area. These shall be designed for sitting for long duration such that these are comfortable for the back. Arm-rests in one piece shall be of poly- urethane and twin wheel castor of glass filled nylon.				
	xi) One Printer Tab shall be provided	le made of Laminated Woc for printer.	od or Heavy Du	ity MDF	
	xii) All the furniture s	shall be of reputed make (Go	drej or Equivale	ent).	
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13.0	HMIPIS HARDWARE						
	i)	<ul> <li>The HMIPIS as specified shall be based on latest state of the art Workstations and Servers and technology suitable for industrial application &amp; power plant environment.</li> </ul>					
	ii)	The Workstation/Servers employed for HMIPIS implementation shall be redundant based on industry standard hardware and software which will ensure easy connectivity with other systems and portability of Employer developed and third party software.					
	iii)	iii) Redundant sets of communication controllers shall be provided to handle all the communication between the HMIPIS and redundant system bus and to ensure specified system response time and parametric requirements. Each communication controller shall have message checking facility. Power Fail Auto Restart (PFAR) facility with automatic time update shall be provided.					
	<ul> <li>iv) All the peripherals shall conform to the following minimum requirement but the exact make &amp; model shall be as approved by Employer during detailed engineering. The LAN to be provided under HMIPIS shall support TCP/IP protocol (Ethernet connectivity) with OPC RDI for interface with PLCs/other systems and shall have data communication speed of min. 100 MBPS. All network components of LAN and Workstations shall be compatible to the LAN, without degrading its performance.</li> <li>Engineering Workstations/ Operator Workstations/ Historian/ Portable EWS</li> </ul>						
	SI No.	Features	Industrial Grade Engineer Workstations/ Operator workstations/ Documentation part of prog. Stn.)	ing Cum Ope workstations/ station (in cas	erator Other e not		
	1.	Processor	Engineering Cum Operator Server Grade (Xeon or E minimum	Workstations: Equivalent), Oct	64 bit acore		
	2	Memory	For other Workstation: 64 bi	t (i5 or Equivaler	nt)		
	2.	Wernory	RAM upgradable to 24 GB min	nimum			
			For other Workstation: 8 GB RAM upgradable to 16 GB				
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		3.	Hard Disk	Engineering Cum Operator RAID1	Workstations:	1 TB
				For Historian: 1 TB ultra wid	e RAID1	
				For other Workstation: 500 for OWS/ 500 GB for Portable	GB ultra wide R e EWS	RAID1
			Communication port	Engineering Cum Operator	Workstations:	
				<b>For other Workstation:</b> 4 S slot=2	- Serial bus, Expa	nsion
		4.	Monitor (color)	Min 22" TFT Flat Monitor refresh rate min. 75 Hz, Graph	with non-inter nic Memory = 16	faced MB
		5.	Removable bulk storage drive (DVD / DAT)	k 6 GB (minimum) e		
		6	Network Connectivity	Engineering Cum Operator Workstations: 4 Nos. Built-in Ethernet Network Port		
				For other Workstation: 2 Nos. Built-in Ethernet Network Port		
		7.	DVD R/W	16x or higher for EWS and OV	VS	
		8.	Keyboard	ASCII		
		9.	Pointing Device	Mouse		
		10.	Additional general purpose software (for using over network by servers/workstat ions/PCs)	Comprehensive disk maintenance utility for disk clean sweep/ crash guard/antivirus, etc. r r		disk
		11.	Software	MS. Windows latest, MS Office Editor (EXCEL,WORD, POWER POINT), Adobe Acrobat, Anti Virus, Network Security, Etc.		
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			LED Displa	ay			
	1	LED Display	isplay 50 Inch LED Display, Display Resolution : 192 1080, Wall Mounted, Reputed make (Samsung/Sony/LG or Equivalent)				
			Printer				
	Sr Features Networked Color Laser Print					nter	
	1	Paper Size					
	2	Printing Spee	eed (min.)- in 6 ppm (Color)				
		paper	101 A4 SIZE	W)			
	3	Туре		Heavy dut pages/mont	y, at least h	50000	
	4	Resolution (blac	:k) (min.)	600 dpi full =<1 min for color,			
	5	First page out graphic display)	time (with full				
				<45 sec for	BW		
	6	Paper input cap	acity (min.)	500 sheets			
	7	Additional featur	res	Automatic D	uplex Printing		
	8	Paper sheets ( sheets) with p	1 ream = 500 rinter (To be	10 reams (A	.3)		
		supplied with pr	inter)	20 reams (A	4)		
14.0	14.0 SUPPLY OF OUTDOOR WIRELESS ACCESS POINT						
	wirel	er has to supply 2 ess access point	with 2x10/100	Base-T(X) ha	aving Far Dista	ance Air	
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	Connectivity up to 7 K pole with minimum ope	M and protection class IP-67 erating temperature of 55 De	′ .lt shall be sui g C.	table for		
	Bidder to note that W Bidder shall be respo OWS for location oth OFC/CAT/WiFi link as	Bidder to note that Wireless Access Point is for NTPC's own use only. Bidder shall be responsible to provide Communication connectivity for OWS for location other than CMCS, if required under the scope using OFC/CAT/WiFi link as feasible and approved during detail engineering.				
15.0	ADDITIONAL CLAUSE					
	Please refer to the Cha section of specification.	apter A-2 for additional claus	e, if any relate	d to this		
16.0	FACTORY ACCEPTAN	ICE TEST (FAT)				
	FAT procedure shall be submitted by bidder for NTPC approval and after approval of FAT procedure, FAT will be witnessed by NTPC Engineering or authorized representative of NTPC. SCADA shall communicate with all third party devices which are part of Solar Plant and the same shall be demonstrated during the FAT.					
17.0	TIME SYNCHRONISAT	ION EQUIPMENT				
	Time Synchronization equipments shall be provided and shall be located in the Control Room. It shall receive Coordinated Universal Time (UTC) transmitted through Geo Positioning Satellite (GPS) for time synchronization of all components of the SCADA.					
17.1	It shall be complete in a equipment, etc.	Ill respects including antenna	a, all cables, pro	ocessing		
17.2	All auxiliary systems an equipment shall be supp	d special cables required for plied and commissioned by th	r synchronizatione Contractor.	on of the		
17.3	It shall work from DC su in battery backup is pr lithium batteries.	upplies only and the Contract rovided, in which case, sam	tor to clarify if a ne shall be of	ny built- long life		
17.4	It shall be immune to ho to be provided against systems and antenna fe	ostile electrical environment. lightning surges and over-vo eeders.	Suitable protect Itages in powe	ions are r supply		
17.5	The system shall be full as IEC: 801 and IEC: 25	y tested to the relevant interr 55.	national standa	rds such		
17.6	All components of the Workstations, Bay Cont all numeric protection	e SWYD SAS, including s rol Units (BCU) and Bay Pro relays as per requirement	Substation Cor tection units (B t under this s	ntrollers, PU) and cope_of		
Development         of         20MW         Solar         PV         TECHNICAL SPECIFICATION         PART-C         Part-C						

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	technica accurac	I specification of y of 1ms.	or offered by bidder shall be synchroni	zed with an		
17.7	The GP under th commur other de	The GPS shall be synchronized with the SCADA system to be supplied under this contract. Necessary software and Hardware (including laying of communication cable) required for time synchronization with SCADA and all other devises shall be in scope of contractor				
17.8	The sys <sup>.</sup> no interr	The system should be able to track more than 1 satellite at a time to ensure no interruptions of synchronization signals.				
17.9	The sys output s	tem shall have ignals:	e provisions for combination of any of t	he following		
	•	NTP (network t	time protocol) 100Mbits Ethernet port			
	•	IRIG-B00x (TTI	L, pulse width modulated signal)			
	•	2 x Pulse per outputs via pote	r half-hour/ Pulse per minute/ Pulse ential free contacts	per second		
	•	Any other output	ut port as may be required for the offered	d system.		
	•	Alarm status co	ontact indicating healthy status of system	ı		
17.10	These of equipme as per s also be requiren during d	These output ports shall be compatible with the requirement of the equipment to be synchronized i.e. BCUs/ BPUs/Numerical Relays/IEDs etc as per scope of the specification. The master clock in control room shall also be synchronized with the time synchronization system. The actual port requirements (no./type) in line with the system offered shall be finalized during detailed engineering.				
17.11	The equ periodic second size of a	ipment should ity. The equipme (24 hour mode) ipprox. 144mm	have a periodic time correction facility ent shall also have real time display in h ) and have a separate time display, ha height.	of one-sec. our, minute, ving display		
18.0	TECHN		CATION FOR NETWORK FIREWALL			
	Offered fi	rewall shall include	but not limited to the following features.			
	Techni	ical Requirements	s for Network Firewall			
	S No	Feature	Required parameter			
	Α	General				
	A1	Common Criteria Certification.	<sup>a</sup> The offered product series or its operating system series must have achieved EAL (Evaluation Assurance Level) Certification of EAL4 or higher in the Common Criteria for Information Technology Security Evaluation (ISO/IEC 15408) for computer			
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					security certification.		
					The financell should be a r		ah ya na
		A2	Architecture		appliance based next gene solution having application prevention function.	awareness & Int	oware GFW) rusion
		A3	End of sale		OEM End-of-sale declaration released for the offered mod submission.	n shall not have lel at the time of t	been he bid
		В.	Hardware Specif	icat	tions & Performance Paramet	ers	
					Minimum <b>Four or AS REC</b> 10/100 base T Ethernet ports	<b>UIRED</b> Nos of good to be provided.	gigabit
					Provision of addition of at least Two Nos of gigabit Fiber SFP ports shall be available.		
	B1 Fire		Firewall Interfaces		Each Port must be configurab zone as per the requirement assignments.	le flexibly in any se without any fixed	ecurity I zone
					All the above specified inte interfaces. Internal Switch i considered.	rfaces shall be f interfaces shall n	irewall ot be
					The Firewall shall NOT have any wireless interfaces.		
		B2	Security Zones		At least four Security zones m	ust be supported.	
		С	Firewall Inspection	on			
					Should support standard proto	ocols	
		C1	Application Suppo	ort	Internet based applications li http DNS ICMP etc should	ke Telnet, FTP, S be supported for fil	SMTP, Itering
					Internet web 2.0 applications	& widgets.	
					Dynamic NAT as well as one	to one NAT	
		C2	NAT & PAT		Port / IP Address Forwarding		
			Decistance to	The firewall shall be able to detect and block evas		vasion	
		C3	Evasion	techniques including SYN flood, Address spoofing			oofing
		D	Application awar	ene	ess		
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	D1	Application intelligence and control	Firewall should support detection of application regardless of port, protocol etc. firewall must identify and control applications sharing the same session The firewall should allow creation of securities policies to identify, allow, block or limit an application regardless of port, protocol etc.
	E	Intrusion Preven	tion System (Integrated with firewall)
	E1	General	The IPS must provide intrusion prevention functionality out of the box.The IPS should be capable of accurately detecting intrusion attempts and discern between the various types and risk levels, including unauthorized access attempts, pre-attack probes, suspicious activity, vulnerability exploitation etc
			The IPS should provide protection from Advanced Botnets, inbound and outbound. The IPS should use stateful detection and prevention techniques and provide zero-day protection against worms, Trojans, spyware, keyloggers, and other malware from penetrating the network.
	E2	Detection Method	S The offered solution should use the following methods for detection of malicious traffic: (a) Signature based detection (b) Statistical Anomaly based detection
	E3	Threat Intelligence and signature Updates	e The IPS OEM should have a 24x7 security service update and should support real time signature update of the system as soon as updates are released.
	E4	Exception List	The IPS should support the creation of Access Control Lists to bypass the inspection of any specific flow.
	E5	DoS/ DDoS protections	The offered solution should be capable of preventing Denial of Service and Distributed denial of service attacks.
	E6	Threat control features	<ul> <li>The offered solution should provide the following Security features:</li> <li>a) Detection and blocking malicious web traffic on any port.</li> <li>c) Capability of detecting attacks within protocols independent of port used</li> <li>d) IPS Sensor should allow the admin to create IPS policies on the basis of IP addresses and range.</li> </ul>
Development of 20MW Solar PV Project at Central Coalfields Limited (CCL) CHP/CPP Piparwar, Jharkhand		N Solar PV alfields Limited ar, Jharkhand	TECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-9296-004-9PART-C CHAPTER-C7Page 22 of 23

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	E7	Signature Tuning	The offered solution should of each individual signature. allow granular tuning to suit u	allow enabling/dis . Each signature s ser requirement.	abling should
Development Project at C (CCL) CHP/C	of 20MW entral Coa PP Piparwa	/ Solar PV Ifields Limited r, Jharkhand	TECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-9296-004-9	PART-C CHAPTER-C7	Page 23 of 23

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	CHAPTER-C8 INSTRUMENTATION AND COMMUNICATION CABLE							
1.0	COMMUNICATION CABLE (Optic Fibre Cable)							
	Optic Fiber cable shall armored, fully water bl /indoor application so a have multiple single-mo to avoid the usage of a Retardant, UV resistant manufacturer's name, sequential on-line mark sheath. The cable core shall h prevention of damage d tube design, 4 fibers p tubes duly filled with T maximum tensile force tensile force of 1000 N be 3000 N minimum & temperature shall be -20	be <b>8/12</b> core, galvanized of locked with dielectric central s to prevent any physical date of or multimode fibers on a any repeaters. The outer shift number of manufacturing, year of manufacturing, king of length in meters at have suitable characteristics uring pulling viz. Steel central per buffer tube (minimum), hixotropic jelly etc. The cab of 2000 N during installation minimum. The compressive crush resistance 4000 N m 0 deg. C to 70 deg. C.	corrugated stee al member for amage. The cal is required basis eath shall have be identified v progressive au every meter of and strengthe al number, Loos Interstices and le shall be suit a, and once insis strength of cal inimum. The op	el taped outdoor ole shall is so as e Flame with the utomatic on outer ning for e buffer d buffer able for talled, a ole shall perating				
	All testing of the optic fill IEC, EIA and other inter	per cable being supplied shal mational standards.	l be as per the	relevant				
	Bidder to ensure that spare in all types of opti	minimum 50% (but not less cal fiber cables	3 4) cores are	kept as				
	Cables shall be suitable underground buried inst	e for laying in conduits, duct allation.	ts, trenches, ra	cks and				
	Spliced/ Repaired cable	s are not acceptable.						
	Penetration of water restandard.	sistance and impact resistan	ce shall be as	per IEC				
1.1	Communication Cable	(Modbus)						
	Data (Modbus) Cable copper conductor base each with conductor siz with DIN 47100. Cable	to be used shall be shield d on VDE 0881 . Cable shal e of 0.5 SQMM and core ide <u>shall be flame retardant acc</u>	ed type with s I have minimur ntification shall ording to IEC 6	tranded n 2 pair comply 0332-1-				
Development at Central CHP/CPP Pip	of 20MW Solar PV Project Coalfields Limited (CCL) arwar, Jharkhand	TECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-9296-004-9	PART-C CHAPTER-C8	Page 1 of 6				

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	2. or e approv	2. or equivalent Standard Surge protection device to be provided shall be approved from UL/CSA or any national/international approved lab.							
2.0	INSTR		ABLES						
2.1	Comm	Common Requirement							
	S No.	Property		Requirement					
	1.	Voltage grade		225 V (peak val	ue)				
	2.	Codes and standa	ard	All instrumenta comply with VD Part 4, Part 5, VDE 0472, SE MC 96.1, IS-87 editions) and read along with	ation cables s DE 0815, VDE 02 Part 6, VDE 08 EN 4241475, A 84, IS-10810 (la their amendme this specificatior	shall 207, 316, NSI itest ents 1.			
	3.	Continuous suitability	operation	At 70 deg. C for	all types of cabl	les			
	4.	Progressive auto sequential markin meters	matic on-line g of length in	To be provided on outer sheath	at every one m	eter			
	5.	Marking to read 'F	RLS	To be provided on outer sheath	I at every 5 me	ters			
	6.	Allowable Toleran diameter	ice on overall	+/- 2 mm (m declared value	aximum) over in data sheet	the			
	7.	Variation in diame	eter	Not more than 1.0 mm throughout the length of cable.					
	8.	Ovality at any cros	ss-section	Not more than 2	1.0 mm				
	9.	Others		a) Durable mar exceeding 625 manufacturer's material, condu of pairs, volta cable, year of provided.	king at intervals mm shall incl name, insula ictor's size, num ge rating, type manufacturer to	not ude tion ber of be			
				b) Cables sha laying in condu racks and installation	all be suitable its, ducts, trencl underground-bu	for nes, ried			
	10	Color		c) Repaired ca acceptable.	ables shall not	be			
Development at Central ( CHP/CPP Pip	of 20MW Coalfields arwar, Jha	Solar PV Project Limited (CCL)	TECHNICAL SI BIDDING RE-CS-92	PECIFICATION DOC. NO: 196-004-9	PART-C CHAPTER-C8	Page 2 of 6			

CLAUSE NO		TECHNIC		6	(	एनरीपीसी NTPC
			Blue			
2.2	Specifi					
	S		Property	Requ	irement	
	NO.		Type of Cable	F and	I G Type cables	
		A. Conductors				
	1.		Cross section area	0.5 sc	q. mm	
	2.		Conductormaterial	Higho bare	conductivityAnne	aled
	3.		Colour code	As pe	er VDE-815	
	4.	(	Conductor Grade	Elect	rolytic	
	5.		No & dia of strands	7x0.3	mm (nom)	
	6.		No. of Pairs	4,8,12	2,16,24,48	
	7.		Max. conductor resistance per Km (in ohm) at 20 deg. C	73.4	(loop)	
	8.		ReferenceStandard	VDE	0815	
		B. Insulation				
	1.		Material	Extru	ded PVC type Y	13
	2.	-	Thickness in mm (Min/Nom/Max)	0.25/0	0.3/0.35	
	3.		Volume Resistivity (Min) in ohm-cm	1 x 1 1x10 <sup>-</sup>	014 at 20 deg. 11 at 70 deg. C.	C &
	4.		Reference	VDE	0207 Part 4	
	5.	(	Core diameter above insulation	Suital conne	ble for cage o ector	clamp
		C. Pairing & Twi	isting			
	1.		Single layer of binder tape on each pair provided	Yes		
	2.		Bunch(Unit formation) for more than 4P	To be	e provided	
	3.	i	Conductor /pair identification as per VDE081	To be	e provided	
		D. Shielding				
	1.	]	Type of shielding	Al-My	lar tape	
	2.		Individual pair shielding	To be cabl	e provided for F	-type
	3.		Minimum thickness of	28 mi	cron	
Development at Central ( CHP/CPP Pipa	of 20MW S Coalfields arwar, Jha	Solar PV Project Limited (CCL) rkhand	TECHNICAL SPECIFICATIO BIDDING DOC. NO: RE-CS-9296-004-9	ON	PART-C CHAPTER-C8	Page 3 of 6

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			Individual pair shielding			
	4.		Overall cable assembly shielding	To be	provided	
	5.		Minimum thickness of Overall cable assembly shielding	55 mi	cron	
	6.		Coverage Overlapping	100% overla	coverage with apping	20%
	7.		Drain wire provided for individual shield	Yes mm2, of ,Anne coppe	(for F-type) Size No.ofstrands=7, strands =0.3 ealed Tin co er	e=0.5 Dia mm pated
	8.		Drain wire provided for overall shield	Yes. strand strand Tin co	Size=0.5 mm2, I ds=7,Dia ds=0.3mm Anne pated copper	No.of of ealed
		E. FILLERS				
	1.		Non-hygroscopic, flame retardant	To be	e provided	
		F. Outer Sheath				
	1.		Material	Extru YM1	ded PVC comp with FRLS prope	ound rties
	2.		Minimum Thickness at any point	1.8 m	IM	
	3.		Nominal Thick-ness at any point	>1.8	mm	
	4.	-	Resistant to water, fungus, termite & rodent attack	Requ	ired	
	5.		Minimum Oxygen index as per ASTMD-2863	29%		
	6.		Minimum Temperature index as per ASTMD- 2863	250 c	leg.C	
	7.		Maximum acid gas generation by weight as per IEC-60754-1	20%		
	8.		Maximum Smoke Density Rating as per ASTMD-2843	Maxir To be	num 60% e provided	
				(defir area the densi	ed as the ave under the curve v results of sr ty test plotted	erage when noke on a
Development at Central ( CHP/CPP Pipa	of 20MW Coalfields arwar, Jha	Solar PV Project Limited (CCL) arkhand	TECHNICAL SPECIFICATIO BIDDING DOC. NO: RE-CS-9296-004-9	ON	PART-C CHAPTER-C8	Page 4 of 6

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				curve absor ASTN	indicating ption vs. time a /ID-2843)	light s per
	9.		Reference standard	VDE2	207 Part 5,VDE-0	0816
		G. Electrical Par	rameters			
	1.		Mutual Capacitance Between Conductors At 0.8 Khz (Max.)	120 n 100 n	F/km for F type	
	2.		Insulation Resistance(Min.)	100 N	I Ohm/Km	
	3.		Cross Talk Figure (Min.) At 0.8 Khz	60 dE	3	
	4.		Characteristic Impedance (Max) At 1 Khz	320 C	OHM FOR F-TYF	Έ ΣΕ
	5.		Attenuation Figure At 1 Khz (Max)	1.2 dl	o/km	
		H. Complete Ca	ble			
	1.		Complete Cable assembly	Shall Chim SS 42	pass Swo ney test as per 3 241475 class F3.	edish SEN-
	2.		Flammability	Shall per conju speci	pass flammabili IEEE-383 read nction to fication	ty as d in this
		I. Tests				
	1.		Routine & Acceptance tests	Refer requi	Type rement	Test of
	2.		Type tests	Speci Syste	fication for C m	& I
		J Cable Drum	<del>.</del>			
	1.		Гуре	Non-returnable wooden drum (wooden drum to be constructed from seasoned wood free from defects with wood preservative applied to the entire drum) or steel drum.		oden to be from from wood o the rum.
	2.		Outermost layer covered with waterproof paper	Yes		
	3.		Painting	Entire	e surface to	be
			Length	1000	<u>m + 5% tor up</u>	υä
at Central ( CHP/CPP Pipa	Coalfields arwar, Jha	Limited (CCL) rkhand	TECHNICAL SPECIFICATIO BIDDING DOC. NO: RE-CS-9296-004-9	ЛС	PART-C CHAPTER-C8	Page 5 of 6

CLAUSE NO		TECHNI		6		एनरीपीसी NTPC
				incluc	ling 12 pairs	
				500 r pairs	m + 5% for at	bove12
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CLAUSE NO	TECHN	ICAL SPECIFICATIONS		एनरीपीम्री NTPC
	CHAPTER-0	C9 : EARTHING SYSTE	М	
1.0	GENERAL REQUIRM	ENTS		
	This specification is (grounding) for Solar a Project. It is not the intrand construction since implementation of eart and functional require which are not specificat installation, testing an satisfactory operation bidder.	intended to outline the re rray (DC) side and AC Powe ent of the specification to spe the bidder has full responsib thling system meeting the in ment. Any additional equipr ally mentioned herein but are d commissioning of earthlin of the plant shall be includ	equirement of r block side of ecify all details of bility for enginee tent of the spe nent, material, e required for so led under scop	earthing Solar PV of design ering and cification services uccessful safe and be of the
	Earthing requirement mentioned elsewhere i scope of this chap yard/Switchyard is spe	for outdoor metering yard n the specification and hence oter unless earthing req cifically mentioned in this cha	I/Switchyard h e shall be exclu uirement of apter.	as been ded from metering
	Electrical Resistivity T bidder.	est (ERT) of the soil is in	cluded in the	scope of
1.1	EARTHING DESIGN F	REQUIRMENT		
	The object of protective a surface under and a and as nearly zero or this is to ensure that, in shall be at earth po- attendants shall be at e earth surface of uniform can exist no difference or injure an attendant take place.	e earthing system is to provid round a station which shall b absolute earth potential as p n general, all parts of apparat tential, as well as to ensu- earth potential at all times. Al m potential under and surrou of potential in a short distant when short-circuits or other	de as nearly as be at a uniform ossible. The put tus other than li ure that opera so by providing unding the stati- nce big enough r abnormal occ	possible potential urpose of ive parts, tors and such an on, there to shock currences
	Care must be taken for not disrupted due to un	r equipment with functional ea idesired disturbances in prote	arthing that its s active earthing s	service is system.
1.2	CODES AND STANDA	ARD		
	The equipment/produce requirements of all the	ct furnished for earthing sy applicable relevant National	/stem shall r /International co	meet the odes and
Development at Central CHP/CPP Pip	of 20MW Solar PV Project Coalfields Limited (CCL) arwar, Jharkhand	TECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-9296-004-9	PART-C CHAPTER-C9	Page 1 of 11

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	standards or th certification has and standard for	standards or their latest amendment Codes and Standards. P certification has to be CE/UL/BIS/TUV or equivalent. The relevant and standard for earthing system are tabulated below.					
	IS 3043	Code	of practice for Earthing				
	IEEE: 80	IEEE	guide for safety in AC	C substation			
	IEEE: 837	Standa used i	ard for qualifying permanen n substation grounding	t connections			
	IS: 2309	Code and al	of Practice for the protection lied structures against lightning	on of building ng.			
	IS: 802 Code of practice for the use of Structural Steel in Overhead Transmission Line Towers.						
	IS: 2629	Recon of iron	nmended practice for hot di & steel	p galvanizing			
	IS: 2633	Metho coated	d for testing uniformity of co l articles	pating on zinc			
	IS: 513	Cold r	olled low carbon steel sheets	and strips			
	IS: 6745	Metho coatin	ds for determination of n g on zinc coated iron & steel	nass of zinc articles.			
	IS 2062	HOT F STRU	ROLLED MEDIUM AND HIGH CTURAL STEEL — SPECIFI	H TENSILE			
	IS: 4736	Hot-di	p Zinc coating for MS Tubes.				
	IS: 458	Preca: Reinfo	st Concrete Pipes (With rcement)	and Without			
	UL-467	Grou	nding and Bonding Equipmer	nt			
	IEC 62561- 7	Requir compo	rements for earthing ounds	enhancing			
		CEA r	egulations for electrical safety	y-2010			
		Indian	Electricity Rules/ Indian Elec	ctricity Act.			
	All standards, specifications and codes of practice referred to herein shall be the latest editions including all applicable official amendments and revisions as on date of opening of bid. In case of conflict between this specification and those (codes and standards, etc.) referred to herein, the former shall prevail. All work shall be carried out as per the above standards/ codes as applicable.						
	The earthing sys in suitable pit siz	tem ind ze, con	cludes earth electrode, install struction of earth pit with co	ation of earth e over for the ins	lectrode tallation,		
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CLAUSE NO	TECHNI	CAL SPECIFICATIONS		एनरीपीमी NTPC	
	connection of earth ele of equipment to equipot	ctrode with equipotential ear ential earth bus.	rth bus and cor	nnection	
2.0	EARTH ELECTRODE				
	The earth electrode is i conducting earth curren good electrical conduc corrode in wide variety following type of vertica	n direct contact with the grount with ground. Earth Electroc ctivity and mechanical stre of soil conditions. For an eff l earth electrodes can be use	und provides material shouted and shouted	eans for uld have ould not system,	
	I. MS Rods Hot rolled, Medi length not less th	um or High Tensile Steel R an 3000 mm and diameter o	od as per IS f 40 mm.	2062 of	
	II. Copper Bonded High tensile-low 14/17 mm of Le current. The F Grade 43A or 99.99% pure hig coating thicknes surface shall be oxide layer or fo	Rods carbon steel rod having or ength 3000 mm to be select Rod shall comply with req EN10025:2-004 S275JR, r gh conductivity copper on ou as 250 micron or more in co e clean, free from mechanica preign material.	diameter not le ed based on ea uirements of E nolecularly bor ter surface with onformity to UL I defect and an	ess than arth fault SS 4360 nded by n copper -467. Its y visible	
2.1	Earthing Enhancemen	t Compound			
	A low resistance eart impedance path for the protect personnel and potential differences. used to improve the material shall be a su effectiveness, especial of moisture variation, conform to the require	h electrode system is impo e better dissipation of lightnir l equipment by minimizing Earthing (ground) enhancer ground electrode resistance perior conductive material w ly in areas of poor conductive sandy soils etc.). It shall ements of IEC 62561-7.It si	rtant to provid ng/fault currents and equalizing nent materials e. Earth enhar hich improves ity (rocky groun be tested and hall have the f	e a low s, and to voltage shall be ncement earthing d, areas should ollowing	
	a) High conductivit retention capat	ty, improves earth's absorbin pility non-corrosive in nati	ng power and l ure having lov	humidity v water	
	solubility but hig b) Carbon based v	hly hygroscopic. vith min 95% of fixed carbon	content premi	xed with	
	corrosion resista mix separately &	ant cement to have set prope & shall not have Bentonite.	erties. Cement	shall not	
Development Project at C (CCL) CHP/CI	of 20MW Solar PV entral Coalfields Limited PP Piparwar, Jharkhand	TECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-9296-004-9	PART-C CHAPTER-C9	Page 3 of 11	
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---	--	---	----------------------	-------------------	--
	<ul> <li>c) Resistivity of less than 0.2 ohms -meter.</li> <li>d) It shall not depend on the continuous presence of water to main its conductivity and shall be permanent &amp; maintenance free a its "set form", maintains constant earth resistance with time.</li> <li>e) It shall not dissolve, decompose or leach out with time and share nvironmental friendly, suitable for soils of different resistivity any kind of earth electrode.</li> <li>The Earth enhancement material shall be supplied in sealed, moin proof bags, marked with Manufacturer's name or trade name, quantity. The minimum quantity of earth enhancement compound to be used each earth-pit shall be 25 Kg.</li> </ul>				
2.2	Earthing conductor				
	Earthing conductor is the conductor for buried below the ground at the depth of 600 mm connecting earth pits to make interconnection of earth pit. To interconnect earth pits, following type of conductor can be used. Application of specific conductor and its size has been mentioned in relevant clause:				
	I. Galvanised Steel Flat (GS) Flat GS/GI Flat (Strip) conductor shall comply to IS 2026 with Galvanization of 85 Micron as per IS. Material shall be clean and free form mechanical defects.				
	II. Copper Clad Steel (CCS) Earthing Conductor The Copper Bonded Steel Grounding Conductor shall be made of steel with the coating of 99.99% pure copper complying to ASTM B 869-96 and ASTM B 452-93 standards. Each strand of CCS shall have continuous, uniform coating and the conductor surface shall be smooth and free from mechanical defects.				
	III. MS Rod Hot rolled, Medium or High Tensile Steel Rod as per IS 2062 of length not less than 3000 mm and diameter of 40 mm.				
2.3	Earthing Technical and	d Installation Requirement			
	Careful consideration should be given to installing an earthing system that meet or exceed statutory requirements. Contractor shall select certified product and ensure good workmanship for installation for satisfactory performance to fulfill the designed parameters all the times. Following care shall be taken while installation of earthing.				
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	I.	Metallic frame/ structure of all electrical equipment shall be earthed by two separate and distinct connections to earthing system, each of 100% capacity, Crane rails, tracks, metal pipes and conduits shall also be effectively earthed at two points. Steel RCC columns, metallic stairs, and rails etc. of the building housing electrical equipment shall be connected to the nearby earthing grid conductor by one earthing ensured by bonding the different sections of hand rails and metallic stairs. Metallic sheaths/screens, and armour of multi-core cables shall be earthed at both ends. Metallic Sheaths and armour of single core cables shall be earthed as per requirement mentioned elsewhere in the specification. Every alternate post of the switchyard fence shall be connected to earthing grid by one GS flat and gates by flexible lead to the earthed post. Portable tools, appliances and welding equipment shall be earthed by flexible insulated cable. Metallic column for Inverter/Switchgear shelter/E-house shall be earthed with two distinct connections at minimum two column. All the wall cladding section shall be earthed at minimum two location with flexible copper cable of not less thar 50 sq. mm.				
	11.	Each continuous laid lengths of cable tray shall be earthed at minimum two places by G.S. flats to earthing system, the distance between earthing points shall not exceed 30 meter. Wherever earth mat is not available, necessary connections shall be done by driving an earth electrode in the ground.				
	111.	Neutral connections and metallic conduits/pipes shall not be used for the equipment earthing. Lightning protection system down conductors shall not be connected to other earthing conductors above the ground level.				
	IV.	The earth condu	uctors shall be free from pitelectrical, mechanical defects	tting, lamination	ns, rust,	
	V.	Connections between earth leads and equipment shall normally be of bolted type. Contact surfaces shall be thoroughly cleaned before connections. Equipment bolted connections after being tested and checked shall be painted with anti-corrosive paint/compound.				
	VI.	VI. Suitable earth risers as approved shall be provided above finished floor/ground level, if the equipment is not available at the time of laying of main earth conductor.				
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	VII.	Connections bett earthing conduct welds should be thickly coated wi be made by elect more than the res	Connections between equipment earthing leads and between main earthing conductors shall be of welded type. For rust protection the welds should be treated with red lead compound and afterwards thickly coated with bitumen compound. All welded connections shall be made by electric arc welding. Resistance of the joint shall not be more than the resistance of the equivalent length of conductors.			
	VIII.	Earthing conduct below grade leve filling material to stones and harm 150 mm.	tors buried in ground shall be el unless otherwise indicate be placed over buried condu ful mixtures. Back filling sha	e laid minimum d in the drawir ictors shall be f ll be placed in l	600 mm g. Back ree from ayers of	
	IX.	Earthing conduct shall have approx	tors embedded in the concre ximately 50 mm concrete cov	ete floor of the ver.	building	
	Χ.	A minimum earth earth conductor pipes at crossing installed in pipes less than 300 m water, steam pip bonded to the columns, walls, e at interval of 100	um earth coverage of 300 mm shall be provided between nductor and the bottom of trench/foundation/underground crossings. Earthing conductors crossings the road can be in pipes. Wherever earthing conductor crosses or runs at n 300 mm distance along metallic structures such as gas, eam pipe lines, steel reinforcement in concrete, it shall be to the same. Earthing conductors along their run on , walls, etc. shall be supported by suitable welding / cleating al of 1000mm and 750mm respectively.			
	XI.	Earth pit shall b embedded prefe spacing between	shall be constructed as per IS:3043. Electrodes shall be d preferably below permanent moisture level. Minimum etween electrodes shall be 600mm.			
	XII.	Earth pits shall resistivity is more	be treated with earth enhate than 20 ohm meter.	ancement comp	oound if	
	XIII.	On completion of installation, continuity of earth conductors and efficiency of all bonds and joints shall be checked. Earth resistance at earth terminations shall be measured and recorded. All equipment required for testing shall be furnished by contractor.				
	XIV.	Contractor shall obtain all necessary statutory approvals for the earthing system before charging of the plant and electrical equipments.				
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3.0	TECHN	ICAL DETAILS	FOR A	C EARTHIN	IG SYSTE	EM	
	This se system bonding electrica	This section outlines the requirements of protective and functional earthing system to discharge AC fault current to earth and provide equipotential bonding for Transformer, HT and LT Switchgear Panel and other similar electrical equipments, Transformer neutral and shield.					
	The Co IEEE 80	Contractor shall furnish the detailed design and calculations as per 80/IS 3043 for Employer's approval for equipment earthing.					
3.1	Earthin	Earthing System requirement for AC Earthing: 1. Conductors above ground level and in built up trenches -Galvanized steel					
	2. 3. E	<ol> <li>Conductors buried in earth -Mild steel</li> <li>Earth electrodes - Mild steel rod of diameter 40mm or Copper bonded steel rod of dia not less than 17 mm</li> </ol>					17 mm
	<ul> <li>4. Life Expectancy - 25 years</li> <li>5. Fault Level - Mentioned Elsewhere</li> <li>6. Min. Steel corrosion - As per IS 3043</li> <li>7. Soil Restivity -Actual as per site condition</li> </ul> The sizes of earthing conductors for various electrical equipment shall be as below:						
	S Equipment Earth Earth conductor above No. Conductor ground level and in buried in built up trenches Earth					oove 1 in	
	1	33kV/11kV/6.6l kV/ swit equipment and 415V switchge	kV/3.3 chgear l ar		65 x 8	mm GS flat	
	2	415 V Distribution boards Transformers	MCC/		50 x 6	mm GS flat	
	3	LT Motors above 125 KW50 x 6mm GS flatLT Motors 25 KW to25 x 6mm GS flat					
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	125 KW 5 LT Motors 1 K	W to 25	25 x 3mm GS flat			
	6 Fractional power motor	House	8 SWG GS wire			
	7 Control par control desk	nel &	25 x 3 mm GS flat			
	8 Push station/Junctio Box	button n	8 SWG GI wire			
	9 Columns, stru cable trays a ducts enclosures	uctures, ind bus	50 x 6mm GS flat			
	10 Crane, rails tracks & Other non carrying metal parts	s, rail -current	25 x 6mm GS flat			
3.2	Contractor shall ensur earthing of each Transf Battery Charger/UPS/C shall be located near interconnected with p equipment.	e there at least two former, HT/LT Switcl Control Panel etc. sh to the equipment a arallel conductor b	o earth pits each dedi hgear panel, transforme nall be provided. Earth nd all earth electrodes uried in earth surrour	cated for er neutral, electrode shall be nding the		
3.3	Earthing system of different locations such as Inverter room/Pooling Switchgear/Sub pooling switchgear/Inverter shelter etc. shall be interconnected in single network with buried conductor of the size 65X8 GS Flat laid at 600 mm depth. Contractor shall submit the calculation based on the system of earth conductor and electrode connected in single network. Location and manner of interconnection shall be approved during detail engineering					
	Bidder shall also intere NTPC existing earthing	connect the earthing system wherever a	g system of Solar PV <sub>I</sub> vailable.	plant with		
3.4	For functional earthing of electronic component such as SCADA, contractor shall provide 1 no. (Min) isolated earth electrode near to the equipment connected with 2 run of copper cable of size not less than 25 sqmm. Contractor shall comply to the recommendation of OEM ( Original					
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	Equipment Manufacture connected with other ea	er) for electronic earthing arth electrode as per recomm	and electrode nendation of OE	can be M.	
3.5	Each inverter duty transformer having shield between HV and LV winding shall be provided with 2 nos. Isolated earth electrode connected with each other for functional earthing of transformer shield. Each electrode shall be connected with transformer shield with separate 25X6 Cu flat.				
4.0	TECHNICAL DETAIL S	OLAR ARRAY (DC) EART	HING (if applica	able)	
	This section outlines the earthing requirement for discharging DC fault current to earth of Solar PV plant and provide equipotential bonding for Module Mounting Structure (MMS), SMB Mounting structure, Module Frames etc.				
	System Requirement fo	r the solar array DC earthing	g:		
	Conductors buried in ea	arth -GS Flat or CCS			
	Conductors above grou	nd level -GS Flat or CCS			
	Earth Electrode	-40 mm MS Rod or Copper bonded steel rod of dia. not less than 14 mm			
	Life Expectancy	-25 Years			
	System fault level	-5 KA for 3 Sec.			
	Soil resistivity	-Actual as per site	e conditions		
	Min. Steel corrosion	-As per IS 3043			
4.1	Each Module mounting structure (MMS), SPV Module frames, mounting arrangement for String Monitoring Boxes, Metallic Junction Boxes, Metal frames/Panel, Metallic Pipes of the solar array shall be effectively earthed by two separate and distinct connections to earthing system. Earthing system for solar array shall consist interconnected earth pits electrodes connected by 25X6 GS flat (Min.) or Copper Clad Steel (CCS) earthing Conductor of size not less than 120 SQMM laid at the depth of 600 MM below the ground. Minimum size of riser conductor to connect the structures to buried earthing conductor and structure to structure in the solar farm shall be 25X3 GS Elector CCS of Min. 70 SO MM size				
4.2	Periphery fencing wherever provided shall be earthed at every 100 meter interval with 25X3 GS flat connected with DC or AC side nearest buried earthing conductor.				
4.3	Earthing conductor for connection to structure and equipment may be kept on the ground below MMS. However, these conductor shall be laid 300 mm below the ground along the pathway and/or crossing the pathway.				
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4.4	Equipment and structu to the IS: 3043 (Code Rules/Acts.	re in the solar farm shall be e of Practice for Earthing)	earthed in con and Indian E	npliance lectricity	
4.5	The Contractor shall Owner's approval as pe size of earth conductor. earthing shall be as pe	furnish the detailed design or IS 3043 to determine the r However the no. of earth p r Clause. 2.0 of Chapter A-2	n and calculat number of earth it electrodes for	ions for pit and the DC	
4.6	Buried earth conductor shall be laid all around periphery of solar array farm . GS flat above the ground for structure earthing shall be connected to the nearest buried conductor or electrode. All the earth electrodes shall be interconnected in single network/mesh and no electrode or group of electrodes shall be isolated/islanded. These electrodes shall be uniformly distributed in the solar farm at maximum practical extent and location of earth electrode shall be approved during detail engineering. A continuous earth path is to be maintained throughout the PV array.			ray farm ed to the shall be proup of iniformly cation of ntinuous	
4.7	Connection of DC earthing system and AC earthing system with location and manner of connection shall be approved during detail engineering. Contractor shall submit the design calculation of earthing system of AC and DC side as standalone (no interconnection) system.				
4.8	Connection of riser to the structures shall be bolted or welded type. Portion of galvanized structure which undergoes welding at site shall be coated with two coats of cold galvanizing and anti-corrosion paint afterwards.				
4.9	Connections between equipment earthing leads and between main earthing conductors shall be of welded type. For rust protection, welds should be treated with red lead compound and afterwards thickly coated with bitumen compound. All welded connections shall be made by electric arc welding				
4.10	Each PV Module frame shall be earthed in accordance with module manufacturer guidelines. In case module frame earthing is to be separately provided, it shall be earthed with minimum 2.5 SQMM flexible copper cables with lug at suitable location of module frame. Nos. of PV modules in single loop of earthing connection to module frame shall be as per Module manufacturer recommendation. Both ends of the loop of copper cable for earthing shall be connected with nearest earthed structure or earth				
4.11	Contractor shall seek owner's approval for connecting solar array earth mesh with any other earth mat/earth grid of the solar PV plant.				
4.12	Size of earth conductor, nos. of earth pits given in this clause is applicable for solar array earthing only. Relevant method and practice of laying of earthing conductor, earth pits and riser not mentioned herewith but given elsewhere in this specification is applicable to solar array earthing also.				
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4.13	Inverter functional earthing (Negative earthing, Anti PID Earthing) shall be carried out as per guideline of OEM. Contractor shall submit complete detail of such earthing from OEM and implement the earthing accordingly.				
<mark>5.0</mark>	EARTHING REQUIREN	IENT FOR EQUIPMENT ON	FLOATER <mark>(IF</mark>		
	INCLUDED IN THE SC	OPE OF BIDDER)			
5.1	Aforementioned requirement of the earthing are applicable earth surfaces. For Floater area, contractor shall lay 25X6 GI Flat all along the periphery of the floater area. This periphery GI Flat shall be connected at suitable location by laying minimum 2 Nos. of 25X6 GI flat equi-spaced (Location to be decided during detail engineering) along East-West and North-South direction making a grid 25X6 GI Flat on the floater.				
5.2	All the equipment/devices, module metallic frame & structure on the floater shall be connected with 25X6 Flat.				
	The earthing system of Floater shall be connected with earthing system of ground at each location of Inverter transformer with 2 (two) nos. of 120Sqmm copper earthing cable.				
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		CHAPTER-C10				
	PLANT		M			
	/					
	This chapter covers su along the peripheral roa and CMCS room,CMCS facilities inside the plant	pply and installation of suita ads and along the approach 5 room, inverter room(s), tran	ble illumination roads to invert sformer yard a	system er room nd other		
1.0	DESIGN PHILOSOPHY					
	A comprehensive illumin Each building shall be fans, etc. Exhaust fans	nation system shall be provid provided with adequate light shall also be provided in toile	ed in the entire fittings,6A/16A ts, battery roon	project. socket, n, etc		
	All outdoor lighting syste timer or photocell. Pro provided in the panel.	I outdoor lighting system shall be automatically controlled by synchronous ner or photocell. Provision to bypass the timer or photocell shall be ovided in the panel.				
2.0	LIGHTING SYSTEM DESCRIPTION for CMCS and inverter room					
	Normal AC Lighting System: AC lighting system 415V, 3Phase, 4wire, will be fed from lighting panels Control Board (LPs) which in turn will be fed from the lighting distribution boards (LDBs) of AC Switch board MCC. Emergency AC Lightning System: The emergency lighting system consisting of 20% of the lights shall be fed from UPS DB or DCDB as per scheme adopted by the EPC bidder. Load of the same has to be considered for UPS/ Battery and charger sizing. Bidder shall provide indoor and outdoor emergency lighting at each inverter room, CMCS, security room and main gate.					
3.0	Lighting Fixture, Lamp	os & Accessories				
	<ul> <li>a. All lighting fixtures and accessories shall be designed for continuous operation for its life under atmospheric conditions existing at site.</li> <li>b. AC lighting fixtures and accessories shall be suitable for operation on 240 V, AC, 50 Hz supply with supply voltage variation of +/-10%, frequency variation of +/- 5% and combined voltage and frequency variation (absolute sum ) of 10% DC lighting fixtures and accessories shall be suitable for operation on 220 V, with variation between 190 V &amp; 240 V.</li> <li>c. All lighting fixtures shall be complete with lamp(s), lamp holder(s), LED chip assembly, terminal blocks, clamps, locking arrangements, fixing brackets etc. Driver circuit/Control gears shall be provided as applicable</li> </ul>					
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<b>4.0</b> 4.1	<ul> <li>/ specified. The fixtinternal wiring of the halogen free thermod PTFE copper conduprotection of suitable specifically for LED conductor shall be of the maximum temper service conditions will uminaire when instance screws, washers, nights source or by referred to the ear continuity through outer the fixtures shall be suitable for metal enclosed parts connected to the ear continuity through outer for the fixtures shall be suitable or proven a generative shall be replayed or proven a generative shall be replayed or proven a generative shall be replayed or proven a generative shall be suitable for metal enclosed parts connected to the ear continuity through outer for the fixtures shall be suitable for metal enclosed parts andized or proven a generative shall be replayed or proven a generative shall be replayed or proven a generative shall be replayed or proven a generative shall be suitably LED luminaires body housing shall be mo and shall be suitably LED luminaires hout use of any interference suppress.</li> <li>h. LED luminaires body housing shall be mo and shall be suitably and shall be su</li></ul>	tures shall be fully wired up e fixtures shall be done wi p-plastic or silicon rubber ins inctor wires of suitable size a ole rating in input side sh luminaires. However, the n ot less than 0.5 Sq. mm and 6 mm. The wiring shall be of erature to which it will be sub vithout deterioration and affe illed and connected to the su uts, brackets, studs etc, sh hall be provided with an exter connecting 14 SWG, GI earl of the housing and accessor rthing terminal as so to ensu ut the fixture shall be designed for minimu- such that no bright spots are p flection I be manufactured from ( ed. The aluminium reflectors heet, polished electrochem alternate arrangement of ano bi-metal electrodes and high aceable without disturbing the tool. Starter shall have bra- sing capacitor. / shall such designed that he unted outside the overall lum / clearing the driver circuit. F exposed heat sink shall be su s accumulation on the same. sing/body shall be pressure or CRCA as specified alor be taken in the design the context of ano bise taken in the design the context of the driver circuit. F	to terminal bloc th suitable low ulated or fire re- and type. Furth hall also be p ormal cross set minimum thick capable of withs bjected under s ecting the safet pply. All fixing all be zinc pla ernal, brass/GI thing wire. All ies shall be bon re satisfactory um glare. The roduced either CRCA sheet s is shall be made ically brighten dizing h mechanical s e reflector or lar as contacts ar at sink/heat dis inaires fixture h further for outd itably designed die cast alumi ngwith finished nat there is n	ck. The v smoke etardant her fuse provided ection of kness of standing pecified y of the /locking ted and earthing metal or ded and earthing finish of by direct steel or e of high ied and strength. mps and nd radio ssipating nousing, oor type to avoid inium or powder o water
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	All standards and codes of practice referred to herein shall be the latest edition including all applicable official amendments & revisions as on date of techno-commercial bid opening. In case of conflict between this specification and those (IS codes, standards etc.) referred to herein, the former shall prevail. All work shall be carried out as per the following standards & codes.				
	16101:2012	General Lighting. LEDs and LED modules Terms and definitions			
	16102(Part 1):2012	Self Ballasted LED Lamps for General Lighting Services. Part-1 Safety Requirements.			
	16102(Part 2):2012	Self Ballasted LED Lamps for General lighting Services. Part-2 Performance Requirements.			
	16103(Part I):2012	LED modules for General lighting Safety Requirements.			
	15885(Part 2/Sec. 13) :/	2012Lamp control gear Part 2 particular Requirements Section 13 d.c. or a.c. Supplied Electronic control gear for LED modules			
	16104:2012	d.c. or a.c. Supplied Electronic control gear for LED modules - Performance Requirements.			
	16105:2012	Method of Measurement of Lumen maintenance of Solid-state Light (LED) Sources.			
	16106:2012	Method of Electrical and photometric Measurements of Solid State Lighting (LED) Products			
	16107:2012	Luminarie Performance			
	16108:2012	Photobiological safety of Lamps and Lamp Systems			
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	IS 513	Cold rolled low carbon ste	eel sheets and	strips
	IS 12063	Classification of degree o	f protection pro	ovided
	IS 14700 (Part 3/Sec. 2)	Electro magnetic compatibility (EMC) – Limits for Harmonic emission – THD < 15% (equipment, input current < 16 Amps. per pha		
	IS 9000 (Part 6)	Environment testing: Test Z – AD: composite temperature/humidity cyclic test.		
	IS 15885 (Part 2/Sec. 13) IS 16004 – 1 and 2)	Lamp control gear: particular requirements for DC or AC supplied electronic control gear for LED modules.		
	IS 4905 IEC 60598	Method for random sampling Ingress protection, luminaire performance a safety		
	IEC 61000-3-2	Total Harmonic Distortion		
	IEC 61000-4-5	Surge Protection		
	IES-LM 80 along with TM 21/ IS 16105	Lumen Depreciation and	Rated life of LE	D chip
	IES-LM 79 / IS 16106	Luminaire optics and colo electrical parameter	or parameter an	d
4.2	LED LIGHTING SYSTE	М		
	LED Luminaires shall be used for the lighting of all the indoor & outdoor areas. However for DC lighting & hazardous areas conventional type luminaires shall be used. In false ceiling area LED luminaires shall be recessed mounting type & in non-false ceiling area the LED luminaires shall be surface mounting type. The individual lamp wattage for LED shall be upto 3 watt for outdoor type luminaires. However for indoor type luminaires fractional wattage LEDs are also acceptable. The LED chip efficacy shall be min 120 Lm/W. The luminaire efficacy shall not be less than 80 Lm/W. Heat sink/heat dissipation arrangement shall be provided in the luminaires. The LED used in the luminaires shall have colour rendering index (CRI) of Min 70 and 80 for outdoor and indoor luminaires respectively.			
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	<ul> <li>indoor type LED luminaires. Further for outdoor type luminaires, the colour designation shall be 5000K, except for well glass type LED luminaires, where the colour designation shall be 4000K. The LED luminaires shall have minimum life of 25,000 burning hours with 80% of lumen maintenance at the end of the life.</li> <li>The beam angle for LED chip for indoor type luminaires shall be 120 degrees. However for highbay &amp; flood light type outdoor luminaires the LED chip with suitable beam angle shall be used to deliver better lumen-output. The maximum junction temperature of bare LED without heat sink shall be limited to 85 deg C, further the lumen maintenance at this temperature shall be min 90%. The THD of tube light based LED Luminaires shall be less than 20%. For other type of luminaires, it shall be minimum 10%.</li> <li>Further the EMC shall be as per IS 14700. The power factor of the luminaire shall be as per IS standards. Suitable heat sink/ heat dissipation arrangement, with proper thermal management shall be designed for the luminaires.</li> </ul>					
	<ul> <li>arrangement, with proper thermal management shall be designed for the luminaires.</li> <li>Driver Circuit: LED modules and drivers shall be compatible to each other. The LED module driver's ratings and makes shall be as recommended by corresponding LED manufacturer.</li> <li>LED Drivers may have following control &amp; protections:-</li> <li>Suitable precision current control of LED.</li> <li>Open Circuit Protection</li> <li>Short Circuit Protection</li> <li>Over Temperature Protection</li> <li>Overload Protection</li> <li>Surge Protection</li> <li>Lighting panels shall be powder coated with color shade RAL9002. Lighting panels shall have IP55 degree of protection.</li> <li>Wires of different phase shall normally run in separate conduit.</li> <li>Power supply shall be fed from 415 / 240 V normal AC supply through suitable number of conveniently located lighting distribution boards (LDB) and at least one 6/16A, 240V AC universal socket outlet with switch shall be provided in offices, cabins, etc.</li> <li>Suitable number of 63A, 3ph, 415V AC industrial receptacles shall be provided for welding purposes at one location.</li> <li>Incandescent lamps may be used only with DC Lighting.</li> <li>Electrification of all building shall be carried out as per IS 732-1989, IS 4648-1968 and other relevant standards.</li> </ul>					
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	<ul> <li>Indoor Lighting fixtures shall generally be controlled from switch boxes of each area not directly from lighting panel. Each switch shall control a maximum of three fixtures.</li> <li>All luminaries and their accessories and components shall be of type readily replaceable by available Indian makes.</li> <li>Following test reports to be submitted for LED chip/LED luminaires:</li> <li>a) LED parameters like Lumen per watt, CRI, Beam angle from manufacturer.</li> </ul>					
	manufacturer.	ort				
	c) LM 79/IS: 16106 rep	ort				
5.0	JUNCTION BOXES, CC	ONDUITS, FITTING & ACCES	SSORIES			
	Junction box for indoor lighting shall be made of fire retardant material. Material of JB shall be Thermoplastic or thermosetting or FRP type. Junction boxes for street lighting poles and lighting mast if applicable , shall be deep drawn or fabricated type made of min. 1.6 mm thick CRCA Sheet. The box shall be hot dip galvanized. The degree of protection shall be IP55. All switches and receptacles upto 16A shall be modular type. These shall be provided with pre-galvanized/galvanized modular switchbox & plate. Conduits, Pipes and Accessories: Heavy duty PVC conduits conforming to IS: 9537 Part-III along with various accessories shall be used for indoor wiring in the buildings. These conduits shall be concealed in the wall/floor/roof. However, in PEB's, conduits can be fixed on surface. Pull out boxes shall be provided at suitable interval in a conduit run .Boxes shall be suitable for mounting on Walls, Columns, etc. Pull-out boxes shall have cover with screw. Pull out boxes used outdoor shall be weather proof type suitable for IP: 55 degree of protection and those used indoor shall be					
6.0	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 and white & grey for DC positive & DC negative circuits, respectively. Minimum size of wire shall not be less than 1.5.sq.mm. for copper					
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7.0	LIGHTING POLES					
	The Street Light system and peripheral lighting shall be designed generally in line with design guidelines. Height of the poles should be chosen so as not to affect working of Solar panels. The poles shall be hot-dip galvanized as per relevant IS2629/ IS2633/ IS4759. The average coating thickness of galvanizing shall be min. 70 micron. The System shall be capable of withstanding the appropriate wind load etc as per IS 875 considering prevailing soil/ site condition considering all accessories mounting on pole.					
	The street light poles shall have loop in loop out arrangement for cable entry and light fixture / wiring protected with suitably rated MCB. The required illumination level shall be as per Cl. 9.0 taking consideration of existing lighting infrasture.					
	Hot dipped Galvanized with 80 mm thickness hexagonal/Octagonal lighting pole with inbuilt JB shall also be acceptable					
	The luminaries used shall be minimum 32 W with minimum pole height of 2.5 m with 35m inter-pole spacing for peripheral roads & 50 m for internal roads respectively.					
8.0	EARTHING					
	Lighting panels, etc. shall be earthed by two separate and distinct connections with earthing system. Switch boxes, junction boxes, lighting fixtures, fans, single phase receptacles etc. shall be earthed by means of separate earth continuity conductor. The earth continuity conductor 14 SWG GI wire shall be run along with each conduit run. Cable armours shall be connected to earthing system at both the ends. Alternately Vendor may offer technically superior and proven product subject to approval of employer.					
9.0	AVERAGE ILLUMINATION LEVEL					
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LocationAverage Illumination Level (Lux)Type of FixtureControl Room300LED LuminariesStore Room200LED LuminariesSwitchgear Room, HT Room150LED LuminariesInverter Room150LED LuminariesStreet lighting-Roads10LED LuminariesYard/ Substation20(general) 50(on strategic equipment)LED Luminaries	नरीपीमी NTPC
Control Room300LED LuminariesStore Room200LED LuminariesSwitchgear Room, HT Room150LED LuminariesInverter Room150LED 	
Store Room200LED LuminariesSwitchgear Room, HT Room150LED LuminariesInverter Room150LED LuminariesStreet lighting-Roads10LED LuminariesYard/ Substation20(general) 50(on strategic equipment)LED Luminaries	<b>)</b>
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RoomLuminariesInverter Room150LEDLuminariesStreet lighting-Roads10LEDLuminariesYard/ Substation20(general)LED50(on strategic equipment)Luminaries	
Inverter Room100LED LuminariesStreet lighting-Roads10LED LuminariesYard/ Substation20(general) 50(on strategic equipment)LED Luminaries	-
Street lighting-Roads10LED LuminariesYard/ Substation20(general)LED 50(on strategic equipment)	
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Yard/ Substation 20(general) LED 50(on strategic Luminaries equipment)	
equipment)	
equipment)	
I     Image: Constraint of 20MW Solar PV Project     TECHNICAL SPECIFICATION     PART-C       at Central Coalfields Limited (CCL)     BIDDING DOC. NO:     CHAPTER-C10       CHP/CPP Piparwar, Jharkhand     RE-CS-9296-004-9     CHAPTER-C10	<b>Page</b> 8 of 8

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	CHAPTER-C11						
		AUXILLAR	Y POWER SUF	PPLY SY	STEM		
1.0	GENE	ERAL					
1.1	Auxilia Inverte power shall I auxilia kVA ca	Auxiliary power supply arrangement shall be in line with tender SLD. Each Inverter Room/local pooling/sub-pooling room shall have its own auxiliary power supply system comprising of AC distribution board (ACDB) which shall be fed from LV side of Inverter transformer through suitably rated auxiliary transformers. Following consideration shall be taken while arriving kVA capacity of auxiliary transformer					
	1. 20%	6 design margin.					
1.2	All non-critical auxiliary loads shall be fed directly from ACDB. However, emergency and important load shall be fed from suitable sized Uninterrupted Power Supply (UPS) or Battery Charged. Input AC supply for Uninterrupted Power Supply (UPS) and Battery Charger shall be fed from ACDB. Bidder shall consider the following one of the supply option for feeding different equipment loads:						
	SI No	Equipment Name	)	Option- 1 ACDB	Option- 2	Option-3 Battery	
	1.	SCADA including	g remote RTU/IO		<u>√</u>	√ v	
	2.	SCADA HMI			✓	✓	
	3.	Data logger			✓	✓	
	4.	Fire Detection /A	larm Panel		✓	✓	
	5.	Emergency Light	ing		✓	<ul> <li>✓</li> </ul>	
	6.	CCTV (if applical	ole)		<b>√</b>	<ul> <li>✓</li> </ul>	
	/. o	HIVII OT SCADA	av cupply (if		<b>√</b>	✓ √	
	Ö.	applicable)	y supply (II		v	<b>v</b>	
	9.	Energy Meter/MF	M		✓	✓	
	10.	Sub and Local P	ooling		<ul> <li>✓</li> </ul>	✓	
		Switchgear cont	rol & protection				
	11.	Main Pooling Sw	itchgear			$\checkmark$	
		(CMCS) control &	& protection				
	12.	Switchgear spring	g charging		✓	✓	
	12	motor	boator				
13.switchgear space heaterDevelopment of 20MW Solar PV Project at Central Coalfields Limited (CCL) CHP/CPP Piparwar, JharkhandTECHNIC/ BIDD RE-C			TECHNICAL SPECIF BIDDING DOC. N RE-CS-9296-004	FICATION NO: 4-9	PART- CHAPTER	C R-C11 Pag 1 of	ge 16

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	14.Illumination, Fan15.Module washing16.Other non-critica	supply etc system I auxiliary loads	✓ ✓ ✓			
1.3	UPS system shall comp 1x100% charger and i minutes backup. Bypas 100% UPSDB, and oth UPSDB shall have two above. At a time one ind logic shall be provided system (2 x 100% Batta auxiliary power supply re	orise of 2 x 100% nverter, 1 x 100% as Line static switcher necessary Pro- incomer fed from comer shall be in s In place of UPS ery Charger) of 12 equirement of load	UPS. Eac % Battery tch, manu tective de n two sep service. Su , bidder o 2V or abov ls are in Do	ch UPS shall c bank for prov al bypass swi vices and acce arate UPS as atable auto cha can provide DC ve upto 220V E C.	onsist of iding 30 tch, 1 x essories. mention ingeover C supply DC if the	
1.4	The rated AC output capacity shall be taken for UPS battery size calculation. However the minimum UPS rating shall be 2KVA and the battery sizing shall be calculated on a minimum load of 1 KW (DC) for 30 minute backup. All UPS having rating 5KVA or more shall have three phase input.					
1.5	The Bidder can provide such as power pack with	e alternate arrange n 30 minute backu	ement with p for switcl	suitable redurngears.	ndancies	
1.6	Each Battery charger system shall consist of 1 x 100% charger and 1 x 100% Battery bank for min 30 minutes back up and 1 x 100% DCDB, and other necessary protective devices and accessories. DC supply system voltage shall be 12V or above upto 220V DC					
1.7	It is mandatory to use supply of main pooling F	Battery charger s	system for	control and p	rotection	
1.8	Bidder shall submit configuration diagram, power supply distribution scheme, single line diagram and data sheets, all calculations such as Rectifier Modules/UPS Charger/Inverter rating calculations, battery sizing calculation etc. for UPS, Battery Charger & Battery system during detailed engineering stage for employer's review and approval.					
1.9	Size and rating of UPS, Battery Charger and Battery shall be finalized during details engineering stage.					
2.0	UNINTERRUPTIBLE POWER SUPPLY (UPS) SYSTEM					
2.1	2.1 The minimum capacity of the UPS at load factor of 0.8 lagging inclusive of 10% design margin at 50 deg C. The UPS shall have an overload capacity of 125 % rated capacity for 10 minutes and 150 % rated capacity for 10 seconds. The overall efficiency of UPS shall be at least 80% on full load.					
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2.2	The UPS system shall circuit under all cond components of UPS I guaranteed without the l	Il be capable of operating without D.C. battery in ditions of load and the performance of various like inverter, charger, static switch etc. shall be battery in circuit.					
2.3	For UPS capacity 5 kV/ panel, important alarms provided for use in SCA provide status, common	A or more, in addition to indications/display on UPS s along with important analog signal shall also be ADA. For UPS capacity less than 5 kVA bidder shall alarm and trip DI (soft or hard) signal to SCADA					
2.4	The UPS chargers shall wave rectifier type desi and shall have automat when AC supply voltage charge the required bat inverter. The charger sh within 8 hours. The charger 10% and frequency va there is no component supply and restoration. UPS rating of 5kVA and section below in this spe	shall be self-regulating, solid state silicon controlled, full- designed for single and parallel operation with battery pmatic voltage regulators for close voltage stability even oltage fluctuates. The charger should be capable to fully d batteries as well as supply the full rated load through er shall be able to re-charge the fully discharge battery e charger shall be design for input supply variation of $\pm$ y variation of $\pm$ 5%. Charger design shall ensure that nent failure due to fluctuations of input supply or loss of ion. The detailed specification for the battery charger for A and above has been mentioned in the battery charger					
2.5	The UPS inverter shall be of continuous duty, solid state type using proven Pulse Width Modulation (PWM)/Quasi square wave/step wave technique. Ferro-resonant types Inverters are not acceptable. The nominal voltage output shall be 230 Volts single phase ,50 Hz. The inverter equipment shall include all necessary circuitry and devices to conform to requirements like voltage regulation, current limiting, wave shaping, transient recovery, etc. The total harmonic content shall be 5% maximum and content of any single						
2.6	The static switch shall be provided to perform the function of transferring UPS loads automatically without any break from faulty inverter to standby AC source. Manual bypass switch shall be employed for isolating the UPS during maintenance						
2.7	Contractor has the option of supplying either Nickel Cadmium type batteries or Lead Acid Plante type batteries. The detailed specification for the batteries has been mentioned in the battery and charger section below in this specification.						
2.8	Equipment enclosures freestanding floor moun	shall match and line ted cabinets designed for ind	up in asseml loor service.	olies of			
2.9	Individual enclosure sha less than 1.6-mm thick	Ill be ventilated switchboard t sheet steel. Enclosures s	type fabricated shall be furnish	from not red with			
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	concealed hinges. Fron access to all componen shall be reinforced with self-supporting structure	t and rear doors shall be de ts for maintenance or replac formed steel members as r . Doors shall have three poir	esigned to perr ement. The end required to form at latches.	nit easy closures n a rigid	
2.10	Adequate ventilating louvers and enclosure top panels shall be included. All vent openings shall be covered with corrosion resistant fine screen coverings.				
2.11	The cabinets shall be IF for outdoor application.	P-42 protection class for indo	or application a	ind IP65	
2.12	The temperature rise in deg.C above ambient te	side all the cabinets/enclosui mperature.	res shall not ex	ceed 10	
2.13	The Contractor shall also carry out the site tests on UPS as required to be conducted as a standard practice of the UPS manufacture or deemed necessary by the Employer and mutually agreed between the Contractor and the Employer.				
2.14	One set of tool shall be	provided for maintenance and	d testing purpo	ses.	
3.0	BATTERY CHARGER				
3.1	The chargers shall be self regulating, solid state silicon controlled, full-wave rectifier type designed for single and parallel operation with battery and shall have automatic voltage regulators for close voltage stability even when AC supply voltage fluctuates, effective current limiting features and filters to minimise harmonics. The charger should be capable to fully charge the required batteries as well as supply the full rated load. Furthermore the charger should be able to re-charge the fully discharged battery within 8 hours. The charger shall be current limited for charger circuit protection and protection of battery from overcharge shall also be provided. The current limit shall be continuously adjustable. The chargers shall have a slow walk-in circuit. Charger design shall ensure that there is no component failure due to fluctuations of input supply or loss of supply and restoration. The charger shall be design for input supply voltage variation of ± 10% and				
3.2	Battery Chargers shall charging mode i.e. whet	have a selector switch for her Trickle or Boost charging	r selecting the <sup>J.</sup>	battery	
3.3	All Battery Chargers shall be provided with facility for both automatic and manual control of output voltage and current. A selector switch shall be provided for selecting the mode of output voltage/current control, whether automatic or manual. Means shall be provided to avoid current/voltage surges of harmful magnitude/nature which may arise				
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	during changeover from operating condition.	Auto to Manual mode or vice	e-versa under	normal		
3.4	Soft start feature shall be provided to build up the voltage to the set value slowly. The chargers shall have load limiters which shall cause, when the voltage control is in automatic mode, a gradual lowering of the output voltage when the DC load current exceeds the load limiter setting of the Charger. The load limiter characteristic shall be such that any sustained overload or short circuit in DC system shall neither damage the Charger nor shall it cause blowing of any of the charger fuses. The Charger shall not trip on overload or external short circuit. After clearance of fault, the Charger voltage shall build up automatically when working in automatic mode.					
3.5	When on automatic co output voltage shall rem voltage variation of +/-10 voltage and frequency (a continuous DC load variadjustments of voltage be provided on the front charging output range voltage correction record the respective battery m setting shall also be pos for Trickle charging mod	When on automatic control mode during Trickle charging, the Charger output voltage shall remain within +/-1% of the set value for AC input voltage variation of +/-10%, frequency variation of +3/-5%, a combined voltage and frequency (absolute sum) variation of 10% and a continuous DC load variation from zero to full load. Uniform and step-less adjustments of voltage setting (in both manual and automatic modes) shall be provided on the front of the Charger panel covering the entire Trickle charging output range specified & shall be capable of matching the float voltage correction recommendations (w.r.t. temperature) as suggested by the respective battery manufacturer. Step-less adjustment of the load limiter setting shall also be possible from 80% to 100% of the rated output current				
3.6	During Boost charging, the Battery Chargers shall operate on constant current mode (When automatic regulator is in service). It shall be possible to adjust the Boost charging current continuously over a range of 50 to 100% of the rated output current for Boost charging mode. The charger output voltage shall automatically go on rising, when it is operating on boost mode, as the battery charges up. For limiting the output voltage of the charger, a potentiometer shall be provided on the front of the panel, whereby it shall be possible to set the upper limit of this voltage anywhere in the output range specified for boost charging mode. All voltage and					
3.7	Energizing the Charger with fully charged battery connected plus 10% load shall not result in output voltage greater than 110% of the voltage setting. Time taken to stabilize, to within the specified limits as mentioned elsewhere, shall be less than fifteen seconds.					
3.8	3.8 Momentary output voltage of the Charger, without the Battery connected shall be within 94% to 106% of the voltage setting during sudden load Change from 100% to 20% of full load or vice-versa. Output voltage shall					
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	return to, and remain, w less than 2 seconds afte	vithin the limits specified as r er the above mentioned chan	nentioned elsev ge.	where in	
3.9	Suitable filter circuits shall be provided in all the Chargers to limit the ripple content (peak to peak) in the output voltage to 1% irrespective of the DC load, even when they are not connected to a battery.				
3.10	The DC System shall b potential when healthy. in the DC distribution bo	e ungrounded and float with An earth fault relay shall be p ard for remote annunciation.	n respect to the provided by the	e ground e bidder	
3.11	Digital Outputs shall be time charger status up voltage, float/boost moo SCADA.	e configured for connection t dation. Outputs like charger le, etc may be configured to	to the SCADA output current provide the up	for real- , output pdate to	
3.12	The Battery Chargers as well as their automatic regulators shall be of static type. The Chargers shall be designed to operate, as mentioned above, at an ambient air temperature of 50°C.				
3.13	For Lead Acid plante battery:-Battery chargers shall be capable of continuous operation at the respective rated load in Trickle mode i.e. Trickle charging the associated DC lead-acid Batteries while supplying the D.C. loads. The Batteries shall be Trickle charged at 2.25 Volts per cell. All chargers shall also be capable of Boost charging the associated D.C. Battery at 2.3 to 2.7 Volts per cell at the desired rate.				
3.14	For Nickel-Cadmium battery:-Battery chargers shall be capable of continuous operation at the respective rated load in Trickle mode i.e. Trickle charging the associated DC Nickel-Cadmium Batteries while supplying the D.C. loads. The Batteries shall be Trickle charged at 1.4 to 1.42 Volts per cell. All chargers shall be capable of Boost Charging the associated D.C. Battery at 1.54 to 1.7 Volts per cell at the desired rate.				
3.15	All Battery Chargers shall have an AC contactor on the input side. It shall be of air break type and suitable for continuous duty. A thermal overload relay incorporating a distinct single phasing protection (using differential movement of bimetal strips) shall also be provided for the AC input. The relay shall trip the above contactor				
3.16	The rectifier assembly shall be full wave bridge type and designed to meet the duty as required by the respective Charger.				
3.17	Digital or analog indicating instruments shall indicate DC current, DC voltage & AC voltage.				
3.18	3.18 The Chargers shall be indoor, floor mounted, self supporting sheet metal enclosed cubicle type. The Contractor shall supply all necessary base frames, anchor bolts and hardware. The Charger shall be fabricated using				
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	cold ro type o sheet plates supplie proof. doors Charge backsi cubicle	cold rolled sheet steel shall not be less than 1.6 mm and shall have folded type of construction. The panel frame shall be fabricated using cold rolled sheet steel of thickness not less than 2.0 mm. Removable undrilled gland plates of at least 3.0 mm sheet steel and lugs for all cables shall be supplied by the Contractor. The Charger shall be tropicalised and vermin proof. Ventilation louvers shall be backed with fine brass wire mesh. All doors and covers shall be fitted with synthetic rubber gaskets. The Chargers shall have hinged double leaf doors provided on front and/or backside for adequate access to the Charger internals. All the Charger cubicle doors shall be properly earthed.						
3.19	Treatn powde covers	Treatment as per IS: 6005. Two coats of lead oxide primer followed by powder painting with final shade of RAL9002 for complete panel except end covers & RAL 5012 for end covers.						
3.20	All acceptance and routine tests as per the manufacture recommendations and relevant standards shall be carried out.							
3.21	The cabinets shall be IP-42 protection class for indoor application and IP65 for outdoor application.							
3.22	The Contractor shall also carry out the site tests on battery charger systems required to be conducted as a standard practice of the UPS manufacture or deemed necessary by the Employer and mutually agreed between the Contractor and the Employer.							
4.0	BATTE	ERY: NICKEL-CA	DMIUM E	ATTERY				
4.1	BATT	ERY PARAMETE	RS					
	a)	Battery Voltage		To be decide during	Detail Engineer	ng		
	b)	No. of Cells		To be decide during	Detail Engineer	ng		
	c)	Battery type		Nickel-Cadmium				
	d)	Nominal o	lischarge	1.2				
		voltage per Cell		4.40)//0-1				
	e)	Float voltage		1.42 V/Cell				
	Batter	ies should be su	itable fo	r continuous opera	tion for the m	aximum		
	ambie	nt temperature as	defined i	n technical parame	ters.			
4.2	CODE	S AND STANDA	RDS					
	All sta	indards, specifica	tions and	codes of practice r	referred to here	ein, shall		
	be the	e latest editions	including	all applicable off	icial amendme	nts and		
Dovalormant		ons as on date	ot openir	ig of techno-comm	nercial bid. In	case of		
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	conflict between this referred to herein, the per the following stand IEC 60623/ IS Sp	conflict between this specification and those (IS codes, Standards etc.) referred to herein, the former shall prevail. All works shall be carried out as per the following standards and codes: IEC 60623/ IS Specification for vented type Nickel Cadmium Batteries. 10918					
	IS 106 Qu	ality tolerances for water for stora	age batteries				
	IEC 60993 Electrolyte for vented Nickel-Cadmium cells						
	Indian electricity rules						
	Indian electricity acts						
	Equipment complying with other internationally accepted standards such as IEC., BS, VDE etc. will also be considered if they ensure performance and constructional features equivalent or superior to standards listed above. In such a case, the Bidder shall clearly indicate the standard(s) adopted, furnish a copy in English of the latest revision of the standards alongwith copies of all official amendments and revisions in force as on date of opening of techno-commercial bid and shall clearly bring out the salient features for comparison.						
4.3	DC Batteries shall be stationary Nickel Cadmium Pocket plate type conforming to IS:10918. The batteries shall be high/medium discharge performance type suitable for the backup time as specified. For the purpose of design an ambient temperature of 50 degree centigrade and relative humidity of 85% shall be considered.						
4.4	DC batteries shall be suitable for standby duty. The batteries shall normally be permanently connected to the load in parallel with a charger and shall supply the load during emergency conditions when AC supplies are lost. Batteries shall be suitable for a long life under continuous float operations and occasional discharges. The batteries shall be boost charged at about 1.54 to 1.7 volts per cell maximum and float charged at about 1.42 V/cell						
4.5	Construction Featur	es:-					
a)	Containers						
	Containers shall be made of polypropylene plastic material. Containers shall be robust, heat resistance, leak proof, non absorbent, alkali resistant, non-bulging type and free from flaws, such as wrinkles, cracks, blisters, pin holes etc. Electrolyte level lines shall be marked on container in case of translucent containers.						
b)	Vent Plugs						
	Vent plugs shall be provided in each cells. They shall be antisplash type, having more than one exit hole shall allow the gases to escape freely but						
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	shall prevent alkali from coming out. The design shall be such that the water loss due to evaporation is kept to minimum. In addition the ventilator shall be easily removed for topping up the cells and of such dimensions that the syringe type hydrometer can be inserted into the vent to take electrolyte samples.				
C)	Plates				
	The plates shall be d conditions including hi The construction of pl The separators shall n and shall allow the ele- for continuous immersi	esigned for maximum dural gh rate of discharge and rap ates shall conform to latest naintain the electrical insulat ctrolyte to flow freely. Separa on in the electrolyte without o	bility during all bid fluctuations revisions of IS ion between th ators should be listortion.	service of load. 5:10918. e plates suitable	
	The positive and negat	ive terminal posts shall be cle	early marked.		
d)	Sediment Space				
	Sufficient sediment space shall be provided so that cells will not have to be cleaned during normal life and prevent shorts within the cells.			ve to be	
e)	Electrolyte				
	The electrolyte shall be prepared from battery grade potassium hydroxide conforming to IEC 60993. The cells can be shipped either in charged condition or in dry condition. Necessary electrolyte for make-up shall be supplied separately.				
f)	Connectors and Fast	eners			
	Nickel plated copper connectors shall be used for connecting adjacent cells and PVC insulated flexible copper cables shall be used for inter-row / inter-tier / inter-bank connections. Bolts, nuts and washers shall be Stainless Steel / Nickel coated steel to prevent corrosion. The thickness of Nickel coating of connectors should be not less than 0.02 mm. All the terminals and cells inter-connectors shall be fully insulated or have insulation shrouds.				
g)	Battery racks				
	Mild steel racks for all the batteries shall be provided. They shall be free standing type mounted on porcelain/hard rubber/PVC pads insulators/High impact plastic insulators. Batteries shall preferably be located in the single tier arrangement. However, batteries having a complete cell weight of lower than 50 Kg could be located in the double tier arrangement. The batteries racks and supports for cable termination shall be coated with three (3) coats of anti-alkali paint of approved shade. Name plates, resistant to alkali, for each cell shall be attached on to the necessary				
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	racks. The bottom tier of the stand shall not be less than 150 mm above the floor.							
h)	<b>Test</b> The Contractor shall submit for Owner's approval the reports of all the type tests carried out as per latest IS-1146(for all applicable tests for containers) / IS-10918 (for NI-CD batteries).The complete type test reports shall be for any rating of battery in a particular group, based on plate dimensions being manufactured by supplier. Routine and Acceptance tests shall be as per Quality Assurance & Inspection table of battery.							
5.0	BATTERY: LEA	AD -ACID PLAN	TE BATTERY					
5.1	BATTERY PAR	RAMETER						
	a) Battery V	/oltage	To be decide during D	etail Engineering	g			
	b) No. of Ce	ells	To be decide during D	etail Engineering	g			
	c) Battery type Stationary Lead Acid Plante							
	d) Nominal discharge 2.0V							
	voltage p	voltage per cell						
	e) Float Voltage 2.25V/Cell							
5.2	CODES AND STANDARDS							
	IEC 60896	Stationary Lea	d-Acid Batteries					
	IS : 266	Specification fo	or sulphuric acid					
	IS : 1069	Specification for	or water for storage batt	eries				
	IS : 1146	Specification for storage batteries	or rubber & plastic cor es.	ntainers for lead	acid			
	IS : 1652	Specification for type (with plant	or stationary cells and te positive plates).	l batteries, lead	acid			
	IS : 3116	Specification for	or sealing compound for	r lead acid batter	ries.			
	IS : 8320	General requir	ements and methods	of tests for lead	acid			
	IS : 6071	Specification batteries.	for synthetic separa	tors for lead	acid			
	Indian Electric	ity Rules						
	Indian Electric	ity Acts						
Development at Central CHP/CPP Pip	of 20MW Solar PV Coalfields Limited arwar, Jharkhand	Project TECHN (CCL) B	ICAL SPECIFICATION IDDING DOC. NO: E-CS-9296-004-9	PART-C CHAPTER-C11	Page 10 of 16			

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	Equipment complying as IEC, BS, VDE etc. and constructional fea above. In such a case adopted, furnish a copy alongwith copies of all date of opening of tech salient features for com	with other internationally ac will also be considered if the tures equivalent or superio , the Bidder shall clearly in y in English of the latest re- official amendments and re- nno-commercial bid and sha parison.	cepted standar ey ensure perfo or to standard ndicate the stan vision of the st evisions in forc all clearly bring	ds such ormance Is listed ndard(s) andards e as on out the
5.3	DC Batteries shall be conforming to IS:1652 performance type suitab of design an ambient humidity of 85% shall be	stationary lead acid Plan . The batteries shall be h le for the backup time as spe temperature of 50 degree of e considered.	te positive pla high/medium di ecified. For the centigrade and	ate type scharge purpose relative
5.4	DC Batteries shall be suitable for standby duty. The Batteries shall normally be permanently connected to the load in parallel with a charger and shall supply the load during emergency conditions when AC supplies are lost. Batteries shall be suitable for a long life under continuous float operations and occasional discharges. The batteries shall be boost charged at about 2.7 volts per cell maximum and float charged at about 2.25 V/cell.			
5.5	<b>Construction Features</b>	:-		
a)	Containers			
	Containers shall be made of transparent glass, hard rubber, suitable robust, heat resistance, leak proof, non absorbent, acid resistant, non-bulging type and free from flaws, such as wrinkles, cracks, blisters, pin holes etc. Electrolyte level lines shall be marked on container in case of transparent containers. Float type level indicator shall be provided in case of opaque containers. The stem portion of the float should be long enough to prevent falling of the float inside the container even if there is no electrolyte in the container. The marking for the electrolyte level should be for the upper and lower limits. The material of level indicator shall be acid proof and oxidation proof. Container shall be closed/sealed lid type. Lid and sealing compound shall be non-cracking type. The container made of hard rubber and plastics shall be type tested as per IS : 1146. All type tests shall be carried out for			
	The pole sealing arrangement should be such that no acid particle get entrapped due to acid creep as a result of capillary action and it should be possible to remove and refix the sealing to carry out the maintenance.			
b)	Vent Plugs			
Development at Central CHP/CPP Pip	of 20MW Solar  PV Project Coalfields  Limited  (CCL) arwar, Jharkhand	TECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-9296-004-9	PART-C CHAPTER-C11	Page 11 of 16

CLAUSE NO	TECHNIC	CAL SPECIFICATIONS	(	एनरीपीसी NTPC	
	Vent plugs shall be provided in each cells. They shall be antisplash type, having more than one exit hole shall allow the gases to escape freely but shall prevent acid from coming out. The design shall be such that the water loss due to evaporation is kept to minimum. In addition the ventilator shall be easily removed for topping up the cells and of such dimensions that the syringe type hydrometer can be inserted into the vent to take electrolyte sample.				
c)	Plates				
	The plates shall be de conditions including hig The construction of pla- applicable.	esigned for maximum durat h rate of discharge and rap tes shall conform to latest re	bility during all bid fluctuations evisions of IS :	service of load. 1652 as	
	The separators shall maintain the electrical insulation between the plates and shall allow the electrolyte to flow freely. Separators should be suitable for continuous immersion in the electrolyte without distortion. The positive and negative post shall be clearly marked.				
d)	Sediment Space				
	Sufficient sediment space shall be provided so that cells will not have to be cleaned during normal life and prevent shorts within the cells.				
e)	Cell Insulator				
	Each cell shall be separately supported on PVC/porcelain/hard rubber insulators fixed on the racks with adequate clearance between adjacent cells. Minimum distance between adjacent cells shall be more than the bulge allowed for two cells in accordance with IS:1146.				
f)	Electrolyte				
	The electrolyte shall be prepared from battery grade sulphuric acid conforming to IS:266 and distilled water conforming to IS:1069. The cells shall be shipped dry uncharged. The electrolyte shall be supplied separately.			ric acid he cells supplied	
g)	Connectors and Faste	ners			
	Lead or Lead coated copper connectors shall be used for connecting up adjacent cells and rows. Bolts, nuts and washers shall be effectively lead coated to prevent corrosion. The thickness of lead-coating of connectors should not be less than 0.025 mm. The lead coating thickness shall be measured in accordance with APPENDIX F of IS:6848 (latest edition). All the terminals and cells inter-connectors shall be fully insulated or have insulation shrouds. End take off connections from positive and negative poles of batteries shall be made by single core cables having stranded				
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	copper conductors and PVC insulation. Necessary supports and lugs for termination of these cables on batteries shall also be supplied by the contractor.				
h)	Batter	y racks			
	Woode made specifi rubber prefera having double termin approv attach be les dismai easy a	en racks for all th of good quality f cation. They sha /PVC pads insula ably be located i g a complete cell e tier arrangemen ation shall be c ved shade. Numb ed on to the nece s than 150 mm a ntled condition, su	the batteries shall be provided. First class seasoned teak wood ators/High impact plastic insu- n the single tier arrangement weight of lower than 50 Kg c t. The batteries rack and wood coated with three (3) coats being tags, resistant to acid, essary racks. The bottom tier above the floor. Wherever rac- uitable match markings shall b	These racks od in line with nted on porcel ulators. Batteri nt. However, I could be locate oden support f of anti-acid for each cell of the stand s cks are transp pe provided to	shall be a CPWD ain/hard ies shall batteries ed in the for cable paint of shall be shall not ported in facilitate
i)	Test				
	The Contractor shall submit for Owner's approval the reports of all the type tests carried out as per latest IS-1146 (for rubber & plastic containers for lead-acid storage batteries)/IS 1652 (for lead-acid plante batteries). The complete type test reports shall be for any rating of battery in a particular group, based on plate dimensions being manufactured by supplier. Routine and Acceptance tests shall be as per Quality Assurance & Inspection table of battery.				
6.0	AUXIL	IARY EQUIPME	NTS		
	Manual discharge resistance bank suitable for each type of battery bank of UPS/Battery Charger has to be provided by contractor.				
	a	Hydrometers	······································	2 Nos.	
	b	Set of hydromete holes in different	er syringes suitable for the vent	2 Nos.	
	С	Thermometer temperature	for measuring electrolyte	2 Nos.	
	d	Specific gravity co	prrection chart	2 Nos.	
Development at Central CHP/CPP Pip	of 20MW Coalfields arwar, Jha	Solar PV Project Limited (CCL) arkhand	TECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-9296-004-9	PART-C CHAPTER-C11	Page 13 of 16

CLAUSE NO	TECHNICAL SPECIFICATIONS						
		· · · ·					
		e Wall mounting type holder made of teak wood hydrometer & thermometer				2 Nos.	
		f	Cell testing voltme	eter (3-0-3 V)		2 Nos.	
		g Alkali mixing jar			2 Nos.		
		h	Rubber aprons			5 Nos.	
		i	Pair of rubber gloves				
		j	Set of spanners			5 Nos.	
		k	lo smoking notice for each battery room			2 Nos.	
		1	Goggles (industrial)			2 Nos.	
		m				2 Nos	
		n				1 No per roo	um.
		o Cell lifting facility			1 Set per roo	m	
	Following shall be taken as minimum load value for sizing calculation of UPS/Battery Charger/Battrery system. However, Bidder needs to provide the details auxiliary power rating of each individual equipments. & any other load apart from below required for completion of the system is also in the scope of the bidder.					lation of provide ny other so in the	
	SI Description Rated Power Remarks				S		
		1	HT Switchgea	ar VCB Panel			
		(i)	Closing Coil		300	First minute	load
		(ii)	Tripping Coil		300	Last minute	load
		(iii)	Spring Charg	ing Motor	400	First minute	load
		(IV)	Numerical Re	elay	20	Continuous	load
		(V) (vi)	Auxiliary Rela	ays	20 (total)	Continuous	
		(vi) (vii	) Misc load	пръ	50 (total)	Continuous	load
		2	Inverter (if an	plicable)	300	Continuous	load
		3	SCADA pane	l at CMCS	2500	Continuous	load
		4	SCADA HMI	including LED	1000	Continuous	load
			Display and F	Printer			
		5	SCADA RTU	panel at PEB	500	Continuous	load
		6	I ransformer		100	Continuous	IOAD
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CLAUSE NO	TECHNICAL SPECIFICATIONS				एनरीपीम्री NTPC	
		unit at PEB (i	f applicable)			
	7	Fire Alarm Pa	anel at CMCS	300	Continuous	load
	8	Fire Alarm Pa	anel at PEB	200	Continuous	load
	9	WMS		100	Continuous	load
	10	Emergency L Fan) at CMC	oad (light + S	300	Continuous	load
	11	Emergency L	oad at PEB	100	Continuous	load
	Following shall be considered for HT switchgear; (i) Per switchboard only one VCB panel spring charging motor load shall be considered					
	(ii) All	VCB panel trip	o and closing co	oil load shall b	e considered.	
8.0	SITE TES	STS				
8.1	<ul> <li>The contractor shall carry out the following site tests as applicable on UPS, Battery Charger and Battery system. However, any other site test is required to be conducted as a standard practice of the OEM or deemed necessary by the employer and mutually agreed between the contractor and the employer, the same shall also be carried out.</li> <li>Light Load Test</li> <li>This test is carried out to verify that the UPS/Battery Charger is correctly connected and all functions operate properly. The load applied is limited to</li> </ul>					
8.2	<ul> <li>some percent of rated value. The following points should be checked:</li> <li>a) Output voltage, frequency and the correct operation of meters;</li> <li>b) Operation of all control switches and other means to put units into operation.</li> <li>c) Functioning of protective and warning devices.</li> </ul>					
	The test is performed in UPS/Battery Charger with a fully charged battery and is carried out by tripping input supply feeder or may be simulated by switching off all rectifiers and bypass feeder as at the same time. Output voltage variations are to be checked for specified limits with an oscilloscope/Recorder.					
8.3	A. C Inpu	ut Return Test				
AC input return test is performed in UPS/Battery Charger by closing AC input supply feeder, or is simulated by energizing rectifiers. Proper operation of rectifier starting and voltage and frequency variations are to be observed. This test is normally performed with a fully or partially charged battery.						
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8.4	Auto changeover Test			
	This test shall be carried out in UPS ACDB fed from two separate UPS system. Auto changeover of one UPS source to standby UPS to be check by tripping the active UPS manually or by simulation condition. This test shall be check as per approved auto changeover logic.			
8.5	Transfer Test (for UPS	)		
	This test is applicable for UPS with bypass, particularly in the case of an electronic bypass switch. Transients shall be measured during load transfer to bypass caused by a simulated fault and load retransfer after clearing of the fault.			se of an transfer earing of
8.6	Full load test			
	Load tests are performed by connecting the actual load to the UPS/Charger output. Load tests are necessary for testing output voltage and frequency, rated stored energy, recharge time, ventilation, and temperature.			
8.7	Rated Stored Energy T	ime (Battery test)		
	This test is a load test to prove the actual possible time of battery operation. If rated load is not available in the case of large UPS/Battery charger, it is possible to apply a partial load to check the actual battery discharge characteristics and compare these with characteristics specified by the battery manufacturer. Discharge time with rated load shall then be calculated. The test shall be performed with a fully charged battery and also may be done under other battery conditions to be specified, if so agreed. Active power output of the UPS/Battery Charger and the battery voltage shall be recorded during the test. Since new batteries often do not provide full capacity during a starting up period, the discharge test may be repeated after a reasonable recharge time if the original test has failed.			
8.8	Rated Restored Energy	y Time		
	Restored energy depends on the charging capacity of the rectifiers and the battery characteristics. If a certain recharging rate is specified, it shall be provided by repeating the discharge test after the specified charging period.			
8.9	Battery Ripple Current			
	If battery ripple currents are specified, then the ripple current which depends on UPS operation shall be checked under normal operating conditions. Rough measuring methods are sufficient			
Development at Central CHP/CPP Pip	of 20MW Solar PV Project Coalfields Limited (CCL) arwar, Jharkhand	TECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-9296-004-9	PART-C CHAPTER-C11	Page 16 of 16

CHAPTER-C12 LIGHTNING PROTECTION SYSTEM1.0GENERAL REQUIRMENTSThis specification is intended to outline the requirement of external lightning protection (ELP/Lightning protection) for Solar array (DC) side and AC Power block side of Solar PV Project. It is not the intent of the specification to specify all details of design and construction since the bidder has ful responsibility for engineering and implementation of external lightning protection system meeting the intent of the specification and functional requirement. Any additional equipment, material, services which are no specifically mentioned herein but are required for successful installation testing and commissioning of earthling system for safe and satisfactory operation of the plant shall be included under scope of the bidder.Lightning protection requirement for outdoor metering yard/Switchyard has been mentioned elsewhere in the specification and hence shall be excluded from scope of this chapter unless Lightning protection
<ul> <li>1.0 GENERAL REQUIRMENTS</li> <li>This specification is intended to outline the requirement of external lightning protection (ELP/Lightning protection) for Solar array (DC) side and AC Power block side of Solar PV Project. It is not the intent of the specification to specify all details of design and construction since the bidder has ful responsibility for engineering and implementation of external lightning protection system meeting the intent of the specification and functiona requirement. Any additional equipment, material, services which are no specifically mentioned herein but are required for successful installation testing and commissioning of earthling system for safe and satisfactory operation of the plant shall be included under scope of the bidder.</li> <li>Lightning protection requirement for outdoor metering yard/Switchyard has been mentioned elsewhere in the specification and hence shall be excluded from scope of this chapter unless Lightning protection.</li> </ul>
<ul> <li>This specification is intended to outline the requirement of external lightning protection (ELP/Lightning protection) for Solar array (DC) side and AC Power block side of Solar PV Project. It is not the intent of the specification to specify all details of design and construction since the bidder has ful responsibility for engineering and implementation of external lightning protection system meeting the intent of the specification and functional requirement. Any additional equipment, material, services which are no specifically mentioned herein but are required for successful installation testing and commissioning of earthling system for safe and satisfactory operation of the plant shall be included under scope of the bidder.</li> <li>Lightning protection requirement for outdoor metering yard/Switchyard has been mentioned elsewhere in the specification and hence shall be excluded from scope of this chapter unless Lightning protection</li> </ul>
Lightning protection requirement for outdoor metering yard/Switchyard has been mentioned elsewhere in the specification and hence shall be excluded from scope of this chapter unless Lightning protection
chapter.
1.1 LIGHTNING PROTECTION DESIGN REQUIRMENT
The object of a lightning protection system is to protect buildings/structure and equipments from direct lightning strikes, potential fire as well as the effects of injected lightning currents (non-incentive flash). It consists o termination systems for direct lightning, down conductors and an earth termination system.
Care must be taken for while designing the lightning protection that surges are prevented in the electrical system to reduce failure of electrical and electronic equipments.
1.2 CODES AND STANDARD
The equipment/product furnished for earthing system shall meet the requirements of all the applicable relevant National/International codes and standards or their latest amendment Codes and Standards. Produc certification has to be CE/UL/BIS/TUV or equivalent. The relevant codes and standard for earthing system are tabulated below.
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CLAUSE NO	TECHNICAL SPECIFICATIONS				
	IS/IEC 62305	PROTECTION AGAINST LIGHTNING	7		
	IEEE: 80	IEEE guide for safety in AC substatio	<u> </u>		
	IEEE: 837	Standard for qualifying permanent connection used in substation grounding	5		
	IS: 2629 Recommended practice for hot dip galvanizing of iron & steel				
	IS: 2633 Method for testing uniformity of coating on zinc coated articles				
	IS: 513	Cold rolled low carbon steel sheets and strips			
	IS: 6745	Methods for determination of mass of zin coating on zinc coated iron & steel articles.	с 		
	IS 2062	HOT ROLLED MEDIUM AND HIGH TENSILE STRUCTURAL STEEL — SPECIFICATION			
	IS: 458	Precast Concrete Pipes (With and Withou Reinforcement)	īt		
	UL-467 Grounding and Bonding Equipment				
	IEC 62561- 7	Requirements for earthing enhancin compounds	3		
	NFC 17 - Early streamer emission lightning protection 102 systems				
	CEA regulations for electrical safety-2010 Indian Electricity Rules/ Indian Electricity Act.				
	All standards, specifications and codes of practice referred to herein shall be the latest editions including all applicable official amendments and revisions as on date of opening of bid. In case of conflict between this specification and those (codes and standards, etc.) referred to herein, the former shall prevail. All work shall be carried out as per the above standards/ codes as applicable.				
	The lightning protection system includes lightning terminal, Down conductor, test ink, earth electrode, installation of lightning terminal, down conductor and earth electrode in suitable pit size, construction of earth pit with cover for the installation, connection of earth electrode with lightning terminal.				
	Detail specificat the specification	ion of earthing system has been mentioned els	ewhere in		
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2.0	DOWN CONDUCTORS				
	Down conductors shall be as short and straight as practicable and shall follow a direct path to earth electrode.				
	Each down conductor shall be provided with a test link at 1000 mm above ground level for testing but it shall be in accessible to interference. No connections other than the one direct to an earth electrode shall be made below a test point.				
	All joints in the down conductors shall be welded type.				
	Down conductors shall be cleated on outer side of building wall, at 750 mm interval or welded to outside building columns at 1000 mm interval.				
	Lightning conductor on roof shall not be directly cleated on surface of roof. Supporting blocks of PCC/insulating compound shall be used for conductor fixing at an interval of 1500 mm.				
	All metallic structures within a vicinity of two meters of the conductors shall be bonded to conductors of lightning protection system.				
	Lightning conductors shall not pass through or run inside GI Conduits.				
	Testing link shall be made of galvanized steel of size 25x 6mm.				
	Hazardous areas handling inflammable/explosive materials and associated storage areas shall be protected by a system of aerial earths oxide layer or foreign material.				
3.0	LIGHTNING PROTECT	ION SYSTEM FOR SOLAR	ARRAY		
3.1	Codes and Standard				
	IS/IEC 62305: PF	OTECTION AGAINST LIGH	TNING		
	NF C 17-102 : LIG STI	HTNING PROTECTION WI	TH EARLY N ROD		
3.2	Complete Solar Array Direct Lightning Stroke	with associated structure s e. Lightning Protection for	hall be protect solar array s	ed from shall be	
Development Project at C (CCL) CHP/CI	of 20MW Solar PV entral Coalfields Limited PP Piparwar, Jharkhand	TECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-9296-004-9	PART-C CHAPTER-C12	Page 3 of 5	

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	achieved with any or bo provided in the following	oth of the following two syste g section.	ms as per spec	cification	
	Single Rod Air Termina	l (Faraday Rods)			
	Early Streamer Emissio	n (ESE) Air Terminal			
	Suitable earthling and lightning protection Air manufacturer guidelines	equipotential bonding sha Terminal as per applicab s.	II be ensured le standard/Eq	for the uipment	
	Current carrying parts conductor, Test links procured from OEM of lighting protection syste	and accessories such as cl and earth termination etc Air Terminals if it is suppli m.	amps, fastener c. shall be pr ed by them as	s, down referably part of	
3.3	LIGHTNING PROTECT AIR TERMINAL	ION SYSTEM FOR SOLAF	R ARRAY WIT	H E.S.E	
	Solar array shall be Streamer Emission air t	protected from direct lightr erminal in accordance to NF	ning stroke wi C 17-102 .	th Early	
	Location and layout of ESE terminal shall be in such a manner that it cas no shadow on the PV Modules during 08:30 AM to 04:30 PM. Number an location of ESE air terminal shall be decided during detail engineering. For this purpose, design calculation considering protection level III (minimum and Autocad drawing of the layout of ESE terminal shall be submitted t NTPC for approval.				
	ESE air terminal shall be type tested as per Annexure- C of NF C 17-102 (Latest Revision) in the manner as mentioned in the standard.				
	ESE Air terminal shall be supplied with test link, counter, down-conductor, Tripod Earthing, support mast and accessories required for completeness for ESE Lightning protection system.				
	Owner shall test ESE terminal (Each terminal/Sample basis) before installation with suitable instrument for functionality of terminal. Vendor shall replace the terminal free of cost if found defective.			before Vendor	
	Support mast for ESE Air terminal shall be heavy duty hot dip galvanized material and shall be suitable to withstand dynamic and static forces acting on it without failure. Foundation for the mast shall be M20 Grade concrete or better with minimum depth of 1200 MM.				
4.0	LIGHTNING PROTECT	ION SYSTEM FOR BUILDIN	IG AND ENCLO	SURE	
	Contractor shall provide lightning protection for Inverter room/shelter/enclosure, main control room, Switchgear Room/shelter and similar housing per IS/IEC 62305.				
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CLAUSE NO	TECHNI	CAL SPECIF	ICATIONS		एनरीपीसी NTPC
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CLAUSE NO	ESE Air Terminal sha yard/Switchyard	CAL SPECIF	ICATIONS for lightning	protection of	Metering
Development	of 20MW Solar PV	TECHNICALS	PECIFICATION		
Development Project at C (CCL) CHP/CF	of 20MW Solar PV entral Coalfields Limited PP Piparwar, Jharkhand	TECHNICAL S BIDDING RE-CS-92	PECIFICATION DOC. NO: 296-004-9	PART-C CHAPTER-C12	Page 5 of 5

CHAPTER-C13 METERING SYSTEM           1.0         GENERAL           1.1         Energy meter (0.2s accuracy class suitable for ABT requirement wit metering panel as required conforming to STU/DVC/CCL requirement sha be as per Cl. 2.0 of Chapter-A2.           1.2         For measurement of Auxiliary power consumption, MFM in ACDB income shall be provided by the bidder.           1.3         Meter shall be suitable for interfacing for synchronizing the built-in clock of the meter by GPS time synchronization equipment. All the hardware required for synchronization shall be in scope of bidder.           1.4         The ABT meters supplied under this contract shall also meet th requirement of respective RLDC/State power Utilities.           1.5         This metering system shall have following features: <ul> <li>Meters shall be microprocessor-based MWH meters having a accuracy class of 0.25 or better. MVARH meters shall have accuracy class of 0.5 or better.</li> <li>These meters shall have provision for downloading of data throug an optical port and /or through RS 232/485 port.</li> <li>Even under absence of VT input, energy meter display shall b available and it shall be possible to download data from the energ meters.</li> <li>Contractor shall supply energy meters along with metering station, 4 Nos machine Clients, 20 nos web client license. MRI or lap top (as applicable as per the technical specification given below:</li> <li>Shall be microprocessor-based conforming to IEC 62052-11, IEC 62053 22, IS 14697</li> <li>Shall carry out measurement of active energy (both import and export) an reactive energy (both import and export) by 3-phase, 4 wire principi suitable for balanced/ unbalanced 3 phase</li></ul>	CLAUSE NO			
METERING SYSTEM           1.0         GENERAL           1.1         Energy meter (0.2s accuracy class suitable for ABT requirement wit metering panel as required conforming to STU/DVC/CCL requirement sha be as per Cl. 2.0 of Chapter-A2.           1.2         For measurement of Auxiliary power consumption, MFM in ACDB income shall be provided by the bidder.           1.3         Meter shall be suitable for interfacing for synchronizing the built-in clock of the meter by GPS time synchronization equipment. Bilder sha synchronize the meter using GPS time synchronization equipment. All th hardware required for synchronization shall be in scope of bidder.           1.4         The ABT meters supplied under this contract shall also meet th requirement of respective RLDC/State power Utilities.           1.5         This metering system shall have following features:           I.         Meters shall be microprocessor-based MWH meters shall have accuracy class of 0.5 or better.           III.         Even under absence of VT input, energy meter display shall b available and it shall be possible to download data from the energ meters.           2.0         Technical Requirements of Energy Meters for ABT Requirement           Contractor shall supply energy meters along with metering station, 4 Nos machine Clients, 20 nos web client license. MRI or lap top (as applicable as per the technical specification given below:           a)         Shall be microprocessor-based conforming to IEC 62052-11, IEC 62052 22, IS 14697           b)         Shall carry out measurement of active energy (both import		CHAPTER-C13		
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I. Meters shall be microprocessor-based MWH meters having a accuracy class of 0.2S or better. MVARH meters shall have accuracy class of 0.5 or better.         II. These meters shall have provision for downloading of data throug an optical port and /or through RS 232/485 port.         III. Even under absence of VT input, energy meter display shall b available and it shall be possible to download data from the energ meters.         2.0       Technical Requirements of Energy Meters for ABT Requirement         Contractor shall supply energy meters along with metering station, 4 Nos machine Clients, 20 nos web client license. MRI or lap top (as applicable as per the technical specification given below:         a)       Shall be microprocessor-based conforming to IEC 62052-11, IEC 62053 22, IS 14697         b)       Shall carry out measurement of active energy (both import and export) an reactive energy (both import and export) by 3-phase, 4 wire principl suitable for balanced/ unbalanced 3 phase load.         c)       Shall have an accuracy of energy measurement of at least Class 0.2S for active energy and at least Class 0.5 for reactive energy.         Development of 20MW Solar PV Project at Central Coalifields Limited (CCL) CHP/CPP Piparwar, Jharkhand       TECHNICAL SPECIFICATION RE-C-3926-04-9	1.5	This metering system shall have following features:		
II. These meters shall have provision for downloading of data throug an optical port and /or through RS 232/485 port.         III. Even under absence of VT input, energy meter display shall b available and it shall be possible to download data from the energ meters.         2.0       Technical Requirements of Energy Meters for ABT Requirement         Contractor shall supply energy meters along with metering station, 4 Nos machine Clients, 20 nos web client license. MRI or lap top (as applicable as per the technical specification given below:         a)       Shall be microprocessor-based conforming to IEC 62052-11, IEC 62053 22, IS 14697         b)       Shall carry out measurement of active energy (both import and export) an reactive energy (both import and export) by 3-phase, 4 wire principl suitable for balanced/ unbalanced 3 phase load.         c)       Shall have an accuracy of energy measurement of at least Class 0.2S for active energy and at least Class 0.5 for reactive energy.         Development of 20MW Solar PV Project at Central Coaffields Limited (CCL) CHP/CPP Piparwar, Jharkhand       TECHNICAL SPECIFICATION RE-CS-9296-04-9       PART-C CHAPTER-C13 Page 1 of 3		<ol> <li>Meters shall be microprocessor-based MWH meters having an accuracy class of 0.2S or better. MVARH meters shall have accuracy class of 0.5 or better.</li> </ol>		
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Development of 20MW Solar PV Project at Central Coalfields Limited (CCL)TECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-9296-04-9PART-C CHAPTER-C13Page 1 of 3	C)	Shall have an accuracy of energy measurement of at least Class 0.2S for active energy and at least Class 0.5 for reactive energy.		
	Development at Central CHP/CPP Pip	t of 20MW Solar PV Project Coalfields Limited (CCL) parwar, Jharkhand TECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-9296-04-9 PART-C CHAPTER-C13 Page 1 of 3		

CLAUSE NO	TECHNI		ATIONS	(	एन् <b>रीपी</b> मी NTPC
d)	The active and reactiv primary ratings.	e energy shall	be directly o	computed in C	T & VT
e)	The reactive energy shall be recorded for each metering interval in four different registers as MVARh (lag) when active export, MVARh (Lag) when active import, MVARh (lead) when active export, MVARh (Lead) when active import.				
f)	Two separate registers shall be provided to record MVARH when system voltage is $>103\%$ and when system voltage is $< 97\%$ .				
g)	Shall compute the net MWh and MVARh during each successive 15- minute block metering interval along with a plus/minus sign, instantaneous MWh, instantaneous MVARh, average frequency of each 15 minutes, net active energy at midnight, , net reactive energy for voltage low and high conditions at each midnight.				
h)	Each energy meter shall have a display unit. It shall display the net MWh and MVARh with a plus/minus sign and average frequency during the previous metering interval; peak MWh demand since the last demand reset; accumulated total (instantaneous) MWh and MVARh with a plus/minus sign, date and time; and instantaneous current and voltage on each phases.				
i)	All the registers shall be stored in a non-volatile memory. Meter registers for each metering interval, as well as accumulated totals, shall be downloadable. All the net active/reactive energy values displayed or stored shall be with a plus /minus sign for export/import.				
j)	At least the following data shall be stored before being over-written for the following parameters.				
	Parameters		Details	Min No of c	lays
	1. Net MWH		15 min block	40days in n	neter
	2. Aver Freq		15 min block	40days in n	neter
	3. Net MVARH for V	′ > 103%	15min block	40days in n	neter
	4. Net MVARH for V	′ < 97%	15min block	40days in r	neter
	5. Cumulative Net I midnight	MWH at every		10 days in 40 days in	meter/ PC
	6. Cumulative Net M 103% at every mi	/IVARH for V> dnight		10 days in 40 days in	Meter/ PC
	7. Cumulative Net M	IVARH for V <		10 days in	Meter/
Development at Central CHP/CPP Pip	of 20MW Solar PV Project Coalfields Limited (CCL) arwar, Jharkhand	TECHNICAL SPE BIDDING DO RE-CS-9296	CIFICATION C. NO: 5-04-9	PART-C CHAPTER-C13	Page 2 of 3

CLAUSE NO	TECHNIC	CAL SPECIFIC	ATIONS	(	एनरीपीम्री NTPC
	97% At every mid	night		40 days in	PC
	8. Date and time failure on any pha	blocks of VI ase.			
k)	Shall have a built in clo seconds per month drif pulse.	ock and calend t without assist	ar with an ac ance of exter	curacy of less rnal time synch	than 15 ronizing
I)	Date/time shall be displ by GPS time synchroniz	ayed on dema ation equipmer	nd. The clock It being suppl	shall be synch ied by the contr	nronized actor.
m)	The voltage monitoring to the Substation Auto operate with power draw shall be less than 2 VA.	of shall be inbu omation Syster wn from the VT	uilt feature pro m, The mete supplies. Th	ovided to signal r shall be sui e burden of the	failures table to e meters
n)	VT supply. An automatic backup, in the event of non-availability of voltage in all the phases, shall be provided by a built in long life battery and shall not need replacement for at least 10 years with a continuous VT interruption of at least 2 years. Even under absence of VT input, energy meter display shall be available and it shall be possible to download data from the energy meter. Incase data downloading is not possible in absence of VT supply, meter with provision of 220V DC auxiliary power shall be provided. Date and time of VT interruption and restoration shall be automatically stored in a non-volatile memory.				
0)	Shall have an optical port on the front of the meter for data collection from either a hand held meter reading instrument (MRI) having a display for energy readings or from a notebook computer with suitable software. The contractor shall supply the MRI and/or notebook complete with all optical interface unit required.				
p)	The meter shall have means to test MWh and MVARh accuracy and calibration at site in-situ and test terminal blocks shall be provided for the same.				
q)	Each meter shall have a unique identification code provided by the Owner and shall be permanently marked on the front of the meter and stored in the non-volatile memory of the meter.				
3.0	Type Test requirement	for Energy M	eter		
	All Type Test Reports s 22, IS 14697.	shall be provide	ed as per IEC	62052-11, IEC	62053-
Development at Central CHP/CPP Pip	of 20MW Solar PV Project Coalfields Limited (CCL) arwar, Jharkhand	TECHNICAL SPE BIDDING DC RE-CS-929	CIFICATION C. NO: 6-04-9	PART-C CHAPTER-C13	Page 3 of 3

CLAUSE NO	TECHNICAL SPECIFICATIONS
	CHAPTER-C14 33 kV OUTDOOR YARD EQUIPMENT & 33 kV OVERHEAD LINE
1.0	SCOPE AND GENERAL INFORMATION
1.01	GENERAL INFORMATION
	This specification intends to cover the following activities, services and works in respect 33 kV Outdoor yard and O/H lines for Solar Project at CCL CHP/CPP Piparwar, situated in the state of Jharkhand, India:
	In addition to the requirements indicated in this section (Technical specifications), all the requirements as stated in other sections shall also be considered as a part of this specification as if completely bound herewith.
	The Bidder shall be responsible for providing all material, equipment and services specified or otherwise which are required to fulfill the intent of ensuring operability, maintainability and the reliability of the complete work covered under this specification. The systems, sub-systems and equipment shall conform in all respect to high standards of engineering, design and workmanship, and shall be capable of performing in continuous commercial operation.
1.01.01	The scope of work comprises of
	<ul> <li>i) Construction of Double circuit 33 kV Overhead lines on Galvanised RSJ Poles with ACSR Dog/Rabbit/Panther conductor for evacuation of 20 MW with 100 % redundancy.</li> <li>ii) Execution of two numbers of new 33 kV bays, including Outdoor yard equipments with suitable rating ACSR conductors/ IPS AI tube and terminal connectors in CCL existing outdoor 33 kV central Switching Station, Piparwar.</li> </ul>
	The scope of work shall comprise, but not limited to the design, engineering, manufacture, testing and inspection at manufacturer's works, packing, supply, transportation, transit insurance, delivery to site, unloading, storage and equipment erection, associated civil and structural works. Further, it shall include cabling, lighting, lightning protection, earthing, association of sub vendors if any in the erection, supervision, site testing, inspection and commissioning 33 kV Outdoor yard & Overhead Lines.

Development of 20MW Solar PV Project at Central Coalfields Limited (CCL) CHP/CPP Piparwar, Jharkhand	TECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-9296-004-9	PART-C CHAPTER-C14	Page 1 of 38
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CLAUSE NO	TECHNICAL SPECIFICATIONS
1.01.02	This scope covers all the work required for detailed soil investigation. It shall include mobilization of necessary equipment, providing necessary engineering supervision and technical personnel, carrying out field investigation and tests, laboratory tests, analysis and interpretation of data and results, collecting data regarding geographical conditions from local sources, giving flood details of the area (past history), preparations for the type of foundations and the safe bearing capacity for different sizes of foundations and different founding strata for the various locations.
1.01.03	The equipment and materials to be supplied by the Contractor shall form a complete 33 kV Outdoor yard & Overhead Lines. The equipment and services as detailed in all sections of the bidding documents and as shown on the tender drawings shall be within the scope of supply of the Contractor.
1.02	DETAILED SCOPE OF WORK - ELECTRICAL
1.02.01	Contractor shall be responsible for design and engineering of overall system/station, and all elements, systems, sub-systems, facilities, equipments, material, etc. The Contractor shall submit design calculations, drawings, codes, codes of practices, construction drawings, etc. for Employer's approval.
1.02.02	The basic design shall include, but not limited to, the following:
	<ul> <li>a) Development of general arrangement.</li> <li>b) Development of detailed layout (plan &amp; section/elevation) drawings.</li> <li>c) Development of single line diagram with parameters of equipment and details of protection.</li> <li>d) Protection and control philosophy and selection of protection, control and annunciation schemes.</li> <li>e) Development of interlocking schemes.</li> <li>f) Development of switchyard structure loading details.</li> <li>g) Development of direct stroke lightning protection system.</li> <li>h) Development of direct stroke lightning protection system.</li> <li>i) Insulation coordination of the HV equipment.</li> <li>j) Calculation of static and dynamic force load, and selection of spacer spans and equipment terminal loading.</li> <li>k) Development of clearance diagrams.</li> <li>l) Lighting design, Lux level calculation and conduit wiring diagram.</li> <li>m) Development of power &amp; control cable laying and termination schedules.</li> <li>n) Relay setting calculations.</li> <li>o) Development of erection key diagram with bill of material.</li> </ul>

CLAUSE NO	TECHNICAL SPECIFICATIONS
	<ul> <li>p) Foundation design and construction drawings.</li> <li>q) Development of cable trench layout and sections and construction drawings.</li> <li>r) Effect of nearby conductors due to electric field adjoining building and providing shielding.</li> </ul>
1.02.03	Contractor shall furnish detailed drawings for the various equipments covered in their scope for Employer's approval. The equipment shall conform to type tests as per specification and applicable standards and reports of the same shall be furnished for approval.
1.02.04	Contractor shall furnish design calculations and construction drawings for all civil works showing details of pockets to be left in foundations and embedments to be provided in cable trenches.
	Contractor shall furnish the schematics, general arrangement drawings, cable schedules, interconnection schedules, panel wiring diagrams, etc. for various control and relay panels for Employer's approval. Contractor shall also furnish the recommended relay settings to be adopted.
1.02.05	The Contractor shall note that the list of standards specified elsewhere in this specification is not complete. Whenever necessary the list of standards shall be considered in conjunction with specification, IS & IEC. In case governing standards for the equipment is different from IS or IEC, the salient points shall be clearly brought out along with English language version of the same.
1.02.06	Exposed live parts shall be placed high enough above ground to meet the requirements of Indian Electricity Rules and other statutory codes. All responsibilities regarding co-ordination with Electrical Inspection Agencies and obtaining clearance certificate from them rests with the Contractor.
1.02.07	For 33kV yard, the equipment interconnections shall be through suitable rating ACSR conductor/3" IPS AI. tube For 33 kV overhead lines on poles within Solar plant, ACSR Dog/Rabbit/Panther conductor shall be used. As far as possible, the conductor shall pass without cut/joints unless otherwise necessary for planned shutdown/ maintenance.
	All equipment shall be supplied with suitable terminal connectors. The terminal connector shall be well coordinated with the type/size of conductor and equipment to be connected. The conductor terminations for equipment shall be either rigid or expansion type suitable for 3" IPS Al. tube or horizontal or vertical take off suitable for sufficient rating ACSR conductor. The exact requirement & type of terminal clamps would be finalized by the

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	Contractor in consultation with Employer based on layout requirement. The terminal pads shall preferably be capable of taking the required conductor span under normal, short circuit and meteorological conditions, without effecting the performance of the equipment.			
	The rigid busbars for equipment inter connections shall have rigid connections at one end and expansion /flexible at other end. The tubular Al connections shall have not more than one joint per span. Since no wastages are permissible, the bidder shall workout the cut lengths of Aluminum tube based on the finalized layout & dispatch the same to site without requiring Owner's approval. Corona Bell shall be provided at the end of the rigid busbars. The connectors and clamps shall be rated same as the connected equipments.			
1.02.08	The minimum vertical distance from the bottom of the lowest porcelain part of the bushing, porcelain enclosures or supporting insulators to the bottom of the equipment base, where it rests on the foundation pad shall be 2.55 meters			
	The various minimum heights of the switchyard shall be as given below from plinth level:			
	Voltage levelEqpt./1st level2nd level33 kV4000 mm			
1.02.09	Circuit breakers (as applicable) shall be supplied with necessary interpole cabling and its cost shall be included in the cost of equipment.			
1.02.010	All equipment shall be suitable for hot line washing.			
1.02.011	The Contractor shall cooperate in all respects and exchange the necessary technical data/ drawings with other agencies and Employer's other Contractors under intimation to Employer to ensure proper coordination and completion of work in time.			
1.02.012	Short circuit force calculation shall be submitted by the bidder as per relevant IEC for flexible & rigid bus as applicable. This short circuit force shall be considered for designing of equipment structure and their foundation as applicable.			
1.02.013	The sag tension, conductor spacing, short circuit forces, spacer location, conductor swing and clearances shall be carried out in accordance with IEC 60865 to achieve the specified clearances.			

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1.02.014	All overhead stringing shall be carried ou String insulator assembly.	t by minimum double tension
1.02.015	In 33 kV yard, one no. of bay marshalling bo all feeders. The duplicated power supplie looped.	ox (BMK) is to be provided for s for two (2) BMKs shall be
1.02.016	All the cables used for the switchyard shall b	e armoured type.
1.02.017	Gravel filling shall be provided in the entire l stone filling which shall consist of two layers thick base course of 20mm of normal size an thick surface course of 40 mm nominal size.	Metering yard area with broken a. The first layer shall be 75mm ad second layer shall be 75mm
1.02.018	The cable trenches, where required, shall be provided for all the major equipments in the switchyard. The Contractor shall construct the common sections suitably of appropriate sizes upto common points so that the same can be extended in future.	
1.02.019	For earthing 50x6 mm GS flat shall be used in all cabinets, MOM boxes, panels and balance all other earthing such as all equipments, towers, LM, cable trenches etc shall be through 75x12mm GS Flat.	
1.02.020	The illumination level shall be 20 lux in general and 50 lux on equipment boxes. Lighting Mast/Lightning Mast shall be used for mounting lighting fixtures for metering yard lighting. No lighting fixture shall be mounted on towers/gantries.	
1.02.021	Voltage drop for sizing of power cables shall not be more than 6%. The connectors and clamps shall be rated same as the connected equipments.	
1.03	CLEARANCES	
	The minimum clearances shall be as given b	elow:
	Clearance	33 kV
	Phase to earth clearance	320 mm
	Phase to phase clearance	320 mm
	Section clearance	3000 mm
	Ground clearance	3700 mm
	The Contractor shall supply the structures clearances.	suitable to meet the above

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1.04	SERVICES TO BE PERFORMED BY THE EQUIPMENT BEING SUPPLIED		
	All the equipment/materials covered in this its function satisfactorily without undue str over voltage conditions.	specification shall perform all ain, restrike etc. under such	
1.04.01	SITE SUPERVISION OF EQUIPMENTS		
	The contractor shall ensure that, erection, testing and commissioning of, Circuit Breaker, Isolator, Instrument Transformers, Surge Arrestor, Control & Protection System and Protective relays is carried out, under the supervision of manufacturer of respective equipment.		
1.05	SYSTEM PARAMETERS		
	The system parameters shall be as under:		
	Parameter	33 KV	
	b) Lightning Impulse voltage	+170 kVn	
	c) Power frequency withstand for 1 min.	70 kV (rms)	
	d) Max. fault level (1 sec)	25 kA	
	e) Dynamic withstand Current	2.5 times system fault level	
	f) Minimum creepage distance	900 mm	
	g) Rated ambient temperature	50 deg. C	
	h) System earthing	Effectively earthed	
	i) Rated frequency	50Hz	
1.06	TYPE TEST REQUIREMENTS FOR EQUIPI	MENTS	
	<ul> <li>a) All equipments to be supplied shall be of type tested design. During detail engineering, the contractor shall submit for Owner's approval the reports of all the type tests as listed in this specification and carried out not earlier than ten years prior to the date of techno-commercial 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.</li> <li>b) However if contractor is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, 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</li> </ul>		

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	<ul> <li>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.</li> <li>c) 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.</li> <li>d) The type test reports once approved for any projects shall be treated as reference. For subsequent projects of NTPC, an endorsement sheet will be furnished by the manufacturer confirming similarity and 'No Design Change'. Minor changes if any shall be highlighted on the endorsement sheet.</li> </ul>
2.0	33 kV MAIN EQUIPMENT
2.01	CIRCUIT BREAKER (As applicable)
	Circuit Breakers shall be outdoor type, comprising three identical single pole units, complete in all respects with all fittings and wiring. The circuit breakers and accessories shall conform to IEC- 62271-100 or equivalent Indian Standard.
2.01.01	DUTY REQUIREMENTS
	Circuit breaker shall be totally restrike free under all duty conditions and shall be capable of performing their duties without opening resistor. The circuit breaker shall meet the duty requirement of any type of fault or fault location and shall be suitable for line charging and dropping when used on 33 kV effectively grounded or ungrounded systems and perform make and break operations as per the stipulated duty cycles satisfactorily.
	The circuit breaker shall be capable for breaking the steady & transient magnetizing current corresponding to 33 kV transformers. It shall also be capable of breaking line charging currents as per IEC- 62271-100 with a voltage factor of 1.4.
	The rated transient recovery voltage for terminal fault and short line faults shall be as per IEC:62271-100.
	The circuit breaker shall be reasonably quiet in operation. Noise level in excess of 140 dB measured at base of the breaker would be unacceptable. Bidder shall indicate the noise level of breaker at distance of 50 to 150 m from base of the breaker.

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	The Bidder may note that total exceeded under any duty condition variation of the trip coil voltage, p the proof of the total break time of specifically bring out the effect of poles and show how it is covered in	break time of the breaker s ons specified such as with the oneumatic pressure etc. While complete circuit breaker, the non-simultaneity between san in the guaranteed total break t	hall not be e combined e furnishing Bidder may ne pole and ime.
	While furnishing particulars regated breaker, the Bidder shall note that should correspond to the guaran condition of operation.	rding the D.C. component of at IEC-62271-100 requires that nteed minimum opening time	f the circuit at this value under any
	The critical current which gives the longest arc duration at lock out pressure of extinguishing medium and the duration shall be indicated.		
	All the duty requirements specified above shall be provided with the support of adequate test reports to be furnished along with the bid.		
2.01.02	OPERATING MECHANISM		
	Circuit Breaker shall be operated by electrically spring charged mechanism only.		
	The operating mechanism shall be anti-pumping and trip free (as per IEC definition) electrically and either mechanically or pneumatically under every method of closing. The mechanism of the breaker shall be such that the position of the breaker is maintained even after the leakage of operating media and/or gas. The circuit breaker shall be able to perform the duty cycle without any interruption.		
	Electrical tripping shall be performed by shunt trip coil. Provision shall also be made for local electrical control. 'Local / remote' selector switch and close & trip push buttons shall be provided in the breaker central control cabinet. Remote located push buttons and indicating lamps shall also be provided.		
	Operating mechanism and all accessories shall be in local control cabinet. A central control cabinet for the three poles of the breaker shall be provided along with supply of necessary tubing, cables, etc.		
2.01.03	GENERAL PARAMETER		
	Type of circuit breaker Highest system Voltage Rated continuous current	Vacuum/SF6 type 36 kV Min. 1250 A at rated an	nbient

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## **TECHNICAL SPECIFICATIONS**

	temperature current capacity
Rated frequency	50 Hz
Number of poles	Three (3)
Rated/minimum power	70 kV
frequency Withstand voltage	
Rated lightning impulse	170 kV
Withstand voltage	
Minimum Creepage distance	As per Clause 1.05
Rated operating duty cycle	O - 0.3 sec CO - 3min. – CO
Rated line charging breaking	As per IEC
Current (voltage factor of 1.4)	
Reclosing	Three phase high speed auto
	reclosing
Maximum fault level	As per SLD
Total closing time	Not more than 150 ms.
Auxiliary contacts	As required plus 4NO and 4NC
	contacts per pole as spare.
Noise level	Maximum 140dB at 50m distance
	from base of circuit breaker
Seismic acceleration	0.3g horizontal

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## 2.02 ISOLATORS

The isolators and accessories shall conform in general to IEC 62271-102 (or equivalent Indian standard) except to the extent explicitly modified in specification.

Earth switches shall be provided on isolators wherever called for.

Operating mechanism of Isolator and earth switch	Manual/Electrically Operated
Nominal system voltage	33 kV
Highest system voltage	36 kV
Туре	Outdoor
Rated continuous current	Min. 1250 A at rated ambient temperature current capacity
Rated short time current of isolator and earth switch	As per Clause 1.05
Rated dynamic short time withstand current of isolator and earth switch	As per Clause 1.05
Impulse withstand voltage with 1.2/50 micro sec. wave	170 kVp to earth & 195 kVp across isolating distance
One minute power frequency withstand Voltage	70 kV (rms) to earth & 80 kV (rms) between isolating distance

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CLAUSE NO	Temperature rise         Rated mechanical terminal load         Creepage distance (Total)         No. of Auxiliary Contacts         Material of fixed contact & moving blade         Isolator shall be gang operated for operation of the three poles shall be your the design of linkages and gears shoperate the handle with ease for isolar         They shall be constructed such that short circuit current and wind prewherever provided shall be constructed such that	As per Table-IV of IS: 9921 As per 62271-102 As per Clause 1.05 2NO+2NC for each Isolator 2NO+2NC for each earth switc Silver plated electrolytic copp flat main blades and earth switc well synchronised and interloc all be such so as to allow on ator and earth switch.	thes. The checked. he man to luence of switches the earth
	switches can be operated only when The insulator of the isolator shall have In addition to the constructional inter have provision to prevent their elect associated and other interlocking co shall be of fail safe type. Suitable inter shall be provided. The interlocking operation from DC supply and with relevant section. The interlock coil sh for facilitating permissive logic for 'E well as for AC circuit of the motor to when the interlocking coil is not energy	n the isolator is open and vi e a min. cantilever strength of lock, isolator and earth switch rical and manual operation u onditions are met. All these dividual interlocking coil arran coil shall be suitable for co in a variation range as stip all be provided with adequate DC' control scheme of the is prevent opening or closing of gised.	ce-versa. 350 kg. hes shall inless the interlocks ngements ontinuous oulated in contacts solator as f isolators
2.03	INSTRUMENT TRANSFORMER		
a)	GENERAL REQUIREMENT		
	The instrument transformers i.e. curr single phase transformer units and marshaling box for a set of three sing	rent and voltage transformers d shall be supplied with a le phase units.	shall be common
	The tank as well as top metallics s Grey color as per RAL 9002. No galvanized surface.	hall be hot dip galvanised o oil shall come in contact	r painted with zinc
	The instrument transformers shall be instrument transformers shall be prov	oil filled hermetically sealed u ided with filling and drain plug	units. The js.

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	Polarity marks shall indelibly be marked on each instrument transformer and at the lead terminals at the associated terminal block.
	The insulators shall have cantilever strength of more than 350 kg.
b)	MARSHALLING BOX
	The wiring diagram for the interconnection of three phase instrument transformer shall be pasted inside the box in such a manner so that it is visible and it does not deteriorate with time. Terminal blocks in the marshaling box shall have facility for star/delta formation, short circuiting and grounding of secondary terminals. The box shall have enough terminals to wire all control circuits plus 20 spare terminals.
c)	CURRENT TRANSFORMERS (CTs)
	The CTs shall have single primary of either ring type or hair pin type or bar type. In case of "Bar Primary" inverted type CTs, the following requirements shall be met:
	The secondaries shall be totally encased in metallic shielding providing a uniform equi-potential surface for even electric field distribution.
	The lowest part of insulation assembly shall be properly secured to avoid any risk of damage due to transportation stresses. The upper part of insulation assembly sealing on primary bar shall be properly secured to avoid any damage during transportation due to relative movement between insulation assembly and top dome.
	The insulator shall be one piece without any metallic flange joint. The CT shall be provided with oil sight glass/oil level indicator.
	The core lamination shall be of cold rolled grain oriented silicon steel or other equivalent alloys. The cores shall produce undistorted secondary current under transient conditions at all ratios with specified parameters.
	Different ratios shall be achieved by secondary taps only, and primary reconnections shall not be accepted.
	The guaranteed burdens and accuracy class are to be intended as simultaneous for all cores.
	The instrument security factor at all ratios shall be less than five (5) for metering core. If any auxiliary CT/reactor is used, then all parameters specified shall be met treating auxiliary CTs/reactors as integral part of CT.

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	The auxiliary CT/reactor shall preferably be in-built construction of the one of the one of the construction of t				
	The secondary terminals shall be terminated on stud type suitable no's of non-disconnecting and disconnecting terminal blocks inside the terminal box of degree of protection IP:55 at the bottom of CT.				
	The CTs shall be suitable for horizontal	transportation.			
	The CTs shall have provision for taking oil samples from bottom of CT without exposure to atmosphere to carry out dissolved gas analysis periodically. Contractor shall give his recommendations for such analysis, i.e. frequency of test, norms of acceptance, quantity of oil to be withdrawn, and treatment of CT.				
	The CT shall have provision for measure as erected at site.	ement of capacitance and tan delta			
	PARAMETERS FOR CURRENT TRANS	SFORMERS			
	GENERAL PARAMETERS				
	Rated frequency         System neutral earthing         Installation         Rated short time thermal current         Rated dynamic current         Rated min power frequency withstand         voltage (rms value)         Rated lightning impulse withstand         voltage (peak value)         Partial discharge level         Minimum Creepage distance         Temperature rise         Type of insulation         Number of cores         Number of terminals in marshalling box	50 Hz         effective earthed         Outdoor         As per Clause 1.05         As per Clause 1.05         70 kV         170 kV         10 pico Coulombs max.         As per Clause 1.05         As per IEC 60044         Class A         Tariff CTs shall be single metering core with 0.2S accuracy class.         All terminals of control circuits wired upto marshalling box plus 20 terminals spare			

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d)	VOLTAGE TRANSFORMERS (VTs)
	Voltage transformers shall be of Outdoor type, Oil filled, bottom and dead Tank type electromagnetic, with sealing arrangement as per IS-316-1992. It is also to be equipped with protective and damping devices Oil level indicator with danger level marking is also to be provided.
	They shall be of the oil immersed, self-cooled type and provided alternatively with an inert gas cushion or with metallic bellows above the- insulating oil level. A pressure relief device valve type may also be provided if permitted to design.
	The VTs may be built up of high-grade non ageing cold rolled grain oriented silicon steel lamination, conforming to IS: 3024, of low hysterisis losses and high permeability to ensure high accuracy at both normal rated and above rated voltages.
	The limits of temperatures rise shall not exceed the values specified in Table 3 of IS: 3156 (Part-1) 1998. However, if the voltage transformers has an inert gas cushion above the oil at the top of the tank or housing shall not exceed 50° C. The oil shall be mineral insulating oil conforming to IS: 335-1983.
	The HV neutral end terminal shall not be earthed directly to the metal body of the VT but shall be brought out through a porcelain 2 kV class bushing. A tinned copper link of the bolted type shall be provided to connect the HV neutral end terminal and the earth bushing. Both the HV neutral end bushing and the earth bushing shall be housed in a. dust tight, vermin proof box with a front access bolted type gasketted cover.
	The secondaries shall be protected by HRC cartridge type fuses for all windings. In addition fuses shall also be provided for protection and metering windings for connection to fuse monitoring scheme. The secondary terminals shall be terminated on stud type non-disconnecting terminal blocks via the fuse inside the terminal box of degree of protection IP55. The access to secondary terminals shall be without the danger of access to high voltage circuit.
	The accuracy of metering core shall be maintained through the entire burden range upto 50VA on all three windings without any adjustments during operations.
	PARAMETERS FOR VOLTAGE TRANSFORMERS

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	GENERAL PARAMETERS	
	Highest System Voltage(Um)	36 kV
	System neutral earthing	effective earthed
	Installation	Outdoor
	System Fault level (1 Sec)	As per Clause 1.05
	Rated min power frequency withstand voltage (rms value)	70 kV
	Rated lightning impulse withstand voltage (peak value)	170 kV
	Standard reference range of	96% to 102% for protection and
	frequencies for which the accuracy are valid	99% to 101% for measurement
	Rated voltage factor	1.2 continuous & 1.5 for 30 sec
	Class of Accuracy	For tariff metering VT - 0.2
		Other VTs – 0.2
	Stray capacitance and stray conductance of LV terminal over entire carrier frequency range	As per IEC:358
	One Minute Power frequency Withstand voltage for secondary winding	2 kV rms
	Temp. rise over an ambient temp. of 50 deg. C	As per IEC 60044
	Number of terminals in control spare.	All terminals of control circuits wired Cabinet upto marshalling box plus 10 terminals
	Min Creepage distance	As per Clause 1.05
	Rated total thermal burden	350 VA
	Partial discharge level	10 pC max.
2.04	SURGE ARRESTOR	
	3070 except to the extent modified i hermetically sealed units, self-s mounting on lattice type support technical particulars of Surge arreste	nform in general to IEC 60099-4 or n the specification. Arresters shall be supporting construction, suitable structures. Bidder shall furnish er.
	The SAs shall be of heavy duty stat without any series or shunt gaps. T over-voltages occurring during swi long lines.	ion class and gapless Metal Oxide the SAs shall be capable of dischargitching of unloaded transformers, a
	Arrestors shall be complete with ins Self-contained discharge counters,	sulating base for mounting on structu suitably enclosed for outdoor use a

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	requiring no auxiliary or battery su each single pole unit with necessa meters should also be supplied wit millimeter and counters shall be vis The surge arrestors shall conform routine and acceptance tests in cantilever strength of the insulator s	pply for operation shall be provide ry connection. Suitable leakage cu hin the same enclosure. The readi ible through an inspection glass par to type tests and shall be subjecte accordance with IEC-60099-4. shall be min. 350 kg for 33 kV level.	ed for irrent ng of nel ed to The
	Rate System Voltage	36 kV	
	Rate Arrester Voltage	30 kV	
	Nominal discharge current	10 kA of 8/20 micro-sec wave	
	Minimum discharge capability	5 kilo joule/kV(referred to rated arrestor voltage corresponding to minimum discharge characteristics)	
	Maximum continuous operating	24 kV rms	
	Max. residual voltage (1 kA)	70 kVp	
	Max. residual voltage at 10 kA nominal discharge current (8/20 micro sec wave)	85 kVp	
	Max. switching impulse residual Voltage at 500A peak	70 kVp	
	Max. steep current residual voltage	93 kVp at 10 kA	
	Long duration discharge class	2	
	High current short duration test value (4/10 micro-sec-wave)	100 kAp	
	Low current long duration test value (2000 micro sec.)	As per IEC	
	Current for pressure relief test	As per Clause 1.05	
	Pressure relief class	Class A	
	One minute power frequency withstand voltage of arrestor housing (drv and wet)	70 kV (rms)	
	Impulse withstand voltage of arrestor housing with 1.2/50 micro sec. Wave	170 kVp	
	Nominal creepage distance	As per Clause 1.05	
	Partial discharge at 1.05 MCOV (continuous operating voltage)	Not more than 50 pc	
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2.05	POST INSULATOR					
	The post insulators shall conform in general to latest IS:2544 and IEC – 60815, 60168.					
	Post type insulators shall consist of a porcelain part permanently secured in a metal base to be mounted on the supporting structures. They shall be capable of being mounted upright. They shall be designed to withstand any shocks to which they may be subjected to by the operation of the associated equipment. Only solid core insulators shall be accepted. Height of post insulator shall be preferably as given under parameters of this part.					
	Other requirements of insulator as gi shall also be applicable.	ven under auxiliary requirements				
	In accordance with the stipulations electron conform to type tests and acceptance, IS:2544, IEC-60168 shall be carried out	sewhere the post insulators shall , sample and routine tests as per				
	Туре	Solid core				
	Voltage class	36 kV				
	Rated one minute power frequency withstand Voltage	70 kV (rms)				
	Rated Lightning Impulse withstand voltage with 1.2/50 micro sec. wave	170kVp				
	Total min. cantilever strength	350 kg				
	Min. torsional moment (Nm)	As per IEC 60273				
	Creepage distance (Total)	As per Clause 1.05				
	i) Pottom p.c.d (mm)	76				
	No. of bolts: Top	78 4				
	Bottom :	4				
	Diameter of bolt holes (mm)					
	Top :	M12				
	Bottom :	M12				
3.0	REQUIREMENT OF AUXILIARY ITEMS	8				
3.01	ALUMINIUM TUBULAR CONDUCTOR					
i.	The aluminium tube shall be grade 6340	01 WP (range2) as per IS 5082.				
ii.	There shall be no negative tolerance Other tolerances shall be as per IS:2678	on OD and thickness of the tube. 3 and 2673.				

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iii.	Tests: In accordance with stipulations of specification routine tests sha conducted on tubular conductor as per IS:5082. Also, the wall thick and ovality shall be measured by ultrasonic method. In addition 0.2% tests on both parent material and aluminium tube after welding sha conducted.					
	33 k	33 kV				
	a)	Size	3" IPS	(EH type)		
	b)	Outer diameter	88.90 r	nm with no negative tolerance		
	C)	Thickness of tube	7.62 m	m with no negative tolerance		
	d)	Cross-sectional area	1947 s	q. mm.		
	e)	Weight	5.25 kg	J/m		
	f)	Aluminum grade	63401	WP (range 2) conforming to IS:	5082.	
3.02       ACSR CONDUCTOR         The conductor shall be Aluminium Core Steel Reinforced (ACSR) typ conductor shall confirm to IS:398 (Part-II) except where otherwise sp herein				type. The e specified		
	RAE	BIT CONDUCTOR			7	
	a)	Code and standard		IS 398	-	
	b)	Name		RABBIT ACSR		
	C)	Overall diameter		10.05 mm		
	d)	Weight		0.214 kg/m		
	e)	Ultimate tensile strengt	h	18.25 kN minimum		
	f)	Strands and wire diame	eter of			
		- Aluminium		6 / 3.35 mm		
		- Steel		1 / 3.35 mm		
					7	
	a)	Code and standard		15 398	_	
	b)	Name		DOG ACSR	-	
	c)	Overall diameter		14 15 mm	_	
	(b	Weight		0 394 kg/m		
	e)	Ultimate tensile strengt	h	32.41 kN minimum	-	
	f)	Strands and wire diame	eter of	6/4 72 mm	-	
		- Steel		7/1.57 mm		
					-	
		ITHER CONDUCTOR			_	
	<u>a)</u>	Code and standard		IS 398	_	
	b)	Name		PANTHER ACSR	_	
	C)	Overall diameter		21 mm		

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	d)Weight0.974 kg/me)Ultimate tensile strength89.67 kN minimumf)Strands and wire diameter of - Aluminium30 / 3.00 mm	
3 03	CLAMPS AND CONNECTORS	
3 03 01	The material of clamps and connectors shall be Aluminium allov casting	
0.00.01	conforming to designation A6 of IS:617 for connecting to equipment terminals and conductors of aluminium. In case equipment terminals are of copper, the same clamps/connectors shall be used with 2mm thick bimetal.	
3.03.02	The material of clamps and connectors shall be Galvanised mild steel for connecting to G.S.shield wire.	
3.03.03	Bolts, nuts and plain washers shall be hot dip galvanised mild steel for sizes M12 and above. For sizes below M12, they shall be electro-galvanised mild steel. The spring washers shall be electro-galvanised mild steel.	
3.03.04	All castings shall be free from blow holes, surface blisters, cracks and cavities. All sharp edges and corners shall be rounded off to meet specified corona and radio interference requirements.	
3.03.05	They shall have same current rating as that of the connected equipment. All current carrying parts shall be at least 10 mm thick. The connectors shall be manufactured to have minimum contact resistance.	
3.03.06	Flexible connectors, braids or laminated strips shall be made up of copper/aluminium.	
3.03.07	Current rating and size of terminal/conductor for which connector is suitable shall be put on a suitable sticker on each component which should last atleast till erection time.	
3.04	INSULATORS & INSULATOR STRING HARDWARES	
3.04.01	Porcelain insulator shall comply IS: 731-1976 or equivalent international standard and shall be homogenous, free from laminations, cavities and other flaws or imperfections that might affect the mechanical or dielectric quality and shall be thoroughly vitrified, tough and impervious to moisture. Hollow porcelain should be in one integral piece in green & fired stage	
3.04.02	Pin insulators shall be used on all poles in straight line and disc or shackle insulators on angle and dead end poles.	

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3.04.03	Strain insulators shall be used at line sectionalizing locations, dead end locations, major crossings and locations where the angle of deviation of line is more than 10 <sup>0</sup> .	
3.04.04	For 33 kV lines, Ball & Socket type sourced.	train insulators with fittings shall be
3.04.05	The pins for insulators shall be fixed in the holes provided in the cross-arms and the pole top brackets. The insulators shall be mounted in their places over the pins and tightened. In the case of strain or angle supports, where strain fittings are provided for this purpose, one strap of the strain fittings is placed over the cross-arm before placing the bolt in the hole of cross-arms. The nut of the straps shall be so tightened that the strap can move freely in borizontal direction.	
3.04.06	The insulator hardware shall be of bolt except for insulator cap, which can be generally meet the requirements of cl above.	ed type and shall be of forged steel of malleable cast iron. It shall also amps and connectors as specified
3.04.07	In one span, Tension string assembly suitable turn buckle.	at one end shall be supplied with
3.04.08	DISC INSULATOR	
	The disc insulator shall meet the followi	ng parameters:
	a) Type A	ntifog type insulator
	b) Size of insulator 2	55x145
	c) Electro mechanical strength	20 kN
	d) Leakage distance (mm) 4	30 mm minimum or as
		equired to meet the total
		reepage.
	e) Power frequency withstand 8	5 kV (dry), 50kV (wet)
	voltage	
3.04.09	INSULATOR STRING	
	The insulator string shall meet the follow	wing parameters
	a) Rated Voltage	33 kV
	b) Impulse withstand voltage (Dry	± 170 kVp
	c) Power frequency withstand	130  k/(& 80  k)/(rms)
	voltage (dry and wet) (rms)	
	d) Total creepage distance	
	i) For Porcelain insulators	As per Clause 1.05
	ii) For Polymer insulators	As per Clause 1.05

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e)Pollution level (as per IEC 71)Class -III, Heavyf)Electro mechanical strength120 kN/ String160 kN/ String- Polymer	
g) No. of disc insulator/string 4 nos. (min.) (Porcelain Type)	
3.05 33 kV POLES	
All 33 kV pole shall be of Galvanised RSJ poles of appropriate grade 8 with min. galvanisation thickness of 610 gm/sq.m or 86 microns. All structural members associated with the pole shall be Hot dip galvan unless & otherwise specified.	& size other anised r REC
construction standards or as specified in the table below.	INLO
The following types of pole configurations shall be used at respe- locations given below after finalization of survey & pole spotting	ective
aSP (Single Pole support)i) 0° - 10° deviation.bDP (Double Pole support)ii) 10° - 60° deviation.cFP (Four Pole support)(iii) 60° - 90° deviation	
DESIGN PARAMETERS	
<ul> <li>a) Factor of safety 2.0 in normal condition for 33 kV line &amp; LT line PCC supports.</li> <li>b) Wind Pressure on Pole &amp; conductor – As per IS 802</li> <li>c) Wind load on cross-arms, insulators guy-wire etc. shal considered.</li> <li>d) Wind load on full projected area of conductors and pole is the considered for design.</li> <li>e) Ground clearance shall be minimum 5.2m for 33 kV line for conductor at locations other than along and across road crossinn f) All other clearance shall be as per IE.Rules.</li> <li>g) The live metal clearance shall be as per IS: 5613 and shamin.330 mm for 33 kV line.</li> </ul>	ne for all be to be r bare ngs. all be
shall be provided.	evice,

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	1. Excavation of pole pit
	Excavation cost for pits shall be included by the contractor in the bid for following type of soils inclusive of dewatering of pits and shoring and shuttering wherever necessary.
	a) All type of soils and soil conditions but excluding hard rock
	For the purpose of pole planting, normally pit size shall be 600x500x1500 (mm). In case bidder employs Earth augers, the Pit size can be considered 0.7 meter dia with 1.5 meter depth.
	b) Hard rock
	For hard rock locations, 1 meter deep hole of diameter 20% in excess of the longest dimension of the bottom most portion of pole shall be excavated. The pole shall be grouted in the pit with 1:2:4 nominal concrete mix at the time of pole erection. For hard rock, the excavation cost per location shall remain same for all type of foundations. Controlled blasting shall be permitted only in case of hard or rocky soil.
	The contractor shall be responsible for any damage or accidents arising out of the process of blasting. Blasting shall not be permitted if the area around location is inhabited. In such case, the contractor shall have to follow other methods like drilling etc.
	2. PCC footing and compaction of soil
	The planting depth of pole shall be 1500 mm in the ground except in wet soil and black cotton soil where depth shall be increased by 0.2 mtr. to 0.3 mtr. with reduced wind span.
	3. Earthing of Poles
	In 33 kV, each pole shall be earthed as per REC Construction Standard CS-J-2.
	In rocky areas where digging of earth pits up to 1500mm is not possible spike earthing in horizontal configuration buried at a depth of not less than 800mm may be used.
	In rocky areas where individual earthing of poles is not possible, an overhead GI earth wire shall be run as per REC construction standard drawing- A5. This earth wire shall be earthed at three different points in one
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	km using pipe earthing as per REC construction standard J2. The dimension of overhead GI earth wire 6mm dia. for 33 kV lines.
	Providing of Guys/Strut Poles to Supports
	The arrangement for guys shall be as per REC Construction. Strut poles/flying guys wherever required shall be installed on various pole locations as per REC construction standards. For selection of guying locations REC guidelines & construction practices & IS :5613 shall be followed. The stay rod should be placed in a position so that the angle of rod with the vertical face of the pit is 30 <sup>0</sup> /45 <sup>0</sup> as the case may be.
	In this work anchor type guy sets are to be used. These guys shall be provided at
	<ul> <li>(i) Angle locations</li> <li>(ii) Dead end locations</li> <li>(iii) T-off points</li> <li>(iv) Steep gradient locations.</li> <li>(v) Double Pole &amp; Four poles</li> <li>(vi) Wind stays along tangent locations at 40% of pole locations</li> <li>(vii) For double pole structure (DP), four stays along the line, two in each direction and two stays along the bisection of the angle of deviation (or more) as required depending on the angle of deviation are to be provided. Hot dip galvanized stay sets are to be used.</li> </ul>
	G.I. stay wires of size 7/4 mm with GI turn buckle rod of 20 mm dia & 20 mm dia GI stay rods shall be used for 33 KV line.
	Precast RCC anchor plate as per REC construction standard K1 shall be used for the purpose of anchoring the guy rod with a bolt arrangement at one end and other end is given shape of 40mm dia circle to bind one end of the stay wire.
	The size of the stay pit shall be 500mmx500mmx1600mm with concrete mix of 1:2:4 having volume in stay pit of 800x500x500=0.2 cubic mtr for embedding RCC stay plate assembly and the balance pit to be filled with earth duly rammed.
	In case of firm soil, concreting is not required.
	The turn buckle shall be mounted at the pole end of the stay and guy wire so fixed that the turn buckle is half way in the working position, thus giving the maximum movement for tightening or loosening.

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	If the guy wire proves to be hazardous, it should be protected with suitable asbestos pipe filled with concrete of about 2 m length above the ground level, painted with white and black strips so that, it may be visible at night.
	4. Cross Arms
	Cross Arms for 33 kV Overhead Power Lines shall be made out of 100x50x6 mm M.S. channel.
	For 33 KV line, cross arms a MS strip of 100x50x5 mm shall be welded for providing additional mechanical strength at the seat of the pin insulator.
	All types of cross arms & clamps shall be hot dip galvanized as per IS 2629 with galvanization thickness min. 610 gm/sq.m or 86 microns.
	Fixing of Cross Arms
	After the erection of supports and providing guys, the cross-arms are to be mounted on the support with necessary clamps, bolts and nuts. The practice of fixing the cross arms before the pole erection can also be followed. In case, the cross-arm shall be mounted after the pole is erected, the lineman should climb the pole with necessary tools. The cross-arm shall then tied to a hand line and pulled up by the ground man through a pulley, till the cross-arm reaches the line man. The ground man should station himself on one side, so that if any material drops from the top of the pole, it may not strike him. All the materials should be lifted or lowered through the hand line, and should not be dropped.
3.06	EARTHING CONDUCTOR
	a. The main conductor buried in earth shall be 40mm dia MS rod for main and auxiliary mat. The earthing conductors over the ground shall be of 75x12 mm GS flat. The earthing leads for columns and auxiliary structures, cable trenches shall be of 75x12 mm GS flat. The earthing of the lighting fixtures shall be carried out by 16 SWG wire.
	<ul> <li>All earthing conductors above the ground level shall be galvanised steel only.</li> </ul>
	c. Earthing terminal of each surge arrester, capacitor voltage transformer and lightning down conductors shall be directly connected to rod electrode which in turn, shall be connected to station earthing grid.

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	d. Earthing mat comprising of closely spaced (300mm x 300mm) conductors shall be provided at 300 mm below ground the operating handles of the isolators/earthswitch.		
	e. Earthing conductor shall be buried 2000mm outside the switchyard fence. Every post of the fence and gates shall be connected to earthing loop.		
3.07	LIGHTNING PROTECTION		
	Direct stroke lightning protection (DSLP) shall be provided in the switchyard by LM/shield wires.		
	Lightning protection System down conductors shall not be connected to other conductors above ground level. Also, no intermediate earthing connection shall be made to Surge arrester, Voltage Transformer, earthing leads for which shall be directly connected to earth electrode.		
	Every down conductor shall be provided with a test joint at about 1000mm above ground level. The test joint shall be directly connected to the earthing system. Down conductors shall be cleated on the structures at 2000mm interval.		
	The lightning protection system shall not be in direct contact with underground metallic service ducts and cables.		
3 07 01	Lightning protection system installation shall be in strict accordance with the latest editions of Indian Electricity Rules, Indian Standards and Codes of practice and Regulations existing in the locality where the system is installed.		
0.01101	a) Number of strands 7 of steel		
	b) Strand diameter 3.66 mm		
	c) Overall diameter 10.98 mm		
	d) Weight 583 kg/km approx.		
	e) Ultimate tensile strength 68.4 kN minimum		
	f) Total cross-sectional area 73.65 sq.mm.		
	g) Calculated d.c. resistance 2.5 ohms/km at 20 deg.C.		
	i) Protective coating for storage Boiled linseed oil to avoid wet storage stains (white rust)		

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	The earth wire shall be preformed and post formed quality.				
3.07.02	Earthwire Compression type Tension Clamp & Flexible Copper Bond Tension Clamp For Earthwire				
	The details shall be as per IS:2121 part-3. Compression type tension clamp shall be used to hold 7/3.66 mm galvanised steel earthwire. Anchor shackle shall be supplied which shall be suitable for attaching the tension clamp to strain plates. The strain plates supplied with the towers will have a minimum thickness of 8 mm with a hole of 17.5 mm diameter. Suitable lugs for jumper connection shall also be supplied alongwith necessary bolts and nuts.				
	The dimensions a be as given below	and the dime v:	ensional tolera	ance of the tensio	n clamp shall
	Item	Dimensions compression	before n	Dimensions after compression	
	Inner Dia (mm)Outer Dia (mm)Corner to Corner widthFace to Face width(mm)(mm)(mm)				
	Steel         11.1±0.2         21±0.5         20.2±0.5         17.5±0.5           Dead - end         11.1±0.2         21±0.5         11.1±0.5         11.1±0.5				
	Flexible copper bond shall be fitt be pressed jointe 12 mm dia bolt a also include one with nut and lock	<b>bond:</b> as d red with 2 no ed to either e nd other for 16 mm dia washer.	etailed in is: os. Tinned co nds of the bo 16 mm dia bo 40 mm lug	2121 part 3. The opper connecting ond. One lug shall olt. The complete with ms bolt hot	flexible copper lugs which will be suitable for assembly shall dip galvanised
3.08	BUSHINGS, HOI INSULATORS, A	LOW COLU	JMN INSULA ISULATORS	TORS, SUPPOR	т
3.08.01	Bushings shall b IEC:60137 while in accordance w manufactured ar insulators shall a long and short sh	e manufactu hollow colun rith IEC 621 nd tested as ilso conform reds.	ured and test nn insulators  55/IS 5284. s per IS:254 to IEC 6081	ted in accordance shall be manufac The support ins 4 / IEC 60168/II 15 as applicable	e with IS:2099& tured and tested ulators shall be EC 60273. The having alternate
	Support insulators/ bushings/ hollow column insulators shall be designed to have ample insulation, mechanical strength and rigidity for the conditions under which they will be used.				

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3.08.02	Porcelain used shall be homogenous, free from laminations, cavities and other flaws or imperfections that might affect the mechanical or dielectric quality and shall be thoroughly vitrified, tough and impervious to moisture.
3.08.03	Glazing of the porcelain shall be uniform brown in colour, free form blisters, burns and other similar defects.
3.08.04	The design of the insulator shall be such that stresses due to expansion and contraction in any part of the insulator shall not lead to deterioration. All ferrous parts shall be hot dip galvanised.
3.08.05	Post type insulators shall consist of a porcelain part permanently secured in metal base to be mounted on supporting structures. They shall be capable of being mounted upright. They shall be designed to withstand all shocks to which they may be subjected to during operation of the associated equipment.
3.08.06	Bushing porcelain shall be robust and capable of withstanding the internal pressures likely to occur in service. The design and location of clamps, the shape and the strength of the porcelain flange securing the bushing to the tank shall be such that there is no risk of fracture. All portions of the assembled porcelain enclosures and supports other than gaskets, which may in any way be exposed to the atmosphere shall be composed of completely non hygroscopic material such as metal or glazed porcelain.
3.08.07	All iron parts shall be hot dip galvanised and all joints shall be air tight. Surface of joints shall be trued, porcelain parts by grinding and metal parts by machining. Insulator/ bushing design shall be such as to ensure a uniform compressive pressure on the joints.
3.08.08	In accordance with the requirements stipulated elsewhere, bushings, hollow column insulators and support insulators shall conform to type tests and shall be subjected to routine tests and acceptance test/ sample test in accordance with relevant standards.
3.09	SPACERS
3.09.01	Spacers shall conform to IS: 10162. They shall be of non-magnetic material except nuts and bolts, which shall be of hot dip galvanised mild steel.
3.09.02	Spacers shall generally meet the requirements of clamps and connectors as specified above. Its design shall take care of fixing and removing during installation and maintenance.
3.09.03	In addition to the type tests as per IS:10162, clamp slip test should have been conducted. In this test the sample shall be installed on test span of twin/quad bundle string at a tension of 44.2 kN (4500 kg). One of the clamps when subjected to a longitudinal pull of 2.5 kN (250 kg) parallel to

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	the axis of conductor shall not slip, i.e. permanent displacement between conductor and clamp after the test shall not exceed 1.0 mm. This test should have been performed on all other clamps of the sample.
3.10	CABINETS, BOXES, KIOSKS, PANELS, ETC.
3.010.01	All types of control cabinets, junction boxes, marshaling boxes, lighting panels, terminal boxes, operating mechanism boxes, Kiosks etc. shall generally conform to IS:5039, IS:8623 and IEC:439 as applicable.
3.010.02	They shall be of Stainless steel or Aluminium. The thickness of Stainless steel sheet shall be 1mm. The thickness of aluminium shall be 3mm and shall provide rigidity. Top of the boxes shall be sloped towards rear of the box. However, the junction and switch boxes shall be of hot dip galvanised sheet steel of 1.6mm thickness. The paint shade shall be grey RAL 9002 outside and glossy white inside.
3.010.03	The cabinets/boxes/kiosks/panels shall be free standing or wall mounting or pedestal mounting type. They shall have hinged doors with padlocking arrangement. All doors, removable covers and plates shall be gasketed all around with neoprene gaskets.
3.010.04	The degree of protection of all the outdoor boxes shall not be less than IP 55 as per IS 2147.
3.010.05	The cable entry shall be from bottom, for which removable gasketed cable gland plates shall be provided.
3.010.06	Suitable 240V, single phase, 50Hz ac heaters with thermostats controlled by switch and fuse shall be provided to maintain inside temperature 10deg. above the ambient.
3.010.07	The size of enclosure and the layout of equipment inside shall provide generous clearances. Each cabinet/box/kiosk/panel shall be provided with a 15A, 240V ac, 2 pole, 3 pin industrial grade receptacle with switch. For incoming supply, MCB of suitable rating shall be provided. Illumination of each compartment shall be with door operated incandescent lamp. All control switches shall be of rotary switch type.
3.010.08	Each cabinet/box/kiosk/panel shall be provided with two earthing pads to receive 75mmx12mm/50mmx6mm GS flat. The connection shall be bolted type with two bolts per pad. The hinged door shall be connected to body using flexible wire. The cabinets/boxes/kiosks/panels shall also be provided with danger plate, and internal wiring diagram pasted on inside of the door. The front label shall be on a 3mm thick plastic plate with white letters engraved on black background.

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3.11	BAY MARSHALLING BOX		
3.011.01	Bay Marshaling Box located at a convenient location to receive and distribute cables shall be provided as required. It shall meet all the requirements as specified for cabinets/boxes.		
3.011.02	It shall have three separate distinct compartments for following purposes:		
	- To receive two incoming 415V, three phase, AC supplies controlled by 100A four pole MCBs with auto changeover provision, and to distribute five (5) three phase ac supplies controlled by 32A four pole MCBs. It shall also be provided with 63A, 3 phase 4 pin industrial grade receptacle with rotary switch.		
	<ul> <li>To receive three phase incoming from first compartment and to distribute ten (10) single phase ac supplies controlled by 16A two pole MCBs.</li> <li>min. 200 nos. terminal blocks in vertical formation for interlocking facility.</li> </ul>		
3.12	AUXILIARY SWITCH		
	The auxiliary switch shall conform of following type tests:		
	<ul> <li>a) Electrical endurance test - A minimum of 1000 operations for 2A. D.C. with a time constant greater than or equal to 20 milliseconds with a subsequent examination of mV drop/ visual defects/ temperature rise test</li> </ul>		
	<ul> <li>b) Mechanical endurance test - A minimum of 5000 operations with a subsequent checking of contact pressure test/ visual examination</li> <li>c) Heat run test on contacts</li> <li>d) IR/HV test, etc.</li> </ul>		
	Type tests Requirement for Auxiliary Items		
	All equipment with their terminal connectors, control cabinets, main protective relays, etc. as well as insulators, insulator strings with hardwares, clamps and connectors, marshalling boxes, etc., shall conform to type tests as per relevant standards and shall be subjected to routine and acceptance tests in accordance with the requirements stipulated under respective equipment sections.		
3.13	TERMINAL BLOCKS		
3.013.01	They shall be non-disconnecting stud type of extensible design equivalent to Elmex type CAT-M4.		

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3.013.02	The terminal blocks shall be of min. 650 V grade, and rated to continuously carry maximum expected current. The conducting part shall be tinned or silver plated.
3.013.03	They shall be of moulded, non-inflammable thermosetting plastic. The material shall not deteriorate with varied conditions of temperature and humidity. The terminal blocks shall be fully enclosed with removable covers of transparent, non-deteriorating plastic material. Insulating barriers shall be provided between the terminal blocks so that the barriers do not hinder the wiring operation without removing the barriers.
3.013.04	The terminals shall be provided with marking tags for wiring identification.
3.013.05	Unless otherwise required (expected current rating) or specified, terminal blocks shall be suitable for connecting the following conductors on each side:
	All CT & VT circuits - Min. four 2.5 sq.mm. copper flexible conductor AC & DC power supply -Two 16 sq.mm. aluminium conductor Circuits
	Other control circuits - Min. two 2.5 sq.mm. copper flexible conductor
3.013.06	The terminal blocks for CT and VT secondary leads shall be provided with test links and isolating facilities. CT secondary leads shall also be provided with short circuiting and earthing facilities.
3.14	WIRING
3.014.01	All wiring shall be carried out with 1100 V grade stranded copper wires. The minimum size of the stranded conductor used for internal wiring shall be as follows:
	<ul> <li>All circuits except CT circuits 2.5 sq.mm</li> <li>b) CT circuits 4 sq. mm (minimum number of strands shall be 3 per conductor).</li> </ul>
3.014.02	All internal wiring shall be securely supported, neatly arranged readily accessible and connected to equipment terminals and terminal blocks.
3.014.03	Wire terminations shall be made with solderless crimping type of tinned copper lugs which firmly grip the conductor and insulation. Insulated sleeves shall be provided at all the wire terminations. Engraved core identification plastic ferrules marked to correspond with the wiring diagram shall be fitted at both ends of each wire. Ferrules shall fit tightly on the wires shall not fall off when the wires and shall not fall off when the wire is disconnected from terminal blocks.

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3.014.04	All wires directly connected to trip circuit breaker shall be distinguished by the addition of a red coloured unlettered ferrule. Number 6 & 9 shall not be included for ferrules purposes.	
3.014.05	All terminals including spare terminals of auxiliary equipment shall be wired upto terminal blocks. Each equipment shall have its own central control cabinet in which all contacts including spare contacts from all poles shall be wired out. Interpole cabling for all equipment's shall be carried out by the Contractor.	
4.0	INSTALLATION	
4.01	EARTHING	
	The earthing shall be done in accordance with requirements given in <b>Annexure-I</b> of this section and drawing enclosed with the specifications. Earthing of panels shall be done in line with the requirements given in respective equipment section of this specification.	
4.02	CIVIL WORKS	
	The civil works shall be done in accordance with requirements stipulated elsewhere in the specification.	
4.03	STRUCTURAL STEEL WORKS	
	The structural steel works shall be done in accordance with requirements stipulated elsewhere in the specification.	
4.04	EQUIPMENT ERECTION NOTES	
	All support insulators, circuit breaker interrupters and other fragile equipment shall be handled with cranes with suitable booms and handling capacity.	
	Where, assemblies are supplied in more than one section, Contractor shall make all necessary mechanical and electrical connections between sections including the connection between buses. Contractor shall also do necessary adjustments/alignments necessary for proper operation of circuit breakers, isolators and their operating mechanisms. All components shall be protected against damage during unloading, transportation, storage, installation, testing and commissioning. Any equipment damaged due to negligence or carelessness or otherwise shall be replaced by the Contractor at his own expense. The contractor shall strictly follow manufacturer's recommendations for handling and erection of equipment.	

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	The slings shall be of sufficient length to avoid any damage to insulator due to excessive swing, scratching by sling ropes etc. Handling equipment, sling ropes etc. should be tested before erection and periodically thereafter for strength.				
	Bending of piping should be done by a bending machine and through cold bending only. Bending shall be such that inner diameter of pipe is not reduced. The pipes shall be thoroughly cleaned before installation.				
	Cutting of the pipes wherever required shall be such as to avoid flaring of the ends. Hence only a proper pipe cutting tool shall be used. Hack saw shall not be used.				
	For cleaning the inside and outside of hollow insulators only Muslin leather cloth shall be used.				
	The rigid busbars for equipment interconnections shall have rigid connections at one end and expansion / flexible at the other end. The tubular aluminium connections shall have not more than one joint per span. Since no wastages are permissible, the bidder shall work out the cut lengths of aluminum tube based on finalized layout and dispatch the same to site without requiring owners's approval. Corona bells shall be provided at the end of the rigid busbars.				
4.05	CABLING				
4.05.01	Cabling shall be on cable racks, in trenches, vertical shafts, excavated trenches for direct burial, pulled through pipes and conduits run clamped on steel structures etc. in accordance with the requirements specified elsewhere in the specification.				
4.05.02	Cables inside the switchyard shall be laid on GI angle supports at 600mm spacing with separate tiers for control and power cables. The GI angles shall be bolted / welded to galvanized insert plates inside RCC trenches.				
4.05.03	Cables shall be generally located adjoining the electrical equipment through the pipe insert embedded in the ground. In the case of equipment located away from cable trench either pipe inserts shall be embedded in the ground connecting the cable trench and the equipment or in case the distance is small, notch/opening shall be provided. In all these cases necessary bending radii as recommended by the cable supplier shall be maintained.				
4.05.04	Cabling in the control room shall be done on ladder type cable trays with supports at an interval of 2000 mm.				

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4.05.05	All interpole cables (both power & control circuit) for equipments shall be laid in cable trenches/G.I. Conduit Pipe of NB 50/100mm which shall be burried in the ground at a depth of 300mm.			
5.0	SITE TESTING AND COMMISSIONING			
5.01	INTRODUCTION			
	An indicative list of tests is given below. Contractor shall perform any additional test based on specialties of the items as per the field QP/ instructions of the equipment supplier or Employer without any extra cost to the Employer. The Contractor shall arrange all instruments required for conducting these tests alongwith calibration certificates and shall get the list of instruments approved from the Employer.			
5.02	GENERAL CHECKS			
	<ul> <li>a) Check for physical damage.</li> <li>b) Visual examination of zinc coating/ plating</li> <li>c) Check from name plate that all items are as per older/ specification.</li> <li>d) Check tightness of all bolts, clamps and connecting terminals using toque wrenches.</li> <li>e) For oil filled equipment check for oil leakage, if any. Also check oil level and top up.</li> <li>f) Check ground connections for quality of weld and application of zinc rich paint over weld joint of galvanized surfaces.</li> <li>g) Check cleanliness of insulator and bushings.</li> <li>h) All checks and tests specified by the manufactures in their drawings and manuals as well as all tests specified in the relevant code of erection.</li> <li>j) Pressure test on all pneumatic lines at 1.5 times the rated pressure shall be conducted.</li> </ul>			
5.03				
	<ul> <li>a) Insulation resistance of each pole.</li> <li>b) Check adjustments, if any, suggested by manufacturer.</li> <li>c) Breaker closing and tripping time.</li> <li>d) Slow and power closing operation and opening</li> <li>e) Trip free and anti pumping operation.</li> <li>f) Minimum pick up volts of coils</li> <li>g) Contact resistance</li> <li>h) Functional checking of compressed air plant and all accessories</li> </ul>			

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CLAUSE NO	TECHNICAL SPECIFICATIONS		
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	<ul> <li>Functional checking of control circuits, interlocks, tripping through protective relays</li> <li>Jnsulation resistance of control circuits, motor etc.</li> <li>Resistance of closing and tripping coils.</li> </ul>		
5.04	ISOLATORS		
	<ul> <li>a) Insulation resistance of each pole</li> <li>b) Manual and electrical operation on interlocks</li> <li>c) Insulation resistance of control circuits and motors.</li> <li>d) Ground connections</li> <li>e) Contact resistance</li> <li>f) Proper alignment to minimise the vibration to the extreme possible during operation.</li> <li>g) Measurement of operating torque for isolator and Earth switch</li> <li>h) Resistance of operating and interlocking coils.</li> </ul>		
5.05	CURRENT TRANSFORMERS		
	<ul> <li>a) Insulation Resistance Test</li> <li>b) Polarity test.</li> <li>c) Ratio identification test-checking of all ratios on all cores by primary injection of current.</li> <li>d) Dielectric test of oil (wherever applicable).</li> <li>e) Magnetizing characteristics test.</li> <li>f) Capacitance and tan delta measurement at minimum 10kV.</li> </ul>		
5.06	CAPACITOR VOLTAGE TRANSFOREMER		
	<ul> <li>a) Insulation resistance test.</li> <li>b) Polarity test.</li> <li>c) Ratio test.</li> <li>d) Dielectric test of oil (if applicable).</li> <li>e) Capacitance and tan delta measurement at minimum 10kV.</li> </ul>		
5.07	SURGE ARRESTER		
	<ul> <li>a) Grading leakage current.</li> <li>b) Resistance of ground connection.</li> <li>c) Resistive current drawn at rated voltage after energisation.</li> </ul>		
5.08	PHASING OUT		
	The phasing out of all supplies in the station system shall be carried out.		

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CLAUSE NO	TECHNICAL SPECIFICATIONS
5.09	STATION EARTHING
	<ul> <li>a) Check soil resistivity</li> <li>b) Check continuity of grid wires</li> <li>c) Check earth resistance of the entire grid as well as various sections of the same.</li> <li>d) Check for weld joint and application of zinc rich paint on galvanised surface.</li> <li>e) Dip test on earth conductor prior to use.</li> </ul>
5.10	CONDUCTOR STRINGING AND POWER CONNECTORS
	<ul> <li>a) Physical check for finish</li> <li>b) Electrical clearance check</li> <li>c) Testing of torque by torque by torque wrenches on all bus power connectors and other accessories.</li> <li>d) Sag and tension check on conductors.</li> </ul>
5.11	INSULATORS
	Visual examination for finish damage, creepage distance, etc.

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CLAUSE NO	TECHNICAL SPE	CIFICATIONS	एनरीपीसी NTPC	
			ANNEXURE-I	
a)	EARTHING NOTES FOR SWIT	CHYARD		
i.	GENERAL			
	Earthing of operating boxes, cub while cable trenches, equipment	bicles shall be done s and structure by 7	by 50 X 6 mm GS flat 5 X 12 mm GS flat.	
ii.	Neutral points of systems of di frame works associated with extraneous metal works asso connected to a single earthing sy	Neutral points of systems of different voltages, metallic enclosures and frame works associated with all current carrying equipments and extraneous metal works associated with electric system shall be connected to a single earthing system unless stipulated otherwise.		
iii.	Earthing system installation shall be in strict accordance with the latest editions of Indian Electricity Rules, relevant Indian Standards and Codes of practice and Regulations existing in the locality where the system is installed.			
b)	DETAILS OF EARTHING SYST	EM		
	ltem	Size	Material	
	Main Earthing conductor	40mm dia rod	Mild steel	
	Conductor above ground & earthing leads (for equipment)	75X12/50X6 mm	Galvanized steel	
	Rod Electrode	40mm dia, 3000mr	n Mild steel	
	Pipe Electrode	40mm dia, 3000mr	n GS	
	G.I. Earthwire	7/8 SWG	GI	
c)	For Step and Touch Potent considered	ial the following p	parameters shall be	
	<ul> <li>i) Current distribution factor – 1</li> <li>ii) Duration of fault current – 0.5</li> <li>iii) Human body weight – 50kg</li> </ul>	(one) sec		
d)	Grid resistance shall be less than	n 1 (one) ohm.		

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e)	EARTHING CONDUCTOR LAYOUT
	<ul> <li>Earthing conductors in outdoor areas shall be buried atleast 600mm below finished grade level unless stated otherwise.</li> </ul>
	<li>ii. Spacing between rod electrodes shall be provided based on the earthmat design calculations.</li>
	iii. Wherever earthing conductors cross cable trenches, underground service ducts, pipes, tunnels, railway tracks etc., it shall be laid atleast 300mm below them and shall be re-routed in case it fouls with equipment/structure foundations.
	iv. Tap connections from the earthing grid to the equipment/structure to be earthed, shall be terminated on the earthing terminals of the equipment/structure, if the equipment is available at the time of laying the grid. Otherwise, "earth insert" with temporary wooden cover or "earth riser" shall be provided near the equipment foundation/pedestal for future connections to the equipment earthing terminals.
	v. Earthing conductor along their run on cable trench ladder columns, beams, walls, etc. shall be supported by suitable welding/cleating at intervals of 750mm. Earthing conductors along cable trenches shall be on the wall nearer to the equipment. Wherever it passes through walls, floors etc. galvanized iron sleeves shall be provided for the passage of the conductor. Both ends of the sleeves shall be sealed to prevent the passage of water through the sleeves.
	vi. Earthing conductor around the building shall be buried in earth at a minimum distance of 1500mm from the outer boundary of the building. In case high temperature is encountered at some location, the earthing conductor shall be laid minimum 1500mm away from such location.
	vii. In outdoor areas, tap connections shall be brought 300mm above ground level for making connections in future, in case equipment is not available at the time of grid installations.
	viii.Earthing conductors crossing the road shall be either installed in hume pipes or laid at greater depth to suit the site conditions.
	ix. Earthing conductors embedded in the concrete fibre shall have approximately 50mm concrete cover.

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f)	EQUIPMENT AND STRUCTURE EARTHING
	i. The connection between earthing pads and the earthing grid shall be made by short and direct earthing leads free from kinks and splices. In case earthing pads are not provided on the item to be earthed, same shall be provided in consultation with engineer.
	<li>Metallic pipes, conduits and cable tray sections for cable installation shall be bonded to ensure electrical continuity and connected to earthing conductors at regular interval. Apart from intermediate connections, beginning points shall also be connected to earthing system.</li>
	iii. Metallic conduits shall not be used as earth continuity conductor.
	<li>iv. A separate earthing conductor shall be provided for earthing lighting fixtures, lighting poles, receptacles, switches, junction boxes, lighting conduits, etc.</li>
	<ul> <li>Wherever earthing conductor crosses or runs along metallic structures such as gas, water, steam, conduits, etc. and steel reinforcement in concrete it shall be bonded to the same.</li> </ul>
	vi. Cable and cable boxes/glands, lockout switches etc. shall be connected to the earthing conductor running alongwith the supply cable which, in turn, shall be connected to earthing grid conductor at minimum two points, whether specifically shown or not.
	vii. Railway tracks within switchyard area shall be bonded across fish plates and connected to earthing grid at several locations.
	viii.Earthing conductor shall be buried 2000mm outside the switchyard fence. Every post of the fence and gates shall be connected to earthing loop by one lead.
	ix. Flexible earthing connectors shall be provided where flexible conduits are connected to rigid conduits to ensure continuity.
	<ul> <li>x. Equipment earthing (Riser &amp; welding of two conductors) shall be done as per standard drawing enclosed in this part.</li> </ul>
g)	JOINTING

CLAUSE NO	TECHNICAL SPECIFICATIONS
	i. Earthing connections with equipment earthing pads shall be of bolted type. Contact surfaces shall be free from scales, paint, enamel, grease, rust or dirt. Two bolts shall be provided for making each connection. Equipment bolted connections, after being checked and tested, shall be painted with anti-corrosive paint/compound.
	ii. Connection between equipment earthing lead and between main earthing conductors shall be welded/brazed type. For rust protections, the welds should be treated with red lead and afterwards thickly coated with bitumen compound to prevent corrosion.
	<li>iii. Steel to copper connections shall be brazed type and shall be treated to prevent moisture ingression.</li>
	iv. Resistance of the joint shall not be more than the resistance of the equivalent length of the conductor.
	<ul> <li>v. All ground connections shall be made by electric arc welding. All welded joints shall be allowed to cool down gradually to atmospheric temperature before putting any load on it. Artificial cooling shall not be allowed.</li> </ul>
	<ul> <li>vi. Bending of large diameter rod/thick conductor shall be done preferably by gas heating.</li> </ul>
	vii. All arc welding with large diameter conductors shall be done with low hydrogen content electrodes.
h)	POWER CABLE EARTHING
	Metallic sheaths and armour of all multi core power cables shall be earthed at both equipment and switchgear end. Sheath and armour of single core power cables shall be earthed at switchgear end only.

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	CHAPTER-C15				
		CUIT TELEVISION (CCT	V) SYSTEM		
1.0	General Requirements	5			
1.01	The intent of the specif for the CCTV System areas of the power plan motion sensors as per r	The intent of the specification is to define the functional & design requirements for the CCTV System meant for gathering video information from the various areas of the power plant with display and recording facilities with night vision and motion sensors as per requirement.			
1.02	The Contractor shall be responsible for selection, design, engineering, manufacture, testing at manufacturer's works/site, installation of all the equipments supplied as covered in this specification and commissioning of the system meeting the intent & functional requirements of the specification. All the power supply (UPS), cables, cable trays, power packs, erection hardware (viz. junction boxes, brackets glands, nut-bolts, conduits etc.) and mounting are also included in Contractor's scope.				
1.03	The Contractor's scope shall also include successful demonstration of functional requirements specified herein complete in all respects.				
1.04	The Contractor shall guarantee satisfactory performance of the equipment under stipulated variations of voltage and frequency.				
1.05	The design and manufacture shall be such that equipment / components of same type and rating are interchangeable.				
1.06	The number of camera units, servers, network switches, wireless equipment etc. and their locations shall; be finalized during detailed engineer for effective functional requirements.				
1.07	Any other equipment, module, software required for the safe and satisfactory operation, control, protection, monitoring, testing and maintenance of the system shall also be included by the Bidder within the lump sum quoted price.				
1.08	The equipment furnished under this section shall meet the requirements of all the applicable International codes and standards or their latest amendment Codes and Standards. Camera certification has to be CE/FCC/UL or equivalent.				
2.00	POWER SUPPLY ARRANGEMENT				
2.01	2.01 The CCTV System along with all its components i.e. network switches, storage devices, servers, LAN switches, cameras etc. shall be powered from UPS system. Contractor shall also provide local power distribution boxes as required for sub-distribution of UPS supply.				
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2.02	For cameras to be located in remote areas where the UPS power supply can not be extended due to voltage drop etc., then such cameras can be grouped and fed from mini UPS. Individual mini UPS shall be provided for the cameras which can not be grouped. Mini UPS are to be provided by the contractor within his quoted lumpsum price. Contractor shall also provide local power distribution boxes as required for sub-distribution of supply from these mini-UPS to cameras. The location of mini-UPS & power distribution scheme shall be finalized during detail engineering.				
2.03	If the offered equipment is operating at voltage level other than what is available as auxiliary supply, the Contractor shall provide all required hardware, to make the offered system compatible with specified power supply arrangement.				
3.00	DESIGN AND TECHNI	CAL REQUIREMENTS			
3.01	The CCTV system shall be able to provide surveillance of different locations in the plant, entry gate and all across periphery. The exact locations shall be decided during detailed engineering.				
	The CCTV system shall be designed as a standalone IP based network architecture. System shall use video signals from different cameras at different locations, process the video signals for viewing on monitors at different locations and simultaneously record all the video streams using H.264 or better compression technique. Joystick and mouse-keyboard controllers shall be used for Pan, Tilt, Zoom and other functions of desired cameras.				
	The monitoring of these cameras shall be done at main Control Room or as finalized in detailed engineering. The required no. of hardware/software licenses to meet the requirements shall be supplied by the contractor.				
3.04	Camera and database servers shall offer both video stream management, video stream storage management. These servers shall also manage and store configuration information/database for the whole system. Recording frame rate & resolution in respect of individual camera shall be programmable. It shall be possible to view and record at different resolutions and frame rates and this shall be individually programmable on every camera				
	It shall be possible to take back-up of system configuration and database on portable media device and restoring the same if required.				
3.05	System shall ensure that	at once recorded, video can r	ot be altered.		
3.06	3.06 Camera server shall be provided with minimum 28 TB of storage space to store recordings of all cameras. All recordings shall have camera ID, Location, Date and time of recording.				
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3.07	It shall be possible to without affecting perform	It shall be possible to view, record, search and replay simultaneously without affecting performance of the system.				
3.08	The system supplied shall be complete in all respects for reliable performance. The Contractor shall submit the detailed block schematic, video, signal & power wiring diagram, describing the connections between the network switch/camera server Systems and various cameras, monitors, keyboard, and joystick.					
3.09	The camera & Video Ma S or latest available engineering.	anagement Software shall co applicable ONVIF profile	onform to ONVI at the time c	F profile of detail		
4.0	DETAILED DESCRIPTIO	N OF THE SYSTEM COMPON	ENTS:			
4.01	Application Software for	Application Software for Video Monitoring, Recording & Management.				
	a) The application so the entire surveilla	ftware shall be used to display, nce system.	store, control &	manage		
	b) It shall be possible to control all cameras i.e. PTZ, auto/manual focus, selection of presets, video tour selection etc. The software shall support flexible 1/2/4 windows split screen display mode or scroll mode on the display monitors for live video.					
	c) The system shall s	upport video analytics in respec	ct of the following	I		
	1. Video motion det	ection,				
	2. Object tracking	ion 9 Trocking				
	3. Object classificat	ion & Tracking				
	The feature can be an integral part of camera or a part of camera server. The features shall be user configurable for each camera. It shall be possible to activate recordings automatically based on events generated by video analytics. These events shall also be logged and suitably alarmed on the monitors.					
4.02	Cameras:					
	All the cameras shall be c compatible. There will be shall be high speed integr	color, suitable for day and night two types of cameras viz. PT ated dome type.	surveillance and Z & Fixed. PTZ	network cameras		
	Camera shall be directly connected to network and use of external encoder for connecting to network is not acceptable. The cameras shall be rugged, high performance color cameras. These cameras shall provide high resolution and high sensitivity suitable for operation in a power plant, both in natural and artificial lighted areas.					
	Detailed technical specific	ation is given below.				
	a) PTZ Dome Cam	eras				
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## **TECHNICAL SPECIFICATIONS**



## High Definition (HD) PTZ cameras

		-	4/0 0 4/0" D :	01100	
			1/2.8-1/3" Progressi	ve scan CIVIOS	
	Lens		4.45-4.7 /89-94.0 mn	n focal length	
	Optical Zoom		20x or better		
	Digital Zoom		12x or better		
	Number of Pixels/Effec resolution	tive	1920X1080 (Full HD)	)/2 MP at 25/30 I	PS
	Video compression		H.264 Main Profile/H	igh profile	
	Sensitivity		color mode 0.6 lux , 8 @30IRE, F1.6	3/W mode 0.04lu	X
	Horizontal Angle of view	w	55.4 deg(wide)- 3.5 c	lea (Tele) minim	Jm
	Focus		Auto with Manual Ov	erride	
	Iris Range		F1.6-F2.9		
	Iris Control		Auto with Manual Ov	erride	
	Back Light Compensat	ion	Required		
	White Balance	.on	Automatic with mode	selection option	s
	Electronic Shutter		1/50 to 1/10000 Auto		
	S/N Ratio		>50dB		
	Audio		Full Duplex or 2-way		
	Automatic Gain		Up to 18 dB		
	Compensation				
	Power Supply		The camera nower s	upply should be	of the
			same make as that o	f camera and su	itable
			for the model no offe	red If the Powe	r
			supply from the Cam	era OFM is not	
			available power sup	olv shall be endo	rsed
			by the OEM.		
	Gain Control		Auto/Off		
	Day/Night selection		Auto On-Off		
	IR cut-filter		Yes		
	Protocols		IPV4/IPV6 RTP_UDF	P TCP IP HTTP	)
	1.101000.0		HTTPS FTP	, , ,	,
			DHCP IGMP V2/V3	ICMP ARP SM	ТР
			SNTP SNMP or equi	valent.	,
	Security		Password protection		
	Auto Resume after Pov	ver	Yes		
	Failure	-	-		
	Multiple Streams		H.264 /H.264 & H.26	4/Motion JPEG	
	Operating resolution		Primary stream – 192	20X1080 at 25/30	) FPS
			& other minimum 72	UX576 at 25/30	-PS
	Analytics		Iviotion detection & T	amper alarm	
	PoE supply IEEE 802.3	Bat	Yes		
	compliant or better				
	Rate Control		VRK/CRK		
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		Other Features					
				On screen Menu disp	olay, contour cor	rection	
				and contrast compensation control			
				Automatic Picture Enhancement to give a		ve a	
				balanced picture where there is too			
				Synchronization sele	ction for line lock	and	
				free running		Cana	
				Minimum 2 Alarm I/P	s & 1 alarm out	out	
		PTZ Specifications					
		Pan		360 Deg Continuous			
		Tilt		90 deg			
	Manual Tilt Speed			0.1  deg/sec to  45  deg	a/sec		
	Manual Pan Speed 0.			0.1  deg/sec to  80  deg	a/sec		
		Preset Positions		Minimum 256	9,000		
		Preset Pan Sneed		280 deg/sec min			
		Preset Tilt Speed		160 deg/sec min			
	D)	High Definition	(HD) Fix	ed Camera			
		Image Device		1/2.8-1/3" Progressiv	e scan CMOS		
		Number of Pixels		1920X1080 (Full HD	)/2 MP at 25/30 I	PS	
		Sensitivity(at f1.2,6dB	)	0.21 Lux color & 0.0	5 Lux B/W(at 30	IRE )	
		Lens	/	Varifocal Lens f=8-50	ifocal Lens f=8-50 mm, CS-Mount		
		Lens Mount		CS-Mount	CS-Mount		
		Focus		Auto with Manual Override			
		Iris Range		1.6 to 360			
		Audio		Full Duplex or 2-way			
		IR cut-filter		Yes			
		Protocols		IPV4/IPV6,RTP, UDF	P, TCP, IP, HTTF	P.	
				HTTPS, FTP,			
				DHCP, IGMP V2/V3, ICMP, ARP, SMTP,			
				SNTP,SNMP or equivalent			
		Security		Password protection			
		Iris Control		Auto with Manual Ov	rerride		
		Analytics		Motion detection & T	amper alarm		
		PoE supply IEEE 802.	.3af	Yes			
		compliant					
		SD/SDHC/SDXC in C	amera	Yes ,minimum 32 GE	3 capability		
		(For Local alarm recor	rding &				
		scheduled local record	ding)				
		Rate Control		VBR/CBR			
		Back Light Compensa	ition	Required			
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	White Balance	Automatic with mode	e selection option	s		
	S/N Ratio	>50dB	)			
	Automatic Gain Compensation	Up to 18 dB				
	Power Supply	The camera power same make as that of the model no. offere from the Camera power supply shall OEM.	supply should be camera and suita ed. If the Power OEM is not av be endorsed	e of the able for supply vailable, by the		
	Gain Control	Auto/Off				
	Day/Night selection	Auto On-Off				
	Other Features					
		On Screen Menu Dis and contrast comper	splay, contour constant of the splay is a splay is a splay in the splay is a			
		balanced picture where there is too much/too little light				
	Synchronization selection for line lock and free running					
	Minimum One Alarm I/P Minimum One Alarm O/P					
4.03	Camera Housing & Mou	nt				
	<ul> <li>a) All the cameras an environmental hou with heater and bl assemblies in the a</li> </ul>	nd accessories are to be house sing made of aluminum and S lower installed, shall provide p ambient temperature range of -	ed in Weather Pro un shroud. The rotection for can 0 deg. C to 50 de	oof IP 65 housing, nera/lens eg. C.		
	b) For Non Dome typ controlled heater I purge air arrange housing for camera	be cameras, the housing shall a kit. Continuous duty blower kit ement / Window wipers shall as as indicated against each ap	also have thermo t (with suitable fi be available w plication.	statically ilters) for ithin the		
	c) The camera moun of the same make as specified by the	t, camera housing and camera as that of camera and suitable manufacturer.	a power supply s for the model no	hould be b. offered		
4.04	Keyboard & Joystick-					
	Keyboard shall have full function used for system control and programming for selection of various Network switches, camera/database servers, camera functions including pan, tilt and zoom lens controls and shall be ergonomically designed.					
	Joystick shall be provided for achieving all control functions.					
4.05	Work Station					
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	Operator work station & ne finalized during the detailed	Operator work station & network switch station shall be in Control Room or as finalized during the detailed engineering.					
4.06	WIRELESS CONNECTION WIRELESS CONNCTIVITY)	I EQUIPMENT (FOR CAI ::	MERA SPECIF	IED ON			
	If contractor offer any came cameras shall be mounted of wireless connectivity shall communication for the abo standards including encryp encryption techniques.	era with wireless connectivit on lighting mast/pole. Wirele be decided during detail ove should be subscribing to otion. The wireless modem	y, Access points ss equipment an Engineering. he latest Cyber should support	for these d type of Wireless security dynamic			
5.0	CABLES :						
5.01	Cables shall be of FRLS PVC sheathed cables for use in CCTV and shall conform to latest edition of Indian/International standards. Fiber optic cables are to be provided (as applicable). The remaining cables can be as per CCTV supplier's standard. For details of Fiber Optic cables, refer subsection INST CABLE. All the cables and the hardware required for powering the system are also in the scope of Contractor. All cables required for interfacing alarm contact inputs (to be provided by employer) to CCTV system are also in scope of contractor.						
5.02	For estimation of cable quantities, erection hardware, hardware for wireless communication etc., the Bidder shall refer to General Layout Plant, Equipment Location Plans drawings & other relevant drawings to be finalized during detailed engineering. All the cables are to be provided by the Contractor on as required basis.						
6.0	<ul> <li>Location of CCTV: As per Clause 2.0 of Chapter A-2.</li> <li>Bidder to note: <ol> <li>Location of the CCTV cameras shall be reviewed during detailed engineering.</li> </ol> </li> <li>II. Quantity of camera shall be subject to revision (Increase/Decrease) during detail engineering. Bidder has to offer unit price of camera in relevant schedule of the Bid Document.</li> </ul>						
Development at Central CHP/CPP Pip	of 20MW Solar PV Project Coalfields Limited (CCL) arwar, Jharkhand	TECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-9296-004-9	PART-C CHAPTER-C15	Page 7 of 7			

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	PACIVII	ART-D WORKS	
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	CHAPTER-D1 TOPOGRAPHY SURVEY AND SOIL INVESTIGATION					
1.0	TOPOGRAPHICAL	SURVEY				
	The Vicinity map of the proposed site with tentative site boundary details is enclosed as tender drawing. The topographical survey of the proposed site has been conducted by Owner and is enclosed as tender drawing. The topographical survey work conducted by owner is for bidder information for further usage, if required. The survey details mentioned in the topographical survey drawing and report may vary slightly with respect to actual site conditions. NTPC does not take any responsibility towards the correctness of the survey details. Bidder has to check the correctness of the available topographical survey work with respect to actual site conditions and use for the development of the solar PV plant after due diligence. The same shall be submitted on priority for NTPC approval before start of work. Bidder may also carry fresh topographical survey of the proposed site based (if feel necessary) on its own discretion and submit for NTPC approval. However, the time taken to conduct the fresh topographical survey shall not be considered in project completion schedule.					
2.0	GEOTECHNICAL IN	VESTIGATION SCHEME				
2.0.1	Geotechnical investigation for the scope of work shall be done by the bidder. The scheme for geotechnical investigation shall be as given at Clause 2.1 and shall be approved by Owner before execution. Geotechnical investigation work shall be got executed by the Bidder through the agencies as mentioned in Clause No. 2.1.4. The Bidder shall carry out geotechnical investigation for establishing the sub-surface conditions and to decide type of foundations for the structures envisaged, construction methods, any special requirements/treatment called for remedial measures for sub-soil/ foundations etc. in view of soft sub-soils, aggressive sub-soils and water, expansive/swelling soils etc. prior to commencement of detailed design/drawings. The Bidder shall obtain the approval for the field and laboratory testing scheme proposed by					
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		him from the Owner b work.	before undertaking the ge	otechnical invo	estigation		
	2.0.2	The detailed Geotechnic in line with the Technica foundation etc. based or	cal Investigation has to be c al Specification. Bidder shall n the approved geotechnica	arried out by th I carry out the I report.	he bidder design of		
	2.0.3	Field test shall include Boreholes, Standard P and undisturbed soil s water samples, Electric	Field test shall include but not be limited to the following: Boreholes, Standard Penetration Test (SPT), collection of disturbed and undisturbed soil samples (UDS), Trial Pits (TP), collection of water samples, Electrical Resistivity Test (ERT) etc.				
	2.1	Scheme of Geotechnic;	al Investigation				
	2.1.1)	Minimum 1 No. of boreh acres of land. Few ERT	Minimum 1 No. of borehole of 5m depth shall be carried out in every 12.5 acres of land. Few ERT & TPs shall be carried out as per layout.				
	2.1.2)	The depth of boreholes types of soil deposits upto 20%, met within every 1.5 m interval or shall be 0.5m from grou m interval or at chang	The depth of boreholes shall be 5.0m. SPT shall be carried out in all types of soil deposits and in all rock formations with core recovery upto 20%, met within a borehole. This test shall be conducted at every 1.5 m interval or at change of strata. The starting depth of SPT shall be 0.5m from ground level. UDS shall be collected at every 1.5 m interval or at change of strata.				
	2.1.3) The laboratory tests shall be conducted on soil, rock & water samples collected during field investigations in sufficient numbers as approved by Employer. Laboratory tests shall be carried out on disturbed and undisturbed soil samples for Grain Size Analysis, Hydrometer Analysis, Atterberg Limits, Triaxial Shear Tests (UU), Natural Moisture Content, Specific Gravity and Bulk Unit Weight, Consolidation Tests, Unconfined Compression Test, Free Swell Index, Shrinkage Limit, Swell Pressure Test, Chemical Analysis test on soil and water samples to determine the carbonates, sulphates, chlorides, nitrates, pH, organic matter and any other chemicals harmful to concrete and reinforcement/ steel. Laboratory tests on rock samples shall be carried out for Hardness, Specific Gravity, Unit Weight, Uniaxial Compressive Strength (in-situ & saturated), Slake Durability etc						
Development         of         20MW         Solar         PV           Project         at         Central         Coalfields         Limited         TECHNICAL         SPECIFICATION         PART-D         Pag           (CCL)         CHP/CPP         Piparwar,         Jharkhand         RE-CS-9296-004-9         CHAPTER-D1         2 of				Page 2 of 3			

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2.2	On completion of all field and laboratory work, the Bidder shall submit a Geotechnical investigation report for Owner's approval. The Geotechnical investigation report shall contain field and laboratory observations/ data/ records, analysis of results and recommendations on type of foundation for different type of structures envisaged for all the areas of work. Recommendations on treatment for soil, foundation, based on subsoil characteristics, soft soils, aggressive chemicals, expansive soils, etc. shall also be covered in the report, as applicable. <b>Foundation System</b> Foundation system for various facilities shall be designed and adopted as per approved geotechnical investigation report.						
Development         of         20MW         Solar         PV           Project         at         Central         Coalfields         Limited         BIDDING         DOC. NO:         PART-D         Page           (CCL)         CHP/CPP Piparwar, Jharkhand         TECHNICAL         SPECIFICATION         PART-D         Page           3         of							

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		CHAPTER-D2			
	SITE LI	EVELLING AND GRADI	NG		
1.	SITE LEVELLING ANI	O GRADING:			
1.1	Site levelling works invo	Site levelling works involves the following works:			
	<ul> <li>A. All works related to site clearance including removal of bushes, trees, levelling, grading, finishing and other additional works shall be carried out by the Contractor. Mandatory permission/ licenses/ statutory clearances from Competent Authorities for site levelling activities like removal of tree and bushes, undertaking blasting related works, disposal of cutting material etc. shall be carried out by the contractor.</li> <li>B. Site grading level shall be fixed with due reference to site drainage of the whole area, existing drainage pattern, and system requirements.</li> <li>C. Site levelling works/scheme shall match with the specific functional requirement of Solar PV optimum generation considering the full utilization of the plot area for the desired capacity.</li> <li>D. Consideration from the boundary and fencing requirements.</li> </ul>				
2.2	D. Consideration from the boundary and fencing requirements. Based on the spot level, contour survey done and meeting above requirements, bidder can propose different site grade levels. The site leveling may be carried in patches/blocks. Bidder may also propose the site leveling and grading matching with the <b>natural topography</b> of the land considering the optimized use of the land, however bidder shall ensure to meet the desired power generation capacity in the allotted plot area. Bidder shall also ensure that no water ponding and flooding occurs in the low lying areas & effective drainage is provided in the whole plot area, in all kind of site levelling and grading or plant at natural topography schemes, bidders has to ensure to provide proper and effective drainage system in line with "Drainage System" chapter. After performing the optimization of levels from the detailed site survey by the Contractor, the final formation level of the plot in various areas shall be finalized. The area shall be suitably cut and filled to suit the layout requirement. The site levelling and grading scheme incorporating the above aspects shall be submitted to NTPC for approval.				
2.3	2.3 Fill shall normally be made up of Cohesive Non swelling material capable of being compacted upto 95% Standard Proctor density. In case earth has				
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	to be borrowed from outside the plant boundary, the same shall be arranged by the Contractor himself. The slope at the edge of graded areas shall not be flatter than 1:1.5 (1 vertical to 1.5 horizontal) in cutting and 1:2 in filling. In case of fill by rock material, the same shall be done in line with relevant Indian Standard.					
2.4	All buildings & switchy levelled area. No found case the depth of foun approved in detail engir	All buildings & switchyard area/sub-station area shall be constructed in levelled area. No foundation shall be allowed on back filled soil and in that case the depth of foundations shall reach up to NGL. Final Level will be approved in detail engineering.				
2.5	The slope protection measure shall be provided in case inter levelled patches level difference is more than 2.0m. Random rubble/boulder/stone pitching/concrete blocks etc. shall be provided for the slope protection for road side slope, storm water ditches/drainage, embankment slopes, inter levelled patches slopes etc. as per design requirements.					
2.6	Suitable sand erosion control measure shall be provided in case any sand dune falls inside the plot area. The same may be made with Random rubble/boulder/stone pitching/concrete blocks etc. Bidder shall also provide sufficient grass/buses/trees covers on these dune.					
2.7	<ul> <li>sufficient grass/buses/trees covers on these dune.</li> <li>2.7 Bidder shall also provide suitable sand erosion protection measure around the foundation as mentioned at relevant places in the technical specification</li> </ul>					
Development at Central CHP/CPP Pip	of 20MW Solar PV Project Coalfields Limited (CCL) arwar, Jharkhand	TECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-9296-004-9	PART-D CHAPTER-D2	Page 2 of 2		

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		CHAPTER-D3			
	BOUNDAR	Y WALL, FENCING AND	) GATE		
1.0	<b>General</b> The scope of work inclu- per scope defined in V Plant for the peripheral a) Chain Link Fencing b) RCC Fencing Poles c) Chain Link Fencing	udes providing either or com <b>Vicinity Map/Appendix-D1</b> and common boundary. for Boundary. with Barbed Wire. for Yard	bination of follo of the propose	owing as ed Solar	
1.1	DELETED				
1.2	<ul> <li>Chain Link Fencing for Boundary fencing:</li> <li>a) The minimum se &amp; requirements of the fencing including all items shall be as per the fencing tender drawing title: "Details of Chain Link Fencing for Boundary". The chain link fencing shall compromise of G.I chain link fencing with mesh size 75x75 mm with a nominal mesh size of 3.15 mm diameter. The chain link fencing material requirement shall conform to IS 2721. The chain link fence fabric shall have zinc coating of type 'Heavy' as given in IS 4826.</li> </ul>				
	b) The G.I. chain link wire mesh will be stretched and attached by clips to 3 strands of High Tensile Spring Steel (HTSS) wire of 4 mm dia interwoven in chain link wire mesh and kept under tension which in turn are attached to the fence post with security nuts and bolts. On every fourth post a clamping strip will be threaded through the links of chain link and bolted to the fence post with the help of security nuts and bolts. All nuts, fasteners, bolts, clamping strips, clamps, clips, etc. shall be galvanized.				
	<ul> <li>c) All bolts provided in the fence work shall be minimum 10 mm diameter. Length of all bolts shall be such that after fixing in position it shall have at least 10 mm projected length beyond the nut. All nuts &amp; bolts shall be high quality as per BIS standard and heavy duty galvanized. The threads of projected length of the all bolts beyond nut after fixing in position shall be destroyed by hammering or by any suitable means to protect from any possible theft by miscreants.</li> <li>d) Above the chain link fence three rows of 'Steel Barbed Wire, A-1 IS 278'</li> </ul>				
shall be provided in the Half Y steel post at a maximum spacing of 175					
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	mm c/c. The reinford vertical height 400 mentioned in the fe fencing in plot layou	mm c/c. The reinforced barbed wire will be attached to angle iron posts vertical height 400 mm. The type of section for fence shall be as mentioned in the fencing drawing and details of the scope of work of fencing in plot layouts.				
	<ul> <li>e) All fence posts shall distance. All corner directions and every the fence. All stay foundations for the a the drawing. Toe w along the run of the</li> </ul>	shall be 55X55X5 MS angles spaced at 3.0 meter c/c her fence posts will have two stay posts in orthogonal very tenth post will have a stay post in the direction of stay posts shall be 55X55X5 MS angles. Concrete he angle iron posts and stays shall be provided as per e wall shall be provided between the fence posts all he fence with the foundation as per the tender drawing.				
	f) All MS angles and line with relevant co	MS angles and members used in posts shall also be galvanized in with relevant code provisions.				
	g) Suitable foundation/ scheme to ensure i and exit points in th of MS angles of 75X	g) Suitable foundation/fencing arrangement shall be made in the fencing scheme to ensure intact fencing/safety in the water body/drains entry and exit points in the plot area. The same may be provided with a grid of MS angles of 75X75X5 sizes with foundation.				
1.3	RCC Fencing Poles with Barbed Wire:					
	RCC fencing poles shall be a straight type of total length of 1.8 meters. The height of RCC pole shall min 1.3 meters from finished ground level.					
	Hooks for fixing barbed wire:					
	Hooks shall be made of 6 mm dia MS bar. 5 Nos. Hooks shall be provided for fixing 'Steel Barbed Wire, A-3 or B-3 IS 278' at 1.8 meters poles. The top hook should be provided 100 mm below the top of pole and bottom hook should be provided 300 mm above the bottom of the pole. The central distance between the top and bottom hooks shall be equally divided to fix remaining hooks. Diagonal steel barbed wire fixed with RCC fencing poles hall also be provided			provided les. The bottom e central ed to fix ng poles		
	Inclined strut or stay post on either side shall be provided at every 15 meters c/c, corner and end. The maximum distance between two RCC fencing pole shall be 2.5 meters c/c.					
	Reinforcement of RCC	Poles:				
	<ol> <li>Main vertical bars shall be of 6.0mm dia round MS bars - 4 Nos.</li> <li>Stirrups shall be of 6 mm dia round MS bars 200 mm center to center.</li> <li>10 Nos. Stirrups for 1.8 meters pole</li> </ol>					
Image: Constraint of 20MW Solar PV Project at Central Coalfields Limited (CCL)     TECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-9296-004-9     PART-D Page 2 of 4						

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	Dimensions RCC Poles:         1. Bottom: 100 mm x 100 mm square, and         2. Top: 80 mm x 80 mm square.         Cement Concrete Mix and manufacturing:         Cement concrete to be used having the nominal mix of ratio 1:2:4 with 12.5 mm nominal size coarse aggregate. Sand used should be free from clay & salt. Concrete Mix shall be conforming to Grade M-15 of IS 456 (2000)         RCC Fencing post shall be manufacturer at the factory and In order to ensure desired compressive strength, RCC fencing poles should be compacted with the help of plate form vibrator. The surface shall be uniform					
	ensure desired compressive strength, RCC fencing poles should be compacted with the help of plate form vibrator. The surface shall be uniform and free from voids. The concrete cover over the reinforcement shall not be less than 15 mm. <b>Tolerances for RCC fencing poles:</b>					
	SI no	ltem		Tolera	nce	
	1	Length		(+/-) 0	1%	
	2	Straightness	or how	1/750 of length		
	3	Cross sectio	n dimensions	(+/-)3	mm	
1.4	Chain Link Fencing for Yard (Transformer Yard, Switch Yard, etc.) Refer: Drawing No 000-004-POC-A-003C. 'Details of Chain-link fencing for Yard.'					t <b>c.)</b> ncing for
1.5	Main Gate	e				
	Mild Steel frame gate woven with chain linking having minimum span 4 m conform to IS: 2062 shall be provided. The gate shall be complete with the guide track, castor wheel, all fitting and fixture like hinges, aldrops, locking arrangement, posts etc The width of approach road shall cover the gate width at the main entrance with a suitable transition. All members used in gates shall be finished by cleaning of steel surfaces as per IS: 1477 (Part-II) and applying zinc chrome or zinc phosphate primer, followed by two coats of synthetic enamel paint. For finishing coat suitable colour pigment shall be added. All paints including primer shall be of reputed brand/manufacturer and as approved by the Engineer-In-charge. The					
Development at Central CHP/CPP Pip	of 20MW Sola Coalfields Li arwar, Jharkh	ar PV Project imited (CCL) and	TECHNICAL SPECIFICA BIDDING DOC. NO: RE-CS-9296-004-9		PART-D CHAPTER-D3	Page 3 of 4

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	method of application manufacturer.	shall be as per the rec	commendations	of the	
	One man movement p provided at the main supporting members s main entry gate) for bet	bassage gate (minimum 1.2) entry gate. 400 mm heig hall also be provided on a ter security.	m width) shall ht concertina gate (gates otł	also be with all her than	
	The minimum size & requirements of the Gate's including all items shall be as per the fencing tender drawing title: " <b>Details of Main Gate".</b>				
	The main gate shall be constructed inside the plant/plot boundary line to provide sufficient space for Heavy motor vehicle and light motor vehicle for inspection/check before entering the solar plant and vehicles shall not disturb the traffic in the main approach road				
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		CHAPTER-D4			
	DESIGN OF MODU	LE MOUNTING STRUC WORKS	TURE & CIV	ΊL	
1.	DESIGN CRITERI	DESIGN CRITERIA FOR MODULE MOUNTING STRUCTURE (MMS)			
	This chapter covers the	Specific technical and functi	onal requireme	nts.	
	The design calculations approval of NTPC b construction methodolo submitted for NTPC app	The design calculations and drawings for MMS shall be submitted for prior approval of NTPC before the commencement of construction. The construction methodology for MMS and its foundations shall be also be submitted for NTPC approval before the start of works			
2	Scope:				
	This section covers the loads and design requirement of the structures, racking, and all other items required to furnish and install a complete ground mounting structural system which constitutes a photovoltaic array(s). MMS shall be adequately protected against all adverse climate conditions. The complete MMS, foundation and connections shall be designed & submitted for NTPC approval before the start of work/fabrication.				
3.	Design Loads:				
	A. Dead Load: The load obtained by summing up the weight of modules and self-weight of Structure including Purlins, rafter/beams, Bracings, struts, columns, necessary fittings, etc. to be added as a Dead load.			modules racings, pad.	
	B. Wind Load: The wind load (positive and negative) normal to surface on the modules and wind load on the structural members.				
	C. The basic wind spee k3 and k4 shall conf	ed of the site and design win form to IS 875 (Part-3): 2015.	nd speed factors	s k1, k2,	
D. The design wind pressure derived from the above parameters shall be considered as minimum pressure and shall be further calculated accounting the external and internal pressure coefficients applicable for			shall be Ilculated cable for		
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	different slopes or from a reputed natio	pressure coefficient as per a nal/international facility, for th	a Wind Tunnel ne design of MN	Studies //S.	
	E. The concept of win philosophy for fixed	d tunnel studies may be co and seasonal module mounti	nsidered in the ng structure.	e design	
	If the Bidder is going for complete fixed and sear	or wind tunnel study for the sonal MMS following has to b	design and ana be ensured.	alysis of	
	<ul> <li>i. It must be done from an institute of reputed (IITs in India).</li> <li>ii. If the study is done by any reputed international facility the study results must be vetted by any of the IITs in India.</li> <li>iii. Bidders must ensure that offered MMS has proven design with wind tunnel study simulating actual site conditions. The design, analysis and its vetting shall be completed within two months from the actual date of issue of LOA.</li> <li>iV. Test results and design must comply with Indian codes</li> <li>V. The design shall be shown in STAAD pro for further checking of NTPC if asked to do so.</li> </ul>				
4.	Materials Specification:				
	<ul> <li>A. Hot-rolled/Cold-formed steel sections: MMS frames, post, base plate, assembly of the array structures, etc. shall conform to Indian standards as mentioned in the list of code. IS 2062 - Hot Rolled Medium and High Tensile Structural Steel. IS 811 - Cold Formed Light Gauge Structural Steel Sections. IS 1161- Steel Tubes for Structural Purposes. IS 4923 - Hollow steel sections for structural use.</li> </ul>				
	The Bidder can also propose new structural steel sections other than specified in Indian standards code IS 808 or IS 811 and subjected to approval by NTPC. The minimum thickness of column post shall be 2.5 mm and the minimum thickness of light gauge members like the purlin, rafter, beam, etc. shall be 2.0 mm conforming to IS 1079/ IS 2062.				
	The Bidder can propose purlins and rafters/beams for fixed and seasonal tilt array structure made from pre-galvanized cold rolled steel				
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	sections made of ho metal thickness sha	sections made of hot rolled coils conforming to IS 1079/ IS 2062. Base metal thickness shall not be less than 1.6 mm				
	B. Hot-dip metallic co The Bidder can al connected to modul members with weat 15961 (latest revision minimum coating Cl more than 450 MPa mm. The purlin us section type. The b coated.	ated sheet steel & strip sec so propose purlins section es) for fixed array type struc her protection coating as pe on) standard, AI-Zn alloy wi ass AZ150, yield strength of and base metal thickness sh ed for mounting Modules s idder should ensure that inn	ction: s (structural m ture made of m er ASTM A7921 th hot dip-proc steel sheet sha hall not be less hall be prefera her side should	nembers hild steel M or IS: ess and Il not be than 0.9 ably Hat also be		
	C. In case bidder proposes Auto Tracking system in Module mounting structure, the material specification of the tracking system may be proposed and submitted by the Bidder during detailed Engineering. The materials proposed shall be subject to NTPC approval and acceptance based on NTPC review.					
	D. All materials shall be shall not be required	e fabricated in the shop such I.	that welding in	the field		
5.	Connections:					
	<ul> <li>A. Fasteners (nuts, bolts and washers) shall be of Stainless steel (SS304) type for the following connections:</li> <li>(i) Solar PV module to purlin/structure connection.</li> <li>(ii) Bolts required to loose and tighten seasonally for seasonal tilting in the module mounting structure.</li> </ul>					
	<ul> <li>B. Fasteners (nuts, bolts, washers and U-bolts) shall be of corrosion-resistant austenitic steel. The minimum steel grade of fasteners for connection of steel members shall be A2 &amp; minimum tensile strength shall be 700 N/mm2. All fasteners shall have a good anti-seize finish with proper wax coating for better durability and firm resistance to all types of failure including seasonal removal and re-fixing of bolts.</li> </ul>					
Development at Central CHP/CPP Pip	of 20MW Solar PV Project Coalfields Limited (CCL) arwar, Jharkhand	TECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-9296-004-9	PART-D CHAPTER-D4	Page 3 of 6		

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	C. Fasteners for all or grade HDG 5.6 or 8 provided according be tightened with de	ther structural fixed connec 3.8 in line with IS provisions to the connection design requisioned torque mechanically.	tions shall be . All fasteners uirement. All bo	bolts of shall be blts shall
	D. One set of fastene hexagon shape bolt washers may also b	r shall consists of one hex t, and two washers. The bot e provided.	agonal head r ts and nuts wit	nut, one h inbuilt
	E. All bolts shall be tigl any possible damag stage.	nten immediately after the er ge due to any incidental sto	ection of MMS rm during the	to avoid erection
	F. In the ground mount the column post an be preferably hinged	ting structure system with sea d rafter/beam at seasonal til d plate and bolt system.	asonal tilt arran t point of rotati	gement, on shall
6.	Coating for Structural	Steel Works:		
	A. MMS frames, post, base plate, assembly of the array structures, etc. shall be of MS hot dip galvanized. Hot dip galvanization shall be as per IS: 4759 or relevant Indian standard and the coating average coating thickness shall be 80 micron and local coating thickness shall be minimum 70 micron. In case offered support is made up of Aluminium, anodized coatings on aluminium as per IS: 1868 (Gr AC25) shall be provided for mounting structure.			
	<ul> <li>B. Pre Hot dip Aluminium-Zinc alloy metallic sheet with minimum coating Class AZ150 and Pre Hot dip galvanized metal sheet with grade of coating 600 GSM shall be use for MMS as mentioned in 'material specification' above, the suitable measure shall be taken by providing necessary design/treatment for the exposed cut edges area. Bidder shall submit for review and approval of Engineer-in-charge.</li> <li>IS 4759 - Hot-dip zinc coatings on structural steel and other allied products</li> <li>IS 4736 - Hot-dip zinc coatings on mild steel tubes</li> <li>IS 1868 - Anodic coatings on aluminium and its alloys.</li> <li>IS 2629 - Recommended practice for hot-dip galvanizing of iron and steel.</li> <li>IS 15961 - Hot dip aluminium-zinc alloy metallic coated steel strip and sheet (plain)</li> </ul>			coating grade of material providing . Bidder
				er allied fron and strip and
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	IS 9172 -Recomme steel structures.	ended design practice for c	corrosion preve	ntion of
	Bidder shall also us reduce the risks of c	e principles governing design forrosion as per IS 9172 and	gn that shall pro relevant IS cod	event or es.
7.	Design Parameters:			
	<ul> <li>A. The Ground mountir array(s) shall be de pressure) and adver the solar photovoltai</li> </ul>	ng structure system which co signed to withstand the extr rse wind (negative pressure) c array(s).	onstitutes a pho eme fair wind ) on design tilt	tovoltaic (positive angle of
	<ul> <li>B. The design calculat reference to various standards. For MMS computer program ( submit a write-up of format) and output d</li> </ul>	tions shall be supplemented s clauses of the Technical s design analysis and determ preferably STAAD) is used, a on the computer program u lata for review and approval o	I with neat ske pecification and ination of forces and the contract sed and its inp of Engineer-in-C	etch and d Indian s, where tor shall out (soft Charge.
	C. An increase in allowable stresses of structural materials should not be considered during design and analysis.			d not be
	D. Wind pressure for following loads shall be considered as follows:			:
	<ul> <li>(1) Dead Load of steel with all members, fittings &amp; panels.</li> <li>(2) Load due to fair wind direction on design tilt angles of solar mounting structural members.</li> <li>(3) Load due to adverse wind direction on design tilt angles of solar mounting structural members.</li> <li>(4) Load on the side face of mounting structural members.</li> </ul>			
	Wind pressure coefficie standards (latest revisio	nt, load and load combinatio on) such as IS: 875, IS: 800, I	n shall be as pe IS 801.	er Indian
	Design analysis and th shear and moment) sha	e forces on MMS (Compres	ssive force, upli oundation syste	ift force, m.
	Suitable provision of lifting arrangement for seasonal tilting of the Module Mounting Structure shall also be provided. Lifting force shall be transfered only through rafter/beam for lifting the MMS for a seasonal tilt with a suitable hook, clamp, etc. fixed at rafter as per design. The Bidder may also propose alternate mechanized arrangement subject to NTPC approval.			
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8.	<b>Vertical Deflection and Horizontal Sway Limits:</b> Limiting Deflection: The limiting permissible vertical deflection for structural steel members shall be as per: Maximum vertical deflection in purlin = Span/180, Maximum vertical deflection in rafter (cantilever span) = Span/180 and Maximum lateral deflection in column post = Height/240.				
9.	Span/180 and Maximur Foundation System Top of concrete/ heir 150 mm above FGL shall be 700 sq.cm. The proposed four findings/results of the kind of foundation match 1. Short pile foundata 2. Rock anchor with 3. Isolated, strip or match 4. Concrete ballast for the strip of the str	n lateral deflection in column ght of collar for MMS founda . The minimum plan area of ndation system for MMS ie approved geo technical i ay be provided: tion (Min. 300mm dia.) concrete collar aft foundation foundation	post = Height/2 ation shall be n MMS foundatio shall be ba nvestigation. F	ninimum on collar sed on ollowing	
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	CIVIL & STRUCTUR	E WORKS - GENERAL	DESIGN CRI	TERIA
1.0	<b>GENERAL</b> This chapter covers the design calculations and Steel structure, founda submitted for prior ap construction. The const also be submitted for N	e Specific technical and functi I drawings for RCC structure ation system, road work, c oproval of NTPC before t cruction methodology for road TPC approval before the star	ional requireme e, PEB Inverter Irainage, etc. s he commencer d works, drains t of works.	nts. The Rooms, shall be ment of shall be
	All design of RCC and IS 800 respectively a structures. Refer appen	Steel structures shall be can nd other specific code as dix-D1 for site specific design	rried as per IS applicable to n parameters	456 and specific
2.0	<ul> <li>CMCS, INVERTER ROOMS, SECURITY ROOM &amp; STORE ROOM</li> <li>The following structures shall be designed and provided by the bidder:</li> <li>A. CMCS Building: For the operation and maintenance of SPV Plant one Central Monitoring and Control Station (CMCS) with Switchgear room shall be provided. The CMCS building shall consist of the following: <ol> <li>Air-conditioned SCADA Room.</li> <li>Inverter, battery room, ACDB and Switchgear Room.</li> <li>Store Room.</li> <li>Supervisor room.</li> <li>Toilets (Male and female).</li> </ol> </li> </ul>			
	Inverters, battery room, ACDB and Switchgear room shall be based on manufacturer recommendation, easy passage of O&M persons and cable trench layout required. The CMCS shall be RCC framed structure with bricks/concrete blocks masonry walls. The CMCS shall have entry lobby and portico with a roof for vehicle stoppage.			
	near the CMCS building. The parking shed shall be made of structural steel conforming to IS 1079/2062 with permanently color coated roof sheets.			
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	<ul> <li>The minimum size &amp; requirements of the CMCS Building &amp; all items shall be as tender drawing title: "Details of Central Monitoring &amp; Control Station".</li> <li>B. Inverter Rooms: Inverter rooms consist of PCU's, LT panels, batteries, etc. shall be provided based on manufacturer recommendation, easy passage of O&amp;M persons and cable trench layout required.</li> <li>The inverter rooms shall be made of as mentioned below: <ul> <li>a) RCC framed structure with bricks/concrete blocks masonry walls,</li> <li>b) Pre-Engineered Building in line with PEB technical specification. and</li> <li>c) Steel Containerized solutions</li> </ul> </li> </ul>				
	The battery and its associated equipment shall be suitably segregated inside the Inverter room with proper ventilation arrangement.				
	The equipment inside the inverter room shall be placed so as to provide sufficient space for their maintenance.				
	<b>C. Security Room</b> : Prefabricated security room (4 sqm) near the entry of the main gate with brick/stone masonry toilet and water facility. The wall and roof of security room shall be made of profile PUF panels (having permanently colour coated galvalume sheets) of minimum 40 mm thickness. Alternatively, the bidder may also provide security room with 230mm thick brick/stone masonry with RCC slab. The drawing and the design of the prefab security room and its toilet system shall be approved from NTPC.				
	D. Store Shed (PEB/RCC): One store shed (in addition to all other stores and PEB Invertor room) shall be constructed near CMCS Room for storage of Mandatory Spares during O&M Period by bidders and later on for NTPC after O&M period				
	The layout, design and drawings for all RCC/PEB buildings, etc. and foundation system shall be approved from NTPC before the start of works.				
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	The buildings and allied works shall be designed to meet <b>NATIONAL</b> <b>BUILDING CODE</b> (SP: 07 2016) requirements. Finish floor level of all building shall be minimum 450 mm above from Finish graded level.				
2.1		FOR	RCC BUILDING FOR CE	NTRAL MONIT	FORING
	AND CONTROLS STATION (CMCS) AND OTHER BUILDINGS.				
	The CMCS building shall be made of RCC framed structure with bricks/concrete blocks masonry walls. The thickness of outer masonry walls shall be minimum 230mm in case of bricks and minimum 200mm thick in case of concrete blocks. The following detailed specification shall also be followed for RCC works:				
2.1.1	Floor Finishes:				
	Switchgear/	Cement concrete flooring with ironite hardener.			
	Inverter rooms:				
	SCADA room:	Heavy duty vitrified ceramic tiles			
	Battery room:	Acid Alkali resistance tile flooring or acid alkali resistant			
	Lobby	Heavy duty anti-skid ceramic Tiles and skirting			
	lollet	Heavy duty anti-skid ceramic Tiles and dodo 2100 mm			
	Steps	Kota stone/Granite- 20 mm thick			
	Storeroom	Cement concrete flooring with ironite hardener.			
	<ul> <li>a) Flooring for air conditioned areas area shall be provided with vitrified ceramic tiles of size 600X 600 mm of min 9 mm thickness, laid with 3 mm ground joints as per approved pattern. Cement concrete flooring shall conform to IS 2571.</li> </ul>				
24.2	Dado glaze ceramic tiles upto 2.1m shall be used. The normal size of Ceramic tiles shall be 300mm x 300mm x 9mm and shall comply IS 15622.				
2.1.2	The SCADA room shall be provided with false ceiling of 15 mm thick mineral fibre board, in tile form of size 600mm x 600mm, along with galvanised light gauge rolled form supporting system in double web construction pre painted with steel capping, of approved shade and colour,				
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	to give grid of maximum size of 1200x600 mm as per manufacturers details including supporting grid system, expansion fasteners for suspension arrangement from RCC, providing openings for AC ducts(if required), return air grille (if required), light fixtures, etc., all complete.			
2.1.3	<ul> <li>Roof Finishes:</li> <li>a) Roof of the Building shall consist of Cast-in-situ RCC slab with decking sheet (RCC slab with permanent formwork). The slab formwork decking sheet shall be permanently colour coated profile sheet with minimum 0.6mm thickness of grade SS255 as per ASTM A653M / grade G250 as per AS 1397 coated with zinc of class designation Z275 or aluminium zinc alloy of class designation AZ150 or similar. The decking sheet shall meet the strength, deflection and other functional requirements.</li> <li>b) The Bidder can also provide Roof of the building as Cast-in-situ RCC slab conforming to Indian code.</li> <li>c) The roof of the building shall be waterproof with Polymeric membrane type waterproofing as per DSR. The roof shall be designed for a minimum superimposed load to 150 kg/m2.</li> <li>d) For efficient disposal of rainwater, the runoff gradient for the roof shall not be less than 1:100 and the roof shall be made watertight using suitable watertight treatment. This gradient can be provided either in structure or subsequently by screed concrete 1:2:4 (using 12.5 mm coarse aggregate) and/or cement mortar (1:4). However, minimum 25 mm thick cement mortar (1:4) shall be provided on top to achieve smooth surface. The roof of a building projection may be flush with the building external walls. The parapet wall shall be minimum 300 mm above the top of roof level. Structural steel hand railings of minimum 700 mm height shall also be provided over the parapet wall.</li> <li>e) The bidder shall also provide rainwater harvesting system for CMCS</li> </ul>			
2.1.4	Viewpoint:			
	RCC terrace of CMCS building shall also work as viewpoint. Viewpoint shall be used for security purposes and a viewing gallery. Suitable RCC			
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	half landing staircase shall be provided for access to the roof of the CMCS building.				
2.1.5	Windows, Doors, Vent	tilators and Rolling Shutter	s:		
	<ul> <li>a) Doors, windows and ventilators of air-conditioned areas, entrance lobby of all buildings, and all windows and ventilators of CMCS building shall have, powder coated (minimum thickness of powder coating 50 microns) aluminum framework with glazing. The window shall be provided with suitable aluminum grille.</li> <li>b) Doors of toilet areas shall be made of steel framed solid core flush shutter as per IS 2202. The minimum size of the door provided shall be 2.1 m high and 1.2 m wide. However for toilets minimum width shall be 0.75 m and office areas minimum width shall be 1.20 m.</li> <li>c) The Bidder can also propose uPVC extruded casement/ sliding windows and doors with complete fitting and accessories as per items mentioned in DSR 2016.</li> <li>d) Doors and windows on external walls of the buildings (other than areas provided, with insulated metal claddings) shall be provided with RCC sunshade over the openings with 300 mm projection on both sides of the openings. Projection of sunshade from the wall shall be minimum 450 mm over window openings and door openings except for main entrance door of CMCS shall be provided with Collapsible metal grille with locking system.</li> <li>f) Rolling shutter (Mechanical gear operated). Rolling shutters shall be fabricated from 18 gauge steel and machine rolled with 75 mm rolling shutter with effective bridge depth of 12 mm lath sections, interlocked with rolland with rolland with rollend with effective bridge depth of 12 mm lath sections, interlocked with with effective bridge depth of 12 mm lath sections, interlocked with with effective bridge depth of 12 mm lath sections, interlocked with with effective bridge depth of 12 mm lath sections.</li> </ul>				
2.1.6	Glazing:				
	<ul> <li>a) All accessible ventilators and windows of all buildings shall be provided with min. 4mm thick float glass, tinted for preventing solar radiations, unless otherwise specified.</li> </ul>				
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2.1.7	<ul> <li>b) For single glazed aluminum partitions and doors, toughened float glass of 10 mm thickness shall be used. All glazing work shall conform to IS 1083 and IS 3548.</li> <li>c) The glass to used should be from a reputed brand/manufacturer and as approved by NTPC. The glass should be free from distortion and thermal stress.</li> </ul>				
	Internal wall surfaces: SCADA room All other rooms in pla buildings	-Acrylic Emulsion at -Acrylic Distemper			
	External faces of walls Walls of battery room	<ul> <li>-Exterior emulsion paint</li> <li>-Acid alkali resistant paint, an exposed wall</li> </ul>			
		above Dado -2100 mm high Dado of acid alkali resistant tiling. -Acrylic Distemper			
	All Ceiling				
<ul> <li>a) The paint shall be an anti-fungal quality of reputed brand suitable for masonry. All painting on masonry or concrete surface shall preferably be applied by a roller. If applied by brush then same shall be finished off with roller. For painting on concrete, masonry and plastered surface, IS 2395 shall be followed. Minimum 2 finishing coats of paint shall be applied over a coat of primer.</li> <li>b) For painting on steelwork and ferrous metals, BS: 5493 and IS: 1477 shall be followed. The type of surface preparation, thickness and type of primer, intermediate and finishing paint shall be according to the painting system adopted.</li> <li>c) Ceiling of all rooms except Battery room shall be white washed. The ceiling of Battery room (if provided) shall be acid/alkali resistant paint. A standard colour scheme for the different buildings/structures shall be obtained, before the commencement of work.</li> </ul>					
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2.1.8	<ul> <li>Plumbing and sanitary CMCS building room sh shall have the following (subject to approval from 1) Wall mounted WC holder and all fittings</li> <li>2) Wall mounted Urina male toilet only.</li> <li>3) Washbasin (550 x 4 4) Bathroom mirror (60 5) CP brass towel rail ( 6) Soap holder and lique</li> </ul>	<ul> <li>hall have attached toilet for both genders. Each toilet g minimum fittings of ISI approved of a reputed brand om Engineer in charge).</li> <li>(Western type) 390 mm high with toilet paper roll gs.</li> <li>al (430 x 260 x 350 mm size) with all fittings for the</li> <li>400 mm) above the platform with all fittings.</li> <li>00 x 450 x 6 mm thick) hardboard backing.</li> <li>(600 x 20 mm) with C.P. brass brackets.</li> <li>aud soap dispenser.</li> </ul>				
	Wash basin provision f <b>room</b> .	basin provision for hand wash shall also be provided in the <b>Battery</b>				
	All fittings, fastener, grating shall be brass with chromium-plated as per relevant IS code. Necessary plumbing lines shall be provided for CMCS room building and Security room near the main gate.					
	The bidder shall de plant/septic with soak p of 15 people shall us sewerage plants/septic requirement.	sign & provide packaged it for CMCS and Security roo se the facility. The wastewa tank shall meet the state	sewerage tr m assuming tha ater/effluents fi pollution contro	eatment at a total rom the ol board		
2.2	SPECIFICATION OF INVERTER ROOMS (PEB):					
	The Inverter Rooms sha architectural and civil v are provided in the teo prepare the detailed fa tender drawing title: "I submit to NTPC for a manufactured, supplied shall be made of struct roofing and wall claddin painting, metal facia, r	e Inverter Rooms shall be made of Pre-Engineered Buildings (PEB). The chitectural and civil works drawing of Pre Engineered - Inverter Rooms e provided in the technical specification, tender drawings. Bidder shall epare the detailed fabrication and civil construction drawings based on ider drawing title: "Inverter Room – Pre Engineered Building" and bmit to NTPC for approval before the start of work. PEB shall be inufactured, supplied and erected by the bidder/PEB agency. The PEB all be made of structural steel construction with double skinned metal ofing and wall cladding of approved profile. PEB shall be complete with inting, metal facia, metal gutter, rainwater down comers, sun-shades,				
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	openings, etc., along w work insulation, Trims & plastering, flooring, fo complete life of the sola also be submitted for N	ith associated structural stee Flashings. Each item of PE undation, fittings etc. shal r plant. The construction me TPC approval before the star	el, cladding and B like panels, m I be suitable thodology for Pl t of works.	l roofing hasonry, for the EB shall		
	The layout of the Inver- generated from each in designed for a life of 25 at all joints and connec- and performance during shall be complete in a drawings and other te ventilation system etc. t	ter room shall be designed so verter outside the room. The years. The PEB shall have a tions. The building shall have the adverse weather conditional the adverse weather conditional so the adverse meeting all the re- connical and functional require o ensure effective functioning	so as to divert f inverter room a robust water ti a high class d ions. The PEB s requirements or uirements like g.	the heat shall be ghtness lurability supplied f tender lighting,		
	PEB length can be determined based on actual requirement, however, the grid spacing shall be maintained as per tender drawing title: " <b>Inverter Room – Pre Engineered Building</b> .					
2.2.1	Structure and material specification:					
	The PEB inverter room structural members shall meet the requirements of tender drawings. All hot rolled primary structural members and Rod/Angle/Pipe bracing etc. shall conform to IS: 2062, minimum Grade E250 Quality A. Secondary members for Purlins and Girts shall conform to the specification of IS 811 or ASTM A1003-12 made from steel sheets conforming to ASTM A1011-12b Grade 50 having a minimum yield strength of 345 MPa. The minimum thickness of secondary members shall be 3mm. All other miscellaneous secondary members shall have the minimum yield strength of 250 MDa					
	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 0.019-0.023 W/(m.K) at 10°C. The PUF panels shall be a factory made item ready for installation at site.					
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2.2.2	Fasteners & Connection	ons:					
	Special coated self-dri class 3 as per AS 356 complying with AS 1112 IS 1367 (Part III) Gr. 8. 1367 (Part III) Gr. 4.6 / to IS 5624 and relevant	ated self-drilling screws/fastener shall be used conforming to per AS 3566.1 and AS 3566.2. Steel bolts, nuts and washers with AS 1112:2000. High Strength Bolts for Primary Connections art III) Gr. 8.8 / ASTM A325. Bolts for Secondary Connection IS III) Gr. 4.6 / ASTM A307. Anchor/foundation Bolts shall conform and relevant IS code.					
2.2.3	Roof and Wall claddin	g:					
	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 the relevant para in the specification.						
	PUF insulated panels Metal Sheet for Roofing and side cladding consist of an external sheet as troughed permanently colour coated sheet & internal sheet as plain permanently colour coated sheet.						
	The 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 was done by the bidder of the fastener considering the wind load, self-load and other associated load. The minimum diameter of the fastener shall be 5.5 mm and at-lest 3 nos. of fastener shall be used per sheet. Fillers blocks as a trough filler shall be used to seal cavities formed						
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	shall be manufactured approved by the engine	from black synthetic rubber er.	r or any other	material			
2.2.4	Roof Insulation and ty	vpe:					
	Both metal sheets shal PUF with density 40 W/(m.K) at 10°C with g Top cap of the requir hardware complete. The wall. Stiffening ribs / subtle fl female ends with full re capillary flute inside lap Both upper and lower fastened through zinc /z shall be calculated as p	I have an under insulation of +/- kg/m3 and thermal co gutters and down take pipes red size and colour complete re roof shall be projected at- uting for effective water shed eturn legs on side laps for p sheets shall be separated zinc-tin coated self-drilling sc per the design or manufacture	i minimum 60 n onductivity 0.0 along with Fla ete with all ne least 300 mm f ding and specia ourlin support a through spac rews. The faste	nm thick 19-0.023 ashing & ecessary from the al male / and anti- ers and ener size ations.			
2.2.5	Wall Insulation:						
	All voids of external insulation of minimum thermal conductivity 0.0 as approved. Both the walls should formed steel bars and screws. The external wall of Inv per IS: 1646 - Code electrical installations.	All voids of external and internal metalled walls shall have an under insulation of minimum 40 mm thick PUF with density 40 +/- kg/m3 and thermal conductivity 0.019-0.023 W/(m.K) at 10°C with proper supports etc. as approved. Both the walls should be separated by spacers system made up of cold- formed steel bars and fastened through zinc /zinc-tin coated self-drilling screws. The external wall of Inverter room facing the transformer area shall be as per IS: 1646 - Code of practice for fire safety of buildings (general):					
2.2.6	Doors Frames:						
	Door frames shall be of the iron frame of mild steel sections. All doors shall be provided necessary fittings like hinges, handles, mortice locks, tower bolts, stopper, hydraulic door closer, etc. of CP brass complete fixed to Pre-Engineered structure including necessary filling up of gaps at junctions with required PVC/neoprene felt etc. including hinges / pivots and double						
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	action hydraulic floor s marked, lock, handle drawing or submitted by	oring of approved brand and and all necessary fittings v bidder in shop drawing and	I manufacture I as detailed in approved by N	S: 6315 tender TPC.			
	The door entrance sha steel shall conform to I from steel flats (50 mm latch are to be made wi Bidder can also propo- complete fitting, access 2016.	Il include Mild Steel single le S 7452 and IS 2062. The h and 5 mm thick). The fixture th same materials. sed <b>uPVC</b> extruded caseme sories and panels as per ite	eaf door. The s oldfasts shall b es, fastenings a ent/ sliding doo ems mentioned	tructural be made and door ors, with in DSR			
2.2.7	Windows Frame:						
	Aluminum black powdo minimum 16G thick as grill shall be provided. The Bidder can also p with complete fitting and	Aluminum black powder coated section, frame shall be of 92x31 mm, minimum 16G thick as per approved design. Tinted glass and aluminum grill shall be provided. The Bidder can also propose <b>uPVC</b> extruded casement/ sliding windows with complete fitting and accessories as per items mentioned in DSR 2016.					
2.2.8	Ventilators:						
	Aluminum 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 the 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						
2.2.9	Rolling shutter:						
	Rolling shutter (Hand op machine rolled with 75 mm lath sections, inte	perated) shall be fabricated fr mm rolling Shutter with effect erlocked with each other a	rom 18 gauge s ctive bridge dep and ends lock	teel and oth of 12 ed with			
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	malleable cast iron clip wind load without exce grills as IS: 6248.	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.					
2.2.10	Plinth Protection:						
	500 mm wide plinth p concrete 1:3:6 (1cemer mm nominal size) over well rammed and cor finishing the top smoo Building.	protection minimum with 75 nt : 3 coarse sand : 6 grade 75 mm bed of dry brick balla nsolidated and grouted wit oth, shall be provided arour	5 mm thick of ed stone aggre ast 40 mm nom h fine sand in nd the Pre-Eng	cement egate 20 inal size ncluding gineered			
2.2.11	Floor Finish:						
	Flooring, including pre cement concrete floorin room floor shall be at le	Flooring, including preparation of the surface, cleaning etc. shall be of cement concrete flooring as per IS: 2571 with ironite hardener. The inverter room floor shall be at least 450 mm above the ground level.					
2.2.12	Paint and Coating:						
	Metal sheet shall be colour coated with total coating thickness of 25 microns (nominal) dry film thickness (DFT) comprising of silicon modified polyester (SMP with silicon content of 30% to 50%) paint or Super Durable Polyester (XRW) paint of 20 microns (nominal) on one side (exposed face) on 5 micron (nominal) primer coat and 10 microns (nominal) SMP or Super Durable Polyester paint over 5 micron (nominal) primer coat on other side. SMP and polyester paints system shall conform to Product type 4 as per AS/ANZ 2728. The structural steel shall be hot-dipped galvanized, conform to IS: 4759 or relevant Indian standard						
2.2.13	Lighting:						
	The inverter room shall be provided with electric light to achieve an average illumination level of 150 Lux. However, room should be designed to utilize maximum natural light during the day.						
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2.2.14	Descrip	Descriptions of PEB Structures:								
	Primary Members: Primary structural framing shall include the transverse rigid frames, columns, corner columns, end wall wind columns, beams, truss member, base 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 polysulphide 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 the wall. The material shall be 26 gauge thick conforming to the physical specifications of sheeting. Gutters and Down Comers: Gutters shall be fabricated out of same metal sheet.									
	sheet. N galvaniz system.	laterial sl zed steel	nall be sa pipes or	me as that PVC dea	at of s signed	heeting. I to ensi	Down ure pr	comers oper roc	shall be o of drainage	e e
	Table-1									
Gro up	Grade/ Refere nce code	Yield strengt h (minim um) MPa	Tensile strengt h (minim um) MPa	Coatin g Class Design ation	BM T (m m)	(+) ve Tolera nce (mm)	Up per limi t of BM T (m (m)	(-) ve Tolera nce (mm)	Lower Limit o BMT (mm)	of
	G250/	250	320							
I	AS139 7			Z275	0.6	0.04	0.6	-0.04	0.56	
		1			I					
Development at Central CHP/CPP Pip	of 20MW S Coalfields arwar, Jhar	olar PV Pı Limited ( khand	roject T CCL)	ECHNICAL BIDDING RE-CS-	SPECIF 3 DOC. N 9296-004	FICATION NO: 1-9	P. CHA	ART-D APTER-D5	Page 13 of 28	

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	SS255 / ASTM A653M	255	360				4		
	S250G D/ EN103 26	250	330						
Ш	G350/ AS139 7	350	420	AZ150	0.5	0.04	0.5	-0.04	0.46
	SS340 Class 4/ ASTM A792M	340	410				4		
	S350G D/ EN103 26	350	420						
NO TE:	Minimur	n elongat	ion % sł	nall be as p	er rele	evant Sta	Indaro	d and Cod	le.
	All stee recent laminati specifie	l material manufact ions, pitti d.	s supplie ure, free ng, flak <u>y</u>	ed by the A e from def y, rust, etc	Agenc ects, c. and	y shall b loose m l be of f	e in a ill sca ull we	sound co ale, slag eight and	ondition, of intrusions, thickness
2.3	SPE	CIFICAT	ION OF	STORE R	DOM:				
	One store shed (in addition to all other stores and PEB Invertor room) shall be constructed near CMCS Room for storage of Mandatory Spares during O&M Period by bidders and later on for NTPC after O&M period. The Store shed shall be a Pre Engineered Building with framed structure.								
	The hei all four	ght of sto sides. T	re shall he store	be minimu e PEB size	m 5 m shal	eters an I be min	d it sh imum	all be cov 200 squ	vered from are meter
Developmen at Central CHP/CPP Pij	t of 20MW S Coalfields parwar, Jhar	olar PV P Limited khand	roject (CCL)	TECHNICAL BIDDING RE-CS-	SPECII G DOC. I 9296-004	FICATION NO: 4-9	P CH/	PART-D APTER-D5	Page 14 of 28

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	(width of approx. 7-10m). The store shall have wide gate entry for crane movement and secured against theft etc. The roof and side walls of the store shall be made of permanently color coated galvalume profile sheets. The minimum BMT (Base material thickness) of roof and side wall sheets shall be 0.5mm. Gate provision shall be made on at least three sides of the shed with suitable ramps. The store shall be at least 500mm above NGL & minimum 1 meter height brick works above plinth level all around the store room. The roof sheet shall have a projection of 500 mm on all around.					
2.0	The building shall be made of structural steel material as per relevant IS codes. All RCC work shall be in line with IS: 456. Alternatively, the store shed may also be made with structural steel columns with self-supporting roof truss system. The store shed shall be designed in line with wind loads as per IS: 875, part-III. The store shed shall be designed as a permanent structure with 25 years age. The store shed flooring shall be made of 150mm thick RCC (reinforcement of 8 dia at 200mm c/c both side, single layer) laid over 200mm thick well graded and compacted boulders with sand. All structural members shall be painted with minimum two coats of synthetic enamel paint over one coat of primer. The design and drawing of the store shed shall be submitted for NTPC approval before start of work.					
3.0	GENERAL CIVIL WOR	KS				
3.1	Water Supply GI pipes of Medium qu pipes conforming to IS water distribution supply	ality conforming to IS 1239 15778 shall be used for al y and plumbing works.	(Part I-1990) c I portable hot a	or CPVC and cold		
	The Syntax or equivalent make PVC storage water storage tank conforming to IS: 12701 shall be provided over the roof of the CMCS with adequate capacity for 10 No person and 24 hour requirement, complete with all fittings including float valve, stopcock etc. The capacity of the tank shall be minimum 500 litres.					
3.2	All external surfaces shall have 18 mm cement plaster in two coats, underlayer 12 mm thick cement plaster 1:5 and finished with a top layer 6					
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	mm thick cement plaste be used as per the man	nm thick cement plaster 1:6 (DSR 2013-13.11). White cement primer shall e used as per the manufacturer's recommendation.					
	At least one coat of pl mechanically, to a tota sand. Plastering shall washable distemper on Plaster of Paris putty Anhydrous) conforming punning.	laster shall be applied to inf al thickness of 12 mm using conform to IS 1542, IS 166 a smooth surface applied wit for the control room. Plas g to IS: 2547 shall be use	terior walls by 3 1:6, 1 cemen 31, IS 1630. Oi h minimum 2 m ster of Paris ( ed for plaster o	hand or it and 6 il bound nm thick Gypsum of Paris			
3.3	<ul> <li>Anhydrous) conforming to IS: 2547 shall be used for plaster of Paris (Sypsull Anhydrous) conforming to IS: 2547 shall be used for plaster of Paris punning.</li> <li>Masonry Work <ul> <li>a) Brickworks shall be using at least class designation 7.5 of approved quality as per IS: 1077, IS: 2212 and IS: 3495. Concrete blocks shall be of a minimum compressive strength of 7.5 N/mm2 and shall be of Grade-A as per IS: 2185. Stone masonry work with hard stone in building works, foundation, plinth and drains shall be Coursed Rubble or Random Rubble masonry work with the stone of good quality and durability. The masonry surface shall be plastered with minimum 18mm plaster in case of CMCS walls. The stone masonry work shall be in line with IS: 1597, IS: 1122 and IS: 1126.</li> <li>b) The cement mortar for all kind of masonry work shall be in the ratio 1 cement and 6 sand by weight.</li> <li>c) Bricks/blocks required for masonry work shall be thoroughly soaked in the clean water tank for approximately two hours. Brick shall be liad in English bond style. Green masonry work shall be protected from rain. All masonry work shall be kept moist on all the faces for a period of seven days.</li> <li>d) Bricks of class designation 5.0 N/mm2 and 3.5 N/mm2 may be permitted to have slight distorted &amp; rounded edges provided no difficulty shall arise on this account in laying of uniform courses in non-load bearing structures and shall be subject to the approval of NTPC. Tolerances on dimensions up to +/- 8% shall be permitted. Dimension test to be carried out as per IS code.</li> </ul> </li> </ul>						
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	CMCS facing the tra practice for fire safet f) Use of fly ash brick f g) The suitable damp cement, sand & agg with a waterproofin course shall be mini	CMCS facing the transformer area shall be as per IS: 1646 - Code of bractice for fire safety of buildings (general): electrical installations. Use of fly ash brick for masonry shall be subjected to approval of NTPC. The suitable damp proof course shall be provided the proportion of cement, sand & aggregate shall be 1:2:4 using 6 mm down stone chips with a waterproofing admixtures. The thickness of the damp-proof course shall be minimum 40 mm.					
3.4	<ul> <li>Reinforced Concrete S</li> <li>a) All RCC works shares structural concrete conforming to IS: 84 conforming to IS: 14 cement for sub-strue Investigation report.</li> <li>b) Coarse aggregate for hard, strong, durabe from deleterious marequirements of IS: 3</li> <li>c) Sand shall be hard, organic matter and aggregate in concrete conform to IS: 1542</li> <li>d) Reinforcement steel of grade minimum detailing in accord superstructure and as</li> <li>e) The following minimum mix shall be adopte unless not specified</li> <li>M 25 - All RCC st precast concrete, M Paving, culverts &amp; remained a structure and stru</li></ul>	Structure, Allied Works and all be designed mix as per- items, Ordinary Portland 112 and Fly ash based Portl 89 (Part-1) shall be used for- uctures shall be decided ba- or concrete shall be crushed as le against weathering of lim- terials. It shall be properly gr 383. durable, clean and free from clay balls or pellets. Same ete shall conform to IS: 38 and for masonry work to IS: 3 shall be of high strength de Fe-415 and shall conform dance with IS: 13920 s substructure of all RCC buildi um grades of concrete for d ed for the type of structure elsewhere. ructural elements above an IMS foundation, cable trenco bad. minal Mix of 1:1.5:3)* - Fencion ominal Mix of 1:2:4) - Base sla	I Foundation er IS 456 (200 cement (43 and pozzolana superstructure. ased on the fi stones chemica hited porosity a raded. It shall r m adherent coa d, when used 3. For plaster, 2116. formed TMT st h to IS: 1786. hall be adop ngs/structures. lesign mix and es noted again ad below grour ch, oil pit, Grac ing work. ab of drains.	00). For Grade) cement Type of nal Soil Illy inert, and free neet the atings of as fine it shall eel bars Ductile ted for nominal st each ad level, de Slab,			
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	M-10 (Equivalent Nominal Mix of 1:3:6) - Plain Concrete Cement.						
	The bidder shall carry out the design mix of <b>M-25</b> and <b>M-20</b> grade concrete on priority. The design mix shall be approved from NTPC before the start of work.						
	* The use of nominal mix for M-20 grade may be accepted only in exceptional cases subject to approval of NTPC Engineer-In-Charge. The same shall be the adopted subject to approval from NTPC for specific work.						
	f) In case Geotechnical investigations require any special kind of cement or higher grade of concrete, the same shall be provided. The foundation system shall be made which transfer loads safely to the soil for the module mounting structures, depending on soil conditions, geographical condition, regional wind speed, bearing capacity, slope stability etc. All foundation system and foundation depth shall be decided based on the approved geotechnical investigation report. No foundation allowed on back filled soil and the foundation depth to reach upto natural ground level (NGL).						
	g) All loads shall be o design shall be in ac	considered in line with IS: 8 ccordance with IS: 1893 and	875. Seismic lo relevant Standa	oads for Irds.			
	<ul> <li>h) IS: 2502 Code of P</li> <li>Reinforcement mus</li> <li>shall be followed for</li> </ul>	ractice for Bending and Fixin t complied for reinforcement reinforcement detailing.	ng of Bars for o ts. IS 5525 and	concrete J SP 34			
	<ul> <li>A minimum 75 mm thick PCC shall be provided below RCC wherever RCC structure is laid over the ground. Proper and sufficient formwork/shuttering shall be provided for the required period as per IS 456.</li> </ul>						
3.5	Structural Steel Structural steel design shall be carried out as per IS 800 and IS 801. Structural steel shall conform IS 2062 / IS 1079 or equivalent, Pipe shall be as per medium/high grade of IS 1161, Chequered plates shall conform to						
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	IS 3502 and Hollow st 4923.	eel sections for structural u	se shall confor	m to IS			
3.6	Structural Steel/Steel All non-hot dip galvania SCB structure)/ Outdoor shall be provided with p of fifteen (15) years (h finishing coat suitable of primer shall be of the re Engineer-In-charge. Th recommendations of the appendix-D1	Sheet Painting sed structural steel (excludin or metal containers/ Enclosur paint designed for a minimur igh durability) as per ISO 1 colour pigment shall be add eputed brand/manufacturer a ne method of application he manufacturer. For corro	ng Module Mou e/ Rolling shutt m maintenance <b>2944 and IS 8</b> ed. All paints in and as approve shall be as sive category	unting & er items -free life <b>300</b> . For ncluding d by the per the of refer			
3.4	<b>Grouting</b> Cement mortar (1:2) ( grouting below base pl grout having a minimu N/mm <sup>2</sup> at 28 days.	<b>Grouting</b> Cement mortar (1:2) grout with non-shrink additives shall be used for grouting below base plate of a column. The grout shall be high strength grout having a minimum characteristic compressive strength of min 30 N/mm <sup>2</sup> at 28 days.					
4.0	TRANSFORMER YARI	D AND METERING YARD C	IVIL WORKS				
	a) Transformer and piles/isolated sprea investigation report designed as per IS 8	equipment's foundations s d footings depending on . Metering yard equipment 301 and IS 800.	shall be foun the final geot 's structures s	ded on echnical shall be			
	b) Transformer foundations shall have its own pit which would cover the area of the transformer and cooler banks, so as to collect any spillage of oil or oil drainage in case of emergency. The oil pit shall be filled with granite stones of 40 mm size uniformly graded.						
	c) The bidder can propose soak pit under Transformer or Burnt oil pit at a distance connected to transformer soak pit depending upon oil quantity in Transformers. It shall be sized to accommodate the oil volume of the transformer connected to it, without backflow. The Gravel-filled level under transformer shall be in accordance with FGL outside pit and transformer bottom level.						
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	d) The area around the transformer and equipment's shall be covered with gravel and galvanized chain link fence of height min 1.8 m with fence posts and gates shall be provided. The portion of the fence covering towards rail track shall be made of a removable type for movement of the transformer during erection /removal. In addition, a small gate, 1.2 m wide shall be provided for an entry. The transformer yard fencing work shall conform to CEIG requirements.					
	<ul> <li>e) Transformer track rails shall conform to IS 3443. The requirement of a fire barrier wall between transformers shall be as per Electricity Rules and IS 1646 recommendations.</li> </ul>					
5.0	PIPE /CABLE RACI	<b>KS &amp; TRENCHES</b>				
	Trenches shall be constructed in reinforced cement concrete and wall thickness minimum 100 mm. The top of trenches shall be kept at least 100 mm above the gravel level so that rainwater does not enter the trench. Trench walls shall not foul with the foundations.					
	<ul> <li>a) Outdoor Cable Trenches: RCC cable trenches shall be constructed in the switchyard and pre-cast RCC removable covers with lifting arrangement, edge protected with suitable galvanized angle iron designed to withstand self-weight of top slab + a concentrated load of 150 kg at center of span on each panel.</li> <li>b) Indoor Cable Trenches: RCC indoor cable trenches shall be provided with 50X50X4 mm angles grouted on the top edge of the trench wall for holding minimum 6 mm thick mild steel checkered plate covers (600-1200 mm in length except at ends &amp; bends) conform to IS: 3502 with</li> </ul>					
	lifting arrangement. Angle or channels shall also be grouted at distances of max 1200 mm across the indoor cable trenches to support					
	<ul> <li>the checkered plates.</li> <li>c) Trench Drainage: The trench bed shall have a slope of approx. 1/500 along the run &amp; 1/250 perpendicular to the run. Incase straight length exceeds 30 m, suitable expansion joint shall be provided at appropriate distances. The expansion joint shall run through vertical wall and base of the trench. All expansion joints shall be provided with approved</li> </ul>					
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	quality PVC water s trench shall be provi	stops. Suitable drainage at ided.	the lowest poir	nt of the		
6.0	PLANT DRAINAGE	SYSTEM				
	a) Surface drainage s hourly rainfall inte coefficient shall be o The drainage syste and prevailing indus	system shall be designed insity'. The minimum valu considered as 0.6 in the desi m shall be designed as per try practices.	considering 'm e of surface gn of drainage the IRC speci	aximum run off system. fications		
	b) The drainage scheme shall be designed considering the catchment areas contributing to the plot drains. Drainage scheme with detention ponds which allows for groundwater recharge & maintains the existing drainage pattern as far as possible is desired. A network of open drains shall be designed & provided to carry surface run off. The drains shall be trapezoidal or rectangle section lined with concrete slabs/brick masonry/stone masonry/Precast RCC drain. The minimum thickness of these lining shall be 75mm thick for concrete slab, 115mm for brick masonry, 150 mm thick for stone masonry and 50 mm thick for Precast RCC drain.					
	c) Suitable size drain shall also be provided at side of the road for quick disposal of water from road & solar blocks as per Plant gradients and Design requirements. Provision of culverts and their design to be submitted separately. The road on the culvert portions of the drains shall be concrete road.					
	d) Bidder shall also ensure that drainage from his plot does not encroach/flood in to the adjacent property and adjacent solar plots (if any). Bidder shall try to maintain existing natural drain and shall remodel the natural drains in case of any disturbance made. The same shall be as per the technical/design requirements without affecting the drainage pattern. The bidder plot drainage scheme shall include to drain out the drainage of the allotted plot and shall include contributing catchment area consisting of adjoining plots and nearby catchment area.					
	e) Bidder in its plot shall terminate its plot drains into the nearby main approach road drainage system or the existing natural water body passing through its plot. The same shall be subject to the approval of NTPC. Suitable strengthening of natural drain shall be done at the					
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	terminal point to avoid any erosion of soil/strata. The strengthening shall be done using stone pitching or RCC works.						
	f) The contractor of each plot (in case of multiple bidders) shall also provide 'additional drains' to cater the drainage of the adjacent plot/plots due to natural topography. These 'additional drains' entry point, discharge quantity, invert levels and tentative layouts shall be as per NTPC approval.						
	g) Each bidder shall also made one peripheral drain along the toe wall of the fencing in the area where the water from bidder plot tends to encroach into the adjacent bidder plot following the natural topography. The toe wall adjacent to peripheral drain shall contribute discharge to the 'additional drain' created by the adjoining plot bidder.						
	<ul> <li>bidders can also proposed suitable recharge dugwells, recharge pits, recharge trenchs, and recharge soakways for quick disposal of storm water in the vicinity of the solar block/plot.</li> </ul>						
	<ul> <li>All Buildings shall be provided with plinth protection all around, sloped towards side drains. Plinth Protection shall be 75mm mm thick PCC laid over well compacted 75mm well grades brick ballast base. Building peripheral drains shall be stone masonry/brick masonry/concrete works. These side drains shall be connected to area drains by either open drains or combination of open drains and underground pipes</li> </ul>						
	<ul> <li>j) Grade level shall be fixed with due reference to highest high flood level of the receiving body of water. Laying of Hume pipe shall be in line with IS: 783.</li> </ul>						
7.0	<b>ELECTRIFICATION OF BUILDING</b> Electrification of all building shall be carried out as per IS 732-1989, IS: 4648-1968 and other relevant standards.						
8.0 <b>8.1</b>	<b>ROADS</b> Approach Road: The approach road to the Solar Power Plant shall originate from the main approach road and connect to all Inverter rooms, CMCS building, module cleaning station and gates. Approach road shall be 3.0 meter wide with 500 mm wide shoulder on both sides. Moorum/brick, with a minimum 100 mm thick shall be provided for the						
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	shoulder along the approach road. The crown of the road shall be minimum 150 mm above FGL. The final finished roads shall have a camber of 1in50.					
	<ul> <li>a) The typical approach road section upto CMCS shall be as follows: <ol> <li>Topping: Wearing course of premix carpet 20 mm thick.</li> <li>WBM, compacted 75 mm thick (Grade-III).</li> <li>WBM, compacted 100 mm thick (Grade-II).</li> <li>Granular Subbase, compacted 150mm thick granular sub-base (Gr-I) <li>(WBM 100 mm thickness can be modified to 75 mm for WBM with corresponding increase of 25 mm in subbase thickness.) Bidders can also propose Wet Mix Macadam (WMM) in place of Water Bound Macadam (WBM) for approach road base construction.)</li> </li></ol> </li> <li>5) Sub-grade under road and its shoulders shall be compacted to achieve 95% or more of standard proctor's MDD. CBR value of the subgrade level should be minimum 4%. If actual CBR is less than 4% in a particular stretch then GSB thickness shall be increased suitably.</li> </ul>					
	b) WBM Road: The type module cleaning state the main approach r	'BM Road: The typical approach road section upto Inverter room and odule cleaning station may be WBM top/road and shall originate from e main approach road.				
	The methodology of road construction with material specifications shall be in line with IRC/MORTH and shall be submitted for approval before starts of works. Roadworks shall be carried out as per tender drawing title: "Typical detail of Approach Roads".					
8.2	<b>Peripherals road</b> : Peripheral road along boundary of the plant shall also be provided for easy access to the boundary of the solar plant. The peripheral road shall be formed by compacting mechanically with roller on the existing surface or after making suitable cut/fill of the earth. Wherever the vegetation/grass/root/small boulders are found in the road, same shall be removed upto depth of 200 mm and backfilled with soil. The surface shall be well wetted with water and properly rolled. The layer of soil shall be rolled & compacted to achieve 95% or more standard Procter's Density. Finished road top level shall be at par or above surrounding ground level.					
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	Peripheral road shall be min 2 meter wide. Suitable culverts with RCC slab at top shall be provided at crossing of water bodies. Peripheral road shall also be interconnected with all bituminous approach roads terminating						
9.0	LIST		BLE INDIAN STANDARDS				
	Indian codes, and/or standards shall govern, in all the cases wherever they are available. In case of a conflict between such codes and/or standards and the specifications, the stringent provisions shall govern. Such codes and/or standard referred to shall mean the latest revision, amendments/changes adopted and published by the relevant agencies. In case of any further conflict in this matter, the same shall be referred to the Engineer-in-charge, whose decision shall be final and binding.						
	Other internationally acceptable standards shall be accepted, only if, no Indian Standards are existing. However, other standards also will be accepted if the Contractor establishes that the works are meeting the requirements of Indian Standards also.						
	A brief list	t of Indian Sta	ndards applicable to these w	orks is as belov	V:		
	General						
	IS: 875-I	IS: 875-I Code of Practice for Design Dead Loads for Building and					
	IS: 875-	Code of Pra	actice for Design Imposed	Loads for Bu	uilding		
	П	and Structu	res				
	IS: 875-	Code of practication code of practication code of the	ctice for design loads (other I structures.	than earthqua	ike) for		
	IS: 1893	Criteria for ea	arthquake resistant design of	structures.			
	IS: 4326	Code of F construction	ractice for earthquake re	esistant desig	n and		
	Foundations						
	IS: 1080	Code of pr foundations	actice for design and co	nstruction of s	shallow		
	IS: 1904	Code of prac	ctice for structural safety of b	uilding foundation	ons		
				~			
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	IS: 2950	Code of p	Code of practice for design and construction of raft					
		foundations.	oundations.					
	IS: 4091	Code of Pra	ctice for Design and Constr	uction of Found	dations			
		for Transmis	sion Line Towers and Poles					
	IS: 6403	Code of Pr	actice for determination of	bearing capa	icity of			
		shallow foun	dations					
	IS: 8009	Code of Prac	ctice for foundation settlemer	nt calculations				
	IS: 2911	Design & Co	nstruction of Pile Foundation	- Code of Prac	ctice			
	Concrete Structures							
	IS: 456 Code of practice for plain and Reinforced concrete							
	IS: 3370	70 Code of practice for concrete structures for the storage of						
		liquids.	iquids.					
	IS: 3414	Code of Prac	Code of Practice for design and installation of joints in buildings					
	IS: 5525	Recommend	Recommendation for detailing of reinforced concrete works					
	IS: 6313	Code of prac	tice for anti-termite measure	s in buildings				
	IS:	Ductile detail	iling of Reinforced Concrete	e Structures su	bjected			
	13920	to Seismic fo	orces					
	IS: 1904	Code of prac	ctice for design and construe	ction of foundat	tions in			
		soils general	requirements					
	Steel Stru	ctures						
	IS: 800	Code of practice construction	ctice for use of structural ste	eel in general k	ouilding			
	IS: 801	Code of pra	actice for use of cold-form	ed light gauge	e steel			
		structure me	mbers					
	IS: 802	Code of Pra	actice for use of Structural	I Steel in over	r Head			
		Transmissio	n Line Towers.					
	IS: 806	Code of pra	actice for use of steel tube	es in general b	building			
		construction.						
	IS: 808	Dimensions	for hot rolled steel beam,	column chann	el and			
		angle section	1	-				
	IS: 811	: 811 Specification for Cold Formed Light Gauge Structural Steel						
		Sections						
	15: 813	Scheme of s	ymbols for weiging					
Development of 20MW Solar PV Project at Central Coalfields Limited (CCL) CHP/CPP Piparwar, Jharkhand TECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-9296-004-9 PART-D RE-CS-9296-004-9								

CLAUSE NO	TECHNICAL SPECIFICATIONS						
	IS: 1079	Hot Rolled ca	arbon Steel Sheet and Strip -	<ul> <li>Specification</li> </ul>			
	IS: 2062	Hot Rolled	Medium and High Tensile	e Structural S	Steel –		
		Specification					
	IS: 4923	Hollow steel	sections for structural use.				
	IS 1161	Steel tubes for	or structural purpose				
	IS: 2721	Galvanised s	teel chain link fence fabric –	Specification			
	Painting a	Painting and Coating					
	IS: 4736	Hot-dip zinc of	coatings on mild steel tubes				
	IS: 4759	Hot-dip zinc	coatings on structural st	teel and other	allied		
		products – S	roducts – Specification				
	IS:1868	Anodic coatir	ngs on aluminium and its allo	ys			
	IS 2395-	Painting of C	oncrete, Masonry and Plaste	er Surfaces – C	ode of:		
	1	Operations a	nd Workmanship				
	IS 2395-	Code of pra	ctice for painting concrete,	masonry and	plaster		
	II	surfaces: Sch	nedule				
	IS 1477-	Code of Pra	ctice for Painting of Ferrou	s Metals in Bu	ildings:		
	1	Pre-treatmen	t				
	IS:1477-	Code of pra	ctice for painting of ferrous	s metals in bu	ildings:		
	П	Painting					
	ISO	Paints and va	arnishes - Corrosion protect	tion of steel str	uctures		
	12944-1	by protectiv	e paint systems - Part	2: Classificat	tion of		
		environments	3				
	ISO	Paints and v	arnishes - Corrosion protect	tion of steel str	uctures		
	12944-5	by protective	paint systems - Part 5: Prote	ective paint sys	tems		
	Water sup	oply and sanita	ry				
	IS: 1239	Mild steel tub	es and tubulars and other w	rought steel fitti	ings		
	IS: 1172	Code of bas	sic requirements for water	supply, draina	age and		
		sanitation	•		0		
	IS: 1742	Code of Prac	tice for building drainage				
	IS: 2527	Code of prac	tice for fixing rainwater gutte	ers and down p	pipes for		
		roof drainage	e.				
	IS:	Chlorinated	polyvinyl chloride pipes for	potable hot a	nd cold		
	15778	water distribu	ition supplies				
Development of 20MW Solar PV Project at Central Coalfields Limited (CCL) CHP/CPP Piparwar, Jharkhand		TECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-9296-004-9	PART-D CHAPTER-D5	Page 26 of 28			

CLAUSE NO	TECHNICAL SPECIFICATIONS						
	IS: Chlorinated polyvinyl chloride pipes for automatic sprinkler fire						
	16088	extinguishing	system				
	IS:	Fabricated P	VC fittings for potable water	supplies			
	10124	Lin plaatici <del>z</del> a	d DV/C nines for notable wat	oroupplico			
	15. 4985		d PVC pipes for polable wate	er supplies	Coil and		
	12502	Un-plasticize	Masta Discharge System Inside and Outside Buildings				
	13392	Including Ver	ncluding Ventilation and Rainwater System				
	IS:	Un-plasticize	Jn-plasticized polyvinyl chloride (PVC-U)screen and casing				
	12818	3 pipes for bore/tubewell					
	IS: 2470	Code of Prac	tice for installation of septic	tanks			
	Miscellan	eous					
	IS: 1905	1905         Code of Practice for structural use of un-reinforced masonry					
	IS: 3067	Code of Practice for general design details and preparatory					
		works for dar	np proofing and water proofi	ng of buildings			
	SP: 6	Handbook for	r structural engineers (all pai	rts)			
	SP: 7	National Building Code of India					
	SP: 16	Design Aids for reinforced concrete to IS:456					
	SP: 20	Handbook on	n masonry design and constr	ruction			
	SP: 22	Explanatory I	handbook on codes for earth	iquake enginee	ring		
	SP: 24	Explanatory I plain and reir	handbook on Indian Standa nforced concrete	rd Code of Pra	ctice for		
	SP: 25	Handbook on	n causes and prevention of c	racks in buildin	gs		
	SP: 32	Handbook on	n functional requirements of i	industrial buildir	ngs		
	SP: 34	Handbook of	concrete reinforcement & de	etailing			
	IRC: 37	Guidelines fo	r design of flexible pavemen	ts			
	IRC: 42	Guidelines or	n Road Drainage				
	IRC: 58	Guidelines fo	or the design of rigid paveme	nts for highway	S		
	IRC: 73	Geometric de	esign of roads				
		r					
Development of 20MW Solar PV Project at Central Coalfields Limited (CCL) CHP/CPP Piparwar, Jharkhand		TECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-9296-004-9	PART-D CHAPTER-D5	Page 27 of 28			

CLAUSE NO	TECHNICAL SPECIFICATIONS							
		APPENDIX-D1						
	GENER OTHER	GENERAL DESIGN DATA FOR SOLAR PV SITE REQUIREMENT OTHER THEN MENTIONED IN RESPECTIVE CHAPTER OF D:						
	<ul> <li>A. VICIN Perip work</li> <li>B. WIND wind p</li> <li>C. SEISI</li> <li>D. Maxin</li> <li>E. The C</li> </ul>	<ul> <li>A. VICINITY MAP: Peripheral boundary wall/Fencing with Main gate complete scope of work as per Vicinity Map shall be equally executed by bidders.</li> <li>B. WIND: Basic wind speed shall as per Chapter A-2. The minimum design wind pressure (pd) to be considered as 773 N/m<sup>2</sup>.</li> <li>C. SEISMIC shall be as per IS: 1893 (Part-1).</li> <li>D. Maximum hourly rainfall intensity in mm: 60.</li> <li>E. The CMCS building shall consist of the following with area:</li> </ul>						
	SI No:	Room		Minim	um Area			
	1	Air conditioned	SCADA Room	16 sam				
	2	Inverter hatterv	room ACDB and	manufacturer				
		33 KV Switchge	ar Room	recommendation				
	3	Store Room		25 sgm				
	3	Supervisor room	n	12 sqn	0			
	5	Toilets (Male an	d female)	16 sqm				
	5	Pantry		05 sqm				
	0	T and y		00	3411			
	F. Corro	osive category: C	2.					
Development at Central ( CHP/CPP Pipe	of 20MW So Coalfields arwar, Jharl	olar PV Project Limited (CCL) khand	FECHNICAL SPECIFICA BIDDING DOC. NO: RE-CS-9296-004-9	TION	PART-D CHAPTER-D5	Page 28 of 28		

CLAUSE NO	TECHNI			एनरीपीमी NTPC		
		PART-E				
	GENERAL SYSTEMS					
Development at Central CHP/CPP Pip	of 20MW Solar PV Project Coalfields Limited (CCL) arwar, Jharkhand	TECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-9296-004-9				

CLAUSE NO.	TECHNICAL SPECIFICATIONS						
	CHAPTER-E1 WEATHER MONITORING STATION						
	As a part of weather measuring instruments integrate with SCAD, meteorological instrum with necessary cables, and base stand etc.) pr	As a part of weather monitoring station, Bidder shall provide following measuring instruments with all necessary software & hardware required to integrate with SCADA so as to enable availability of data from meteorological instrument in SCADA. Each instrument shall be supplied with necessary cables, transmitters and accessories (Trackers, Mounting and base stand etc.) provided by OEM of the sensors only.					
	Aux. power required by instruments and data logger (If supplied) shall be from UPS only. Data logger shall have provision to receive redundant power supply.						
	Single sensor for measuring combination of Wind Speed, Wind Direction, Relative humidity and Rainfall is also acceptable however offered sensor shall meet the specification as mentioned in following sections.						
1.0	SOLAR RADIATION SENSORS						
	Contractor shall provide Solar Radiation Sensors as per specification given in following section. Contractor has the option to provide these sensors on separate base or on a single base (radiation monitoring station) with tracker, shadow ring and transmitter etc provided by the OEM. Calibration certificate with calibration traceability to World Radiation Reference (WRR) or World Radiation Centre (WRC) shall be furnished along with solar radiation sensors. Bidder shall provide Instrument manual in hard and soft						
1.1	Pyranometer						
	Bidder shall provide minimum <b>03 (Three) numbers</b> of Secondary Standard Pyranometers as per ISO 9060 for measuring incident solar radiation as for following;						
	<ul> <li>Global Horizontal Irradiance (GHI) - 1 No.</li> <li>Global Inclined Irradiance (GII)-1 No.</li> <li>Diffuse Horizontal Irradiance (DHI)- 1 No.</li> </ul>						
	Technical Requirement of Pyranometer						
	SI.No Details	Values					
Developmer PV Project Station, Ant	nt of 20 MW Floating Solar at NTPC Anta Gas Power a, Rajasthan	TECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-5744-004-9	PART-E CHAPTER-E1	Page 1 of 5			

CLAUSE NO.		TECHNICAL SPECIFICATIONS					
	1	Principle		Thermo	nile		
	1.	Spectral Pesno	neo	310 to 1	2800 nm		
	2.	Sonsitivity	1130.	Min 7 m	2000  mm		
	J.	Time response	(05%)	May 15			
	4.	Non linearity:	(9570).	+0.5%	3		
	5.	Temperature R	Asnonsa.	+2%			
	0.	Tilt error:	esponse.	<u> </u>	6		
	7. 8	Zero offset ther	mal radiation:	+7 w/m	2		
	0.	Zero offset tem	nerature change	±7 w/m	2		
	9.	Operating temp	perature range.		2 +80 deg		
	10.		(95% confider		Max-3% Dai	lv-	
	11.	Level):		Max-2%	6 Niax-570, Dai	'y-	
	12.	Non stability:		Max ±0	.8%		
	13.	Response Time	e(95% of final valu	ie) <5 sec			
2.0 2.1	<ul> <li>Shadow mg/bail for measuring Drif shall require no regular adjustment for of tracker and shadow ring/ball. Pyranometer shall be shaded throughout the day and shall be exposed to diffuse solar radiation only to provide DHI value without any calculation.</li> <li>All the Pyranometer have to be mounted at single location at shadow free area. The GII Pyranometer has to be at the same inclination as the angular tilt of module mounting structure.</li> <li>Bidder shall provide 1 no. (One) Battery powered portable handheld data logger supplied by the OEM of the offered Pyranometer.</li> <li>TEMPERATURE SENSORS</li> <li>Ambient Air Temperature Sensor (Qty -1 no.)</li> </ul>						
	SI.No	Details	Va	lues			
	1	Principle	R1	D (Platinum)	) Resistance		
	1.	_	pro	oportional to	temperature		
	2.	Range	0-{	50 ° C			
	3.	Accuracy	+	0.2 ° C		_	
	4.	Operating Temp	erature 0 t	<u>o 50 °C</u>		_	
	5.	Radiation Shield	NC	n-aspirated	Radiation Shield		
2.2	Indoor A SI.No 1.	Air Temperatur Details Principle	re Sensor (Qty - ע ר ר ע	<b>- 1 no. at ea</b> T <mark>alues</mark> TD (Platinun roportional to	n) Resistance	pom)	
Development of 20 MW Floating Solar PV Project at NTPC Anta Gas Power Station, Anta, Rajasthan		TECHNICAL SPEC BIDDING DOC RE-CS-5744-0	IFICATION NO: 04-9	PART-E CHAPTER-E1	Page 2 of 5		

CLAUSE NO.		TECHNI	CAL SPECIFI	CATIONS	Į.	लरीपीमी NTPC
	2.	Range		0-70 ° C		
	3.	Accuracy		+ 0.2 °C		
	4.	Operating Tem	perature and	0 to 70 °C		
		calibration				
2.3	Module	Temperature S	Sensor (Qty -	– 1 no. per 05	MW)	
	SI.No	Details		Values		
	1.	Principle		RTD (Platinun	n) Resistance	
	2	Danca		proportional to	temperature	
	2.	Range		0-100 °C		
	3.	Accuracy	return	+ 0.2 °C		
	4.	Operating Temp	perature	0 to 100 °C		
3.0 3.1	with adhesive or tape without using any mechanical fastener. Wind Sensor Wind Speed Sensor (Qty- 1 no)					
	SI.No	Details		Values		
	1.	Principle		Frequency pr speed/Ultrase	oportional to w	ind
	2.	Velocity range	•	0-60 m/ sec		
	3.	Threshold		0.3 m/s		
	4.	Operating Ten	nperature	0 to 50 deg C	, ,	
	5.	Accuracy	·	3% (upto 35 m/s), 5% (Above m/s) RMS		ve 35
3.2	Wind D	irection Sensor	r (Qty- 1no)			
	SI.No	Details		Values		
	1.	Principle		Potentiometrie (Resistance p direction)/Ult	c type sensor proportional to V rasonic Sensor	Vind
	2.	Range		0-360 deg		
	3.	Accuracy		±5 deg		
	4.	Operating Ten	nperature	0 to 50 deg C		
	5.		1	Ŭ		
Developmen PV Project Station, Anta	nt of 20 MW at NTPC An a, Rajasthan	Floating Solar Ita Gas Power	TECHNICAL SI BIDDING I RE-CS-57	PECIFICATION DOC. NO: 44-004-9	PART-E CHAPTER-E1	Page 3 of 5

CLAUSE NO.		TECHNICAL SPECIFICATIONS				
4.0	RELATI		(%) (Qty- 1no	)		
	SI.No	Details		Values		
	1.	Range		0-100 %		
	2.	Accuracy		±3%		
	3.	Resolution	moratura	1%	•	
	4.		nperature	0 10 50 deg C	,	
5.0	Additio	nal Measureme	ent			
	As per re also incl	As per regulatory requirement, following measurement for the Solar PV is also included in the scope of bidder.				
	i. ii. iii.	i. Direct Normal Irradiance (DNI) ii. Sunrise and Sunset time iii. Rainfall (mm)				
	iv.	iv. Cloud Cover –(Okta)				
	Instrument and accuracy for the above-mentioned measurement shall comply with applicable regulation ("Implementation of the framework on forecasting, scheduling and imbalance handling for Renewable Energy(RE) generating stations including Power Parks on Wind and Solar at Inter-State Level").					
6.0	CALIBR	ATION				
	All the measuring instruments to be supplied shall have valid and traceable calibration certificate. Each Pyranometer shall be recalibrated at an interval not more than two years and all other instruments shall be recalibrated at an interval an interval not more than four years.					
7.0	DATA L	OGGER				
	Weathe suitable hardwar shall be environr	Weather Monitoring system shall be provided with standalone Data logger suitable for outdoor application with IP65 Protection and industrial grade hardware suitable for operating temperature up to 55 Deg. C. Data logger shall be calibrated and proven in field for at least one year in outdoor environment. Data logger shall have following minimum features:				
	Proces	ssor 32	2 bits			
Developmer PV Project Station, Anta	nt of 20 MW at NTPC An a, Rajasthan	Floating Solar ta Gas Power	TECHNICAL SP BIDDING D RE-CS-574	ECIFICATION OC. NO: 4-004-9	PART-E CHAPTER-E1	Page 4 of 5

CLAUSE NO.	TECHN	ICAL SPECIFICATIONS	Į.	ल्त्रीपीम्री NTPC	
	Time V synchronization C	With Built in GPS Clock or wit GPC Clock	h Solar SCAD	4	
	Wireless C communication	GSM/GPRS Modem			
	Data storage S p fr s fr	SD card, Min 2GB for storage processed data locally at reso or retrieval whenever require shall be in unencrypted CSV of ormat.	of raw and lution of 1 Sec d. Data to be s or equivalent	ond tored	
	Display L	CD display for easy mainten debugging for site engineer	ance and		
	Scan resolution 1	Sec			
	Analog to Digital Converter (ADC)	l6 Bit, Sampling -10 Hz (Min)			
	I/P Channel A	As required with 20 % spare on the spare of	of each type of		
	It shall have facility for arithmetic processing (Time Integration, Simple Average, and Moving Average etc.) of incoming raw data. Data logger shall be interfaced with Solar SCADA on modbus preferably on TCP-IP. Vendor shall submit Factory Acceptance Test (FAT) report and procedure before dispatch of material to site.				
	cables (Power and Sig duty HDPE pipes.	nal) to the data logger shall	be protected w	heavy	
	Project file (software, settings and sample reports) shall be handed over to site on permanent storage media (CD/DVD) in two copies after data integrity is verified by site and weather monitoring is commissioned. Any configuration changes shall be possible only with authorized User ID and password.				
8.0		STATION			
	Sensors shall be installed at suitable height for which Mast/Structure for the sensor shall be provided by the bidder. Proper fencing shall be provided around meteorological station where the Pyranometer, Wind, Ambient Temp. Sensor, Data logger etc. are installed.				
Developmer PV Project Station, Ant	nt of 20 MW Floating Solar at NTPC Anta Gas Power a, Rajasthan	TECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-5744-004-9	PART-E CHAPTER-E1	Page 5 of 5	

CLAUSE NO.		TECHNICAL	SPECIFICA	TIONS		एनरीपीमी NTPC
	F	IRE FIGHT	CHAPTE	ER-E2 ALARN	I SYSTEM	
	The SPV plant systems for proper CEIG requi	shall be equi otection of er rements.	pped with s ntire equipr	suitable fi ment swit	re protection & chyard & con	& fire fighting trol room as
1.0	Bidder shall cor incurring minim applicable statu protection.	mply with reco al premium fo itory requirem	ommendatio r insurance ents, safet	on of Tarif e. The inst y regulatio	f Advisory Co allation shall r ons in terms of	mmittee to meet all f fire
2.0	The fire fighting be consisting of	system for th	e proposed	d power p	lant for fire pro	otection shall
	a) Sand bu b) Portable c) Micropro	ckets fire extinguis ocessor basec	hers I fire alarm	panel.		
2.1	Portable Fire E	Extinguishers	and Sand	I Buckets	;	
	Bidder to pro extinguishers a <b>Rooms</b>	DVIDE following s per relevant DCP Type (ABC type) (10 Kg. Capacity)	ng numbe t code in the CO <sub>2</sub> Type 9 kg capacity	Foam Foam Type Hand 9 kg	vpe tested p nentioned belo Hand Portable pressurized water C0 <sub>2</sub> 9 Litre	Sand Buckets
	Control Room	2	2	1	1	1
	Room/locatio					
	ACDB Room (If applicable)	1	1			
	Each	1	1	1		1
	Switchyard/ Metering Yard	2	2			1
Developmer Project at (CCL) CHP/0	nt of 20MW Solar Central Coalfields L CPP Piparwar, Jharkh	PV .imited and	INICAL SPEC BIDDING DOC RE-CS-9296-0	IFICATION . NO: 04-9	PART-E CHAPTER-E2	Page 2 1 of 3

CLAUSE NO.	TECHN	CAL SPECIFICATIONS	L L	लरीपीमी NTPC	
2.2	Microprocessor base	d fire alarm panel			
	Bidder to provide intelligent modular construction output modules, power modules with 10% spacent system shall include) but	gent microprocessor based complete with central proc r supply module, supervisi are provisions in each loo ut not limited to the following	main fire alarm cessing unit, i on control and p. Fire detecti items	n panel of nput and d isolator on alarm	
	<ul> <li>a. Fire Alarm control Panel</li> <li>b. Multi Sensor smoke detector</li> <li>c. Heat Detectors</li> <li>d. Hooter cum strobe</li> <li>e. Manual call Point</li> <li>f. Hooter</li> <li>g. Fault isolation modules</li> <li>h. Control Modules</li> </ul>				
	<ul> <li>h. Control Modules</li> <li>i. Cables from Sensors to Fire panels.</li> <li>j. Digital output from the fire detection system shall be integrated with SCADA</li> <li>k. Network Control Module</li> <li>l. Interfacing of Fire Alarm System with SCADA for display and storage of status and alarm in SCADA</li> </ul>				
	Multi sensor type smoke detectors and heat detectors shall be provided for below false ceiling areas of control room and ACDB and/or inverter rooms. One (01) sensor shall be provided for each 20 sq. Meter of area. All the cable trench inside the control room and inverter room shall be provided with Multi Sensor smoke detector.				
	Fault Isolation module sensors at location prop detail engineering.	shall be provided in every posed by Bidder to be appro	room and for oved by employ	every 15 /er during	
2.3	Fire Alarm Control Par	nel Indication			
	<ul> <li>i. Alarm conditions shall be immediately displayed on the control panel and in SCADA. Alarm LED shall flash on the control panel until the alarm has been acknowledged. Once acknowledged the LED shall remain lit. A subsequent alarm received from another zone after acknowledgement shall illuminate the alarm LED and the panel display shall show the new alarm information.</li> <li>ii. During an alarm condition, an alarm tone shall sound within the control panel until the alarm is acknowledged.</li> <li>iii. If the audible alarm signals are silenced for any reason, they shall automatically resound if another zone is activated.</li> </ul>				
Developmer Project at (CCL) CHP/(	nt of 20MW Solar PV Central Coalfields Limited CPP Piparwar, Jharkhand	TECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-9296-004-9	PART-E CHAPTER-E2	Page 2 of 3	

CLAUSE NO.	TECHN	ICAL SPECIFICATIONS	ľ	ਸਟੀਪੀਸ਼ੀ NTPC	
	iv. All alarm signal panel until the c and the control p	s shall be automatically "lo operated device is returned panel is manually reset	ocked in" at th to its normal	e control condition	
	There shall be weather proof Hooter cum strobe outside and strobe inside each Inverter room and control room for indication fire alarm for respective zone/area at suitable location that is visible from all direction. All the hardware, relay and accessories required for completeness of fire alarm system is in Bidder scope. Fire alarm system shall have its own batter and charger and it shall be provided power from UPS DB. Each Inverter room and control room shall be also be provided with manual call point Alarm acknowledge and reset facility for alarm for respective zone only.				
	Bidder shall submit document to employer for approval that will include fire alarm system configuration, layout, BoM, Datasheet and necessary test report.				
	Bidder shall consider 30 % design and aging margin for selection of nos. of sensors in each loop and length of each loop. Bidder shall submit the certificate from OEM indicating maximum nos. of sensors in single loop and maximum length of single loop allowed with offered panel and type of cable to be used. Each Fire Alarm Control panel shall have provision for minimum 10 (Ten) % rounded to next higher integer but not less than 2 (two) nos. spare loops for future use of employer.				
	Bidder shall submit Site Acceptance Test (SAT) for approval by employer. Complete fire alarm system shall be checked at site for verification of faithful performance and completeness of the system. Bidder shall carry out necessary modification and supply hardware/accessories if required.			employer. ication of carry out ed.	
Developmer Project at (CCL) CHP/0	nt of 20MW Solar PV Central Coalfields Limited CPP Piparwar, Jharkhand	TECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-9296-004-9	PART-E CHAPTER-E2	Page 3 of 3	

CLAUSE NO.	TECHN	ICAL SPECIFICATIONS	ľ	लशैषीम् NTPC
	CHAPTER-E3 MODULE WASHING SYSTEM			
	Bidder shall propose so of dry cleaning system a or either of these two co	olar modules cleaning syste as well as cleaning with wate omplete cleaning system.	m made of con er through pipe	mbination e network,
1.0	Solar Module Washing	g Systems with Fresh Wate	er:	
1.2	Bidder shall provide per SPV Plant. This shall in motor, requisite storag conforming to IS 4984 a be complete in all resp codes. The complete s including inputs points, the HDPE pipe with ma intervals. The opening p water on module shall for measurement of wat	ermanent arrangement for iclude installing deep tube/b e arrangement and laying and other relevant codes. Th ect and the details shall co scheme shall be subject to design and drawings for the anual isolating valves should pipes for fixing the movable/ be made of GI pipe. Bidde ter consumption.	module washi ore wells with p network of HI ne module was nform to the re approval of t e system. Ope d be provided /Hose pipes for r shall install fl	ng in the pump and DPE pipe hing shall elevant IS he owner ning from at regular r spraying ow meter
1.3	Design of solar PV module cleaning system shall be such that complete solar plant shall be cleaned with fresh water twice in a month. Module cleaning system piping network shall be closed looped pipe network configuration consists of Main pipe, sub-main and branches in the main plot. In array layout, if solar blocks is separated from main plot due to natural water body, nallah, roads, etc; Module cleaning system piping network may be design for dead end/tree pipe network configuration. Cut- off valves shall be provided at suitable junction point so that the repair works may be conducted at a particular area without disturbing the whole area. The water used for cleaning should be of appropriate quality fit for cleaning purpose as per the recommendations of module manufacturer.			
1.4	Bidder shall provide the piping and the instrumentation diagram (P&ID) of water washing arrangement including the physical sequence of branches, reducers, valves, pressure gauge, cleaning points with location of pump(s) and water storage tanks to NTPC for approval during detailed engineering.			
1.5	The HDPE pipe shall be suitably protected against any impact load. The HDPE pipes shall be covered higher diameter GI pipe/NP3 Hume pipe at roads crossing for protection against any heavy loads etc. at roads section. The same protection shall also be provided wherever higher loads are			
Developmer Project at (CCL) CHP/0	nt of 20MW Solar PV Central Coalfields Limited CPP Piparwar, Jharkhand	TECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-9296-004-9	PART-E CHAPTER-E3	Page 1 of 3

CLAUSE NO.	TECHN	ICAL SPECIFICATIONS	ľ	ल्यीपीसी NTPC	
	expected. The bidder r HDPE pipes.	nay also propose some oth	er protection s	ystem for	
1.6	Maximum length of he Tapping point shall be p	ose pipe shall be 50 mete blace above PCC slab/block	ers from tappi	ng point.	
1.7	After laying and jointing be checked by charging N/mm2 or double the The pressure shall be a or, in the case of long driven test pump, provid	g, testing of main pipe, serv g with water. The test pressu maximum working pressure applied by means of a manu- mains or mains of a large ded the pump is not left unat	ice pipe and fir re shall be min e, whichever is ally operated to diameter, by tended.	tting shall imum 0.5 s greater. est pump, a power-	
1.8	End of the branch pipe avoid entry of foreign m	End of the branch pipes/tapping points to be bent horizontal/downward to avoid entry of foreign materials like, earth, sand leaf, gravels, etc.			
1.9	Bidder to ensure interconnection between the sub-systems of module washing system through isolating valve, so as module cleaning may be continued in case of outage of any sub-system.				
1.10	Bidder shall ensure that the complete module washing system is integrated suitably with bore wells, check dam, motor and water pipe line coming at the periphery of the plant.				
2.0	Deleted				
3.0	Tube Well/Bore Well				
3.1	Boring and sinking by rig boring system of min 150 mm x 100 mm dia well to be drill to assess potentiality & quantity / availability of water level for deciding filter position through any type of soil, rock & boulders etc. Bore well shall be min of 250 mm dia. Minimum 2 (two) deep bore well and supply, installation of casing pipes, submersible pumping set including all mechanical & electrical accessories, fittings etc. complete at site for Solar Module cleaning systems and water supply to buildings requirement. PVCU casing pipes shall be as per IS 12818.				
3.2	Bidder shall conduct ground survey & selection of points for bore well to drill by VES (vertical electrical sounding) method to assess potential & such that quantity/availability of waters can be made. The bidder shall suggest location of bore wells accordingly. Bidder may also conduct geophysical investigation of the aquifer by electro-logging system to decide filter location and length of pipes. Tube well/Bore well construction and testing shall conform to per IS 2800.				
Developmer Project at (CCL) CHP/(	nt of 20MW Solar PV Central Coalfields Limited CPP Piparwar, Jharkhand	TECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-9296-004-9	PART-E CHAPTER-E3	Page 2 of 3	

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3.3	New bore well to be ins shall not less than 100 r	talled shall yield turbidity fre meters.	e clean water a	and depth
3.4	Submersible pump sha protection of reputed r shall have Ammeter and	all be provided with motor on the motor of the with LED indication for distribution of the with the work of the wo	control panel w or ON/OFF an voltage display.	vith motor d fault. It
3.5	Suitable capacity wate installed by bidder to m for module cleaning and	er softening/purification or ake the ground water and ra d O&M purposes.	RO system ain water store	shall be d suitable
3.6 3.7	Suitable Earthing shall be provided as per I.E Rule/Act. Mandatory permission for bore well drilling shall be arranged by contractor if required from local competent authority. Suitable Storage Tank for Module washing system shall be provided.			
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		CHAPTER-E4		
	TRIAL RUN & O	THER GENERAL REQU	IREMENTS	
1.0	TRIAL RUN			
	During the trial operatio cumulative 24 hours due be demonstrated and the	n, SPV plant shall perform tro ring which functionality of all le system shall be in Generat	ouble-free oper plant compone ting Mode.	ation for nts shall
	After successful compl Plant shall be deemed t	etion of trial run and accep o be successfully erected & o	otance by NTP commissioned.	PC, SPV
2.0	INSURANCE			
	The bidder's insurance detailed out in Clauses The bidders insurance I Chapter E-5 Clause 4.0	e liabilities pertaining to the titled Insurance in General iabilities during O&M period I	e scope of wo Conditions of C has been broug	orks are Contract. ht out in
3.0	TAKING OVER			
	Chapter E-5 Clause 4.0. <b>TAKING OVER</b> Upon successful completion of all the facilities pertaining to the scope of work contractor shall approach the owner in writing for "final take over" of the plant. On receipt of such request, owner shall issue to the contractor a taking over certificate as a proof of the final acceptance of the system. Such certificate shall not relieve the Contractor of any of his obligations which otherwise survive, by the terms and conditions of the Contract after issuance of such certificate.			
Development at Central CHP/CPP Pip	of 20MW Solar PV Project Coalfields Limited (CCL) arwar, Jharkhand	TECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-9296-004-9	PART-E CHAPTER-E4	Page 1 of 1

CLAUSE NO						
	CHAPTER-E5 OPERATION AND MAINTENANCE					
1.0	The successful bidder shall provide Operation and maintenance of SPV Plant along with grid connecting system which are presently included in bidder's scope of supply and installation of the solar plant from date of successful completion of trial run. During O&M period, CCL personnel shall have unrestricted entry to the solar plant and Control Room any time. CCL may suitably depute its personals to associate with O&M activities. Contractor shall assist them in developing expertise through their day to day O&M activities. All records of maintenance must be maintained by the contractor which can be accessed by CCL on demand. These records are to be handed over to CCL after the O&M period of contract.					
2.0	The bidder shall be responsible for supply of all spare parts, repairs / replacement of any defective equipment(s) at his own cost as required from time to time during the O&M period.					
3.0	The contractor shall be responsible for the Operation and Maintenance of the entire Solar PV plant during the O&M period. The brief scope of works is listed below. The details shall be further elaborated by the bidder in the O&M manual to be submitted to CCL for approval.					
	<ul> <li>(a) Ensuring successful operation of SPV Plant for optimum energy generation.</li> <li>(b) Ensuring Breakdown maintenance, Preventive maintenance overhauls, arranging visit of O&amp;M experts (when required) to maximize the availability of the solar plant.</li> <li>(c) Daily work of the operators involves logging the voltage, current, power factor, power and energy output of the SPV plant, temperature, logging down individual array output data once a day</li> <li>(d) The operator shall record monthly energy output of each array and transformer and reports shall be prepared on performance of SPV plant.</li> <li>(e) Submission of periodical reports to the owner on the energy generation &amp; operating conditions of the SPV plant.</li> <li>(f) Ensuring Safety and protection of the plant by deputing sufficient security personals</li> <li>(g) Monitoring, controlling, troubleshooting, maintaining of records, registers.</li> <li>(h) Supply of all type of maintenance spares, consumables and fixing / application of the same. In order to meet the emergent</li> </ul>					
Development at Central CHP/CPP Pip	I: of 20MW Solar PV Project Coalfields Limited (CCL) arwar, JharkhandTECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-9296-004-9PART-E CHAPTER-E5Page 1 of 7					

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	requirements, contractor, with the permission of Employer can utilize the mandatory spares being supplied under the contract. However, the used spares shall be replenished by the contractor within					
	<ul> <li>reasonable time.</li> <li>(i) Cleaning of the plant including array yard on regular basis and a and when required.</li> </ul>	IS				
	(j) Cleaning of drains, cable trenches, box culverts etc.					
	(k) Module washing as per approved schedule.					
	(I) Herbicide spray and grass cutting on a periodic basis.	a				
	(iii) Module uit angle changing as per the schedule approved durin detailed engineering	g				
	<ul> <li>(n) The contractor shall at his own expense provide all amenities to his workmen as per applicable laws and rules.</li> </ul>	is				
	(o) The Contractor shall ensure that all safety measures are taken a the site to avoid accidents to his employees or his Co-contractor	at 's				
	<ul> <li>(p) The Contractor shall immediately report the accidents, if any, to th</li> <li>Engineer In charge &amp; to all the concerned authorities as perevailing laws of the state</li> </ul>	er				
	<ul> <li>(q) The Contractor shall comply with the provision of all relevant Acts of Central or State Governments including payment of Wages Act 1936, Minimum Wages Act 1948, Employer's Liability Act 1938</li> <li>Workmen's Compensation Act 1923, Industrial Dispute Act 1947</li> <li>Maturity Benefit Act 1961, Employees State Insurance Act 1948</li> <li>Contract Labor (Regulations &amp; Abolishment) Act 1970 or an modification thereof or any other law relating whereto and rule made there under from time to time</li> </ul>	of ct 3, 7, 8, 1y es				
	(r) In order to ensure longevity, safety of the core equipment an optimum performance of the system the contractor should use on genuine spares of high guality standards.	id Iy				
	<ul> <li>(s) Deployment of Plant in Charge, adequate number of technica support staff and other supporting personnel during the O&amp;M period</li> </ul>	al d				
	<ul> <li>(t) Bidder is required to maintain adequate O&amp;M spare during the O&amp;M contract period of the Solar PV plant with the view to maximize availability and generation of the plant. In case, Contractor uses mandatory spares, provided by CCL, the contractor shall have to return/replenish the spare(s) of the matching quality, quantity and rating within shortest possible time.</li> </ul>					
	<ul> <li>At the time handing over of the plant by the contractor to CCL, th contractor shall handover equipment and spares in health condition</li> </ul>	ie iy				
	<ul> <li>(v) Bidder has to take Comprehensive Annual Maintenance Contraction (AMC) from Original Equipment Manufacturer (OEM) or OE</li> </ul>	ct M				
Developme Project at (CCL) CHP/	t of 20MW Solar PV Central Coalfields Limited PP Piparwar, Jharkhand TECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-9296-004-9 PART-E Page CHAPTER-E5 2 of 7					
CLAUSE NO.		TECHNI	CAL SPECIFICATIONS	Į.	लरीपीमी NTPC	
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		<ul> <li>authorized servic trial run) for the fo</li> <li>PCU System - I electronic cards</li> <li>SCADA</li> </ul>	e provider for a period of <b>10</b> ollowing components: Replacement of spares like i as per OEM recommendation	<b>years</b> (after s inductors, capa ons	uccessful acitors,	
	(w) (x)	Replacement of being phased ou in bidder's scope Contractor shall required by stat commercial bid o	equipments/spare parts/ t or not being supported by be responsible to carry ou utory regulation in effect a ppening during O&M period.	updation of s OEM's is also ut all test and as on date of	oftwares included work as Techno-	
4.0	Insu	rance				
	(a)	<ul> <li>(a) CCL shall take Fire &amp; Allied Peril insurance during O&amp;M period. Insurance for theft to be taken by contractor.</li> </ul>				
	(b)	<ul> <li>b) 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     </li> </ul>				
	<ul> <li>(c) 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 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</li></ul>					
Developme Project at	nt of 20	DMW Solar PV Coalfields Limited	- TECHNICAL SPECIFICATION	PART-F	Page	
(CCL) CHP/	CPP Pipa	rwar, Jharkhand	BIDDING DOC. NO: RE-CS-9296-004-9	CHAPTER-E5	Page 3 of 7	

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	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.					
5.0	LD for shortfall in Gener	ation during O&M				
	Methodology for calculation of LD on shortfall in stipulated generation shall be as follows:					
	<ul> <li>Quoted Generation by the Bidder=G1</li> </ul>					
	<ul> <li>Reference Global Horizontal Insolation= H1</li> </ul>					
	<ul> <li>Measured Generation during the O&amp;M period=G2</li> </ul>					
	<ul> <li>#Measured Global Horizontal Insolation during the O&amp;M period= H2</li> </ul>					
	<ul> <li>Modified target Generation during the O&amp;M period (G2')</li> </ul>					
	G2	= (H2/H1) x G1x MCF x PG	F			
	where,					
	MCF = Module correction Operation X 0.007)	on factor for performance de	egradation = (1	I- Year of		
	Thus for third year of op	peration MCF = (1- 3*0.007)	= 0.979			
	<sup>\$</sup> O&M period after PG t	est shall only be considered	I for the first ye	ar O&M.		
	PGF = Performance Guarantee Factor which is ratio of achieved generation to modified target generation during the PG Test. It shall be always less than or equal to 1(one), if contractor has not met their guaranteed generation during the PG Test. It's maximum value shall be 1 even if generation achieved during PG Test is more than guaranteed generation.					
	Therefore, Liquidated E Charges)	Damages for shortfall in gei	neration= ΔG x	k (Energy		
Developme Project at (CCL) CHP/	nt of 20MW Solar PV Central Coalfields Limited CPP Piparwar, Jharkhand	TECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-9296-004-9	PART-E CHAPTER-E5	Page 4 of 7		

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	Then <b>∆G</b> =	Shortfall in gener	ation = G	2'-G2	
	In case G2' < or corresponding O&M p	= G2 then no eriod.	liquidate	ed damages	for the
	The maximum Liquidated Damages for the shortfall of generation during O&M period shall be limited to an amount equivalent to 10 % of the quoted generation by the bidder.				
	Tariff for computing Liquidity damage for O&M Period as per clause mentioned chapter A-2.				
	<sup>#</sup> In case, the GHI is not available because of instrumentation or SCADA problem, the corresponding insolation and generation shall be excluded from the time block for estimation of loss of generation.				
	Generation loss due to the grid outage not attributed to the contractor shall also be excluded for arriving loss of generation.				
	One day shall be equally divided into 96 blocks of 15 minutes each starting from 00:00 Hrs, i.e. 42 <sup>nd</sup> time block shall be from 10:15-10:30 Hrs.				
	In case of shortfall in generation, recovery of LD shall be first deducted from payment towards O&M contract value upto limiting level of 25% of the Annual Contract Value. The adjustment of LD amount shall be done in the 4 <sup>th</sup> Quarter.				
	In case the LD recovery amount exceeds above limiting value, balance amount shall be recovered through Bank Guarantee submitted by EPC Contractor against 'Security against overall system performance during O&M period and AMC Period'. The value of amount encashed from above BG shall have to be replenished by EPC contractor within three months.				
5.1	Calculation of BG and P	Proposal for 20 MW	/ Sample	Project	
	<ul> <li>Value of the Annual O&amp;M Contract = Say Rs. Y per Year</li> <li>O&amp;M Charges payable to the contractor on Quarterly basis= Rs. Y / 4 per Quarter</li> <li>Maximum LD deductible from O&amp;M contract = 25 % of Annual O&amp;M Contract value in Q4 =Rs. (Y / 4)</li> </ul>				
	The complete LD amou	nt shall be adjuste	d in the 4 <sup>t</sup>	<sup>n</sup> Quarter.	
Developmer Project at (CCL) CHP/	nt of 20MW Solar PV Central Coalfields Limited CPP Piparwar, Jharkhand	TECHNICAL SPECIFIC BIDDING DOC. NO RE-CS-9296-004-	CATION D: 9	PART-E CHAPTER-E5	Page 5 of 7

CLAUSE NO.	TECHNICAL SP	ECIFICATIONS	Į.	लरीपीमी NTPC			
	Sample Procedure for determ during O&M period as follow	Sample Procedure for determining LD for shortfall in generation during O&M period as follow					
	<ul> <li>O&amp;M Period being considered being considered being considered and the PGF=0.98 if during the PGF=0.98 if</li></ul>	<ul> <li>O&amp;M Period being considered 2nd Year i.e. MCF=0.986</li> <li>PGF=0.98 if during the PG Test, the shortfall in generation is 2%.</li> <li>Quoted Annual Generation by the Bidder (G1 in Million Unit) =45 MU</li> <li>Reference Global Horizontal Insolation (H1) = 1859 kWh/m2-year</li> </ul>					
	Measured Generation by Bidder	<sup>.</sup> (G2 in Million Units	) = 43.324 MU	(say)			
	Measured Global Horizontal Ins kWh/m <sup>2</sup> -year (say)	Measured Global Horizontal Insolation during O&M period (H2) =1895 kWh/m²-year (say)					
	Modified target Generation during the 2 <sup>nd</sup> year of the O&M period ( <b>G2'</b> ) = G1 x (H2/H1) x MCF x PGF = 45 x (1895/1859) x 0.986 x 0.98=44.324 MU						
	ΔG=G2'-G2=44.324-43.324= 1.0 MU						
	Since G2'>G2, LD applicability =Yes						
	<ul> <li>Value of LD in INR = Shortfall in Generation(MU) x Tariff = INR ΔG x R</li> <li>Maximum Value of LD towards shortfall in generation during O&amp;M period = Energy charges for 10% of Quoted generation = 0.1×G1 × R INR</li> </ul>						
	Where, R is applicable <b>tariff for LD as</b> G is the quoted 1 <sup>st</sup> Year Gen	s per clause mentio eration by the bidd	oned in Chapte ler.	er A-2.			
	Tariff for computing Liquidity mentioned chapter A-2.	/ damage for O&M	l Period as pe	er clause			
	In case of shortfall in generation, recovery of LD shall be first deducted from payment towards O&M contract value upto limiting level of Quarterly amount payable to the contractor towards AMC. In case the LD recovery amount exceeds above limiting value, balance amount shall be recovered through Bank Guarantee submitted by EPC Contractor against" Security against overall system performance during O&M period and AMC Period". The value of amount encashed from BG shall have to be replenished by EPC contractor within three months. The complete LD amount shall be adjusted in the 4th Quarter.						
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CLAUSE NO.		TECHN	ICAL SPECIFICATIONS	la l	ल्यौपीमी NTPC	
5.2	Contra	ctors liability duri	ng AMC period			
	Contrac period	Contractor shall carry out regular predictive maintenance during entire AMC period through OEM or OEM authorized service provider.				
	The Al Joint u EPC co	MC document handertaking docur	as to be submitted before ment (as per Performa attac completion of O&M contract.	completion of ched) is to be	trial run. furnished	
6.0	Handin	g over of the Pla	nt			
	(a)	(a) At the end of the contract period, the contractor shall hand over the plant and equipment back to the owner in completely safe and healthy condition and without any pending defect.				
	(b)	The items supplied by CCL on returnable basis, such as spares parts (from mandatory spares or through procurement)), consumables, tools and plants, documents etc. shall be returned back to CCL. Else suitable recoveries shall be made from the Contractor's bills.				
	After C O&M c O&M o	After O&M period, CCL may at its discretion decide to extend the existing O&M contract on mutually acceptable terms & conditions or undertake the O&M of the SPV Plant on its own				
Developme Project at (CCL) CHP/	Development of 20MW Solar PV Project at Central Coalfields Limited (CCL) CHP/CPP Piparwar, Jharkhand		TECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-9296-004-9	PART-E CHAPTER-E5	Page 7 of 7	

## CHAPTER-E6 PERFORMANCE GUARANTEE (PG) TEST

The final acceptance test as to prove the Performance Guarantee shall be conducted at Site by the Contractor in presence of the Employer. The PG test shall be conducted on the basis of PG test procedure to be submitted by the contractor and approved by NTPC. This test shall be binding on all the parties of the Contract to determine compliance of the equipment with the functional guarantee. Any special equipment, instrumentation tools and tackles and manpower, required for the successful completion of the Performance Guarantee Test shall be provided by the Contractor free of cost. The accuracy class of the instrumentation shall be as per the relevant clause of documents.

The procedure for PG demonstration test shall be as follow:

Any consecutive three months period for the purpose of conducting performance guarantee test shall be chosen on the discretion of NTPC.

- a. Bidder is required to quote the annual target generation in the techno-commercial bid.
- b. Bidder has also to quote the month wise Target Generation per MWp solar capacity for fixed tilt mode in the techno-commercial bid.
- c. If the plant is not able to achieve the target generation as per the PG procedure during the test period, then contractor shall compensate NTPC with an amount equivalent to the loss of generation based on tariff as per Clause mentioned in Chapter A-2 and sample calculation in Table-B.
- d. The maximum amount of liquidated damages for shortfall in generation during PG Test shall not exceed 25% of the contract value, excluding O&M charges.
- e. Sample calculation sheet for arriving month wise target generation for annual quoted generation of 45 MU for 20 MW capacity is shown in Table- A.

CLAUSE NO.	TECHNICAL SPECIFICATIONS					
			Table -A			
	MonthSolar Insolation (kWhr/m2)Month wise Target generation Quoted by Bidder in MWhr*				ntion nr*	
	January 133.8 3635			3635		
	February		146.9			3679
	March		185.1			4455
	April		194.2			4445
	May		206.2			4498
	June		166.3			3736
	July		135.4			3231
	August		141.7			3411
	September		138.5			3228
	October		143.4			3584
	November		133.4			3528
	December 134.1				3570	
			1859		4	45000
	<ul> <li>** Ey=Sum of derived month wise generation in MU.</li> <li># NTPC has right to question the rationality of the month wise quoted generation from both mode of generation.</li> <li>f. Only the generation arrived in column 'F' shall be used for arriving LD during PG test procedure as shown in sample calculation.</li> <li>g. In addition to the two pyranometers to be supplied under the scope of work, the contractor shall install one more calibrated pyranometers at horizontal plane at locations mutually agreed by Contractor and NTPC. The additional pyranometer shall be free of cost on returnable basis</li> </ul>					
<ul> <li>h. Contractor shall also install data logger to store all the pyranometers data during test period. A valid test reports for the installed pyranometers shall be submitted by the Contractor for approval to NTPC. The output of both pyranometers mounted on horizontal plane shall be made available at SCADA during the complete PG test duration i.e. three-month period.</li> </ul>						
	i. During approve	the PG ed schedu	test period, the ule.	module til	t shall be kep	ot as per
	j. Actual e noted fo	energy ex or three o	ported from the consecutive mon	plant at the th period. F	e metering poin for this purpose	t shall be e, the net
Develop Project at (CCL) CHF	Development of 20MW Solar PV Project at Central Coalfields Limited (CCL) CHP/CPP Piparwar, Jharkhand		TECHNICAL SPECI BIDDING DOC. RE-CS-9296-00	FICATION NO: 94-9	PART-E CHAPTER-E6	Page 2 of 4

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	energy exported and pyranomete daily basis for en	energy exported at the metering point (As per CI. 4.0 of Chapter A-1) and pyranometers reading shall be noted at agreed frequency on daily basis for entire PG test period.					
	k. This measured v Target Generatic	alue of energy shall be com on" for the PG test.	pared with "M	onth wise			
	Following factors shall to Generation" and shortfa	be considered for computing III (if any)	the "Target				
	<ul> <li>a. Effect of any meteorological parameters shall not be considered except of solar radiation.</li> <li>b. Variation of Performance Guarantee on account of Generation loss due to grid outage (or power evacuation system which is not in the scope of the Bidder): The measured global solar radiation of the period of the outage of the power evacuation system shall be excluded to calculate the cumulative global Insolation for the month. Under such situation, the radiation corresponding to the warm-up time of inverter as per data sheet shall also be adjusted to arrive at the cumulative global insolation for the month.</li> </ul>						
	If the difference of reading between the two horizontally mounted pyranometers exceeds more than 2%, the test shall be halted and resumed only after rectification of errors which has led to mismatch. The data of that particular day(s) shall be discarded and test period shall be extended by same numbers of day(s).						
	The test shall be repeated in case of outage of following equipments for more than 7 days.						
	<ul> <li>a. Converter transformer</li> <li>b. Power Conditioning Unit</li> <li>c. SCADA and data logger combined</li> <li>d. Both pyranometers.</li> </ul>						
	If bidder is not able to demonstrate PG test during these three (03) months he shall be given one more chance to demonstrate the PG test. In that case, the steps for PG test shall be repeated again as above after carrying out necessary modification/replacement.						
	A sample calculation for shortfall in energy generation for period from 10th January to 09th April and LD calculation for the site is given in next page in <b>Table-B</b> .						
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CLAUSE NO.			TEC			ATION	IS	[4	जरीपीसी NTPC
	Tal End	ble-B: A sa ergy for D	ample esign	e calcu life	lation for th	e Sol	ar Plant f	or Total Sho	ort fall in
Month	Global Solar Insolation of the month (kWhr/(m²xday) <b>(a)</b>	Target Generation (MWhr) (Target generation as per Table- <b>A</b> ) <b>(b)</b>	No of test days of the month (c)	Reference Solar Insolation (d) = (a) x (c) /( <sub>Ndm*</sub> )	Modified Target Generation of the month (MWhr) (e) = (b)x(d)/(a)	Measured Global Horizontal Solar Insolation (kWhr/m2) <b>(f)</b>	Corrected Target Generation (MWhr) (g)= (e) × (f)/(d)	Measured Generation at Metering Point (MWhr) (h)	Shortfall in energy for PG test (g-h)#
January	133.8	3635	22	118.3	2579.677	125	2725.77	9 2795.81	4 70.035
February	146.9	3679	28	176.1	3679	155	3238.18	8 3258.19	8 20.01
March	185.1	4455	31	208.3	4455	195	4170.54	7 4130.38	7 -40.16
April	194.2	4445	9	60.5	1333.5	63	1388.60	3 1438.71	8 50.115
					12047.177		11523.1	.2	100.000
	* N <sub>dm</sub> = Nos of days in the month ** Test is assumed to start from 10 January till 9 <sup>th</sup> April # -ve value denotes excess generation Total Short fall in Energy for the test period ( $\Delta G_{TP}$ ) = 70.035+20.01-40.16+50.115 = 100 MWhr Modified Target generation for the test period (GTP) = 12047.177 MWhr Target yearly generation ( $G_Y$ ) = $G_Y \times \Delta G_{TP} / G_{TP}$ = 45000 x 100/12047.177 = <b>373.531 MWhr</b> Yearly loss of Revenue and applicable LD ( <b>INR</b> ) = $\Delta G_Y \times 1000 \times R \times N$ Applicable LD for complete life of plant (in INR) = <b>373.531</b> x1000 x R x 10.6384 Where <b>R</b> is the applicable <b>tariff for LD as per clause in Chapter A-2.</b>								
Development of 20MW Solar PV       TECHNICAL SPECIFICATION       PART-E       Page         Project at Central Coalfields Limited       BIDDING DOC. NO:       CHAPTER-E6       4 of 4         (CCL) CHP/CPP Piparwar, Jharkhand       RE-CS-9296-004-9       CHAPTER-E6       4 of 4				Page 4 of 4					

CLAUSE NO	TECHNI	CAL SPECIFICATIONS	(	एनरीपीसी NTPC
	S	CHAPTER-E7 AFETY MANAGEMENT		
1.0	Bidder shall submit the as per the requiremen documents.	Safety Plan and the Safety ( t of Attachment No: 18 Sec	Coordination Pr ction-VII of the	ocedure bidding
2.0	During the execution of the contract, the bidder and it's sub-vendor (if any) shall follow safety procedures for the safety of the personnel and the equipments during erection, testing, commissioning, operation and the maintenance during the contract period as per the regulatory requirements and the as per the original equipment manufacturer's recommendations.			
3.0	All the expenses, charges towards compliance of the safety norms by the bidder as per the Safety Plan, Safety Policy, and the Safety Coordination Procedures are deemed to be included in the bid price. No additional claims shall be entertained towards meeting the safety requirements.			
4.0	Safety sign board to switchgear and all such	be provided near outdoor risk zone areas.	transformer y	ard, HT
Dovolonment	of 20MW Solar DV Project	<b></b>		
at Central ( CHP/CPP Pip	Coalfields Limited (CCL) arwar, Jharkhand	TECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-9296-004-9	PART-E CHAPTER-E7	Page 1 of 1

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	PART-F Q	UALITY ASSI	JRANCE
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CLAUSE NO	TECHNICAL SPECIFICATIONS					
	CHAPTER-F1 QUALITY ASSURANCE					
	Components wise QA chapter has been furnished at Annexure-F1.					
	Indicative Vendor list of Civil, Electrical and C&I components are furnished at <b>Annexure-F2</b> .					
,						
Development at Central CHP/CPP Pip	of 20MW Solar PV Project Coalfields Limited (CCL) arwar, Jharkhand	TECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-9296-004-9	PART-F CHAPTER-F1	Page 1 of 1		

1.

# CHAPTER-F2

## QUALITY ASSURANCE AND INSPECTION FOR CIVIL WORKS

### 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.

#### 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

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CLAUSE NO.	TECHNI		R	नरीपीमी NTPC
	approval/ acceptance and of the concern activity.	further shall ensure their avail	ability well befor	e the start
2.	LABORATORY AND FIEL The field laborator up by the contractor in enclosed at Annexure-I. T with the adequate faciliti Temperature and humidit testing of samples. The instrument, which the com for meeting the field qua comprehensive list of the planned/scheduled tests approval. The contractor QA&QC manpower at leas schedule of tests. All equipments an commencement of tests a recommendation and as specify the fitness of the for use. Contractor shall a an NABL / NPL accredited NTPC. The tests which ca at a laboratory of repute government / autonomout testing laboratories. The sealed by the engineer laboratory through the co along with the recomment delay and submitted to NT Based on the sche approved FQP, the contra- to the engineer-in-charge agreed.	LD TESTING y for QA and QC activities shall line with the indicative field Q he Laboratory building shall be ies to meet the requirement y controls shall be available w e quality plan shall identify tractor shall deploy and equip ality plan requirements. The of esting equipments/ instrumer for the execution of works shall mobilize the requisite I ast 15 days prior to the planne d instruments in the field shall and then at regular intervals, a directed by the NTPC. The ca equipments and instruments w arrange for calibration of equip d agency and the calibration re- annot be carried out in the field e. This includes selected IITs is laboratories / organizations test samples for such test shall and thereafter these shall be overing letter signed by NTPC idations shall be obtained from TPC.	all be constructed QA&QC laborato e constructed an of envisaged to therever necessi- the testing eq the field quality contractor shall at required to a for NTPC ac aboratory equip ed test activity a ll be calibrated I as per the manu- alibration certifice vithin the limit of ments and instru- eport shall be su d laboratory shall be sufficiently sel e sent to the of engineer. The to n the laboratories of tests and su the tests as so	d and set- bry set-up d installed est setup. ary during juipments/ laboratory furnish a meet the cceptance/ ment and as per the ufacturer's ates shall tolerance uments by bmitted to II be done 6, reputed ected and concerned rest report es without ge and the bmit them theduled /
Developmer	nt of 20MW Solar PV	TECHNICAL SPECIFICATION	PART-F	Page
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3.	SAMPLING AND TESTIN	G OF CONSTRUCTION MATE	ERIALS		
	The method of sampling for testing of construction materials and work / job sa shall be as per the relevant IS / standards / codes and in line with the require of the technical specifications / quality plans. All samples shall be jointly signed and sealed wherever required, by the contractor and the engineer authorized representative.				
	The contractor shall carry of / codes and in line with th plans. Where no specific te out as per the best preval Engineer. All testing shall be representative in a NABL a includes all IITs, NCB, CS organizations, NITs and ot such test shall be jointly se shall be sent to the conce NTPC engineer. The test re from the laboratories without	hall carry out testing in accordance with the relevant IS / standards ine with the requirements of the technical specifications / quality specific testing procedure is mentioned, the tests shall be carried best prevalent engineering practices and to the directions of the ting shall be done in the presence of the engineer or his authorized a NABL accredited / Govt. Laboratory acceptable to NTPC. This NCB, CSMRS, reputed government / autonomous laboratories / ITs and other reputed testing laboratories. The test samples for e jointly selected and sealed by the engineer and thereafter these the concerned laboratory through the covering letter signed by The test report along with the recommendations shall be obtained ries without delay and submitted to NTPC.			
4.	PURCHASE AND SERVICE				
	<ul> <li>PURCHASE AND SERVICE <ul> <li>All Structural steel and Reinforcement steel supply if in the scope of the contractor shall be procured from Main Steel Producers enlisted by NTPC from time to time. Currently, Main Steel Producers enlisted by NTPC are SAIL, JSW Steel Ltd, Jindal Steel &amp; Power, Tata steel Ltd. (for Reinforcement steel/TMT bars), RINL (for long products/Rolled sections and Reinforcement steel/TMT bars), Essar Steel India Ltd. (for Flat products/ Steel Plates), Electrosteel steel Ltd. (for Reinforcement steel/TMT bars) and Monnet Ispat and Energy Ltd. (for long products/Rolled sections and Reinforcement steel/TMT bars). Subsequently, if any new Main Steel Producer/s are enlisted, they may also be considered for procurement during execution of the contract if proposed by the Contractor.</li> <li>In case of non-availability of certain steel section/s i.e. Angle smaller than 100x100x10 mm, MS flats, rounds, square bars and chequered plate from primary steel producers, an option is given to the Main contractor to source these sections directly from SAIL Conversion/Wet Leasing agent subject to the conditions given at point no. A) below:</li> <li>A) Approval conditions for procurement of structural steel sections through SAIL Conversion/Wet Leasing agent:</li> <li>1. Main Contractor to ensure continuity of BIS license of the manufacturer for the sections being manufactured for NTPC supply.</li> <li>2. Billets shall be procured from NTPC approved Main Steel Producers. Proper records for traceability from raw material to final product shall be maintained.</li> <li>3. 100% chemical analysis of the raw material (Billets) shall be carried out as per IS: 2062 on finished product.</li> <li>4. Each lot of delivery of finished product shall be accompanied with co-relatable Manufacturer's Test Certificate (MTC). MTC of finished sections shall be correlated</li> </ul> </li> </ul>				
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	with original MTC for Billets received from Main Steel Producer and Manufacturer Test Report of chemical analysis of Billets mentioned at point no.3. MTC of finished sections shall include the reference of MTC for Billets from Main Steel Producer. 5. NTPC will have access to carry out the surveillance checks for in-process stage. 6. In case of any defects are seen in the material, Main Contractor will replace the material without any cost implication to NTPC.				
	In case of non-availability of certain size/s of steel tubes conforming to IS:116 <sup>-</sup> and Hollow (square and rectangular) steel sections conforming to IS: 4923 from primary steel producers, the same may be sourced from BIS approved sources having valid BIS license subject to the conditions given at point no. B) below: B) Approval conditions for procurement of Steel tubes conforming to IS: 1161 and Hollow (square and rectangular) steel sections conforming to IS: 4923 from BIS approved sources:				
	<ol> <li>Main Contractor to ensure continuity of BIS license of the manufacturer for the sections being manufactured for NTPC supply.</li> <li>Raw materials shall be procured from NTPC approved Main Steel Producers.</li> <li>100% chemical analysis of the raw material (steel) shall be carried out as per IS: 228. Testing of samples of steel tubes and hollow sections from each lot shall be carried out as per IS: 1161 &amp; IS: 4923 respectively on finished product.</li> <li>Each lot of delivery of finished product shall be accompanied with co-relatable Manufacturer's Test Certificate (MTC).</li> </ol>				
	<ul><li>5. NTPC will have access to carry out the surveillance checks for in-process stage.</li><li>6. In case of any defects are seen in the material, Main Contractor will replace the material without any cost implication to NTPC.</li></ul>				
	The specific methodology to be followed for procurement of Structural Steel and Reinforcement Bars through conversion route/BIS approved sources route shall be subject to approval by NTPC in advance.				
	For Module Mounting Structures, Structural steel shall be procured from mutually agreed suppliers."				
	The other conditions are covered in the chapter 'GTR'.				
5.	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-03/F2, 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				t the Field pproval of es, quality technical ver for all right from eld Quality	
Developmer Project at (CCL) CHP/0	nt of 20MW Solar PV Central Coalfields Limited CPP Piparwar, Jharkhand	TECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-9296-004-9	PART-F CHAPTER-F2	Page 4 of 6	

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6.	Plan for civil works is en structural steel works). GENERAL QA REQUIRE	closed at Annexure – II (Ind <b>MENTS</b>	icative FQP for	civil and
	The contractor shall ensure contract whether manufactur contractor's premises or at accordance with the NTPC approved drawings / data se services shall be carried out the directions of the Engine	e that the works, BOIs and se ured or performed within contra t the NTPC's site or at any o C technical specification, appli sheets / quality plans and BOC it as per the best prevalent en-	rvices under the ctor's works or a ther place of wo cable standards a. All the works, gineering practic	e scope of at his sub- ork are in a / codes, BOIs and ces and to
	Lists of Items requiring Quality Plan and Sub-Supplier Approval has been attached at Annexure-III.			
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		QA/QC LAB EQI	JIPMENT	JRE – I OF CHA	APTER F2
	S.No	Equipment		Approximate Nos.	9
	1.	Cube Moulds f	or cement testing	12	
	2.	Sieve shaker	¥	1	
3. Sieves for sa		Sieves for san	d, coarse & fine aggregate	1 set for each	۱
	4.	Sieves for coa	rse aggregate	1 set	
	5.	Slump testing	equipment	6 sets	
	6. Oven			2	
	7. Physical balance		се	1	
	8. Thermometer 9. Burret			4	
			2		
	10. Measuring cylinders		3		
	12 Compression testing machine		1 set		
12.     Compression testing machine       13.     Cube moulds for Concrete       14.     Mechanical weighing machine		or Concrete	18		
		Mechanical we	ighing machine	1 (100 capacity)	kg
15.		Drum Type Co	ncrete Mixer (for trial mixes)	1	
16. Proctor Testing		g Equipment	1 set		
<ul> <li>Note:</li> <li>1. The equipments listed above are indicative and required to be mobilized as minimum requirement. Additional equipment if any, required for successful completion of work shall be provided /arranged by the contractor.</li> <li>2. All test reports/ inspection reports have to be computerized and maintained on LAN with an access to the owner</li> <li>3. Based on the schedule (L2/L3 Network), Quality control &amp; 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.</li> </ul>					
Developmer Project at (CCL) CHP/0	nt of 20MW Central Coalf CPP Piparwar,	Solar PV ields Limited Jharkhand	TECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-9296-004-9	PART-F CHAPTER-F2	Page 6 of 6

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	GENERAL TE	PART-G ECHNICAL REQUI	REMENTS	
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CLAUSE NO.	TECHN	CAL SPECIFICATIONS	L.	लरीपीसी NTPC
	G-1 GENER	RAL TECHNICAL REQUIRE	MENTS	
1.0	INTRODUCTION			
	This part covers techni the Contract. The follo technical requirements Technical Data Sheets.	cal requirements which will wing provisions shall supp brought out in the Technica	form an integr plement all the al Specification	al part of detailed s and the
2.0	BRAND NAME			
	Whenever a material o particular brand, manuf be understood to be ind restrictive; other manu sufficient information is the products proposed a	r article is specified or desc acturer or vendor, the speci dicative of the function and afacturer's products may b furnished to enable the Em are equivalent to those name	cribed by the n ific item mentic quality desired pe considered ployer to deter ed.	ame of a oned shall l, and not provided mine that
3.0	BASE OFFER & ALTER	RNATE 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.			
4.0	COMPLETENESS OF FACILITIES			
a)	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.			
b)	b) 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			in every cessories erection, nd for the s, though
Developmer Project at (CCL) CHP/0	nt of 20MW Solar PV Central Coalfields Limited CPP Piparwar, Jharkhand	TECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-9296-004-9	PART-G	Page 2 of 31

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	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.				
5.0	Codes & Standards				
5.1	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				
	<ul> <li>Pollution Control Regulations of Department of Environment, Government of India</li> </ul>				
	j) State Pollution Control Board.				
	k) Rules for Electrical installation by Tariff Advisory Committee (TAC).				
	<ol> <li>Any other statutory codes / standards / regulations, as may be applicable.</li> </ol>				
5.2	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)				
Developmer Project at (CCL) CHP/0	nt of 20MW Solar PV Central Coalfields Limited CPP Piparwar, Jharkhand TECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-9296-004-9 PART-G Page 3 of 31				

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	e) American Petro	eum Institute (API)		
	f) Standards of the	e Hydraulic Institute, U.S.A.		
	g) International Or	ganization for Standardization	n (ISO)	
	h) Tubular Exchan	ger Manufacturer's Association	on (TEMA)	
	i) American Weldi	ng Society (AWS)		
	j) National Electric	al Manufacturers Association	n (NEMA)	
	k) National Fire Pr	otection Association (NFPA)		
	I) International Ele	ectro-Technical Commission	(IEC)	
	m) Expansion Joint	Manufacturers Association (	EJMA)	
	n) Heat Exchange	Institute (HEI)		
5.3	Other International/ Na shall also be accep standards, subject to f furnish, alongwith the standards are equivale all such cases the E deviations from the si together with the comp normally not published	ational standards such as Di ted for only material cod the Employer's approval, for offer, adequate information ant or superior to the standar bidder shall furnish specific tandards mentioned elsewh olete word to word translation in English.	IN, VDI, BS, G es and manu which the Bio on to justify the ds mentioned ally the variate ere in the spen n of the standa	OST etc. ufacturing dder shall hat these above. In ions and ecification ard that is
5.4	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.			
5.5	In the event of any cor the above clauses requirement of Technic	flict between the codes and and the requirement of al Specification shall govern.	standards refe this specifica	erred to in tion, the
5.6	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.			
5.7	In case of any change of bid opening and th Employer shall have th	in codes, standards & regulate date when vendors proce e option to incorporate the c	ations betweer ed with fabrica hanged require	the date ation, the ements or
Developmer Project at (CCL) CHP/0	nt of 20MW Solar PV Central Coalfields Limited CPP Piparwar, Jharkhand	TECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-9296-004-9	PART-G	Page 4 of 31

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CLAUSE NO.	TECHN to retain the original sta to bring to the notice of of the resulting effect.	ICAL SPECIFICATIONS Indard. It shall be the respond f the Employer such change	sibility of the Ces and advise	Contractor Employer
Developmer Project at (CCL) CHP/0	nt of 20MW Solar PV Central Coalfields Limited CPP Piparwar, Jharkhand	TECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-9296-004-9	PART-G	Page 5 of 31

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6.0	EQUIPMENT FUNCTIC	NAL GUARANTEE		
a)	The functional guaran Contract is given el guarantees shall suppl covered under General	unctional guarantees of the equipment under the scope of the act is given elsewhere in the technical specification. These shall supplement the general functional guarantee provisions ed under General Conditions of Contract.		
b)	Liquidated damages for the performance guarar Contractor as specified	r shortfall in meeting functional guarantee(s) during ntee tests shall be assessed and recovered from the elsewhere in this specification.		
7.0	DESIGN OF FACILITIE CONSIDERATIONS	S/ MAINTENANCE & AVAIL	ABILITY	
a)	Design of Facilities			
	All the design procedure already been adequate reliability under similar of	res, systems and componer ely developed and shall ha conditions elsewhere.	nts proposed s ave demonstra	hall have ted good
	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			
b)	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.			
c)	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.			ovided by ng weight	
Developmer Project at (CCL) CHP/0	nt of 20MW Solar PV Central Coalfields Limited CPP Piparwar, Jharkhand	TECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-9296-004-9	PART-G	Page 6 of 31

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	Lifting devices like lifting hoist / crane shall be p and accessories covere	g tackles, slings, etc. to be c provided by the contractor f d under the specification.	connected to he for lifting the e	ook of the quipment	
8.0	DOCUMENTS, DATA A CONTRACTOR	ND DRAWINGS TO BE FU	RNISHED BY		
a)	Bidders may note that the elsewhere in the specification, fully integrated, engineer technical specification, ensuring a completely mechanical, electrical, or per the scope.	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.			
b)	The Contractor shall for covered under this specified information as specified documentation shall inc	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 :			
a)	INSTRUCTION MANUAL	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 & Commi	ssioning Manuals/Checklis	sts		
	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.			submitted ctivities of ntain the	
	a) Erection strategy.				
	b) Sequence of erec	tion.			
	c) Erection instructio	ns.			
	d) Critical checks an	d permissible deviation/toler	ances.		
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	e)	List of tool, tackle	es, heavy equipment like c	ranes, dozers,	,	
	f)	Bill of Materials				
	g)	Procedure for ere	ction.			
	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 / Chec	k list for pre-commissioning	activities.		
	I)	I) Procedure / Check list for commissioning of the system.				
	m) Safety precautions to be followed in electrical supply distribution during erection					
	(b) Operation & Maintenance Manuals					
<ul> <li>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.</li> </ul>					drawings shall be in dismantle, all give a but during ntenance, chemical complete s of the tract shall over until	
	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 i	nclude the following :			
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	a. List of spare procedure for	parts along with their drawi ordering spares.	ng and catalog	jues and	
	<ul> <li>b. Lubrication Schedule including charts showing lubrication checking, testing and replacement procedure to be carried daily, weekly, monthly &amp; at longer intervals to ensure trouble free operation.</li> </ul>				
	c. Where applicable, fault location charts shall be included facilitate finding the cause of mal-operation or break down.				
	<ul> <li>v. Detailed specificatio greases, chemicals required for the comp</li> </ul>	ns for all the consumables etc. system/equipment/assen plete plant.	including lubr hbly/sub-assemt	icant oils, oly - wise	
	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.				
b)	Project Completion Rep	ort			
	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.				
c)	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 a	pproval of the	Employer	
	b) Information that	would be submitted for Empl	over's informat	tion only	
	The Engineering Inform	ation Schedule shall be upd	ated month-wis	se.	
	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				
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	and delivery of equipments while determining the o	ent and hardware and this s verall performance and prog	shall be duly co ress	onsidered	
d)	ENGINEERING PROGRE	SS AND EXCEPTION REPOR	RT		
,	Report giving the status	of each engineering information	ation including		
	(a) A list of dra unapproved for submission	awings/engineering inform more than four (4) weeks	ation which after the dat	remains e of first	
	(b) Drawings which	were not submitted as per a	greed schedule	9.	
	The draft format for four (4) weeks of discussed and finalis	this report shall be furnished the award of the contrac sed with the Employer.	d to the Emplo t, which shall	yer within then be	
e)	TECHNICAL CO-ORDIN	ATION MEETING			
	<ul> <li>The Contractor progress Meetin during the period progress &amp; reso shall attend such such persons an</li> </ul>	shall organize and attend ogs with the Employer/Emp of Contract at mutually agree lving technical clarifications meetings at his own cost a d agencies involved during t	at least one bloyer's repres eed venues for , if any. The C and fully co-ope he discussions	monthly sentatives review of Contractor erate with	
	<ul> <li>The Contractor shall ensure availability of theconcerned 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.</li> </ul>				
	<ul> <li>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.</li> </ul>				
f)	DESIGN IMPROVEMENT	S			
	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				
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	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.				
g)	EQUIPMENT BASES				
	A cast iron or welded steel base plate shall be provided for all rota equipment which is to be installed on a concrete base, unless other specifically agreed to by the Employer. Each base plate which suppor unit and its drive assembly, shall be of a neat design with pade anchoring the units, shall have a raised lip all around, and shall h threaded drain connections				
h)	PROTECTIVE GUARDS				
	Suitable guards shall be rotating and/or moving for easy installation and	e provided for protection of p machine parts. All such gu I removal for maintenance p	ersonnel on all uards shall be urpose.	exposed designed	
i)	LUBRICANTS, SERVO F	LUIDS 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.				
	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 alongwith lubrication requirements.				
	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.				
j)	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.				
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k)	RATING PLATES, NAME	PLATES & LABELS			
	Each main and auxiliary item of plant including instruments shall have permanently attached to it in a conspicuous position, a rating plate of no corrosive material upon which shall be engraved manufacturer's nam equipment, type or serial number together with details of the rating service conditions under which the item of plant in question has bee designed to operate, and such diagram plates as may be required by th Employer.				
	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 or both front and rear sides.				
	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.				
	Nameplates shall be as per best practices of the industry				
	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.				
	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				
I)	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.				
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m)	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.				
n)	COLOUR CODE FOR AL	L EQUIPMENTS/ PIPINGS/ P	IPE SERVICES		
	All equipment/ piping/ p accordance with Emplo furnished to the Contrac	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.			
o)	PROTECTION AND PRE	SERVATIVE SHOP COATING			
	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.				
	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.				
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	All other steel surfaces suitable rust preventive	which are not to be paint compound subject to the ap	ed shall be co proval of the E	ated with mployer.	
	All piping shall be clea means approved by the pickled.	ned after shop assembly b Employer. Lube oil piping	y shot blasting or carbon stee	or other I shall be	
	Painting for Civil structures shall be done as per relevant part of technica specification				
9.0	QUALITY ASSURANCE	PROGRAMME			
a)	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:				
b)	(a) His organisation structure for the management and implementation of the proposed quality assurance programme				
	(b) Quality System Manual				
	(c) Design Control System				
	(d) Documentation and Data Control System				
	(e) Qualification data for bidder's key personnel.				
	(f) 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.				
	(g) System for shop manufacturing and site erection controls including process, fabrication and assembly.				
	(h) Control of non-c and resolution of	onforming items and system	m for correctiv	e actions	
	(i) Inspection and activities.	test procedure both for	manufacture	and field	
	(j) Control of calibra	tion and testing of measurin	ig testing equip	oment.	
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	(k) System for Quali	ty Audits.			
	(I) System for identi	ification and appraisal of ins	pection status.		
	(m)System for aut Employer.	horising release of manufa	actured produ	ct to the	
	(n) System for hand	ling, storage and delivery.			
	(o) System for main	tenance of records, and			
	(p) Quality plans for specific quality o characteristics re	r manufacturing and field ac control procedure adopted fo elevant to each item of equip	ctivities detailin or controlling tl ment/compone	g out the he quality ent.	
c)	GENERAL REQUIREME	NTS - QUALITY ASSURANCE			
	a) All materials, specification commissioned comprehensive programme of for some of th specification. comprehensive draw up and i Employer. The activities shall Employer for a plans will be fin QAI-P-01/F3.	components and equipme shall be procured, m and tested at all the e Quality Assurance Progra inspection/tests to be carried in major items is given in the This is, however, not e programme as it is the con- implement such programme e detailed Quality Plans for be drawn up by the Bidder approval. Schedule of fina- nalised before award on encl	ent covered u hanufactured, e stages, as ramme. An ed out by the o the respective intended to tractor's respon e duly approve manufacturing and will be sub alisation of suc osed format Ne	nder this erected, per a indicative contractor technical form a nsibility to ed by the and field omitted to ch quality o. QS-01-	
	<ul> <li>b) 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.</li> <li>c) 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</li> </ul>				
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	<ul> <li>d) 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.</li> </ul>				
	<ul> <li>e) 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).</li> </ul>				
	f) 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.				
	g) 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.				
	<ul> <li>h) 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.</li> </ul>				
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	All welding/brazing procedures shall be submitted to the Employer or its authorised representative for approval prior to carrying out the welding/brazing.					
	<ul> <li>a) 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.</li> </ul>					
	b) Welding procedure qualification & Welder qualification test result shall be furnished to the Employer for approval. However, where required by the Employer, tests shall be conducted in presence of Employer/authorised representative.					
	c) 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.					
	d) Unless otherwise proven and specifically agreed with the Employer, welding of dissimilar materials and high alloy materials shall be carried out at shop only.					
	e) No welding shall be carried out on cast iron components for repair					
	<ul> <li>f) All the heat treatment results shall be recorded on time temperature charts and verified with recommended regimes.</li> </ul>					
	g) 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.					
	<ul> <li>a) 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</li> </ul>					
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	Contractor and Employer's ap The contractor established a process stabili along with h contractors en approval withi discussion ar procurement. contractor from contract.	d finalised with the Employ proval on enclosed format N or's proposal shall inclu t the respective works, t zation, QC systems followe is own technical evaluati closed and shall be submit n the period agreed at the nd identified in "DR" can Such vendor approval n any obligation, duty or n	ver, shall be s No. QS-01-QAI Ide vendor's the process of ed, experience on for identif ted to the Emp he time of pr ategory prior shall not re responsibility u	subject to I-P-01/F3. facilities capability, e list, etc. fied sub- ployer for re-awards to any lieve the under the			
	<ul> <li>b) For components/equipment procured by the contractors for purpose of the contract, after obtaining the written approval of Employer, the contractor's purchase specifications and inquishall call for quality plans to be submitted by the suppliers. quality plans called for from the sub-contractor shall set out, due the various stages of manufacture and installation, the que practices and procedures followed by the vendor's quality corroganisation, the relevant reference documents/standards us acceptance level, inspection of documentation raised, etc. Sequality plans of the successful vendors shall be finalised with Employer and such approved Quality Plans shall form a part of purchase order/contract between the Contractor and secontractor. With in three weeks of the release of the purch orders /contracts for such bought out items /components, a cop the same without price details but together with the deta purchase specifications, quality plans and delivery conditions set furnished to the Employer on the monthly basis by Contractor along with a report of the Purchase Order placed so</li> </ul>						
	c) 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.						
	d) 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						
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	tests/inspection conform to r codes/standa carrying out te	tests/inspection required to establish that the items/equipmen conform to requirements of the specification and the relevan codes/standards specified in the specification, in addition to carrying out tests as per the approved guality plan.					
	<ul> <li>e) Quality audit/surveillance/approval of the results of the tests inspection will not, however, prejudice the right of the Employer reject the equipment if it does not comply with the specifical when erected or does not give complete satisfaction in service the above shall in no way limit the liabilities and responsibilitie the Contractor in ensuring complete conformance of materials/equipment supplied to relevant specification, stand data sheets, drawings, etc.</li> </ul>						
	f) For all spares and replacement items, the quality requirements agreed for the main equipment supply shall be applicable.						
	<li>g) Repair/rectification procedures to be adopted to make the jol acceptable shall be subject to the approval of the Employer authorised representative.</li>						
	Environmental Stress Screening						
	a) Environmenta eliminating inf system & for o components ( transmitter, C necessarily fu assessment a vendors of ab test procedure it is asked for inspection / di	I stress screening test proces ant mortile components for D other systems having substan as determined by employer) I CTV components, PA system rnished for any sub vendors p nd approval for this contract. ove mentioned systems, cont e for eliminating infant mortile by the employer before these spatched to site.	as / procedure f DCMIS / PLC f itial electronics ike Electronic as etc. shall be proposed for ve For other appr fractor shall fur components ir e items are offe	for based endor oved sub nish the n case, if ered for			
	Software Reliability /	Quality Certification					
	<ul> <li>a) Certification from OEM's authorized signatory that software offered with DDCMIS, PLC, CCTV, PA, Pyrometer, CEMS, AAQMS, EQMS, BHMS etc. declaring that the all the offered software(s) had gone through the established software quality test and offered software is not of β-version and offered software is also free from all known bugs as on date of approval of systems documents by NTPC as a part of quality documentation review and approval process during detail engineering.</li> </ul>						
	NTPC follows a well of	lefined sub-contractor's/sub-	vendor assess	ment and			
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	approval process, the broad contours of which are also defined at NTPC website <u>www.ntpctender.com</u> alongwith a FAQ which answers most of the queries on the subject.							
	An indicative list of sub-vendors which has been accepted by NTPC in the past for Corporate Awarded similar packages based on the respective Technical Specifications are enclosed in the tender specification for reference purpose only. The purpose of this list is to provide general guidance to the prospective Bidders / Main Contractors for this package only. Further, 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. However, it is not the intention to limit the sub-vendor to only such names appearing in the above list and Main contractor is free to propose additional sub-vendors in his bid offer which will be subject to NTPC sub-vendor assessment system upon receipt of requisite details in a time bound mutually agreed schedule. Moreover listed suppliers may or may not be able to supply the material as per current Tech Specifications 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.							
	Standard Manufacturing Quality Plan (SQP)/Indicative Manufacturing Quality Plan(IQP)/ Standard Field Quality Plan (SFQP)/ Indicative Field Quality Plan(IFQP) are enclosed for the major items, which can be used as a reference purpose for item under consideration.							
	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 subcontractors and shall be submitted to the Employer for approval within a time bound schedule drawn during detailed engineering process. Such sub-vendor proposed in his bid offer shall be deemed to be identified in DR category and upon final acceptance by NTPC in writing, contractor can place order on such accepted sub-vendor only.							
	Monthly progress reports on sub-contractor detail submission / approval shall be furnished as per Engineering Co-ordination Procedure. Such vendor approval shall not relieve the contractor from any obligation, duty or responsibility under the contract. Sub-vendor whose details are not submitted within the agreed cut-off date, shall be deemed to be withdrawn by the contractor.							
Developmer Project at (CCL) CHP/0	nt of 20MW Solar PV Central Coalfields Limited CPP Piparwar, Jharkhand	TECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-9296-004-9	PART-G	Page 20 of 31				

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d	<ul> <li>QA DOCUMENTATION F</li> <li>The Contractor shall be hard copies and two CI tick mark.</li> <li>b) Each QA Docubearing name an index of its an anufacturing.</li> <li>The final quality docum assembly place of equipissued not later than the assembly place of equipissued not later than the application and ap an index of an interpretation and ap c) Manufacturer / work applicable codes an approved Quality Pla</li> <li>d) Non-destructive examplicable codes an approved Quality Pla</li> <li>d) Non-destructive examples and contractor for the place of traceability of the examples of traceability of the examples of the place of the</li></ul>	PACKAGE required to submit the QA I D ROMs, as identified in res mentation shall have a proje & identification number of e contents with page control of on file shall be progressive r to allow regular reviews b ent will be compiled and issu- pment before dispatch. Howe ree weeks. QA Documentation is as below proved Quality Plans. s test reports/results for test d standard referred in the sp ans. mination results /reports incl s. Sketches/drawings used for radiographs to the location of tificate/Record (Time- tempen n-conformance Reports (Maj echnical details / repair proc ports duly signed by the Insp ne agreed Customer Hold Po- mance (COC) wherever app	Documentation pective quality ect specific Cover quipment and n each docume vely completed by all parties of ued at the final ever CD-Rom n dow:- coming required as pecification and luding radiogra for indicating th on the equipme erature Chart) jor/Minor) / dev edure). pector of the Er coints. Dicable.	in two plan with ver Sheet including ent. d by the during the may be apper phy e method ent. viation, mployer
Developmer Project at (CCL) CHP/0	nt of 20MW Solar PV Central Coalfields Limited CPP Piparwar, Jharkhand	TECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-9296-004-9	PART-G	Page 21 of 31

CLAUSE NO.	TECHNICAL SPECIFICATIONS					
	<ul> <li>Similarly, the contracopies and two CD field activities as permanuals/ procedure</li> <li>Before dispatch / carnake sure that the protracted phased document file is corregarding the reading for review.</li> <li>(a) If the result of the the Inspector section) for released (b) If the quality document (or a requirements as quality document (or a requirements as quality document Inspector.</li> <li>(c) If a decision is cannot be readily that time. The equipment, send signed by the Su the committed d submission. The applicable section of QA document the dispatch of expected of the committed of the committed of the dispatch of expected of the dispatch of the dispatch of expected of the dispatch dispatch</li></ul>	actor shall be required to su ROMs), containing QA Doct er Approved Field Quality F s, prior to commissioning of ommissioning of any equipa corresponding quality docu- deliveries, the applicable mpleted. The supplier will the these of the quality document e review carried out by the shall stamp the quality do use. Sument is unsatisfactory, the acompleteness, thus allowin applicable section) by time applicable section) by time applicable section) by time applicable section) by time applicable section wade dispatch, whereas y cleared for the release of supplier shall immediately, d a copy of the quality do upplier Representative to the ate for the completion of a e Inspector shall stamp the on when it is effectively com- ation package shall not be quipment.	bmit two sets umentation per Plans and othe individual syste ment, the Supp ument or in the section of the hen notify the at (or applicable Inspector is sa ocument (or a Supplier shall g to finalize the compatible When it is of on) is stamped all outstanding the quality doc upon shipme ocument Revie e Inspector and I outstanding e quality documpleted. The su later than 3 we	(two hard taining to er agreed em. blier shall e case of re quality Inspector e section) tisfactory, applicable endeavor ne quality with the done, the d by the g actions tument by nt of the ew Status d notify of actions & ument for ubmission eeks after		
Developmen Project at (CCL) CHP/0	nt of 20MW Solar PV Central Coalfields Limited CPP Piparwar, Jharkhand	TECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-9296-004-9	PART-G	Page 22 of 31		

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e)	Project Manager's Supe	rvision					
	To eliminate delays and the parties to the Contr to the Project Manag 'Arbitration' clause in S comply with the Project	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					
	<ul> <li>The work shall be Manager. The scor the Contract, will inc</li> </ul>	performed under the sup be of the duties of the Proje lude but not be limited to the	ervision of the ct Manager pu e following:	e Project irsuant to			
	(a) Interpretation of specifications:	all the terms and conditions	of these docun	nents and			
	(b) Review and in engineering data	nterpretation of all the , etc:	Contractor's	drawing,			
	(c) Witness or his a either at the mai work is performe	(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 c contract :	(d) Inspect, accept or reject any equipment, material and work under the contract :					
	(e) Issue certificate payment certifica	of acceptance and/or progre ates	essive payment	and final			
	(f) Review and sug schedules from t	gest modifications and imp ime to time, and	rovement in c	ompletion			
	(g) Supervise Qual stages of the wo	ity Assurance Programme rks.	implementatio	on at all			
f)	INSPECTION, TESTING	AND INSPECTION CERTIFIC	ATES				
	<ul> <li>The word 'Inspect authorised represen behalf of the Emp workmanship of the</li> </ul>	or' shall mean the Projec tative and/or an outside insp loyer to inspect and exan works during its manufacture	et Manager a bection agency nine the mate e or erection.	nd/or his acting on rials and			
	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.						
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	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.					
	<ul> <li>The Project Manage date of inspection Contractor, or any o and workmanship w contract. The Co objections and shall meet the said objections Manager/Inspector of necessary to comply</li> </ul>	r or Inspector shall within fir as defined herein give n bjection to any drawings an hich is in his opinion not ontractor shall give due either make modifications the ections or shall inform in giving reasons therein, that with the contract.	fteen (15) days otice in writin nd all or any e in accordance consideration nat may be nec writing to the at no modifica	from the g to the quipment with the to such eessary to e Project tions are		
	<ul> <li>When the factory test contractor's works, certificate to this effect the tests are not w certificate shall be is Contractor's test cert Manager /Inspector Contractor from provident tests or the issue of accept the equipment not to comply with th</li> </ul>	actory tests have been completed at the Contractor's or sub- s works, the Project Manager /Inspector shall issue a o this effect fifteen (15) days after completion of tests but if re not witnessed by the Project Manager /Inspectors, the shall be issued within fifteen (15) days of the receipt of the s test certificate by the Project Manager /Inspector. Project nspector to issue such a certificate shall not prevent the from proceeding with the works. The completion of these e issue of the certificates shall not bind the Employer to equipment should it, on further tests after erection be found by with the centract				
	<ul> <li>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.</li> <li>The inspection by Project Manager / Inspector and issue of Inspection</li> </ul>					
Project at (CCL) CHP/	Central Coalfields Limited CPP Piparwar, Jharkhand	TECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-9296-004-9	PART-G	Page 24 of 31		

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	of the Contractor Programme forming	in respect of the agreen a part of the contract.	ed Quality A	ssurance				
	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.							
	<ul> <li>All inspection, meas be calibrated period test/measurement to relevant records of p shall produce the specifically, the c equipment in the pre</li> </ul>	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						
g)	ASSOCIATED DOCUME	NT FOR QUALITY ASSURAN	CE PROGRAM	ME:				
	c) List of items r Format No.:QS	<ul> <li>c) List of items requiring quality plan and sub supplier approval. Format No.:QS-01-QAI-P-01/F3-R0.</li> </ul>						
	d) Manufacturing Quality Plan Format No.: QS-01-QAI-P-09/F1-R1							
	e) Field Quality Pl	an Format No.: QS-01-QAI-	P-09/F2-R1.					
10.0	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							
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	long time, the Contrac always be present at sit	ctor's workmen required for the during such operations.	or the above	test shall	
h)	All erection & commissi on mutually agreed term	ioning checks shall be as pe ns	r manufacturer	's manual	
	(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 par 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.				
	<ul> <li>(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</li> </ul>				
	(c) The time consumed in the inspection and checking of the units shall be considered as a part of the erection and installation period.				
	<ul> <li>(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 ove for commissioning (start-up), should be checked out and cleaned The checking and inspection of individual systems should ther follow a prescribed commissioning documentation [SCL (Standard Check List) / TS (Testing Schedule) / CS (Commissioning Schedule)] to be furnished by the manufacturer/supplier</li> </ul>				
<ul> <li>(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</li> </ul>					
Development of 20MW Solar PV Project at Central Coalfields Limited (CCL) CHP/CPP Piparwar, Jharkhand		TECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-9296-004-9	PART-G	Page 26 of 31	

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11.0	SAFETY ASPECTS DU	IRING CONSTRUCTION AN	ND ERECTION				
	In addition to the requ (ECC) the following sha	In addition to the requirements given in Erection Conditions of Contract (ECC) the following shall also cover:					
	(a) Working platforr access.	ms should be fenced and	shall have r	means of			
	(b) Ladders in accor and erection sha All the stairs sha erection.	(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.					
12.0	PACKAGING AND TRA	ANSPORTATION					
	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.						
13.0		SURE					
	All electrical equipmer ventilation devices sha maximum relative humi	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.					
14.0	Instrumentation and C	control					
	All instrumentation and furnished under this co stated herein, unless ot	control systems/ equipmen ntract shall be in accordanc herwise specified in the deta	t/ devices/ con e with the requailed specificati	nponents, uirements ons.			
a)	All instrument scales a units and shall have li have the normal reading	nd charts shall be calibrate near graduation. The rang g at 75% of full scale.	ed and printed es shall be se	in metric elected to			
	All scales and charts sh	all be calibrated and printed	in Metric Unite	6			
b)	All instruments and or miniaturized design, su front draw out facility ar	control devices provided on itable for modular flush no nd flexible plug-in connection	on panels sha nounting on pa n at rear.	all be of anels with			
Developmer Project at (CCL) CHP/(	nt of 20MW Solar PV Central Coalfields Limited CPP Piparwar, Jharkhand	TECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-9296-004-9	PART-G	Page 27 of 31			

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c)	All ele all inpu tropica	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.					
15.0	ELEC	FRICAL NOISE C	ONTROL				
	The e technic electric additic proble protec (RFI) a damag	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.					
16.0	ELEC	FRONIC MODUL	E/COMPONENT DETAIL	S			
	The E diagra electro microp instrur It is ma the pa the sa	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 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.					
	Annex	ure-1 of GTR					
	S. N.	Description Of	Documents	No Prints (Sets	of NO. C s ROMs/F :)	DF CD- Floppy	
	1.       Drawings for Initial Submission (Either 8       1       Soft of 0         "FOR APPROVAL" or "FOR (through 2 set INFORMATION Category) and resubmissions after review by NTPC CD-Rom (including Data sheets/ Calculations, all through E-Materia Equipment/instrument schedule, BOM etc)       1       Soft of 0				oft Copy 2 sets of or 1 no of or E-Mail)		
	<ol> <li>Final Approved Drawings (Cat-I &amp; Cat – IV 3 4 CD- Roms Approved) (As referred in SI no: 1 above)</li> </ol>						
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CLAUSE NO.	TECHNICAL SPECIFICATIONS							
	Annex	Annexure-1 of GTR						
	S. N.	Description Of Documents	No of Prints (Sets)	NO. OF CD- ROMs /Floppy				
	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				
	11	Commissioning Procedure (If applicable) (DRAFT)	4 sets	1 CD ROMS				
	12.	Commissioning Procedure (If applicable) (FINAL)	4 sets	1 CD ROMS				
Development of 20MW Solar PV     TECHNICAL SPECIFICATION     Page       Project at Central Coalfields Limited     BIDDING DOC. NO:     PART-G     Page       (CCL) CHP/CPP Piparwar, Jharkhand     RE-CS-9296-004-9     PART-G     29 of 31								

CLAUSE NO.	TECHNICAL SPECIFICATIONS								
	Annex	ure-1 of GTR							
	S. N.	Description Of	Docι	uments		No Prii (Se	of nts ts)	NO. ( ROMs //	OF CD- Floppy
	13	Performance Procedure (Draft)	and )	Guarantee	test	8		1 So (through Floppy o CD-Rom through	oft Copy 2 sets of or 1 no of n or E-Mail)
	14.	Performance Procedure (Final)	and )	Guarantee	test	8		1 Soft Floppy o CD-Rom through	Copy (2 or 1 no of n or E-Mail)
	16	Progress Reports	6			8		3 FLOP	PIES
	16	Project completion	n repo	rt		3 S	ets	3CD ROMS	
	17	QA programme implementation (with revision-ser	QA programme including Organisation for implementation and QA system manual (with revision-servicing)			1		1 CD-ROM	
	18	Vendor details vendors includin report.	in res g con	spect of prop tractor's evalu	oosed lation	1		1 CD –F	ROM
	19	Manufacturing ( welding schedu documents like POR etc.	QPs, les ar test	Field QPs, nd their refe procedures, N	Field rence WPS,				
		i) For review/con	nment	-		3		1 set of	soft copy
		(ii) For final appro	oval	1 set flop	opies	4		1 CD RO	М
	20	20 Welding Manual, Heat Treatment Manuals,							
		Storage & preser	vation	manuals					
		Draft				4 se	ets		
Development of 20MW Solar PV Project at Central Coalfields Limited (CCL) CHP/CPP Piparwar, Jharkhand		IW Solar PV balfields Limited var, Jharkhand	TECH	NICAL SPECIFIC BIDDING DOC. NO: RE-CS-9296-004-9	ATION		PA	RT-G	Page 30 of 31

CLAUSE NO.	TECHNICAL SPECIFICATIONS						
	Annex	Annexure-1 of GTR					
	S. N.	Description Of	Documents	No of Prints (Sets)	NO. C ROMs /F	OF CD- Floppy	
		Final		4 sets	2 CD RC	DMS	
	21	Monthly Vendor status	Approval /QP approval	2 sets	1 FLOPF	Pγ	
	22	QA Documentation activities on equi	on Package for field pment / systems at site	2 Sets	2 CD RC	DMS	
	23	QA Documentation Package for field 2 Sets 2 CD RON activities on equipment / systems at site				MS	
Developmer Project at (CCL) CHP/0	nt of 20M Central Co CPP Piparw	IW Solar PV balfields Limited ar, Jharkhand	TECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-9296-004-9	PA	RT-G	Page 31 of 31	

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		PART-H CONDITIONS OF	CONTRACT
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	H-1 ERECT	ION CONDITIONS OF CON	ITRACT		
1.0	GENERAL				
	The following provisions in the other parts of the that portion of the work erection requirements shall be in accordance manufacturer, or as m Contractor prior to comm	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.			
	The Contractor upon si Coordinator, nominate Site suitably designate ordination of the Work function from the Site of tract.	gning of the Contract shall another responsible officer d for the purpose of overa s to be performed at Site office of the Contractor durin	, in addition to as his represe Ill responsibility e. Such a per ng the pendenc	a Project entative at y and co- rson shall cy of Con-	
2.0	CODE REQUIREMENT	S			
	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.				
3.0	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.				
4.0	INSPECTION AND TES	STING INSPECTION CERTI	FICATES		
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					
Developmer Project at (CCL) CHP/0	nt of 20MW Solar PV Central Coalfields Limited CPP Piparwar, Jharkhand	TECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-9296-004-9	PART-H	Page 2 of 18	

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	Contractors and/or agentiation the replacements or re-	ncies, which might have got work done to the Contractor'	damaged or a 's work.	ffected by
5.0	CONTRACTOR'S SITE	OFFICE ESTABLISHMEN	г	
	The Contractor shall e authorised representativ or instruction of the Em communicated to the Contractor and the san the Contractor at his leg	stablish an Office at the Si ve for the purpose of the Con ployer or his duly authorised said authorised resident he shall be deemed to have gal address.	ite and keep p ntract. Any wri d representativ representativ e been commu	oosted an itten order e shall be e of the nicated to
6.0	CONTRACTOR'S FIEL	D OPERATION		
	The Contractor shall ke field activity plans and Any review of such pla shall not relieve the Cor activities. Such review any risk or liability by the claim of the Contractor inefficiency of any such Contractor shall be se efficiency of plant and e	ep the Employer informed in schedules for carrying out in or schedule or method on tractor of any of his responses s shall also not be consider the Employer or any of his or will be entertained becomplan or schedule or method colely responsible for the quipment and his erection method	n advance reg each part of t of work by the sibilities toward red as an assu representative cause of the d of work revie safety, adequire thods.	arding his he works. Employer is the field imption of es and no failure or ewed. The uacy and
	the Work-Site including Sub-Contractor and a performance of the wor completion of the Contr The construction review of Contractor's safety adequacy or otherwise.	the safety of all persons of the safety of all persons of the properties under h k. This requirement shall a act and shall not be limited t v by the Employer is not int measures in, on or near th	employed by h nis custody d pply continuou to normal work rended to inclu he Work-Site,	nations of him or his uring the sly till the ing hours. de review and their
7.0	PROTECTION OF WO	RK		
	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			
Developmer Project at (CCL) CHP/0	nt of 20MW Solar PV Central Coalfields Limited CPP Piparwar, Jharkhand	TECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-9296-004-9	PART-H	Page 3 of 18

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	such damaged Works because of any delay in the resolution of such dis- putes. The Contractor shall proceed to repair the Work immediately and no cause thereof will be assigned pending resolution of such disputes.			such dis- ly and no
8.0	FACILITIES TO BE PR	OVIDED BY THE CONTRA	CTOR	
8.1	Contractor's site office	e Establishment		
	The Contractor shall es authorized representativ	tablish a site office at the s ve for the purpose of the con	site and keep p itract, pursuant	oosted an to GCC.
8.2	Tools, tackles and sca	ffoldings		
	The Contractor shall pro and scaffoldings rea commissioning and con under the Contract. Th such as Dozer, Hydra purpose of fabrication, e	ovide all the construction equired for pre-assembly, ducting Guarantee tests of e Contractor shall arrange , Cranes, Trailer, etc. whe erection and commissioning.	uipments, tool installation, the equipment machinery & e erever require	s, tackles testing, s covered equipment d for the
8.3	Testing Equipment an	d Facilities:		
	The contractor shall pro	vide the necessary testing, e	equipment and	facilities.
8.4	Testing of constructio	n material at the site:		
	Contractor shall make a at the site wherever req	Contractor shall make arrangements for the testing of construction material at the site wherever required, under the scope of services of the contract.		
8.5	First-aid			
	The Contractor shall employees, representa number of Contractor's	provide necessary first-ai tives and workmen workin personnel shall be trained in	id facilities fo ig at the Site administering	or all his . Enough first-aid.
8.6	Water			
	Contractor shall make construction water as w at the worksite/colony.	<ul> <li>all arrangements himse ell as potable water for labe</li> </ul>	elf for the s our and other	supply of personnel
9.0	FIRE PROTECTION			
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				
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	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 sup- shall be trained for fire- duties. Enough of sucl during the entire period	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 equipment for the ware	provide suitable quantity nouses, office, temporary str	& type fire uctures etc.	protection	
10.0	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.				
11.0	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 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.				
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12.0	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.				
	<ul> <li>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.</li> <li>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.</li> </ul>				
	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, co moisture and water dam couplings, motor pump cleaned and coated with protected with suitable ensure their full protection	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 anti weather tight enclosure:	friction or sleeve bearings s.	shall be pro	tected by	
	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.				
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	Provisions shall be me equipment during shipment	nade to ensure that wate lent or in storage at the plan	er does not e t site.	enter any
	Returnable containers a manufacturer's field rep	nd special shipping devices resentative at the Contractor	shall be returr r's expense.	ned by the
	While packaging the mappoint of view of availabil	aterial, care shall be taken f ity of railway wagon sizes in	or the limitation India.	n from the
13.0	MATERIALS HANDLIN	G AND STORAGE		
13.1	All the equipments furn be promptly received, u spaces by the Contracto	ished under the Contract a inloaded and transported an or.	nd arriving at nd stored in th	Site shall e storage
13.2	Contractor shall be so transit, handling and / o Any demurrage, wharfa porters, railways etc. sh	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.		
13.3	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.			
13.4	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			
13.5	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			
13.6	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.			
13.7	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 guality by storage.			
13.8	All the materials stored in the open or dusty location must be covered with suitable weatherproof and flameproof covering material wherever applicable.			
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14.0	CONSTRUCTION MANAGEMENT			
	Contractor shall be resp with the specified cons falling behind the sched such delays by increa otherwise accelerate th and shall communicate that his action will com allowed any extra comp	consible for performance of struction schedule. If at any lule, he shall take necessary asing his work force or b e progress of the work to c such actions in writing to opensate for the delay. The ensation for such action.	his works in ac time, the Cor action to make by working ov omply with the the Employer, Contractor sh	ccordance ntractor is e good for ertime or schedule satisfying all not be
	The Employer shall how labour and/or materials	wever not be responsible for or supply or any other servio	or provision of ces to the Cont	additional ractor.
15.0	FIELD OFFICE RECOR	RDS		
	The Contractor shall m drawings, specification supplementary data co Contractor shall also changes to the abov supplementary data, etc assignment under the drawings and other En- the equipment furnishe and Engineering data Employer.	he Contractor shall maintain at his Site Office up-to- date copies of all awings, specifications and other Contract Documents and any other pplementary data complete with all the latest revisions thereto. The ontractor shall also maintain in addition the continuous record of all anges to the above Contract Documents, drawings, specifications, pplementary data, etc. effected at the field and on completion of his total signment under the Contract shall incorporate all such changes on the awings and other Engineering data to indicate as installed conditions of e equipment furnished and erected under the Contract. Such drawings and Engineering data shall be available for inspection & review to the nployer.		
16.0	PROTECTION OF PROPERTY AND CONTRACTOR'S LIABILITY			
16.1	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			
16.2	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.			
17.0	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,				
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	greases, oils and other blasting.	foreign materials by wire bro	ushing, scrapir	ng or sand
18.0	UNFAVOURABLE WO	RKING CONDITIONS		
	The Contractor shall co can be performed wit adverse effects during i etc. and during other activities shall be perfor adversely affect the precautions or measur satisfactory manner in concurrence of the Em will in no way relieve Works as per the sched	onfine all his field operation hout subjecting the equip nclement weather condition unfavourable construction med by the Contractor unde quality and efficiency the res are taken by the Conta the performance of such ployer. Such unfavourable the Contractor of his respondent.	ns to those wo oment and ma s, like monsoo n conditions. er conditions wh hereof, unless tractor in a pro- tractor in a pro- h Works and construction of consibility to pe	orks which aterials to n, storms, No field hich might s special roper and with the conditions erform the
19.0	PROTECTION OF MON	NUMENTS AND REFERENCE	CE 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.			
20.0	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 foundatio grinding as required to b to provide the necessa bearing strength.	n surfaces shall be properl pring the top of such foundat ary roughness for bondage	y prepared by tion to the requ and to assur	chipping, iired level, e enough
20.1	GROUT			
	The grout shall be high strength grout having a minimum characteristic compressive strength of 60 N/mm2 at 28 days. The grout shall be chloride - free, cement based, free flowing, non-metallic grout.			
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	The Grout shall have go ratio.	ood flowability even at very	low water/ gro	ut powder
	The Grout shall have on occupy its original volur Grout shall be of pre-ubefore use.	haracteristics of controlled ne to fill the voids and to co mix variety so that only wa	expansion to to to to the second seco	be able to shrinkage. be added
	The mixing of the Gro manufacturer of the Gro	out shall conform to the reput.	ecommendatio	ns of the
20.2	PLACING OF GROUT			
	After the base has be checked and approved shall be set around th manipulation of the gro above the bottom of the introduced under the ba be moved back & forth the base.	een prepared, its alignmen and before actually placin e base at a distance that ut. The height of such dam base. Suitable size and nu se before placing the grout, to push the grout into every	nt and level g the grout, a will permit po n shall be at lea umber of chain so that such o part of the spa	has been low dam uring and ast 25mm s shall be hains can ace under
	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 be followed.	, recommendations of Grout	t manufacturer	shall also
20.3	FINISHING OF THE ED	GES 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.			s well set. h extends be cut off, inted and ody of the face. The icent floor steel and age of the
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21.0	SHAFT ALIGNMENTS	SHAFT ALIGNMENTS				
	All the shafts of rotating matching equipments to shall be free from exces or other conditions whi The vibration level of shall conform to VDI 20 be thoroughly cleaned a	g equipment shall be properly as perfect accuracy as pra- sive vibration so as to avoid ich may tend to shorten th rotating equipments measu 56. All bearings, shafts and and suitably lubricated before	y aligned to the cticable. The e l overheating o e life of the e ired at bearing other rotating p e starting.	ose of the equipment f bearings quipment. g housing parts shall		
22.0	DOWELLING					
	All the motors and c alignment of shafts with the Employer.	other equipment shall be h tapered machined dowels	suitably dowe s as per the di	eled after irection of		
23.0	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					
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	as possible, to the point of the first conductor branch. The insulate conductors from which the jacket is removed shall be neatly twined bundles and terminated. The bundles shall be firmly but not tightly tie utilising plastic or nylon ties or specifically treated fungus protected con made for this purpose. Control cable conductor insulation shall be secure 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.					
24.0	EQUIPMENT INSTALL	ATION				
A	GENERAL REQUIREM	IENTS				
	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 prepar furnished under this s furnished by this specifi	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 contractor shall contractor shall contract the shall contract of the shall be sha	oordinate his work with oth s are to be installed under sp	er suppliers w pecifications.	here their		
В	INSTALLATION MATE	INSTALLATION MATERIALS				
	All materials required for installation, testing and commissioning of the equipment shall be furnished by the Contractor.					
С	REGULATORY REQUIREMENTS					
	All installation procedures shall confirm with the accepted good engineering practice and with all applicable governmental laws, regulations and codes.					
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D	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.						
E	INSTALLATION OF F NON-FREE	IELD MOUNTED INSTRU	MENTS/DEVIC	ES AND			
	Standing Equipment						
	The installation drawing furnished under this s specification, applicable manufacturers of instrue as specified elsewhere	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 instrun the construction toleran on the plant arrangeme	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.						
F	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						
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	calibration shall also specifications.	be included as a part of	the work und	der these			
G	EQUIPMENT PROTEC	TION					
	All equipment to be ere from damage of any commissioning of each	ected under these specifica kind from the time of unit.	tions shall be f contract aw	protected /ard until			
	The equipment shall be	The equipment shall be protected during storage as described herein.					
	Equipment shall be prot	ected from weld spatter duri	ng constructior	າ.			
	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.						
25.0	DEVIATIONS DISPOSI	TIONING:					
	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.						
26.0	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						
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	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.					
27.0	EMPLOYMENT OF LA	BOUR				
	In addition to all local la labour to be complied Contractor will be expe employees with experie employed after darknes be employed.	aws and regulations pertaini d with by the Contractor cted to employ on the work nce of the particular work. N is. No person below the age	ng to the emplo pursuant to ( c only his regu lo female labou e of eighteen y	oyment of GCC, the lar skilled ur shall be ears shall		
	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 labour or any Govern Minimum Wages Act, Regulation Abolition Ac Contractor, the Employ same from the Contract	In case the Employer becomes liable to pay any wages or dues to the abour 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.				
28.0	WORK & SAFETY REC	GULATIONS				
	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.					
	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.					
				ompotont		
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	person strictly in accordance with the Code of Practices/Rules framed under Indian Explosives Act pertaining to handling, storage and use of explosives.				
	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.				
	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.				
	<ul> <li>(a) Working platforms should be fenced and shall have means of access.</li> <li>(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.</li> </ul>				
	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.				
	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.				
Developmer Project at (CCL) CHP/0	nt of 20MW Solar PV Central Coalfields Limited CPP Piparwar, Jharkhand	TECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-9296-004-9	PART-H	Page 16 of 18	

CLAUSE NO.	TECHNICAL SPECIFICATIONS					
28.1	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.					
28.2	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:-					
	<ol> <li>Fatal injury or accid causing death applic</li> <li>Major injuries or acc</li> </ol>	ent. These are R cable ident R ca pe	s. 1,00,000/- s. 20,000/- ausing 25% ermanent co orkmen or e	- per person - per person fo or more injury lisablement to mployees whose	r death/ / to any person pever	
	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.					
28.3	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.					
29.0	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.					
Developmen Project at (CCL) CHP/0	it of 20MW Solar PV Central Coalfields Limited CPP Piparwar, Jharkhand	TECHNICAL SPECIF BIDDING DOC. I RE-CS-9296-00	FICATION NO: 4-9	PART-H	Page 17 of 18	

CLAUSE NO.	TECHN	CAL SPECIFICATIONS	6	लरीपीम्री NTPC	
	Workmen's Compensa	ation 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 ProvisionsEmployee's Liability-As per Statutory Provisions				
	Comprehensive Autor	nobile 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 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	0 each person 0 each occurre	nce	
	Property Damage	: Rs.100,000	) each occurre	nce	
	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.				
	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.				
Developmen Project at (CCL) CHP/0	nt of 20MW Solar PV Central Coalfields Limited CPP Piparwar, Jharkhand	TECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-9296-004-9	PART-H	Page 18 of 18	

CLAUSE NO.	TECHN	ICAL SPECIFICATIONS	6	লরীধীর্মা NTPC		
		PART-I				
	MAND	ATORY SPARE	ES			
1.0	GENERAL					
(a)	The general requirements pertaining to the supply of mandatory spares is as under. The bidder shall indicate the prices for each and every item (except for items not applicable to the bidders design) in the 'Schedule of mandatory Spares' whether or not he considers it necessary for the Owner to have such spares. If the bidder fails to comply with the above or fails to quote the price of any spare item, the cost of such spares shall be deemed to be included in the contract price. The bidder shall furnish the population per unit of each item in the Bid Forms and Price Schedules. Whenever the quantity is mentioned in "sets" the bidder has to give the item details and					
(b)	prices of each item. Whenever the quantity is indicated as a percentage, it shall mean percentage of total population of that item in the station (project), unless specified otherwise, and the fraction will be rounded off to the next higher					
(c)	Wherever the requirement has been specified as a 'set' it will include the total requirement of the item for a unit, module or the station or as specified. Where it is not specified a 'set' it will include the total requirement of the item for a unit, module or the station or a as specified. Where it is not specified a 'set' would mean the requirement for the single equipment/system as the case may be. Also one set for the particular equipment. e.g. 'set' of bearings for a pump would include the total number of bearings in a pump. Also the 'set' would include all components required to replace the item; for example, a set of bearings shall include all hardware					
(d)	normally required while replacing the bearings. The Owner reserves the right to buy any or all the mandatory spares parts					
(e)	The prices of mandatory spares indicated by the Bidder in the Bid Proposal sheets shall be used for bid evaluation purposes					
(f)	All mandatory spares shall be delivered at site at least two months before scheduled commissioning of the solar plant. However, spares shall not be dispatched before dispatch of corresponding main equipments					
(g)	Wherever quantity is sp	ecified both as a percentage	e and a value, t	he Bidder		
(h)	has to supply the higher quantity until and unless specified otherwise. The Mandatory Spares shall be handed over to the Bidder during O&M Period for use in the Plant Capacity Block through an Indemnity Bond (Format Attached). The spares shall be replenished by the bidder as and when it is used.					
Developmer Project at (CCL) CHP/0	nt of 20MW Solar PV Central Coalfields Limited CPP Piparwar, Jharkhand	TECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-9296-004-9	PART-I	Page 1 of 2		

CLAUSE NO.	TECHN	ICAL SPECIFICATIONS	L.	जरीपीसी NTPC
	The spares in total quan condition at the end of t	ntity shall be returned to the the O&M Period	Employer in wo	orking
Developmer Project at (CCL) CHP/(	nt of 20MW Solar PV Central Coalfields Limited CPP Piparwar, Jharkhand	TECHNICAL SPECIFICATION BIDDING DOC. NO: RE-CS-9296-004-9	PART-I	Page 2 of 2

CLAUSE NO.	TECHNICAL SPECIFICATIONS			<u> </u>		
	LIST OF T		PART- ENDEF	J R DRAW	/ING	
	SL. NO.	DRAWING NO.			TITLE	
	1	1       000-004-POC-A-001       Vici         2       9296-004-POC-A-001A       Con         3       000-999-POC-A-002       Typical Details of Ch         4       000-999-POC-A-003C       Details of Ch         5       000-999-POC-A-004       Details         6       000-999-POC-A-005       PEB Inv         7       000-999-POC-A-006       Details of Ca		Vic	inity Map	
	2			Coi	Contour Map	
	3			tails of Approa Roads	ch	
	4			Details of C for Peripl	hain Link Fencing heral Boundary	
	5			Details of Main Gate		
	6			PEB Inverter Room		
	7			Details of Central Monitoring & Control Station - Architectural Plan		
	8	9296-004-PO	E-A-002/1,2	Basic Single Line Diagram		
	9	9296-004-P	OE-A-003	Power Evacuation Route		
Developmer Project at	nt of 20MW Central Coal	Solar PV fields Limited			PART-J	Pa

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2 1 1	DRG. NO. 000-004-POC-A-002	PICAL DETAILS OF APPROACH ROADS	AT CCL PIPRAWAR	FOR TENDER PURPOSE ONI		ED WITH INCREASE IN GSB THICKNESS. DES OF THE ROAD SHALL BE PROPERLY I 150 MM ABOVE FGL. BE MODIFIED TO 75MM THICKNESS FOR RRESPONDING INCREASE OF 50 MM IN	AND LEVELS ARE IN METRES. HE ROAD SHALL CORRESPOND TO THE NOUS CARPET AT THE CENTRE OF ROAD. AT SUBGRADE LEVEL. ADE LEVEL SHOULD BE MINIMUM 4%. IF M A PARTICUALR STRETCH THEN THE		S PER DESIGN)			
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SIZE SCALE DRG. NO. A1 NTS 000-004-POC-A-003C	TITLE DETAILS OF CHAIN LINK FENCING	FOR TENDER PURPOSE O NTPC NTPC Limited (A GOVERNMENT OF INDIA ENTERPRISE) ENGINEERING DIVISION	<ul> <li>ECIFICATIONS.</li> <li>IAIN LINK FENCE &amp; FIXING DETAILS INCLUDING MATERIAL R THE WORKS SHALL BE AS PER IS : 2721 (2003) &amp; PER TECHNICAL SPECIFICATIONS.</li> <li>SS WIRE AND CHAIN LINK FENCE SHALL BE ERECTED LLY AFTER ERECTION OF EACH SEGMENT OF FENCE POST: D STAY POSTS. SEGMENT IS AS SHOWN IN THE PLAN.</li> <li>L PCC SHALL BE MIN 75 MM THICK E DEPTH OF FOUNDATION SHALL BE TAKEN FROM NGL D HEIGHT OF STRUCTURE SHALL BE TAKEN ABOVE FGL.</li> <li>TERNAL PLASTER OF 12 MM THICK (1:6) SHALL BE IN T- LL SECTION ABOVE GROUND IN CASE BRICK MASONRY IS OPOSED.</li> <li>BOLTS USED SHALL BE MINIMUM 10 MM DIA GI BOLTS.</li> </ul>	E AND SHAPE OF FOUNDATION MAY BE SUITABLY DECIDE DER MEETING THE MINIMUM CROSS SECTION AREA REQUI TH MENTIONED DIMENSIONS. DIMENSIONS. DIMENSIONS ARE IN METRES & DIMENSIONS ARE IN MM. L LEVELS ARE IN METRES & DIMENSIONS ARE IN MM.		STAY POST DETAIL		ISA 75X75X6 1200	TO MAX. NAX. 1000	
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		RAL	NUR SHADE ON INSIDE FACE	
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G	TABLE -2         S		12MM-ø,3# 12MM-ø,3# 12MM-ø,0 8MM-ø@130C/C 2-L STIRRUPS 5500 PB-2 (300X400) PB-2 (300X400)	¢,3# 40 40 40 40 40 40 40 40 40 40	,3# 4 4 4 4 4 4 4 4 4 4 4 4 4	A PB-1	
	S S S S S S S S S S S S S S S S S S S			(REFER F			
00	COLOUMN IRAFTERBASE PLATESISMB 200350X20ISMB 300400X22450X25		DPB (EL(+)0.40M)	8% - @ 150C/C 16% - 8# 16% - 8# EFER RELEVANT TABLE) 15MB - 200 1000	(300X400) (300X400) −L STIRRUPS		PB 2
	D     IZE     PEDESTAL     MAIN       0     400X400     16       500X400     16       16     16	S.NO. SBC (IN T/SQM) 1 20 < = SBC 2 10 <=SBC < 2 3 7 <=SBC < 10 4 5 <=SBC < 10 1 20 < = SBC < 7 A 5 <=SBC < 7 S.NO. SBC (IN T/SQM) 1 20 < = SBC < 7 2 10 <=SBC < 2 3 7 <=SBC < 10 4 5 <=SBC < 10 4 5 <=SBC < 7	BLE -1, PART-A (FOR SPA)         S.NO.       SBC (IN T/SQM)         1       20 < = SBC         2       10 <=SBC < 2         3       7 <=SBC < 10         4       5 <=SBC < 7	E, 4#)	TOPB (EL(+)0.40M)	2750	2750
7	RAINFORCEMENT         EDESTAL         Ø-8NOS         Ø-8NOS         Ø-10NOS	FOUNDATI           FOUNDATI           COLUMN         A           FO1         15           FO1         15           FO1         19           FO1         19           FO1         21           FO1         21           FO1         23           FO1         23           FO1         23           FO1         23           FO1         23           FO1         20           FO1         20           FO1         20           FO1         22           FO1         24	V S=5.5M) FOUNDATI O FO1 14 FO1 18 FO1 20	N.G.L.(EL <u>± 0.00M</u> T.O.F.(EL <u>-1.20M</u> ) B.O.F.(EL <u>± 1.50M</u>	F.F.L.(EL+ 0.50M	UU (2 55	<
	REV.NO.	ON       REINFORCEMEN         00       A'       B         00       1600       1500         00       2000       1900         00       2200       1900         00       2200       2100         00       2400       2300         00       1700       1600         00       2100       2000         00       2100       2000         00       2300       2200         00       2300       2200         00       2300       2200         00       2300       2200         00       2300       2200	ON REINFORCEME         00       A'       B         00       1500       1400         00       1900       1800         00       2100       2000         00       2300       2200				2750
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![](_page_582_Figure_2.jpeg)

![](_page_582_Figure_3.jpeg)

![](_page_582_Figure_4.jpeg)

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THE SIZES OF STRUCTURAL STEEL MEN DIFFERENT RANGES OF SPAN.	THE SIZES OF FOUNDATION MENTIONED SIZE TO BE ADOPTED BY BIDDER.	THE OPENINGS SHOWN IN PEB ARE TE ENGG. BASED ON NTPC APPROVAL. VE AND SUBMIT FOR NTPC APPROVAL BEF	ALL BRACINGS LIKE BRC-1, BRC-2 SH ARE INCREASED. THE NO OF BAYS MAY IN EVERY ALTERNATE BAY. BIDDER SHA PORVIDED IN PEB.	BIDDER SHALL SUBMIT THE DETAILED F (DEVLOPED BASED ON NTPC TENDER D INFORMATION BEFORE START OF WORK.	THE FGL OF PEB ROOM SHALL BE MIN ALL STRUCTURAL STEEL MEMBERS SHA BE IN LINE WITH IS4759. HOWEVER MIN AS 85 MICRON FOR ALL MEMBERS	ALL AROUND THE PEB ROOM IN LINE	CONNECTED TO NEAR BY DRAINS	SBC SHALL BE DECIDED BY GEOTECHN AND APPROVAL BY NTPC IN GEOTECHN DRAWING SHALL NOT BF SCALED. ONLY	IF ROCK IS ENCOUNTERED AT SHALLON	MENTIONED FOR DIFFERENT RANGES OF BASE PLATE, REINFORCEMENT DETAILS. CONSIDERING THE SBC AND C/C SPAN DESIGN BY BIDDER CONSIDERING PROJ	BIDDER MAY CHOOSE BUILDING SPAN	ALL HOOKS, BENDS, LAPS AND SPLICE	LAPPING OF BARS SHALL BE SUITABLY BARS SHALL BE LAPPED AT ANY SECTI	LAP LENGTH SHALL BE 50D WHERE D	FOOTING - 50MM, COLUMN - 50MM,	GRADE OF CONCRETE SHALL BE M-25 Reinforcement shall be of high y Fason conforming to 19:1786	ALL DIMENSIONS ARE IN MILLIMETRES,	

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	000-004-POC-A-005 SHEET 2 OF 3 A	A 1
$\triangleright$	AT CCL PIPRAWAR PEB INVERTOR ROOM DRG. NO. REV.NO.	SIZE
	20MW SOLAR POWER PROJECT	PROJECT
	्त NTPC Limited	एन ही पीउ NTPC
	FOR TENDER PURPOSE ONLY	
Φ	TABLE-2 ARE MINIMUM SIZES TO BE ADOPTED FOR	ED IN TABLE EMBERS IN
	ENDOR SHALL FINALIZE THE SAME DURING DETAILED AND DUCTS SHALL BE DESIGN CONSIDERING HEAT CALCULATION UTION/MANUFACTURING.	TENTATIVE V ENTILATIONS EFORE EXEC
	N DRAWING AND PUFF PANAL DETAILS ND TECHNICAL SPECIFICATION) FOR NTPC KS SHALL BE EXCUTED IN LINE WITH APPROVED DRAWING'S. DNTINUED IN EVERY ALTERNATE BAY IN CASE THE NO. OF BAYS JCED BASED ON BIDDER REQUIREMENT MAINTAINING THE BRACING E THAT THE BRACING IN BOTH THE DIAGONAL DIRECTIONS ARE	FABRICATIO DRAWING A 4. ALL WOR HALL BE CO AY BE REDU HALL ENSUR
0	INICAL SPECIFICATION. MM ABOVE SURROUNDING NGL. _VANISED.THE THICKNESS OF GALVANIZATION SHALL CKNESS OF GALVANIZATION SHALL BE MAINTAINED	INIMUM 500 HALL BE GAI MINIMUM THI
	STIGATION WORK CARRIED OUT BY CONTRACTOR STIGATION REPORT. DIMENSION SHALL BE FOLLOWED. L AROUND THE PEB INVERTOR ROOMS AND HK. PCC LAID OVER WELL COMPACTED 75MM DRY BRICK BALLAST	NICAL INVES NICAL INVES LY WRITTEN BE MADE AL BE MADE AL
	OF SBC LESS THEN 5 T/SQM, FOUNDATION SHALL BE FIC CONDITIONS AND SHALL BE SUBMITTED FOR NTPC APPROVAL. 9 SOIL. THEN FOUNDATION MAY BE PLACED AT TOP OF FOUNDATION SHALL BE LESS THAN 1M.	N. IN CASE JECT SPECI BACK FILLEI OW DEPTH OF
	BE AS PER RELEVANT IS CODE M 5.5M TO 7.5M. FOUNDATION DETAILS HAVE BEEN ARING CAPICITY(SBC). FOUNDATION COLUMN PEDESTAL, S.SHALL BE DECIDED BASED ON TABLE-1 & TABLE-2	CES SHALL (C/C) FRC OF SAFE BE SIZES ET(
	ALL BE AS FOLLOWS BEAM-50MM, SLAB-20MM. IA OF THE SMALLER BAR BEING LAPPED ED AND IN NO CASE MORE THAN 50%	CEMENT SH, M, PLINTH E D IS THE D _Y STAGGER
ГЛ	otherwise specified. Omm down graded aggregates NGTH deformed bar of grade	, UNLESS ( 25 WITH 2 YIFI D STRF
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G		FO1
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![](_page_583_Figure_0.jpeg)

![](_page_583_Figure_1.jpeg)

				SPAN (S)			MATERIAL	GRADE	GALVANIZATION
S.NO.	PART MARK	DESCRIPTION	S = 5.5M	5.5M< S <=6.5M	6.5M< S <= 7.5M	SHAPE	SPECIFICATION	OF MATERIAL	THICKNESS
	PR1	C-PURLIN *	100×50×20×3.15	100×50×20×3.15	100x50x20x3.15		COLD FORM	350	AS PER IS 4759
2	GT1	C-GIRT	100x50x20x3.15	100x50x20x3.15	100x50x20x3.15		COLD FORM	350	AS PER IS 4759
3	RF1	RAFTER	ISMB-200	ISMB-250	ISMB-300	<b>[]</b>	HOT ROLLED	250	AS PER IS 4759
4	CO1	COLUMN	ISMB-200	ISMB-250	ISMB-300	F=1	HOT ROLLED	250	AS PER IS 4759
U	C02	COLUMN	ISMB-200	ISMB-250	ISMB-300	) 	HOT ROLLED	250	AS PER IS 4750
6	C03	COLUMN	ISMB-200	ISMB-250	ISMB-300	ļ	HOT ROLLED	250	AS PER IS 4750
7	SP1	STRUT ANGLE	ANGLE-65x65x5	ANGLE-65x65x5	ANGLE-65x65x5	Γ	HOT ROLLED	250	AS PER IS 475
00	BM1	BEAM HEADER	ISMB-150	ISMB-150	ISMB-150	<b>⊨</b>	HOT ROLLED	250	AS PER IS 475
9	SA-1	SAG ANGLE	50X50X3	50X50X3	50X50X3	<b>~</b>	HOT ROLLED	250	AS PER IS 475
10	SA-2	SAG ANGLE	50X50X3	50X50X3	50X50X3	Γ	HOT ROLLED	250	AS PER IS 475
11	SA-3	SAG ANGLE	50X50X3	50X50X3	50X50X3	Γ	HOT ROLLED	250	AS PER IS 475
12	BRC-1,BRC-2	STRUT PIPE	89MM (OD)	89MM (OD)	89MM (OD)	$\bigcirc$	HOT ROLLED	250	AS PER IS 4759

![](_page_583_Figure_4.jpeg)

![](_page_583_Figure_5.jpeg)

![](_page_583_Figure_6.jpeg)

![](_page_583_Figure_7.jpeg)

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![](_page_583_Figure_11.jpeg)

![](_page_583_Figure_12.jpeg)

![](_page_583_Figure_13.jpeg)

GABLE END ELEVATION ALONG GRID-6

![](_page_583_Figure_14.jpeg)

![](_page_583_Figure_15.jpeg)

![](_page_583_Figure_16.jpeg)

FLOOR Qo DETAILS OF -X PUFF PANEL CONNECTION DETAIL

NO T T S

4 70 70 V ALL DIMENSIONS ARE IN MI GRADE OF CONCRETE SHALL REINFORCEMENT SHALL BE Fe500 CONFORMING TO IS:1 MIN CLEAR COVER TO MAIN FOOTING – 50MM , COLUMN LAP LENGTH SHALL BE 50D LAPPING OF BARS SHALL BE 50D ALL HOOKS, BENDS, LAPS , BIDDER MAY CHOOSE BUILDI MENTIONED FOR DIFFERENT BASE PLATE, REINFORCEMENT ON FOUNDATION SHALL BE AND DESIGN BY BIDDER CONSIDE NO FOUNDATION SHALL BE IF ROCK IS ENCOUNTERED , NO FOUNDATION SHALL BE IF ROCK SHALL NOT BE SC PERIPHERAL GARLAND DRAIN CONNECTED TO NEAR BY DF 750MM WIDE PLINTH PROTE ALL AROUND THE PEB ROOM SH ALL STRUCTURAL STEEL MEN BE IN LINE WITH IS4759. HO AS 85 MICRON FOR ALL ME BIDDER SHALL SUBMIT THE (DEVLOPED BASED ON NTPC INFORMATION BEFORE START

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	<u>ч</u> б	a 20 4 1						
	STORE ROOM	SCADA ROOM BATTERY ROOM	ROOM ROOM ROOM				)	_
11	CERAMIC TILE SIZE IS 300x300mm KOTA STONE/GRANITE- 20mm THICK CEMENT CONCRETE FLOORING WITH IRONITE HARDENER	HEAVY DUTY VITRIFIED SIZE OF 600x600 ACID/ALKALI RESISTANCE TILE FLOORING OR ACID ALKALI RESISTANT EPOXY COATING HEAVY DUTY VITRIFIED CERAMIC TILES AND SKIRTING HEAVY DUTY HEAVY DUTY	FLOOR CEMENT CONCRETE FLOORING WITH HARDENER					
	UPTO 2100MMHT. AND T SIZE OF TILE IS 300X300MM 12MM THICK CEMENT PLASTER WITH 1:5, WITH ACRYLIC DISTEMPER PAINTING PAINTING PAINTING	12MM THICK CEMENT PLASTER WITH 1:5, WITH ACRYLIC EMULSION PAIN 12MM THICK CEMENT PLASTER, ACID ALKALI RESISTANT PAINT, AN EXPOSED WALLS ABOVE DADO-2100MM HIGH DAI OF ACID/ALKALI RESIST, TILING 12MM THICK CEMENT PLASTER WITH 1:5, WITH ACRYLIC DISTEMPER PAINTING HEAVY DUTY ANTI-SKID CERAMIC TILES AND DOD	FINISHING SCHE INTERNAL WALL 12MM THICK CEMENT PLASTER WITH 1:5, WITH ACRYLIC DISTEMPER PAINTING				<b></b>	
10	HE PLASTER WITH T:6, WITH PAINTING EMULSION 1 - 18MM THICK CEMENT PLASTER WITH 1:6, WITH EXTERIOR EMULSION PAINTING	18MM THICK CEMENT PLASTER WTH 1:6, WTH EXTERIOR EMULSION DO ANT HEXTERIOR EMULSION PAINTING PAINTING HEXTERIOR EMULSION PAINTING PAINTING PAINTING PAINTING PAINTING PAINTING HASTER WTH 1:6, WTH	EDULE EXTERNAL WALL 18MM THICK CEMENT PLASTER WITH 1:6, WITH EXTERIOR EMULSION PAINTING		POWE	SWITCHGEAR		10
	6MM TH CEMENT WITH CEMENT WITH WITH DIST	15MN MINER, BOARD FOR 600X60C CE ACID R RESIN RESIN CEMENT DIST CEMENT	6MM TH CEMENT DIST		R CONDI	ROOM		

![](_page_584_Figure_1.jpeg)

CMCS ARCHITCTURAL GROUND FLOOR PLAN

![](_page_584_Figure_3.jpeg)

		REV.NO		A	
	6	DES		TENDE	
	5			R DRAWING	
			DRAWN	RAVI	
			DESIGN	LDB	
			CHKD.	AKS	
	4	CLE I	MECH (L/O)		
		ARED 3Y	MECH (WS)		
			ELEC.		
			C&I		
			STR.		
			APPD.		
	3		DATE	25.03.19	
1					

WITH OR WITHOUT PARTION WALL FOR PCU AS PER

 $\times$ 

- $\bigcirc$ EQUIPMENT IN CMCS SWITCHGEAR ROOM AS PER AF MINIMUM CLEARENCE BETWEEN BACK SIDE OF ANY 850 MM OR MANUFACTURER RECOMENDATION, WHICH MINIMUM WORKING CLEARENCE BEFORE FRONT PANE GENERALY SHALL NOT BE LESS THEN 2200MM, CMCS BUILDING EQUIPMENTS ROOM LENGTH/GRID C.

СЛ

- $\omega$  4
- $\sim$ THE DETAIL CONSTRUCTION & DESIGN DRAWING O AND SUBMITTED TO NTPC FOR APPROVAL BEFORE SOME MINOR CHANGES IN DETAIL CONSTRUCTION MAY BE PORPOSE BY BIDDER AS PER RECOMENT AND LOCATION OF SCADA ROOM AND VIEW POINT
  - \_\_\_\_

SUF	PAN	ТОІ	STC	SC/	CM
JPE	ANTF	DILE	fori	CAD,	MC

TABLE

(h)	(g)	(f)	(e)	(d)	(c)	(d)	(d)	GROL	CMC	
LOBBY	TOILET	PANTRY	SUPER'	BATTER	STORE	SWITCH(	INVERT(	JND FLC	SBUILD	

![](_page_584_Figure_16.jpeg)

	000-004-POC-A-006 A	SIZE SCALE DRG. A1 NTS NTS
$\triangleright$	AT CCL PIPRAWAR ONITORING & CONTROL STATION ARCHITECTURAL PLAN	TITLE CENTRAL N
	NTPC Limited (A GOVERNMENT OF INDIA ENTERPRISE) (ENGINEERING DIVISION)	एन टी पी सी NTPC
σ	F MANUFACTURER. FOR TENDER PURPOSE ONLY	RECOMENDATION
α	ED BASED ON ACTUAL REQUIREMENT,	D CAN BE DETERMI
O	AND LAYOUT. PANEL AND THE WALL SHALL BE	APPROVAL OF SLI NY FLOOR MOUNTEI HICHEVER IS HIGHE ANELS OF ANY SW
	SHALL BE DEVELOPED BY BIDDER WITH RESPECT TO TENDER DRAWING NT MANUFACTURER, BETTER PERFORMANCE BE SUBJECT TO NTPC APPROVAL.	OF CMCS BUILDING E START OF WORK OF CMCS BUILDIN DATION OF EQUIPM T. THE SAME SHALI
	12 SQM.	RVISOR ROOM
	12 SQM. (TOTAL) 4 SQM.	RY 2 NOS
	MINIMUM AREA 16 SQM. 50 SQM.	A ROOMS
ГЛ		
٦٦		
		AREA
		Y SNDS
		RY ROOM
G	VIEW POINT	ROOM
	) SCADA ROOM	OR ROOM
	INIMUM ROOMS AS BELOW	DING CONSIST OF
I		

![](_page_585_Picture_0.jpeg)

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# Annexure-F1

<b>QUALITY ASSURANCE &amp; INSPECTION</b>								MODULE NO. SQE-16						
									Pa	ge 1	of 1			
CABLING	, EA	<b>RT</b>	HINO	G, LIC	HT	NIN	G PI	ROT	'EC'	FION	I	r	· · · · · ·	
ATTRIBUTES / CHARACTERISTICS														ation
ITEMS/COMPONENTS / SUB SYSTEMS	Dimension	Paint shade, paint thickness, adhesion	Pre-treatment of sheet	IP protection	Proof load*	Surface finish	Deflection test*	HV & IR	Galvanise Test (If Applicable)	Functional	Bought out items/Bill of material	Routine tests as per relevant standard $\&$ specification	Acceptance tests as per relevant standard $\&$ specification	Constructional feature as per NTPC Specific
Wall Mounted-Lighting Panel (IS- 513, IS:5, IS:2629, 2633, 6745)	Y	Y	Y	Y		Y		Y	_	Y	Y	Y	Y	Y
Switch box/junction box/ Receptacles Panel (IS-513, IS:5,	Y	Y	Y	Y		Y		Y	Y	Y	Y	Y	Y	Y
IS:2629, 2633, 6745)	3.7													17
Cable glands(BS-6121)	Y													Y
Lighting wire (IS 604)	Y V											V		Y
Elevible conduite	Y V											Y V		V
Conduits (Galvanise & Epoxy) IS- 9537 & IS-2629, 2633, 6745	Y		Y						Y			Y		Y
RCC Hume Pipe (IS-458)												Y	ĺ	
Cable termination & straight through joint (IS 13573)	Y											Y		Y
Cable Trays, bends, tees, crosses, Flexible supports system & accessories IS-513, 2629,2633,6745	Y		Y		Y	Y	Y		Y			Y	Y	Y
Trefoil clamp	Y													Y
GI flats for earthing & lighting protection (IS 2062, 2629, 6745,2633)	Y		Y						Y			Y		Y
GI wire (IS-280)	Y											Y		
Fire Sealing System (BS –476)												Y	Y	Y

.Note:1.This is an indicative list of tests /checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents.

2.\* Deflection Test on cable trays and Proof Load test on cable trays support system will be as per details given in the NTPC technical specification & approved MQP. The above acceptance tests shall be done only on one sample from each size of offered lot. This test is not applicable on bends, tees & crosses.

3. Make of all items will be subject to NTPC approval.

![](_page_587_Picture_0.jpeg)

#### **QUALITY ASSURANCE**

## **Control Cables**

Attributes / Characteristics Item / Components / Sub System Assembly	Make, Type & T.C as per relevant standard	Dimension/surface finish	Mechanical properties	Chemical Composition	Spark Test(as applicable)	Electrical properties	Lay length & Sequence	Armour coverage, cross over, looseness, gap between two	Sequential marking/ Batch marking/ surface finish/ cable length	T.S & elongation before & after ageing on outer sheath & insulation	Thermal stability	Anti termite coating on wooden	Constructional requirements feature as per NTPC	Routine & Acceptance Tests as per relevant standard & NTPC	FRLS Tests
Copper (IS-8130)	Y	Υ	Υ	Υ		Υ									
PVC insulation Compound (IS: 5831)	Y		Υ			Υ				Y	Υ				
FRLS PVC Compound	Y		Υ							Y	Υ				Y
(IS-5831, ASTM-D2843, IS10810( Part 58), IEC-60754 Part-1)															
Extrusion & curing /Manufacturing of Core		Y			Υ						Υ				
Core Laying							Υ								
Armour wire/strip	Y	Y	Υ												
Inner sheath	Y	Υ													
Armouring		Υ						Y							
Outer Sheathing		Υ							Y						
Finished Cable (IS-5831, ASTM-D2843, IS10810( Part 58), IEC-60754 Part-1, IEC							Y	Y	Y	Y	Y		Y	Y	Y
60332 part III cat B)															
Wooden drum(IS-10418) /Steel Drum		Υ										Υ	Y		

#### Notes:

<sup>1.</sup> This is an indicative list of tests / checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents.2. Make of all major Bought out items will be subject to NTPC approval.

ROUTINE TESTS	Following routine tests shall be carried out on each drum of finished cables for all sizes.											
1)	Conduct	or Posistanco tost										
1)	Conduct											
2)	High voli	tage test										
ACCEPTANCE TESTS	Followin	ng Acceptance tests shall b	e carried out on each size of cables, in the offered lot.									
A) For Conductor (as per sam	pling plan	ng plan mentioned in IS: 1554)										
	1)	1) Annealing test (Copper)										
	2)	2) Resistance test										
B) For Armour Wires / Forme	d Wires	( If applicable ) (as per s	ampling plan mentioned in IS: 1554)									
	1.	Measurement of Dimension	S									
	2.	Tensile Tests										
	3.	Elongation Test										
	4.	Torsion Test	For Round wires only									
	5.	Wrapping Test										
	6.	Resistance Test										
	7.	Mass of Zinc coating test	For G S wires / Formed wires									
			only									
	8.	Uniformity of Zinc coating	For G S wires / Formed wires									
			only									
	9.	Adhesion test	For G S wires / Formed wires									
			only									
	10.	10. Freedom from surface defects										
C) For PVC insulation & PVC	Sheath	(as per sampling plan ment	ioned in IS: 1554)									
	1)	1) Test for thickness										
	2)	Tensile strength & Elongation	on before ageing (for tests after ageing see "D")									

![](_page_589_Picture_0.jpeg)

D) Following tests will be carri	ied out	on completed cables as per IS on each size:									
	1)	Insulation resistance test (Volume resistivity method)									
	2)	High voltage test									
E) Following tests shall be carried out on only one size of offered lot (comprising of all sizes):											
	1)	Thermal stability test on PVC insulation and outer sheath									
	2)	Oxygen index test on outer sheath									
	3)	Smoke density rating test on outer sheath									
	4)	Acid gas generation test on outer sheath									
F) Flammability test as per IEC sampling plan:	60332	- Part- 3 (Category- B) on completed cable will be carried out as per following									
		This test will be carried out using composite sampling i.e. irrespective of size; cables of one particular type (i.e. armoured, unarmoured) will be bunched together, as per calculations in line with the IEC. All sizes of armoured & unarmoured cables shall be covered.									
G) Following tests shall be car	ried on	one length of each size (armoured & unarmoured) of offered lot:									
	1)	Constructional / dimensional check, surface finish, length measurement, sequence of cores, armour coverage, Gap between two consecutive armour wires / formed wires, Sequential marking, drum / outer sheath extrusion's batch number marking									
	2)	Measurement of Eccentricity & Ovality									

DC SYSTEM SQE\_19

	LEAD	ACID I	BATTI	ERY				
ATTRIBUTES / CHARACTERISTICS	Dimensions & Finish	Conformance to relevant part drg. $\&$ Manufacturer's standards	Chemical composition	Lead Coating Thickness (min. 25 microns, IS: 6848 App.F) & Adhesion Check	Conformance to CPWD Spec. for Teak Wood	Paint Process checks, Paint Shade, Thickness, Adhesion & Finish	Constructional requirements as per NTPC Spec.	Routine & acceptance tests as per relevant standard
Container & Lids (IS: 1146)	Y	Y						
Vent Plugs	Y	Y						
Sealing Compound (IS: 3116)		Y	Y					
Positive & Negative Plates		Y	Y					
Separators (IS: 6071)	Y	Y						
Electrolyte (Water / Sulphuric Acid) (IS: 1069 / 266)		Y	Y					
Inter-cell Connectors & Fasteners	Y	Y		Y				
Battery Stand	Y	Y			Y	Y		
Cell Insulators	Y	Y						
Stack Assembly	Y	Y						
Lead Acid Battery (IS: 1652)	Y						Y	Y

Note: This is an indicative list of tests / checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents.

		Ni-	Cd BA	TERY				
ATTRIBUTES / CHARACTERISTICS			unufacturer's				lish	int standard
ITEMS, COMPONENTS, SUB SYSTEM ASSEMBLY	Dimensions & Finish	Impact Strength	Conformance to relevant part drg. & Ma standards	Resistance to Alkali	Chemical composition	Nickel Plating thickness	Paint Shade, Thickness, Adhesion & Fin	Routine & acceptance tests as per releva
Container & Lids	Y	Y	Y	Y				
Vent Plugs	Y		Y	Y				
Perforated Steel Strips	Y		Y	Y		Y		
Active Material for Positive & Negative Plates			Y		Y			
Separators	Y		Y	Y				
Electrolyte			Y		Y			
Inter-cell Connectors & Fasteners	Y		Y	Y		Y		
Battery Stand	Y			Y			Y	
Cell Insulators	Y		Y	Y			1	
Stack Assembly	Y		Y				1	
Ni-Cd Battery (IS: 10918)	Y							Y
<ol> <li>Notes:</li> <li>This is an indicative list of a indicating the practice and a 2. Makes of all major Bought</li> </ol>	tests / che procedure Out Item	ecks. The e along w s will be	manufact ith relevar subject to	urer is to f at supportion NTPC app	urnish a o ng docun proval.	detailed ( nents.	Quality I	Plan

		BA	ГТЕ	RY	CHA	RGER								
Attributes / Characteristics	Jake, Model, Type, Rating & Finish	Verification of Routine test reports as per relevant IS	sheet Steel Pretreatment & Painting process checks	Conform to relevant Standard & NTPC spec	Dimensional check and Paint shade, thickness, adhesion & Finish checks	Complete physical examination for constructional eatures as per NTPC approved drgs & specification	cemperature Rise Test	kipple Content Test, Load Limiter & AVR Operation Test	Dynamic Response Test	Derational & Functional Checks	HV & IR Test	3urn-In Test at 50°C for 48 hrs in energised condition	Alternating current measurement test	Degree of Protection Test as per NTCP Spec.
Rectifier Transformer and	Y	Y	01	Y	18	f	Y	нг	Ι	)	Y	I	ł	Ι
Electronic Components including Potentiometer (Vernier Type)	Y			Y		Y								
Electronic Cards	Y			Y								Y		
PCB & racks for electronic cards	Y					Y								
Control & Selector Switches (IS: 6875)	Y			Y						Y				
Indicating Meters (IS : 1248)	Y			Y						Y				
Indicating Lamps (IS: 13947)	Y			Y						Y				
Air Break Switches / Fuses (IS: 13947 / 13703)	Y			Y						Y				
Control Terminal Blocks (IS : 13947)	Y			Y										
Control Transformer (IS: 12021)	Y			Y						Y				
Push Buttons ( IS : 4794 )	Y			Y						Y				
MCB ( IS : 8828)	Y			Y						Y				
PVC insulated Copper control wires (IS: 694)	Y			Y										
Sheet Steel (IS: 513)	Y		Y	Y										
Synthetic Rubber Gaskets	Y			Y										
Annunciator	Y									Y		Y		
Battery Charger	Y				Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Notes: 1 This is an indicative list of	tests	/ check	s Tl	he m	anufacti	irer is to	) furnisł	n a detail	led C	)uali	v Pl	an ind	licati	ng

ıg the practice and procedure along with relevant supporting documents.Makes of all major Bought Out Items will be subject to NTPC approval.

		BA	TTERY	CH	IARGEI	R				
(	of caj	pacity	upto 24	V / 48	3 V , 150 A	ADC)			1	
Attributes / Characteristics	Make, Model, Type, Rating	Dimensional check and Paint shade, thickness, adhesion & Finish checks	Complete physical examination for constructional features as per approved drgs	Ripple Content Test, Load Limiter operation & AVR Operation Test	Operational & Functional Checks of aux. Devices like annunciator, switches, indiactors etc.	HV & IR Test	Burn-In Test	Dynamic response test	AC input current measurement test	Temperature rise test
Battery Charger	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Note										

This is an indicative list of tests / checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents.
 Makes of all major Bought Out Items will be subject to NTPC approval.

		DC	HE	AL	FH MO	ONIT	ORI	NG	SYST	EM
Attributes / Characteristics		SI	10		esion	u				
Items / Components / Sub- assembly	Make, Model, Type, Rating & Finish	Verification of Routine test reports as per relevant	Sheet Steel Pretreatment & Painting process checks	Conform to relevant Standard & NTPC spec	Dimensional check and Paint shade, thickness, adh & Finish checks	Complete physical examination for constructional features as per NTPC approved drgs & specification	Operational & Functional Checks	HV & IR Test	Burn-In Test at 50°C for 48 hrs in energized condition	Degree of Protection Test as per NTCP Spec.
Enclosure	Y		Y	Y	Y					Y
Synthetic Rubber Gaskets	Y			Y			* 7			
Control & Selector Switches ,Indicating Meters, Indicating Lamps	Y			Y			Y			
Control Terminal Blocks ,Push Buttons, MCB	Y			Y			Y			
MCB	Y			Y			Y			
PVC insulated Copper control / signal cables	Y	Y		Y						
Transducers / detectors	Y	Y		Y			Y			
PCB & racks for electronic cards	Y									
Electronic Cards	Y						Y		Y	
Microprocessor Based Controller	Y						Y		Y	
SCADA	Y						Y			
Software	Y						Y			
DC Health Monitoring System	Y			Y	Y	Y	Y	Y	Y	Y
Notes:	•									
3. This is an indicative list of Quality Plan indicating the documents.	tests prac	s / check ctice and	ts. Tl d pro	ne m cedu	anufactı re along	urer is to g with re	o furr leva	nish a nt su	a detailed	1

4. Makes of all major Bought Out Items will be subject to NTPC approval.

## MV (3.3 kV / 6.6. kV / 11 kV / 33 kV) Cables

Attributes / Characteristics Item / Components / Sub System Assembly	Make, Type & T.C as per relevant standard	Dimension/surface finish	Mechanical properties	Chemical Composition	Spark Test(as applicable)	Electrical properties	Hot Set Test/ Eccentricity &	Lay length & Sequence	Armour coverage, cross over, looseness, gap between two wires	Sequential marking/ Batch marking/ surface finish/ cable length	T.S & elongation before & after ageing on outer sheath & insulation	Thermal stability on outer sheath	Metallic ( Cu ) Screening ( If applicable)	Anti termite coating on wooden drums	Constructional requirements feature as per NTPC specification	Routine & Acceptance Test as per relevant standard & NTPC specification	FRLS Test
Aluminum (IS-8130)	Y	Y	Y	Y		Y											
Semiconducting Compound	Y		Y			Y											
XLPE Compound (IS-7098 Part-II)	Y		Y			Y					Y						
FRLS PVC Compound (IS-5831, ASTM-D2843, IS10810( Part 58) ,IEC-60754 Part-1)	Y		Y								Y	Y					Y
Triple Extrusion & curing /Manufacturing of Core		Y			Y		Y										
Copper Tape	Y	Y	Y			Y											
Polyster tape	Y	Y															
Core Laying								Y									
Armour wire/strip	Y	Y	Y														
Copper tapping	Y	Y											Y				
Inner sheath	Y	Y															
Armouring		Y							Y								
Outer Sheathing		Y								Y							
Power Cable (Finished)								Y	Y	Y	Y	Y			Y	Y	Y
Wooden drum(IS-10418) /Steel Drum		Y												Y	Y		

Notes:

This is an indicative list of tests / checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents.
 Make of all major Bought out items will be subject to NTPC approval.

ROUTINE TESTS	Followin	g routine tests shall be carried out on each drum of finished cables for all types & sizes.
1)	Conducto	r Resistance test
2)	High volt	age test
3)	Partial di	scharge test (for Screened cables only)
ACCEPTANCE TESTS	Following lot.	g Acceptance tests shall be carried out on each size of each type (voltage rating) of cables, in the offered
A) For Conductor (as per sampling	ng plan mer	ntioned in IS: 7098 Part II)
	1)	Annealing test (Copper)
	2)	Tensile Test ( Aluminum)
	3)	Wrapping Test ( Aluminum)
	4)	Resistance test
B) For copper tape / Wires (as pe	er sampling	plan mentioned in IS: 7098 Part II)
	1)	Measurement of Dimensions
	2)	Conductivity check
<b>B) For Armour Wires / Formed</b>	Wires (I	f applicable ) (as per sampling plan mentioned in IS: 7098 Part II)
	1.	Measurement of Dimensions
	2.	Tensile Tests
	3.	Elongation Test
	4.	Torsion Test For Round wires only
	5.	Wrapping Test
	6.	Resistance Test
	7.	Mass of Zinc coating test For G S wires / Formed wires only
	8.	Uniformity of Zinc coating For G S wires / Formed wires only
	9.	Adhesion test For G S wires / Formed wires only
	10.	Freedom from surface defects
C) For XLPE insulation & PVC	Sheath (	as per sampling plan mentioned in IS: 7098 Part II)
	1)	Test for thickness
	2)	Tensile strength & Elongation before ageing (for tests after ageing see "D")
	3)	Hot set test (For XLPE insulation)

D) Ageing test	:					
	Cri	teria		Condition	Test Requirements	Remarks
PVC outer sheath :	Samples as per releving size of each type (voc cables in the offered for tensile strength & ageing). <b>Tensile &amp; shall preferably be computerized mac</b> The values will be concorresponding value Type Test report acc	vant IS, fro oltage ratio l lot, shall & elongatio elongatio e done w chine. ompared v s mention cepted by	om each ng) of be tested on (before on testing ith a vith ed in the NTPC.	All sizes which meet the criteria	For PVC: The size which has maximum negative deviation from type test report values will be put on accelerated ageing test. The samples shall be aged in air oven at temperature of 130°c+/- 2°c for 5 hours and tested for TS & elongation. Acceptance norms shall be as per IS.	In case the size does not meet the requirement in accelerated ageing test then all sizes (which had met the criteria) will be put on ageing test as per IS.
	These values of Ten Elongation (before a within +/ - 15% of t values of Type Test that test values shou minimum values indi standard).	sile Streng Igeing) sha the corresp report. (Pl uld be mor icated in r	ould be bould be bonding lease note re than the elevant	Sizes which do not meet the criteria	Every size will be put on ageing test as per IS.	
XLPE Insulation	Samples as per relev per IS.	/ant IS, fro	om each size	of each type (voltage ra	ating) of cables in the offered lot, will be pu	It on ageing test as
E) Following to	ests will be carried	out on c	ompleted ca	ables as per IS on eac	ch size of each type	
		1)	Insulation res	sistance test (Volume res	istivity method )	
		2)	High voltage	test	11 1 \	
		3)	Partial discha	arge test (for Screened ca	ables only )	
F) Following to	ests shall be carried	d out on	only one siz	e of offered lot (com	prising of all sizes & types)	
		1)	Thermal stab	ility test on outer sheath		
		2)	Oxygen inde	x test on outer sheath		
		3)	Smoke densi	ty rating test on outer shea	ath	
		4)	Acid gas gen	eration test on outer sheat	h	
		5)	Flammability	v test as per IEC 60332 - P	Part- 3 (Category- B) on completed cable	
G) Following t	ests shall be carrie	d on one	length of ea	ach size of each type	of offered lot:	
		1)	Construction Gap between number of ou	al / dimensional check, su two consecutive armour v iter sheath extrusion	rface finish, length measurement, sequence of c wires / formed wires, Sequential marking, mark	ores, armour coverage, ing of drum no. / Batch
		<i>∠</i> )	wicasuiciiicii	tor Decemberry & Ovalley	y	

QA TABLE FOR HT SWITC	HGE	CAR												
ATTRIBUTES /														1
CHARACTERISTICS						lal			sh			r		arc
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ITEMS. COMPONENTS.	Ľ	ц.	an	1iCi	insi	tru ires	to	eati	sh	tioı	& I	Cs	be	no
SUB-SYSTEM ASSEMBLY	ake	ect	ecł	len	me	atu	В	etre	int	nc	>	egr I'P(		1 R
	Σ	E	Μ	Cŀ	Di	Сс Fe	Ite	$\mathbf{Pr}$	Ра	Fu	Н	D D	G	AI
CRCA steel sheet/ Aluzinc*/	Y		Y	Y	Y		Y							
Zincalum*/ Galvalum*	1		•	1	1		1							
Aluminum Bus bar material	v	v	v	v	v		v							
$(18 \cdot 5082)$	1	1	1	1	1		1							
Copper Bus har material	v	v	v	v	v		v							
$(15 \cdot 613)$	1	1	1	1	1		1							
Bus har Support Insulator	v	v	v		v		v				v			
Bus bar Support Insulator	1	1	1		1		1				1			
UT Circuit Progler (IEC	v				v	V	v			v			V	v
62271 100)	I				I	I	I			I			I	I
$\frac{022}{1-100}$	v				v	V	v			v				v
HI Contactors (15.9040 / IEC 60470)	I				I	I	r			I				I
Directorian & Auxilliant Dalara	v				V	V	v			V				v
FIOLECTION & Auximary Kerays	I				I	I	I			I				I
UT CT's & DT's	v				v		v							v
$\Pi \cup I \otimes \alpha \cap I \otimes$ ( $I \otimes 2705 / 2156$ )	I				I		I							I
(15.270375130)	v				v	V	v							
$\frac{\text{HI Fuses}(15.9385)}{\text{Summary}(150.00, 4)}$	Y V				Y	Y	Y V							v
Surge Arrester (IEC : 99 –4)	Y				Y	V	Y			V				Y
L1 Contactors (18 : 13947)	Y				Y	Y	Y			Y				
Control & Selector Switches	Ŷ				Y	Y	Y			Y				
(IS: 68/5)													<u> </u>	
Indicating Meters (IS : 1248)	Y				Y	Y	Y			Y			<u> </u>	Y
Indicating Lamps (IS : 13947)	Y				Y	Y	Y			Y				
Push Buttons (IS: 4794)	Y				Y	Y	Y			Y				
Control Transformer	Y				Y	Y	Y			Y				Y
(IS:12021)														
LT Fuses ( IS : 13703)	Y				Y	Y	Y							
Energy Meters (IS: 722)	Y				Y	Y	Y			Y				Y
Transducers (IEC: 60688)	Y				Y	Y	Y			Y				Y
Diodes	Y	Y				Y	Y			Y				
Terminal Blocks	Y	Y				Y	Y							
Synthetic Rubber Gasket	Y	Y			Y		Y							
(IS: 11149 / 3400)														
Breaker Handling Trolley	Y				Y	Y			Y	Y				
HT Switchgear Panel	Y				Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
IEC-62271-200)	-				-	-	-	-	-	-	-	-	-	
Notes:		1				L	I	L						

Notes:

This is an indicative list of tests / checks. The manufacturer is to furnish a detailed Quality Plan 1. indicating the practice and procedure along with relevant supporting documents.

2. Make of all major Bought Out Items will be subject to NTPC approval.

3. \*. Temperature rise test reports for diode plates with actual heat sink will be verified.

CRCA Galvanized steel with metal coating composed of Al (55%), Zn (43.4%) & Si (1.6%),

	· ·								
Attributes / Characteristics	ensional check	toperties	ngth	erties	perties	PI	, Vector Group & Polarity	'Rating / Model /TC / cal Inspection	as per relevant standard / cation
Items/Components Sub Systems	Visual & Dim	Mechanical pi	Electrical stre	Thermal Prop	Chemical Proj	NDT / DP / M	Voltage Ratio	Make / Type / General Physi	Routine Test NTPC Specifi
Enclosure door, H.V. & L.V. Cable Box / Flange Throat	Y	Y						Y	
Copper Conductor	Y	Y	Y		Y				
Insulating Material	Y			Y	Y				
CRGO Lamination & Built Core	Y							Y	
Porcelain Bushing /Insulator (IS:2544 / 5621)	Y	Y	Y					Y	Y
Gasket (IS 2712)	Y	Y						Y	Y
Off-Circuit Tap Changer	Y							Y	Y
Core Coil Assembly	Y						Y		
Marshalling Box	Y								Y
WTI, Thermistor, Terminal Connector	Y							Y	
Complete Transformer (IS:11171 / IEC 60076)	Y								Y

## LT INDOOR TRANSFORMER (DRY TYPE TRANSFORMER)

Notes: 1) This is an indicative List of test/checks. The manufacturer is to furnish a detailed Quality Plan indicating his practice and procedure along with relevant supporting documents during QP finalisation for all item.2) All major Bought out Items will be subject to NTPC approval.

ल्त्रीवर्म NTPC

# LT Power Cables

Attributes / Characteristics Item / Components / Sub System Assembly	Make, Type & T.C as per relevant standard	Dimension/surface finish	Mechanical properties	Chemical Composition	Spark Test(as applicable)	Electrical properties	Hot Set Test/ Eccentricity & Ovality	Lay length & Sequence	Armour coverage, cross over, looseness, gap between two	Sequential marking/ Batch marking/ surface finish/ cable length	T.S & elongation before & after ageing on outer sheath & insulation	Thermal stability	Anti termite coating on wooden	Constructional requirements feature as per NTPC	Routine & Acceptance Tests as per relevant standard & NTPC	FRLS Tests
Aluminum (IS-8130)	Y	Υ	Υ	Υ		Υ										
XLPE Compound (IS-7098)	Υ		Υ			Y	Y				Y					
PVC insulation Compound (IS: 5831)	Υ		Υ			Y					Y	Υ				
FRLS PVC Compound (IS-5831, ASTM-D2843, IS10810( Part 58), IEC-60754 Part-1)	Y		Y								Y	Y				Y
Extrusion & curing /Manufacturing of Core ( PVC / XLPE)		Y			Y		Y					Y				
Core Laying								Y								
Armour wire/strip	Y	Y	Y													
Inner sheath	Y	Y														
Armouring		Y							Y							
Outer Sheathing		Y								Y						
Power Cable (Finished) (IS-5831, ASTM- D2843, IS10810( Part 58), IEC-60754 Part-1, IEC 60332 part III cat B)		X						Y	Y	Y	Y	Y	V	Y	Y	Y
Wooden drum(IS-10418) /Steel Drum		Y											Y	Y		

#### Notes:

1. This is an indicative list of tests / checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents.2. Make of all major Bought out items will be subject to NTPC approval.

एनरीपीसी NTPC

### QUALITY ASSURANCE

ROUTINE TESTS	Followi	ng routine tests shall be carried out on each drum of finished cables for all types
1)	(PVC/)	ter Desistence test
1)		Itage test
2)	High vo	nage lest
ACCEPTANCE TESTS	Followi	ng Accentance tests shall be carried out on each size of each type (PVC / XI PF
	insulate	ed) of cables, in the offered lot.
A) For Conductor (as p	er samp	ling plan mentioned in IS: 1554 / 7098)
	1)	Annealing test (Copper)
	2)	Tensile Test ( Aluminum)
	3)	Wrapping Test (Aluminum)
	4)	Resistance test
		•
B) For Armour Wires / F	ormed W	Vires ( If applicable ) (as per sampling plan mentioned in IS: 1554 / 7098)
	1.	Measurement of Dimensions
	2.	Tensile Tests
	3.	Elongation Test
	4.	Torsion Test For Round wires only
	5.	Wrapping Test
	6.	Resistance Test
	7.	Mass of Zinc coating test For G S wires / Formed wires only
	8.	Uniformity of Zinc coating For G S wires / Formed wires only
	9.	Adhesion test         For G S wires / Formed wires only
	10.	Freedom from surface defects
C)For PVC / XLPE insu	lation &	PVC Sheath (as per sampling plan mentioned in IS: 1554 / 7098)
	1)	Test for thickness
	2)	Tensile strength & Elongation before ageing (for tests after ageing see "D")
	3)	Hot set test (For XLPE insulation)

Г

<ul> <li>D) Following tests will be carr insulated)</li> </ul>	ried out	on completed cables as per IS on each size of each type (PVC / XLPE
	1)	Insulation resistance test (Volume resistivity method)
	2)	High voltage test
E) Following tests shall be ca	rried ou	t on only one size of offered lot (comprising of all sizes & types)
	1)	Thermal stability test on PVC insulation and outer sheath
	2)	Oxygen index test on outer sheath
	3)	Smoke density rating test on outer sheath
	4)	Acid gas generation test on outer sheath
F) Flammability test as per IE	C 60332	- Part- 3 (Category- B) on completed cables as per following sampling plan:
		This test will be carried out using composite sampling i.e. irrespective of size; cables of one particular type (i.e. armoured PVC insulated, unarmoured PVC insulated, armoured XLPE insulated, unarmoured XLPE insulated) will be bunched together, as per calculations in line with the IEC. All sizes of PVC & XLPE insulated, armoured & unarmoured cables shall be covered. For one particular type, cables with OD less than or equal to 30 mm shall be clubbed together in touching formation while cables with OD greater than 30 mm shall be clubbed together leaving a gap equal to OD of cable having least diameter. Cable OD shall be taken as nominal overall diameter as per NTPC approved datasheet.
G) Following tests shall be ca		i one length of each size of each type (PVC / XLPE insulated) of offered lot:
	1)	Constructional / dimensional check, surface finish, length measurement, sequence
		of cores, armour coverage, Gap between two consecutive armour wires / formed
		wires, Sequential marking, drum / Batch (outer sheath extrusion batch )number
	2)	Management of Facentricity & Ovelity
	∠)	weasurement or Eccentricity & Ovality

<u>SQE\_10</u>

( MCC, PCC, ACDB	, DCI	)B, F	L USE	LT S BOA	SWI ARD	TCH( S, LOC	GEA CAL I	R PUSH	I BUT	TON	STA	TIO	N, LOC	AL
	·		I	MOT	<b>FOR</b>	STAR	<b>FERS</b>	5)					·	
ATTRIBUTES / CHARACTERIS- TICS						per			Finish				)er	& IS
ITEMS/ COMPONENTS/ SUB SYSTEM ASSEMBLIY	Make, Model, Type, Rating & TC	Dimensions & Finish	Electrical properties	Mechanical Properties	Chemical properties	Functional & Operational Features as NTPC Spec.	Item to conform to relevant Standards	Pretreatment as per IS 6005	Paint Shade, Adhesion, Thickness &	Functional Checks	Milli-volt drop Test	IR – HV – IR Test	Degree of Protection Routine test as p NTPC spec	All Routine tests as per NTPC spec. $\delta$
Sheet Steel (IS : 513)	Y	Y		Ŷ	Y		Y							
Aluminum Bus bar Material (IS : 5082)	Y	Y	Y	Y	Y		Y							
Copper Bus bar Material (IS : 613)	Y	Y	Y	Y	Y		Y							
Support Insulator	Y	Y	Y	Y			Y							
Air Circuit Breaker ( IS: 13947)	Y	Y				Y	Y			Y	Y			Y
Energy Meters ( IS : 13010, 13779 )	Y	Y				Y	Y			Y				Y
Power & Aux. Contactors (IS : 13947)	Y	Y				Y	Y			Y				
Protection & Aux. Relays (IS : 3231) (IEC 60255 / IEC 61850)	Y	Y				Y	Y			Y				Y
Control & Selector Switches (IS: 13947)	Y	Y				Y	Y			Y				
CT's & PT's (IS 2705 / 3156)	Y	Y					Y							Y
MCCB ( IS : 13947 )	Y	Y					Y			Y				
Indicating Meters ( IS : 1248 )	Y	Y				Y	Y			Y				Y
Indicating Lamps ( IS: 13947)	Y	Y				Y	Y			Y				
Air Break Switches (IS: 13947)	Y	Y				Y	Y			Y				
Control Terminal Blocks	Y	Y				Y	Y							

			Ι	T S	WI	TCHO	<b>JEA</b>	R						
(MCC, PCC, ACDB	, DCI	)B, Fl	USE I	BOA MOT	ARD FOR	S, LOC STAR	CAL H FERS	PUSH S)	BUT	TON	STA	TIO	N, LOC	CAL
ATTRIBUTES / CHARACTERIS- TICS	Make, Model, Type, Rating & TC	Dimensions & Finish	Electrical properties	Mechanical Properties	Chemical properties	Functional & Operational Features as per NTPC Spec.	Item to conform to relevant Standards	Pretreatment as per IS 6005	Paint Shade, Adhesion, Thickness & Finish	Functional Checks	Milli-volt drop Test	IR – HV – IR Test	Degree of Protection Routine test as per NTPC spec	All Routine tests as per NTPC spec. & IS
Fuse ( IS 13703)	Y	Y				Y	Y							
Control Transformer (IS: 12021)	Y	Y				Y	Y			Y				Y
Push Buttons ( IS : 4794 )	Y	Y				Y	Y			Y				
Transducer ( IEC : 60688)	Y	Y				Y	Y			Y				Y
MCB ( IS : 8828)	Y	Y				Y	Y			Y				
Breaker Handling Trolley	Y	Y				Y			Y	Y				Y
Synthetic Rubber Gasket (IS : 11149)	Y	Y		Y	Y		Y							
LT SWITCHGEAR (IS:8623)	Y	Y				Y	Y	Y	Y	Y		Y	Y	Y
Notes:														

1. This is an indicative list of tests / checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents.

2. Makes of all major Bought Out Items will be subject to NTPC approval.

				Ľ	ГВ	USI	)U(	СТ							
ATTRIBUTES,															
CHARACTERISTICS								()				•			C
ITEM, COMPONENTS, SUB SYSTEM ASSEMBLY	Dimension & Surface Finish	Make, Type, Rating & TC	Electrical Properties	Mechanical Properties	Chemical Properties	Item to conform to relevant IS	WPS Approval, Welder Qualification	Weld Quality Check ( DP test & x-ray Tes	Paint Shade, Thickness, Adhesion & Finish	Tightness by Torque measurement	Electrical Clearances	Galvanizing Test as per IS 2629/ 2633/ 475	IR – HV – IR Test	Phase Sequence Check	Degree of Protection routine test as per NTI spec.
Aluminum Sheets / Plates / Strips / Flexibles / tubes (IS: 5082 / 737)	Y	Y		Y	Y	Y	Y	Y							
CRCA Flats / ISMC ( IS 2062 )	Y	Y		Y	Y	Y									
Neoprene / Synthetic Rubber Gaskets ( IS 11149 / 3400 )	Y	Y		Y	Y										
Rubber Bellows (IS : 3400)	Y	Y		Y	Y										
Support Insulator ( BS : 2782, IEC : 660, IS : 10912 )	Y	Y	Y	Y											
Galvanized Structure & GI Earthing Flat (IS : 2629 / 2633 / 4749 )	Y	Y				Y						Y			
Space Heater &		Y	Y										Y		
Thermostat	X7	V				V	V	V	V	V	V		V	V	V
PART 2)	Ŷ	Ŷ				Ŷ	Ŷ	Ŷ	Ŷ	Ŷ	Ŷ		Ŷ	Ŷ	Y
Notes:															
1. This is an indicative	list	of tes	sts / o	checl	ks. T	he n	nanut	factu	rer i	s to f	urni	sh a	detailed	l Qualit	y

Plan indicating the practice and procedure along with relevant supporting documents.2. Makes of all major Bought Out Items will be subject to NTPC approval.

#### AUXILIARY / LT TRANSFORMER

Attributes / Characteristics Items/Components Sub Systems	Visual & Dimensional Checks	Mechanical properties	Electrical strength	Thermal properties	Chemical Composition	Compatibility with oil	NDT / DPT / MPI / UT	Ageing Test.	Voltage Ratio, Vector Group & Polarity, Magnetic Balance Test	Make / Type / Rating / Model / TC / General Physical Inspection.	Functional check	WPS & PQR	Routine Test as per relevant standard / NTPC Specification
Tank, H.V. & L.V. Cable Box / Flange throat	Y	Y					Y					Y	
Conservator / Radiator / Cooler / Pipes	Y	Y					Y						
Copper Conductor (IS:191)	Y	Y	Y		Y								
Insulating Material	Y	Y	Y	Y	Y	Y							
CRGO Lamination & Built Core	Y	Y	Y		Y	Y				Y			
Bushing / Insulator (IS:2544 / 5621)	Y	Y								Y			Y
Gasket	Y	Y			Y	Y		Y		Y			Y
Transformer Oil (IEC296)			Y										Y
OLTC / Off-Circuit Tap Changer	Y									Y			Y
Core Coil Assembly & Pre-tanking	Y								Y	Y			
Marshalling Box	Y									Y	Y		Y
WTI, OTI, MOG, PRD, Breather, Terminal Connector, Bucholz Relay, Valves	Y									Y	Y		
Welding (ASME Sect-IX)	Y						Y			_		Y	
Complete Transformer (IS:2026/ IEC-60076)	Y												Y

Note: 1) This is an indicative list of tests / checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents.

2) All major Bought Out Items will be subject to NTPC approval.

Attributes / CharacteristicsMake, model, Type & Rating, Test CertificateRoutine & Acceptance Test as per IS / IECFunctional requirements as per NTPC SpecificationItems/Components Sub SystemsYYYEnergy meterYYYCircuit Breaker (IEC:62271-100)YYYYYYY	SWITCHYARD			<b>SQE_20</b>
CharacteristicsType & Rating, Test CertificateAcceptance Test as per IS / IECrequirements as per NTPC SpecificationItems/Components Sub SystemsYYYEnergy meterYYYCircuit Breaker (IEC:62271-102)YYY	Attributes /	Make, model,	Routine &	Functional
Items/ComponentsTest CertificateTest as per IS / IECNTPC SpecificationSub SystemsYYYEnergy meterYYYCircuit Breaker (IEC:62271-100)YYYIsolator (IEC:62271-102)YYY	Characteristics	Type & Rating,	Acceptance	requirements as per
Items/ComponentsIECSpecificationSub SystemsYYEnergy meterYYCircuit Breaker (IEC:62271-100)YYIsolator (IEC:62271-102)YY		Test Certificate	Test as per IS /	NTPC
Items/Components Sub SystemsYYEnergy meterYYCircuit Breaker (IEC:62271-100)YYIsolator (IEC:62271-102)YY			IEC	Specification
Items/Components Sub SystemsYYEnergy meterYYCircuit Breaker (IEC:62271-100)YYIsolator (IEC:62271-102)YY				
Sub SystemsYYEnergy meterYYCircuit Breaker (IEC:62271-100)YYIsolator (IEC:62271-102)YY	Items/Components			
Energy meterYYYCircuit Breaker (IEC:62271-100)YYYIsolator (IEC:62271-102)YYY	Sub Systems			
Energy meterYYYCircuit Breaker (IEC:62271-100)YYYIsolator (IEC:62271-102)YYY				
Circuit Breaker (IEC:62271-100)         Y         Y         Y           Isolator (IEC:62271-102)         Y         Y         Y	Energy meter	Y	Y	Y
Isolator (IEC:62271-102) Y V V	Circuit Breaker (IEC:62271-100)	Y	Y	Y
	Isolator (IEC:62271-102)	Y	Y	Y
Current Transformer Y Y	Current Transformer	Y	Y	
(IEC:60044/BS:3938/IS2705/ IEC: Y	(IEC:60044/BS:3938/IS2705/ IEC:			Y
61869)	61869)			
Potential Transformer	Potential Transformer			
(IEC:186A / Y Y Y	(IEC:186A /	V	Y	Y
358/IS3156/IEC60044/ IEC:	358/IS3156/IEC60044/ IEC:	1	1	1
61869)	61869)			
Bus Post Insulator Y Y Y	Bus Post Insulator	Y	Y	Y
(IEC:168 / 815 / IS:2544)	(IEC:168 / 815 / IS:2544)	-	-	-
Disc, Pin & String Insulator Y Y Y	Disc, Pin & String Insulator	Y	Y	Y
(IEC:383 / IS:731)	(IEC:383 / IS:731)			
Surge Arrestor (IEC:99-4/IS:3070) Y Y Y	Surge Arrestor (IEC:99-4/IS:3070)	Y	Y	Y
Spacers, Clamps & Connector Y Y Y	Spacers, Clamps & Connector	Y	Y	Y
(15:10162/5561/61/)	(15:10162/5561/61/)			
Galvanised Steel Structures Y Y Y	Galvanised Steel Structures	Y	Y	Y
(1S:2062/2629/4/59/6/45)	(15:2062/2629/4/59/6/45)	37	37	37
Vibration Damper (IS:9708) Y Y Y	Vibration Damper (IS:9/08)	Y	Y	Y
Sag Compensating Spring Y Y Y	Sag Compensating Spring	Y	Y	Y
DIN:2089/2096 IS:3195 / /906	DIN:2089/2096 IS:3195 / 7906	37	37	37
SF6 Gas filling & evacuating plant Y Y Y	SF6 Gas filling & evacuating plant	Y	Y	Y
SF6 Gas Leak Detector Y Y Y	SF6 Gas Leak Detector	Y	Y	Y
Leakage Current Analyser Y Y Y	Leakage Current Analyser	Y	Y	Y
Protection Relays Y Y Y	Protection Relays	Y	Y	Y
Relay Test Kit Y Y Y	Relay Test Kit	Y	Y	Y
Surge Monitor Y Y Y	Surge Monitor	Y	Y	Y

Notes : 1) This is an indicative list of test/checks. The manufacture is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents during QP finalisation for all items.2) All major Bought Out Items will be subject to NTPC approval.

# **Array Junction Box**

Array Junction quality plan should include the following:

A) Checks on bought out items as per internal standards of the manufacturer

B) In-process checks, as per internal standards of the manufacturer

C) Sample tests as per following:

1) IR-HV-IR test (sampling as per General Inspection Level-II and AQL 1.0% as per IS 2500 Part 1)

2) String Monitoring Card/ Power Supply card/ DC-DC Converter function check (sampling as per General Inspection Level-II and AQL 1.0% as per IS 2500 Part 1)

3) Communication Function Test (sampling as per General Inspection Level-II and AQL 1.0% as per IS 2500 Part 1)

# <u>PCU</u>

- A) Incoming Quality Checks on bought out items
- B) In-process quality checks
- C) Routine tests as per following on the assembled PCU:
  - 1) Test to demonstrate automatic / manual synchronization and connection to utility service
  - 2) Test to demonstrate operation protective (including utility service interface protection) and instrumentation circuits demonstrated by direct test if feasible or by simulation operation conditions for all parameters that cannot be directly tested.
  - 4) Test to demonstrate operation of start-up, stable operation of the PCU, disconnection and shutdown controls and response to other control signals

D) Following sample tests on the assembled PCU :(1 Panel per offered lot)

- 1. Sample testing to include measurement of phase currents, efficiencies, harmonic content and power factor at four points preferably 25, 50, 75 and 100% of the rated nominal power.
- 2. Maximum power point tracking (MPPT) functional check

# SPV module

SPV modules quality plan should include the following:

A) Incoming Quality Checks on bought out items (listed in third party test reports of relevant standard)

B) In-process Quality Checks

C) Sample tests as per following:

1) SPV modules to be checked visually for following defects: (sampling as per General Inspection Level II and AQL 1.5% as per IS 2500 Part 1)

a) Scratches on the frame and/or glass

b) Excessive or uneven glue marks on glass or frame

c) Inconsistent cell colors

d) Completeness of module in all respects

2) Performance of SPV module at STC (sampling as per General Inspection Level II and AQL 1.5% as per IS 2500 Part 1)

3) IR-HV-IR test (sampling as per General Inspection Level II and AQL 1.5% as per IS 2500 Part 1)

4) Robustness of terminations on 1 sample per offered lot

5) Mechanical load test on 1 sample per offered lot
| STATION LIGHTING  |                         | SQE       | _17                   |                                       |                     |        |                                    |         |                              |   |   |  |                                       |
|---|-------------------------|-----------|-----------------------|---------------------------------------|---------------------|--------|------------------------------------|---------|------------------------------|---|---|--|---------------------------------------|
| Item Components<br>Sub System<br>Assembly<br>Attributes<br>Characteristics  | Aake, Type , Rating/ TC | Dimension | re-Treatment of sheat | aint Shade Thickness Adhesion & inish | Jalvanization Tests | P Test | sought Out Items/ Bill of Material | IV & IR | unctional Check as per spec. | Constructional Feature as per<br>VTPC spec. | toutine Test as per relevant std<br>nd spec | vcceptance Test as per relevant<br>td and spec | tem to conform to relevant<br>tandard |
| L : : (10.10202 D /   | Z V                     | Ι         | Ц                     | Ц                                     | $\cup$              | I<br>V | H                                  | ц<br>V  | F                            | )<br>V                                      | цю  | N N  | N N                                   |
| Luminaries (IS-10322 Part-<br>5 Sec 1 (non LED type)  | Ŷ                       |           |                       |                                       |                     | Ŷ      |                                    | Ŷ       |                              |   | Ŷ   | Ŷ  | Ŷ                                     |
| <u>S Sec. 1 (11011 – LED type)</u>  | v                       |           |                       |                                       |                     |        |                                    |         |                              |   |   | V  | V                                     |
| Electronic Banast   | I                       |           |                       |                                       |                     |        |                                    |         |                              |   | Y   | 1  | 1                                     |
| Lighting Wire (IS-694)  | Y                       |           |                       |                                       |                     |        |                                    |         |                              |   | Y   |  |                                       |
| Fans (IS-374)   | Y                       |           |                       |                                       |                     |        |                                    |         |                              |   | Y   |  |                                       |
| Pole (IS-2713)  | Y                       |           |                       | Y                                     |                     |        |                                    |         |                              | Y   | Y   | Y  |                                       |
| Lamps (IS-9800, IS-9974)  | Y                       |           |                       |                                       |                     |        |                                    |         |                              |   | Y   | Y  |                                       |
| Lighting Mast (with raise & lower lantern type)   | Y                       | Y         |                       |                                       | Y                   |        |                                    |         |                              | Y   | Y   | Y  |                                       |
| Wall Mounted Lighting<br>Panel (IS-513, IS-5)   | Y                       | Y         | Y                     | Y                                     | Y                   | Y      | Y                                  | Y       | Y                            | Y   | Y   | Y  |                                       |
| Switch Box/ Junction<br>Box/Receptacles/ Local<br>Push Button Station /<br>Lighting Panel (IS-513,<br>2629, 2633, 4759, 6745) | Y                       | Y         | Y                     | Y                                     | Y                   | Y      | Y                                  | Y       | Y                            | Y   | Y   | Y  |                                       |
| Cable Gland (BS-6121)   | Y                       | Y         |                       |                                       |                     |        |                                    |         |                              |   | Y   |  |                                       |
| Cable Lug (IS-8309)   | Y                       | Y         |                       |                                       |                     |        |                                    |         |                              |   | Y   |  |                                       |
| Flexible Conduit  | Y                       |           |                       |                                       |                     |        |                                    |         |                              |   | Y   |  |                                       |
| Lighting Transformer (IS-<br>11171)   | Y                       |           |                       |                                       |                     |        |                                    |         |                              | Y   | Y   |  |                                       |
| Epoxy & Galvanised<br>Conduit (IS-9537, 2629,<br>2633, 4759, 6745)  | Y                       | Y         |                       |                                       |                     |        |                                    |         |                              |   | Y   |  | Y                                     |

LED Luminaire quality requirements:

- 1) LED modules to conform to IS: 16103 part 2. Manufacturer to issue a certificate of compliance for the same.
- 2) Control gear to conform to IS 15885 part 2 section 13. Manufacturer to issue a certificate of compliance for the same.
- 3) LED luminaire to conform to IS 16107 part 2 section 1. Manufacturer to issue a certificate of compliance for the same.
- 4) LED luminaire marking to be as per IS 16107 part 2 section 1. Manufacturer to issue a certificate of compliance for the same.
- 5) Acceptance tests as per IS 16107 part 2 section 1 to be carried out on LED luminaire except long duration tests i.e. a) Chromaticity coordinates & correlated color temperature (CCT);
  b) Color rendering index (CRI). Manufacturer will submit a COC for above tests i.e. CCT & CRI
- 6) LED driver make, model, type & rating may be as per recommendations of LED module manufacturer.

## Notes:

- 1. This is an indicative list of tests / checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents.
- 2. Make of all major Bought Out Items will be subject to NTPC approval.

MEASURING INSTRUMENTS (PR	IMA	RY	AND	SEC	OND	ARY)	Pa	ge-1	/2		
TESTS											
ITEMS	Dimensions (R)	Make, Model, Type, Rating (R)	Process / Electrical connection (R)	Calibration (R)	Test as per standard(R)	Insulation Resistance (R)	IBR Certification (if applicable )(R)	Hydro Test(R)	Material Test certificate ®	Degree of Protection	Complete Function Test
1. PR Gauge (IS-3624)	Υ	Υ	Y	Υ	Y				Υ		
2. Pr./D.P.Switch(BS-6134)	Υ	Υ	Y	Υ	Y	Y				Y	
3. Electronic Transmitter( Pr / DP and DP Based Flow/ Level) (IEC-60770)	Y	Y	Y	Y	Y	Y				Y	
4. Temp. Gauge (BS-5235)	Υ	Υ	Υ	Υ	Y				Υ		
5. Temp. Switch	Y	Υ	Y	Υ	Y	Y				Y	
6. Thermocouples (IEC – 60584 / ANSI-MC-96.1/IS-12579)	Y	Y	Y	Y	Y	Y				Y	
7. RTD(IEC-60751)	Υ	Υ	Υ	Υ	Y	Y				Υ	
8. Thermowell (ASME 19.3)	Υ		Y				Υ	Y	Υ		
9. Temp Transmitter	Υ	Υ	Y	Υ	Y	Y				Y	
10. Level Transmitter( UT/ GWR)	Y	Υ	Y	Υ		Y				Y	
11. Level Transmitter(3D/ Strain Gauge)	Y	Y	Y			Y				Y	Y
12. Level Switch (Float/Displacer/ Capacitance/RF)	Y	Y	Y	Y	Y		Y	Y	Y	Y	
13. Electrical Metering Instrument (IS-1248)	Y	Y	Y	Y	Y	Y				Y	
14. Transducer (IEC-60688)	Y	Υ	Υ	Υ	Y	Y				Υ	
R-Routine Test A- Acceptance Te	st	•	Y – T	est a	applic	able					
: Note: 1) This is an indicative list of a detailed quality plan inc along with relevant suppor	f test licati ting	s/ch ng t doci	iecks he Pi umen	. Th racti ts.	ne ma ces a	inufac ind Pr	turer	is to lure	o furr adop	nish oted	

MEASURING INSTRUMENTS	S (PF	RIMA	RY	AND	SE	CON	DAR	RY)	Paç	je- 2	/2	
TESTS												
ITEMS	Dimensions (R)	Make, Model, Type, Rating (R)	Process / Electrical connection (R)	Calibration (R)	Test as per standard (R)	WPS approval (A)	Non-destructive testing (R)	Insulation Resistance (R)	IBR Certification as applicable (R)	Hydro test (R)	Material test certificate (A)	Complete Function test
15. Conductivity Type Level Switches (Electrodes /Pressure Vessels /Valves)	Y	Y	Y				Y	Y	Y	Y	Y	Y
16. Flow Switch	Y	Υ	Υ	Y								Y
17. Orifice plate(ASME PTC 19.5/BS-1042/EN 5167)	Y	Y	Y	Y #	Y		Y		Y	Y **	Y	
18. Flow nozzle(ASMÉ PTC 19.5/BS-1042/EN 5167)	Y	Y	Y	Y #	Y	Y	Y		Y	Y	Y	
19. Impact head type element	Y	Y	Υ								Υ	
20.Flow Transmitter( Coriolis/ Positive displacement /Electromagnetic /Ultrasonic)	Y	Y	Y	Y				Y		Y **		
21.Densitiy Meter	Υ	Υ	Υ	Υ								
22. Wet Analyzers	Υ	Υ	Υ	Υ								
23. Gas Analyzers	Υ	Υ	Υ	Y								
24. Sample Handling System Y Y Y Y Y Y Y Y Y										Y		
R-Routine Test A- Accepta	ance	Tes	t			Y	– Te	est a	pplic	able		
Note: 1) This is an indicative	list	of te	ests/	chec	ks.	The	ma	nufa	cture	er is	to	
furnish a detailed quali	ty pl	an ir	ndica	ting	the I	Pract	tices	and	Pro	cedu	re	
adopted along with rele	vant	sup	porti	ng d	ocur	nent	S.					
# - Wet Calibration to be carried out on one flow element of each type and												
size if calibration carried out as	type	e test	san	ne sh	all n	ot be	e rep	eate	d.			
** If Applicable												

POWER SUF	PLY	FOR					IS (		S/B	ATT	ER	Y/B	AT	TEF	RY		
ITEMS	/isual/dimension/rating/ Paint Adhesion/ Thickness R)	General arrangement/BOM/make of components	Efficiency ,regulation(R)	nput voltage variation (A)	Out put voltage and frequency adj. range(A)	Preliminary light load test(R)	-oad transfer retransfer test (R) *	AC input failure and return test (R)	arallel operation and current division(R)	Relative harmonic content(R)	Restart with PRI A.C and battery (separately)(R)	System transfer and retransfer (R)*	Asynchronous transfer(R)	Ripple content(R)	-oad limiter operation (R)	R/HV(R)	Fests as per standard &specification (R)&(A)
UPS/CONVERTER	>	> \ >	- -	- ~	~ ~	×	 >	` >	×	- -	F	~ ~		×	 >	- ~	' V
(IEC-146 PT-4)		-	-	-		-	-	'	-	-	-	'	'	-	-	-	-
STABILISER	Y	Y	Y	Y	Υ					Υ		Υ				Υ	
LEAD ACID BATTERY(TUBLAR )-IS-1651																	Y
LEAD ACID BATTERY (PLANTE)-IS-1652																	Y
NICKEL CADMIUM BATTERY(IS- 10918/IEC-623)																	Y
SMF BATTERY																	Y
ACDB/DCDB	Y	Y														Y	Y
CHARGER	Y	Y	Y	Y	Y				Y					Y	Y	Y	Y
R-Routine Test		A- A	cce	ptar	ice -	Test					Y	′ – ٦	<b>Fest</b>	app	olica	ble	
<ul> <li>Transfer time and recorded.</li> <li>Note: 1) This is an detailed qu with relevant</li> </ul>	Over indic uality nt sup	shoo ative plan portir	list indic ng do	of to catin	sho ests ng th men	oot /che ne F ts.	duri ecks Prac	ng I . T tice:	oad he s ar	& s mar nd F	syste nufa Proc	em ctur edu	tran er is re a	sfer s to adop	fur fur	all b nish alo	e a ng

INSTRUMENTATION CAL	BLE														
TESTS	Conductor Resistance	High Voltage ® & (A)	Insulation Resistance ® & (A)	Constructional detail, dimensions (A)	Outer-Sheathe/core marking, end sealing (A)	Thermal Stability (A) +	Visual, Surface finish (A) +	Electrical Parameters ** (A) +	Persulphate Test (A) +	Overall/Coverage/Continuity (A)	Swedish chimney Test (SS-4241475) (A) ++	FRLS Test * (A) ++	Tensile & Elongation before & after aging (A) ++	Vol. Resistivity.at room & Elevated Temp. (A) ++	Spark test report review ®
1. Instrument cable															
twisted and shielded															
Conductor(IS-8130)	Υ			Y			Υ								
Insulation(VDE-207)				Y	Υ	Υ	Υ						Υ		Y
Pairing/Twisting				Y	Υ		Υ								
Shielding				Y			Υ			Υ					
Drain wire	Υ			Y			Υ		Υ	Υ					
Inner Sheath				Y	Υ	Υ	Υ					Υ	Υ		
Outer Sheath				Y	Υ	Υ	Υ					Υ	Υ		
Over all cable	Υ	Y	Y	Y	Υ		Υ	Υ			Y			Y	
Cable Drums(IS-				Y			Υ								
10418)															
Note: High Temp. cal	bles	sha	all	be s	ubje	cted	to	test	s a	s pe	er VI	DE-	207	(Par	t-6)
Compensating cables s	shal	l be	cheo	cked	for 7	Ther	mal	EM	=/En	dura	ance	tes	t as	per	IS
8/84.	- 411 /	- 1:-	4 - f	44-	/ - <b> </b>	مادم	ть					- 4.	. <i>.</i>		
dotailed Quality Plan	ind	e lis licati		iesis.	racti	CKS.	יו ס פ		nanu		ure i Iona	SIC	) IU hhr	nisi	ant
supporting documents d	lurir		D fin:	no p alizati	on fo	or all	l itor	ne	Suur	c a	long	VVI	LII I		an
Note: R - Routine Test	t A	Ar	cent	ance	Tes	t an		113.	Y -	Tes	t Anr	olica	ble		
<b>Note :</b> Sampling Plan for Acceptance test shall be as per IS 8784 (As applicable)															
<ul> <li>* FRLS Tests: Oxv</li> </ul>	aen	/ Te	emp	Index	( A	STM	1 D-2	2863	3). 3	Smo	ke D	ens	itv F	Ratin	a (
ASTM – D 2843), H	ČL E	Emis	sion	(IEC	-754	-1)			,,				,		Ŭ V
• ** Characteristic Im	ped	lance	e, At	tenua	ation	, Mu	itual	Ca	pacit	tanc	e, Cı	ross	з Та	lk (	As
applicable)															
+ Sample size will be	One	No.	of e	ach s	ize/t	уре	per	lot.							
++ Sample size will b	e C	Dne	No.	samp	ole f	or c	omp	lete	lot	offe	ered	irre	spec	ctive	of
size/type.															

ELECTRICAL ACTU	ATC	DR V	VITH	I IN	ΓEG	RAL	ST.	ART	ER				
Test/Attributes Characteristics ITEM/ COPONENT/ SUB SYSTEM ASSEMBLY/ TESTING	RPM ®	No Load Current ®	IR & HV Test®	Mounting Dimension®	All routine Test as per Standard & Specification®	Correct Phase Sequence®	Operation & Setting of limit Switch/Torque Switch®	Stall Torque/Current (A)	Hand Wheel operation/ Auto de clutch function (A)	Function of Aux. like Potentiometer, space heater, position indicator ®	EPT output ®	Grease leakage ®	Local/ Remote ( Open-Stop-Close) Operation® Safety check (Single phasing, Phase correction, Tripping etc.) (A)
ELECTRICAL ACTUATOR WITH INTEGRAL													
SIAKIEK(IS_9334) Motor	Y	Y	Y	Y	Y								
Final Testing	Y	Ý	Ý	Ý	Ý	Y	Y	Y	Y	Y	Y	Y	Y
Note: 1) This is an inc detailed qual with relevant	licativ ity pl supp	ve lis an in portin	t of te dicati g doo	ests/c ing th cume	check ne pra ents.	s. Th actice	ne ma es an	anufa d pro	icture ocedu	er is t ure a	o furr dopte	hish a ed alo	a ong
Note: 1) This is an inc detailed qual with relevant ® - Routine Test	ity pl supp (A	ve lis an in portin ) - Ac	t of te dicati g doo	ests/c ing th cume ance	check ne pra ents. Test	s. Th actice	ne ma es an	anuta d pro <u>Y - T</u>	icture ocedi est a	er is t ure a ipplic	o furr dopte able	nish a ed alo	a ong

	PR	OGR	AMN	/IABLI	E LC	)GIC	COI	NTR	OLLEF	२					
ITEMS	Visual ®	GA, BOM ,Lay Out of components ®	Dimensions ®	Paint Shade/ Thickness/Adhesion ®	Alignment of Section ®	Component Rating/ Make / Type ®	Wiring ®	IR & HV ®	Review of TC for instruments/ Devices/ Recorders, Indicators/ Mosaic Items/ Transducers ®	Accessibility of TBS/ Devices ®	Illumination ®	Functional Check for Control Element , Annunciation ®	Mimic ®	Test as per IEC 1131 ® *	Test as per Std ® & ( A)
1. PLC Panel	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y		Y	Y
2. Control Desk With PLC	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
Note: 1) This is an indicative	e list	of test	/ che	cks. Th	ne ma	nufac	turer	is to	furnish a	deta	iled o	quality p	blan		
indicating the Practi	ice a	nd Pro	ocedu	ire alon	g wit	h relev	ant s	uppo	rting do	cume	nts.				
*Applicable for PLC		Y - T	est A	pplicabl	e,®	- Roi	utine	Test	(A) - A	ccep	tance	Test			

CONTROL DES F	K, I IRF	LVS Z AL	PA .AR	NEI M d	L, P & C	'LC ON'	PA TRO	NEI DL 3	L, SM( SYSTI	OKH EM	E DI	ETE	СТ	OR	,	
ITEMS	Visual ®	GA, BOM ,Lay Out of components ®	Dimensions ®	Paint Shade/Thickness/Adhesion ®	Alignment of Section ®	Component Rating/ Make / Type ®	Wiring ®	IR & HV ®	Review of TC for instruments/ Devices/ Recorders, Indicators/ mosaic Items/ Transducers ®	Accessibility of TBS/ Devices ®	Illumination ®	Functional Check for Control Element , Annunciation ®	Mimic ®	Test as per IEC 1131 ® *	Test as per Std $\circledast$ & ( A)	Functional test of complete system(a)
1. Control Desk	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		17	3.7
2. LVS Panel	Y V	Y V	Y V	Y V	Y	Y V	Y V	Y V	Y V	v	V			V	Y V	Y V
Control, PLC Panel		1	1	1		1	T	1	1	1	1			Ĩ	1	1
4.Smoke Detectors (UL-268,EN-54 PT-7), Heat Detectors(UL- 521/EN 54 PT-5) Annunciation/ Control Panel (UL -864, EN- 54, PT-2)															Y	Y
Note: 1) This is an i quality play documents • *Applicabl • Y - Test A	ndica n ind le for pplic	ative icatir PLC able	list on the second seco	of tes e Pra - Roi	t/ ch octice	ecks. e and Test	The Proc	e mai edur	nufactur e along	er is with ce Te	to fu relev est	rnish /ant :	a de supp	etaile orting	d g	

<b>CLOSED CIRCUIT TELEV</b>	ISIO	N S	YST	EM	(CC	TV)	– IP	<b>Bas</b>	sed
\ Attributes									
Characteristics									
Item Components Sub System Assembly	Make, Model, Type, Rating, TC®	Dimension/constructional requirement®	Functional/operational check®	Switching capability and sequence®	No. of inputs/outputs, display®	Provision for connectivity with the LVS®	Pan range/speed, tilt/tilt speed®	Operational check from key board/control panel®	Commands from LAN Switch/Network Switch®
LAN Switch/Network Switch	Y		Y	Y	Y	Y			
Key boards	Y		Y						
Cameras	Y	Y	Y						
Lens	Y	Y	Y						
Camera Housing	Y	Y	Y						
Pan & Tilt unit	Y	Y	Y				Y		
Media Converter	Y		Y						
Monitor	Y	Y	Y						
Software	Y		Y						
Server, Work Station, Storage	Y		Y						
Device									
Complete System	Y	Y	Y	Y	Y	Y	Y	Y	Y
Note : 1) This is an indicative list of t detailed quality plan indicatin relevant supporting documen R –Routine Test Y -Test Applie	est/ch ng the ts. cable	ecks. Prac	The tice a	manu nd pro	ifactu ocedu	rer is re alo	to fur ngwi	nish a th	a

	PROJECT: Solar					Owner DOC NO	
NTPC	PACKAGE:	LISTO		MS REQUIRING QUALITY PLAN AND APPROVAL Bid Doc. 08/ CE( E&S)/U	SUB- SUPPLIER No.: NL/2018-19	REV. NO.	
	MAIN SUPPLIER:			SUB SYSTEM: CIVIL WORKS		DATE	27.03.2019
	CONTRACT NO.:						
SR. NO.	ITEM	QAP / INSP. CAT	QA P NO.	PROPOSED SUB SUPPLIER	PLACE OF MANUFACTURIN G	APPROVAL STATUS / CATEGORY	REMARKS
				TATA STEEL BSL LIMITED	RAIGAD	А	Formerly BHUSHAN STEEL AND STRIPS LTD.
				ESSAR STEEL LTD	PUNE	A	
				NATIONAL STEEL & AGRO INDUSTRIES LTD	DHAR	A	
1.	COLOUR COATED METAL DECK & CLADDING SHEET (COIL)	ш		JSW STEEL COATED PRODUCTS LTD	KALMESHWAR (NAGPUR)	А	Formerly JSW ISPAT Steel Ltd
				BHUSHAN STEEL LTD.	SAHIBABAD	A	
				JSW LTD	THANE	A	
				BHUSHAN POWER & STEEL LTD	SAMBALPUR (ODISHA)	А	
				TATA BLUESCOPE STEEL LTD	JAMSHEDPUR	А	*AL-ZN COIL FOR CLADDING
2.	ELECTROFORGED GRATING	111	-	MAIN CONTRACTOR APPROVED SOURCE	-	-	
3.	CEMENT	111	-	BIS APPROVED SOURCES HAVING VALID BIS LICENCE	-	-	
4.	CONSTRUCTION CHEMICALS, WATER PROOFING COMPOUNDS AND GROUTS	ш	-	MAIN CONTRACTOR APPROVED SOURCE	-	-	
5.	PAINT AND PAINTING SYSTEM	Ш	-	MAIN CONTRACTOR APPROVED SOURCE	-	-	
6.	PROFILERS FOR COLOUR COATED METAL DECK & CLADDING SHEETS	III	-	MAIN CONTRACTOR APPROVED SOURCE	-	-	
7.	CI PIPES	III	-	BIS APPROVED SOURCES HAVING VALID BIS LICENCE	_	-	

	PROJECT: Solar					Owner DOC NO	
NTPC	PACKAGE:	LISTO	FILEN	AS REQUIRING QUALITY PLAN AND APPROVAL Bid Doc. 08/ CE( E&S)/U	SUB- SUPPLIER . No.: NL/2018-19	REV. NO.	
	MAIN SUPPLIER:			SUB SYSTEM: CIVIL WORKS		DATE	27.03.2019
	CONTRACT NO.:						
SR. NO.	ITEM	QAP / INSP. CAT	QA P NO.	PROPOSED SUB SUPPLIER	PLACE OF MANUFACTURIN G	APPROVAL STATUS / CATEGORY	REMARKS
8.	MS BLACK/GI PIPES (IS:3589, IS:1239)	Ш	-	BIS APPROVED SOURCES HAVING VALID BIS LICENCE	-	-	
9.	RCC PIPES	ш	-	BIS APPROVED SOURCES HAVING VALID BIS LICENCE	-	-	
10.	CPVC/UPVC PIPES	ш	-	BIS APPROVED SOURCES HAVING VALID BIS LICENCE	-	-	
11.	PVC WATER STOP	III	-	BIS APPROVED SOURCES HAVING VALID BIS LICENCE	-	-	
12.	POLYTHENE WATER STORAGE TANKS	ш	-	BIS APPROVED SOURCES HAVING VALID BIS LICENCE	-	-	
13.	BITUMEN ASPHALT	III	-	ALL GOVERNMENT REFIINARIES	-	-	
14.	HIGH SOLID CONTENT LIQUID APPLIED URETHANE BASED ELASTOMERIC MEMBRANE FOR WATER PROOFING	111	-	MAIN CONTRACTOR APPROVED SOURCE	-	-	
15.	CERAMIC / VITRIFIED TILES	Ш	-	BIS APPROVED SOURCES HAVING VALID BIS LICENCE	-	-	
16.	PARTICLE BOARDS, PLYWOOD, MDF	III	-	BIS APPROVED SOURCES HAVING VALID BIS LICENCE	-	-	
17.	FOUNDATION BOLT	III	-	MAIN CONTRACTOR APPROVED	-	-	

<b></b>	PROJECT: Solar					Owner DOC NO	
NTPC	PACKAGE:	LISTO	OF ITEMS REQUIRING QUALITY PLAN AND SUB- SUPPLIER APPROVAL Bid Doc. No.: 08/ CE( E&S)/UNL/2018-19 SUB SYSTEM: CIVIL WORKS QA P NO. PROPOSED SUB SUPPLIER APPROVAL STATUS / G CATEGORY				
	MAIN SUPPLIER:			SUB SYSTEM: CIVIL WORKS		DATE	27.03.2019
	CONTRACT NO .:						
SR. NO.	ITEM	QAP / INSP. CAT	QA P NO.	PROPOSED SUB SUPPLIER	PLACE OF MANUFACTURIN G	APPROVAL STATUS / CATEGORY	REMARKS

LEGENDS:

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

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

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

2. QP/INSPN CATEGORY:

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

CAT-III: For these items the Quality control to be exercised as per Main Contractor Quality Assurance System. The final acceptance by OWNER shall be on the basis of Certificate of conformance (COC) by Main Contractor.

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 OWNER-EIC/ FQA on the basis of MTC / certificate of conformance in line with Indicative FQP / Technical Specifications.

एन N	एनरीपीसी NTPC PROJECT : Dev Coalfields Limi PACKAGE : SO CONT. NO. : R		Develop Limited( : SOLAR . : RE-CS-	ment of 20 CCL) CHP/0 -9296-004-1	OMW Solar PV at Central CPP Piparwar,Jharkhand 9	INDICATIVE VEN Subsystem- Elec Mechanical	DOR LIST trical &	DOC NO. : RE-CS-9296-004-9 REVISION NO. 00 PAGE : 1
SI. No.	ITEM		QP / INS CAT.	QP No	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
-				1				
1.	SPV modul	е		Q-001	BHEL	Bangalore	A	
					Warree	Surat	A	
					Emmvee	Bangalore	A	
					Vikram Solar	Parganas	A	
					Lanco Solar	Chattisgarh	A	
				-	Tata Power Solar	Bangalore	A	
					Alpex	Solan	A	
					Synergy	Durgapur	A	
					Photonix	Satara	A	
					HHV Solar	Bangalore	A	
2.	Power Con Unit (PCU)	ditioning	I	Q-002	Schneider	Bangalore	A	Conditions apply
					ABB	Bangalore	Α	Conditions apply
					Bongfiglioli	Germany	А	Conditions apply
					Fecon	Germany	Α	Conditions apply
					AEG	Bangalore	А	Conditions apply
					Hitachi-Hirel	Gandhinagar	· A	Conditions apply
					Hitachi-Hirel	Sananad	Α	Conditions apply
					Vacon	Bangalore	А	Conditions apply
3.	String Mor Box (SMB)	nitoring	II	Q-003	Trinity Touch	Palwal	A	Conditions apply
					Hensel	Sriperumbuc ur	A	Conditions apply
					AEG	Bangalore	A	Conditions apply
					Statcon	Pilkhuwa	A	Conditions apply
					Weidmuller	Spain	А	Conditions apply

एन N	रीपीसी TPC	PROJECT : Coalfields PACKAGE CONT. NO	Develop Limited( : SOLAR . : RE-CS	ment of 20 CCL) CHP/C	MW Solar PV at Central PP Piparwar,Jharkhand	INDICATIVE VEI Subsystem- Elec Mechanical	IDOR LIST ctrical &	DOC NO. : RE-CS-9296-004-9 REVISION NO. 00 PAGE : 2
SI. No.	ITEM		QP / INS CAT.	QP No	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
			•					
4.	Weather station III panel (comprising of Pyranometer, anemometer & thermometer etc.)			Any make-model with VDE approved with CML no. (R	E/ CE/UL/ CSA mar lefer Note-6)	king or BIS		
5.	DC Cable Connector III Any make-model which having marking of VDE/ (Refer Note-1)			Type Tested as pe E/UL/ CSA/ "BIS wi	r EN 50521 or th CML no."			
6.	Floor mound out type in Switchgean (MCC etc.) Refer Note	nted Draw Idoor LT r Panel e-5	I	Q-004	L&T Mumbai / Coimbatore/ Ahmednagar		/r A	BOIs preferably with VDE/CE/UL/CSA marked or BIS approved with valid CML no.
					GE	Bangalore	A	
					C&S Electric	Noida / Hardwar	А	
					Schneider	Nasik	А	ACB from Schneider, France
					Siemens	Kalwa	A	Conditions apply
					Tricolite	Sahibabad/ Manesar	A	Conditions apply
					Nitya Electrocontrols	Noida	А	
7.	LV Air Cir Breaker	cuit	*		C&S Electric	Noida	A	*(part of Swgr MQP)
					L&T	Mumbai	А	
					GE	Bangalore	A	
					Siemens	Germany	A	

एनर्ट NT	पीमी PC	PROJECT : Coalfields PACKAGE : CONT. NO.	Developr Limited(C SOLAR . : RE-CS-S	ment of 201 CCL) CHP/CI 9296-004-9	MW Solar PV at Central PP Piparwar,Jharkhand	INDICATIVE VENDOR LIST Subsystem- Electrical & Mechanical		DOC NO. : RE-CS-9296-004-9 REVISION NO. 00 PAGE : 3
SI. No.	ITEM		QP / INS CAT.	QP No	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS

I	1	I	1				
1	1	1	1		T		
				Schneider	France	A	
8.	Floor mounted Fixed	1	Q-005	Switching Circuits	Kolkata		BOIs preferably with CE/VDE/UL/CSA marked or BIS
	type indoor LT			C C			approved with valid CML no.
	Switchgear Panel						
						A	
	(ACDD) DCDD)						
	Refer Note E						
	Refer Note-5						
				Hindustan Control &	коїката	А	with fabrication & painting at unit II & MP Electrical
				equipment Ltd	•		Narendrapur
				Maktel	Vadodara	Α	Prior Type Testing
				Jakson	Greater		
					Noida	A	
				Vidyut Control	Gaziabad	A	
				Adlec Power	Rohad (		
					Jhajjar)	A	
				Pyrotech	Udaipur	А	
				Conquerent Control System	Manesar	A	Condition apply ,upto 1250A
				Control & Schematics	Hyderabad	A	
				Positronics	Vadodara	A	
				Anand Power Ltd.	Noida	A	
			•	Additionally all vendors			
				identified for Floor mounted			
				Draw out type indoor LT			
				Switchgear Panel			
9.	Wall mounted fixed	I	Q-006	Control Devices	Kolkata		BOIs preferably with CE/VDE/UL/CSA marked or BIS
	type indoor /					A	approved with valid CML no.
	outdoor LT						
	1	1			1	ı	1
				•			

एन N1	एनरीपीसी         PROJECT           NTPC         Coalfield           PACKAGI         CONT. N           .         ITEM		Develop Limited( : SOLAR . : RE-CS-	ment of 20 CCL) CHP/0 9296-004-9	OMW Solar PV at Central CPP Piparwar,Jharkhand 9	INDICATI Subsyster Mechanic	VE VEN m- Elec cal	DOR LIST trical &	DOC NO. : RE-CS-9296-004-9 REVISION NO. 00 PAGE : 4
SI. No.	ITEM		QP / INS CAT.	QP No	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE		SC APPL STATUS	REMARKS
	Switchgea compartm Panel ( Lighting p / DC Fuse etc.) Refer Note	r non entalized banels / AC boards e-5	non ntalized nels / AC pards						
					Jasper	Noid	a	A	
					Havells	Farid	abad	A	
					distribution systems	iviuri	lidi	A	
					Avaid Technovator	Mane	esar	A	
					Additionally all vendors identified for Floor mount Draw out type indoor LT Switchgear Panel	ed			
					Additionally all vendors identified for Floor mount fixed type indoor LT Switchgear Panel	ed			
10.	Lighting & Transform	Welding er		Q-007	Southern Electric	Cheni	nai	А	
					Indcoil	Thane	ć	A	
					Pragati	Thane	ć	А	
					Prayog	Pune		A	
					Precise	Mum	bai	А	
					Logicstat	Delhi		A	
					Gujarat Plug in	Vadoo	dara	A	

एन N1	ीपीसी PC	PROJECT : Coalfields PACKAGE CONT. NO	Develop Limited(( : SOLAR . : RE-CS-	ment of 20 CCL) CHP/0 9296-004-9	MW Solar PV at Central CPP Piparwar,Jharkhand	INDICATIVE VENDOR LIST Subsystem- Electrical & Mechanical		DOC NO. : RE-CS-9296-004-9 REVISION NO. 00 PAGE : 5
SI. No.	ITEM		QP / INS CAT.	QP No	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
			•					
					AE	Thane	Α	
					Power Pack Enterprises	Mumbai	A	
					Amex Impex,	Ahmedabad	A	
					1 /			
11.	LT CT/PT/CI Control Tra	BCT/ nsformer	- 111		Карра	Bangalore	A	
					Southern Electric	Chennai	A	
					Precise	Mumbai	A	
					G&M	Baroda	A	CBCT Only
					Silkaans	Mumbai	A	
					Ind Coil	Mumbai	Α	
					Pragati	Thane	A	
					Prayog	Pune	А	
					AE	Mumbai	A	
					Logicstat	Delhi	А	For control transformer only
					C&S Electric	Noida	А	For CT only
					Newtek	Aurangabad	A	For CT/PT/Control transformer
12.	1.1Kv LT Po (From SMB	wer Cable to PCU)	Refer Note- 2	Q-008	Universal Cable Ltd.	Satna	A	
					NICCO	Shamnagar , Kolkata	A	
					Torrent Cable Ltd	Nadiad	Α	
					Incab	Pune	Α	
					Hindustan Vidyut Products Ltd	Faridabad	A	
					KEI Industries	Bhiwadi	Α	
					Delton Cable Ltd	Faridabad	Α	A) Unarmoured cable all sizes.

एन 1	एनरीपीसी NTPC Sl. ITEM		Develop Limited( : SOLAR . : RE-CS-	ment of 20 CCL) CHP/C 9296-004-9	MW Solar PV at Central CPP Piparwar,Jharkhand	INDICATIVE VEN Subsystem- Elec Mechanical	IDOR LIST trical &	DOC NO. : RE-CS-9296-004-9 REVISION NO. 00 PAGE : 6
SI. No.	IIEM		QP / INS	QP No	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
			CAT.					
								B) Armoured cable up to 3.5 x 240 sq. Mm with GI strip armour and 1CX70 sq mm with AI strip armour
					Paramount Cable	Khushkhera	Α	
					Polycab Wires Pvt. Ltd	Daman	Α	
					Gemscabs Industries	Bhiwadi	A	
					Cords Cables	Bhiwadi	Α	
					Havells India Ltd.	Alwar	A	
					Sri ram Cables	Bhiwadi	А	
					Ravin Cables	Pune	А	
					Thermocables	Hyderabad	A	
					Sbee Cables	Bangalore	Α	
					Suyog Cables	Vadodara	A	
					Gupta Power Cables	Khurda	Α	
					Finolex	Pune	Α	
					Scot Innovation wires and	Baddi	Α	
					cables			
					Anhui Hualing	China	Α	
					LS Cable	K <mark>or</mark> ea	A	
					Radiant Cables	Hyderabad	Α	
					Tirupati Plastomatics	Jaipur	Α	
					Apar Industries	Umbergaon	Α	
					Special Cables	Rudrapur	Α	
					ABB Kabel	Germany	Α	
					Advance cable	Bengaluru	Α	
					Step Industries	Shahjahanpı r	A	
					Taihan Electric Wire	Korea	A	
	1				Tbea Shandong	China	A	
<u> </u>	1				CMI	Baddi	A	
			•			•	•	·

एनरीपीसी NTPC		PROJECT : I Coalfields I PACKAGE : CONT. NO.	Developr Limited(C SOLAR : RE-CS-S	ment of 201 CCL) CHP/CI 9296-004-9	MW Solar PV at Central PP Piparwar,Jharkhand	INDICATIVE VENDOR LIST Subsystem- Electrical & Mechanical		DOC NO. : RE-CS-9296-004-9 REVISION NO. 00 PAGE : 7
SI. No.	ITEM		QP / INS CAT.	QP No	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS

				Dynamic Cables	Jaipur	А	Conditional Approval
				Indo Alusys	Bhiwadi	Α	
13.	1.1 KV Control Cable	Refer Note- 2	Q-009	Universal Cable Ltd.	Satna	A	
				NICCO	Shamnagar , Kolkata	А	
				Torrent Cable Ltd	Nadiad	А	
				Incab	Pune	A	
				Polycab WiresPvt. Ltd	Daman	A	
				Hindustan Vidyut Products Ltd	Faridabad	А	
				KEI Industries	Bhiwadi	A	
				Delton Cable Ltd	Faridabad	A	
				Paramount Cable	Khushkhera	А	
				Gemscabs Industries	Bhiwadi	A	
				Cords Cables	B <mark>hi</mark> wadi	A	
				SPM Cables	Hyderabad	A	
				Elkay Telelink	Faridabad	A	
				Havells India Ltd.	Alwar	A	
				R.R. Kabel	Silvasa	A	
				Ravin Cables	Pune	А	
				Gupta Power cable	Khurda	A	
				Thermocables	Hyderabad	A	
				Finolex	Pune	A	
				Sbee Cables	Bangalore	A	
				Suyog Cables	Vadodara	A	
				Scot Innovation wires and	Baddi	A	

एन N	एनरीपीसी NTPC Coalfield PACKAG CONT. N		<b>Develop</b> Limited( SOLAR .: RE-CS-	ment of 20 CCL) CHP/0 9296-004-	OMW Solar PV at Central CPP Piparwar,Jharkhand 9	INDICATIVE VEI Subsystem- Elec Mechanical	NDOR LIST ctrical &	DOC NO. : RE-CS-9296-004-9 REVISION NO. 00 PAGE : 8
SI. No.	ITEM		QP / INS	QP No	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
			CAT.					
					Cables			
					Anhui Hauling	China	Δ	
					IS Cable	Korea		
					Radiant Cables	Hyderabad	<u>А</u>	
					Tirupati Plastomatics	laipur	A	
					Apar Industries	Umbergaon	A	
					Special Cables	Rudrapur	A	
					Advance cable	Bengaluru	A	
					Step Industries	Shahjahanp	u A	
						r		
					Taihan Electric Wire	Korea	Α	
					Tbea Shandong	China	A	
					CMI	Baddi	А	
					Goyoline Fibres(I) Ltd	Daman	A	
					Indo Alusys	Bhiwadi	A	
14.	HT Cable	Upto 11KV	Refer Note 2	Q-010	Universal Cable Ltd.	Satna	A	
					NICCO	Shamnagar, Kolkata	A	
				•	Torrent Cable Ltd	Nadaid	A	
					Incab	Pune	А	
					Polycab Wires Pvt. Ltd	Daman	А	
					KEI Industries	Bhiwadi	А	
					Havells India Ltd.	Alwar	А	
					Sri ram Cables	Bhiwadi	A	
					Krishna Electrical Industrie Ltd	es Gwalior	A	

एन N	एनरीपीसी NTPC I. ITEM		Develop Limited( : SOLAR . : RE-CS-	ment of 20 CCL) CHP/0 9296-004-1	OMW Solar PV at Central CPP Piparwar,Jharkhand 9	INDICATIVE VENDOR LIST Subsystem- Electrical & Mechanical		DOC NO. : RE-CS-9296-004-9 REVISION NO. 00 PAGE : 9
SI. No.	ITEM		QP / INS CAT.	QP No	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
					Apar Industries	Valsad	Α	
					Finolex	Pune	A	
					KEC International	Vadodara	А	
					Tirupati Plastomatics	Jaipur	А	
					Gupta Power	Kashipur	A	
					Paramount	Khuskhera	Α	
					Gemscab	Bhiwadi	A	
					Sterlite	Haridwar	A	
15.	HT Cable ι	upto 33KV	Refer Note 2	Q-011	Universal Cable Ltd.	Satna	A	
			-		Torrent Cable Ltd	Nadiad	Α	
					Polycab Wires Pyt. Ltd	Daman	A	
					, KEI Industries	Bhiwadi	A	
					Havells India Ltd.	Alwar	A	
					Apar Industries	Valsad	А	
					Finolex	P <mark>un</mark> e	А	
					KEC International	Vadodara	А	
					Gupta Power	Kashipur	А	
					Paramount	Khuskhera	Α	
					Gemscab	Bhiwadi	Α	
					Sterlite	Haridwar	Α	
					Gupta Power	Kashipur	А	
16.	DC Cable (Interconr Modules, Module to	necting SPV SPV o SMB)		Q-012	Siechem	Pondicherry	A	Upto 35 sq.mm.
					•			

एनरीपीसी NTPC		PROJECT : I Coalfields L PACKAGE : CONT. NO.	Develop Limited(( SOLAR : RE-CS-	ment of 201 CCL) CHP/CI 9296-004-9	MW Solar PV at Central PP Piparwar,Jharkhand	INDICATIVE VENDOR LIST Subsystem- Electrical & Mechanical		DOC NO. : RE-CS-9296-004-9 REVISION NO. 00 PAGE : 10	
SI. No.	ITEM		QP / INS CAT.	QP No	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS	

	As per NTPC specification						
				Apar	Khatalwada	A	Conditions apply
17.	Battery ( Ni-Cd)	Ш	Q-013	M/S HBL-Power System	Hyderabad	A	Up to 990 Ah with conditions
				M/S Amcosaft	Bangalore	А	8Ah to 990Ah- KPH type
							10Ah to 1365 Ah- KPM type
							11Ah to 1550Ah – KPL type
18.	Battery Plante	Ш	Q-014	M/s Exide	Kolkata	A	
	/Tubular						
				Hoppeke	Brilon,	А	
					Germany		
19.	Battery charger	II	Q-015	M/s Amararaja	Tirupati	A	
				M/s HBL- Power S <mark>ys</mark> tem	Hyderabad	A	
				M/s Chhabi electrical	Jalgaon	A	
				M/s. Chloride Power	K <mark>ol</mark> katta	A	
				M/s Statcon	Hapur	A	Up to 220, V 850 A
				M/s Dubas	Bangalore	A	Up to 220 V, 250 A
				M/s Saft Nife Power Systems	Singapore	A	
				M/s Masstek	Jalgaon	A	
20.	Earthing & Lightning	111		Main contractor Approved	Sources box s	ubject to	
	Protection Material			galvanization at NTPC appro	ved sources as p	per Note-4	
	like GI Strip/GI Wire						
	etc						
				~			
21.	HT Cable Termination			M/s 3M Electro &	Pune	A	Upto 33KV

एनर NT	PRO Coal PAC CON	JECT : Develo fields Limited KAGE : SOLAF	pment of 20 d(CCL) CHP/0 S-9296-004-	DMW Solar PV at Central CPP Piparwar,Jharkhand 9	INDICATIVE VENDOR LIST Subsystem- Electrical & Mechanical		DOC NO. : RE-CS-9296-004-9 REVISION NO. 00 PAGE : 11
SI. No.	ITEM	QP / INS CAT.	QP No	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
	Kits & Straight Through Jointing (Heat shrinkable type)	Kit		Communication			
				Raychem	Halol	A	Upto 33KV
				Hari Consolidated	Delhi	A	Upto 11KV( conditions apply)
22.	Lighting fixtures accessories inclu lamp (Filament t	with II ding ype)	Q-016	M/s Crompton	Mumbai	A	
				M/s Bajaj Electricals	Mumbai	A	
				M/s Philips	Noida	А	
				M/s Wipro	Mumbai	Α	
				M/s Surya Roshni	Noida	Α	Conditions apply
23.	Lighting fixtures accessories inclu lamp (LED type)	with II ding	Q-017	M/ s Wipro	Pune	A	Conditions apply
				M/s Surya Roshni	Noida	A	Conditions apply
				M/s Bajaj	Mumbai	A	Conditions apply
				M/s Goldwyn	Noida	A	
			•	M/s Philips	Noida	A	
24.	MCB Boxes/Junc boxes / Link Boxe Test Link Box/ Adopter box, Sw Boxes, Pull Boxes (Hot Dip Galvan	tion III es/ itch s ized)		Main Contractor approved from NTPC approved sourd	d sources with ga ces	lvanization	BOIs preferably with CE/VDE/UL/CSA marked or BIS approved with valid CML no, Refer Note-6

एन N1	우ROJI Coalfi PACK CONT	ECT : Develop ields Limited AGE : SOLAR . NO. : RE-CS	oment of 20 (CCL) CHP/( -9296-004-	DMW Solar PV at Central CPP Piparwar,Jharkhand 9	INDICATIVE VEI Subsystem- Ele Mechanical	NDOR LIST ctrical &	DOC NO. : RE-CS-9296-004-9 REVISION NO. 00 PAGE : 12
SI. No.	ITEM	QP / INS CAT.	QP No	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
25.	Industrial /weldin receptacles & box	g III es		Schneider	Nasik	A	
				M/s BCH	Faridabad	A	
				M/s Ajmera	Mumbai	A	
				M/s. Sakthi & Crown	Chennai	А	
				Any other make having CE with valid CML number.	/ UL / CSA mark o	or BIS approval	
26.	26. PVC conduit/hume pipe/lighting wire/GI pipes/HDPE pipe/Structural Steel/ GI steel rigid conduit/ epoxy conduit			BIS licensee with valid CM CM	IL number / ISI ma IL number	arked with valid	
			0.010				
27.	MV Switchgear Panel (Refer Note	-5)	Q-018	BHEL	Bhopal	A	Upto 33KV
				Megawin	Salem	A	Upto 33KV
				L&T	Ahmednagar	A	Upto 33KV
				Siemens	Mumbai	A	Upto 33KV
				Jyoti	Vadodara	A	Upto 33KV
				АВВ	Nasik	Α	Upto 33KV
				Schneider	Kolkata	А	Upto 11KV -Salt lake works -VG series Interrupter made at Salt Lake Works

एन N1	ीपीसी ГРС	PROJECT : Coalfields PACKAGE CONT. NO	Develop Limited(( : SOLAR . : RE-CS-	ment of 20 CCL) CHP/C 9296-004-9	MW Solar PV at Central CPP Piparwar,Jharkhand 9	INDICATIVE VENDOR LIST Subsystem- Electrical & Mechanical		DOC NO. : RE-CS-9296-004-9 REVISION NO. 00 PAGE : 13
SI. No.	ITEM		QP / INS CAT.	QP No	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
L								
28.	MV Vacuum Circuit Break	Type ker	(part of Swgr MQP)		Siemens	Mumbai	A	Upto 33kv
					BHEL	Bhopal	A	Upto <mark>3</mark> 3kv
					L&T	Ahmednagar	А	Upto 33kv
					ABB	Nasik	A	Upto 33kv
					ABB	Italy	A	Upto 33Kv
					Megawin	Salem	А	Upto 33kv
					Jyoti	Vadodara	A	Upto 33kv
					Schneider	Kolkata	Α	Upto 11kv
29.	IEC 61850 co Numerical Pr Relays	ompliant rotection	(Part of Swgr MQP)		SEL	Pullman, USA	A	
					ALSTOM T&D	Stafford, UK	А	P14X, P34X, P44X, P64X, P74X models only.
					ALSTOM T&D	Chennai	A	P14X, P24X, P34X, P44X, P64X, P74X models only.
					ABB	Finland	А	
					АВВ	Baroda	А	For 6XX Series
					GE Multilin	Zamudio, Vizcaya, Spain/ Markham, Ontario, Canada	A	F-650 only
					Schneider	Stone, UK	A	PX30, PX40, VAMP 5X and VAMP 2XX models only.
_								

एनरीपीसी NTPC	PROJECT : Develop Coalfields Limited( PACKAGE : SOLAR CONT. NO. : RE-CS-	ment of 20 CCL) CHP/C 9296-004-9	MW Solar PV at Central PP Piparwar,Jharkhand	INDICATIVE VENDOR LIST Subsystem- Electrical & Mechanical		DOC NO. : RE-CS-9296-004-9 REVISION NO. 00 PAGE : 14
SI. ITEM No.	QP / INS CAT.	QP No	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS

			Schneider	Finland	A	VAMP-5X model only
			Siemens	Germany	А	7SX Series only
			Siemens	Goa	A	7SR2X , 7SJ66X series only
30.	Single Rod Air Terminal Type Solar Array Lightning Arrestor		Main Contractor appr manufacturer / supplier h per IS 2309 or equivalent S	roved sources: aaving valid Type Te Standard	subject to est Report as	
31.	ESE Type Solar Array Lightning Arrestor		Main Contractor approved manufacturer / supplier ha per latest version of NF C 1 documents	l sources: subject to aving valid Type Test 17-102 & country of	Report as origin	
32.	Lighting Poles		BIS Licensee as per IS 2713			
33.	Cable Lug	- 111	M/s Dowell	Mumbai	А	
			M/s Billets Elektro Werke Ltd. ( 3 D)	Umbergaon	A	
			M/s Chetna	Nasik	A	
			Additional Vendors with M VDE/ UL/CSA / BIS with CM	lake-Model having ML no. Refer Note-1	mark of	
34.	Cable Gland		Any Make-Model having m CML no. Refer Note-1	nark of VDE/ UL/CS	A / BIS with	
1					1	

SI. ITEM No. ITEM 35. GI Cable accessor bends 	PROJECT : Coalfields PACKAGE CONT. NC	Develop Limited( : SOLAR . : RE-CS-	ment of 20 CCL) CHP/0 9296-004-1	OMW Solar PV at Central CPP Piparwar,Jharkhand 9	INDICATIVE VEN Subsystem- Elec Mechanical	IDOR LIST trical &	DOC NO. : RE-CS-9296-004-9 REVISION NO. 00 PAGE : 15
35. GI Cable accessor bends		QP / INS CAT.	QP No	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
	Tray, fitting, ries including	y, fitting, Refer Q-019 including Note- 3		Inar Profiles Ltd	Enkapalli A (Vishakhapatna m)		
				Vatco	Mumbai	A	Galvanization at Sigma Mumbai
				Indiana cable trays	Mumbai	A	Galvanization at Karamtara galvanizer- Mumbai
				Industrial Perforation	Kolkata	A	Galvanized and offered for inspection at M/s Industrial Perforation Pvt Ltd, Ganganagar , Kolkata, WB
				Ratan Projects	Howrah	A	Galvanization at DMP Projects- Howrah
				India Electric Syndicate	Kolkata	A	Galvanization at BMW Industries/B.P Projects- Howrah
				Steelite engg.	Mumbai	A	•
				Premier Power Products	Howrah	A	Galvanising at Neha Galvaniser- Howrah
				Indiana Gratings	Pune	A	
				M.J. Engineering	Okhla/ Bhiwadi	А	
				T.R.G	Chennai	A	Galvanization at TM Radhakrishna Chetty & Co-Chennai
				Amtech	Pune	А	Galvanization at B.G. Shirke - Pune
				Kannade Anand Udyog	Mumbai	A	<ul> <li>Fabrication at their units: Plot No. 42, Morivali, MIDC</li> <li>Thane &amp; Plot No.: D-35</li> <li>Anand Nagar MIDC, Addl. Ambernath , Dist.Thane</li> <li>Galvanization and offer the galvanized</li> <li>cable trays for inspection at D-34</li> <li>Anand Nagar MIDC, Addl. Ambernath,</li> <li>Dist.Thane.</li> </ul>
				Rukmani	Raipur	А	Ladder type cable trays only
				Passive Infra	Hasangarh (Rohtak)	А	
				Unitech Fabricators & Engineers	Howrah/ Hoogly (Kolkata)	A	

एन N1	ीपीसी PC	PROJECT : Coalfields PACKAGE CONT. NO	Develop Limited(( : SOLAR . : RE-CS-	ment of 20 CCL) CHP/0 9296-004-	OMW Solar PV at Central CPP Piparwar,Jharkhand 9	INDICATIVE VI Subsystem- El Mechanical	ENDOR LIST ectrical &	DOC NO. : RE-CS-9296-004-9 REVISION NO. 00 PAGE : 16
SI. No.	ITEM		QP / INS CAT.	QP No	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
					Patny System	Hyderabad	А	
					Rabi Engg	Kolkata	А	Galvanizing from NTPC approved sources
					MKSD Industries	Taloja	А	Galvanising at Encorp Power trans PVT Ltd, Palghar
					Reliable Sponge	Kalunga	A	
					Rukmani	Hoogly	А	Galvanization at Rukmani Fab & Gal- Howrah
					Eros Metal Works	Nagpur	А	Conditions apply
					Indmark Formtech	Pune	A	Conditions Apply
36.	Cable Tray F Tray Suppor	lexible t System	Refer Note- 3	Q-020	Vatco	Mumbai	A	Galvanising at Sigma Mumbai
					Inar profiles	Enkapalli	A	
					Industrial perforations	Kolkata	А	
					Premier power products	Howrah	A	Galvanising at Neha Galvaniser- Howrah
					Steelite engg.	Mumbai	А	
					Indiana gratings	Pune	А	Galvanising at Poona Galvaniser- Pune
					Amtech	Pune	А	Galvanising at B.G. Shirke- Pune
					Ratan Projects	Howr <mark>ah</mark>	А	Galvanization at NTPC approved sources
					MKSD Industries	Taloja	А	Galvanising at Encorp Power trans PVT Ltd, Palghar
					Indmark Formtech	Pune	Α	Conditions apply
					Patny Systems	Hyderabad	А	
37.	MS pipes for washing sys	r module tem	II		BIS approved source	ces; with valid BI	S license	
38.	Fire Extingui	isher			BIS approved sources with	valid BIS License	2.	
39.	Circuit Breal (outdoor typ	ker 33KV pe)	II II	Q-027	Siemens	Aurangabad	A	
					•			

एन N1	ीपीसी IPC	PROJECT Coalfields PACKAGE CONT. NC	: Develop : Limited( : SOLAR ). : RE-CS	oment of 20 (CCL) CHP/( -9296-004-	DMW Solar PV at Central CPP Piparwar,Jharkhand 9	INDICATIVE VEN Subsystem- Elec Mechanical	NDOR LIST ctrical &	DOC NO. : RE-CS-9296-004-9 REVISION NO. 00 PAGE : 17
SI. No.	ITEM		QP / INS CAT.	QP No	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
			•					
					ABB	Vadodara	А	
					CGL	Nasik	A	
					BHEL	Hyderabad	A	
-					GE T&D	Kanchipuram	A	
40.	Isolator 33 (outdoor t	3 kv sype)	II	Q-028	GR Power	Hyderabad	А	
					Hivelm	Chennai	A	
					S&S Power	Pondicherry	А	
					Switchgear & Structurals	Hyderabad	A	
					Siemens Ltd	Hyderabad	A	
41.	PT (Outdo upto 33Kv	or Type, )	II	Q-029	Mehru	Bhiwadi	A	
					Vishal Transformer	Meerut	A	
					Heptacare	Meerut	A	
42.	33KV CT (0 Type)	Dutdoor	II	Q-030	Mehru	Bhiwadi	A	
					GE T&D	Hosur	A	
					ABB	Vadodara	A	
					CGL	Nasik	A	
					BHEL	Jhansi/Bhopal	A	
L					Vishal Transformer	Meerut	A	
					Heptacare	Meerut	A	
L								
43.	Surge Arre	estor		Q-032	Oblum	Hyderabad	A	
					•			

एन N	ीपीसी ГРС	PROJECT Coalfield PACKAG CONT. N	: Develop s Limited( E : SOLAR O. : RE-CS	oment of 20 (CCL) CHP/0 -9296-004-	DMW Solar PV at Central CPP Piparwar,Jharkhand 9	INDICATIVE VEN Subsystem- Elec Mechanical	IDOR LIST trical &	DOC NO. : RE-CS-9296-004-9 REVISION NO. 00 PAGE : 18
SI. No.	ITEM		QP / INS CAT.	QP No	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
	1			1				
					Lamco	Hyderabad	Α	
					Xian	China	Α	
					CGL	Nasik	Α	
44.	AB Tariff e meter	energy	II	Q-033	SEMS	Udaipur/Solan	A	Inspection with representative from Local Electricity Board.
					Elster	Mumbai	А	
					L&T	Mysore	А	With CMS software.
45.	Conductor	r	II		Smita	Ghaziabad	A	
					Gupta Power Infra	Bhubaneswar	А	
					Saravathy	Bangalore	A	
					Galaxy	Sangli	A	
					Hindustan Vidyut products	Faridabad	A	
					Apar Industries	Vadodara / Silvassa	A	
					Hira Cables	Hira <mark>kud</mark>	Α	
					JSK	Silvasa	Α	
					DIAMOND	VADODARA	А	
					HIREN ALUMINIUM	SILVASSA	А	
					LUMINO	KOLKATA	А	
46.	Disc Insula Insulator	ator/Pin	II		Aditya Birla	Rishra	A	
					IEC	Bhopal	A	
					WSI	Chennai	А	
					BHEL	Bangalore	А	

एन N	ीपीसी PC	PROJECT : Coalfields PACKAGE CONT. NO	Develop Limited( : SOLAR . : RE-CS	oment of 20 CCL) CHP/0 -9296-004-	OMW Solar PV at Central CPP Piparwar,Jharkhand 9	INDICATIVE VEN Subsystem- Elec Mechanical	IDOR LIST ctrical &	DOC NO. : RE-CS-9296-004-9 REVISION NO. 00 PAGE : 19
SI. No.	ITEM		QP / INS CAT.	QP No	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
			1					
					Imperial Ceramics	Bikaner	А	Upto 90KN
					SARVANA	CUDDALORE	Α	
47.	Bus Post li	nsulator	П		Aditya Birla	Halol	A	
					IEC	Bhopal	A	
					WSI	Chennai	A	
					MODERN Insulator	Abu Road	A	
					SARAVANA Global	Cuddalore	А	
					Energy			
48.	Clamps &	connectors			KLEMMEN ENGG	CHENNAI	A	
					MILIND	MUMBAI	А	
					EMI	MUMBAI	A	
					NOOTAN ENGG	MUMBAI	A	
					TAG CORPORATI <mark>O</mark> N	CHENNAL	A	
					ITPL		A	
					RASHTRAUDYOG	KOLKATA	A	
					PEE VEE ENGG	BANGALORE	A	
					MEGHA Engg	CHENNAI	A	
					EXALT	Mumbai	A	
49.	Insulator h conductor accessorie earthwire	nardware, - es & accessories			RASHTRA UDYOG	KOLKATA	A	
					IAC	KOLKATA	A	
					ITPL	MUMBAI	A	
					•			

एन N	ीपीसी TPC	PROJECT : Coalfields PACKAGE CONT. NO	Develop Limited( : SOLAR . : RE-CS-	ment of 20 CCL) CHP/0 9296-004-	OMW Solar PV at Central CPP Piparwar,Jharkhand 9	INDICATIVE VE Subsystem- Ele Mechanical	NDOR LIST ctrical &	DOC NO. : RE-CS-9296-004-9 REVISION NO. 00 PAGE : 20
SI. No.	ITEM		QP / INS CAT.	QP No	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
					EMI Transmission	MUMBAI	Α	
					EMTT	Kolkatta	Α	
50.	Aluminium	n tube			HINDALCO	RENUKUT	А	
					INDALCO	ALUPURAM	A	
					CENTURY EXTRUSIONS	KOLKATA	Α	
					JINDAL ALUMINUM TUBE	BANGALORE	A	
					ALOM EXTRUSIONS	KOLKATA	A	
					BALCO	KORBA	А	
					SUDAL	NASIK	A	
					Banco	Vadodara	Α	
51.	Switchyard Relay Pan	l Control & el / SAS	I	Q-034	GE (Alstom)	Chennai	A	
					Siemens	Kalwa/Goa	А	
					ABB	Peenya	А	
					Schneider	Noida	А	
					BHEL	Bhop <mark>al</mark>	А	Approved for C&R Panel only
52.	Numerical	Relays for	(part		GE	UK/Chennai	A	
	Switchyard	1	of C&R MQP)		$\langle \rangle$		A	
					Siemens	Germany	A	
					АВВ	Sweden/ Bangalore	A	
53	FIBRE OPT	IC CABLES			BIRLA ERICSSON	REWA	Α	
55	FIDRE OP I				BIRLA ERICSSON	REWA	A	

SI. ITE	EM	a		296-004-9		INDICATIVE VENDOR LIST Subsystem- Electrical & Mechanical		DOC NO. : RE-CS-9296-004-9 REVISION NO. 00 PAGE : 21
NO.		IN C	QP / NS CAT.	P / QP No	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
L						11		
					OPTICAL			
					AKSH FIBER	BHIWADI	А	
					FINOLEX	PUNE/GOA	А	
					R&M	SWITZERLAND	A	
					HFCL	GOA	A	
54 REL	LAY TEST KIT		III		OMICRON	USA/AUSTRALIA	A	~
					DOBLE	USA	A	
					MEGGER	UK	A	
SS LEA							A	
AN, FOI ARI	NALYSER DR SURGE RRESTOR		111		TRANSINOR	NORWAY	A	
56 00								
56 GP:	5		111		HATHWAY	USA	A	
					SIEMENS	GERMANY	A	
					HUPF	GERMANY	A	
					SERIEL		A	
					ARBITER	USA	A	
57 956							Δ	
AN			111				A 	
EV	ACUATING/				EMT		Α	
	ANT, GAS				ENERVAC		Δ	
PUI PL/	JRIFYING ANT, GAS	×			VACCUUM PLANT INDUSTRIES	PUNE	A	

एनर्ट	वीसी	PROJECT :	Develop	ment of 201	WW Solar PV at Central	INDICATIVE VEN	IDOR LIST	DOC NO. : RE-CS-9296-004-9
NT		Coalfields	Limited(C	.CL) CHP/CI	PP Piparwar, Jharkhand	Subsystem- Electrical &		REVISION NO. 00
<u> </u>		PACKAGE :	SOLAR			Mechanical		<b>PAGE :</b> 22
		CONT. NO.	: RE-CS-9	9296-004-9				
SI.	ITEM		QP /	QP No	ACCEPTABLE SUPPLIER	PLACE	SC APPL	REMARKS
No.			INS		AS PER DATABASE		STATUS	
			CAT.					

	LEAKAGE					
	DETECTOR		WIKA	USA	A	
58	Transformer (Oil					up to 400 kV Class
	filled type)	1	BHEL	Bhopal		
	Refer Note-8					
			GE( T&D)	Naini		up to 400 kV Class
			Toshiba	Hyderabad	A	up to 400 kV Class
			TELK	Agnamaly,	A	up to 400 kV Class
				Kerala	•	
			ABB	Vadodara	A	up to 765 kV Class
			CG Power & Industrial	Kanjur Marg	A	up to 400 kV Class
			Solutions Ltd.			
			EMCO	Thane	A	up to 400 kV Class
			BHEL	Jhansi	A	up to 220 kV Class
			Schneider	Vadodara	A	up to 50 MVA, 132 kV Class
			T&R	Ahmedabad	A	up to 90 MVA, 132 kV Class
			Kanohar	Merrut	A	up to 16 MVA, 33 kV Class
			EMCO	Jalgaon	A	up to 16 MVA, 33 kV Class
			Kirloskar	Mysore	A	up to 16 MVA, 33 kV Class
			Andrew Yule	Chennai	A	up to 10 MVA, 33 kV Class
			Tesla (unit-2)	23A, Sector-B,	A	up to 5.0 MVA, 33 kV Class
				Industrial Area,		
				Govindpura,		
				Bhopal		
			Indotech Transformers	Chennai	A	up to 16 MVA, 11 kV Class

एनरीपीमी NTPC		PROJECT :	Develop	ment of 20	OMW Solar PV at Central	INDICATIVE VENDOR LIST		DOC NO. : RE-CS-9296-004-9		
		Coalfields	Limited(	CCL) CHP/0	CPP Piparwar,Jharkhand	Subsystem- Ele	ectrical &	REVISION NO. 00		
		PACKAGE	: SOLAR			Mechanical		<b>PAGE</b> : 23		
	-	CONT. NO	.: RE-CS-	9296-004-	9					
SI.	ITEM		QP /	QP No	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL	REMARKS		
No.			INS				STATUS			
			CAT.							
	1		1	1	I	1				
					Hammond Power Solutions	Hyderabad	A	up to 10 MVA, 33 kV Class		
					CG Power & Industrial Solutions Ltd.	Malanpur	A	up to 7.5 MVA, 33 kV Class		
					ECE	Sonepat	А	up to 4.0 MVA, 11 kV Class		
					Voltamp	Savli	Α	up to 3.5 MVA, 33 kV Class		
					Kirloskar	Pune	A	up to 2.0 MVA, 33 kV Class		
					RAYCHEM RPG	Pune	A	Up to 5 MVA, 33 kV Class		
					Esennar	Medak	A	Up to 16 MVA, 66 kV Class		
					Technical Associate Ltd	Sitarganj	A	up to 16 MVA, 33 kV Class, Approval Conditions Apply		
					Prime Meiden Ltd	Nellur	Α	up to 63 MVA, 132 kV Class		
					KRYFS Power Components Ltd	Silvassa	А	Up to 2.5 MVA, 33 kV Class		
					Sudhir Transformers	Bangalore	A	Up to 12.5 MVA, 33KV Class		
					Sudhir Power Ltd	Silvassa	A	Up to 12.5 MVA, 33KV Class		
59	Dry Type		1	Q-036	ABB	Savli	A	up to 8 MVA, 24 kV Class		
	Transform	er			Raychem	Pune	Α	Up to 3.5 MVA, 33 kV Class		
	(refer note	e-8)			Toshiba	Hyderabad	А	Up to 2.0 MVA, 33 kV Class		
					BHEL	Jhansi	Α	Up to 6.3 MVA, 33 kV Class		
					Kirloskar	Pune	Α	Up to 4.0 MVA, 33 kV Class		
				•	Voltamp	Savli	Α	Up to 3.25 MVA, 33 kV Class		
					Hammond Power Solutions	Hyderabad	А	Up to 95 KVA, 33 kV Class		
					Sudhir Power Ltd	Silvassa	А	Up to 1 MVA, 11 KV Class		
60.	132KV Cab	oles		Q-037	Iljin Electric	South Korea	Α			
					KEI Industries	Bhiwadi	А			
					Phelps Dodge	Bangkok	A			
					Phelps Dodge	Bangkok	A			
एन N1	विमित्ती PC	PROJECT : Coalfields PACKAGE : CONT. NO.	Developr Limited(C SOLAR : RE-CS-S	ment of 201 CCL) CHP/CI 9296-004-9	MW Solar PV at Central PP Piparwar,Jharkhand	INDICATIVE VEN Subsystem- Elec Mechanical	IDOR LIST ctrical &	DOC NO. : RE-CS-9296-004-9 REVISION NO. 00 PAGE : 24		
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SI. No.	ITEM		QP / INS CAT	QP No	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS		

				Universal Cable Ltd.	Satna	A			
61.	Battery Health Monitoring System (220V/110V)	111	Q-038	M/s. Chloride Power	Kolkatta	А			
				M/s Dubas	Bangalore	А			
				M/s HBL- Power System	Hyderabad	A			

Under Sub Supplier approval status as per NTPC column:

A: mean that manufacturer proposed main contractor for this items is acceptable to NTPC.

CA: mean that manufacturer proposed by main contractor is acceptable to NTPC with certain conditions

DR-mean that manufacturer proposed by main contractor for the items will be assessed by NTPC. Main contractor is obliged to procure the item from

"DR" category manufacturer only after written approval from NTPC

# Under QP / INSPN CATEGORY column:

CAT-I : For these items the Quality Plans approved by NTPC & 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 basis of verification of documents as per approved QP

CAT-III : For these items Main supplier approves the Quality Plans. The final acceptance by NTPC shall be on basis of certificate of conformance by the main supplier.

# **General Notes:**

# 1) Vendors acceptance is subject to sub-QR clearance as applicable. Sub-QR/Proveness criteria as per the scope/technical specification shall also be applicable for consideration as approved manufacturer/vendor

- 2) Vendor list & inspection category of the mandatory spares shall be as mentioned above.
- 3) For item not appearing in the above list, Main Contractor to approach NTPC for acceptable vendors & inspection categorization of the same.
- 4) NTPC Approval conditions to above identified vendors shall be adhered to. Vendor's approval conditions will be informed on specific request of Main Contractor.

एनर्ट NT	पीमी PC	PROJECT : Coalfields PACKAGE : CONT. NO.	Developr Limited(C SOLAR : RE-CS-S	ment of 201 CCL) CHP/CF 9296-004-9	MW Solar PV at Central PP Piparwar,Jharkhand	INDICATIVE VEN Subsystem- Elec Mechanical	IDOR LIST trical &	DOC NO. : RE-CS-9296-004-9 REVISION NO. 00 PAGE : 25
SI. No.	I. ITEM o.		QP / INS CAT.	QP No	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS

**Note-1**- "TYPE TEST REPORT AS PER EN 50521" OR "VDE / CE / UL / CSA MARKING CERTIFICATION PREFERABLY FROM THIRD PARTY AGENCY" OR "BIS APPROVAL LETTER" SHALL BE SUBMITTED FOR NTPC'S VERIFICATION /INFORMATION.

#### Note-2-

# **Category of inspection for LT Power Cable:**

TOTAL CONTRACT QUANTITY PER SIZE	CATEGORY OF INSPECTION
For cable total quantity ≤ 2.5 KM	Cat-III - submission of TC & Certificate of Conformance by Main Contractor for the
	manufacturers having successfully supplied to any NTPC project-site through Corporate
	contracts for atleast 2 years
For cable total quantity above 2.5 km & up to $\leq$ 10 km per	Cat-II for the manufacturers having successfully supplied to any NTPC project-site
size/type	through Corporate contracts for atleast 2 years
TOTAL QUANTITY MORE THAN 2.5 KM PER SIZE/TYPE	Cat-I

#### **Category of inspection for Control Cable :**

TOTAL CONTRACT QUANTITY PER SIZE	CATEGORY OF INSPECTION
For cable total quantity ≤ 2.5 KM	Cat-III - submission of TC & Certificate of Conformance by Main Contractor for the
	manufacturers having successfully supplied to any NTPC project-site through Corporate
	contracts for at least 2 years
For cable total quantity above 2.5 km & up to $\leq$ 10 km per	Cat-II for the manufacturers having successfully supplied to any NTPC project-site
size/type	through Corporate contracts for at least 2 years
For cable total quantity above 10 km per size/type	Cat-I

# **Category of inspection for HT cables**

TOTAL CONTRACT QUANTITY PER SIZE/TYPE	CATEGORY OF INSPECTION
LESS THAN EQUAL TO 500 M	CAT-III
GREATER THAN 500 M	CAT-I

एनर्ट NT	पीसी 'PC	PROJECT : Coalfields PACKAGE : CONT. NO.	Developr Limited(C SOLAR : RE-CS-S	ment of 201 CCL) CHP/CI 9296-004-9	MW Solar PV at Central PP Piparwar,Jharkhand	INDICATIVE VEN Subsystem- Elec Mechanical	IDOR LIST strical &	DOC NO. : RE-CS-9296-004-9 REVISION NO. 00 PAGE : 26		
SI.	ITEM		QP /	QP No	ACCEPTABLE SUPPLIER	PLACE	SC APPL	REMARKS		
No.	.		INS		AS PER DATABASE		STATUS			
			CAT.							

#### Note-3-

# FOR CABLE TRAYS & CABLE TRAY SUPPORT SYSTEM THE CATEGORY OF INSPECTION SHALL BE AS FOLLOWS

TOTAL CONTRACT QUANTITY PER SIZE /TYPE	CATEGORY OF INSPECTION
For cable total quantity ≤ 2.5 KM	Cat-III - submission of TC & Certificate of Conformance by Main Contractor for the
	manufacturers having successfully supplied to any NTPC project-site through Corporate
	contracts for at least 2 years
For cable total quantity above 2.5 km & up to $\leq$ 10 km per	Cat-II for the manufacturers having successfully supplied to any NTPC project-site
size/type	through Corporate contracts for at least 2 years
TOTAL QUANTITY MORE THAN 2.5 KM PER SIZE/TYPE	Cat-I

# Note-4- Indicative List of acceptable galvanizing sources:

1. M/s M J Engg,Delhi	8. M/s National Galvanizer, Kolkata	15. M/s Sigma, Mumbai	22. Indian Gratings, Pune
2. M/s Indmark , Pune	9. M/s Unistar Galvanizer, Kolkata	16. M/s Radhakrishnan Shetty,	23. Encorp Power trans PVT Ltd, Palghar
<ol><li>M/s A.V. Engg, Kolkata</li></ol>	10. M/s B.P. Project. Ko <mark>lk</mark> ata	Chennai	24. Reliable Sponge, Kalunga
4. M/s Inar Profiles, Vishakapatnam	11. M/s Bajaj Pune	17. Karamtara Mumbai	25- Rukmani Fab & Gal- Howrah
5. M/s Anand Udyog, Mumbai	12. M/s Electrocare Industries,	18.Poona Galvanizers Pune	
6. M/s Techno Engg,Chandigarh	Mumbai	19. Neha Galvanizer- Kolkata	
<ol><li>7. M/S Steelite Engg, Mumbai</li></ol>	13. M/s B.G. Shirke, Pune	20. Unitech Fabricators &	
	14. M/s Gurpreet Galvanizer,	Galvanizers- Hoogly	
	Hyderabad	21. Patny Systems- Mehdak	

# Note-5:

a. Raw material & Bought Out components for main equipment will be finalized with vendor identified by Main Contractor.

**Note-6**: "VDE / CE / UL / CSA MARKING CERTIFICATION PREFERABLY FROM THIRD PARTY AGENCY" OR "BIS APPROVAL LETTER" SHALL BE SUBMITTED FOR NTPC'S VERIFICATION /INFORMATION.

एनरीपीसी NTPC		PROJECT : Coalfields PACKAGE : CONT. NO.	Developr Limited(C SOLAR : RE-CS-S	ment of 201 CCL) CHP/CI 9296-004-9	MW Solar PV at Central PP Piparwar,Jharkhand	INDICATIVE VEN Subsystem- Elec Mechanical	IDOR LIST ctrical &	DOC NO. : RE-CS-9296-004-9 REVISION NO. 00 PAGE : 27
SI.	ITEM		QP /	QP No	ACCEPTABLE SUPPLIER	PLACE	SC APPL	REMARKS
No.	.		INS		AS PER DATABASE		STATUS	
			CAT.					

**Note-7**: Approval conditions shall be adhered to.

# Note-8:

**8.1** Raw material & bought out components for main equipment will be finalized with vendor identified by Main Contractor.

8.2 For Auxiliary Transformers (Oil Filled & Dry Type- below 1.0 MVA, 11 KV Class):

a. Main Contractor's approved sub-vendors will also be acceptable subject to sub-vendor shall have minimum two years of supply experience for similar rating & type of transformers.

b. NTPC will review the Routine Test Inspection Report, witnessed by Main Contractor as per IS 2026/IS 1180 for Oil Filled Transformer and as per IS 11171 for Dry type Transformer

PROJECT : Centra		al Coalfi	elds L	Limited (CCL)	LIST O	f OF ITEMS			DOC. No. :		
Ň	TPC	<b>CHP/CPP</b> Piparwa	r, Jhark	hand	-20MW	REQUI	RING QUALITY	7	Revi	Revision No. :	
		PACKAGE: SOLA	R			PLAN A	ND SUB- SUPP	LIER	DAT	DATE: 28.03.2019	
SUPPLIER :					APPROVAL				<b>PAGE : 1 OF 7</b>		
		CONT. NO.:				SUB SY	STEM: <u>C &amp; I</u>				
SL. NO.	ITEM		QP/IN SPN CAT	QP NO.	PROPOSED SUPPLIER		PLACE	SUB- SUPPL APPRO STATU CATEO	IER DVAL JS/ GORY	REMARKS	
1	INSTR	UMENTATION	(REFER		DELTON CABLES LTD		FARIDABAD	А		PVC FRISTYPE	
	CABLE		NOTE- 1)		PARAMOUNT COMMUNICATION LTD		KHUSHKHERA	A		PVC, FRLS TYPE	
					CORDS CABLE INDUSTRIES LTD		BHIWADI/ KAHARANI	А		PVC, FRLS TYPE	
					KEI INDUSTRIES LTD		BHIWADI	A		PVC, FRLS TYPE	
					POLYCAB WIRES PVT. LTD		DAMAN	A		PVC, FRLS TYPE	
					THERMOCABLES		HYDERABAD	A		PVC, FRLS TYPE	
					ELKAY TELELINKS		FARIDABAD	A	L	PVC, FRLS TYPE	
					GUPTA POWER		KHURDHA	A	L	PVC,FRLS,SHIELDED, MULTI	
					NICCO		VOLVATA	Δ		PAIR, TWISTED, TYPE A, B, F&G	
							SATNA			PVC FRISTVPF	
					CMI		FARIDARAD	A		ONLY FOR F& G TYPE	
					ADVANCE CABLES PV	ТІТО	BANGLORE	A		ONLY FOR 0.5 SOMM F&G TYPE CABLES	
					GEMSCAR INDUSTRIES I TD		BHIWADI	A		ONLY FOR 0.5 SOMM F&G TYPE CABLES	
					APAR INDUSTRIES LIMITED		VALSAD	A		ONLY FOR 0.5 SOMM F&G TYPE CABLES	
					SUYOG ELECTRICALS I	TD	HALOL	A		ONLY FOR 0.5 SOMM F&G TYPE CABLES	
					SPECIAL CABLES PVT I	TD	RUDRAPUR	А		ONLY FOR 0.5 SQMM F&G TYPE CABLES	
					T C COMMUNICATION	Y	GHAZIABAD	А		PVC, FRLS TYPE	
					TEW & C		USA	А			
					HABIA CABLES		SWEEDEN	А			
					KERPEN CABLES		GERMANY	А			
					LAPP CABLES		GERMANY	A			
					THERMO ELECRTA BV		NETHERLAND	D A			
					APAR INDUSTRIES		GUJARAT	А			
2	FIRE A	LARM PANEL OPROCESSOR BASED	II		NOTIFIER		USA	А	L	UL CERTIFICATION OF MODEL NO ALSO PROVIDED WITH COC	
	& MANNUAL CALL POINTS				ТҮСО		USA	A		SIMPLEX BRAND	

PR		<b>PROJECT : Centr</b>	al Coalf	ields I	Limited (CCL)	LIST OF ITEMS			DOC. No. :		
Ň	TPC	<b>CHP/CPP</b> Piparwa	ar, Jharl	khand	-20MW	REQUI	RING QUALITY	7	Revision No. :		
_		PACKAGE: SOLA	AŔ			PLAN A	ND SUB- SUPP	LIER	DATE: 28 03 2019		
SUPPLIER :					APPROVAL			PACE : 2 OF 7			
		CONT. NO.:				SUB SY	STEM: C & I				
SL. NO.	. ITEM		QP/IN SPN CAT	QP NO.	PROPOSED SUPPLIER		PLACE	SUB- SUPPLIER APPROVAL STATUS/ CATEGORY		REMARKS	
					AUTRONICA		NORWAY	A			
					SCHRAK		AUSTRIA	А			
					EDWARDS		USA	А			
					TOSHNIWAL INDUSTRIAL PVT LTD		AJMER	A		CONDTIONAL AS PER APPROVAL LETTER NETRA/STH/03	
					M/S SHIELD FIRE SAFE SECURITY LTD	TY AND	UK	A			
3	3 ADDRESSABLE DETECTORS (MULTI SENSOR), INTERFACE		II		NOTIFIER		USA/GURGAON	A			
			TERFACE		ТҮСО		USA	A	L	SIMPLEX BRAND	
	STROB	E & HOOTER			AUTRONICA		NORWAY	A	L		
					SCHRAK		AUSTRIA A		L		
					EDWARDS		USA	А			
					SHIELD FIRE SAFTY		UK	A			
4	FIBRE	OPTIC CABLES	(REFER		BIRLA ERICSSON OPTIC	CAL	REWA	A			
			NOTE		AKSH FIBER		BHIWADI	A	L		
			2)		FINOLEX		PUNE/GOA	A	L		
					R&M		SWITZERLAND	A	L		
					HFCL		GOA	A	L		
					JIANGSU TONGGUANG		CHINA	A	L		
					R&M		SWITZERLAND	A			
					MOLEX		UK	A			
					CORNING		USA	A			
					KEC INTERNATIONAL	LTD	MYSORE	A	L		
5	OPERA STATIO	TOR WORK DN	III		DELL/HP/IBM/LENEVO/ /FUJITSU OR OEM APPF SOURCES	COMPAQ ROVED		А	L		
6	24V IN	TELLIGENT	Ι		ELTEK		GURGAON	A		MODULES FROM ELTEK	
	BATTE	RY CHARGER			MASS TECH		JALGAON	А	L	MODULES FROM ELTEK	

	PROJECT : Centra	al Coalfi	ields I	imited (CCL) LIST OF ITEMS				DOC. No. :					
Ň	<b>TPC</b> CHP/CPP Piparwa	r, Jhark	khand	-20MW	REQUI	RING QUALITY	ζ	Revi	sion No. :				
_	PACKAGE: SOLA	R			PLAN A	ND SUB- SUPP	LIER	DAT	E: 28.03.2019				
	<b>SUPPLIER :</b>				APPRO	VAL		PAG	E: 3 OF 7				
	CONT. NO.:				SUB SY	STEM: <u>C &amp; I</u>							
SL.	ITEM	QP/IN	QP	PROPOSED SUPPLIER		PLACE	SUB-	1	REMARKS				
NO.		SPN	NO.				SUPPL	JER					
		CAI					STATI	JVAL JS/					
							CATE	GORY					
		T	-			LAL CAON							
	/DCDB & BHMS			СННАВІ		JALGAON	A	1	MODULES FROM EMERSON				
				VERTIV ENERGY PVT L	JTD	MUMBAI	A	1	WITH MODULES FROM EMERSON-CHINA				
7	PLC BASED SCADA	Ι		M/S BEIJING K&U ELEC	TRICAL	BEIJING	A	۱ ۱	CQA/9518/LWA/B-437 DTD 01.02.2018				
	SYSTEM	YSTEM I GE INTELLEGEN PVT LTD					A	ţ	NOTESHEET NO. 3428 DTD 12.11.2010				
				ABB		BANGALORE	A	· · ·					
				SCHNEIDER		NASIK	A						
				ROCKWELL	SAHIBABAD	A	<u> </u>						
				SIEIVIEINS		INASIK		1	APPROVAL AS PER LETTER DATED CW-				
				HONEYWELL		PUNE		1	EN-9661-M03-001 DTD 28.02.2014				
				M/S VIRTUAL AUTOMA	TION	RANGAREDDY	A	1	CQA/001/151/NKTPP/V-205/VIRTUAL AUTOMATION DTD 29.08.2017				
				M/S COTMAC ELECTRO	NICS	PUNE	A	1	CQA/001/151/NKTPP/C-352/COTMAC DTD				
				PVTLTD			•		16.08.2017				
				M/S TECH-MASTERS		HYDERABAD	A	1	DTD 16.08.2017				
				M/S POWERTECH SWIT (I) PVT LTD	CHGEAR	SONEPAT	A	1	CQA/001/147/KHARGONE/PLC PANEL DTD 10.07.2017				
				M/S UNITY INDUSTRIAL AUTOMATION PVT LTD		DELHI	A	L	CQA/5505/906/TAPOVAN/U-131/PLC PANEL DTD 27.10.2017				
				EMCONS	¢	RANCHI	A	L	CQA/4410-155E/E-350/EMCONS DTD 31.01.2018				
				SCHNEIDER		BANGALORE	A	1	01/PETF/9548-155/TATA DTD 06.11.2015				
				M D INDUSTRIES		VADODARA	A	L .	CQA/5505-902/ M472/PLC PANEL DATED 24.05.2018				
8	NI-CD BATTERY FOR PLC I AMCO SAFT		AMCO SAFT		BANGALORE	A	1						
	SYSTEM	HBL POWER SYSTEM		HBL POWER SYSTEM		HYDERABAD	A	1					
	II SAFT			SAFT		FRANCE/ SWEDEN	A	1					
	HOPPECKE BATTEF & CO KG				GMBH	GERMANY	A	L					

	PROJECT : Centr	al Coalf	ields I	Limited (CCL)	LIST O	F ITEMS		DOC. No. :				
	CHP/CPP Piparwa	ır, Jharl	khand	-20MW	REQUI	RING QUALITY	ζ	Revi	sion No. :			
	PACKAGE: SOLA	R			PLAN A	ND SUB- SUPP	LIER	DAT	E: 28.03.2019			
	SUPPLIER :				APPRO	VAL		PAG	E:40F 7			
	CONT. NO.:				SUB SY	STEM: <u>C &amp; I</u>						
SL. NO.	ITEM	QP/IN SPN CAT	QP NO.	PROPOSED SUPPLIER	PLACE SU SU Al		SUB- SUPPL APPRC	IER )VAL	REMARKS			
							STATU CATE(	S/ FORY				
L	l					CITIE						
9	BATTERY(LEAD-ACID PLANTE)	II		HOPPECKE BATTERIEN & CO KG	GMBH	GERMANY	А					
	(REFER NOTE 3)	EXIDE		KOLKATA	A							
10	ELECTRICAL ACTUATOR	II		ANTRIEB TECHNIK PVT	T LTD	CHENNAI	A					
		II		AUMA		BANGALORE	A		×			
		II		LIMITORQUE		FARIDABAD	A					
		II		ROTORK	BANGLORE	A						
		Ι		ROTORK CONTROLS (IN PRIVATE LTD	NDIA)	CHENNAI	A					
		III		AUMA		GERMANY	A					
		III		LIMITORQE		USA	А	-				
		III		ROTORK		UK	A					
		III		NIPPON GEAR		JAPAN	A					
		III		DREHMO GMBH		GERMANY	A					
11	SMF LEAD-ACID BATTERY	III		AMARRAJA		TIRUPATI	А					
	MICROPROCESSOR BASED			EXIDE		KOLKATTA	А					
	FIKE ALAKM PANEL			HBL POWER SYSTEM	<i>v</i>	HYDERABAD	А					
12	UPS SYSTEM WITH ACDB	(DEEED		FUJI ELECTRIC		JAPAN	A	-				
		NOTE		HITACHI HIREL		GANDHINAGA R	А		APPROVED UP TO 120 KVA, 1Φ			
	4) VERTIV ENERGY PV		LTD	PUNE	А		А		UP TO 125 KVA FOR 1 PHASE & 300 KVA FOR 3 PHASE			
	VERTIV ENERGY PVT I			LTD	MUMBAI A UP T			UP TO 160 KVA				
	KELTRON				TRIVENDRUM A							
	MERLIN & GERIN					FRANCE	А	-				

	PROJECT : Centra	al Coalfi	ields I	Limited (CCL)	LIST O	F ITEMS		DOC. No. :					
Ň	<b>THE</b> CHP/CPP Piparwa	r. Jhark	khand	-20MW	REOUI	RING OUALITY	7	Revi	sion No. :				
_	PACKAGE: SOLA	R			PLAN A	ND SUB- SUPP	LIER	DAT	E: 28 03 2019				
	SUPPLIER :				APPRO	VAL		PAG	E • 5 OF 7				
	CONT. NO.:			SUB SYSTEM: C & I									
SL.	ITEM	OP/IN	OP	PROPOSED SUPPLIER		PLACE	SUB-		REMARKS				
NO.		SPN	NO.				SUPPLIER						
		CAT				APPROVAL							
						STATUS/ CATEGORY							
			1				0.112						
				GUTUR		SWITZERLAND	A	1					
				AEG (SAFT)		GERMANY	A	1					
				M/S CONSUL NEOWAT	Γ	PUNE	A	1					
13	GPS/MASTER SLAVE I CLOCK SYSTEM			SIGNALS AND SYSTEM LTD. (SANDS )	S PVT.	CHENNAI	А		~				
	CLOCK SYSTEM     I     LTD. (SANDS )       I     MASIBUS					GANDHINAGA R	A						
		Ι		SERTEL ELECTRONICS LTD.	PVT.	CHENNAI	A						
		II		HOPF ELECTRONIK GM	BH	GERMANY	A	1	BRAND NAME: MOBATIME				
		II		HATHWAY		USA	A	1					
		II		MEIN BERG		GERMANY	A	1					
		II		MOSER BAER AG		SWITZERLAND	A	1					
14	CONTRO DESK			SOLUTIONS PVT LTD	CE	UDAIPUR	A	1	BOI SHALL BE AS PER NTPC APPROVED MAKES				
		Ι		COSMOS MEDIA PRODU PVT LTD	JCTS	GREATER NOIDA	A		<ol> <li>H BLOCK SHOULD BE FROM KNURR GERMANY</li> <li>COMPLETE INTEGRATED MOSAIC GRID SHOULD BE PROCURED FROM NTPC APPROVED SOURCES LIKE PRO PLAN/SUBKLEW</li> <li>SOLID ACRYLIC SURFACE SHOULD BE PROCURED FROM DU PONT/NTPC APPROVED SOURCES</li> <li>EXTRUDED AL PROFILE STRUCTURE SHOULD BE PROCURED FROM HINDALCO (WITH KNURR DESIGN)</li> </ol>				
				ADARSHA CONTROL SY PVT LTD	YSTEM	BANGALURU	A	Υ.	<ol> <li>MOSAIC ITEMS SHOULD BE FROM NTPC APPROVED SOURCES .</li> <li>ACRYLIC SOLID SURFACE (ASS) SHOULD BE PROCURED FROM DU PONT /NTPC APPROVED SOURCES</li> <li>WOOD WORKS ARE TO BE DONE BY</li> </ol>				

	मेरीकी	<b>PROJECT : Centra</b>	al Coalfi	elds I	Limited (CCL)	LIST OF ITEMS DO				OC. No. :			
Ň	TPC	<b>CHP/CPP</b> Piparwa	r, Jhark	hand	-20MW	REQUI	RING QUALITY	ζ	Revi	evision No. :			
		PACKAGE: SOLA	R			PLAN A	AND SUB- SUPP	LIER	DAT	TE: 28.03.2019			
		<b>SUPPLIER :</b>				APPRO	VAL		PAG	GE : 6 OF 7			
		CONT. NO.:				SUB SY	'STEM: <u>C &amp; I</u>						
SL.	ITEM		QP/IN	QP	PROPOSED SUPPLIER		PLACE	SUB-	IED	REMARKS			
NO.			SPN CAT	NO.					IEK )VAL				
			0.11					STATU	JS/				
								CATEC	GORY				
										M/S C K FURN BANGALURU			
15	IP BASI	ED CCTV								Conditional as per approval letter			
10					AXIS		SWEDEN	A		01/CQA/2130-430/Axis Comm			
										AB,Sweden/NTPC dated 12/01/2015			
					BOSCH		BENGALURU	Δ		Conditional as per approval letter			
			III		bosen		DEROFILORO			01/CQA/1240/2250-405 dated 30-08-12			
					HONEYWELL SECUR	ITY &	CURCLON			Conditional as per approval letter			
					FIRE	IRE GURGAON				01/CQA/9562-405/Honeywell dated			
										05.11.2010 01/COA/0330 186A DTD 17.03 2016(NO			
					PELCO		USA	A		CONDITION)			
			Ι	-	SIEMENS		GURGAON	A					
			Ι		LTTS		BANGALORE	A	L	CC:PET:9578:001/VA DTD 26.03.18			
16	BLANK	PANELS /	III		MAIN CONT	RACTOR A	PPROVED SOURCE	ES					
17	CABIN	ETS	ш				DDDOVED SOUDCI	70					
1/	FITTIN	GS(SS)	111		MAIN CONT	KACTOR A	IPROVED SOURCE	20					
18	COMPL	JTER FURNITURE	III		MAIN CONTI	RACTOR A	PPROVED SOURCE	ES					
19	DESK F	FOR	III		MAIN CONT	RACTOR A	PPROVED SOURCE	ES					
	OWS/E	WS/PRINTER/SERVE											
20	R	NOTION DOX	ш			DACTOD A	DDDOVED SOUDCI	70					
20	FRP JU	NCTION BOX			MAIN CONT	RACIOR A	PPROVED SOURCE	25					
21	GRAPH	IC INTERFACE UNIT			MAIN CONTI	RACIOR A	PPROVED SOURCE	25					
22		SE PIPES/IUBES			MAIN CONT	RACIOR A	PPROVED SOURCE	20					
23	& BOA	RD TYPE)	111		MAIN CONT	KACIUK A	APPROVED SOURCE	20					
24	MINI U	PS UP TO 3.5 KVA	III		MAIN CONTI	RACTOR A	PPROVED SOURCE	ES					
25	PRINTE	ER (INKJET / LASER)	III		MAIN CONTI	RACTOR A	PPROVED SOURCE	ES					
26	TERMI	NAL BOX	III		MAIN CONTI	NTRACTOR APPROVED SOURCES							
27	27 INSTRUMNETATION III MAIN C				MAIN CONT	RACTOR A	PPROVED SOURCE	ES		UP TO 300 CLASS AND SIZES UP TO 600 NB			

No. :		
Revision No. :		
28.03.2019		
:7 OF 7		
REMARKS		

SIREN

MAIN CONTRACTOR APPROVED SOURCES

LEGENDS:

28

# 1. SYSTEM SUPPLIER / SUB-SUPPLIERSTATUS CATEGORY (SHALL BE FILLED BY NTPC).

Ш

A – For those items proposed Sub-vendors are acceptable to NTPC subject to meeting NTPC Technical specification requirement.

# 2. INSPECTION CATEGORY:

Cat I: For those items the quality plans are approved by NTPC and final acceptance will be on physical inspection witness by NTPC.

CAT II: For those items the quality plans are approved by NTPC. However no physical inspection will be done by NTPC. The final acceptance by NTPC shall be on the basis of review of documents as per QP.

CAT III: For those items Main Supplier approves quality plans. The final acceptance by NTPC shall be on the basis of certificate of conformance by Main Supplier.

**NOTE-1**: For Instrument cable <= 1 KM inspection category CAT - III, FOR > 1 KM to <= 10 KM Inspection category CAT - II COC & FOR> 10 KM Inspection category CAT-I **NOTE-2**: For Fiber Optic cable <= 10KM inspection category CAT - III & for > 10KM Inspection category CAT-II.

**NOTE 3:** Batteries for UPS <= 10 KVA and batteries for intelligent battery charger 24 V DC <= 40 Amp inspection category CAT-III & for Batteries for UPS> 10KVA and batteries for intelligent battery charger 24 V DC > 40 Amp rating inspection category CAT-I

NOTE 4: UPS <= 10 KVA rating, inspection category CAT-III & for > 10KVA rating inspection category CAT-I

**NOTE 5:** For item not appearing in the pre-award list, bidder and NTPC will mutually discussed in future.

**NOTE 6:** Empty cabinets, computers, signal isolator/ multiplier and TB shall also be acceptable from owner accepted in QP. If the total integrated panel and FAT is conducted indigenously.

NOTE 7: For the C & I instruments mounted on the skid of the main item or supplied as an integral part of the main item, instrument to be supplied as per proven practice of the manufacturer meeting the Customer technical specification requirement.

		IN	DICATIVE FIELD C	UALITY	PLAN						Annexure-II
	एनरीपीरी NTPC	ITEM : CIVIL WORK		QP NO. :		1	PROJECT:	140MW SPV at	Bilhaur		
				REV. NO	:	0	PACKAGE:				
				DATE :			CONTRACT NO.				
		SUB-SYSTEM : CIVIL AND STRUCTUR	RAL STEEL WORKS				MAIN CONTRACTOR				
				PAGE :							
SI. No	Activity and operation	Characteristics / instru	uments	Class of check	Type of Check	Quantum Of check	Reference Document	Acceptance Norms	Form	nat of cord	Remarks
1	2	3	-	4	5	6	5 7	8	9	D*	10
1	GENERAL REQUIREMENTS										
Α	Availability of QA& QC manpower and laboratory		-	A	Physical	Once prior to start of work and thereof monthly	Tech Specs and Const. [	Drawings	SR	$\checkmark$	
в	Sampling for testing of building materials, concrete mix design etc.		As agreed / required	A	Physical	As specified in FQP for various materials	Tech Specs and Const. [	Drawings	SR/TR	V	Test report along with the recommendations from specialist agency to be submitted to NTPC.
с	Submission of schedule of tests to be done monthly / quarterly		-	A	Physical	Once prior to start of work and thereof monthly	Tech Specs and Const. [	Drawings	SR	V	
D	Stacking and storage of construction materials and components at site		As per IS:4082	A	Physical	Random	Tech Specs and Const. I 4082	Drawings and IS:	SR	V	
2	<b>EXCAVATION AND FILLING I</b>	FOUNDATION WORKS									
	Excavations-			-							
2.1		Nature, type of soil/rock before and during excavations	As agreed / required	С	Visual	Random in each shift	Tech Specs and Const. [	Drawings	SR		
2.2		Initial ground level before start of excavations	As agreed / required	С	Measurement	100%	Tech Specs and Const. [	Drawings	SR	$\checkmark$	
2.3		Final shape and Dimensions of excavations.	As agreed / required	С	Measurement	100%	Tech Specs and Const.	Drawings	SR		
2.4		Final excavation levels	As agreed / required	В	Measurement	100%	Tech Specs and Const. [	Drawings	SR		
2.5		Side slope of final excavation	As agreed / required	В	Measurement	Random in each shift	Tech Specs and Const.	Drawings	SR		
	Fill/ Backfill -		A							1	
2.6	Standard proctor Test	dry density before fill	As per IS: 2720 Proctor needle apparatus,etc.	, В	Physical	One in every 10000 cum for each type and source of fill materials	IS 2720 (Pt.VII), Tech Sp Drawings	ecs and Const.	SR/TR	N	
2.70	Moisture content	Moisture content of fill before compaction	As per IS: 2720, balance, oven, rapic moisture meter, etc.	, B I	Physical	One in every 10000 cum for each type and source of fill materials	IS 2720 (Pt.II), Tech Spe Drawings	cs and Const.	SR/TR	V	
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 10000 SQM area for each compacted layer.	IS 2720 (Pt. XXIX), Te Const. Draw OR IS 2720 (Pt. XXVIII), Const. Draw	ech Specs and /ings Tech Specs and /ings	SR/TR		

		IN	DICATIVE FIELD O	QUALITY PLAN							Annexure-II
	एनरीपीसी NTPC	ITEM : CIVIL WORK		QP NO. :		1	PROJECT:	140MW SPV at	Bilhaur		
				REV. NO	.:	C	PACKAGE:				
				DATE :			CONTRACT NO.				
		SUB-SYSTEM : CIVIL AND STRUCTUR	RAL STEEL WORKS				MAIN CONTRACTOR				
				PAGE :							
SI. No	Activity and operation	Characteristics / instr	uments	Class of check	Type of Check	Quantum Of check	Reference Document	Acceptance Norms	Form	at of	Remarks
1	2	3	1	4	5	6	§ 7	8	9	D*	10
3.0											
3.1		Physical & Chemical Properties	as per IS:4031	A	Testing	At Random	As per relevant IS Specification	Codes/ Tech	TR	1	Each consignment of cement shall be duly correlated with manufacturers TC. One sample from each lot shall be tested for stetting time and compressive strength . If cement is stored more than 90 days in godown of contractor same shall be retested for comp. Strength & setting time.
3.2	Coarse Aggregate	Moisture content	as per IS:2386	В	Physical	Once for each stack of 100 Cu.M. or part there of	IS : 456 IS : 383/Tech	Spec	SR/LB	V	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:383/Tech Spec	IS:456,	SR/LB/ TR	V	
111		Sieve analysis, flakiness index, elongation index,	IS:2386	В	Physical	One per 100 cum., or part thereof	IS: 2386 Part-I, Spec	IS:383/Tech	SR/LB	$\checkmark$	
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	
v		Soundness	IS:2386	A	Physical	-do-	IS: 2386 Part-V, IS:383		SR/LB/ TR	$\checkmark$	
vi		Crushing value abrasion value and impact value	IS:2386	A	Physical	-do-	IS:383, IS-2386 Part IV/T	ech Spec	SR/LB/ TR	$\checkmark$	
3.3	Fine Aggregate										
i		Moisture content, water absorption	balance , oven, rapio moisture meter etc.	В	Physical	To be done every day before start of work	IS: 2386 Part-III	IS:383	SR/LB/T R	$\checkmark$	
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	1	
111		All other tests similar to coarse aggregates as mentioned above.					IS-2386, IS-383		SR/LB/T R	$\checkmark$	except test for flakiness index, elongation index, abrasion value, impact value
3.4	Water										
i		Complete tests as per IS:456	Burette, conical flask pipette etc.	, B	Testing	One for each source.	IS:3025 part 22 and 23 (f), IS:456(for acceptance	for test procedure criteria )	SR/LB/T R	V	

		INI	DICATIVE FIELD C	QUALITY	PLAN						Annexure-II
	एन <b>रीपी</b> सी NTPC	ITEM : CIVIL WORK		QP NO. :		1	PROJECT:	140MW SPV at	Bilhaur		
				REV. NO	.:	C	PACKAGE:				
		SUB-SYSTEM CIVIL AND STRUCTUR	AI STEEL WORKS	DATE :			CONTRACT NO.				
				PAGE :			MAIN CONTRACTOR				
SI. No	Activity and operation	Characteristics / instru	uments	Class of check	Type of Check	Quantum Of check	Reference Document	Acceptance Norms	Form Rec	at of ord	Remarks
1	2	3	Γ	4	5	6	5 7	8	9	D*	10
3.5	CONCRETE	4 Trial mixes to ascertain the workability and cube strength	After receiving the recommended mix design from specialist agency,	e K t	Physical	One for each mix proportion	NTPC tech specification		SR/LB	V	
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 Te	ch. Spec.	SR/LB/ TR	$\checkmark$	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	В	Physical	At the time of concrete pouring at site every two hrs.	IS:456/NTPC Tech. Spec		SR/LB/T R	$\checkmark$	
3.5.1	Admixtures for Concrete	Type of admixture	As per IS:9103	В	Review of MTC	For each lot received at site	Designed mix and IS:910	3	MTC	V	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 cha 4926	rt/ Certificate, IS		V	
ii		Arrangement for transportation & placement of concrete.	As required	С	Visual	100%	Before clearance fo	r concreting	Inspectio n Report	V	
111		Handling and Transportation of concrete	As required	С	Physical	100%	As per construction/erect (to be approved one wee	ion methodology k prior to start of	SR		
iv		Placement of concrete	Visual	В	Physical	100%	As per construction/erect and tech.specs / No segr	ion methodology egation	SR	$\checkmark$	
v		Compacting	As required	С	Physical	At Random	IS:456		SR	$\checkmark$	
vi		Curing	As required	С	Physical	At Random	Period of curing as per IS bags / curing compound)	8 456 (use gunny	/ SR	$\checkmark$	
3.7	TEST/CHECK ON RCC STRUC	TURE IN HARDENDED CONDITIONS									
i		Dimensional check on finished structures & Dimensional tolerances	As required	В	Measurement	Approved Drawing	As per IS:456/ tech. Spec	cification.	SR/LB	$\checkmark$	
ii		vvater Tightness Test of liquid retaining structure/ tanks	As required	В	Test	100%	IS:3370/ Tech. Specificat	ion	SR/LB	V	
<u>3.8</u> i	REINFORCEMENT STEEL	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 and Const. Drawings	6, Tech Specs	MTC		
ii		Freedom from cracks surface flaws, Lamination.	As agreed / required	C	Visual	Random in each shift	IS: 1852, IS:432, IS:1786 and Const. Drawings	, Tech Specs	SR		To be checked at site. Steel collected from source should be free from excessive rust. To be stored as per Technical Specs.

		INI	DICATIVE FIELD (	QUALITY	PLAN						Annexure-II
	एन् <b>रीपीसी</b> NTPC	ITEM : CIVIL WORK		QP NO. :		1	PROJECT:	140MW SPV at	Bilhaur		
				REV. NO	.:	0	PACKAGE:				
				DATE :			CONTRACT NO.				
		SUB-SYSTEM : CIVIL AND STRUCTUR	AL STEEL WORKS				MAIN CONTRACTOR				
				PAGE :							
SI No	Activity and operation	Characteristics / instru	uments	Class of	Type of Check	Quantum Of chock	Reference Document	Acceptance	Form	nat of	Remarks
31. NU				check	Type of Check		_	Norms	Rec	ord	
1				4	5	6	7	8	9	D*	10
3.9	PLACEMENT OF REINFORCE	Bar bending schedule with pecessary		B	Viewel 8		Approved Drowings Teel		SR		
i		lap, Spacers & Chairs	As agreed / required		Measurement	Random in each shift	Const. Drawings, IS:2502			$\checkmark$	
ii		Bending of bars, cutting tolerance	As agreed / required	C	Visual & Measurement	Random in each shift	Approved Drawings, Tech Const. Drawings, IS:2502	n Specs and	SR	$\checkmark$	
		Acceptance - Cover, spacing of bars,		В					SR		
iii		spacers and chairs after the reinforcement cage is put inside the formwork	As agreed / required		Visual & Measurement	Random in each shift	Approved Drawings, Tech Const. Drawings	n Specs and		$\checkmark$	
3.10	STAGING AND FORMS										
i		Materials and accessories	As agreed / required	С	Visual	Once before start of work	As per relevant IS, Tech Const. Drawings	Specs and	SR		
ii		Soundness of staging, shuttering and scaffolding including application of mould oil / release agent	As agreed / required	С	Visual	Once before start of work	As per manufacturer's sp 3696,4014, 4990, Tech S Drawings	ec.and as per pecs and Const.	SR		
		Acceptance of formwork before start of concreting		В	Physical / visual	Before start of each concreting	As per provisions and tole Specs and Const. Drawin	erances, Tech Igs	SR	$\checkmark$	
3.11	DAMP PROOF COURSE						Tech Specs and Const. I	Drawings			
i		Material - Hot bitumen and water proofing materials etc.	As agreed / required	В	Review of MTC	Each batch of delivery at site	Tech Specs and Const. I	Drawings, IS 702	SR	$\checkmark$	
ii		Acceptance of damp proof course	As agreed / required	В	Acceptance	100%	Tech Specs and Const. I	Drawings	SR		
3.12	GROUTING										
i		Material	As agreed / required	В	Review of MTC	Each batch of delivery	Tech Specs and Const. D	Drawings	SR	$\checkmark$	
		Type of mix - fluid mix, plastic mix, stiff mix etc.	As agreed / required	С	Physical	Prior to start of work	Tech Specs and Const. D	Drawings	SR	$\checkmark$	
ii		Mixing, placement, application and grout pressure	As agreed / required	С	Physical	Random in each shift	Tech Specs and Const. E	Drawings	SR		
111		Compressive strength	As agreed / required	С	Physical	Random in each shift	Tech Specs and Const. D	Drawings	SR		
iv		Acceptance of the grouts	As agreed / required	В	Physical	Each grout section	Tech Specs and Const. D	Drawings	SR		
3.13	PRE-CAST CONCRETE										
i		Crushing strength	compression strength testing machine	A	Physical	one sample of six cubes per 50m m3 or part thereof	IS:516 & IS: 456		SR/LB	$\checkmark$	A minimum of three specimen shall be tested for 7 and 28 days compressive strength
ii		Workmanship and dimensions	Visual	В	Physical	100%	As per IS:456/NTPC Tec	h. specification.	Register		
		Load Test	As required	В	Physical	1% up to 1000 nos. and 0.5% for more than 1000 nos. for each type	IS:456/ As decided by NT charge.	PC Site Engr. In	Inspectio n Report	$\checkmark$	Applicable members i.e. drains covers .

		IN	DICATIVE FIELD	QUALITY	' PLAN						Annexure-II
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				REV. NO	:	C	PACKAGE:				
				DATE :			CONTRACT NO.				
		SUB-STSTEM: CIVIL AND STRUCTUR	AL STEEL WORKS				MAIN CONTRACTOR				
SI. No	Activity and operation	Characteristics / instru	uments	Class of	Type of Check	Quantum Of check	Reference Document	Acceptance	ptance Format of		Remarks
1	2	3		4	5	6	<b>7</b>	8	9	D*	10
4.00	BRICK MASONARY										
4.1	Test on Bricks	Dimensions , shape, compressive strength, water absorption, warpage, efflorescence.	As agreed / required	В	Measurement/ Physical Test	As per relevant IS Code/ One Sample for 30,000 nos. or part thereof	IS: 1077, IS:13757, IS: 12 Specs and const. Drawing	2894 / Tech gs	Inspectio n Report	V	Efflorescence shall be checked at each source. Warpage test is applicable for facing bricks only as per IS:2691. For clay bricks as per IS 1077, warpage test is not required.
4.2	Masonry construction	Workmanship, verticality and alignment	As agreed / required	В	Visual/ Physical	100%	IS 2212, IS 1905 , Tech S Drawings	Specs and Const	. SR/LB		
5.00	FINISHING AND ALLIED WO	RKS									
5.1	PLASTERING - WORKMANS	HIP									
i		Curing	As agreed / required	С	Physical	100%	Tech specifications, cons drawings and agreed met	truction thodology	SR		
ii		Thickness and finishing of plaster, grooves etc.	As agreed / required	В	Visual/ Measurement	Random in each shift	Tech Specs and Const. D	Drawings	SR/LB		
iii		Trueness of plastering system	As agreed / required	В	Visual/ Physical	Random in each shift	Tech Specs and Const. D	Drawings	SR		
6.00	SHEETING AND OTHER WO	RKS									
6.1	PAINTING SYSTEM - CONCI	RETE WORKS AND PLASTERED MASON									
i	Materials and accessories- Oi Bound, Acrylic Emulsion, Chemical Resistant, Oil	I Shade, type from brand and manufacturer as approved by NTPC EIC	As agreed / required	В	Review of MTC	Each batch of delivery	Tech Specs and Const. D	rawings	SR/MTC	$\checkmark$	
ii	Surface preparation	As required	As agreed / required	С	Physical /visual	Random in each shift	Tech Specs and Const. I	Drawings	SR		
iii	Acceptance of painted surface	s As required	As agreed / required	В	Physical	Each surface at random	Tech Specs and Const. D	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 Con	ist. Drawings	SR/MIC	V	
ii		Surface preparation	As agreed / required		Physical /visual	Each Erection Mark	Tech Specs and Con	st. Drawings,	SR		
111				В	Measurement	Each Erection Mark	Tech Specs and Con	ist. Drawings	SR	V	
iv		DFT of paint Acceptance of painted surfaces	Elcometer	B	Measurement	Each Erection Mark	Tech Specs and Con	ist. Drawings	SR	N	
7.3	WATER PROOFING				measurement						
		Methodology for the application of water proofing system	As required	В	Review	for each type of treatment	Tech Specs and Const. I	Drawings	SR	$\checkmark$	
7.3.1	Roof / Basement Treatment	-									
i	Graded under bed	Levels / slopes	As required	С	Physical	100%	Tech Specs and Const. I	Drawings			
ii	Elastomeric coatings	Material- Primer coat, finishing coat	As required	В	Review of MTC	Each lot of delivery	Tech Specs and Const. I	Drawings	SR	$\checkmark$	
iii	Wearing course	Materials - PCC, chicken wire mesh, elastomeric sealant	As required	В	Review of MTC	Each lot of delivery	Tech Specs and Const. I	Drawings	SR	$\checkmark$	
iv		Acceptance of water proofing work	As agreed / required	В	Physical	100%	Tech Specs and Const. D	)rawings			
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7.4	Fencing and Gates										
i	PVC coated chain link fencing, Welded wire mesh (IS 1566), Reinforced barbed tape galvanized (IS 2629) etc.	Materials	As agreed / required	В	Review of MTC	Each batch of delivery	Tech Specs and Const.	Drawings	SR/MTC	$\checkmark$	MTC shall contain all the parameters specified in the technical specifications / relevant IS Codes
ii		Acceptance of the installation	As agreed / required	В	Physical /	Each installation	Tech Specs and Const. D	Drawings	SR		
7.5	FLOOR FINISHES AND ALIED	WORKS			measurements						
7.5.1	Cement Concrete Flooring										
i		Glass/ PVC strips in joints	As agreed / required	С	Physical	Random in each shift	Tech Specs and Const. I	Drawings	SR		
ii		Finishing and acceptance	As agreed / required	В	Physical	100%	Tech Specs and Const. E	Drawings	SR		
7.5.2	Tiles										
i	Ceramic, vitrified, glass mosaic, acid alkali resistant, heavy duty cement concrete	Materials	As agreed / required	В	Review of MTC	Each lot of delivery	Tech Specs and Const. E	Drawings	SR	$\checkmark$	MTC shall contain all the parameters specified in the technical specifications / relevant IS Codes
ii		Finishing and acceptance	As agreed / required	В	Physical	100%	Tech Specs and Const. E	Drawings	SR		
7.5.3	Kota Stone, Granite and Marb	ble									
i		Quality, texture, thickness, colour for each lot of delivery from approved source	As agreed / required	с	Physical	Each batch of delivery	Tech Specs and Const. E	Drawings	SR		
ii		Finishing and acceptance	As agreed / required	В	Physical	100%	Tech Specs and Const. E	Drawings	SR		
8.0	WATER SUPPLY / SANITORY	INSTALLATIONS									
8.1	Water supply fittings and fixt	ures									
i	Materials	GI/ MS pipes and fittings	As agreed / required	В	Review of MTC	Each lot of delivery as	Tech Specs and Const.	Drawings	SR	$\checkmark$	
ii	Disinfection	Before use	As agreed / required	с	Physical	Each installation	Tech Specs and Const.	Drawings	SR		
iii	Hydraulic test	Before use / leakage	As agreed / required	В	Physical	Each installation	Tech specs and const dra	awings	SR	$\checkmark$	
iv		Acceptance and working	As agreed / required	В	Acceptance	Random	Tech Specs and Const. D	Drawings	SR		

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8.2	Sand cast iron / cast iron pipe	9S									
i	Material	SCI / CI pipes and fittings / joints	As agreed / required	В	Review of MTC	Each lot of delivery as per Specifications	Tech Specs and Const. D	Prawings	SR	$\checkmark$	
ii		Acceptance and leakage	As agreed / required	В	Physical	Random	Tech Specs and Const. D	rawings	SR		
							4				
8.3	Sanitary fittings and fixtures										
		closets, urinals, wash basins, sinks,				Fach lat of dolivery on			SR		
i	Material	mirrors, shelves, towel rail, soap	As agreed / required	В	Physical	per Specifications	Tech Specs and Const. D	rawings		$\checkmark$	
		containers, geyser, water cooler, etc.,									
ii		Acceptance of finitiations of all and a	As agreed / required	В	Acceptance	100%	Tech Specs and Const. D	rawings	SR		
8.4	RCC Pipes										
i	Material	RCC pipes	As agreed / required	B	Review of MTC	Dendem	Tech Specs and Const. D	Prawings /IS 458	SR	N	
	Water Storage Tenks		As agreed / required	В	Physical	Ranuom	Tech opecs and Const. L	nawings	<u> </u>		
0.0	water Storage Talks					Each lot of delivery as			SP		
i	Material	Over head / loft type	As agreed / required	B	Physical	per Specifications	Tech Specs and Const. D	Drawings			
 	SPECIAL ITEMS	Acceptance and leakage	As agreed / required	В	Acceptance	Random	Tech Specs and Const. I	Jrawings	SR		
9.1	Earthing Mat (Grounding Syst	em)									
i	Material	Earthing mat	As agreed / required	В	Physical	Each lot of delivery as per Specifications	As per relevant IS and Te Manufacturer's, IS 3043	ch. Specs /	SR/MTC	$\checkmark$	
ii		Weld sizes & length	Visual/Tape	В	Visual/ Measurement	100%	Tech Specs and Const. D	Prawings			NTPC approved electrodes shall be used
111		D P test	DP test Kit	В	Physical	10% at random of the offered lot	Tech Specs and Const. D	Prawings	TR	$\checkmark$	
iv		Earth test	Earthing test kit	A	Physical	100%	Tech Specs and Const. D	Prawings,	SR		

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10.00	ROAD WORKS							-
10.1	Construction of Sub-Grade and	nd earthen/hard shoulders		-				
i		Standard proctor Test to determine optimum moisture content and max. dry density	As per IS: 2720, Proctor needle apparatus,etc.	A	Physical	One in every 2000 cum for each type and source of fill materials		
ii		Moisture content of fill before compaction	As per IS: 2720, balance, oven etc.	В	Physical	One in every 2000 cum for each type and source of fill materials		
111		Dry density by core cutter method OR Dry density in place by sand displacement method	As per IS: 2720/compaction test (core cutter), balance etc.	A	Physical	One in every 500 SQM area for each compacted layer.		
10.2	Granular Sub Base (GSB)							
i		Gradation	As required / agreed	В	Physical	One test per 200 cum of aggregate		
ii		Atterberg Limit	As per IS: 2720	В	Physical	One test per 200 cum of aggregate		
iii		Moisture content prior to compaction	As per IS: 2720	В	Physical	One test per 250 SQM of aggregate	-	
iv		Density of compacted layer	As per IS: 2720	A	Physical	One test per 500 SQM of aggregate	As per Technical Spec	cification
v		Deleterious constituents	As required / agreed	В	Physical	As required	/IRC/MOR	₹TH
vi		CBR	As per IS: 2720	В	Physical	As required		
10.3	Water Bound Macadam (Non-	Bituminous)						
i		Aggregate Impact value	Aggregate Impact value Test Apparatus	A	Physical	One test per 200 cum of Test aggregate		
ii		Grading	Set of IS Sieves	В	Physical	One test per 100 cum of aggregate	]	
		Flakiness index and elongation index	Flakiness test gauge	В	Physical	One test per 200cun of aggregate		
iv		Atterberg Limits of binding material	Atterberg limits determination	A	Physical	One test per 25 cum of binding material	]	
v		Atterberg Limits of portion of aggregate passing 425 micron sieve	Atterberg limits determination	A	Physical	One test per 100cum of aggregate		

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10.4	Bituminous Surfacing - Oper	n graded premix carpet and Seal coat	1				-				
i			Penetrometer with St. needle		Physical	No. of samples per Lot & tests as per IS:73, IS:217, IS:8887 as applicable					
ii		Aggregate Impact Value / Los angeles abrasion value	Aggregate Impact Value Test apparatus	A	Physical	One test per 50 cum of aggregate	As per T				
111		Flakiness Index and elongation index of aggregates	Flakiness test gauge	В	Physical	One test per 50 cum of aggregate					
iv		Stripping value of aggregate (Immersion tray test)	As required / agreed	В	Physical	representative specimen per source, and on every	,				
v		Water absorption test		A	Physical	representative specimen					
vi		Water sensitivity of mix	As required / agreed	A	Physical	representative specimen					
vii		Grading of aggregates	Set of Sieves	В	Physical	One test per 25 cum of aggregates					
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					
ix		Polished stone value	As required as per BS:812(Part 114)	В	Physical	As required	]				
x		Temperature of binder at application	Thermometer	В	Physical	At regular close intervals	]				
xi		Binder content	Bitumen extractor	A	Physical	One test per 500 cum& not less than two tests per day	As per T				
xii		Rate of spread of materials	As required / agreed	В	Physical	and not less than 2 tests					

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1	2	3		4	5	6	7	8
xiii		Percentage of fractured faces	Bitumen extractor	A	Physical	When gravel is used one test per 50cum of aggregates		
10.5	Tack Coat/ Prime coat/ fog c	oat						
i		Quality of binder	Penetrometer with Standard needle	A	Physical	tests as per IS:73, IS:217, IS:8887 as		
ii		Temperature of binder at application	Thermometer	В	Physical	At regular close intervals		
iii		Rate of spread of binder	As required / agreed	В	Physical	One test per 500 cum		
10.6	Alignment, Level, Surface re	gularity and rectification						
		Horizontal alignment, Surface levels	As required / agreed	В	Physical	As per section 900 of MORTH specification	As per Technical Specifications/ BOQ/ Referred Standards and construction	
		Rectification	As required / agreed	В	Physical	Each rectification	As per Technical Spec	ifications/ BOC
11.00	False Ceiling							
i		Materials ( gypsum glass, glass fibre membrane, fibre board acoustical tiles etc)	As agreed / required	В	EIC Approved source and review of MTC/ test reports	For each lot received at site	Tech Specs and Const. I	Drawings
ii		Installation finishing and acceptance	As agreed / required	В	Visual / physical	Random	Tech Specs and Const.	Drawings
12.0	GEOTECHNICAL INVESTIGA	TION WORK						
i		Deployment of approved Geotechnical Investigation Agency - Equipments, Manpower etc.	As required / agreed	A	Physical	Once before commencement of work	As per technical specifica relevant IS Codes	ations and
11		Execution of Geotechnical Investigation - locations, type etc. as per scheme	As required / agreed	В	Physical	Each Location	As per technical specification relevant IS Codes	ations and
iii		Collection of disturbed and undisturbed samples , their packing and storage	As required / agreed	В	Physical	each sampling	As per technical specifica relevant IS Codes	ations and
iv		Conducting filed tests as per investigation scheme- such as, SPT/ERT/SCPT/PLT/PMT etc.	As required / agreed	В	Physical	each field test	As per technical specification relevant IS Codes	ations and
v		Submission of Field Bore logs in approved format	As required / agreed	В	Review	Within 24 hours after completion of each BH	As per technical specification relevant IS Codes	ations and
vi		Submission of laboratory test schedule and selection of samples for laboratory testing	As required / agreed	A	Review and acceptance	as per consultation with engineer during dispatch of samples to approved laboratory	As per technical specifica relevant IS Codes	ations and
vii		Submission of Final Geotechnical investigation report along with recommendations	As required / agreed	В	Physical	After completion of investigation work and review of draft reports	As per technical specification relevant IS Codes	ations and
13.00	STRUCTURAL STEEL MATE	RIAL (For Site Fabrication)	1					
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 Drawings, IS	and Constructi 2062
13.1	PRE-WELDING REQUIREME	NTS						

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en gravel is used one per 50cum of regates			SR	√ 					
or samples per Lot & s as per IS:73, 217, IS:8887 as			SR						
egular close intervals			SR						
e test per 500 cum			SR						
	As non Tashniasi Orasi	finations/ DOO/	0.5						
per section 900 of RTH specification	Referred Standards an	d construction	SR						
h rectification	As per Technical Specif	fications/ BOQ/	SR	$\checkmark$					
each lot received at	Tech Specs and Const. D	rawings	SR	$\checkmark$	Compare MTC with technical specification and requirement				
ndom	Tech Specs and Const. I	Drawings	SR						
ce before Imencement of work	As per technical specifica relevant IS Codes	tions and	SR	V					
h Location	As per technical specifica relevant IS Codes	tions and	SR	$\checkmark$					
h sampling	As per technical specifica relevant IS Codes	tions and	SR						
h field test	As per technical specifica relevant IS Codes	tions and	SR						
hin 24 hours after apletion of each BH	As per technical specifica relevant IS Codes	tions and	SR	V					
per consultation with ineer during dispatch amples to approved pratory	As per technical specifica relevant IS Codes	tions and	SR	$\checkmark$					
er completion of estigation work and ew of draft reports	As per technical specifica relevant IS Codes	tions and	-	V					
each batch of each tion delivered at site	Technical Specification a Drawings, IS	nd Construction 2062	SR	V	Correlated MTC shall be verified.				

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				PAGE :						Annexure-II         r       Remarks         ormat of Record       Remarks         D*       10         S       *To be approved by CQA         √       If required suitable stiffeners shall be provided to prevent deflection.         √       If required suitable stiffeners shall be provided to prevent deflection.		
SI. No	Activity and operation	Characteristics / instruments		Class of check	Type of Check	Quantum Of check	Reference Document	Acceptance Norms	Format of Record		Remarks	
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i		Welding Procedure Specification * (WPS*)	-	A	Review	Each Welding Process	Technical Specification a Drawings, ASME-IX/	and Construction AWS D 1.1	WPS		*To be approved by CQA	
11		PQR and Welder's Qualification	-	А	Physical	Each welder	PQR/ WQR, AWS-D1.1/ASME-IX, Technical Specifi- cation and Construction		TR	$\checkmark$		
iii		Welding consumables	-	В	Physical	Random in each shift	Approved WPS, Latest N	TPC	SR	$\checkmark$		
13.2	FIT-UP											
i		Marking and Cutting	Tape, ruler etc.	В	Visual & Measurement	Each plate/ Section	Technical Specification a Drawings/ Approved	and Construction cutting plan	SR			
ii		Match markings for trial assembled components	-	В	Physical	Each fit-up	Technical Specification a Drawings	and Construction	SR			
iii		Weld Fit Up- Edge Preparation/ Gap/ Alignment	Tape, ruler etc.	В	Physical	Each fit-up	Technical Specification and Construction Drawings, IS 7215		SR	$\checkmark$	If required suitable stiffeners shall be provided to prevent deflection.	
13.3	PRE HEATING (wherever app	licable)										
i		Pre-Heating Temperature	Thermal chalk	В	Measurement	Each pre-heating	Technical Specification a	and Construction	SR	$\checkmark$		
ii		Post Weld Heat Treatment (PWHT), if required	Thermo couple with time temperature	A	Time & Temperature	Each PWHT	Technical Specification a Drawings, Approv	and Construction ved WPS	SR	$\checkmark$		

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13.4	- WELDING REQUIREMENTS				5	<b>`</b>		•				
		Sequence of welding		В			Technical Specification a	nd Construction	SR			
i		3	-		Physical	Random in each shift	Drawings, Agreed	scheme				
ii		Removal/ grinding of temporary	-	B	Measurement	All cleats/ attachments	Technical Specification ar	nd Construction	SR			
		Completeness after welding-		B	) / in the l	Each structure	Technical Specification a	nd Construction	SR	1		
111		Dimensions/ distortion	weld gauge		Visual	component	Drawings, IS	822		N		
iv		Completeness of welding (each butt &		В	Visual	Each structure	Technical Specification a	and Construction	SR	N		
		fillet weld)			Viouai	component	Drawings, Approved Drg.			, ,		
13.5	NON DESTRUCTIVE AND DES											
13.5.1	FILLET WELDS	aize and viewel exemination			Viewel/		As per technical apart	ifications and	00		As not requirement of NTDC Engineer	
i		size and visual examination	As required/ agreed	В	VISUAI/ Measurement	100%	construction drawings IS		SK		As per requirement of NTPC Engineer	
		Dve Penetration Test		В	Measurement	5% of Weld length	As per technical speci	ifications and	SR			
ii			As required/ agreed		Physical	with min. 300mm at each	construction drawings,	IS 822, AWS D	<u>e</u>			
						location	1.1					
13.5.2	BUTT WELDS											
i		Visual examination	As required/ agreed	В	Visual	Random in each shift	As per technical speci	ifications and	SR		As per requirement of NTPC Engineer	
		DPT		В		after back gouging on	As per technical speci	ifications and	IR		All butt welds to be back gouged before	
			As required/ agreed		Physical	root run and 10% on	construction drawings,	IS 822, AWS D			DPT	
		Radiography Test		Δ		final wold	1.1		IR		Wherever RT is not feasible LIT to be	
											carried out. In case of failure of any welds	
							As per technical speci	ifications and			in SPOT/RT or UT the % of retesting shall	
iii			As required/ agreed		Physical	10%	construction drawings,	IS 822, AWS D		$\checkmark$	be doubled at that particular location.	
							1.1				Acceptance criteria of NDT on welds shall	
											be as per AWS D1.1.	
13.6												
13.0		Dimensions and levels- Shape lines		B	Physical/				SR			
i		(including diagonal checks)	Theodolite, Tape etc.		Measurement	Each Foundation	Tech Specs and Const. D	rawings		$\checkmark$		
		Foundation Bolts and Embedment's-	Theodolite, Tape,	В	Physical/	Fach Foundation	Tech Space and Const. D	rowingo	SR			
		Verticality, Levels, pitch distance	Piano wires etc.		Measurement	Each Foundation	Tech Specs and Const. D	rawings		Ň		
13.7	PAINTING SYSTEM			<u> </u>								
i		Paining Materials and accessories	-	A	Review of MTC	Each batch of delivery	Tech Specs and Const. D	rawings	SR/MTC	$\checkmark$	Consignment received.	
ii		Submission of painting methodology	-	B	For Review of painting system	work	Tech Specs and Const. D	orawings		,		
<u> </u>		Surface preparation	As agreed / required	B	Physical /visual	Each Erection Mark	Tech Specs and Const. D	rawings,	SR	N		
iv		Primer Thickness	Elcometer	B	Measurement	Each Erection Mark	Tech Specs and Const. D	rawings	SR	N		
V		DFT OF Paint	Elcometer	B	Visual and		Tech Specs and Const. D	rawings	SK SD	N		
vi		Acceptance of painted suffaces	Elcometer		measurement	Each Erection Mark	Tech Specs and Const. D	rawings	38			

		INI	INDICATIVE FIELD QUALITY PLAN								Δ	Annexure-II
	एनरीपीर्स NTPC	ITEM : CIVIL WORK		QP NO. :		1	PROJECT:	140MW SPV at	Bilhaur			
				REV. NO .:			PACKAGE:					
		OUD OVOTEN - ON/U AND OTDUOTUD		DATE :			CONTRACT NO.					
		SUB-SYSTEM : CIVIL AND STRUCTUR	AL STEEL WORKS				MAIN CONTRACTOR					
				PAGE :								
SI. No	Activity and operation	Characteristics / instruments		Class of check	Type of Check	Quantum Of check	Reference Document	Acceptance Norms	Form Rec	at of ord	Remarks	
1	2	3		4	5	6	7	8	9	D*	10	
13.8	PRE-ASSEMBLY CHECKS											
i		Punch Erection marks and match marks	-	В	Visual/ Physical	Each structural member	Tech Specs and Const. I	Drawings			Markings for -	
ii		Pre-assembly as per match mark	-	В	Visual/ Physical	Each structural member	Tech Specs and Cor	st. Drawings				
111		Camber, sweep and total length after trial assembly of structure.	Theodolite, Tape, plumb, piano wires etc.	В	Visual/ Physical	Each structural member	Tech Specs and Cor	ist. Drawings	SR	$\checkmark$		
iv		Control assembly check at shop	Theodolite, Tape, plumb, piano wires etc.	В	Visual/ Physical	Every first and tenth set of identical structure	Tech Specs and Const. Drawings					
v		Completion of primer & intermediate coat of paint		В	Visual / Physical	Random	Tech Specs and Const. Drawings		SR			
13.9	13.9 ERECTION CHECKS											
i		Alignment, slopes, level, tolerances of erected member	Theodolite, Tape, plumb, piano wires etc.	В	Measurement	Each structural member	Tech Specs and Const. Drawings		SR	$\checkmark$		
ii		Tightening of bolts/ Torque including foundation bolts with lock nuts	Wrench/ Torque wrench if specified	В	Visual/ Physical	Each structural member	Tech Specs and Const. Drawings		SR	$\checkmark$		
iii		Completion of all erection fillet & butt welds		В	Visual	Each structural member	Tech Specs and Const.	Drawings	SR	$\checkmark$		
iv		Acceptance of erected structure	Theodolite, Tape, plumb, piano wires etc.	В	Visual/ Physical	Each erected structure	Tech Specs and Const. D 7215 and IS 12843	Drawings, IS	SR	$\checkmark$		
13.10	PERMANENT BOLTS AND NU	ITS 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. I	Drawings	SR/MTC	$\checkmark$		
11		Contact surfaces before bolting	-	В	Physical	Random before assembly for bolting	Tech Specs and Const. E 4000	Drawings, IS	SR			
iii		Inspection of the assembled bolts	-	В	Physical	Randomly in each shift for assembled bolts	Tech Specs and Const. E	Drawings, IS	SR			
iv		Tensioning	As agreed / required	В	Physical	Randomly during snug tight test and after full tensioning	Tech Specs and Const. D 4000	Drawings, IS	SR	$\checkmark$		
v		Acceptance of installed bolts	-	В	Physical	Each bolt	Tech Specs and Const. I	Drawings	SR			
Legend to	be used: Class # : A = Critica	I, B=Major, C=Minor; SR = Site Register	΄, TR= Test Report,Μfr	IC = Manu	itacturer's Test Cei	rtificate	4					
Categoriz		(AS PER NIPC QA&I System)									Enaa	
Format NG	J., QJ-VI-QAI-F-VJ/FZ-KI										⊏ngg.	