BHARAT HEAVY ELECTRICALS LIMITED

TRANSMISSION BUSINESS GROUP
SUBCONTRACTS MANAGEMENT
PLOT NO. 25, SECTOR 16A, NOIDA,
DISTT. – GAUTAM BUDDH NAGAR (U.P.) - 201301

TENDER DOCUMENTS

FOR

Erection work of Structure and Stringing at 765/400/220 kV AIS Switchyard at POWERGRID KOPPAL-II & KOPPAL Extn. Project in Koppal, Karnataka.

CUSTOMER

POWERGRID CORPORATION OF INDIA LIMITED (PGCIL)

TENDER SPEC. NO.: TBSM/KOPPAL-II/EREC-STR/TENDER/25-26

DATE: 08.05.2025

TRANSMISSION BUSINESS GROUP

SUBCONTRACTS MANAGEMENT

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BHARAT HEAVY ELECTRICALS LIMITED

TRANSMISSION BUSINESS GROUP

SECTOR-16A, NOIDA -201301

e-mail: akmeena**@bhel.in**

NOTICE INVITING TENDER

REF.: TBSM/KOPPAL-II/EREC-STR/TENDER/25-26 **DATE: 08.05.2025**

SUB: TENDER FOR "Erection work of Structure and Stringing at 765/400/220 kV AIS Switchyard at POWERGRID KOPPAL-II & KOPPAL Extn. Project in Koppal, Karnataka".

Dear Sirs,

1. **Sealed tenders are invited for the following:**

NAME OF WORK	TIME OF COMPLETION	EARNEST MONEY DEPOSIT	TENDER SUBMISSION DATE AND TIME	TENDER OPENING DATE & TIME
Erection work of Structure and Stringing at 765/400/220 kV AIS Switchyard at POWERGRID KOPPAL-II & KOPPAL Extn. Project in Koppal, Karnataka	05 months from the date of LOI	Rs. 2,00,000/- As per Annexure to conditions of contract for ETC works	22.05.2025 11.00 hrs.	22.05.2025 16.00 hrs. (Technical bid only)

2. Bidder **has** to submit offer directly through E-PROCURMENT MODE. Bidder may visit **https://eprocurebhel.co.in**

Procedure for Submission of Tenders through e-tendering: The tender is also floated online through our E-Procurement Site https://eprocurebhel.co.in . The bidder may respond by submitting their offer online in our e-Procurement platform at https://eprocurebhel.co.in

Offers are invited in two-parts only.

Documents Comprising the e-Tender

The tender shall be submitted online EXCEPT EMD (which shall be submitted in physical form (as described in NIT cl. No.1) above as mentioned below:

a) Technical Bid (Un priced Tender)

All Technical details (e.g. Eligibility Criteria requested (as mentioned below)) should be attached in e-tendering module, failing which the tender stands invalid & may be REJECTED. Bidders shall furnish the following information along with technical tender (preferably in pdf format):

i) Earnest money Deposit (EMD) furnished in accordance with NIT Clause 4.0

ii) Technical Bid (without indicating any prices).

b) Price Bid:

i) Prices are to be quoted in the attached Price Bid format online on e-tender portal.

ii) The price should be quoted for the accounting unit indicated in the e-tender document.

iii) Note: It is the responsibility of tenderer to go through the Tender document to ensure furnishing all required documents in addition to above, if any. Any deviation would result in REJECTION of tender and would not be considered at a later stage at any cost by BHEL.

iv) A person signing (manually or digitally) the tender form or any documents forming part of the contract on behalf of another shall be deemed to warrantee that he has authority to bind

such other persons and if, on enquiry, it appears that the persons so signing had no authority to do so, the purchaser may, without prejudice to other civil and criminal remedies, cancel the contract and hold the signatory liable for all cost and damages.

v) A tender, which does not fulfil any of the above requirements and/or gives evasive information/reply against any such requirement, shall be liable to be ignored and rejected.

c) Uploading of the price bid in prequalification bid or technical bid may RESULT IN REJECTION of the tender.

d) Tenders shall be uploaded with all relevant PDF/zip format. The relevant tender documents should be uploaded by an authorized person having Class 3- SHA2- 2048 BIT-SIGNING & ENCRYPTION digital signature certificate (DSC).

3. **Tender must be accompanied by the prescribed amount of Earnest Money Deposit (EMD) in the manner described in "Annexure to the Conditions of contract for ETC work "which shall be part of the Technical Bid.**

   In case of E-Tenders, no paper bids shall be accepted, therefore, the scanned copy of the Banker's Cheque/ Demand Draft/ Pay Order/ Details of payment made through Electronic Fund Transfer/ Fixed Deposit Receipt (FDR) / Bank Guarantee should be uploaded in the E-Procurement Portal and hard copy of the same should reach to following address at before the due date and time of bid submission. BHEL shall not be responsible for postal or any other delays in this regard.)

TO,

Ashok Kumar Meena
Sr. DGM (TBSM)
BHARAT HEAVY ELECTRICALS LIMITED,
TRANSMISSION BUSINESS GROUP,
6th Floor, BHEL SADAN, Plot no.: - 25, Sector- 16A, Noida,
Distt. – Gautam Buddh Nagar, UP-201301
TELEPHONE: 0120-6748545, 9831038136
E-mail: akmeena@bhel.in

4. **Bidders may please note that no other mode of bid submission shall be considered for evaluation apart from Clause no. 02 to 03 mentioned above.**
5. The prospective bidders who have downloaded the tender documents from our website are requested to send their acknowledgement and willingness to participate in the tender to the undersigned, through fax or email.
6. Offers should be strictly in accordance with the Tender Specifications and General Instructions to Tenderer enclosed herewith.
7. "BHEL shall be resorting to Reverse Auction (RA) (Guidelines as available on www.bhel.com) for this tender. RA shall be conducted among the techno-commercially qualified bidders as per RA Guidelines.

   Price bids of all techno-commercially qualified bidders shall be opened and same shall be considered for RA. In case any bidder(s) do(es) not participate in online Reverse Auction, their price bid along with applicable loading, if any, shall be considered for ranking."

8. The contractor shall give his explicit confirmation without any deviations to the HSE (Health, Safety and Environment) requirements as per enclosed specification No. TBSM/HSE/NIT-01, Rev-02 Date 31.01.2024. Contactors are also required to furnish details as per Annexure (HSE) to NIT along with their offer. Offers received without compliance & data about HSE requirements are liable to be rejected.
9. All documents submitted with the offer shall be signed and stamped in each page by authorized representative of the bidder.

10. Clarifications, if any, can be obtained from the undersigned but such requests should be submitted well before the due date for submission of tenders. Due date for submission and opening of tenders will not be extended on such grounds.

11. Please note that wherever there is a contradiction between the 'ANNEXURE TO CONDITIONS OF CONTRACT FOR ETC WORKS' and 'Conditions of contract for ETC works', the 'ANNEXURE TO CONDITIONS OF CONTRACT FOR ETC WORKS' clauses shall be governing and binding on the contractor.

12. Drawings & FQP enclosed with the NIT (if provided) are for tender purpose only. Drawings & FQP may get change during execution stage and work to be carried as per latest RFC drawings & Field Quality Plan (FQP).

13. Construction/RFC drawing/ Fronts shall be furnished progressively as per project requirement and no claim towards idling charges/ project overheads etc. borne by the contractor on account of non-availability of drawings/ fronts shall be entertained.

14. Completion period of the work has been envisaged under best possible conditions. Any changes/ deviation during execution shall be dealt as per relevant clauses mentioned in general/ special conditions of contract for ETC works.

15. *"In case this tender is awarded to first time contractor*, then the bidder shall be eligible to qualify for the next tender of similar work# of BHEL, TBG; only after successful executing of 50% (fifty percent) of this work prior to the date of next tender (in which bidder desires to quote) and on satisfactory performance feedback by BHEL site Incharge."*

    ** First time contractor: The bidders who have not successfully executed more than 50% (fifty percent) of awarded similar work by BHEL (TBG/ ISG/Power Sector/Any BHEL Unit) in last 5 years from date of NIT.*

    The bidders who have taken any order from BHEL under 1st time category, and desires to further participate in BHEL tenders, needs to submit a certificate/ undertaking mentioning the reason of not executing 50% of awarded work, hence the criteria under 1st time bidder shall not be applicable to them. The certificate/ undertaking shall be duly certified by Site In charge of BHEL

    # Similar work: Similar to nature of work of the tender under consideration.

16. **Before submission of offer, the tenderer is advised to inspect the work & the environments and be well acquainted with the actual working and other prevalent conditions, facilities available, sourcing of material and labour, means of transport and access to site, accommodation, etc.** No claim will be entertained later on the grounds of lack of knowledge on any of these conditions/ resources.

17. The offers of the bidders who are under suspension as also the offers of the bidders, who engage the services of the banned firms, shall be rejected. The list of banned firms is available on BHEL web site www.bhel.com.

18. Integrity commitment, performance of the contract and punitive action thereof:

    18.1. Commitment by BHEL:

    BHEL commits to take all measures necessary to prevent corruption in connection with the tender process and execution of the contract. BHEL will during the tender process treat all Bidder(s) in a transparent and fair manner, and with equity.

    18.2. Commitment by Bidder/ Supplier/ Contractor:

    18.2.1. The bidder/ supplier/ contractor commits to take all measures to prevent corruption and will not directly or indirectly influence any decision or benefit which he is not legally entitled to nor will act or omit in any manner which tantamount to an offence punishable under any provision of the Indian Penal Code, 1860 or any other law in force in India.

    18.2.2. The bidder/ supplier/ contractor will, when presenting his bid, disclose any and all payments he has made, and is committed to or intends to make to agents, brokers or any other

intermediaries in connection with the award of the contract and shall adhere to relevant guidelines issued from time to time by Govt. of India/ BHEL.

18.2.3. The bidder/ supplier/ contractor will perform/ execute the contract as per the contract terms & conditions and will not default without any reasonable cause, which causes loss of business/ money/ reputation, to BHEL.

If any bidder/ supplier/ contractor during pre-tendering/ tendering/ post tendering/ award/ execution/ post-execution stage indulges in mal-practices, cheating, bribery, fraud or and other misconduct or formation of cartel so as to influence the bidding process or influence the price or acts or omits in any manner which tantamount to an offence punishable under any provision of the Indian Penal Code, 1860 or any other law in force in India, then, action may be taken against such bidder/ supplier/ contractor as per extant guidelines of the company available on www. bhel.com and/or under applicable legal provisions".

19. Also, offer of the bidders who are suspended (under hold/ delist) for business dealings by BHEL, TBG shall not be considered. Please note that lifting/ restoration of suspension (Ban/Hold/ De-list) of business dealing is not automatic after expiry of specified suspension period. Hence, vendor shall be considered as suspended for business till suspension is lifted by BHEL in writing on specific request of the vendor as per extant guidelines.

20. BHEL Fraud Prevention Policy, "The Bidder along with its associate/ collaborators/ sub-contractors/ sub-vendors/ consultants/ service providers shall strictly adhere to BHEL Fraud Prevention Policy displayed on BHEL website http://www.bhel.com and shall immediately bring to the notice of BHEL Management about any fraud or suspected fraud as soon as it comes to their notice."

21. Offers will be scrutinized based on the qualifying requirements and only those who are technically and financially capable to execute the Job and who fulfil the Pre-Qualifying Requirements (PQR) are eligible to quote against the above NIT. However, final acceptance of the bidder/ offer shall be subject to acceptance of our customer.

22. The evaluation currency for this tender shall be INR.

23. The Submission of EMD is compulsory for subject tender. In case requisite Amount of EMD not submitted by the bidder before tender opening or along with offer, the offer shall not be considered for evaluation and the offer shall be rejected.

24. In the course of evaluation, if more than one bidder happens to occupy L-1 status, effective L-1 will be decided by soliciting discounts from the respective L-1 bidders.

    In case more than one bidder happens to occupy the L-1 status even after soliciting discounts, the L-1 bidder shall be decided by toss/ draw of lots, in the presence of the respective L-1 bidder(s) or their representative(s).

    Ranking will be done accordingly. BHEL's decision in such situations shall be final and binding.

25. Technical Bid will be opened in the office of undersigned. If required, technical discussions will be held with only those bidders who have taken any deviations. The price bids will be opened subsequently, after Technical Bids of all the bidders have been evaluated and freezed. Bidders should quote their most competitive rates as there will not be any price negotiation. However, if felt necessary by BHEL, price negotiation will be held with lowest bidder (L-1) only. **IT WOULD BE PREFERRED THAT YOUR OFFER IS WITHOUT ANY DEVIATION w.r.t. TENDER SPECIFICATIONS AND THE SAME MAY BE CLEARLY MENTIONED ON THE COVERING LETTER ACCOMPANYING THE TECHNICAL BID.** Offers with deviations are likely to be rejected.

26. In case any adverse information is received concerning performance, capability or conduct of the bidder after issue of tender enquiry, BHEL reserves the right to reject the offer at any stage as deemed fit.

27. **Integrity Pact (IP)**

    (a) IP is a tool to ensure that activities and transactions between the Company and Its Bidders/ Contractors are handled in a fair, transparent and corruption free manner. Following

Independent External Monitors (IEMs) on the present panel have been appointed by BHEL with the approval of CVC to oversee implementation of IP in BHEL

Sl no.	IEM	E- mail
1	Shri Otem Dai, IAS (Retd.)	iem1@bhel.in
2	Shri Bishwamitra Pandey, IRAS (Retd.)	Iem2@bhel.in
3.	Shri Mukesh Mittal, IRS (Retd.)	Iem3@bhel.in

(b) The IP as enclosed with the tender is to be submitted (duly signed by authorized signatory) along with techno-commercial bid (part-I in case of Two/ Three Part Bid). Only **those bidders who have entered into such an IP with BHEL would be competent to participate in the bidding**. In other words, entering into this Pact would be a preliminary qualification,

(c) Please refer Section-8 of the IP for Role and Responsibilities of IEMs. In case of any complaint arising out of the tendering process, the matter may be referred to any of the above IEM(s). All correspondence with the IEMs shall be done through e-mail only.

Note: -

No routine correspondence shall be addressed to the IEM (phone/ post/ email) regarding the clarifications, time extensions or any other administrative queries, etc. on the tender issued. All such clarification/ issues shall be addressed directly to the tender issuing (procurement) department's officials whose contact details are provided below":

Details of contact person (s): -

1) Name: - Ajay Kumar Chowdhary Department: - TBG, Subcontracting Address: - BHEL/ TBG, Noida Phone: - 01206748129 E mail: - akchowdhary@bhel.in	2) Name: - Ashok Kumar Meena Department: - TBG, Subcontracting Address: - BHEL/ TBG, Noida Phone: - 01206748545 E mail: - akmeena@bhel.in

28. Any materials (if required) for ETC works have to be procured from Customer approved sources only. It will be the bidder's responsibility to get the approval of materials and vendors for materials.

29. The purchase preference for central P.S.U.s shall be given as per the prevailing Government policy.

30. Work schedule and the deployment of manpower and T&P resources committed by the contractor in their offer, to match the scheduled completion, shall be submitted by contractor and mutually agreed with site In-charge immediately after the award of work. Further, the contractor shall mobilise at site within two weeks of award of work.

31. In case an offer is not being submitted by the prospective bidders against this tender, they may send their "regret" letter to this office, for information.

32. Details of qualifying work(s) executed by the bidder will be forwarded to the principal employer for verification of the work with respect to completion, commencement & completion date and value of the work executed. Performance feedback of the bidder will also be sought from the principal employer.

33. The bidder representative may be called for discussion with the committee. His originals may be verified by the committee. In addition to above their organisation chart and detail list of manpower, tools & plants and technically capability will be discussed and ascertained by the committee.

34. **Conflict of Interest among bidders/Agents:** -

"A bidder shall not have conflict of interest with other bidders. Such conflict of interest can lead to anti-competitive practices to the detriment of Procuring Entity's interests. ***The bidder found to have a conflict of interest shall be disqualified****. A bidder may be considered to have a conflict of interest with one or more parties in this bidding process, if:*

a) they have controlling partner (s) in common; ***or***

b) they receive or have received any direct or indirect subsidy/ financial stake from any of them; ***or***

c) *they have the same legal representative/agent for purposes of this bid;* ***or***

d) *they have relationship with each other, directly or through common third parties, that puts them in a position to have access to information about or influence on the bid of another Bidder;* ***or***

e) *Bidder participates in more than one bid in this bidding process. Participation by a Bidder in more than one Bid will result in the disqualification of all bids in which the parties are involved. However, this does not limit the inclusion of the components/ sub-assembly/ Assemblies from one bidding manufacturer in more than one bid;* ***or***

f) *In cases of agents quoting in offshore procurements, on behalf of their principal manufacturers, one agent cannot represent two manufacturers or quote on their behalf in a particular tender enquiry. One manufacturer can also authorise only one agent/dealer. There can be only one bid from the following:*

1. *The principal manufacturer directly or through one Indian agent on his behalf; and*
2. *Indian/foreign agent on behalf of only one principal;*

or

3. *A Bidder or any of its affiliates participated as a consultant in the preparation of the design or technical specifications of the contract that is the subject of the Bid;* ***or***
4. *In case of it holding company having more than one independently manufacturing units, or more than one unit having common business ownership/management, only one unit should quote. Similar restrictions would apply to closely related sister companies. Bidders must proactively declare such sister/ common business/ management units in same/ similar line of business.* "

Thanking you,

Yours faithfully,
For and on behalf of BHEL,

(Ashok Kumar Meena)
Sr. DGM /TBSM

TO BE FILLED BY TENDERER OVER THEIR LETTERHEAD

ANNEXURE – X

REF: TBSM/KOPPAL-II/EREC-STR/TENDER/25-26 **DATE: 08.05.2025**

SUB: Tender for "Erection work of Structure and Stringing at 765/400/220 kV AIS Switchyard at POWERGRID KOPPAL-II & KOPPAL Extn. Project in Koppal, Karnataka."

It is certified that General Instructions and Information for tenderer have been read/ complied/ agreed to and each page of tender offer has been initialled and stamped.

Also It is being declares that we (……Bidder Name …….) will not enter into any illegal or undisclosed agreement or understanding, whether formal or informal with other Bidder(s). This applies in particular to prices, specifications, certifications, subsidiary contracts, submission or non-submission of bids or any other actions to restrict competiveness or to introduce cartelization in the bidding process.

In case, the Bidder is found having indulged in above activities, suitable action shall be taken by BHEL as per extant policies/ guidelines

(Signature of Tenderer)

Name and Designation of Authorised person (s)
Signing the tender on behalf of the tenderer

(TO BE FILLED BY TENDERER OVER THEIR LETTERHEAD)

ANNEXURE – Y

REF: TBSM/KOPPAL-II/EREC-STR/TENDER/25-26 **DATE: 08.05.2025**

SUB: Tender for "Erection work of Structure and Stringing at 765/400/220 kV AIS Switchyard at POWERGRID KOPPAL-II & KOPPAL Extn. Project in Koppal, Karnataka."

Subject: Declaration confirming knowledge about Site conditions

I/We, _____ hereby declare and confirm that we have visited the Project Site with reference to above BHEL Tender Specifications and acquired full knowledge and information about the Site conditions including Wage structure, Industrial Climate, the Law & Order and other conditions prevalent at and around the Site. Also, we have acquired information about availability of manpower, construction material, water, electricity etc.

We further confirm that the above information is true and correct and we shall not raise any claim of any nature due to lack of knowledge of Site conditions.

I/We, hereby offer to carry out work as detailed in above mentioned Tender Specification, in accordance with Terms & Conditions thereof.

Site Visited Official Name & Contact Details:

(Signature of Tenderer)

Name and Designation of Authorised person (s)
Signing the tender on behalf of the tenderer

ANNEXURE – Z

REF: TBSM/KOPPAL-II/EREC-STR/TENDER/25-26 **DATE: 08.05.2025**

SUB: Tender for "Erection work of Structure and Stringing at 765/400/220 kV AIS Switchyard at POWERGRID KOPPAL-II & KOPPAL Extn. Project in Koppal, Karnataka."

Subject: Authorization of representative who will participate in the Online Reverse Auction Process:

1	NAME & DESIGNATION OF OFFICIAL	
2	POSTAL ADDRESS (COMPLETE)	
3	TELEPHONE NOS. (LAND LINE & MOBILE BOTH)	
4	FAX NO.	
5	E-MAIL ADDRESS	
6	NAME OF PLACE / STATE / COUNTRY, WHEREFROM S/HE WILL PARTICIPATE IN THE REVERSE AUCTION	

FORMAT OF NO DEVIATION CERTIFICATE
(To be submitted in the bidder's letter head)

REF: …….. **Dated**…….

BHARAT HEAVY ELECTRICALS LIMITED,
TRANSMISSION BUSINESS GROUP,
6th Floor, BHEL SADAN,
Plot No- 25, Sector- 16A, Noida,
Distt. Gautambudh Nagar, UP-201301

SUB: TENDER FOR "Erection work of Structure and Stringing at 765/400/220 kV AIS Switchyard at POWERGRID KOPPAL-II & KOPPAL Extn. Project in Koppal, Karnataka."

Tender Ref.: TBSM/KOPPAL-II/EREC-STR/TENDER/25-26, DATE: 08.05.2025

Dear Sir,

With reference to above, this is to confirm that as per tender conditions, we have visited subject site before submission of our offer and noted the job content & site conditions etc.

We also confirm that we have not changed / modified the tender documents as appeared in the website and in case of observance at any stage, it shall be treated as null and void. We hereby confirm that we have not taken any deviation from tender clauses together with other references as enumerated in the above referred NIT and we hereby convey our unqualified acceptance to all terms and conditions as stipulated in the tender and NIT. In the event of observance of any deviation in any part of our offer at a later date whether implicit or explicit, the deviations shall stand null & void.

We confirm to have submitted offer strictly in accordance with tender instructions.

Thanking you,

Yours faithfully,

(Signature, date & seal of authorized representative of the bidder)

DECLARATION FOR RELATION IN BHEL

(To be typed and submitted in the Letter Head of the Company/Firm of Bidder failing which the offer of Bidder is liable to be summarily rejected)

Ref: **Date……..**

To,
Sr. DGM/TBSM
Transmission Business Group,
Bharat Heavy Electricals Limited,
6th Floor, BHEL SADAN,
Plot No. 25, Sector-16A, Noida,
Distt. – Gautam Buddh Nagar, UP-201301

Dear Sir,

Sub: Declaration for relation in BHEL

Ref: 1) NIT/Tender Specification No.: TBSM/KOPPAL-II/EREC-STR/TENDER/25-26, Date: 08.05.2025

I/We hereby submit the following information pertaining to relation/relatives of Proprietor/ Partner(s)/Director(s) employed in BHEL

Tick (√) any one as applicable:

1. The Proprietor, Partner(s), Director(s) of our Company/Firm DO NOT have any relation or relatives employed in BHEL

OR

2. The Proprietor, Partner(s), or Director(s) of our Company / Firm HAVE relation / relatives employed in BHEL and their particulars are as below:

a)

b)

Signature of the Authorized Signatory

Note:

1) Attach separate sheet, if necessary.
2) If BHEL Management comes to know at a later date that the information furnished by the Bidder is false, BHEL reserves the right to take suitable against the Bidder/ Contractor.

DECLARATION BY AUTHORISED SIGNATORY OF BIDDER

(To be typed and submitted in the Letter Head of the Company/Firm of Bidder)

To,

Sr. DGM/TBSM
Transmission Business Group,
Bharat Heavy Electricals Limited,
6th Floor, BHEL SADAN,
Plot No. 25, Sector-16A, Noida,
Distt. – Gautam Buddh Nagar, UP-201301

Dear Sir,

Sub : Declaration by Authorized Signatory regarding Authenticity of submitted documents.

Ref : 1**) NIT/Tender Specification No: TBSM/KOPPAL-II/EREC-STR/TENDER/25-26 Date: 08.05.2025**

2) **All other pertinent issues till date**

I/We, hereby certify that all the documents submitted by us in support of possession of "Qualifying Requirements" are true copies of the original and are fully compliant required for qualifying / applying in the bid and shall produce the original of same as and when required by Bharat Heavy Electricals Limited.

I / We hereby further confirm that no tampering is done with documents submitted in support of our qualification as bidder. I / We understand that at any stage (during bidding process or while executing the awarded works) if it is found that fake / false / forged bid qualifying /supporting documents / certificates were submitted, it would lead to summarily rejection of our bid / termination of contract. BHEL shall be at liberty to initiate other appropriate actions as per the terms of the Bid / Contract and other extant policies of Bharat Heavy Electricals Limited.

Yours faithfully,

(Signature, Date & Seal of Authorized
Signatory of the Bidder)

Date:

Place

Annexure-MII

DECLARATION REGARDING MINIMUM LOCAL CONTENT IN LINE WITH REVISED PUBLIC PROCUREMENT (PREFERENCE TO MAKE IN INDIA), ORDER 2017 DATED 04TH JUNE, 2020 AND SUBSEQUENT ORDER(S).

(To be typed and submitted in the Letter Head of the Entity/Firm providing certificate as applicable)

To,
Sr. DGM/TBSM,
Bharat Heavy Electricals Limited, TBG, TBSM,
6th Floor, BHEL SADAN, Plot No. 25, Sector-16A, Noida, U.P.-201301

Dear Sir,
Sub: Declaration reg. minimum local content in line with Public Procurement (Preference to Make in India), Order 2017-Revision, dated 04th June, 2020 and subsequent order(s).
Ref:
1) NIT/Tender Specification No: **TBSM/KOPPAL-II/EREC-STR/TENDER/25-26, Date: 08.05.2025**

2) All other pertinent issues till date

We here by certify that the items/works/services/ offered by (specify the name of the organization here) has a local content of _____ % and this meets the local content requirement for – Class 1 Local supplier/ Class II local supplier** as defined in Public Procurement (Preference to Make in India), Order 2017-Revision dated 04.06.2020 issued by DPIIT and subsequent order(s).

The details of the location(s) at which the local value addition is made are as follows:

1. _____ 2. _____

3. _____ 4. _____

Thanking you,

Yours faithfully,

(Signature, Date & Seal of Authorized Signatory of the Bidder)

** - Strike out whichever is not applicable.

Note:

1. Bidders to note that above format Duly filled & signed by authorized signatory, shall be submitted.
2. In case the bidders quoted value is excess of 10 crores, the authorized signatory for this declaration shall necessarily be the statutory auditor or cost auditor of the company (in the case of companies) or a practising cost accountant or practicing chartered accountant (in respect of suppliers/contractors other than companies).
3. In the event of false declaration, actions as per the above order and as per BHEL Guidelines shall be initiated against the bidder.

Annexure-1

INTEGRITY PACT

Between

Bharat Heavy Electricals Ltd. (BHEL), a company registered under the Companies Act 1956 and having its registered office at "BHEL House", Siri Fort, New Delhi - 110049 (India) hereinafter referred to as "The Principal", which expression unless repugnant to the context or meaning hereof shall include its successors or assigns of the ONE PART

and

_____, (description of the party along with address), hereinafter referred to as "The Bidder/ Contractor" which expression unless repugnant to the context or meaning hereof shall include its successors or assigns of the OTHER PART

Preamble

The Principal intends to award, under laid-down organizational procedures, contract/s for _____

_____ (hereinafter referred to as "Contract"). The Principal values full compliance with all relevant laws of the land, rules and regulations, and the principles of economic use of resources, and of fairness and transparency in its relations with its Bidder(s)/ Contractor(s).

In order to achieve these goals, the Principal will appoint panel of Independent External Monitor(s) (IEMs), who will monitor the tender process and the execution of the contract for compliance with the principles mentioned above.

Section 1- Commitments of the Principal

1.1 The Principal commits itself to take all measures necessary to prevent corruption and to observe the following principles: -

1.1.1 No employee of the Principal, personally or through family members, will in connection with the tender for, or the execution of a contract, demand, take a promise for or accept, for self or third person, any material or immaterial benefit which the person is not legally entitled to.

1.1.2 The Principal will, during the tender process treat all Bidder(s) with equity and reason. The Principal will in particular, before and during the tender process, provide to all Bidder(s) the same information and will not provide to any Bidder(s) confidential/ additional information through which the Bidder(s) could obtain an advantage in relation to the tender process or the contract execution.

1.1.3 The Principal will exclude from the process all known prejudiced persons.

1.2 If the Principal obtains information on the conduct of any of its employees which is a penal offence under the Indian Penal Code 1860 and Prevention of Corruption Act 1988 or any other statutory penal enactment, or if there be a substantive suspicion in this regard, the Principal will inform its Vigilance Office and in addition can initiate disciplinary actions.

Section 2 - Commitments of the Bidder(s)/ Contractor(s)

2.1 The Bidder(s)/ Contractor(s) commit himself to take all measures necessary to prevent corruption. The Bidder(s)/ Contractor(s) commits himself to observe the following principles during participation in the tender process and during the contract execution.

2.1.1 The Bidder(s)/ Contractor(s) will not, directly or through any other person or firm, offer, promise or give to the Principal or to any of the Principal's employees involved in the tender process or the execution of the contract or to any third person any material, immaterial or any other benefit which he/ she is not legally entitled to, in order to obtain in exchange any advantage of any kind whatsoever during the tender process or during the execution of the contract.

2.1.2 The Bidder(s)/ Contractor(s) will not enter with other Bidder(s) into any illegal or undisclosed agreement or understanding, whether formal or informal. This applies in particular to prices, specifications, certifications, subsidiary contracts, submission or non-submission of bids or any other actions to restrict competitiveness or to introduce cartelization in the bidding process.

2.1.3 The Bidder(s)/ Contractor(s) will not commit any penal offence under the relevant Indian Penal Code (IPC) and Prevention of Corruption Act; further the Bidder(s)/ Contractor(s) will not use improperly, for purposes of competition or personal gain, or pass on to others, any information or document provided by the Principal as part of the business relationship, regarding plans, technical proposals and business details, including information contained or transmitted electronically.

2.1.4 Foreign Bidder(s)/ Contractor(s) shall disclose the name and address of agents and representatives in India and Indian Bidder(s)/ Contractor(s) to disclose their foreign principals or associates. The Bidder(s)/ Contractor(s) will, when presenting his bid, disclose any and all payments he has made, and is committed to or intends to make to agents, brokers or any other intermediaries in connection with the award of the contract.

2.2 The Bidder(s)/ Contractor(s) will not instigate third persons to commit offences outlined above or be an accessory to such offences.

2.3 The Bidder(s)/ Contractor(s) shall not approach the Courts while representing the matters to IEMs and shall await their decision in the matter.

Section 3 - **Disqualification from tender process and exclusion from future contracts**

If the Bidder(s)/ Contractor(s), before award or during execution has committed a transgression through a violation of Section 2 above, or acts in any other manner such as to put his reliability or credibility in question, the Principal is entitled to disqualify the Bidder(s)/ Contractor(s) from the tender process , terminate the contract, if already awarded, exclude from future business dealings and/ or take action as per the separate "Guidelines on Banning of Business dealings with Suppliers/ Contractors", framed by the Principal.

Section 4 - **Compensation for Damages**

4.1 If the Principal has disqualified the Bidder (s) from the tender process before award / order acceptance according to Section 3, the Principal is entitled to demand and recover the damages equivalent to Earnest Money Deposit/ Bid Security.

4.2 If the Principal is entitled to terminate the Contract according to Section 3, or terminates the Contract in application of Section 3 above , the Bidder(s)/ Cotractor (s) transgression through a violation of Section 2 above shall be construed breach of contract and the Principal shall be-entitled to demand and recover from the Contractor an amount equal to 5% of the contract value or the amount equivalent to Security Deposit/ Performance Bank Guarantee , whichever is higher, as damages, in addition to and without prejudice to its right to demand and recover compensation for any other loss or damages specified elsewhere in the contract.

Section 5 - Previous Transgression

5.1 The Bidder declares that no previous transgressions occurred in the last 3 (three) years with any other company in any country conforming to the anti-corruption approach or with any other Public Sector Enterprise in India that could justify his exclusion from the tender process.

5.2 If the Bidder makes incorrect statement on this subject, he can be disqualified from the tender process or the contract, if already awarded, can be terminated for such reason or action can be taken as per the separate "Guidelines on Banning of Business dealings with Suppliers/ Contractors", framed by the Principal.

Section 6 - Equal treatment of all Bidder (s)/ Contractor (s) / Sub-contractor (s)

6.1 The Principal will enter into Integrity Pacts with identical conditions as this Integrity Pact with all Bidders and Contractors.

6.2 In case of Sub-contracting, the Principal Contractor shall take the responsibility of the adoption of Integrity Pact by the Sub-contractor(s) and ensure that all Sub-contractors also sign the Integrity Pact.

6.3 The Principal will disqualify from the tender process all Bidders who do not sign this Integrity Pact or violate its provisions.

Section 7 - Criminal Charges against violating Bidders/ Contractors /Subcontractors

If the Principal obtains knowledge of conduct of a Bidder, Contractor or Subcontractor, or of an employee or a representative or an associate of a Bidder, Contractor or Subcontractor which constitutes corruption, or if the Principal has substantive suspicion in this regard, the Principal will inform the Vigilance Office.

Section 8 -Independent External Monitor(s)

8.1 The Principal appoints competent and credible panel of Independent External Monitor (s) (IEMs) for this Integrity Pact. The task of the IEMs is to review independently and objectively, whether and to what extent the parties comply with the obligations under this Integrity Pact.

8.2 The IEMs are not subject to instructions by the representatives of the parties and performs his functions neutrally and independently. He reports to the CMD, BHEL.

8.3 The IEMs shall be provided access to all documents/ records pertaining to the Contract, for which a complaint or issue is raised before them as and when warranted. However, the documents/records/information having National Security implications and those documents which have been classified as Secret/Top Secret are not to be disclosed.

8.4 The Principal will provide to the IEMs sufficient information about all meetings among the parties related to the Contract provided such meetings could have an impact on the contractual relations between the Principal and the Contractor. The parties offer to the IEMs the option to participate in such meetings.

8.5 The advisory role of IEMs is envisaged as that of a friend, philosopher and guide. The advice of IEMs would not be legally binding and it is restricted to resolving issues raised by a Bidder regarding any aspect of the tender which allegedly restricts competition or bias towards some Bidders. At the same time, it must be understood that IEMs are not consultants to the Management. Their role is independent in nature and the advice once tendered would not be subject to review at the request of the organization.

8.6 For ensuring the desired transparency and objectivity in dealing with the complaints arising out of any tendering process or during execution of Contract, the matter should be examined by the full panel of IEMs jointly, who would look into the records, conduct an investigation, and submit their joint recommendations to the Management.

8.7 The IEMs would examine all complaints received by them and give their recommendations/ views to the CMD, BHEL at the earliest. They may also send their report directly to the CVO, in case of suspicion of serious irregularities requiring legal/ administrative action. Only in case of very serious issue having a specific, verifiable Vigilance angle, the matter should be reported directly to the Commission. IEMs will tender their advice on the complaints within 30 days.

8.8 The CMD, BHEL shall decide the compensation to be paid to the IEMs and its terms and conditions.

8.9 IEMs should examine the process integrity, they are not expected to concern themselves with fixing of responsibility of officers. Complaints alleging mala fide on the part of any officer of the Prinicpal should be looked into by the CVO of the Principal.

8.10 If the IEMs have reported to the CMD, BHEL, a substantiated suspicion of an offence under relevant Indian Penal Code / Prevention of Corruption Act, and the CMD, BHEL has not, within reasonable time, taken visible action to proceed against such offence or reported it to the Vigilance Office, the IEMs may also transmit this information directly to the Central Vigilance Commissioner, Government of India.

8.11 After award of work, the IEMs shall look into any issue relating to execution of Contract, if specifically raised before them. As an illustrative example, if a Contractor who has been awarded the Contract, during the execution of Contract, raises issue of delayed payment etc. before the IEMs, the same shall be examined by the panel of IEMs. Issues like warranty/ guarantee etc. shall be outside the purview of IEMs.

8.12 However, the IEMs may suggest systemic improvements to the management of the Principal, if considered necessary, to bring about transparency, equity and fairness in the system of procurement.

8.13 The word `Monitor' would include both singular and plural.

Section 9 - Pact Duration

9.1 This Integrity Pact shall be operative from the date this Integrity Pact is signed by both the parties till the final completion of contract for successful Bidder, and for all other Bidders 6 months after the Contract has been awarded. Any violation of the same would entail disqualification of the bidders and exclusion from future business dealings.

9.2 If any claim is made/ lodged during currency of this Integrity Pact, the same shall be binding and continue to be valid despite the lapse of this Pact as specified above, unless it is discharged/ determined by the CMD, BHEL.

Section 10 - Other Provisions

10.1 This Integrity Pact is subject to Indian Laws and exclusive jurisdiction shall be of the competent Courts as indicated in the Tender or Contract, as the case may be.

10.2 Changes and supplements as well as termination notices need to be made in writing.

10.3 If the Bidder(s)/ Contractor(s) is a partnership or a consortium or a joint venture, this Integrity Pact shall be signed by all partners of the partnership or joint venture or all consortium members.

10.4 Should one or several provisions of this Integrity Pact turn out to be invalid, the remainder of this Integrity Pact remains valid. In this case, the parties will strive to come to an agreement to their original intentions.

10.5 Only those bidders / contractors who have entered into this Integrity Pact with the Principal would be competent to participate in the bidding. In other words, entering into this Integrity Pact would be a preliminary qualification.

10.6 In the event of any dispute between the Principal and Bidder(s)/ Contractor(s) relating to the Contract, in case, both the parties are agreeable, they may try to settle dispute through Mediation before the panel of IEMs in a time bound manner. In case, the dispute remains unresolved even after mediation by the panel of IEMs, either party may take further action as the terms & conditions of the Contract. The fees/expenses on dispute resolution through mediation shall be shared by both the parties. Further, the mediation proceedings shall be confidential in nature and the parties shall keep confidential all matters relating to the mediation proceedings including any settlement agreement arrived at between the parties as outcome of mediation. Any views expressed, suggestions, admissions or proposals etc. made by either party in the course of mediation shall not be relied upon or introduced as evidence in any further arbitral or judicial proceedings, whether or not such proceedings relate to the dispute that is the subject of mediation proceedings. Neither of the parties shall present IEMs as witness in any Alternative Dispute Resolution or judicial proceedings in respect of the dispute that was subject of mediation.

For & On behalf of the Principal
(Office Seal)

For & On behalf of the Bidder/ Contractor
(Office Seal)

Place _____
Date _____

Witness:_____
(Name & Address) _____
_____

Witness:_____
(Name & Address) _____
_____

FORMATS FOR EPAYMENTS

To,

Sr.DGM (Finance)
Transmission Business Group
BHEL, TBG Finance,
Plot no. - 25, Sector - 16A
Noida - 201301; U.P.

Subject: E-Payments vide RTGS/NEFT

I/We request and authorise you to effect Epayment vide any of the above two modes to my/our bank account as per the details given below:

Vendor Name	:
Title/Name of Account in the bank	:
Account Type(Saving /current)	:
Bank Account Number	☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐
Name & address of Bank	
Bank /Branch contact person's name	:
Bank /Branch Tele Numbers with STD code	:
Bank Branch MICR code	☐☐☐☐☐☐☐☐☐
	(please enclose a copy of a cheque. This cheque should not be a payable at par cheque)
Bank Branch RTGS IFSC code	☐☐☐☐☐☐☐☐☐☐☐
Bank Branch NEFT IFSC code	☐☐☐☐☐☐☐☐☐☐☐
	(you can obtain this from branch where you have your account)
Your Email address	: **(not more than 20 character)**
Name of the Authorised Signatory	: (Please mention here name of person from your organization signing this letter.)
Contact Person's name	: (please mention here the name of a person in your company/organization)

I/We confirm that information provided above is correct & any consequences due to any mistake in above will be borne by us.

Thanking you

For
(Autorised Signatory)

We confirm that we are enabled for receiving RTGS/NEFT credits and we further confirm that the account number of (Please mention here name of the account holder), the signature of the authorised signatory and the MICR and IFSC Codes of our branch mentioned above are correct.

Bank's Verification
(Manager's/Officers signature under
bank Stamp)

Note:- Please attach cancelled original Cheque leaf.

BHARAT HEAVY ELECTRICALS LIMITED
TRANSMISSION BUSINESS GROUP, NOIDA
PRE-QUALIFYING REQUIREMENTS

REF.: TBSM/KOPPAL-II/EREC-STR/TENDER/25-26 **DATE: 08.05.2025**

SUB: TENDER FOR "Erection work of Structure and Stringing at 765/400/220 kV AIS Switchyard at POWERGRID KOPPAL-II & KOPPAL Extn. Project in Koppal, Karnataka".

Tenders (Under two-part bid system) are invited from competent contractors for subject works. Only those who are technically and financially capable to execute the Job and who fulfil the Pre-Qualifying Requirements [PQR] given under are eligible to quote against the above NIT. Tenderers should submit their offer as per the procedure specified in tender documents. The PQR of contractor for tender submission shall be is as under:

Sl. No.	Criteria	Description
A	Turn Over	Bidders should have a minimum average annual turnover (Annual Gross Revenue from operations/ Gross operating income as incorporated in the profit & loss account excluding Other Income) of **₹ 2,61,57,252/- for best three fin. Years i.e. 36 months out of last five financial years (2019-20, 2020-21, 2021-22, 2022-23 & 2023-24 OR 2020-21, 2021-22, 2022-23, 2023-24 & 2024-25)** and should submit audited balance sheet and Profit & Loss Account Sheet of these years. The audited financial statements must be signed by the owner and the auditor. Auditors seal, Name, Membership No., Firm Registration No. & firm name (if applicable), UDIN and the capacity in which he is signing (Proprietor/Partner), must be mentioned on the Profit & Loss A/c and Balance Sheet. In case of proprietorship and partnership firms where Audited Profit & Loss A/c and Balance Sheet is not mandatory as per extant rules, CA certificate certifying turnover and profit for the required financial years must be submitted. CA certificate must be on his letter head mentioning his/her name, Membership No., Firm Registration No. & firm name (if applicable), UDIN, capacity in which he is signing (Proprietor/Partner), date and place of signing.
B	Profit & Networth	Bidder should have earned profit in at least one financial year during the period of last three Financial Years as per Sl. No. A above and Net worth of the Bidder based on the latest Audited Accounts as furnished for 'A" above should be positive. Net worth = Paid up share capital + Reserves. (Net worth is required to be evaluated in case of companies)
C	Similar Work*	Bidder should have successfully completed "**Erection/ installation of Switchyard/ transmission lines including erection of tower/ beam & stringing work of voltage rating 220kV & above"** during last seven years ending on **30.04.2025** and should be either of the following: i. Three similar jobs costing (except service tax/GST) not less than **₹ 1,23,46,996/-** each. OR ii. Two similar jobs costing (except service tax/GST) not less than **₹ 1,54,33,745/-** each. OR iii. One similar job costing (except service tax/GST) not less than **₹ 2,46,93,992/-**

Note:

1. The Bidder shall submit the Contract Agreement/Work Order/LOI along with BOQ and Performance/completion/execution certificate issued by customer/contractor along with technical bid in support of qualification.
2. Only those work credentials will be considered that already completed and completion certificate available for that work.
3. In order to technically qualify in this tender, bidder should meet all criteria i.e. A, B & C mentioned above.
4. If the job is completed in the last seven years period, as specified above, even if it has been started earlier, the same will also be considered meeting the qualifying requirements.
5. Consortium/ JV bidding is not allowed.
6. BHEL reserves the right to:
   (a) Accept or reject any bid received at its discretion without assigning any reasons whatsoever.
   (b) Postpone the above-mentioned date, split and distribute the work among more than one bidder without assigning any reason whatsoever.
   (c) May ask for further qualification during techno commercial scrutiny of bids received.
   (d) May ask for further proofs including TDS certificates/ Form 26AS/ Final bill/ payment detail for the said job for cross- verification.
7. BHEL shall not be responsible for any delay, loss, damage for bids sent by post.
8. BHEL shall not be liable for any expenses incurred by bidder in preparation of bid irrespective of whether it is accepted or not.
9. Quotations received from bidders who do not fulfil the PQR shall be summarily rejected without any further evaluation and information to bidders.
10. Canvassing i.e. soliciting favour, seeking advantage etc. in any form is strictly prohibited and any bidder found to have engaged in canvassing shall be liable to have his bid rejected summarily.
11. If the bidder deliberately gives any wrong information in his tender to create in circumstances for the acceptance to his bid, BHEL reserves the right to reject such application.
12. Bidder's selection is subject to approval of BHEL's customer for this work. The approval/acceptance of bidders from Customer is mandatory requirement for subject tender.
13. All corrigenda, addenda, amendments and clarifications to this Tender will be hosted in web page, www.bhel.com and https://eprocurebhel.co.in and not in the newspaper. Bidders shall keep themselves updated with all such amendments.

PROJECT INFORMATION

1.0 CUSTOMER:

M/s POWERGRID CORPORATION OF INDIA LIMITED (PGCIL)

2.0 PROJECT LOCATION AND DETAILS:

TENDER FOR "**Erection work of Structure and Stringing at 765/400/220 kV AIS Switchyard at POWERGRID KOPPAL-II & KOPPAL Extn. Project in Koppal, Karnataka.".**

SITE ADDRESS:

POWERGRID Koppal Gadag Transmission Limited,
Lakmanagule village, Yelburga (TK), Koppal District, Karnataka, PIN - 583230

Contact person: - Sh. Anupam Verma- Sr. Manager- 8171744488

3.0 CONTACT PERSON: FOR CONTRACTUAL ISSUES

Ashok Kumar Meena
Sr. DGM (TBSM)
SUBCONTRACTS MANAGEMENT,
TRANSMISSION BUSINESS GROUP,
Plot No. 25, Sector-16A, Noida,
Distt. Gautambudh Nagar, UP-201301

PHONE: 0120-674-8545/ 9831038136
E-mail: **akmeena@bhel.in**

CONTACT PERSON: FOR ENGINEERING ISSUES

Amit Srivastava
Manager (TBEM)
TRANSMISSION BUSINESS GROUP,
Plot No. 25, Sector-16A, Noida,
Distt. Gautambudh Nagar, UP-201301

PHONE: 0120- 674- 8596
E-mail: **amits@bhel.in**

CONTACT PERSON: FOR CONTRACT EXECUTION ISSUES

Sanjeev Kumar
SDGM & Sector Head/TBSS
TRANSMISSION BUSINESS GROUP,
PE & SD Building , Hyderabad
PHONE:9515368320
E-mail: ksanjeev@bhel.in

HSE CONDITIONS
at a GLANCE (for bidders)

Health Safety and Environment Management

BHARAT HEAVY ELECTRICALS LIMITED

TRANSMISSION BUSINESS GROUP

Transmission Business Group, Noida

DOCUMENT CONTROL			
Document number:	**TBG/HSE/NIT-01**		
Issue number:	00	Issue date:	08.01.2020
Revision number:	01	Revision date :	22.10.2021
Revision number:	02	Revision date :	31.01.2024

	Prepared by	Approved and Issued for use by
Name	Arvind Kumar Pandey	RS Pathwar
Designation	Sr. Engineer	Dy. General Manager
Signature	-sd-	-sd-
Date	31.01.2024	31.01.2024

Doc. copy issue no. :	Doc. copy issue date :

	Name	Designation	Signature
Issued to :			
Issued by :			

BHARAT HEAVY ELECTRICALS LIMITED

TRANSMISSION BUSINESS GROUP

BHEL TBG through its long experience and policy, has developed a culture to consider wellbeing of the society, protection of environment and occupational health and safety of its workers first. TBG has also a culture of transparency in all its business activities. In line to this culture, this NIT annexure is prepared as a peeping window in to the TBG HSE requirements which need to be 100% complied by the successful bidders while executing the contract. Interested bidders should go through these HSE conditions:

1. BHEL HSE Policy

In BHEL, Health, Safety and Environment (HSE) responsibilities are driven by our commitment to protect our employees and people we work with, community and environment. BHEL believes in zero tolerance for unsafe work/non-conformance to safety and in minimizing environmental footprint associated with all its business activities. We commit to continually improve our HSE performance by:

- Developing safety and sustainability culture through active leadership and by ensuring availability of required resources.
- Ensuring compliance with applicable legislation, regulations and BHEL systems.
- Taking up activities for conservation of resources and adopting sound waste management by following Reduce/Recycle/Reuse approach.
- Continually identifying, assessing and managing environmental impacts and Occupational Health & Safety risks of all activities, products and services adopting approach based on elimination/ substitution/reduction/control.
- Incorporating appropriate Occupational Health, Safety and Environment criteria into business decisions, design of products & systems and for selection of plants, technologies and services.
- Imparting appropriate structured training to all persons at workplace and promoting awareness amongst customers, contractors and suppliers on HSE issues.
- Reviewing periodically this policy and HSE Management Systems to ensure its relevance, appropriateness and effectiveness.
- Communicating this policy within BHEL and making it available to interested parties.

Atul Sobti
Chairman & Managing Director

June 5, 2018

Creating BHEL of tomorrow

2. Legal Compliances:

a. Statutory Provisions: All the sub-contractors are to comply with client specific rules and procedures, the National legislations and codes, in particular the following or their revised versions:

Srl. No	Acts/Rules Name	Srl. No	Acts/Rules Name
1	The Factories Act 1948, Amendment Act 1947	11	Contractor labour Act, 1970 (Regulation and abolition)
2	The Environment Act 1986	12	Provident fund Act, 1952
3	Workmen's Compensation Act, 1923	13	Payment of gratuity Act, 1972
4	Building and Other Construction Workers (Regulation of employment and condition of service) Act, 1996	14	Indian Explosives Act and the explosives Rules 2008
5	Buildings and Other Construction Workers Welfare Act, 1996	15	The Gas Cylinder Rules, 2016, Static and Mobile Pressure Vessels (Unfired) Rules 2016
6	Payment of wages Act, 2017 Equal remuneration Act,	16	The Indian Electricity Act 2003 and Indian Electricity Rules 2005
7	Minimum wages Act.1948	17	The Atomic Energy Act, 2015
8	Employers liability Act, 1938	18	The atomic energy (Radiation Protection) Rules. 2004
9	Industrial dispute Act, 1947	19	National Fire Protection Association (NFPA),
10	maternity benefit amendment act 2017	20	National Building Code of India 2016 etc.

b. Indian Standard (IS) Codes related to HSE

All the sub-contractors are to comply with client specific rules and procedures, the National legislations and codes in particular the following or their revised versions:

Srl	IS Code	Applies on
1	IS: 4081 -1986	Safety code for Blasting and Related Drilling operations
2	IS: 3764 -1992	Safety code for excavation work

3	IS: 5121 -1969	Safety code for pilling and other deep foundations
4	IS: 2750 -1964	Specification for steel scaffoldings
5	IS: 3696 (Part-I)-1987	Safety code for scaffolds and Ladders: Part- I Scaffolds
6	IS: 3696 (Part-II) -1991	Safety code for scaffolds and Ladders: Part –II Ladders
7	IS: 4082 -1977	Recommendations on stacking and storage of construction materials at site (First revision)
8	IS: 4130-1976	Safety code for demolition of building (First revision)
9	IS: 4912-1978	Safety requirements for floor and wall openings, railings and toe boards (First revision)
10	IS: 5916- 1970	Safety code for constructions involving use of hot bituminous materials
11	IS: 7205 -1974	Safety code for erection of structural steel work
12	IS: 7969 -1975	Safety code for handling and storage of building materials
13	IS: 8989 -1978	Safety code for erection of concrete framed structures
14	IS: 7293 -1974	Safety code for working with construction machinery
15	IS: 2212 -1991	Pipe lines –Identification –Colour code
16	IS: 5216 -1982	Recommendations on safety procedures &practices in Electrical works (Part -I &II)
17	IS: 875 -1964	Code of practice for structural safety of buildings and loading standards
18	IS: 10386 -1983	General aspects Part-1 -1983, Part-2 -1982, Part-6 -1983, Part-10 -1983- Amenities, Protective clothing and equipment, construction, storage, handling, detection and Safety measures for gases, chemicals and flammable liquids
19	IS: 10500-2012	Drinking water (Specification)
20	IS: 10291 -1982	Code of dress in civil engineering works
21	IS: 2925-1984	Safety helmets
22	IS: 1179-1967	Welding helmets
23	IS: 7524 -1979 (Part-I)	Safety goggles
24	IS: 9167 -1979	Ear muff /Ear plugs
25	IS: 6994 -1973 (Part-I)	Canvas hand gloves, Cotton hand gloves, Chrome leather gloves
26	IS: 4770 -1991	Rubber hand gloves tested for 15,000 volts
27	IS: 3521 -1999	Full body safety harness
28	IS: 11057 -1984	Specification for Industrial safety nets

29	IS: 13415 -1992	Protective Barriers in & around buildings (Code of safety)
30	IS: 13416 -1992	Preventive measures against Hazards at work places-Recommendations part-I Falling materials hazards Prevention part-I
31	IS: 13416 -1992	Preventive measures against Hazards at work places-Recommendations part-II Fall Prevention
32	IS: 15298 -2011 (Part 1&2)	Personal Protective Equipment -Safety shoes
33	IS: 12254 -1993	Poly vinyl chloride (PVC) industrial boots
34	IS: 5557:2004	Industrial and Protective Rubber knee and Ankle boots
35	IS: 2878 -2004	Co2 Type fire extinguisher
36	IS: 2171 -1999	Dry chemical powder fire extinguisher
37	IS: 13849 – 1993	Fire extinguisher for ABC fires
38	IS: 10204-2001	Mechanical Foam type extinguisher (Foam used shall conform to IS: 4989 -1974 and Co2 cartridge shall conform to IS: 4947 -1985)
39	IS: 3786 -1983	Methods for computation of Frequency rate and Severity rates for Industrial injuries and classification of Industrial accidents (First revision)

c. The Sub-contractors need to

- Attend HSE familiarization program at TBG-HQ with his site management team. This will be a half day long awareness session on HSE requirements and compliances which the agency is supposed to fulfil during contract execution at site. The session shall be taken by TBG HSE department on intimation by TBSM. **(Rev-01)**
- Request for issuance of Form-V in their name from customer on behalf of BHEL
- Get the Labour license registration from concerned Labour office.
- Get the BOCW Registration done along with the labour license.
- Get their labourers registered under BOCW for benefits provided by the office.
- Maintain Seven registers of labours as per BOCW requirement.
- Ensure payment of wages to labours not less than the current minimum wages applicable in the premises.
- Ensure PF deduction of labourers and submission of proof to BHEL office (Wage sheet, ECR & Challan copies) duly signed.
- Submit Labour Payment Certificate by 10th of Every month.
- File timely returns, get renewals done and submit a copy to BHEL office.

- Get Workmen's Compensation policy before the start of work, covering all the labourers and staff,
  - Policy should clearly mention the project name and location,
  - should be as per labour class and wage.
  - Should cover all the height workers with clear mention of Max. height.
  - Policy should be submitted to BHEL office and renewal before expiry.
- Issue employment card to every worker.

3. Labour Welfare and Medical Facilities

a. Labour Welfare

1. Declaration of normal working hours and weekly off day, Payment day & intervals
2. Paid rest days & holidays.
3. Payment of overtime @ twice the normal wage rate.
4. No labour shall be allowed overtime >12 hrs/week, limited to 48 hrs/month.
5. Rest and lunch area.
6. Separate Male/Female Toilets and Lavatories, clearly marked in local Language and provided with signage.
7. Cold and clean drinking water facility suitable to strength and near workplace
8. Creche for children of female workers as per BOCW requirements
9. Arranging labour accommodation in hygienic environment with the facilities of Water (Drinking, Sanitation), washing and bathing area, toilets in sufficient nos., clean and safe camps and surrounding, access road, well illuminated camp and roads, mode of contact, transport facility, first aid centre, 24x7 Security etc.
10. Cooking and eating place to be maintained in hygienic condition
11. General awareness of health and hygiene.

b. Medical facilities and Health centres

- Availability of first aid box at every work location and agency office, with contents as per BOCW requirement.
- Emergency vehicle (four-wheeler) at work place
- Availability of stretchers in emergency vehicle and in office.
- Trained first aider
- Medical check-up for all the supervisors and workers including cooks, at the time of induction and annually thereafter.
- Tetanus Vaccination for all in every six months.
- Identification and tie-up with nearby reputed hospital(s) and display of their contact number in Emergency contact list.

4. House Keeping & Storage

Housekeeping is a continuous process and is the part of work. Agencies shall maintain safe and presentable housekeeping all the time in their respective areas, common work locations and passage areas. Roads, passages, staircases, entrance/exit gates shall always be maintained obstruction free. No material shall be left or stacked at the roof edges. Agency shall make arrangements to remove scraps on regular basis and dispose them at a space provided by customer, clearly fenced and marked by the sub-contractor as **"SCRAP YARD"**. Suitable arrangement like dedicated housekeeping team and tractor/hydra should be identified for this work.

Construction materials like shuttering materials, staging materials, cables, re-bars, cements bags, earthing flats and rods, FF pipes, surplus soil etc should be stored/stacked properly such that it should neither pose threat to safety of man nor should obstruct the free movement of man and machineries.

Every sub-contractor should have separate and well-maintained storage area for his own materials, T&Ps, PPEs and BHEL issued materials. Consumables like diesel, cotton, grease, oil, paint, admixtures and other fire potential materials should be stored separately with suitable firefighting facility.

Fire capacity of store area to be assessed and accordingly fire extinguishers shall be planned suiting the class and capacity of fire. Sand heaps may also be stacked in open store yards suitably to use in case of fires.

5. Site Safety

a. Induction and others safety trainings

Every sub-contractor shall make arrangement to provide induction training as per BHEL and/or customer requirement on a pre-approved and fixed module to all its new inductees irrespective of class or grade of appointment/hire. He shall also arrange the required facilities for induction training such as board, marker, dummy, posters/banners with all the mandatory PPEs.
Sub-contractor shall also arrange for periodic trainings on fire-fighting, first aid, CPR, importance and use of PPEs, electrical safety, hot work safety, Height work safety, confined space, deep excavations and barricading, concreting work safety etc.

b. Appointment of Safety Officer/Supervisor

Every sub-contractor shall appoint full time **safety officer(s)** as per **Schedule VIII** of **BOCW Act-1996**. The safety officer so appointed, shall not be assigned any duty/work other than assisting in fulfilment of legal and contractual obligations at site. He shall perform his duties in line to meet the requirements of TBG HSE MANAGEMENT SYSTEMS, such as ensuring daily TBT, conducting induction and other HSE training and awareness programs, organising HSE campaigns, health check-ups, periodic mock drills, reporting & record keeping and other such compliances as per **HSE Plan for Site Operation (TBG/HSEP-14)** on regular basis. **(Rev-01)**, **(Rev-02)**

c. Safety organisation, Safety committees and meetings

Safety officer shall report directly to the head of the projects of the sub-contractor management. There shall be some appointed or nominated **safety stewards** from each sub-group like shuttering, bar-bending, concreting, brick work, material handling, structure erection, cable laying, pipe work, maintenance, batching plant, housekeeping, etc.

A **safety committee** shall be formed including members from different agencies, BHEL and customer covering at-least 50% participation from workers. Safety committee shall meet on weekly basis or as may be decided by customer, outcomes shall be complied as committed.

d. Personal Protective Equipment.

Unless mentioned otherwise, there will be three mandatory PPEs- Safety shoes, Safety Helmet and Reflective jackets conforming to relevant IS codes as mentioned above. Every person entering in the project premises shall use above mandatory PPEs.
There will be other PPEs too, based on the work requirement like: Twin lanyard full body harness, fall arresters and life lines for height workers, Face shield for welders and grinders, Induction helmets and Electrical resistant shoes with FRP/PVC toe for electricians and commissioning engineers, Gum boots for concrete workers and manual excavators, Goggle for gas cutters and grinders, Aprons for welders, shoulder pads for material handlers, Hand gloves – Leather for binders/welders/grinders, certified Rubber gloves for electricians, PVC for concrete/cement

handlers, cotton-housekeeping team/brick coolies/erectors, cable laying men and other material handlers. Dust mask for cement handlers.

e. Material Handling

BHEL as a policy discourages continuous manual handling. Material handling contributes a major portion in the project and hence proper means (mechanical/ electrical powered) should be deployed appropriately for this work. Cranes/Faranas/hydras should not be used for material transportation for long distances(>100m), if such movement is un-avoidable, it must be accompanied by a trained signal man. Long materials should be guided by tagline. Roads for material movement should be free from obstructions. Lifting appliances must be in good condition and must have test/inspection certificates.
Lifting tackles like- D-shackles, chains, ropes, slings, belts shall be periodically inspected and shall have valid test certificate and/or third-party inspection certificates.
Painted/galvanized structures/materials to be lifted by adequate capacity nylon belts only.
If a machine undergoes a major maintenance, fresh TPI shall be required before use. Hydraulic/pneumatic machines shall be free from leakages. Daily checklist to be filled and witnessed by the concerned supervisor before start of the work.

f. Vehicle/Machinery Documents and other safety requirements

- Crawler mounted boom cranes/Tyre mounted telescopic cranes/tower cranes
  1. Valid third-party inspection certificate.
  2. Valid Insurance policy
  3. Registration Certificate (if applicable)
  4. Valid Pollution under control (PUC) (if applicable)
  5. Fitness certificate from RTO (if applicable)
  6. Operator's valid license, experience and/or competence certificate.
  7. Swing horn
  8. Reverse horn
  9. Boom aviation light
  10. Approved Load chart (inside cabin)
  11. Fire extinguisher (inside cabin)
  12. First aid kit (inside cabin)
  13. Boom angle indicator
  14. Hook Latch
  15. Reflector strips on around cabin and on boom

- Loader backhoe (JCB), crawler excavators (Poclain), Hydra,
  1. Valid third-party inspection certificate.
  2. Valid Insurance policy
  3. Registration Certificate (if applicable)
  4. Valid Pollution under control (PUC) (if applicable)

5. Fitness certificate from RTO (if applicable)
6. Operator's valid commercial license, experience and/or competence certificate.
7. Reverse horn
8. Approved Load chart (inside cabin) (Hydra)
9. Fire extinguisher (inside cabin)
10. First aid kit (inside cabin)
11. Hook Latch (Hydra)
12. Reflector strips on around cabin and on boom

- Tipper, Transit mixtures (TM), Self-loading concrete mixture (Ajax Fiori), Tractors
    1. Valid third-party inspection certificate.
    2. Valid Insurance policy
    3. Registration Certificate
    4. Valid Pollution under control (PUC)
    5. Fitness certificate from RTO
    6. Operator's valid commercial Heavy license, experience and/or competence certificate.
    7. Reverse horn
    8. Fire extinguisher (inside cabin)
    9. First aid kit (inside cabin)
    10. Reflector strips on around cabin and on body

Note: 1. Tractors may be allowed with Light Commercial/non-commercial license on customer's consent.

- Cars, Taxis, scooters, motor cycles and other public carriers
    - Valid 2/4-wheeler license (as applicable- commercial/non-commercial)
    - Registration Challan
    - Valid Insurance
    - Pollution under control

g. Man-lifts (Cherry pickers), Scissors Lifts

1. Trained operator with experience/competence certificate and license
2. Valid third-party inspection certificate.
3. Valid Insurance policy
4. Registration Certificate (if applicable)
5. Valid Pollution under control (PUC) (if applicable)
6. Swing horn
7. Reverse horn
8. Boom aviation light
9. Fire extinguisher (inside cabin)
10. First aid kit (inside cabin)
11. Reflector strips on around cabin and on boom

Note:

1. No one shall ride man-lift bucket without safety belt, safety shoes, helmet and reflective jacket.
2. Not more than 3 persons at a time will board in bucket of man-lift (without any heavy materials) including operator.
3. Operator will not leave the machine while persons are elevated and working.
4. No one other than the authorised operator will operate the man lifts/Scissors lifts.

h. Excavation

Prior permission/clearance from customer is a must for excavations in areas where underground service services such as gas/water/oil/chemical/electrical lines may be routed. Due precautions shall be taken during excavation in such area. Excavations near water bodies (ponds/canals etc.) shall be done with sand/soil bags ready to plug water from accidental damaged/burst of edges. All the excavations shall be done by either step cutting (min. 600mm step at every 1.5m depth) or slope cutting at 1:2(X:Y axis) (or greater depending upon the soil condition). Where step cutting/slope cutting is not possible due to space constraints, shoring/shuttering or sheet piling to be used to check collapse of soil.

Excavated soil shall be stacked away from edge of the pit, at-least 1.5 meters or half of the depth whichever is higher. Height of the stack shall not exceed 2m in height.

Ramps shall be provided for access of the workers in large pits and ladder of metal/good built for small pits. Ladders shall be of sufficient length protruding at least 1m above the ground level.

Pumps of adequate capacity shall be available for pumping out of water. No lone worker shall be allowed to work in any excavation. Overloaded vehicle shall not be allowed near excavated pits.

i. Bar bending and Binding

Bar bending machine shall be installed under shed/roof. It shall be properly earthed and maintained for operation. Housekeeping of the area shall be team's responsibility on daily basis. All be bar benders shall be given hand gloves (leather/cotton) in addition to mandatory PPEs. Scrap shall be segregated and moved to scrap yard on regular basis. Bar bending station shall be located away from Main plying roads/passages. The station shall be well illuminated, shall have a maintained first aid kit and potable water. Station shall be located in such a way that the movement of the material be minimised.

j. Concreting

No electric vibrators shall be allowed to use. All the concrete workers shall be issued gum boots, safety helmets, reflective jackets and PVC hand gloves. Free fall of concrete from chute shall not exceed 1m in height. Heavy machineries/ vehicles shall be kept at least 2m away from the edge. Emergency vehicle shall be available near concreting work. Late night works shall be avoided, if it is unavoidable, a prior permission from BHEL/Customer is mandatory.

k. Welding, Gas Cutting & other hot works

Welding: Only experienced welders should be deployed for welding jobs. Welders shall be provided with apron, hand gloves, arm pads, leg pads, face shield and safety shoes. Welding leads shall be joint less and insulated. Power input point shall be fully covered at machine.

Gas cutting: If LPG is being used, domestic cylinder is strictly prohibited inside the project premises, (not allowed for site kitchen too). Hose pipes shall be in good condition without cracks, cuts, punctures or joints. Ends should be clamped with worm clamps. Dial gauges shall be of good quality and duly calibrated. Flash back arresters is a must for both oxygen/acetylene or LPG/Oxygen combination. Cylinders shall be stored, transported and used in vertical position only. When not in use, they shall be capped. Empty and filled cylinders to be stored separately with distinct marking.
Cylinders shall neither be rolled on the ground nor thrown during loading/unloading.

Grinding: Grinder shall be given clear glass face shield, apron, safety shoes, ear muffs and hand gloves. Grinder machines shall have wheel guard. Plug tops to be used for power connection preferably three wire type. Only trained persons shall be allowed to use grinders, abrasive cutters. Electrical connection shall be free from cuts, joints etc.

l. Erection & Height Work

Only trained filters and experienced helpers shall be engaged in erection work. Step bolts of lattice towers shall be checked for full tightness with spring washers before use. Height pass shall be issued to the identified group of erectors who have passed medical test and have working experience at height. Name of such workers shall be displayed at appropriate place. These workers only shall be allowed to work at height. Height work shall not be permitted in high wind/bad weather condition, during raining or in night/dark.

m. Electrical Safety

BHEL usually provided single point power source and sub-contractors draw power from there. Otherwise agencies make their own arrangement for construction power like DG sets etc. Sub-contractors shall submit their load requirement (amperage & phase) to BHEL before start of work. Accordingly, they shall make arrangements to draw power and distribution arrangements too in a safe way. MCCBs and HRC fuses to be put in circuit for short circuit and overload protections and RCCBs of 30mA sensitivity to be put at each distribution panel for human safety. Earthing pits shall be installed at each distribution point and maintained below three Ohm resistivity which shall be inspected randomly. The distribution points shall be clean, free from vegetation and water logging, easily accessible and covered/protected from three sides and top for rain. Earthing of DBs shall be done by 25x3mm GI flats connected from proper earth pits. Insulation mat, PVC Sheet/Wooden plank to be placed before DBs as platform. DB Sheds shall be legibly marked with name of agency, contact no of electrician and SLD of that DB. Only industrial plugs and sockets shall be allowed. Three wire (Phase, neutral and earth) system shall be used for tools, lights and machineries and two wire power draws shall be strictly prohibited. PTW and LOTO system shall be maintained to work on LT system. Name and contact no of authorised electricians who will be responsible of electrical power facility maintenance shall be submitted to BHEL by Agencies. Unauthorised sharing of power from one agency to other is strictly prohibited. Electricians shall use standard PPEs and insulated

tools only. Standard and tested/certified discharge rods to be used in the areas where there is a possibility of residual current or induction charge. The induction rod to be connected to the earth first and removed in the last. Induction helmets only to be used in the charged area. Electricians to be provided with electrical resistant safety shoes having FRP/PVC toe.

n. Dust Gases and fumes

Sub-contractor shall make arrangements to avoid accumulation of dust fumes and gases. Cement handlers inside store or at batching plant and gravel spreader shall be given effective nose masks and jaggery (at least 200g per person per day). DG sets and other machineries like cranes excavators etc. shall have valid and effective PUC certificate and shall have maintained engine with silencer. No IC engine operated machine shall be used in confined and covered area like hall, sheds, store etc. where accumulation due to lack of ventilation can increase to harmful levels. Dedicated arrangements (tanker or tractor with sprinkler) shall be made by the sub-contractors (individual or jointly) to continuously subside the dusts arising out of the movement of the vehicle's roads/passages. Welding activities near roof accumulates harmful gases. Welders in such positions shall be provided with effective masks conforming to IS standards.

o. Vehicular Traffic

Speed limits defined within the premises shall strictly be followed by the drivers/commuters of construction as well as other vehicles.
Every construction machinery, man-lift shall display the name, contact no and passport size photograph of the authorised operator (There can be one or more authorised operators).
No one other than operator and co-operator shall sit inside the cabin of any construction machine while it is working.
Construction machineries (tractor, trucks, tippers, JCBs, hydra, Fassi cranes etc. shall never be used as mode of public transport. Machineries like Ajax Fiori and hydra shall not be driven in back direction except for small distances. No overloaded vehicle shall be permitted entry in the project premises.
Over speeding shall be reported and driver/operator shall be barred from entry or shall be penalised.
Drunken drivers shall be barred from entry in the project.
Carrying harmful weapons like knives (>6"), guns etc. shall permanently disqualify the person from entry in project premises.

p. Barricading and floor openings

Every pit deeper than 4 feet (1.2m) shall be barricaded immediately after excavation and will remain barricaded till backfilling.

Pits/trenches drains near roads, passages whether temporary or permanent shall be hard barricaded and well illuminated. Roof edges and openings shall be strictly hard barricaded and illuminated. Height works like masonry works, structure erection, erection by cranes, Lattice tower/beam erection areas shall be barricaded to restrict entry. Areas under charging/commissioning shall be barricaded and caution boards shall be displayed on newly charged areas.

q. Scaffold & Ladder

No bamboo/wooden scaffold shall be allowed to be used. Only tubular steel scaffolds with couplers conforming to the relevant IS codes shall be allowed with base plates. Standard steel or wooden planks to be used as platforms and no packing materials shall be used. All the platforms shall be built with provisions of **top rail at 1m height, mid rail at 0.5m height and toe boards of min 6" height** at floor level. Minimum width of platform shall be 900mm and if wheel barrow is to be used then 1200mm. Means of access to be provided in the form of ladders, ramps or staircase. Multilevel work platforms or those platforms having passage underneath shall be provided with safety net, screen or canopy at each level for protection from falling objects. Platforms shall be free from concrete, debris or other materials. Platforms shall not extend out of the putlogs and shall be secured and fastened. Decking shall be made non-skidding.
Scaffolds under erection shall be tagged **"RED"**, under repair/maintenance/inspection shall be tagged **"YELLOW"** and ready for use shall be tagged **"GREEN"**

Only metal ladders in the construction site and FRP ladders in charged areas shall be allowed. Ladders made from packing materials shall not be used. Ladders shall be securely fixed at bottom, top and long ladders at middle points too at an interval not more than 2400mm and must have a landing at every 6m. Inclination angle should be approximately 1:4 (X:Y) or 75deg. Ladder must extend at least 1m above the platform/access area. Gap between two rungs shall not exceed 300mm. Portable ladder should not be more than 4m in length. Minimum width of the ladder shall not be less than 300mm.

Use of Mobile aluminium scaffold is preferably advisable for erection of transformers/reactors.

r. Illumination

The sub-contractor shall ensure that the areas such as work stations, buildings, batching plants, passages/roads, stores, rest areas, power sources, staircases etc. are illuminated sufficiently to make safe work conditions at site and shall not be less than the relevant IS standards. Excavations/ below ground level structures near passages/roads shall also be sufficiently illuminated.

s. Safety banners/posters, caution boards

Sub-contractors shall display boards and banners in sufficient quantity having safety signs, slogans, important messages, pictures, cautions at prominent locations to promote safety and spread awareness for important precautions such as "Deep Excavation Ahead", Speed Limit", "Charged Area", "Do not operate", "Hard hat area", "No smoking Zone" etc. Boards containing messages of Emergency contacts, First aid facility, rates of minimum wages, working hours, rest day etc. should be displayed at specific areas.

t. Waste management and disposal

Sub-contractor shall make suitable and effective arrangement to remove waste material from site on regular basis and store them in an identified and safe location. Disposal of wastes shall also be done as per manufacturer's instructions or as per the guidelines laid by legal authorities. Re-bars, Cement bags, packing material (wooden/metal/plastic/paper), paint, oil, grease, cables (armour, sheathing, insulation),

civil debris, metal chips, GI sheet scraps, batteries etc. are the common waste materials. Sub-contractor shall arrange disposal of the hazardous wastes/materials in conformance to the legal and contractual requirements only.

u. Inspection of PPEs, T&Ps, Machineries and lifting appliances

All the PPEs, T&P and lifting appliances purchased newly by sub-contractors shall have test certificates which shall be submitted to BHEL office periodically or on demand. There shall be at least monthly joint inspection schedule for inspection of healthiness of all the PPEs, T&Ps and lifting appliances. All the lifting appliances shall be tested and examined by a competent person before taking into use for the first time or after it has undergone any alterations or repairs liable to affect its strength or stability

and also once at least in every twelve months. To confirm quality of the PPEs as per the relevant IS codes, BHEL may ask sub-contractors to get any or all types of PPEs tested through NABL approved lab as per relevant IS codes. At any stage, the 100% cost of such tests shall be in the scope of respective sub-contractors.

v. Cable Laying

Sub-contractor shall ensure cable trenches free from water, mud, debris, snakes, Scorpios, lizards before start of the work in trenches. Cable drum rollers shall be used to pull cables out of drums to avoid twisting of cables. Hand gloves, Safety shoes/gum boots, reflective jackets, safety helmets shall be provided to the workers. Cable laying area shall be well illuminated.

w. Fire Protection

Every sub-contractor has to maintain their working area, store and office area free from bushes. Stacking of flammable materials like wood, paper, plastic, paint, oil, grease, fuel, cotton, gases etc. at isolated place disconnected from other storage and office areas. Adequate arrangements of firefighting means like suitable extinguishers, fire/water buckets, water tanks, sand dunes etc. shall be made by the agency depending upon the fire capacity assessed or as per MSDS. Fire drills and trainings on how to operate fire extinguishers and how to react in case of fire breakouts shall be the part of regular training program. Guards and store persons must be a regular participant of such training programs. A list of trained firefighting persons and periodicity of such training programs shall be submitted to BHEL by every agency and same to be adhered. Sufficient number of fire extinguishers with suitable class shall be placed at such locations where there can be fire hazard like stores, pantry, office, DG set, electrical distribution panels etc.

x. Fencing of exposed rotating parts

Exposed rotating parts poses great threat to the person in vicinity. Such parts need to be fenced/covered. Guards are mandatory of grinders, abrasive cutters. Flywheels of the engines of heavy machines, Diesel engines, DG sets need to be covered. Electric winch machines, pulleys, chains, shafts, exhaust fans at reachable height, table fans, need to be caged/fenced. Such fencing/guard shall not be removed while machinery is in operation.

y. Emergency preparedness response plan and periodic mock drills.

Sub-contractor shall comply JSA (Job Safety Analysis) and arrange to mitigate the effects of identified possible hazards. He shall also define following in response to emergency preparedness:
An emergency assembly point and put a board of the same with information to all in induction training.
Have facility of ambulance or tie-up with nearest hospital for service in minimum possible time (Max-30min) if there is not ambulance inside the premises.
Ensure availability of emergency vehicle with driver all the time at site during work.
Conduct mock-drills on possible risks like electrocution, fall from height, fire, heat stroke etc., record responses and take photographs to submit in BHEL office. Stretchers availability in emergency vehicle or at work place should be well accessible. Provide fire extinguishers of right type at right place in right quantity with information to all. Display emergency contact nos. to various risk locations and at office, service building or at major work locations. Provide first aid training by doctors for and display names of such trained first aiders and fire fighters. Rescue kit with trained staff or man lift or both to rescue a man hanging by safety belt at height. Provide running water tap near chemical storage and handling points. Agencies shall follow emergency response plan prepared by BHEL in each area of work, store and office.

z. Safety reports & Reporting of accidents

BHEL will provide ''formats and checklists'' for the purpose of records/documents pertaining to the compliance of aforesaid clauses. Agencies shall be responsible for strict adherence and compliance for timely generation and fill-up of the checklists and reports. These shall be submitted on weekly and monthly basis as specified in the formats.

Agency shall also promote such an environment that the near misses, incidents and accidents are reported by every person, whosoever witnesses them. These shall help in analysing the trend and taking measures in reducing/stopping the accidents/incidents. Initial reporting can be in any form-by call, SMS, WhatsApp, e-mail, letter etc.
Major and fatal accidents or high potential incidents shall be investigated for route cause and outcomes shall be immediately implemented to check recurrences.

6. General conditions and penalty clauses

Following are the general conditions:

PPEs shall not only bear the ISI mark but also be conforming to the required standards, 100% compliance of the PPEs is mandatory.
Over speeding of vehicles shall attract penalty/notice and recurrence will attract debarring from entry into project premises.
Hiding of facts like incidents, accidents, fake/forged reports/certificates shall also attract penalty/ notice or both. Only approved third party agencies shall be allowed to inspect the machines, T&Ps. Reports shall directly be sent to BHEL/customers by the third parties.

Insurance and TPIs to be renewed before expiry. Machines, T&Ps shall not be allowed to work if renewal delayed. Continuity of WC policy to be maintained religiously by the respective agencies.

Agency shall submit the status report of his labour license, BOCW registration, WC Policy, insurance & TPI validity on monthly basis with list of machineries and T&Ps

Sub-contractors shall also maintain a buffer stock of all the PPEs in at least 20% excess to the present strength of the work force.

If construction power is not drawn as per the guidelines laid in clause no. 5(m), given above, BHEL may take-up this work at the risk and cost of the agency and/or may withhold a sum of min. Rs. 50,000/- (Rs. Fifty Thousand) or more as the site in-charge deems fit till the system is aligned as per aforesaid requirement.

Agencies shall be responsible for the compliance of the above requirements. Failure in one or more clauses/area shall attract a notice or monitory penalty or a combination of above.

Monitory penalty will be

- Rs. 1000/- per person/incident per day for non-conformity in above areas.
- A Major/severe accident shall attract a penalty of Rs. 2,00,000/- per head
- Fatality or permanent disability with total loss of earning capacity, if any, will attract a penalty of Rs. 5,00,000/- (Rs. Five Lakh).
- Further fatality/permanent disability shall attract double the last penalty imposed on the agency.
- Above penalties are exclusive of medical expenses of the victim or compensation to the family through insurance policy (WC Policy or group insurance).
- **Penalties imposed by customer shall be fully transferable to the sub-contractor. In the event of above cases, penalties shall be imposed whichever will be higher.**
- Evaluation of agency's performance on HSE compliance shall be done as per BHEL guide lines/system.

Revision History

Revision Date	Revision No.	Old Text	New Text	Reason	Revised by (with sign)
03.05.2019	00	N/A	Full Document	New Release	
12.10.2021	01	Nil	Attend HSE familiarization program at TBG-HQ with his site management team. This will be a half day long awareness session on HSE requirements and compliances which the agency is supposed to fulfil during contract execution at site. The session shall be taken by TBG HSE department on intimation by TBSM. (at page no. 5)	For better understanding of HSE requirements to agency. (HSE Review meeting dated 23.08.2021)	
12.10.2021	01	Edition	Inclusion of penalty provisions in case of non-deployment of safety person(page-8)	Introduction of HSEP-14	
17.01.2024	02	Edition	Appointment and duties of qualified safety officer (Page-8)	As per BOCW 1996	

-:End of Document:-

BHARAT HEAVY ELECTRICALS LIMITED

TRANSMISSION BUSINESS GROUP,

NEW DELHI

CONDITIONS OF CONTRACT

FOR

ERECTION WORKS

DOC. NO. – TB-ETC-GCC,REV.-02
20th JUNE, 2005

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SECTION- A

GENERAL INSTRUCTIONS TO TENDERERS

SECTION - A

GENERAL INSTRUCTIONS AND INFORMATION FOR TENDERER

A.1.0 : PROCEDURE FOR SUBMISSION OF SEALED TENDERS

Please refer Annexure to the Conditions of Contract for Erection work attached with the tender documents

PART - II (PRICE - BID) COVER - II:

Rate/Price Schedule only shall be given in this part - II "Price Bid".

A.2.0 : PROCEDURE FOR EVALUATION OF PRICE BID

Please Refer "ANNEXURE TO CONDITIONS OF CONTRACT FOR ETC WORKS" attached with the tender document

A.3.0

Please Refer "ANNEXURE TO CONDITIONS OF CONTRACT FOR ETC WORKS" attached with the tender document

A.4.0

A.5.0

A.6.0

A.7.0

A.8.0

A.9.0

A.10.0

A.11.0

A.12.0

A.12.1

A.12.2 Please Refer "ANNEXURE TO CONDITIONS OF CONTRACT FOR ETC WORKS" attached with the tender document

A.12.3 Three years financial turn over (certified), present commitments with all orders in hand, value of total order, value completed, and balance with completion dates as per Annexure-A.

A.12.4 **ORGANISATION CHART & MANPOWER DEPLOYMENT**:

The organisation pattern and the manpower that are totally available with him & that will be deployed by the tenderer for this work in the form of month wise and category wise deployment plan duly indicating the number of Engineers, Supervisors, Skilled and Unskilled Workers etc. as per proforma at Annexure-B shall be submitted.

A.12.5 A list of machines, tools and plant that the tenderer is having and those that will be deployed on this job giving proof of ownership or any tie-up of equipment as per proforma enclosed at Annexure-C.

A.12.6 Analysis of unit rate quoted as per proforma enclosed at Annexure-D.

A.12.7 Declaration sheet as per proforma enclosed at Annexure-E.

A.12.8 Checklist as per proforma enclosed at Annexure-F.

A.12.9 Certificate from schedule Bank to prove his financial capacity to undertake the work or solvency certificate from the concerned Government Authority.

A.12.10 A certificate of Income Tax/Sales Tax verification from the appropriate authority in the forms prescribed duly indicating annual turnover. These certificates shall be valid for one year from the date of issue or for the period prescribed therein for all tenders submitted during the period.

A.12.11 In addition to the above, the particulars required elsewhere in the tender documents.

A.12.12 NOTE: In terms of clauses A.12.1 to A.12.11 above, all the data required to be enclosed with the tender need to be furnished neatly typed, signed & stamped in the given formats only (in the form of separate sheets) failing which the tender may be considered as incomplete and is liable for rejection. Documentary proof wherever necessary also need to be enclosed.

A.13.0 EARNEST MONEY DEPOSIT

A.13.1 Please refer " Annexure to conditions of contract for ETC Work" attached with the tender documents.

A.13.2

A.13.3

A.13.4

A.13.5 Please refer " Annexure to conditions of contract for ETC Work" attached with the tender documents.

A.13.6

A.13.7

A.13.8

Above clause No. A.13.0 stands deleted. Please refer Annexure to conditions of contract for ETC works.

A.14.0 **AUTHORISATION AND ATTESTATION:**

A.14.1 Tenders shall be signed by persons duly authorised / empowered to do so. Certified copies of such authority and relevant documents shall be submitted along with the tenders.

A.15.0 **VALIDITY OF OFFER:**

A.15.1 THE OFFER SHALL BE KEPT OPEN FOR ACCEPTANCE FOR A MINIMUM PERIOD OF FOUR MONTHS FROM THE DATE OF OPENING OF TENDERS. In case the BHEL calls for negotiations, such negotiations shall not amount to cancellation or withdrawal of the original offer which shall be binding on the tenderer.

A.16.0 **EXECUTION OF CONTRACT :**

A.16.1 The successful tenderer's responsibility under this contract commences from the date of issue of the Letter of Intent by BHEL. The successful tenderer shall be required to execute an agreement in the prescribed form as per Annexure-H with BHEL within a reasonable time after the acceptance of his tender and in any case before submitting the first bill for payment. The expenses for completion, stamping and registration of the agreement with prescribed authority if necessary, shall be borne by the contractor.

A.17.0 **SECURITY DEPOSIT:**

A.17.1 Please refer " Annexure to conditions of contract for ETC Work" attached with the tender documents.

e)

f)

Please refer " Annexure to conditions of contract for ETC Work" attached with the tender documents.

g)

h)

i)

j)

k)

l)

Note

A.17.2

Please refer " Annexure to conditions of contract for ETC Work" attached with the tender documents.

A.17.3

A.17.4

A.17.5

A.17.6

A.17.7

Above clause No. A.17.0 stands deleted. Please refer Annexure to conditions of contract for ETC works.

.

A.19.0 **REJECTION OF TENDER & OTHER CONDITIONS:**

A.19.1 Please Refer "ANNEXURE TO CONDITIONS OF CONTRACT FOR ETC WORKS" attached with the tender document

A.19.2

A.19.3

A.19.4

A.19.5

A.19.6

A.19.7

Please Refer "ANNEXURE TO CONDITIONS OF CONTRACT FOR ETC WORKS"
attached with the tender document

A.19.8

A.19.9

A.19.10

A.19.11

A.19.12

A.19.13 The tenderers must go through Annexure 'Q' of Section-B which details out the List of Tools, Tackles & Calibrated Test Equipments to be arranged by ETC contractor together with special purpose instruments which can be provided by BHEL free of cost for execution of work provided the same is informed to BHEL on award of contract.

Also, Annexure 'Q' gives the details of specialised Services which can be provided by BHEL for system commissioning on NO CHARGE basis with advance intimation to 'ENGINEER' in this regard. The tenderer must also see Clause E.4.2 & E.6.3 of Section E for more details.

A.19.14 IT WOULD BE PREFERRED THAT YOUR OFFER IS WITHOUT ANY DEVIATION w.r.t. TENDER SPECIFICATIONS AND THE SAME MAY BE CLEARLY MENTIONED ON THE COVERING LETTER ACCOMPANYING THE TECHNICAL BID. Offers with deviations are likely to be rejected. However if the bidder insists on any technical or commercial deviations, from the specification and/or tender conditions, the price implication if any, of withdrawing the deviations must be submitted along with the price bid in a separate sealed envelope superscribed "Price Implication for withdrawal of deviations". No price implication for withdrawal of deviation shall be accepted at a later date, after the opening of technical bid.

ANNEXURE - A

DETAILS OF WORK EXECUTED / BEING EXECUTED

A) WORK EXECUTED

SL. NO.	FINANCIAL YEAR	CUSTOMER	DESCRIPTION OF WORK	TOTAL ORDER VALUE	REMARKS

B) WORK BEING EXECUTED

SL. NO.	CUSTOMER	DESCRIPTION OF WORK	TOTAL VALUE	VALUE OF THE PORTION COMPLETED	ACTUAL START DATE	EXPECTED COMPLE-TION DATE	REMARKS

(SIGNATURE OF TENDERER)
WITH STAMP

ANNEXURE - B

(A) PROPOSED MANPOWER (ENGINEERS / SUPERVISORS) RESOURCES FOR EXECUTION OF WORK

SL. NO.	NAME OF STAFF	QUALIFICATION	EXPERIENCE IN YEARS	REMARKS

(B) MONTH WISE MANPOWER DEPLOYMENT PLAN

SL. NO.	CATEGORY	INDICATE NO. OF PERSONS TO BE DEPLOYED IN EACH MONTH								
		1st	2nd	3rd	4th	5th	6th	7th	8th	AND SO ON

(C) Total Man-days planned to be deployed for the work : .....Man-days

Plus man-days for unskilled labour as per site requirement.

(SIGNATURE OF TENDERER)
WITH STAMP

ANNEXURE - C

(A) STATUS OF TOOLS, PLANTS & INSTRUMENTS

Sl. No.	Name of Eqpt.	Quantity owned	Registration No. wherever applicable	Documents enclosed for proof of Ownership/Tie-up	Present Location	Quantity proposed to be deployed for this job

(B) MONTH WISE TOOLS, PLANTS & INSTRUMENTS DEPLOYMENT PLAN

Sl. No.	Description of Tools, Plants and Instruments	(Indicate No. to be deployed in each month)							
		1st	2nd	3rd	4th	5th	6th	7th	and so on

(SIGNATURE OF TENDERER)
WITH STAMP

ANNEXURE - D

ANALYSIS OF UNIT RATE

Sl. No.	DESCRIPTION	PERCENTAGE OF THE UNIT RATE	REMARKS
01	Salary & Wages for staff & workers		
02	Materials (a) .....) (b) .....) (c) .....) (d) .....)		
03	Depreciation & maintenance for T & P		
04	Depreciation & maintenance for other items		
05	Establishment & Admn. expenses of site		
06	Overheads		
07	Profit		

(SIGNATURE OF TENDERER)
WITH STAMP

ANNEXURE -E

DECLARATION SHEET

I ..... hereby certify that all the information and data furnished by me with regard to this Tender Specification No. ..... are true and complete to the best of my knowledge. I have gone through the specification, conditions and stipulations in detail and agree to comply with the requirements and intent of specifications.

(SIGNATURE OF TENDERER)
WITH STAMP

ANNEXURE - F

CHECKLIST & SCHEDULE OF GENERAL PARTICULARS

NOTE: Tenderers are requested to fill in the following details and no column should be left blank.

1.	Name & Address of the Tenderer	:	
2.	Telegraphic/telex address		:
3.	Phone/Fax No. (Office)	:	
4.	Name & designation of the official of the tenderer to whom all the references shall be made	:	
5.	Tenderer's Proposal No. & date	:	
6.	Whether EMD submitted (by cash/ Bank Guarantee/Bank Draft)	:	By.....
7.	Validity of offer/rates quoted for six months from the date of opening of tender	:	Yes/No
8.	Attested copy of power of attorney as per Clause-A.12.1	:	Yes/No
9.	Solvency Certificate submitted as per Clause-A.12.9	:	Yes/No
10.	Income Tax/Sales Tax Certificate submitted as per Clause-A.12.10	:	Yes/No
11.	Details of work executed/being executed as per Annexure-A	:	Yes/No
12.	Monthwise & Category wise manpower deployment plan as per Annexure-B	:	Yes/No
13.	Status of Tools, Plants and Instruments & their month wise deployment plan as per Annexure-C	:	Yes/No
14.	Analysis of unit rate quoted as per Annexure-D	:	Yes/No
15.	Declaration sheet as per Annexure-E	:	Yes/No
16.	Request for registration (for new tenderers) submitted	:	Yes/No

Date .....

(SIGNATURE OF TENDERER)
WITH STAMP

WITNESS : (Signature with full particulars)

1.
2.

ANNEXURE - H

C O N T R A C T A G R E E M E N T

CONTRACT NO. :
LETTER OF INTENT NO. :
WORK ORDER NO. :

1. The Contract Agreement entered into the day of ....., 20... (..... day of .....two thousand and……. ....) at New Delhi between M/S BHARAT HEAVY ELECTRICALS LIMITED, TRANSMISSION BUSINESS GROUP, New Delhi, having it's Registered Office at BHEL House, Siri Fort, New Delhi - 110 049 (hereinafter called the FIRST PARTY which expression shall include their executors, administrators, successors and permitted assigns)

   AND

   M/S ..... (hereinafter called the SECOND PARTY which expression shall include their executors, administrators, successors and permitted assigns).

2. And whereas the FIRST PARTY called for the offer for the work of..... as per approved specifications, drawings and quality plan at ..... as per Tender Specification No..... , dated .....

3. Whereas the SECOND PARTY submitted their offer No. ..... dated ..... against above.

4. Whereas the FIRST PARTY has accepted the offer referred to above & issued Letter of Intent No....., dt..... and also detailed Work Order No…….. dt .....

5. Whereas the SECOND PARTY has agreed to work as Sub-Contractor of the FIRST PARTY on the conditions specified in the Tender Specifications at a contract price of Rs...……..(Rupees.....)

6. Now, therefore it is hereby mutually agreed to by and between the parties hereto as under :

   a) The SECOND PARTY shall execute the works of ..... at ..... on the conditions specified in Tender Specifications of FIRST PARTY and Letter of Intent referred to herein before at a total contract price of Rs..... ……(Rupees .....)

   b) That the SECOND PARTY shall organise all activities and mobilisation of facilities so that the work specified herein before is completed by .....as per the time bound programme mentioned in the Tender Specifications.

c) That all disputes arising out of or relating to this agreement shall be referred to the sole Arbitrator as per arbitration clause mentioned in the Tender Specifications. The Arbitrator from time to time with the consent of the parties enlarge the time for making and publishing award without reference to the court for the purpose.

d) That the jurisdiction in all suits or claims arising out of this agreement shall be of New Delhi Courts only.

e) The Following documents shall form part of this agreement :-

i)
ii)
iii)
iv)
v)
vi)

7. Deviation Limit : The contract value is subject to deviations depending upon the actual requirement within plus or minus 30%. Quantities of individual items may vary to any extent or may get deleted.

8. Terms of Payment : The terms of payment applicable to this contract shall be those covered under Point No.... of Work Order dt. ..... and as per Tender Specifications.

9. Abandoning the work : In the event of the SECOND PARTY abandoning the work, FIRST PARTY reserves the right to get the unfinished work done at the risk and cost of the SECOND PARTY.

10. All other terms and conditions shall be as stipulated in the Tender Documents.

11. This contract agreement consists.... pages.

IT WITNESS WHEREOF, the parties have signed this agreement on the date, month and year first above written in presence of:

For and on Behalf of
(FIRST PARTY)

WITNESS (WITH ADDRESS)

For and on Behalf of
(SECOND PARTY)

1.
2.

ANNEXURE - I

MODEL FORM OF BANK GUARANTEE (FOR SECURITY DEPOSIT)

1.

Please Refer "ANNEXURE TO CONDITIONS OF CONTRACT FOR ETC WORKS" attached with the tender document

2.

b)

c)

5.

Please Refer "ANNEXURE TO CONDITIONS OF CONTRACT FOR ETC WORKS" attached with the tender document

6.

7.

NOTE

ANNEXURE - J

PROFORMA FOR PERFORMANCE GUARANTEE
(to be used in appropriate value non - judicial stamp paper)

1. This deed of guarantee made this ..... day of ..... 20… by ..... Bank Limited ..... in favour of Bharat Heavy Electricals Limited, having their registered office at BHEL House, Siri Fort, New Delhi - 110 049.

2. Whereas M/s ..... (hereinafter called the CONTRACTOR / SELLER have entered into a Contract bearing No. ..... dated..... (hereinafter called the CONTRACT) for supply / civil works /erection, testing and commissioning of M/s Bharat Heavy Electricals Limited (hereinafter called the COMPANY).

3. And whereas the said CONTRACT Inter - alia provides that the CONTRACTOR / SELLER shall pay to the COMPANY a sum of Rs. ..... only towards Performance Guarantee in the form and manner therein specified.

4. And whereas the SELLER / CONTRACTOR have approached ..... Bank Limited (hereinafter referred to as the GUARANTOR) and at their request and in consideration of the arrangement arrived at between the CONTRACTOR and the GUARANTOR, the GUARANTOR has agreed to give the Guarantee as hereinafter mentioned in favour of the COMPANY.

NOW THIS DEED WITNESSES AS FOLLOWS:

5. The GUARANTOR by the hand of Mr. ..... and its lawfully and fully constituted attorney and do hereby guarantee the due and faithful performance of the said CONTRACT and do hereby irrevocably undertake and promise to pay the COMPANY without any demur merely on demand made by them a sum not exceeding Rs. ..... only in case the COMPANY sustains any loss or damage by reason of any breach, default by the CONTRACTOR / SELLER of any of the terms, conditions, stipulations or undertakings or any one of them contained in the said CONTRACT and the tender documents attached hereto and for payment of any moneys payable by the CONTRACTOR / SELLER to the COMPANY under the terms and conditions of the said CONTRACT. The decision of the COMPANY regarding the breach, default, loss, damage and payment shall be conclusive and binding in the GUARANTOR, irrespective of the fact whether the CONTRACTOR / SELLER admits or denies such claims or questions its correctness in any court, tribunal or arbitration proceedings or before any other authority.

6. The COMPANY shall have the fullest liberty without effecting in any way the liability of the GUARANTOR under this guarantee, from time to time to vary any of the terms and conditions of the CONTRACT or extend time by the SELLER / CONTRACTOR or to postpone for any time and from time to time any of the powers exercisable by its against the SELLER / CONTRACTOR and either to enforce or forbear from enforcing any of terms and conditions governing the CONTRACT or securities available to the COMPANY and the GUARANTOR shall not be released from its liability under these presents by any exercise by the COMPANY of the liberty with reference to the matters aforesaid or by reason of time being given to the SELLER or any other forbearance, act or omission on the part of the COMPANY or any indulgence by the COMPANY to the SELLER / CONTRACTOR or of any other matter or thing whatsoever which under the law relating to sureties, would but for this provision have the effect of so releasing the GUARANTOR / CONTRACTOR from its liability under this Guarantee.

7. This Guarantee shall remain in full force and effect and the GUARANTOR shall be liable under the same irrespective of any concession or time being granted by the COMPANY to the CONTRACTOR in or for fulfilling the said CONTRACT and this Guarantee shall remain in full force irrespective of any change in terms and conditions, stipulations or any variations in the terms of CONTRACT irrespective of whether notice of such change and / or variation is given to the GUARANTOR or not and the claim to receive such notice of any change and or variation of the terms / or conditions of the CONTRACT is hereby specially waived by the GUARANTOR.

8. The GUARANTEE herein contained shall not be determined, prejudiced or effected by the liquidation or winding up or insolvency of or change in the constitution of the CONTRACTOR but shall in all respects and for all purposes be binding and operative until all payments or all moneys due or that may hereafter become payable to the COMPANY are paid in respect of any liability or obligation of the CONTRACTOR under the CONTRACT.

b) The GUARANTOR further agree that the Guarantee herein contained shall remain in full force and effect during the period that would be taken for the commencement of the CONTRACT till end of the CONTRACT and its claim satisfied or discharged and till the COMPANY certified that the terms and conditions of the CONTRACT have been fully and properly carried out by the SELLER and accordingly discharges this guarantee, subject, however, that the COMPANY shall have no claim under this Guarantee after ..... months from the date of completion of the Guarantee has been served on the GUARANTOR before the expiry of the said period in which case the same shall be enforceable against GUARANTOR not withstanding the fact that the same is enforced after expiry of said period.

The GUARANTOR undertake not to revoke this Guarantee during the period it is in force except with the previous consent of the COMPANY in writing and agree that any liquidation or winding up or insolvency or dissolution or any change in the constitution of the SELLER or the GUARANTOR shall not discharge the GUARANTOR's liability here under.

It shall not be necessary for the COMPANY to proceed against the SELLER before proceeding against the GUARANTOR and the Guarantee herein contained shall be enforceable against them not withstanding any security which the company may have obtained or obtained from the SELLER shall at the time when proceedings are taken against the GUARANTOR here under be outstanding or unrealized.

The GUARANTOR hereby declares that it has power to execute this Guarantee and the executant has full powers to do so on its behalf under the proper authorities granted to him / them by of the guarantor.

10. Not withstanding anything herein before contained, our liability under this Guarantee is restricted to Rs. ..... (Rupees .... only) and will expire on ..... and unless a claim in writing is presented to us or an action or suit to enforce the claim is filed against us, within six months from the date, all our rights shall be forfeited and we shall be relieved and discharged from all our liabilities thereunder.

IN WITNESS whereof the ..... (Bank) have hereunto set and subscribed their hands the day, month and year first above written.

SIGNED FOR AND ON BEHALF OF THE BANK

WITNESS:

NAME AND ADDRESS **SIGNATURE**

1.

2.

ANNEXURE - K

REVISED PRICE OFFER IN LIEU OF WITHDRAWAL OF DEVIATIONS/ CLARIFICATIONS OFFERED BY BHEL DURING TECHNICAL DISCUSSION

Sl. No.	Clause Ref.	Description of Deviation/ Clarification	Whether Increase/ Decrease in Price	Unit Rate (if applicable)	Total Increase/ Decrease	Remarks

NOTE: Total increase or decrease in total price shall be indicated either in percentage or in value (Rs.).

(SIGNATURE OF TENDERER)
WITH STAMP

ANNEXURE -L

(On Bank's Letter Head)

To,
AGM(Finance)
Transmission Business Group,
Block-VI, Central Annexe, IInd Floor,
Bharat Heavy Electricals Ltd.
Bhopal – 462 022

Ref & Date

Sub : Confirmation of Bank Guarantee no. <<BG No.>>

We are a Scheduled Bank other than Co-operative sector Bank under the RBI Act 1934. The aforesaid << BG No.>> for Rs. <<BG Amount>>/ (In Words Also) and valid up to <<validity date>> is issued by us on behalf of M/s << Beneficiary's Name>> in favour of BHARAT HEAVY ELECTRICALS LTD.
The format of the Bank guarantee is strictly as per the format prescribed by M/s BHEL and the stamp papers forming part of the BG are as per the state rules extant.

The signatures to the Bank Guarantee are duly authorised.

Thanking you,

For & On behalf of
Name of the Bank & Seal

(Please Sign here)

SECTION-B

GENERAL TERMS AND CONDITIONS

SECTION - B

GENERAL TERMS AND CONDITIONS

B.1.0 The following terms shall have the meaning hereby assigned to them except where the context requires otherwise:-

B.1.1 BHEL (or B.H.E. Ltd.) shall mean Bharat Heavy Electricals Limited, a Company registered under Indian Companies Act 1956, with its Registered Office at BHEL House, Siri Fort, New Delhi-110 049 or its Authorised Officers or its Engineer or other Employees authorised to deal with any matters with which these persons are concerned.

B.1.2 "GENERAL MANAGER" shall mean the Officer in Administrative charge of the Contracting Unit of BHEL.

B.1.3 "ENGINEER" OR "ENGINEER-IN-CHARGE" shall mean Engineer deputed by BHEL. The term includes "Deputy General Manager, Construction Manager, Resident Engineer, Assistant Site Engineer of BHEL/at the site as well as the officers in charge at Head Office.

B.1.4 "SITE" shall mean the place or places at which the plants/equipments are to be erected and services are to be performed as per the specification of this tender.

B.1.5 "CLIENTS OF BHEL" or "CUSTOMER/OWNER" shall mean the organisation to whom BHEL is responsible for this work.

B.1.6 "CONTRACTOR" or “ETC CONTRACTOR” shall mean the individual, firm or Company who enters into this Contract with BHEL and shall include their executors, administrators, successors and assigns.

B.1.7 "CONTRACT" or "CONTRACT DOCUMENT" shall mean and include the agreement, the work order, the accepted appendices of rates, Schedules of Quantities, if any, General Terms and Conditions of Contract, Special Conditions of Contract, Instructions to Tenderer, the drawings, the Technical Specifications, the Special Specifications, if any, the tender documents and the Letter of Intent\Accepting Letter issued by BHEL. Any conditions or terms stipulated by the tenderer in the tender documents or subsequent letters shall not form part of the Contract unless specifically accepted in writing by BHEL in the Letter of Intent and incorporated in the Agreement.

B.1.8 "GENERAL CONDITIONS OR CONTRACT" shall mean the "Instructions and Information for Tenderer and General Terms and Conditions" pertaining to the work detailed.

B.1.9 "TENDER SPECIFICATIONS" shall mean the Special Conditions, Technical Specifications, Appendices, Site Information and drawings pertaining to the work for which the tenderer are required to submit their offer. Individual Specification Numbers will be assigned to each technical specifications.

B.1.10 "TENDER DOCUMENTS" shall mean the General Terms and Conditions and Tender Specifications.

B.1.11 "LETTER OF INTENT" shall mean the intimation by a letter/telegram/telex/ fax to the tenderer that the tender has been accepted in accordance with provisions contained in the letter. The responsibility of the contractor commences from the date of issue of this letter and all the terms and conditions of contract are applicable from this date.

B.1.12 "COMPLETION TIME" shall mean the period by date specified in the Letter of Intent/Work Order or date mutually agreed upon for handing over of the erected equipment/plant which are found acceptable by the Engineer being of required standard and conforming to the specifications of the contract.

B.1.13 "ZERO DATE" shall mean the planned commencement date of work under this tender and shall be date of issue of Letter of Intent.

B.1.14 "PLANT OR PROJECT OR SWITCHYARD" shall mean and connote the entire assembly of the plant and equipments covered by the contract.

B.1.15 "EQUIPMENT" shall mean all equipments, machineries, materials, structural, electrical and other components of the plant covered by the contract.

B.1.16 “TESTS" shall mean and include such test or tests to be carried out by the contractor as are prescribed in the contract or considered necessary by BHEL, in order to ascertain the quality, workmanship, performance and efficiency of the contracted work or part thereof.

B.1.17 "APPROVED" "DIRECTED" or "INSTRUCTED" shall mean approved, directed or instructed by BHEL.

B.1.18 "WORK OR CONTRACT WORK" shall mean and include supply of all categories of labour, specified consumables, tools and tackles required for complete and satisfactory site transportation, handling, stacking, storing, civil and electrical works, erection, testing & commissioning of the equipment to the entire satisfaction of BHEL.

B.1.19 "SINGULAR AND PLURAL" etc. words carrying singular number shall also include plural and vice versa, where the context so requires. Words imparting masculine gender shall be taken to include the feminine gender and words imparting persons shall include any Company or Association or Body or Individuals, whether incorporated or not.

B.1.20 "HEADINGS" The headings in these General Conditions are solely for the purpose of facilitating reference and shall not be deemed to be part thereof or be taken into consideration in the interpretation of construction thereof or the contract.

B.1.21 "MONTH" shall mean calendar month.

B.1.22 "WRITING" shall include any manuscript typewritten or printed statement under the signature or seal as the case may be.

B.2.0 **LAW GOVERNING THE CONTRACT & COURT JURISDICTION**:

The Contract shall be governed by the Law for the time being enforce in the Republic of India. The Civil Court at New Delhi having ordinary Original Civil Jurisdiction shall alone have exclusive jurisdiction in regard to all claims in respect of this contract.

B.3.0 **ISSUE OF NOTICE**:

The contractor shall furnish to the Engineer, the name, designation and address of his authorised agent and all complaints, notices, communications and references shall be deemed to have been duly given to the Contractor, if delivered to the Contractor or his authorised agent and shall be deemed to have been so given in the case of posting on the day on which they would have reached such address in the ordinary course of post or at which they were so delivered or left.

B.4.0 **USE OF LAND:**

No land belonging to BHEL or its customer under temporary possessions of BHEL shall be occupied by the contractor without the written permission of BHEL.

B.5.0 **COMMENCEMENT OF WORK:**

B.5.1 The contractor shall commence the work within fifteen days of Letter of Intent or the time indicated in the Letter of Intent/Work Order and shall proceed with the same with due expedition without delay.

The Contractor shall have to give programme of work in Annexure 'M' to the ENGINEER-IN-CHARGE after mobilisation at site. This will have to be regularly updated / revised so as to meet the Project completion schedule as per requirement of BHEL /Owner.

B.5.2 If the successful tenderer fails to commence the work within the stipulated time, BHEL, at its sole discretion will have the right to cancel the Letter of Intent/ Contract. His Earnest Money and/or Security Deposit will stand forfeited without any further reference to him without prejudice to any and all of BHEL's other rights and remedies in this regard.

B.5.3 All the works shall be carried out under the direction and to the satisfaction of BHEL/Customer/Owner.

B.5.4 The transported equipment, erected/constructed plant or work performed under the contract, as the case may be, shall be taken over when it has been completed in all respect and/or satisfactorily put into operation at site.

B.6.0 **MEASUREMENT OF WORK AND MODE OF PAYMENT:**

B.6.1 All payments due to the contractor shall be made only by "Account Payee Cheques".

B.6.2 For progress/running bill payments, the contractor shall present detailed measurement sheets in duplicate duly indicating all relevant details based on technical documents, protocols & material test reports and connected drawings for the work done during the calendar month/period under different categories in line with terms of payment as per Letter of Intent. The basis of arriving at the quantities/ weights shall be the relevant documents and drawings released by BHEL.

These measurement sheets shall be prepared jointly with Engineer and signed by both parties. Where required, joint measurement with Customer/Owner shall have to be taken.

B.6.3 The measurement sheets will be checked by the Engineer and quantities and percentage eligible for payment under different groups shall be decided by him. The abstract of quantities and percentage so arrived at based on the terms of payment shall be entered in the Measurement Book & signed by both the parties. Where required counter signature of Customer/Owner shall have to be taken.

B.6.4 Based on the above quantities, contractor shall prepare the bills in the prescribed proforma and work out the financial value. These will be entered in the Measurement Book and signed by both the parties. Payment shall be made by BHEL after effecting the recoveries due from the Contractor.

B.6.5 All recoveries due from the contractor for the month/period shall be effected in full from corresponding running bills unless specific approval from Competent Authority is obtained to the contrary.

B.6.6 Measurement shall be taken jointly by person duly authorised by BHEL and the Contractor.

B.6.7 The Contractor shall bear the expenditure involved, if any, in taking the measurements and testing of materials to be used in the works. The Contractor shall without extra cost to BHEL, provide all the assistance with appliances and other things necessary for measurement.

B.6.8 If at any time due to any reason whatsoever, it becomes necessary to remeasure the work done, in full or in part, the expenses towards such re-measurement shall be borne by contractor.

B.6.9 Passing of bills covered by such measurement does not amount to acceptance by BHEL of the completion of the work measured. Any left out work has to be completed by the Contractor, as directed by BHEL.

B.6.10 Final measurement bill shall be prepared in the proforma prescribed for the purpose, based on the certificate issued by the Engineer that the entire work as stipulated in the tender specification has been completed in all respects to the entire satisfaction of BHEL.

The contractor shall give unqualified "No claim" and "No Demand" certificates. All the tools and tackles loaned to him should be returned in condition satisfactory to BHEL. The abstract of final quantities and financial values shall also be entered in the Measurement Book and signed by both the parties. The final bill shall be paid after completion of all the defects/deficiencies etc. pointed out by BHEL. The contractor should submit all the original documents such as material consumption, site order book etc. maintained at site. After payment of final bill only guarantee obligation, percentage value shall remain unpaid which shall be released in accordance with Clause A.15.0.

B.7.0 **RIGHTS OF BHEL:**

B.7.1 Please Refer "ANNEXURE TO CONDITIONS OF CONTRACT FOR ETC WORKS" attached with the tender document

B.7.2

B.7.3

B.7.4

B.7.5 Please Refer "ANNEXURE TO CONDITIONS OF CONTRACT FOR ETC WORKS" attached with the tender document

B.7.6

B.7.7

B.7.8

B.7.9

Please Refer "ANNEXURE TO CONDITIONS OF CONTRACT FOR ETC WORKS" attached with the tender document

B.7.10

B.7.11

B.8.0 **RESPONSIBILITY OF THE CONTRACTOR IN RESPECT OF LOCAL LAWS, EMPLOYMENT OF WORKERS ETC:**

The following are the responsibilities of the Contractor in respect of observance of local laws, employment of personnel, payment of taxes etc.

B.8.1 As far as possible, unskilled workers shall be engaged from the local areas in which the work is being executed. In case of any necessity is felt by the contractor to bring labourers from out side State, provisions of law governing such immigration by the concerned State are to be followed.

B.8.2 The Contractor at all times during the currency of this contract, shall in all his dealings with the local labour for the time being employed on or in connection with the work, have due regard to all local festivals, religious and other customs.

B.8.3 The contractor shall comply with all State and Central Laws, Statutory Rules, Regulations etc., such as : The payment of wages to, The Minimum Wages Act, The Workmen Compensation Act, The Employees Liability Act, The Industrial Dispute Act,The Employees Provident Fund and Miscellaneous Provisions Act 1952, Employees State Insurance Scheme, The Contract Labour (Regulations &Abolition) Act 1970 and other Acts, Rules and Regulations for labour as may be enacted by the Government during the tenure of the contract and having in force or jurisdiction at site. The Contractor shall give to the local Governing Body, Police and other concerned Authorities all such notice as may be required under law.

The contractor should have Provident Fund Code Number and shall ensure compliance of the EPF& MP Act, 1952 by the sub-contractors, if any engaged by the contractor for the said work,

B.8.4 The contractor, as required, will obtain independent license under the Contract Labour (Regulations and Abolition) Act 1970 from the concerned authorities based on the certificate (Form-V) issued by the Principal Employer/Customer.

B.8.5 The Contractor shall pay all taxes, fees, license charges, deposits, duties, tolls, royalty, commissions or other charges which may be Leviable on account of any of his operations connected with this contract. The Contractor is responsible to furnish documentary evidence towards GST Registration of the State wherein the site is located and any other documents as per GST Act which may be required from time to time by BHEL.The contractor should have to get the contract registered immediately after award of works as per rules and regulations of the State Government. The contractor will file regular return as per statute of the State/

Centre and provide all information to BHEL as required for the assessment of the project concerned . In case BHEL is forced to make any of such payments, BHEL shall recover the same from the contractor either from moneys due to him or otherwise as deemed fit.

B.8.6 Arrangements for the periodical visits of inspection agencies such as Electrical Inspector etc. to site, inspection certificates etc. will have to be made by the contractor at his cost. The contractor will also meet all expenses in connection with his welder's qualification/ re-qualification tests etc.

B.8.7 The contractor shall be responsible for provision of health and sanitary arrangements {more particularly described in the Contract Labour (Regulation & Abolition) Act 1970} and safety precautions as may be required for safe and satisfactory execution of the contract.

B.8.8 The Contractor shall be responsible for proper accommodation including adequate medical facilities for the personnel employed by him.

B.8.9 The Contractor shall be responsible for the proper behaviour and observance of all regulations by the staff employed by him.

B.8.10 The contractor shall ensure that no damage is caused to any person/property of other parties working at site. If any such damage is caused, it shall be the responsibility of the contractor to make good the losses or compensate them.

B.8.11 All the properties/equipment/components of BHEL/its customer loaned with or without deposit, to the contractor, shall remain the properties of BHEL/its customer. The contractor shall use such properties for the purpose of execution of this contract. All such properties/equipment/components shall be taken to in good condition unless notified to the contrary by the contractor within 48 Hrs. The Contractor shall return them in good conditions as and when required by BHEL/its customer. In case of non-return, loss, damage repairs etc., the cost thereof, as may be fixed by the Engineer, will be recovered from the contractor.

B.8.12 It shall not be obligatory on the part of BHEL to supply any tools and tackles or materials other than those specifically agreed to be given by BHEL. However, depending upon availability/possibility, BHEL/its customer's equipment and other materials may be made available to the contractor on payment of the hire charges as fixed by them, subject to the conditions laid down by BHEL/its Customer from time to time. Unless paid in advance, such hire and other charges shall be recovered from out of dues to the contractor or Security Deposit in one instalment.

B.8.13 The Contractor shall fully indemnify and keep indemnified BHEL/its customer against all claims of whatsoever nature arising during the course of execution of this contract.

B.8.14 In case the contractor is required to undertake any work outside the scope of this contract, the amount payable shall be as may be mutually agreed upon.

B.8.15 Any delay in completion of works or non-achievement of periodical targets, due to reasons attributable to the contractor, will have to be compensated by the contractor either by increased manpower and resources or by working extra hours or more than one shift at no extra cost to BHEL.

B.8.16 The contractor shall execute the work under the conditions usual to such construction work and in conjunction with numerous other operations at site and proceed in a manner that shall help in the progress of work at site as a whole.

B.8.17 The contractor will be directly responsible for payment of wages to his workmen. A pay roll sheet giving details of all payments made to the workmen duly signed by the contractor's representative should be furnished to BHEL, along with each Running Account Bill. Also, Contractor shall display wages paid by him as per The Minimum Wages Act.

B.8.18 In case of any class of work for which there is no specification laid down in the contract, such work shall be carried out in accordance with the instructions and requirements of the Engineer.

B.8.19 No levy, payment or charges made or imposed shall be impeached by reason of any clerical error or by reason of any mistake in the amount levied, demanded or charged.

B.8.20 No idle labour charges will be admissible in the event of any stoppage of work resulting in the contractor's workmen being rendered idle due to any reason any time.

B.8.21 The contractor shall take all reasonable care to protect the materials and the work till such time the place/equipment has been taken over by BHEL/its customer.

B.8.22 The contractor shall not stop work or abandon the site for whatsoever reason or dispute, excepting for force majeure conditions. All problems/disputes shall be separately discussed and settled without effecting the progress of work. Stoppage or abandonment of work, other than under force majeure conditions, shall be treated as breach of work of contract and dealt with accordingly.

B.8.23 The contractor shall keep the area of work clean and shall remove debris etc. while executing day-to-day work. Upon completion of work, the contractor shall remove from the vicinity of works, all scrap, packing materials, rubbish, unused and other materials and deposit them in places specified by the Engineer. The contractor will also demolish all the hutments, sheds, offices etc. constructed and used by him and shall clean the debris. In the event of his failure to do so, the same will be arranged to be done by the Engineer and the expenses recovered from the contractor.

B.8.24 The contractor shall execute the work in the most substantial and workman like manner in the stipulated time. Accuracy of work and timely execution shall be the essence of this contract. The contractor shall be responsible to ensure that the quality, assembly and workmanship conform to the dimensions and clearance given in the drawings and/or as per instructions of the Engineers.

B.8.25 The contractor shall furnish progress reports on work at regular intervals as required by the Engineer.

B.9.0 **RESPONSIBILITIES OF CONTRACTOR IN RESPECT OF SAFETY OF MEN, EQUIPMENT, MATERIAL & ENVIRONMENT**:

B.9.1 All safety rules and codes applied by BHEL/its customer at site shall be observed by the contractor and his workmen without exception. The contractor shall be responsible for the safety of the equipment/materials and work to be performed by him and shall maintain all lights, fencing guards, signs etc. or other protections necessary for the purpose. Contractor shall also take such additional precautions as may be indicated from time to time by the Engineer, with a view to prevent pilferage, accidents, fire hazards etc. and suitable number of clerical staff, watch and ward, store keepers to take care of equipment, materials and construction tools and tackles shall be posted at site by the contractor till the completion of the work under this contract. The contractor shall arrange for such safety devices as are necessary for this type of work and carry out the requisite site tests of handling equipment, lifting tools, tackles etc. as per usual standards and practices.

B.9.2 The contractor shall provide to its work force and ensure the use of required personal protective equipment as found necessary & as directed by the authorised BHEL officials in line with latest Amendments / Revisions of various Indian Standards.

i) Safety helmets conforming to IS-2925 : 1984.

ii) Safety belts conforming to IS-3521 : 1983.

iii) Safety shoes conforming to IS-1989 : 1978.

iv) Eye and face protection devices conforming to IS-8520 : 1977 and IS-8940 : 1978.

v) Hand and body protection devices conforming to IS-2573 : 1975, IS-6994 : 1973, IS-8807 : 1978 and IS-8519 : 1977.

B.9.3 All tools, tackles, fitting appliances, material handling equipment, scaffolds, cradles, safety nets, ladders, equipment, etc. used by the contractor (as per Annexure 'N') shall be of safe design and construction and maintained in good condition. However BHEL officials shall have the right to ban use of any of them or get them tested at their discretion.

All test & measuring instruments to be pre-calibrated through certifying agency before use. Also, please see. Cl. E.4.2 & E.6.3 of section - E for more details.

All electrical equipment, connections and wiring for construction power, its distribution and use shall conform to the relevant requirements of Indian Electricity Act and Rules. Only electricians licensed by the appropriate statutory authority shall be employed by the contractor to carry out electrical works.

B.9.4 All electrical appliances including portable electric tools used by contractor shall have safe plugging system to source of power and be appropriately earthed.

B.9.5 The contractor shall not use any hand lamp energised by electric power with supply voltage of more than 240 volts. For work in confined spaces, lighting shall be arranged with power source of not more than 240 volts.

B.9.6 Where it becomes necessary to provide and/or store petroleum products, explosives, chemicals and liquid or gaseous fuel or any other substance that may cause fire or explosion, the contractor shall be responsible for carrying out such provision and/or storage in accordance with the rules and regulations laid down in the relevant Government Acts, such as Petroleum Act, Explosive Act, Petroleum and Carbides of Calcium Manual of the Chief Controller of Explosives, Government of India etc. Prior approval of the authorised BHEL official at the site shall also be taken by the contractor in all such matters.

B.9.7 The contractor shall arrange at his cost appropriate illumination as required at all work spots for safe working, when natural day light may not be adequate for clear visibility.

B.9.8 In case of a fatal or disabling injury/accident to any person at construction sites pertaining to this work, the victim and/or his/her dependents shall be compensated by the contractor as per statutory requirements. However, if considered necessary, BHEL shall have the right to impose appropriate financial penalty on the contractor & recover the same from payments due to the contractor for suitably compensating the victim and/or his/her dependents. Before imposing any such penalty, appropriate enquiry shall be held by BHEL giving opportunity to the contractor to present his case.

B.9.9 In case of any damage to property due to lapse by the contractor, BHEL shall have the right to recover the cost of such damages from the payments due to the contractor.

B.9.10 In case of any delay in the completion of a job due to mishaps attributable to lapses by the contractor, BHEL shall have the right to recover cost of such delay

from the payments due to the contractor, after notifying the contractor suitably and giving him opportunity to present his case.

B.9.11 If contractor fails to improve the standards of safety in its operation to the satisfaction of BHEL after being given reasonable opportunity to do so and/or if the contractor fails to take appropriate safety precautions or to provide necessary safety devices and equipment or to carry out instructions regarding

safety issued by the authorised BHEL official, BHEL shall have the right to take the corrective steps at the risk and cost of the contractor after giving appropriate notice indicating the steps that would be taken by BHEL.

B.9.12 The contractor shall submit report of all accidents, fires, property damaged & dangerous occurrences connected with his area of work or caused due to his action/ inaction, to the authorised BHEL official immediately after such occurrence, but in any case not later than 12 hours of the occurrence.

B.9.13 During the course of construction, alteration or repairs scrap lumbers with protruding nails, sharp edges etc. and all other debris including combustibles scrap shall be kept cleared from working areas, passage ways and stairs in and around site.

B.9.14 Cylinders shall be moved by tilting and rolling them on their bottom edges. They shall not be intentionally/ negligently dropped, struck or permitted to strike each

other violently. When cylinders are transported by powered vehicles, they shall be secured in a vertical position.

B.9.15 The contractor shall be responsible for the safe storage of his radioactive sources if same have been permitted to use.

B.9.16 All contractor's supervisory personnel and sufficient number of workmen shall be trained for fire fighting and first aid duties and shall be assigned specific duties. Enough number of such trained personnel must be available during the tenure of the contract.

B.9.17 Contractor shall provide enough fire protecting equipment of the types & numbers at his office, stores, construction/erection site, other temporary structures, labour colony area etc. Access to such fire protection equipment shall be easy and kept open at all times. Compliance of the above requirement under fire protection system at project site shall in no way relieve the contractor of any of his responsibilities & liabilities to fire accident occurring. In the event of fire safety measures being not to BHEL's satisfaction, BHEL shall have option to provide the same and recover the cost plus incidentals from contractor's bills and/or impose penalty as deemed fit by the Engineer.

B.9.18 Before commencing the work, the contractor shall appoint/nominate a responsible officer to supervise implementation of all safety measures and liaison with BHEL Engineer at site.

B.9.19 If safety record of the contractor in execution of the awarded job is to the satisfaction of Safety Department of BHEL, issue of an appropriate certificate to recognise the safety performance of the contractor may be considered by BHEL after completion of the job.

B.10.0 **CONSEQUENCES OF CANCELLATION:**

B.10.1 Whenever BHEL exercises its authority to terminate the contract/withdraw a portion of work, the work may be got completed by any other means at the contractor's risk and cost provided that in the event of the cost of completion (as certified by the Engineer which shall be final and binding on the contractor) being less than the contract value, the advantage shall accrue to BHEL. If the cost of completion exceeds the money due to the Contractor under the Contract, the Contractor shall either pay the excess amount demanded by BHEL or the same shall be recovered from the contractor. This will be in addition to the forfeiture of Security Deposit and recovery of liquidated damages as per relevant clauses.

B.10.2 In case BHEL completes the work under the provisions of this clause, the cost of such completion to be taken into account for determining the excess cost to be charged to the contractor shall consist of cost of materials purchased and/or labour provided by BHEL with an addition of such percentage to cover supervision and establishment charges as may be decided by BHEL.

B.11.0 **INSURANCE:**

B.11.1 BHEL/its customer shall arrange for insuring the project materials/properties of BHEL/its customer covering the risks during transit, storage, construction, erection and commissioning.

B.11.2 It shall be the sole responsibility of the Contractor to insure his workmen against risks of accident and injury while at work as required by the relevant rules and to pay compensation, if any, to them as per Workmen's Compensation Act. The Contractor shall also insure his staff against accidents. The work will be carried out in a protected area and all the rules and regulations of BHEL/its client in the project area which are in force from time to time will have to be followed by the contractor.

B.11.3 If due to negligence and/or non-observance of safety and other precautions any accident/injury occurs to any other person/public, the contractor shall pay necessary compensation and other expenses, if so decided by the appropriate authority.

B.11.4 It shall be the responsibility of the contractor to provide security and insurance claim related information/reports, FIRs etc. for the equipment/material belonging to BHEL/its customer and handed over to the contractor for transportation/erection/ construction till these are taken over by BHEL after erection/construction or are returned to BHEL/its customer's store.

B.11.5 If due to Contractor's carelessness, negligence, non-observance of safety precautions, improper security arrangements or due to non-compliance of paper work needed for lodging insurance claim, damage to BHEL/its Customer's property and/or personnel should occur, and if BHEL is unable to recover its claim from the Insurance Company, the deficit will be recovered from the Contractor. **All losses arising out of theft of material from the contractor's store/erection site shall be recovered from the contractor irrespective of the insurance claims.**

B.12.0 **STRIKES & LOCKOUTS:**

B.12.1 The Contractor will be solely responsible for all disputes & other issues connected with his workmen. In the event of the contractor's workmen resorting to strike or the contractor resorting to lockout and if the strike or the lockout so declared is not settled within a period of one month, BHEL shall have the right to get the work executed by employing its own men or through other agencies or both. The cost incurred by BHEL in this regard shall be recovered from the Contractor.

B.12.2 For any purpose whatsoever, the employees of the contractor shall not be deemed to be in the employment of BHEL/its Customer.

B.13.0 **FORCE MAJEURE:**

B.13.1 The following shall amount to force majeure conditions:-

Acts of God, Act of any Government, war, Sabotage, riots, civil Commotion, Police Action, Revolution, Flood, Fire Cyclone, Earthquake, Epidemic and other similar causes over which the contractor has no control.

B.13.2 If the contractor suffers delay in the due execution of the contract, due to delays caused by force majeure conditions, as defined above, the agreed time of completion of the work covered by this contract may be extended by a reasonable period of time in consultation and after agreement of BHEL's clients / owner, provided that on the occurrence of any such contingency, the Contractor immediately reports to BHEL in writing the causes of delay. The Contractor shall not be eligible for any compensation on this account.

B.14.0 **GUARANTEE:**

B.14.1 Even though the work will be carried under the supervision of BHEL Engineers, the contractor will be responsible for the quality of the workmanship and shall guarantee the work done for a period of 12 months from the date of putting the complete system into commercial operation or 18 months from the date of system is declared completely erected duly tested and accepted by customer whichever is later and shall rectify free of cost all defects due to faulty erection detected during the guarantee period starting from the date of the completion of rectification. In the event of the contractor failing to repair the defective works within the time specified by the Engineer, BHEL may proceed to undertake the repairs of such defective works at the contractor's risk and expense without prejudice to any other rights and recover the same from Security Deposit/other dues.

B.15.0 **ARBITRATION:**

B.15.1

Please refer " Annexure to conditions of contract for ETC Work" attached with the tender documents.

Please refer " Annexure to conditions of contract for ETC Work" attached with the tender documents.

NOTE:

Above clause No. B.15.0 stands deleted. Please refer Annexure to conditions of contract for ETC works.

B.16.0 **VARIATIONS AND VALUATIONS:**

B.16.1 **QUANTITIES:**

The quantities set out in the Bill of Quantities are the estimated quantities of the work but they are not to be taken as the actual and correct quantities of the works to be executed by the Contractor in fulfilment of his obligations under the Contract.

B.16.2 **VARIATIONS:**

B.16.2.1 The Engineer shall have power to make any variation of the form, quantity of the Works or any part thereof that may in his opinion be necessary and for that purpose or if for any other reason it shall in his opinion be desirable shall have power to order the Contractor to do and Contractor shall do any of the following:-

a) Increase or decrease the quantity of any work included in the contract.

b) Omit any such work.

c) Change the character or quality or kind of any such work.

d) Execute additional work of any kind necessary for the completion of the works and no such variation shall in any way vitiate or invalidate the contract but the value (if any) of all such variation shall be taken into account in ascertaining the amount of the Contract Price.

e) Restrict the extent of work of any item covered under Clause E.10.0 of Section - E "Schedule of Equipment".

B.16.2.2 Orders for Variations to be in writing. No such variation shall be made by the contractor without an order in writing of the Engineer provided that, no order in writing shall be required for increase or decrease in the quantity of any work where such increase or decrease is not the result of an order given under this clause but is the result of the quantities exceed in for being less than those stated in the Bill of Quantities. Provided also that if for any reason the Engineer shall consider it desirable to give any such order verbally the Contractor shall comply with such order and any confirmation in writing of such verbal order given by the Engineer whether before or after the carrying out of the order shall be deemed to be an order in writing within the meaning of this clause. Provided further that if the contractor shall confirm in writing to the Engineer any verbal order of the Engineer and such confirmation shall not be contradicted in writing by the Engineer, it shall be deemed to be an order in writing by the Engineer.

B.16.3 **VALUATION OF VARIATIONS:**

The Engineer shall determine the amount (if any) which in his opinion should be added to or deducted from the sum named in the Contract in respect of any extra or additional work done or work omitted by his order. All such work shall be valued at the rates set out in the Contract if in the opinion of the Engineer the same shall be applicable. If the contract shall not contain any rates applicable to the extra or additional work then suitable prices shall be derived from the nearest item of BOQ or arrived at from the actual cost of manpower utilised (the cost of T&P and testing equipment etc. are not to be taken into account for arriving at the rates of additional/extra works) plus 10% for contractor's OH and profit. The rates for manpower shall be as per the minimum wages applicable for the project area.

Above clause No.B.16.3 shall be read in conjunction with clause No.1.of of Annexure to conditions of contract for ETC works.

B.16.4 **POWER OF ENGINEER TO FIX RATES:**

If the nature or amount of any omission or addition relative to the nature or amount of the whole of the contract work or to any part thereof shall be such that in the opinion of the Engineer the rate or price contained in the Contract for any item of the Work is by reason of such omission or addition rendered unreasonable or inapplicable then a suitable rate or price shall be agreed upon between the Engineer and the Contractor. In the event of disagreement the Engineer shall fix such other rate of price as shall in his opinion be reasonable and proper having regard to the circumstances and the same shall be binding on the contractor. But under no circumstance the contractor shall suspend the work on the plea of non-settlement of rates falling under the clause or claim any compensation on that account.

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ANNEXURE - M

PROGRAMME OF WORK

SL.NO.	ACTIVITY	DURAION
01.	Award of work.	Zero week
02.	Mobilisation & setting up of site office	..... weeks
03.	Start / finish of structure erection	..... weeks
04.	Start / finish of stringing of shielding wire and conductors	..... weeks
05	Start / finish of Circuit Breaker erection	..... weeks
06.	Start / finish of other equipment erection	..... weeks
07.	Start / finish of testing and precommissioning	..... weeks
08.	Start / finish of commissioning	..... weeks
09.	Final Handing over	..... weeks

(SIGNATURE OF TENDERER)
WITH STAMP

ANNEXURE - N

LIST OF TEST EQUIPMENTS TO BE ARRANGED BY ETC CONTRACTOR

All measuring and testing instrument shall be pre-calibrated through a certifying agency before use. The certificate of calibration shall be submitted to BHEL Site Engineer for records. Also see clause E.4.2 & E.6.3 under Section E of the tender specification for more details.

A -	**General purpose**	**Qty.**
1.	Digital multimeter - 4½ digits Accuracy ± 1% (Any reputed make - preferably Fluke - make)	4 Nos.
2.	Megger 2.5 kV - 5kV, range 0.5 MΩ - 10,000 MΩ (Motorised/Electronic) (Any reputed make)	1 No.
3.	Meggar having voltage multiplier 0-500V- 1000V, (Motorised / Electronic) Range 0.5 MΩ - 1000 MΩ (Any reputed make)	1 No.
4.	Single phase variac 8 A, 0.-250V, 50 HZ	2 No
5.	Three phase variac 15A, 0-440V, 50 HZ	1 No
6.	Single phase transformer 220V / 4000V, 500VA, 50HZ	1No
7.	Stop watch	1No
8	Micro- ohm- meter (mV drop test kit) 0-200ADC, 0-2000 micro ohm with suitable calibrated cable leads for current injection and mV drop.	1 No
9.	Phase sequence meter	1 No
10.	Two way intercom set with 50 to 100 M cables for checking of cable continuity	2 sets
11.	Walkie - Talkie sets with battery charging sets Receiver + Transmitter, Type GP 300 - Motorola - make	1 set
12.	Variable D.C. power supply 0-220VDC, 10 A	2 Nos
13.	4 pole Miniature moulded case breaker 16 A	3 No
14.	Capacitance meter having range 20 PF- 100mfd ± 1%	1 No
15.	Isolation Transformer 1KVA, 240V AC, 1 phase, 50Hz	2 Nos

B	**For testing of current transformer**	
1.	Primary injection test kit, range 0-2000A with a pair of leads & C clamps for testing of CT's	1 No
2.	Secondary injection test kit suitable for 5A& 1A with banana plug cable leads.	1 No
3.	Digital Tongue tester 0-2000A, 600VAC, 50 Hz (Any reputed make).	1 No
4	Digital Tongue tester 0-20A, 600V AC, 50 Hz (Any reputed make).	1 No
5.	Digital Tongue Tester, 0-1A, 600V AC, 50Hz	2 Nos.
C -	**For testing of oil cooled transformer and AC reactor**	
1.	Transformer winding resistance meter or Kelvin's double bridge	1 No
2.	Transformer turns ratio meter	1 No
3.	PPM tester for transformer oil	1 No
4.	BDV tester for transformer oil	1 No
D	**For testing of relays**	
	Single phase / 3 phase relay test kit having timer current source 5A, 1A, voltage source 0-220VDC, 0-110 VAC 50 HZ. (Any reputed make)	1set
E-	**For time measurement of breaker**	
	Breaker closing and / opening time measurement timer	1 No
F	**For testing of relays and distance protection**	1 Set
1.	CFB kit or equivalent - of any reputed make	
2.	ZFB kit or equivalent - of any reputed make	

G **For testing of transformer bushings CT, CVT & Circuit Breaker used in HV System**

Capacitance and tan Delta kit suitable for 12KV 1 Set
(Any reputed make)

H. **Safety / protective means**

- Protective earth rod suitable for 220Kv / 400 KV system 2 Nos
having leakage current meter, 70MM^2 copper cables and C clamps
(Any reputed make).
- Helmets and hand globes etc.

I. **For PLCC Equipment:**

b) Digital time interval meter and frequency counter, 8 digits with frequency range 10 Hz to 10MHz.

c) 200Hz to 620KHz Selective level meter.

d) 200Hz to 620KHz Selective level generator.

Note:

1. Above is only a specimen/indicative list and any other test equipment (s) as may be required by Owner / BHEL at site during the execution of work will be arranged by the contractor well in time.
2. The status of tools, plants and instruments mentioned in annexure C of section - A does not relieve the subcontractor of his responsibility to make available all the test equipments and tools & tackles mentioned in annexure N of section B as per requirement of project.

ANNEXURE - P

ACTIVITIES FOR TESTING AND COMMISSIONING BY ETC CONTRACTOR

1. Preparation of joint inspection records / observation by BHEL, BHEL customer and the contractor on the pending activities of erection holding for starting of testing and commissioning.

2. Issue of certificate for completion of erection activities to the satisfaction of BHEL customer.

3. Compilation of documents (scheme, cable schedules, FQP, technical literature, operation and maintenance manuals, technical reports, works test certificate for the equipments / components, and other relevant documents to expedite commissioning) in a systematic manner to present to customer/owner to meet the contractual requirement.

4. To expedite the testing activities contractor has to arrange the engineers and his staff and instruments at site for testing and commissioning of switchyard equipments as follows:

4.1 Testing of individual relay, energy meter, transducer and meters for their satisfactory operation.

4.2 Protection devices / relays will be tested with appropriate current and voltage injections.

4.3 Individual control and protection panels testing for their satisfactory operation as per scheme.

4.4 Individual CT, PT, CVT, Breaker, Transformer and Isolator LA, MB, Battery Charger etc. where ever possible to test them independently.

4.5 Wiring check as per scheme and cable schedule preferably in the following sequences:

- Between marshalling Kiosk in the yard to other yard equipments.
- Between equipments in the yard.
- Yard equipments to control room equipments.
- Inter connection between control room equipments.

5. All cables to be properly glanded, identified and terminated suitably.

6. Cables should have proper / accurate cross reference ferruling and necessary cable tags for identifications as per recommendation by BHEL/ Customer.

7 Green marking in cable schedule and scheme after wiring check. Contractor to make also “As Built” scheme and cable schedule for submission to BHEL/Customer.

8. List of wiring mistakes, component damage and mal-operation of components.

9. Successful completion of equipment level testing operative from local and remote and desired FQP filled up and approved by ultimate customer. Approval/acceptance on FQP results by customer has to be obtained by Contractor. For any technical clarifications, BHEL will only assist.

10. In case the contractor is finding difficulty to understand the technicalities to undertake testing and commissioning of a particular equipment, subsystem and system he has to inform BHEL in advance with in 2 months from the date of award of contract for necessary information and explanation.

11. For erection/commissioning of SF6 Circuit Breakers (If called for in BOQ), the services of experts +for supervision will be extended by BHEL free of cost. Contractor will provide adequate support by providing skilled manpower and tools & tackles**.** However the complete responsibility for erection and commissioning lies with subcontractor.

12. Contractor has to keep a senior and experienced person in the area of testing and commissioning associated with his skilled staff till charging and handing over of complete switchyard to the satisfaction of BHEL customer.

13. Contractor has to be well equipped at site with testing instruments and safety measures (like helmet and hand globes) while doing testing and commissioning.

14. Contractor will also carry out design validation tests as per BHEL / BHEL customer documents.

15 If the contractor fails to take up testing and commissioning work as per the requirement of contract or project requirement, then BHEL will be at liberty to hire services of third agency for this work at the risk and cost of subcontractor.

16 Testing of mandatory spares or any other spare (if required by customer / BHEL), cleaning and handing over to customer's stores is also included in the scope of this Tender Specification. The site Test Reports of these mandatory spares will also be generated by subcontractor in such a case.

17 In case contractor fails to arrange Test equipments as referred in Annexure 'N' (as per requirement of equipment covered in BOQ), BHEL will arrange the instruments at the risk and cost of contractor for providing such instruments.

18. Contractor has to repeat any tests free of cost, even if already conducted, whenever required to prove and check the healthiness of system before power flow, such tests could be primary injection and secondary injection in CT, CVT, meggering, and functional tests or any other tests as required by BHEL/customer.

19. Oil processing/filtering in a transformer, CT and CVT shall also be repeated free of cost if required before charging and handing over of the switchyard to the owner in case BDV and PPM of oil is not satisfactory.

20. As isolator is a rotating equipment and its alignment is likely to get disturbed. Therefore contractor has to do alignment of isolators and measurement of contact resistance repeatedly free of cost as and when required till handing over of the station.

21. Commissioning means charging of total system in a sub-station and inter connected equipments by power flow. Accordingly the payment will be made to the contractor as per payment terms.

22. Contractor has to deploy adequate and experienced man power at site as per project requirement and advice of BHEL site in-charge. Non compliance of this requirement will be treated as indiscipline and non cooperation of the contractor. Accordingly BHEL will hire the man power as required at the risk and cost of the contractor after giving a single notice.

23. Based on site requirement, for the works not stipulated in the contract, the contractor has to provide assistance of skilled manpower with required tools and test instruments.

24 If any Expert services of manufacturer for commissioning supervision of special protection relays / numerical relays / equipment is felt necessary by the contractor, the same shall be arranged by the contractor themselves at their cost. Contractor shall provide testing & Commissioning, Engineer, electrician, other tools tackles and consumables for these equipments and for total system.

Any delay in arranging special testing & commissioning equipment and expert supervisor shall not entitle the contractor to any claim (idle labour, additional time etc.) whatsoever.

25. Any idle days of the expert supervisor at site due to reasons attributable to the contractor, due to lack of readiness in erection, delay in arranging of manpower, tools etc. shall be to contractor's account.

NOTES :-

(1) Above is only an indicative list. Contractor has to mobilise and keep adequate competent commissioning staff at site to ensure that all mile stones & events and relevant commissioning activities are completed successfully in a scheduled time.

(2) In case contractor is not finding competent and adequate staff with him, he can hire the commissioning services from out side agencies approved and accepted by BHEL. Contractor will furnish the details (experience, qualification) of all commissioning staff and the commissioning tools and instruments available with the contractor OR obtained on loan basis with in 60 days from the date of award of the work.

ANNEXURE - Q

LIST OF TOOLS & TACKLES TO BE ARRANGED BY CONTRACTOR

Sl. No.	PARTICULARS
01.	Electrical Drilling Machine & Hand drilling Machine.
02.	Hydraulic Bending Machine for Al. pipes.
03.	Gas Welding Set & Gas Cutting Set.
04.	Hand Operated Winches.
05.	Electric Welding machine.
06.	Jack with axle for lifting Cable Drum.
07.	Jointers Tool Box.
08.	Blow Lamps.
09.	Compression Tools suitable for Cables.
10.	Pull Lifts.
11.	Pulley Blocks.
12.	Hooks/Chains
13.	Cable Rollers.
14.	Hydraulic Jacks - For cable laying.
15.	Aluminium Rollers.
16.	D- Shackles.
17.	Dynamometers.
18.	TIG, Welding machine (for Aluminium welding).
19.	High Vacuum 1000 GPH Oil Filtration Machine for Transformer / Reactor oil suitable for 760mm vacuum. In case 250 MVA / 315 MVA transformer ETC work is covered in the scope, Oil filtration equipment of 1500 GPH suitable for High Vacuum along with 30 kL capacity storage tank for oil storage and processing of oil should be provided.
20.	Hydraulic cranes including accessories (20 tonne or more and boom height of 15mts. Vertical or more) suitable for erection of transformer bushings accessories and other equipments.
21.	Hydraulic Crimping tools for conductor / Shield wire.
22.	Crimping tools for cable termination.
23.	Torque wrenches of different ranges in sufficient numbers.
24.	All general purpose hand tools in sufficient quantities.
25.	Shearing Machine for cutting of Earthing Flat.

26. Tool Kit for fitters.
27. Tool Kit for Electrician.
28. Bench Vice.
29. 'A' type collapsible Al. ladder height 8M.
30. 'H' type Al. ladder height 5M.
31. Pressure Gauge 0-1kg/Sq.cm for measurement of N2 pressure.
32. Vacuum gauges for measuring fire vacuum of less than 1 torr in transformer.
33. Nylon slings for 4T capacity with different lengths.
34. Turper
35. Angle meter for measurement of bushing angle during erection.
36. Nylon hammer.
37. Wedge for cutting of 'O' rings/neoprene gaskets.
38. Die/Drill tool for making holes in gland plates (All sizes in sufficient numbers)
39. Phoenix screw drivers for handling of Terminal Blocks.

IMPORTANT NOTE:

1. The Contractor shall submit the copies of latest test certificate of lifting tackles, slings, pulleys etc. after mobilisation at site to the ENGINEER-IN-CHARGE.
2. Above is only a specimen/indicative list and any other Tools & Tackles as may be required by Owner/ BHEL at site during the execution of work will be arranged by the contractor promptly.
3. The status of tools, plants and instruments mentioned in annexure C of section - A does not relieve the subcontractor of his responsibility to make available all the test equipments and tools & tackles mentioned in the annexures of section B as per requirement of project.

SECTION-C

SPECIAL CONDITIONS OF CONTRACT

SECTION - C

SPECIAL CONDITIONS OF THE CONTRACT

C.1.0 **QUALIFICATION OF THE CONTRACTOR :**

C.1.1 The contractor must have the experience of execution of identical work in the past as specified in the tender documents and must have executed contracts of similar nature. The contractor must furnish enough evidence to establish his capacity in erection, testing and commissioning of similar equipments covered under this specification.

C.1.2 The contractor should be able to obtain clearance from the Electrical Inspector/ State Authorities on completion of the installations. If required, the Contractor is supposed to obtain such clearances on part completion of the installation as required by BHEL / Owner time to time. Also, before the start of work the contractor should obtain the supervisory license from the concerned Electrical Authorities.

C.1.3 The Contractor will have following certificates.

a) Contractor electrical licence.

b) Supervisor competency certificates to deal with Electrical high voltage equipments for their installation and for their installation and testing.

Such certificates from two persons of subcontractors representatives who will be posted at site will be required.

C.1.4 The contractor should be aware of the local conditions and be well acquainted with the site.

C.1.5 The contractor shall be preferred who has worked for State Electricity Boards/BHEL/Steel Authorities/Public Undertakings.

C.1.6 The contractor should have a very good engineering background and capability of carrying out erection and commissioning work of large scale.

C.2.0 **TERMS OF PAYMENT FOR ERECTION, TESTING AND COMMISSIONING :**

C.2.1

C.2.2

C.2.3

Please refer " Annexure to conditions of contract for ETC Work" attached with the tender documents.

C.2.4

C.2.5

C.2.6

C.2.7

Please refer " Annexure to conditions of contract for ETC Work" attached with the tender documents.

C.2.8

Above clause No. C.2.0 stands deleted. Please refer Annexure to conditions of contract for ETC works.

C.3.0 **SECURITY DEPOSIT:**

C.3.1

C.3.2

Please refer " Annexure to conditions of contract for ETC Work" attached with the tender documents.

C.3.3

C.3.4

C.3.5 **RETURN OF SECURITY DEPOSIT:**

The contractor should refer the clause A.17.7.

No interest shall be payable by BHEL on Earnest Money/Security Deposit or on any money due to the contractor by BHEL.

C.4.0 **PERFORMANCE GUARANTEE:**

C.4.1 The contractor shall be responsible for any defects in the execution of work noticed in guarantee period of 12 months reckoned from the date of putting the complete system into commercial operation/handing over to customer or 18 months from the date of system is declared completely erected, duly tested and accepted by BHEL and customer. The Contractor shall submit a bank guarantee worth 10% of the total contract value of erection, testing and commissioning of equipment in the prescribed proforma form of BHEL. If the contract is for more than one sub-station and the substations are completed and taken over by customer in stages, then the performance BG for the substation completed and handed over may be submitted based on the contract value of individual substation at the time of submitting the final bill, substation wise.

C.5.0 **LD/PENALTY FOR DELAY IN EXECUTION:**

C.5.1

Please refer " Annexure to conditions of contract for ETC Work" attached with the tender documents.

Above clause No.C.5.0stands deleted. Please refer Annexure to conditions of contract for ETC works.

C.6.0 **RECEIPT/ UNLOADING, HANDLING, TRANSPORTATION, SECURITY AND PRESERVATION OF EQUIPMENT AT SITE:**

C.6.1 The contractor shall take the delivery of all the equipment, structures and materials etc. at site and their security shall be the responsibility of the contractor. Further transportation of materials to work place as per requirements will be in the scope of the contractor. For any delay, demurrage/wharfage/detention charges will be borne by the contractor.

In order to ensure timely completion of project, some of the equipment/material as covered under clause no. E.10.0 of Section-E (Schedule of equipment) may arrive at site and are unloaded and stacked/stored prior to mobilisation of ETC Contractor for the work covered under this Tender Specification. In such a case, the amount actually spent by BHEL on unloading and storage till the time of mobilisation by the ETC contractor shall be debited to their account. Immediately after mobilisation, the contractor shall take these into their custody and all the conditions as applicable for the material directly received by the contractor will be applicable for these material.

C.7.0 **FACILITIES TO BE PROVIDED AT SITE BY THE CONTRACTOR:**

C.7.1 Watch and ward by authorised/licensed agency for the safe custody of the equipment shall be responsibility of the contractor.

C.7.2 It is the responsibility of the contractor to dismantle and take away all the materials of his office accommodation as soon as the project in handed over to BHEL/Owner and clean the area off debris.

C.8.0 **TESTING AND COMMISSIONING:**

C.8.1 All the electrical/mechanical test of the materials and equipment will be arranged by the contractor as per standard Specification/Field Quality Plan/ Erection Manual/Directive of the Site Engineer and Owner. The contractor shall have to fill the check list (site inspection record forms)for receipt, storage, erection, testing and commissioning of all the equipments as per BHEL systems to ensure proper quality of work.

C.8.2 All the testing equipment required to carry out the site test for all the equipment or the erected equipment shall be calibrated and shall be arranged by the contractor at his own cost. However, necessary instruction and the guidelines will be given by BHEL/owner.

In case Contractor is unable to provide the calibrated measuring and test instruments to the satisfaction of 'ENGINEER' then as per his own wisdom/ judgement can recommend a deduction of maximum limit up to 5% from the Contractor's bill. But this in no way relieves the Contractor from arranging the test & measuring instruments / equipment as required for completion of the 'PROJECT' without affecting the quality of work and meeting any Contractual obligation whatsoever.

C.8.3 The contractor shall be completely responsible for the satisfactory erection and providing Test Equipment and skilled manpower for testing, commissioning of all equipment, not withstanding the fact that he may be assisted by BHEL or its authorised representative.

C.8.4 The installation of all electrical equipment shall be carried out only by an electrical contractor holding a valid License for carrying out installation work of the voltage classes involved, under the direct supervision of and by persons holding valid certificates of competency for the same voltage classes, issued or recognised by the State Government. Contractor shall submit the particulars of the License held by him.

C.8.5 The contractor shall furnish to BHEL the names and particulars of certificates of competency of the supervisors and workmen to be engaged for carrying out installation work against this specifications.

C.8.6 The work shall be executed in a workman like manner in accordance with the requirements specified in the General Specification of Electrical Equipment installation, testing and commissioning specifications. Copy of such specifications/ drawings will be given to successful bidder before starting the work.

C.8.7 All electrical work shall also comply with standard norms and practices adopted by the State Electricity Board. Site test reports shall be prepared and submitted by the contractor.

C.8.8 Before charging the installation in part or full, this shall have to be approved by Statutory Govt. Authorities like Electrical Inspector, other concerned agency and the contractor has to arrange approval for the same as and when required by BHEL/Owner.

C.8.9 Any feasible modification in the equipment or installation that may be demanded by Electrical Inspector shall have to be carried out by the contractor at no extra charges to BHEL. The contractor shall take all necessary steps to enable BHEL/Owner to get the installation approved by the above authorities & shall render all necessary assistance to BHEL/Owner in the matter.

C.9.0 **COMPLETION OF CONTRACT:**

C.9.1 All equipment, mountings, fittings accessories or apparatus which may not have been specifically mentioned but which are usual or necessary for completing the erection and commissioning work of system, shall be done by the contractor without any extra charges.

C.10.0 **TRIAL OPERATION AND HANDING OVER:**

C.10.1 On completion of erection of the equipment and before pre-commissioning tests of the equipment, each of the equipment shall be inspected by the BHEL/Owner for the correctness and completeness of the installation. Thereafter commissioning engineers shall carry out all pre-commissioning tests. The results of such pre-commissioning tests shall be signed jointly by the contractor`s representative and BHEL/Owner.

C.10.2 On conclusion of satisfactory pre-commissioning tests, the trial operation of the equipments shall start. The equipment shall be on trial operations during which period all necessary adjustments shall be made.

C.10.3 After completion of trial operation, the plant will be handed over to the owner, after the period to be specified by BHEL. On taking over the plant, the owner shall issue a certificate to that effect.

C.10.4 BHEL/Owner shall be at liberty from time to time or at any time before the completion of the works to take possession and use any part of the completed works and in such case the contractor shall completely finish the said uncompleted part or parts of the works as and when the engineer shall direct whether before or after the respective prescribed time or extended time (if any) for the completion of the works and if required by the engineer while the owner is in possession of the said part or parts, of the site or works.

C.10.5 If due to reason of any default on the part of Contractor, a taking over certificate has not been issued in respect of any portion of the works, within one month after the time for completion or extended time as the case may be, the Owner/BHEL shall be at liberty to use the works or any portion thereof in respect of which a taking over certificate has not been issued, provided that the works or the portion so used as aforesaid shall be reasonably capable of being used and that the Contractor shall be afforded the earliest opportunity of taking such steps as may be necessary to permit the issue of the taking over certificate.

C.11.0 **ADDITIONAL EXPENDITURE:**

In case any additional expenditure is incurred in the works arising out of the faulty execution of the works by the contractor, such additional expenditure shall be borne by the contractor.

C.12.0 **SPLITTING THE WORK:**

BHEL reserves the right to split the work and award any part of the work to any agency without assigning any reason whatsoever.

C.13.0 **SUPPLY OF MATERIAL:**

C.13.1 The Contractor shall in no case be entitled to any compensation or damage on account of any delay in supply or non- supply there of for all or any such materials and stores but the contractor shall be entitled to suitable extension of time as may be determined by the Engineer whose decision shall be final and binding.

C.13.2 The contractor shall satisfy himself of the quantity and quality of the materials at the time of taking delivery from the BHEL/Owner. No claim whatsoever will be entertained by the BHEL/Owner on account of quality or quantity after the materials are taken by the contractor from the BHEL/Owner.

C.14.0 **ELECTRICITY AND WATER:**

C.14.1 Electricity for construction work shall be provided at one point on chargeable basis at the rate prevailing at the time of drawal of power, unless specified otherwise. The contractor shall have to make their own arrangements, at their cost, for distribution to various locations for their works including proper switch/fuse units, distribution boards, cables, poles etc. to ensure safety of men and equipment. Where required the contractor shall employ diesel operative equipment in addition to electric operated ones to ensure timely completion of work.

In case BHEL is unable to provide Electricity on chargeable basis then the contractor has to arrange same at his end.

C.14.2 The contractor shall indicate in his offer the power load required by him along with the load details for which power is required.

C.14.3 The owner shall not be responsible for any inconvenience caused due to any failure of lighting and power supply and no compensation for delay in works can be claimed by the contractor due to such non-supply on the grounds of idle labour, machinery or any other grounds.

C.14.4 The contractor should ensure that the work in critical areas is not held up in the event of lighting and power breakdown and for the same he should have some standby arrangement at his cost. In the event of breakdown in the electric supply, if the progress of work is hampered, it will be the responsibility of the contractor to step up the progress after restoration of electric supply so that over all progress of work is not affected. The contractor shall make proper arrangement of illumination at work place while working in late hours or in darkness.

C.14.5 Unless stated otherwise in the scope of works, the contractor shall make his own adequate arrangement for procuring clear water to be used in the works.

C.15.0 **INSURANCE :**

C.15.1 Contractor shall take insurance cover(s) to cover his Tools and Plants, Assets, workmen compensation and third party liability. The contractor shall make available the original insurance cover(s) to the Engineer for necessary verification before commencement of work.

C.16.0 **ESCALATION/PRICE VARIATION :**

C.16.1 Under this contract, **No escalation/ Price variation** is allowed. The quoted prices are FIRM till complete commissioning and handing over of the Project to Customer/Owner.

C.17.0 **OVERRUN CHARGES:**

C.17.1 Above clause No.C-17.0 stands deleted. Please refer Annexure to conditions of contract for ETC works.

C.18.0 **CONSTRUCTION SCHEDULE:**

C.18.1 While submitting the offer the contractor shall furnish Bar Chart detailing out all major activities, as to how he proposes to complete the work maintaining the completion schedule as given in Notice Inviting Tender. If the contractor fails to achieve any milestone indicated in the Bar Chart/completion schedule mentioned elsewhere, the contractor shall be levied penalty as per clause C.5.0.

C.19.0 **HEAVY MATERIAL HANDLING EQUIPMENT:**

The contractor must clearly indicate the details of all Heavy Materials Handling Equipment owned by him in Annexure-C of Section-A, General Instructions to the Tenderer. The boom length, capacity of handling load and other relevant details must also be given.

C.20.0 **CALIBRATED TEST INSTRUMENTS:**

Contractor is required to bring all the required testing equipments and instruments for conducting pre-commissioning test. All instruments should be calibrated as this is an ISO System requirement and the contractor should furnish test certificate for calibration. Also, please see clause E.4.2 and E.6.3 of Section-E for more details.

C.21.0 Contractor should maintain moisture free store.

C.21.1 Illumination system in & around store should be maintained by the contractor.

C.21.2 All the material stored in the open yard shall be covered by tarpaulins to be arranged by the contractor.

C.22.0 **PROTECTION OF WORK :**

C.22.1 Contractor shall effectively protect his work, equipment, material from theft, damage or tempering at his own expenses till the work is finally taken over by the BHEL/Owner.

C.22.2 Finished work where required, shall be suitably covered to keep it clean and free from defacement or damage.

C.22.3 Necessary fire protection arrangement is to be made by the contractor for store and place of work.

C.23.0 **SAFETY MEASURES :**

C.23.1 All safety rules and codes as applicable to work shall be followed without exception.

C.23.2 All safety appliances and protective devices including safety belt, hand gloves, aprons, helmets, shield goggles etc. shall be provided by the contractor to his personnel. Also, the Contractor must follow BHEL Quality system to ensure safety in all activities of site work.

C.24.0 **QUALITY RECORDS (FQPs, MATERIAL MANAGEMENT ETC.)**

C.24.1 Contractor should follow field quality plan furnished by BHEL to ensure quality in all activities of work performed at site.

C.24.2 The contractor shall have to maintain records pertaining to Material Verification on receipt at site as well as Daily Receipt Register, Stock Register as per the various quality systems of BHEL.

C.25.0 The contractor shall remove all scaffolding, ladders, temporary structures etc. erected by him during erection in order to leave place neat and clean to the satisfaction of the owner.

C.26.0 All packing/items are to be checked immediately on receipt at site. Any shortages, damages are to be reported to BHEL within a week's time in writing.

C.26.1 All parts shall be thoroughly cleaned, all rust removed and surface polished as required before erection of any equipment.

C.26.2 Cleaned and polished parts shall be coated with anti-corrosive paints wherever necessary.

C.27.0 After completion of work, reconciliation is to be done for all the material issued to the contractor. Balance materials are to be returned to BHEL/Owner.

C.28.0 **WORKING HOURS:**

If in the opinion of BHEL, the progress of the erection work by the contractor at any stage needs expediting so as to ensure completion of work within stipulated time, BHEL shall have the right to instruct the Contractor to increase the Contractor's manpower and working hours and the contractor shall comply with such instructions without any Extra Charges.

C.29.0 **DIVISION OF WORK:**

Prices are to be quoted for schedule of Equipment - E.10.0 of Section-E. Work can be split-up and awarded to more than one contractor as per requirement of BHEL/Owner for timely completion of Project.

C.30.0 **INCOME TAX / SALES TAX / WORKS TAX/VAT**

~~The prices to be quoted by bidder should be EXCLUSIVE of service tax and~~

Please refer " Annexure to conditions of contract for ETC Work" attached with the tender documents.

Above clause No.C-30.0 stands deleted.Please refer Annexure to conditions of contract for ETC works.

C.31.0 DISCREPANCIES AND ADJUSTMENT OF ERRORS

C.31.1 The several documents forming the contract are to be taken as mutually explanatory of one another, detailed drawings being followed in preference to small scale drawings & figures dimensions in preference to scale & special conditions in preference to general conditions.

C.31.2 In case of discrepancies between schedule of quantities, the specification and/or the drawings the following order of preference shall be observed.

a) Description in Schedule of Quantities.
b) Special Conditions.
c) Drawings
d) Technical Specifications.
e) General Conditions of Contract.

C.31.3 If there are varying or conflicting provisions made in any one document forming part of the contract, the Engineer shall be deciding authority with regard to the document.

C.31.4 Any error in the description, quantity in schedule of quantities or any omission there from shall not vitiate the contract or release the contractor from the execution of the whole or any part of the works comprised therein according to the drawings and specifications or from any of his obligations under the contract.

C.31.5 If on check there are found to be differences between the rates given by the contractor in words and figures or in the amount worked out by him in the schedule of quantities and general summary, the same shall be adjusted in accordance with the following rules. :

a) In the event of discrepancies between description in words and figures quoted by tenderer, the description in words shall prevail.

b) In event of an error occurring in the amount column of schedule of quantities as a result of wrong extension of the unit rate and the quantity, the unit rate shall be regarded as firm and extension shall be amended on the basis of the rates.

c) All errors in totalling in the amount column and in carrying forward totals shall be corrected.

d) The totals of sections of bill of quantities amended shall be carried over to the general summary and the tendered sum amended accordingly. The tendered sum so altered shall, for the purpose of tender be substituted for the sum originally tendered and considered for acceptance instead of the original sum quoted by the tenderer. Any rounding of quantities or in sections of bill of quantities or in general summary, by the tenderer, shall be ignored.

C.31.6 If neither drawings nor specifications contain any mention of minor details of construction which in the opinion of the Engineer, whose decision shall be final and conclusive, are reasonable and obviously and fairly intended for satisfactory completion of work, such details shall be provided by the contractor without any extra cost, as if they were specially mentioned and shall be deemed to be included in the contract.

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SECTION-D

ERECTION CONDITIONS OF CONTRACT

SECTION - D

ERECTION CONDITIONS OF CONTRACT

D.1.0 **GENERAL:**

D.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.

D.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 purposes 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 the contract.

D.2.0 **REGULATION OF LOCAL AUTHORITIES AND STATUTES:**

D.2.1 The contractor shall comply with all the rules and regulations of local authorities during the performances of his field activities. He shall also comply with the **Minimum Wages Act, 1948 and the Payment of Wages Act** (Both of Government of India) and the rules made there under in respect of any employee or workman employed or engaged by him or his sub-contractor.

The Contractor should note that all instructions of Engineer shall be binding for example display of Minimum Wages paid to the workmen, construction of toilets etc. in the vicinity of working area from health and sanitation standpoint etc.

D.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 provision of the statutory laws and it's amendments from time to time during erection in respect of the plant equipment ultimately to be owned by the Owner/BHEL shall be to the account of the Owner/BHEL. Should any such inspection or registration need to be rearranged 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.

D.3.0 **OWNER'S LIEN ON EQUIPMENT :**

The owner/ BHEL shall have lien on all equipments including those of the contractor brought to the site for the purposes of erection, testing and commissioning of the plants. The Owner/ BHEL shall continue to hold the lien on all such equipments through out 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 permission of BHEL.

D.4.0 **RE-WORKS ETC. :**

In case Owner/BHEL/consultant during inspection at site rejects an item already agreed and the same is agreed to by BHEL and any re-execution of works of other contractors and/or his agencies, which might have got damaged or affected by the replacements will have to be attended to by the contractor free of cost.

D.5.0 ACCESS TO SITE AND WORKS ON SITE :

D.5.1 Suitable access to and possession of the site shall be provided to the contractor by Owner/ BHEL in reasonable time.

D.5.2 The works so far as it is carried out on the owner's premises shall be carried out at such time as the owner/BHEL may approve and the Owner/ BHEL shall give the contractor reasonable help/ facility for carrying out the works.

D.5.3 In the executions of the works, no persons other than the Contractor or his duly appointed representative, Sub- contractor and workmen shall be allowed to do work on the site except by the special permission in writing by BHEL.

D.6.0 **CONTRACTOR'S SITE OFFICE ESTABLISHMENT:**

The contractor shall establish site office at the site and keep posted an authorised representative for the purpose of contract. Any written order or instruction of BHEL or his duly authorised representative shall be communicated to the contractor at the site office and the same shall deemed to have been communicated to the contractor at his legal address.

D.7.0 **CO-OPERATION WITH OTHER CONTRACTORS:**

D.7.1 The contractor shall co-operate with all other contractors or tradesmen of the owner/BHEL who may be performing other works on behalf of them and the workmen who may be employed by the owner/BHEL doing work in the vicinity of the works under the contract. The contractor shall also arrange to perform his work as to minimise to the maximum extent possible interference with the work of other contractors and his workmen. Any injury or damage that may be sustained to the employees of the other contractors, BHEL and the owner due to the contractor's work shall promptly be made good at contractors own expenses. The owner/ BHEL shall determine the resolution of any difference or conflict that may arise between the contractor and other contractor's or between the contractor and workmen of the owner and BHEL in regard to their work. If the works of the contractor is delayed because of any acts or omission of another contractor, the contractor shall have no claim against the owner/ BHEL on that account other than an extension of time for completing his works.

D.7.2 BHEL shall be notified promptly by the contractor of any defects in the other contractor's works that could affect to the contractor's works. The owner/BHEL shall determine the corrective measures if any, required to rectify this situation which shall be binding on the contractor.

D.8.0 **DISCIPLINE OF WORKMEN:**

D.8.1 The contractor shall adhere to the disciplinary procedure set by the owner in respect of his employees & workman at site. The owner/BHEL shall be at liberty to object to the presence of any representatives or employee of the contractor at the site, if in the opinion of the owner/ BHEL 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.

D.9.0 **CONTRACTOR'S FIELD OPERATION:**

D.9.1 The contractor shall keep informed in advance regarding his field activity plans & schedule for carrying out such part of the works. Any review of such plan or schedule or method of work by the BHEL shall not relieve the contractor of any of his responsibilities towards the field activities and its schedule. Such reviews shall also not be considered as an assumption of any risk or liability by the owner/BHEL or consultant 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 or work reviewed. The contractor shall be solely responsible for the safety adequacy and efficiency of plant and equipments and his erection methods.

D.9.2 The contractor shall be completely responsible 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 requirements shall apply continuously till the completion of contract and shall not be limited to normal working hours.

D.10.0 **PHOTOGRAPH AND PROGRESS REPORT:**

D.10.1 The Contractor shall furnish to BHEL photographs of the progress of work / work done at site. Photographs shall be taken as & when indicated by BHEL representative. Photograph shall be adequate in size & number to indicate various stages of erection. Each photograph shall contain the date, the name of the Contractor and the title of the Photograph. The cost of photographs is to be born by the Contractor.

D.10.2 The above Photographs along with the soft copy (on floppy/CD) 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 action proposed for corrective measures wherever necessary.

D.11.0 **MANPOWER REPORT:**

D.11.1 The Contractor shall submit to BHEL from the first working day of every month, a Manpower report of the previous month detailing the number of persons scheduled to have been employed and actually employed skill-wise and the areas of employment of such labour.

D.12.0 **PROTECTION OF WORK:**

The Contractor shall have total responsibility for protecting his works till it is finally taken over by the owner. No claim will be entertained by the BHEL for damage or loss to the Contractor's works & the contractor shall be responsible for the complete restoration of the damaged work to its original condition to comply with the specification & drawings. Should any such damage to the Contractor's works occur because of other party not under him directly, & if disagreement or

conflict or dispute develops between the contractor & the other party or parties concerns works the same will be resolved as per the provisions of the clause D.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 dispute. The contractor shall proceed to repair the work immediately & no cause thereof will be assigned pending resolution of such dispute.

D.13.0 **EMPLOYMENT OF LABOUR:**

D.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 person below the age of eighteen years shall be employed.

D.13.2 All travelling expenses including provision of all necessary transport to and fro for Site, lodging allowance and other payments to be Contractor's employees shall be the sole responsibility of the contractor.

D.13.3 The hours of work on the Site shall be decided by the owner/BHEL and the Contractor shall adhere to it. Working hours will normally be eight (8) hours per day Monday through Saturday or depending upon the situation/ requirement.

D.13.4 Contractor's employees shall wear identification badges while on the work at site.

D.13.5 In the case of owner/BHEL become 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, Contractor Labour Regulation Abolition Act or any other law due to act or omission of the Contractor, BHEL may make such payment and recover the same from the Contractor's bills or from any amount which is already under process of payment to the Contractor.

D.14.0 **FACILITIES TO BE PROVIDED BY OWNER:**

D.14.1 Space: The Contractor shall advice BHEL within Fifteen (15) days from the date of acceptance of the Letter of Intent about his exact requirement of space for his office, storage area. The above requirements shall be reviewed by the Owner/BHEL & space will be allotted to the Contractor for construction of his temporary structures like office and storage sheds.

D.14.2 Construction water and power (Electricity) (Refer Clause C.14.0).

D.15.0 **FACILITIES TO BE PROVIDED BY THE CONTRACTOR:**

D.15.1 **CONSTRUCTION EQUIPMENTS, TOOLS, TACKLES AND SCAFFOLDINGS:**

The Contractor shall provide all the construction equipments, tools, tackles and scaffoldings required for pre-assembly, erection, testing and commissioning of the equipments covered under the contract. He shall submit a list of all such materials to the BHEL before the commencement of work at Site. These tools and tackles shall not be removed from site without the written permission of the owner/BHEL.

D.15.2 **COMMUNICATION:**

The Contractor will make his own arrangement for all his communication needs such as telephone, fax etc., at his site office and his residential accommodation.

D.15.3 **FIRST AID:**

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

D.15.4 **CLEANLINESS:**

D.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 owner/BHEL. Materials and 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 the flame resistant, oil proof shield shall be provided to protect the floor from such damage.

D.15.4.2 Similarly the labour colony, the office & the residential areas of the Contractor's employees and workmen shall be kept clean & neat to the entire satisfaction of the Owner/BHEL. Proper sanitation arrangements shall be provided by the contractor in the workmen areas, office and residential areas of the contractor.

D.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 the layout of the works. Basic horizontal and vertical control points as required will be established & marked by the Owner/BHEL at Site at suitable points.

These points shall be used as datum for the works under the contractor. The contractor shall inform the Engineer well in advance of the time 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 Owner/BHEL to enable the contractor to proceed with his works. Any work done without being properly located may be removed and/or dismantled by the Owner/BHEL at Contractor's expenses.

D.17.0 **FIRE PROTECTION:**

D.17.1 The work procedures that are to be used during 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 equipments and material storage and areas in safe containers. Untreated canvas paper, plastic or other flammable 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 materials before moving in to the construction area or storage.

D.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 of water proof and flame resistance type. All 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.

D.17.3 All the contractors supervisory personnel and sufficient number of workers shall be trained for fire-fighting and assigned specific fire protection duties. Enough of such trained personnel must be available at the Site during the entire period of the Contract.

D.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 all times.

D.18.0 **SECURITY:**

The Contractor shall have total responsibility for all equipments & 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, equipments and works from theft, fire, pilferage & other damages and losses. All materials belonging to the Contractors shall enter and leave the project site only with the written permission of the Owner/BHEL in the prescribed manner.

D.19.0 **CONTRACTOR'S AREA LIMITS:**

The Owner will make out the boundary limits of access roads, parking spaces, storage and construction 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 the areas marked out for his operations. In case of such a need for the contractor's personnel to work in the areas not marked out for him, the same shall done only with written permission of the Owner/BHEL.

D.20.0 **CONTRACTOR'S COOPERATION WITH THE OWNER/ BHEL:**

In cases where the performances of the erection work by the contractor affects the operation of the system facilities of the Owner/BHEL such erection work of the contractor shall be scheduled to be performed only in the manner stipulated by the Owner/BHEL and the same shall be acceptable at all times to the contractor. The Owner/BHEL may impose such restriction on the facilities provided to the contractor such as electricity, water etc., as he may think fit in the interest of the Owner/BHEL and the contractor shall strictly adhere to such restrictions and cooperate with the Owner/BHEL. It will be responsibility of the contractor to provide all necessary temporary instrumentation and other measuring devices required during start up and operation of the equipment system which are erected by him. The contractor shall also be responsible for flushing and initial filling of all the oil and lubricant required for the equipment furnished and erected by him, so as to make such equipments ready for operation. The contractor shall be responsible for supplying such flushing oil & other lubricants unless otherwise specified elsewhere in these documents and specifications.

D.21.0 **PRE-COMMISSIONING TRIALS AND INITIAL OPERATIONS:**

The pre-commissioning trials and initial operations of the equipments furnished and erected by the contractor shall be the responsibility of the contractor as detailed in relevant clauses. The contractor shall provide in addition, test instruments calibrating devices etc. and the labour required for the successful performance of these trials. If it is anticipated that the above test may prolong for a long time, the Contractor's workmen required for the above test shall always be present at site during such trials.

D.22.0 **MATERIAL HANDLING AND STORAGE:**

D.22.1 All the equipments furnished under this contract arriving at site shall be promptly received, unloaded, transported and stored in the storage spaces by the contractor.

D.22.2 Contractor shall be responsible for examining all the shipments immediately on receipt at site and notify BHEL immediately if any damage, shortage, discrepancy. Filling of material verification reports on receipt of materials shall be carried out by the Contractor as per the instructions of Engineer. For any shortages or damages in transit, handling and/or in storage and erection of the equipments at site shall be intimated to BHEL/ equipment supplier promptly to enable them lodge claim with the underwriters. Any financial and/or time loss happened due to contractor's negligence in this regard shall be to the account of the contractor. Any demmurrage, wharfage and any other charges claimed by the Transporter or Railways due to any reason attributable to the contractor such as delay in taking delivery in time shall also be to the account of the contractor.

D.22.3 The Contractor shall maintain an accurate and exhaustive record detailing out the list of all equipments received and keep such record open for the inspection of the Owner/BHEL at any time.

BHEL is an ISO Company and the contractor shall extend all help in maintaining records of receipts, issue and stock in line with Material Management System issued by BHEL. Also, he shall assist in periodic inspection of equipment/materials in stores as per this system.

The Contactor shall carryout all field activities related with ETC work as per Field Quality Plans (FQPs) provided by Engineer to ensure Quality of work at site as well as meet the contractual obligation to BHEL/Owner.

D.22.4 All equipments 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 equipments without the specified written permission of BHEL. The equipment stores 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.

D.22.5 All electrical panels, control gears, 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 rotation parts if any, in assembled conditions shall be periodically rotated to prevent corrosion due to prolonged storage.

D.22.6 All the electrical equipment, such as motors, transformers etc. shall be tested for insulation resistance at least once in three months from the date of receipt till the date of commissioning and record for such measured insulation values maintained by the contractor. Such records shall be open for inspection by the Owner/BHEL.

D.22.7 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 equipments are installed.

D.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.

D.22.9 All the materials stored in the open or dusty location must be covered with suitable weather proof & flame proof covering materials wherever applicable.

D.22.10 If the materials belonging to the contractor are stored in areas other than these earmarked for him, the Owner/BHEL will have the right to get it removed to the area earmarked for the contractor at the contractor's cost.

D.22.12 **STORAGE INSTRUCTION FOR GAS FILLED EQUIPMENTS:**

D.22.12.1 All transformers despatched to site are fitted with Nitrogen cylinder in the tank to maintain positive pressure. It will be the responsibility of the contractor to maintain the pressure and replace the empty Nitrogen cylinder with Nitrogen filled cylinder of required purity at his own cost whenever such cylinders are become empty. Contractor should also maintain the periodic record of the pressure of Nitrogen in the transformer in a register for this purpose.

D.22.12.2 For all other gas filled equipments, like CTs, VTs, CVTs etc. the contractor should also maintain the gas pressure & if it falls below the required value, contractor should refill the leaked gas of required purity at his own cost.

D.23.0 **CONSTRUCTION AND ARRANGEMENTS:**

D.23.1 The field activities of the contractors working at site, will be coordinated by BHEL and BHEL decision shall be final in resolving any dispute or conflicts between the contractor and other contractor's and tradesmen of the BHEL regarding scheduling and coordination of work. Such decisions shall not be cause for extra compensation for time to the contractor.

D.23.2 The Owner/Consultant shall hold weekly meetings of all the contractors working at the site at a time and a place so designated. The contractor along with BHEL shall attend such meetings and take notes of discussions during the meeting and the decisions of the Owner/BHEL/Consultant shall be strictly adhered to in performing his works. In addition to the above weekly meetings, the Owner/Consultant/BHEL 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 with BHEL.

D.23.3 Time is the essence of the contract & the contractor shall be responsible for performance of his work 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 delay 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 BHEL satisfying them that his action will compensate for the delay. The contractor shall not be allowed any extra compensation for such action.

D.23.4 BHEL shall however not be responsible for provision of additional labour and/or materials or supply or any other service to the contractor except for the coordination work between various contractors as set out earlier.

D.24.0 **FIELD QUALITY PLANS AND RECORDS:**

The contractor shall maintain at his Site Office upto date copies of all drawings, specifications, FQPs and other contract documents and any other supplementary data complete with all the latest information 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/build conditions of the equipments furnished and erected under the contract.

Such "AS BUILT DRAWINGS" and "ENGINEERING DATA" shall be submitted to BHEL in required number of copies.

D.25.0 **CONTRACTOR'S MATERIALS BROUGHT ON TO SITE:**

D.25.1 The contractor shall bring to site all equipments, components, parts, materials, including construction equipment, tools & tackles for the purpose of the works under intimation to the owner/BHEL. All such goods shall, from the time of there being brought to site 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 BHEL.

D.25.2 After the completion of the works the contractor shall remove from the site under the direction of the BHEL the material such as construction equipment, erection tools and tackles, scaffolding etc. with the written permission of BHEL. If the contractor fails to remove such materials within fifteen (15) days of issue of a notice by the BHEL to do so, then BHEL shall have the liberty to dispose/remove such materials and expanses incurred by BHEL in this regard will be recovered from the Contractor.

D.26.0 **PROTECTION OF PROPERTY AND CONTRACTOR'S LIABILITY:**

D.26.1 The contractor shall be responsible for any damage resulting from his operation. He shall also be responsible for protection of all persons including members of public and employees of the Owner/BHEL and the employees of other contractors and subcontractors building, other plants and equipments and utilities either above or below the ground.

D.26.2 The contractor will ensure provisions of necessary safety equipments such as barriers, sign-boards, warning lights and alarm etc. to provide adequate protection to persons and property. The contractor shall be responsible to give reasonable notice to Owner/BHEL of public or private property and utilities when such property and utilities are likely to get damaged or injured during the performance of his work shall make all necessary arrangements with such owners related to removal and or replacement or protection of such property and utilities.

D.27.0 **PAINTING:**

All exposed metal parts of the equipment including pipings, structures, railings etc. wherever applicable shall be first painted with at least one coat of suitable primer after thoroughly cleaning all such parts off dirt and rust scales, greases, oil and other foreign materials by wire brushing, scraping or/and blasting and the same being inspected and approved by the Engineer for painting. After wards the above parts shall be finished with two coats of enamel paint. The quality of the finish paint shall be as per the standards of ISI equivalent and to be of the colour as approved by the Owner/BHEL.

D.28.0 **PROTECTION OF MONUMENTS AND REFERENCE POINTS:**

The contractor shall ensure that at points 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 & handed over to the owner under intimation to BHEL. Similarly the contractor shall ensure that the bench marks reference points etc. which are marked out either with the help of owner or by BHEL shall not be disturbed in any way during the performance of his works. If any work is to be performed which may disturb such references, the same shall be only after these are transferred to other suitable locations under the direction of BHEL. The contractor shall provide all necessary materials and assistant for such relocation of reference points etc.

D.29.0 **WORK AND SAFETY REGULATIONS:**

D.29.1 The contractor shall ensure the safety of all the workmen, materials, and equipment either belonging to him or to others working at site.

D.29.2 The contractor will notify the BHEL office of his intention to bring on to site any equipment or any container with liquid or gases, fuel or other substances which may create hazards. BHEL shall have the right to prescribe the conditions under which such equipment or container may be handled and used during the performance of the works and the contractor shall strictly adhere to such instructions. BHEL shall have strictly the right to inspect any construction plant and to forbid its use, if in his opinion it is unsafe. No claim due to such prohibition shall be entertained by BHEL.

D.29.3 Where it is necessary to provide and/or store petroleum products or petroleum mixtures & explosive, 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. Explosively Act,1948 and petroleum and carbide of calcium manual published by the Chief Inspector Of Explosive of India. All such storage shall have prior approval of BHEL in case any approval are necessary from the Chief Inspector of Explosive of any statutory authorities, the contractor shall be responsible for obtaining the same.

D.29.4 The contractor shall be responsible for the safe storage of his & his sub-contractor's radio-active source if any.

D.30.0 **ELECTRICAL SAFETY REGULATIONS:**

D.30.1 In no circumstances will the contractor interfere with fuses and Electrical Equipment belonging to BHEL/Owner or to the other contractors.

D.30.2 Before the contractor connects any electrical appliances to any plug or sockets belonging to the other contractor or Owner, he shall:

(a) Satisfy the Owner/BHEL that the appliances are in good working conditions.
(b) Inform the Owner/BHEL of the maximum current, relating, voltage etc. of the appliances.
(c) Obtain permission of the Owner detailing the sockets to which the appliances may be connected.

D.30.3 The BHEL will not grant permission to the contractor until he satisfies that:

(a) The appliance is in good conditions and fitted with suitable plug.
(b) The appliance is fitted with a suitable cable having proper earthing provisions.

D.30.4 No cable in use will be disturbed by the contractor without prior permission. No weight of any description will be imposed on any such cable and no ladder or similar equipment will rest against or attached to it.

D.30.5 No work shall be carried out on any live equipment. The equipment must be made safe by the BHEL/Owner and a permit to work issued before any work is carried out.

D.30.6 The contractor shall employ the necessary number of qualified full time electrician to maintain his temporary electrical installation.

D.31.0 **CONSUMABLES:**

The contractor shall make arrangements for an adequate inventory at site of necessary consumable prior to erection so that the requirements of the same will not come in the way of timely completion of the works under the contract.

D.32.0 **MILD STEEL AND ALUMINIUM WELDING & OTHER SPECIAL PROCESSES :**

D.32.1 Only an approved and qualified welder shall be employed by the contractor. The welder will be subjected to pre-qualification test by Owner/BHEL.

D.32.2 The Contractor shall ensure that personnel employed for doing other special processes like tube/pipe bending etc. are having proper experience and are qualified for doing such work.

D.32.3 Erection of Aluminium tubular bus bar shall include cutting, bending, aluminium welding with sleeves (sleeves supplied by BHEL), Radiographic testing and D.P test of 100% welded joints, fixing corona end bells etc to complete.

D.32.4 For MS welding, red lead paint shall be applied followed by aluminium paint and bitumen after welding. For GS welding , two coats of cold galvanising anti-corrosive paint shall be applied after welding. In case any special process is indicated in customer's specification, then the same shall be applicable.

D.32.5 10% welded joints in earthing shall be tested for Dye penetration test.

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SECTION – E

SCOPE OF WORK AND COMPLETION SCHEDULE

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E.1.0 **SCOPE OF WORK :**

The scope of work of the successful tenderer shall comprise but not limited to the following. The Tenderer shall read this scope of work in conjunction with all terms and conditions (Section -A,B,C & D) contained else where in this document. The quoted rates for various equipments/activities are deemed to include all the below mentioned activities and nothing extra is payable on account of these.

E.1.1 **For Contractor supplied materials:** It shall be prime responsibility of contractor to ensure safe storage of material supplied by him. The contractor may construct open/ covered store to ensure proper storage of the materials as per site requirement. Contractor will be permitted to dismantle and take back the stores after completion of the work. No additional payment shall be made/deducted on account of stores constructed by contractor for storing these materials.

For BHEL supplied materials: Contractor shall construct open/ covered store only if the same is mentioned in the Bill of Quantities.

If due to any reason the material can not be unloaded in designated store/open yard and it is unloaded at some nearby place on instructions of site Engineer then this material has to be shifted by subcontractor to designated store/open yard when it is ready without any additional claim. Any multiple handling of material within project premises is not payable by BHEL

Some items may get delivered at stores of other BHEL unit on account of convenience of despatch within the plant area. These material will be collected/shifted by subcontractor to switchyard store at no extra cost.

E.1.2.1 Inspection / verification of equipment / materials received for any shortage / damage after opening the packing cases and intimating the same to BHEL/ Owner and underwriters within the time period specified by BHEL and to strictly follow the procedures specified. Storage of equipment indoor / open stores in line with the instructions of the manufacturer / BHEL.

Conservation / maintenance / upkeep of the equipment in the store.

Temporary lighting in stores & construction area wherever required.

Safety / Security of equipments / materials.

E.1.2.2 **Watch and ward of Erected Equipment/Material** - Soon as the erection of switchyards are taken up, the watch and ward for the erected items will also be arranged by the subcontractor till the switchyards are taken by BHEL/customer

E.1.3 Erection, levelling and fixing of GI Structures of towers, beams including all the equipment support structures on their respective foundations in line with drawings to be furnished by BHEL. Final adjustment of foundation levels by chipping and dressing, checking location, elevation, etc., and checking position of foundations / anchor bolts and grouting/under pinning of anchor bolts and base plates wherever necessary for certain aux. equipment and accessories of main equipment. Materials such as M.S. packing shims of required thickness for levelling and alignment and civil material for final grouting with 1:1 cement mortar with approved make anti-shrinkage compound and finishing shall be arranged by contractor. *The grouting/underpinning of all tower and equipment foundation bolts as per specifications is in the scope of Contractor ie Bidder.*

Fixing and assembly including minor modification, where required, of all cable trench materials like cable tray racks, cable trays, coupler plates, 'T' and 'L' bends etc in line with drawings to be furnished by BHEL. The work shall also covers laying of all cables including glanding and termination for all the equipments covered under BOQ . At various crossing and wherever necessary the cables to pass through pipes laid underground in line with drawing to be furnished by BHEL. Pipes will be supplied by BHEL for cabling from trench to equipment and laying of the same including excavation and backfilling and making and finishing of holes in trench walls will be carried out by the contractor.

E.1.4 Transportation of equipment/material from stores to erection site, erection of equipment materials in line with the drawings/instructions to be furnished by BHEL including filtration of oil wherever required, testing and commissioning and handing over to owner/customer.

E.1.5 Earthing (if called for in BOQ) : laying of earth mat and risers including excavation, bending, cutting, welding, cleaning and painting of joints, backfilling and earth compaction etc. as per BHEL drawings/specifications.

Cutting, pointing and driving of MS rod electrode, installation of pipe electrode and construction of chambers as per drawings.

Earth connections from risers to equipment, structures etc. through GI flat including bending, cutting, welding, cleaning and painting of welded joints as per BHEL's drawings/specifications.

Welding electrode should be of reputed make company ISI certified, and as per BHEL's specifications.

E.1.6 Providing for all consumables : It shall be noted by the tenderer that BHEL shall supply only the equipments/materials listed in schedule of equipments as free issue items. Any other sundry items required for completion of the job shall be procured by the contractor.

All Equipment fixing hardware shall be arranged by BHEL.

All cable glands shall be arranged by BHEL. However cable accessories like ferrules, lugs and markers, cable dressing and tying material etc. shall be in the scope of the contractor. The lugs shall be of reputed make company and as advised by BHEL site Incharge.

E.1.7 Maintenance of switchyard and associated equipment till handing over to the owner, any other activity necessary for completion of the job but not specifically mentioned in this specification.

E.1.8 Unloading, shifting, storing, verification, preservation during storage and handing over of spare items/maintenance equipment to Customer/Owner.

E.1.9 Reconciliation and shifting of all the balance excess material and scrap material to BHEL store or handover in customer store, as the case may be.

This excess material may include erection spares for various items of BOQ such as ACSR/AAC conductor, Al tube, Cable trench materials, Cables etc. Excess erection spare (except main equipment) supplied by purchaser upto 10% of the erected quantity shall be absorbed by the contractor & shall not be payable. Only as erected quantity of the various items of BOQ shall be payable as per the unit rates. However, any erection spares (excluding main equipment) handled in excess of 10% of the erected quantity shall be payable @ 10% of the unit rate (to account for only unloading, storage and watch & ward. However, any additional quantity of main equipment, handled but not erected, shall be paid @ 10% of the item rate.

E.2.0 **ERECTION, TESTING & COMMISSIONING REQUIREMENTS :**

E.2.1 All the switchyard equipment shall be erected, installed, tested and commissioned by the contractor to the satisfaction of BHEL/Owner adhering to the latest national standard and codes. Some of the Reference standards are given below which are normally applicable for Switchyard work. ETC activity of all other equipment to be done as per relevant standards.

a) IS : 10118-1982 Code of practice for selection, installation and maintenance of switchgear & control gear.

b) IS : 10028-1985 Code of practice for installation and maintenance of transformer.

c) IS : 732-1963 Code of practice for electrical wiring.

d) IS : 3043-1963 Code of practice for earthing.

e) IS : 2309-1989 Code of practice for the protection of building and allied structure against lightning.

f) IS : 1646-1982 Code of practice for fire safety of building (General) Electrical installations.

E.2.2 All electrical equipment and installations hall also conform to the latest Indian Electricity rules as regards safety, earthing and other essential provisions specified therein for insulation and operation of electric plants.

E.2.3 Earthing system, earth connections, testing of earthing system and connection, lightning protection system, electrical clearance and safety shall be strictly followed as per the national specifications which will be given to the successful bidder.

E.2.4 The schedule of equipment indicates the quantity of the equipment and these will be procured by BHEL and are to be erected by the contractor. The contractor has to erect, test all equipment for system commissioning and putting the same into operation. The trial run of individual equipment and final commissioning upto the handing over of the system to the customer of BHEL is the responsibility of the contractor.

Contractor will have to provide necessary support i.e.. suitable manpower, common tools, conventional testing instruments as per Annexure 'N' and other assistance as required by BHEL wherever expert services of any equipment are arranged by BHEL viz.. SF6 circuit breakers.

E.2.5 All equipments, material and accessories provided by the contractor shall conform to the requirements of the relevant Indian standard or International standard.

E.3.0 **METHOD OF WORKMANSHIP & QUALITY OF WORK**:

E.3.1 Workmanship will be in accordance with the best engineering practices to ensure satisfactory performances and service life.

E.3.2 All works shall be installed in a first class manner with technical skill in the trade involved to achieve quality of work of high standard. BHEL site supervisor's comments regarding quality of work should be taken care by the contractor.

E.3.3 The erection work shall be supervised by the competent supervisor holding supervisory license by the state or central Government or statutory licensing authority, as the case may be.

E.3.4 The installation shall be carried out in such a manner not to obstruct access to the other equipment installed or likely to be installed in the vicinity.

E.3.5 The complete erection shall be performed in accordance with the modern practices for similar substation equipments.

E.4.0 **EQUIPMENT, MATERIAL & SERVICES TO BE FURNISHED**

E.4.1 The contractor shall employ sufficient labours, skilled, unskilled, supervisory and administrative personnel for timely and effective execution of the contract.

E.4.2 The contractor shall arrange as per Annexure - Q erection tools and tackles, mobile crane, all transport vehicles, measuring & testing equipments necessary for timely and effectively execution of the contract. All measuring & testing instruments shall be pre-calibrated through a certifying agency before use. The certificate of calibration shall be submitted to Engineer for records. In case Contractor is unable to provide the calibrated measuring and test instruments then 'ENGINEER' according to his own wisdom / judgement can recommend a deduction of maximum limit up to 5% from the Contractor's bill. But this in no way relieves the Contractor from arranging the test & measuring instruments / equipment as required for completion of work without affecting the quality of work and meeting any Contractual obligation whatsoever.

E.4.3 All equipment including individual component fittings and accessories shall be properly stored at site so as to obviate any deterioration of electrical properties and mechanical damages.

E.4.4 All equipment shall be thoroughly cleaned of packing materials, scales rust, oil grease etc. prior to commencement of the installation work.

E.4.5 All equipment shall be checked physically for the completeness of all components and devices before taking up installation.

E.4.6 The contractor shall repair all minor defects in equipment, free of charge, if required prior to installation in consultation with equipment manufacturer of BHEL, so that manufacturer's guarantee is not affected in any way. In case of any major damage to the equipments, the same shall be rectified or replaced by the manufacturer's representatives with the approval of BHEL / Owner.

E.4.7 All equipments and accessories shall be installed strictly in accordance with the manufacturer's instructions / drawings. Equipment supplied in sections or in dismantled conditions shall be re-assembled at site with all associated accessories as per manufacturer's instructions.

E.4.8 If the services of BHEL engineers, suppliers, and / or of any equipment manufacturers are required by the contractor at any stage of work, it will made available on chargeable basis at existing rates prevailing at that time.

E.4.9 All consumable items required to carry out welding, brazing, soldering etc. for the erection and commissioning is included in the offer of contractor and shortages in hardware (due to careless / negligent handling at site) to be made up free of cost by the contractor. The quality of such replenishment shall be at par with main supply and to be acceptable to BHEL / Owner.

E.4.10 The successful contractor should note that after execution of work they will send marked up drawings "as erected" drawings to Project Manager at site for preparation of firm "AS BUILT" drawings. "AS BUILT" drawings will bear the signature of Project Manager of BHEL and Contractor's representative.

E.4.11 **OIL FILTRATION (IN CASE OF TRANSFORMERS COVERED IN BOQ):**

An extra high vacuum oil filtration plant with a minimum of thousand GPH capacity shall be employed by the contractor for oil filtration.

An empty oil tank of minimum of 12000 ltrs. capacity also shall be arranged by the contractor to prepare the oil before pushing it into the transformer.

E.5.0 **TESTING AND COMMISSIONING OF EQUIPMENT:**

E.5.1 The testing of all electrical equipment as well as the system as a whole shall be carried out to ensure that the equipment and its components are in satisfactory condition and will successfully perform its functional operation. All required tests shall be carried out by the contractor using his own instruments, testing equipments as well as qualified testing personnel. The tests on power transformer (if covered in BOQ) shall include winding resistance, tan-delta, PPM of moisture, acidity in oil. For SF-6 Circuit Breaker (if covered in BOQ) closing and tripping timing test shall also be carried out in addition to other routine tests.

E.5.2 At site all equipments shall be energised only after certification by the personnel performing the test that the equipment is ready for energising and with the concurrence of BHEL / Owner.

E.6.0 **PREPARATION FOR COMMISSIONING:**

E.6.1 After completion of the installation at site and for the preparation of system commissioning the contractor shall carry out checking and testing of all equipment and installation in accordance with the agreed standards, codes of practices of Indian Standards Institutions and specific instruction furnished by the particular equipments suppliers as well as the Owner.

E.6.2 Required checking to be made on all equipment and installation at site. This shall include but not limited to the following:

a) Physical inspection for removal of any foreign bodies external defects such as damaged insulators, loose connecting bolts, loose foundation bolts etc.

b) Check for grease insulating / lubricating oil leakage and its proper level / quantity.

c) Check for free movement of mechanism of the circuit breaker / isolator and rotating parts of other rotating machine and devices.

d) Check for tightness of all the cables, busbars as well as earth connection in the main earthing net work.

e) Check for clearance of live busbar and conductors from the metal enclosures.

f) Continuity check in case of power and control cables.

g) Checking of all mechanical and electrical interlocks, including tripping of breakers using manual operation of relay.

h) Checking of alarm and annunciation circuits by manual actuation of relevant relays like buchholz relay in case of transformer.

i) Check and calibrate devices requiring field adjustments / calibration like adjustment of relay setting etc.

j) Check proper connection to earth-mat work of all non current carrying parts of equipments & installation.

E.6.3 All the measuring and testing instruments will be arranged by the contractor and while submitting his quotation he shall furnish list of testing equipments which are readily available with him and also which can be procured by him from outside agency for the purpose of testing and commissioning.

E.7.0 **MINOR CIVIL WORK:**

E.7.1 Minor civil works including secondary grouting/under pinning of structure i.e. filling the gap between structure and foundation after levelling, alignment shall be done by the contractor at no extra cost. This shall also include necessary materials required for doing the work.

E.7.2 Minor civil works of final / secondary grouting of structures, towers equipment has to be arranged by the contractor and the rate for the same should be included in respective erection. Final / secondary grouting means filling the gap between the structure and foundation after levelling, alignment etc.

E.7.3 Minor civil work shall also include fixing of foundation bolts for radiator / cooling oil pump etc. Foundation bolts for such work shall however be arranged by BHEL.

E.8.0 **PRICE SCHEDULE**

E.8.1 The prices to be quoted FIRM and should be valid till the work is completed to the satisfaction of BHEL / Owner and handed over the system to Owner.

E.8.2 The quantities given in schedule of equipment are estimated ones and may vary up to ± 30% on the total value of the contract. Quantity of individual item may vary up-to any extent.

E.9.0 **START OF WORK AND COMPLETION SCHEDULE**

E.9.1 The contractor shall mobilise at site within one week from the date of LOI.

E.9.2 The entire work under this tender is required to be completed as indicated in Letter of Intent.

E.9.3 Detailed Bar Chart (activity schedule) should be submitted by the bidder in Annexure 'M' showing as to how the work is proposed to be executed in order to meet the completion schedule. This shall be filled in by the bidder after mobilisation at site and to be given to ENGINEER-IN-CHARGE at site.

E.9.4 The contractor is required to commence the work within the time as indicated in Letter of Intent failing which the contract is liable to be cancelled and EMD/SD shall be forfeited.

E.10.0 **SCHEDULE OF EQUIPMENT:**

The estimated quantities in the Schedule of Equipment given in Annexure-1 is tentative to give idea of work and to enable tenderer to quote unit rates. The actual quantities required to be erected shall be based on relevant drawings and latest revisions.

Form WAM 6

BHARAT HEAVY ELECTRICALS LIMITED
DIVISION.....
Running Account Bill
(Para 4.3.1 of Works Accounts Manual)

Departmental Bill No.

Name of the Contractor — Date:

Name of the Work: — Division: — Sub-Division:

Sanctioned Estimate: — Date of written order to commence the Work: — Period of work covered in this bill:

Code No.: — Date of commencement of work:

Contract Agreement No.: — Dated: — Due date of completion as per agreement

Date of approval of Competent Authority for time extension as applicable (copy to be enclosed).

I. ACCOUNT OF WORK EXECUTED

Adhoc payment for work not previously measured **			Item No. of work	Description of work	Quantity as per agreement	Quantity executed upto date	Rate	Unit	Payment on the basis of actual measurement upto date	Quantity executed since last RA bill	Payment on the basis of actual measurement since last running account bill	Remarks
Total as per last running account bill	Since last running account bill	Total upto date										
1	2	3	4	5	6	7	8	9	10	11	12	13

** 1. Whenever payment is made on adhoc basis without actual measurements the amount in whole rupees should be entered in columns 1 to 3 only and not in columns 7 to 12

2. Whenever there is an entry in column 12 on the basis of actual measurement, the whole of the amount previously paid without detailed measurement should be adjusted by a minus entry in column 2 equivalent to the amount shown in column 1, so that the total upto date in column 3 may become nil.

Total value of work done upto date (A) -------

Deduct value of work shown on the last Running Account Bill (B) -------

Net value of work done since last Running Account Bill (C) -------

Rupees (in words) ..... Only

Note :
Wherever adhoc payments to contractors against running bills are made in accordance with the extant Works Policy, the amount so paid shall be adjusted.

II. MEMORANDUM OF PAYMENTS

			I	II
1.	Total value of work actually measured as per Account No. I, Column 10	(A)	----------	----------
2.	Total upto date adhoc payment for work covered by approximate or plan measurements as per Account I, Col. 3	(B)	----------	----------
4.	Total upto date payments [(A)+(B)]	(C)	----------	----------
5.	Total amount of payments already made as per entry (D) of last Running Account Bill No. ..... dated ..... forwarded to the Accounts Department on	(D)		----------
6.	Balance [(C) - (D)]			----------
7.	Payments now to be made:		----------	
	a) by cash / cheque		----------	
	b) by deduction for value of materials supplied by BHEL vide Annexure A attached		----------	
	c) by deduction for hire of tools and plant vide Annexure B attached		----------	
	d) by deduction for other charges vide Annexure C attached		----------	
	e) by deduction on account of security deposit		----------	
	f) by deduction on account of Income Tax			----------

Note :	Amounts relating to items 4 to 6 above should be entered in column II and those relating to item 7 in column I. The amount shown against item 6 and the total of item 7 should agree with each other.

III. CERTIFICATE OF THE ENGINEER IN CHARGE

1	The measurements on which the entries in column 7 to 12 of Part I of this Bill (Account of work executed) are based were made by ---------- and are reorded at pages - ---------- of Measurement Book No. ---------- (Name and Designation)
2	Certified that the methods of measurement are correct and the work has been carried out in accordance with the terms and conditions, schedules, specifications and drawings etc. forming part of the contract agreement, subject to deviations included in the deviation statement (Annexure D)
3	Certified that in addition to and quite apart from the quantities of work actually executed as shown in column 10 of Part I, some work has actually been done in connection with several items and the value of the such work is, in no case, less than the adhoc payments as per column 3 of Part I, made or proposed to be made, for the convenience of the contractor in anticipation of, and subject to the results of, detailed measurement which will be made as soon as possible.
4	Certified that measurements by Engineer-incharge and test check of prescribed percentage of measurements by the concerned superior authorities has been carried out.
5	Certified that there are no pending recoveries from the contractor on account of chargeable items (e.g T&P, consumables, material, etc.) issued either by BHEL or by the customer and other recoveries like power, water, quarter, tax liability towards declaration forms etc.
6	Certified that with regard to the free issues, regular reconciliation is being done, completed upto ---------- and there are no recoveries pending from the contractor on account of such issues in excess of requirement for execution of work as per contract.
7	Certified that there is no pending recovery for damaged material issued free of cost.
8	Certified that the contractor has fulfilled all the requirements as per contract with reference to statutory obligations (PF, ESI, Minimum Wages, BOCW, Insurance etc.), support services such as service manpower, computer system , T&P etc

Signature of Contractor

Date:

Signature of Engineer in Charge

Designation:

Date:

IV. CERTIFICATE OF THE SENIOR ENGINEER

1	Certified that the measurements have been check measured to the prescribed extent by .... at site and also by the undersigned and the relevant entries have been initialed in the Measurement Book. (vide pages .....) (Name and Designation)
2	Certified that all the measurements recorded in the measurement book have been correctly billed for
3	Certified that all recoverable amounts in respect of materials tools and plant etc. and other charges have been correctly made vide annexures A to C attached.

Certified for payment * of Rs. ..... (Rupees ..... only)

*** Here specify the net amount payable.**

Date: **Signature of Senior Engineer**

V. ENTRIES TO BE MADE IN THE FINANCE DEPARTMENT

Code No.:

Accounts Bill No. ---------- dated ----------

Entered in Journal Book vide entry No. ---------- dated ----------

Passed for ---------- Rs.----------

Less Deductions ---------- Rs.----------

Net amount payable ---------- Rs.----------

(Rupees ---------- only)

Payable to Shri / M/s ---------- by cheque / cash

Entered in Contractors ledger No. ---------- Page ----------

	ALLOCATION	
Estimate No :	Debit	Credit
	(Gross amount)	(Deductions)
Name of Work :		
Account code head		
Total		

Assistant
Date:

Accountant
Date:

Finance Executive
Date:

Form WAM 6 (Contd.)

ANNEXURE A

Statement showing details of materials issued to the contractor Shri / M/S..... in respect of Contract Agreement / Work Order No.....Dated..... and covered by the agreement

Sl.No.	Stores Issue Voucher No. and date	Issue voucher No. and date allotted by stores to the SIV	Description of material issued issued to the contractor	Quantity issued		Quantity actually incorporated in the work	Balance quantity with contractor		If recoverable from the contractor				
				Free	Chargeable		Free	Chargeabl	Rate at which recoverable	Amount recoverable	Amount recovered upto previous bill	Balance now recovered	Remarks
1	2	3	4	5	6	7	8	9	10	11	12	13	14
							Total						

Certified that …….. (balance quantity of free issue material as per Col. 8 above) is physically available with the Contractor.

Signature of Contractor
Date:

Signature of Engineer in Charge
Date:

Signature of Senior Engineer
Date:

ANNEXURE B

Statement showing tools and plant issued to the contractor Shri/M/s..... in respect of Contract Agreement No.....Dated.....

Sl. No.	Description of Tools and Plant Issued	Period for which issued	Rate at which recovery is to be made	Amount recoverable	Amount recovered upto previous bill	Balance Recovered now	Remarks
1	2	3	4	5	6	7	8
			TOTAL				

Signature of Contractor
Date :

Signature of Engineer in Charge
Date :

Signature of Senior Engineer
Date:

Form WAM 6 (Contd.)

ANNEXURE C

Statement showing details of other recoveries to be made from the contractor Shri/M/s----------in respect of contract Agreement No. .....Dated .....

S. No.	Particulars	Unit	Quantity	Rate	Amount recoverable	Amount recovered up to previous bill	Amount now recovered	Remarks
1	2	3	4	5	6	7	8	9
1	Water charges							
2	Electricity charges							
3	Seignorage charges							
4	Medical charges							
5	Cost of empty gunny bags and empty containers not returned							
6								
7								
8								
				TOTAL				

Signature of Contractor
Date :

Signature of Engineer in Charge
Date :

Signature of Senior Engineer
Date:

ANNEXURE D
DEVIATION STATEMENT

Name of the Contractor:

Contract Agreement No

Name of Work:

Date:

S. No.	Description of Item	Unit	Quantity as per agreement	Quantity as executed	Quantity further anticipated	Total quantity anticipated on completion	Rate as per agreement	Rate as executed	Amount as per agreement	Amount as executed	Amount further anticipated	Total Amount anticipated on completion	Difference		Reason for deviation with authority, if any
													Excess	Savings	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

Signature of Engineer in Charge
Date :

Signature of Senior Engineer
Date :

Form WAM 7

BHARAT HEAVY ELECTRICALS LIMITED
DIVISION.....
.....And Final Bill
(Para 4.3.2 of Works Accounts Manual)

Departmental Bill No:
Date:
Name of the Contractor: Division: Sub-Division:
Name of the Work: Date of Written order to commence the work:

Sanctioned Estimate: Date of commencement of the Work:
Contract Agreement/ Work Order No: Dated: Due date of completion as per Agreement:
Date of actual completion of the work:

I. ACCOUNT OF WORK EXECUTED

Adhoc payment for work not previously measured **			Item no. of the agreement / work order	Description of work	Quantity as per agreement	Quantity executed upto date	Rate	Unit	Payment on the basis of actual measurement upto date	Quantity since last running account bill	Payment on t he basis of actual measurement since last running account bill	Remarks
Total as per last running account bill	Since last running account bill	Total upto date										
1	2	3	4	5	6	7	8	9	10	11	12	13

** Whenever there is an entry in column 12 on the basis of actual measurement, the whole of the amount previously paid without detailed measurement should be adjusted by a minus entry in column 2 equivalent to the amount shown in column 1, so that the total upto date in column 3 may become nil.

Total value of work done upto date	(A)	-------
Deduct value of work shown on the last Running Account Bill	(B)	-------
Net value of work done since last Running Account Bill	(C)	-------

Rupees (in words) ..... Only

Form WAM 7 (Contd.)

II. MEMORANDUM OF PAYMENTS

1	Total value of work actually measured as per Account No. I column 10		(A)	----------
2	Deduct amount of payments already made as per last running account bill No. ..... dated		(B)	----------
3	Payment now to be made [(A) - (B)]		(C)	----------
4	Deduct amounts recoverable from the contractor on account of :			
	a) Materials supplied by BHEL vide Annexure A attached	----------		
	b) Hire of tools and plant vide Annexure B attached	----------		
	c) Other charges vide Annexure C attached	----------		
	d) Income Tax	----------		
	Total Deductions			----------
5	Balance			----------
6	Refunds of Security Deposit			----------
7	Net amount to be paid to the contractor			----------

Net value Rupees (in words) ..... Only

I/ We hereby certify that I/We have performed the work as per the terms and conditions of Contract Agreement/Work Order No.....Dated.....for which payment is claimed as above and that I/We have no further claim under this agreement/work order.

Signature of the Contractor

Date:

III CERTIFICATE OF THE ENGINEER IN CHARGE

1. The measurements on which the entries in columns 7 to 11 of Part I of this bill (Account of work executed) are based were made by.....
.....are recorded at pages.....of measurement book No..... (Name and Designation)
2. A statement showing the quantities of stores issued to the contractor (whether free or on recovery basis) and their disposal is attached.

Date:

Signature of Engineer incharge

Designation:

Form WAM 7 (Contd.)

IV CERTIFICATE OF THE SENIOR ENGINEER

1. Certified that I have personally inspected the work and that the work has been physically completed on the due date in accordance with the terms and conditions, schedules, specifications and drawings etc., forming part of the contract agreement, subject to the deviations noted in Deviation Statement (Annexure D).
2. Certified that the measurements have been check measured to the prescribed extent by..... ..... and by the undersigned at site and the relevant entries have been initiated in the measurement book (vide pages.....) (Name and Designation)
3. Certified that the methods of measurement are correct.
4. Certified that the measurements have been technically checked with reference to contract drawings, deviations etc.
5. Certified that the measurements recorded in the measurement book have been correctly billed for at the contract rates or approved rates.
6. Certified that all recoverable amounts in respect of stores, tools and plant, water, electricity charges etc. have been correctly made vide Annexures A to C and that there are no other demands outstanding against the contractor on this contract.
7. Certified that the issues of all stores as per statement attached (whether charged to the contractor or direct to the work) have been technically checked and represent fair and reasonable issues for the items of work executed vide Annexure E.
8. Certified that all statutory requirements including PF, ESI, Minimum wages, Insurance, GST, BOCW, etc. are complied with by the Contractor. This should be duly backed by the relevant documents.

Certified for payment of * Rs.....(Rupees.....only).

***Here specify the net amount payable**

Signature of Senior Engineer

Date

IV ENTRIES TO BE MADE IN THE FINANCE DEPARTMENT

Account code head	Debit (Gross Amount)	Credit (Deductions)
TOTAL		

Passed for.....Rs.....
Less Deductions.....Rs.....
Net Amount Payable.....Rs.....
(Rupees.....only)

Assistant

Date:

Accountant

Date:

Finance Executive

Date:

Form WAM 7 (Contd.)

ANNEXURE A
Part I

Statement showing details of materials issued to the contractor Shri / M/S.....in respect of Contract Agreement / Work Order No.....Dated..... and covered by the agreement.

Sl.No.	Stores Issue Voucher No. and date	Issue voucher No. and date allotted by stores to the SIV	Description of material issued issued to the contractor	Quantity issued	Quantity actually incorporated in the work	Whether recoverable from the contractor or supplied free	If recoverable from t he Contractor				
							Rate at which recoverable	Amount recoverable	Amount recovered upto previous bill	Balance now recovered	Remarks
1	2	3	4	5	6	7	8	9	10	11	12
						Total					

Signature of Contractor
Date:

Signature of Engineer in Charge
Date:

Signature of Senior Engineer
Date:

ANNEXURE A
Part II

Statement showing details of materials issued to the contractor Shri / M/S..... in respect of Contract Agreement / Work Order No.....Dated..... and not covered by the agreement

Sl.No	Stores Issue Voucher No.and Date	Issue Voucher No. and date allotted by stores to the SIV	Description of material issued to the contractor	Quantity issued	Quantity actually incorporated in the work	Issue Rate	Amount recoverable	Amount recovered upto previous bill	Balance now recovered	Remarks
1	2	3	4	5	6	7	8	9	10	11

TOTAL
Add Departmental Charges
Add GST (Wherever applicable)
GRAND TOTAL

Signature of Contractor
Date:

Signature of Engineer-in-Charge
Date:

Signature of Senior Engineer
Date:

Note: Cost of materials recovered in this bill should be shown against item 4 (a) of the memorandum of payments. The amounts of taxes and departmental charges recovered in this bill should be incorporated in Annexure C.

Form WAM 7 (Contd.)

ANNEXURE B

Statement showing tools and plant issued to the contractor Shri /M/S.....in respect of contract Agreement / Work Order No.....Dated.....

Sl.No.	Description of Tools and Plant Issued	Period for which issued	Rate at which recovery is to be made	Amount recoverable	Amount recovered upto previous bill	Balance now recovered	Remarks
1	2	3	4	5	6	7	8
			TOTAL				

Signature of Contractor
Date

Signature of Engineer-in-Charge
Date

Signature of Senior Engineer
Date

ANNEXURE C

Statement showing details of other recoveries to be made from the contractor Shri/M/s..... In respect of Contract Agreement / Work Order No.....Dated.....

Sl.No.	Particulars	Unit	Quantity	Rate	Amount recoverable	Amount recovered upto previous bill	Amount now recovered	Remarks
1	2	3	4	5	6	7	8	9
1	Water charges							
2	Electricity charges							
3	Medical charges							
4	Cost of empty gunny bags and empty containers not returned							
5								
6								
7								
			TOTAL					

Signature of Contractor
Date

Signature of Engineer in Charge
Date

Signature of Senior Engineer
Date

Form WAM 7 (Contd.)

ANNEXURE D

DEVIATION STATEMENT

Name of the Contractor: Contract Agreement/Work Order No.

Name of the Work: Date:

SL. No.	Description of Item	Unit	Quantity as per agreement	Quantity as executed	Rate as per agreement	Rate as executed	Amount as per agreement	Amount as executed	Difference		Reason for the deviation with authority, if any
									Excess	Savings	
1	2	3	4	5	6	7	8	9	10	11	12

Signature of Engineer in Charge Signature of Senior Engineer

Date: Date:

ANNEXURE E

Statement showing the consumption of materials issued to the contractor Shri/M/s…… in respect of Contract Agreement / Work Order No……Dated……

Name of the Work:

ON RECOVERY BASIS

SL. No.	Description of material	Unit	Quantity actually issued	Quantity actually incorporated in the work	Balance	Particulars of disposal of balance	Quantity to be issued as per approved data for work actually done	Variation in consumption (difference between colum 5 & 8)		Rate chargeable for excess/short consumption, if any	Amount Recoverable for excess/short consumption, including materials not returned, if any	Remarks
								More	Less			
1	Cement											
2	Bricks											
3	Wood											
4	Asbestos Sheet											
5	Iron Material											
6												
7												

Signature of Contractor Signature of Engineer in Charge Signature of Senior Engineer

Date: Date: Date:

Note

1. The quantities shown in columns 4 and 5 above should tally with those shown in columns 5 & 6 respectively of Annexure A (Part I and II)
2. Data statement of theoretical consumption should be attached in support of quantity specified in column 8.

Form WAM 7 (Contd.)

ANNEXURE F

Statement showing details of materials issued to the contractor Shri/M/s..... in respect of Contract Agreement / Work Order No.....dated.....

Name of the Work:

FREE OF COST

Sl.No	Stores Issue Voucher No.	Description of material	Unit	Quantity issued	Quantity required as per data	Quantity consumed in the work	Balance (if any)	Nature of disposal for the balance	Rate chargeable for material not returned	Amount recoverable for material not returned	Remarks
1	2	3	4	5	6	7	8	9	10	11	12

Signature of Contractor
Date:

Signature of Engineer in Charge
Date:

Signature of Senior Engineer
Date:

ANNEXURE G

QUESTIONNAIRE TO BE ANSWERED BY THE ENGINEER IN CHARGE AND SENIOR ENGINEER

(Correct particulars and answers to be recorded)

1. Name of the Work:
2. Name of the Contractor:
3. Date of commencement of the Work:
4. Contract agreement /Work Order No. and date:
5. Reference to the supplementary Agreement No. if any:
6. Whether administrative approval and technical sanction has been accorded by the competent authority? If so, cite reference?
7. Whether sanction of the competent authority and financial concurrence of the Finance Department for award of the work has been accorded? If so, cite reference.
8. Whether the work has been completed in time? If not whether penalty has been levied or sanction of the competent authority for extension of time granted and communicated to the Finance Department with reasons for grant of extension? (Due and actual date of completion of the work and reference to letter No. and date granting the extension of time should be given).
9. (a) Whether the rates allowed in the bill have been checked with the contract agreement?

   (b) Whether the rates for extra/supplemental items have been approved by the competent authority and the sanction communicated to the Finance Department together with rate analysis? If so, cite reference
10. Whether deviations have been approved by the competent authority? If yes, give reference to the approval; if not, give reasons.
11. Whether the rates of recovery of stores issued to the contractor which are not provided for in the contract agreement have been settled in consultation with Finance?
12. Whether discrepancies pointed out by the Finance department in the stores statement have been reconciled and accepted by the Finance Department?
13. Whether materials issued to the contractor in excess of the theoretical requirements have been returned to the Stores department and the No. and date of such returned stores vouchers have been shown in Stores statement? If not, whether the cost of such excess materials has been recovered at the prescribed rate? Whether consumption statements in respect of materials chargeable to the work have been attached to the bill?
14. Whether consumption of materials shown has been technically checked by Senior Engineer?
15. Whether materials issued and used in the work is not less than that required for consumption in work according to our specifications? If consumption is less, whether necessary recovery has been made in the bill?
16. Whether measurements have been checked by the Engineer and Senior Engineer to the extent required and certificates of check recorded in the measurement books?
17. Whether contractor has signed the bill and the measurement books without reservations? If not, whether reasons have been intimated to the Finance Department?
18. Whether arithmetical calculations have been checked and certificate recorded in the measurement books by a person other than the one who calculated initially?
19. Whether any work was done at the risk and cost of the contractor and whether such cost has been recovered from him? Give particulars.
20. Whether all advance payments on running accounts have been recovered?
21. Whether all the recoveries due for services given to the contractor like rent of accommodation, water charges, electricity charges have been recovered and whether payments made by the company on behalf of the contractor have been adjusted?
22. Whether the files containing abstracts from measurement books/standard measurement books have been completed/updated?
23. Whether hire charges for tools & plant have been recovered and the statement of hire charges with full details attached?
24. Whether the certificate of workmanship and completion of work according to specifications, drawings etc. is recorded by Engineer Incharge/Senior Engineer and whether recoveries have been made for defective works, if any?
25. Whether all corrections in the bill/measurement books etc. have been neatly made and attested and there are no overwriting?
26. Whether final measurements have been taken as soon as possible after completion of the work and the certificate of completion issued? If not, whether reasons for delay have been recorded and communicated to finance department?
27. In respect of quantities reduced in the final bill as compared to the running payment, whether adequate reasons have been recorded and communicated to finance department?
28. Whether the expenditure has been classified correctly according to heads of account recorded in the sanctioned estimate?
29. Whether the work has been completed within the estimated cost? If not, what is the percentage of excess over the sanctioned estimate/ administrative approval? In case the excess is beyond the competency of the Senior Engineer, what action has been taken for obtaining the approval of the authority competent to sanction the excess?
30. (a) If the contractor has furnished bank guarantee in lieu of cash security deposit towards proper execution of works and guarantee against defects during the maintenance period, whether the period of currency of the bank guarantee covers the entire maintenance period?

    (b) If not whether security deposit has been proposed to be recovered from the final bill?
31. Whether all the previous audit objections raised on running account bills have been settled? If so, cite references.

Signature of Engineer in Charge
Date:

Signature of Senior Engineer
Date:

ANNEXURE TO CONDITIONS OF CONTRACT FOR ETC WORKS

The following terms and conditions shall form a part of the tender document. If any discrepancies found between below mentioned clauses and clauses in the Conditions of Contract for Erection Works, DOC. NO. – TB-ETC-GCC, REV.-02, dated 20th JUNE, 2005, the clauses mentioned in this annexure shall prevail.

A. Condition of Contract for Erection works (DOC. NO. – TB-ETC-GCC, REV.-02, 20th June, 2005):

A. 1.0: GENERAL INSTRUCTION

1.1 **All pages of the tender documents shall be duly signed, stamped and submitted along with the offer in token of complete acceptance thereof.** The information furnished shall be complete by itself. The tenderer is required to furnish all the details and other documents as required in the following pages.

1.2. Tenderers are advised to study all the tender documents carefully. Any submission of tender by the tenderer shall be deemed to have been done after careful study and examination of the tender documents and with the full understanding of the implications thereof. Should the tenderers have any doubt about the meaning of any portion of the Tender Specification or find discrepancies or omissions in the drawings or the tender documents issued are incomplete or shall require clarification on any of the technical aspect, the scope of work etc., tenderer shall at once, contact the authority inviting the tender well in time (so as not to affect last date of submission) for clarification before the submission of the tender. Tenderer's request for clarifications shall be with reference to Sections and Clause numbers given in the tender documents. The specifications and terms and conditions shall be deemed to have been accepted by the tenderer in his offer. Non-compliance with any of the requirements and instructions of the tender enquiry may result in the rejection of the tender.

A.2.0 PROCEDURE FOR SUBMISSION OF SEALED TENDERS

A.2.1 Bidders may please refer Cl no. 2 to Cl no. 4 of the Notice inviting tender.

A.2.2 The tenders received after the specified time of their submission shall be treated as 'Late Tenders' and shall not be considered under any circumstances.

A.2.3 Tenders shall be opened by the officers concerned of BHEL at the time, date and venue as specified in the tender enquiry. Tenderer or their authorized representative may witness the bid opening.

A.2.4 The tenderer shall closely pursue all the clauses, specifications and drawings indicated in the Tender Documents before quoting. Should the tenderer have any doubt about the meaning of any portion of the Tender Specifications or find discrepancies/omission in the drawings or the tender documents issued are incomplete or shall require clarification on any of the technical aspect, scope of work etc. he shall at once contact the authority inviting the tender for clarification before the submission of the tender.

A.2.5 Before submission of offer, the tenderers are advised to inspect the work & the environments and be well acquainted with the actual working and other prevalent conditions, facilities available, sourcing of material and labour, means of transport and access to site, accommodation, etc. No claim will be entertained later on the grounds of lack of knowledge on any of these conditions/ resources.

A.2.6 Tenderer must fill up all the schedules and furnish all the required information as per the instructions given in various sections of the tender specification. Each and every page of the Tender Specification must be SIGNED AND SUBMITTED ALONG WITH THE OFFER by the Tenderer in token of complete acceptance thereof the information furnished shall be complete by itself.

A.2.7 The tenderer shall quote the rates in English Language and international numerals. Total price offered should be entered in figures as well as in words. For the purpose of the tender, the metric system of units shall be used.

A.2.8 T**he tenderer shall quote a percentage above/ below/At Par the rates shown in the "Bill of Quantities Cum Price Schedule (Annexure-I)" of subject tender.**

A.2.9 **The quoted percentage will apply to the individual items of "Annexure-I i.e Bill of Quantity Cum Price Schedule" uniformly.**

A.2.10 All entries in the tender shall either be typed or be written legibly in ink. Erasing and overwriting are not permitted and may render such tender liable for rejection. All cancellations and insertions shall be duly attested by the tenderer.

A.2.11 The tenderer must provide the registered e-mail of their registered office along with the addresses and authorised phone/mobile nos.

A.3.0 <u>ADJUSTMENT PRICE DISCREPANCY (IES): - Not Applicable being e procurement.</u>

A.4.0 <u>EVALUATION OF TECHNICAL BIDS</u>

4.1 Technical Bids submitted by the tenderer will be opened first and evaluated for fulfilling the Pre-Qualification criteria and other conditions in NIT/Tender documents, based on documentary evidences submitted along with the offer.

4.2 In case the same qualifying experience is claimed by more than one bidder due to subletting of work by main contractor to subcontractor (s) then following conditions shall be applicable.

a) For labour + consumable contract without material and T&P:
Benefit of work experience shall be given to the subcontractor who has actually executed job and not to the contractor offloaded down the line.

b) For contract with complete scope i.e. with materials, T&P, labour and consumable:

i) Benefit of work experience shall be given to the subcontractor who has actually executed job and not to the contractor offloaded down the line.

ii) If the contractor offloads the labour and/or T&P portion only, benefit of work experience shall be given to the main contractor and not to the subcontractor who has executed only as labour supply contractor

The bidder's qualification shall be subject to submission of documentary proof. BHEL reserves the right to ask for further proofs including submission of TDS certificates/ for the said job

4.3 In case the qualifying experience is claimed by private organizations based on Work

Order and completion certificates from another private organization, BHEL reserves the right to ask for further proofs including submission of TDS certificates/ form 26AS /bills for the said job.

4.4 Credentials of all the bidders participating in open tender will be scrutinized thoroughly by the nominated committee w.r.t. the pre-qualifying requirement for the tender.

4.5 Details of qualifying work(s) executed by the bidder will be forwarded to the principle employer for verification of the work with respect to completion, commencement & completion date, scope and value of the work executed. Performance feedback of the bidder will also be sought from the principle employer.

4.6 BHEL may conduct onsite verification of at least one of the qualifying works to verify completion of the work and evaluate capability and performance of the bidder.

4.7 The bidder representative may be called for the discussion with the committee. His originals may be verified by the committee. In addition to above their organization chart and detailed list of manpower, tools & plants and technical capability may be discussed and ascertained by the committee.

5.0 **EVALUATION OF PRICE BIDS**

5.1 Price Bids of unqualified bidders shall not be opened.

5.2 The offers will be evaluated on the basis of total price basis (refer "BILL OF QUANTITY AND PRICE SCHEDULE) as shown in the price bid.

5.3 Reasons for rejection of the bid shall be intimated in due course after issue of LOI/LOA to successful bidder and receipt of unconditional acceptance of LOI /LOA from the successful bidder

5.4 In case of electronic Reverse Auction, the unqualified bidders shall not be allowed to participate in reverse auction.

A.6.0 DOCUMENTS TO BE ENCLOSED:

Full information shall be given by the tenderer in respect of the following.

6.1 Tenders shall be signed by persons duly authorized/empowered to do so. An attested copy of the Power of Attorney to be submitted in all cases except where the sole proprietor is the signatory to the tender documents

6.2 *PERMANENT ACCOUNT NUMBER:*

Certified copies of Permanent Account Numbers as allotted by Income Tax Department for the Company / Firm / Individual Partners, etc. shall be furnished along with tender.

6.3 AUDITED *BALANCE SHEET AND INCOME TAX RETURN*:

Copy of Audited Balance sheets and income tax return for last three financial years (financial years as specified in PQR)

6.4 *SOLVENCY CERTIFICATE:*

If asked in NIT, bidder should submit solvency certificate (not older than 12 months from date of tender notification) issued by any scheduled bank.

6.5 *DOCUMENT RELATED TO INCORPORATION OF BUSINESS ENTITY:*

6.5.1 *IN CASE OF INDIVIDUALTENDERER:*
His/her full name, address and place & nature of business.

6.5.2 *IN CASE OF PARTNERSHIP FIRMS:*
The names of all the partners with address. A copy of the partnership deed/instrument of partnership duly certified by the Notary shall be enclosed.

6.5.3 *IN CASE OF COMPANIES:*
Date & place of registration including date of commencement certificate in case of Public Companies and the nature of business carried on by the company. Certified copies of Memorandum and Articles of Association are also to be furnished.

6.6 Offer forwarding letter over the letterhead

6.7 *Declaration sheets (As per Prescribed format) over the letter head*

6.8 *No Deviation certificates (As per Prescribed format) over the letterhead*

6.9 GST Registration certificate

All the data required to be enclosed with the tender need to be furnished neatly typed, signed & stamped in the given formats only (in the form of separate sheets) failing which the tender may be considered as incomplete and is liable for rejection. Documentary proof wherever necessary also need to be enclosed.

A.7.0 VALIDITY OF OFFER

The rates in the Tender shall be kept valid for acceptance for a minimum period of **Four Months** from latest due date of offer submission (including extension(s), if any). In case BHEL (Bharat Heavy Electricals Limited) calls for negotiations, such negotiations shall not amount to cancellation or withdrawal of the original offer which shall be binding on the tenderer.

A.8.0 REJECTION OF TENDER & OTHER CONDITIONS:

8.1 The decision of acceptance of tender will rest with BHEL which does not bind itself to accept the lowest tender or any tender and reserves to itself full rights for the following without assigning any reasons whatsoever:

(a) To reject any or all of the tenders.

(b) To split up the work amongst two or more Tenderer as per NIT

(c) To award the work in part as per NIT

(d) In either of the contingencies stated in (b) and (c) above to modify the time for completion suitably.

8.2 Conditional tenders, unsolicited tenders, containing abnormally low/ unworkable rates & amounts, tenders which are incomplete or not in the form specified or defective or have been materially altered or not in accordance with the tender conditions, specifications etc. are liable to be rejected.

8.3. Tenders are liable to be rejected in case of unsatisfactory performance of the tenderer with BHEL, or tenderer under suspension (hold / banning / delisted) by any unit / region / division of BHEL or tenderers who do not comply with the latest guidelines of Ministry / Commissions of Govt. of India. BHEL reserves the right to reject a bidder in case it is

observed that they are overloaded and may not be in a position to execute this job as per the required schedule in line with 'NIT'. The decision of BHEL will be final in this regard.

8.4 In case of any adverse information is received concerning performance, capability or conduct of the tenderer after issue of tender enquiry or opening of tender or award of work, BHEL reserves the right to reject the offer at any stage as deemed fit.

8.5 Offers with inadequate Tools & Plants, Manpower Deployment Plan, and Method Statement are liable for rejection.

8.6 If a tenderer who is a proprietor expires after the submission of his tender or after the acceptance of his tender, BHEL may at its discretion, cancel such tender. If a partner of a firm expires after the submission of the tender or after the acceptance of the tender, BHEL may cancel such tender at its discretion unless the firm retains its character.

8.7 BHEL will not be bound by any Power of Attorney granted by the tenderer or by changes in the composition of the firm made subsequent to the execution of the contract. BHEL may, however, recognise such Power of Attorney and changes after obtaining proper legal advice, the cost of which will be chargeable to the contractor concerned.

8.8 If the tenderer deliberately gives wrong information in his tender, BHEL reserves the right to reject such tender at any stage or to cancel the contract, if awarded, and forfeit the Earnest Money/Security Deposit/any other moneys due.

8.9 Canvassing in any form in connection with the tender is strictly prohibited and the tenders submitted by the tenderer who resorts to canvassing are liable to be rejected.

8.10 In case the Proprietor, Partner or Director of the Company / Firm submitting the Tender, has any relative or relation employed in BHEL, the authority inviting tender shall be informed to the fact as per specified format along with the offer, failing this, BHEL may, at its sole discretion reject the tender or cancel the contract and forfeit the Earnest Money/ Security Deposit.

8.11 The successful tenderer should not sub-contract the part or complete work detailed in the tender specifications without written permission of BHEL's Site In charge/ Sector Head. For this the contractor shall submit request application to site in charge supported by credentials (financial and technical) and resource mobilisation schedule of such sub-contractor. Such request is to be considered in consultation with end user/ultimate customer (if applicable) and subject to satisfactory credentials, fund flow arrangement between them, HSE and other contractual and statutory obligations. The tenderer is solely responsible to BHEL for the work awarded to him.

8.12 The Tender submitted by a tenderer shall become the property of BHEL who shall be under no obligation to return the same to the bidder. However unopened price bids and late tenders shall be returned to the bidders.

8.13 unsolicited discount received after the due date and time of Bid Submission shall not be considered for evaluation. However, if the party who has submitted the unsolicited discount/rebate becomes the L-I party, then the awarded price i.e contract value shall be worked out after considering the discount so offered.

8.14 BHEL shall not be liable for any expenses incurred by the bidder in the preparation of the tender irrespective of whether the tender is accepted or not.

A.9.0 NO DEVIATIONS ARE ACCEPTABLE: -

Offers with deviations are likely to be rejected. However, if the bidder insists on any technical or commercial deviations from the specifications and / or tender conditions, **the price implication, if any, of withdrawing the deviations must be submitted along with the price bid in a separate sealed envelope** super-scribed "**PRICE IMPLICATION FOR WITHDRAWAL OF DEVIATIONS**". No price implication for withdrawal of deviation shall be accepted at a later date, after opening of technical bid.

A.10.0 Consortium**/** JV bidding is not allowed under this NIT.

B. EARNEST MONEY DEPOSIT

Every tender must be accompanied by the prescribed amount of Earnest Money Deposit (EMD) mentioned in NIT.

1. Mode of EMD deposit:

Every tender must be accompanied by the prescribed amount of Earnest Money Deposit (EMD) mentioned in NIT.

Mode of EMD deposit:

EMD can be submitted in any one of the following modes:

i) Cash deposit as permissible under the extant Income Tax Act (before tender opening),

ii) Electronic Fund Transfer credited in BHEL account (before tender opening). Details of BHEL account mentioned in tender document.

iii) Banker's cheque/Pay order/Demand Draft, in favour of 'BHEL' and payable at New Delhi (Along with offer)

iv) Fixed Deposit Receipt (FDR) issued by schedule Banks/Public Finance Institutions as defined in the companies ACT (FDR should be in the name of the contractor, a/c BHEL)

v) Insurance Surety Bonds

No other form of EMD remittance shall be acceptable to BHEL.

Note: The Submission of EMD is compulsory for subject tender. In case requisite Amount of EMD not submitted by the bidder along with offer or before technical bid opening, the offer shall not be considered for evaluation and the offer shall be rejected.

2. **Forfeiture of EMD**

EMD by the bidder will be forfeited as per NIT conditions, if

i) After opening the tender and within the offer validity period, the bidder revokes his tender or makes any modification in his tender which is not acceptable to BHEL.

ii) The contractor fails to deposit the required Security deposit or commence the work within the period as per LOI/contract.

3. EMD by the tenderer shall be withheld in case any action on the tenderer is envisaged under the provision of extant "Guidelines on Suspension of business dealing with

Supplier/contractors" and forfeited/ released based on the action as determined under these guidelines.

4. In the case of unsuccessful bidders, the Earnest Money will be refunded to them within a reasonable time after award of work.

5. EMD shall not carry any interest.

6. EMD of successful bidder shall be retained as part of Security Deposit.

7. Bidders may please note that "One Time EMD" provision stands deleted. Hence, bidders who have deposited Rs. 2 Lakh as 'One Time EMD' with BHEL are also required to submit the requisite amount of EMD.

8. **No MSE benefits shall be given to MSEs bidder for WORKS CONTRACT. Please refer clause no. O (facilities provided to MSEs) for detail.**

C. SECURITY DEPOSIT

Security Deposit means the security provided by the Contractor towards fulfilment of any obligations in terms of the provision of the contract.

1. Upon acceptance of Tender, the successful Tenderer should deposit the required amount of Security Deposit for satisfactory completion of work. **The total amount of Security Deposit will be 5% of the Contract Value. EMD of the successful tenderer shall be converted and adjusted towards the required amount of Security Deposit.**

2. Mode of Security deposit:
The security Deposit should be furnished **before start of the work** by the contractor.

"Bidders agrees to submit performance security required for execution of the contract within the time period mentioned. In case of delay in submission of Performance security, enhanced performance security which would include interest (Repo rate + 4%) for the delayed period, shall be submitted by the bidder.

Further, if performance security is not submitted till such time the first bill becomes due, the amount of performance security due shall be recovered as per terms defined in NIT / Contract, from the bills along with due interest".

The balance amount to make up the required Security Deposit of 5% of the contract Value may be furnished in any of the following forms:

i) Cash (as permissible under the extant Income Tax Act)

ii) Local cheques of scheduled banks (subject to realization) / Pay Order / Demand Draft / Electronic Fund Transfer, in favour of BHEL.

iii) Bank Guarantee from Scheduled Banks / Public Financial Institutions as defined in the Companies Act. The Bank Guarantee format for Security Deposit shall be in the prescribed formats enclosed with general conditions of contract.

iv) Fixed Deposit Receipt issued by Scheduled Banks / Public Financial Institutions as defined in the Companies Act. The FDR should be in the name of the contractor, A/C BHEL and duly discharged on the back.

v) Securities available from Indian Post Offices such as National Savings Certificates, Kisan Vikas Patras etc. (Certificates should be held in the name of Contractor furnishing the

security and duly endorsed/hypothecated/pledged, as applicable, in favour of BHEL and duly discharged on the back).

vi) Insurance Surety Bonds.

(NOTE: BHEL will not be liable or responsible in any manner for the collection of interest or renewal of the documents or in any other matter connected therewith)

3. **Submission of Security Deposit:**

   i) At least 50 % of the required Security Deposit, including the EMD, shall be submitted before start of work. Balance of the Security Deposit can be submitted by way of deduction of 10% of the gross amount progressively from each running bills of the contractor till the total amount of the required Security Deposit is collected.

   ii) In case of delay in submission of performance security, enhanced performance security which would include interest (Repo rate + 4%) for the delayed period, shall be submitted by the bidder.

   iii) If the value of work done at any time exceeds the contract value, the amount of Security Deposit shall be correspondingly enhanced and the additional Security Deposit shall be immediately deposited by the Contractor or it shall be recovered from payment/s due to the Contractor.

   iv) The recoveries made from running bills (cash deduction towards balance SD amount) can be released against submission of equivalent Bank Guarantee in acceptable form, but only once, before completion of work, at the discretion of BHEL.

4. The BG shall be submitted only through the Banker. Along with the BG, the Bank shall also furnish a letter of confirmation (in the prescribed formats enclosed with general conditions of contract).

5. The validity of the Bank Guarantee furnished towards Security Deposit shall be up to three months more than the period of completion of work as stipulated in the LOI and the same will be kept valid by proper renewal till the completion of the work.

6. BHEL reserves the right of forfeiture of Security Deposit in addition to other claims and penalties in the event of the contractor's failure to fulfil any of the contractual obligations or in the event of termination of contract as per terms and conditions of the contract. BHEL reserves the right to set off the Security Deposit, against any claims of any other contracts with BHEL.

7. **Conditions for acceptance of bank guarantees**

   Contractors are advice to obtain Bank Guarantee preferably from any of the following BHEL consortium banks

Sl. No.	Name of Bank	Sl. No.	Name of Bank
1	State Bank of India	11	Punjab National Bank
2	Canara Bank	12	Union Bank of India
3	IDBI Bank Limited	13	Yes Bank Limited
4	ICICI Bank Limited	14	RBL Bank Ltd.
5	HDFC Bank Limited	15	Standard Chartered Bank
6	Axis Bank	16	Indian Overseas Bank
7	IndusInd Bank Limited	17	Kotak Mahindra Bank Limited
8	Bank of Baroda	18	Federal Bank Limited
9	Exim Bank	19	Hongkong and Shanghai Banking Corporation Ltd
10	Indian Bank		

Bank Guarantees from Banks outside BHEL's consortium shall be as below:

The Bank Guarantees of all Public sector banks can be accepted (in addition to consortium banks)

The Bank Guarantees of Co-operative banks shall not be accepted.

Bank Guarantees of other than consortium bank and public sector bank can be accepted subject to an overall exposure limit (at New Delhi) of Rs. 10 crores for banks with net worth of more than Rs. 500 crores as on last balance sheet date and Rs 5 crores for banks with net worth between Rs. 350 to Rs 500 crores (A certificate and copy of latest Balance Sheet to be given by the Bank at the time of submission of Bank Guarantees).

In case of private sector banks, a clause to be incorporated in the text of Bank Guarantee that it can be enforceable by being presented at any branch of the bank.

In case of foreign vendors, the bank guarantees issued by foreign banks may be confirmed by our consortium bank in India.

In case of Bank Guarantees given by Non-Consortium banks (Private sector or Public sector), the Bank Guarantees are to be enforceable in New Delhi or the town/ city in which the sector office is located.

8. RETURN OF SECURITY DEPOSIT:

If the contractor duly performs and completes the work in all respects to the entire satisfaction of BHEL and presents an absolute "No demand certificate", returns properties belonging to BHEL, taken, borrowed or hired by him for carrying out the said works, and furnishes performance bond BG in the prescribed proforma, Security Deposit will be released to the contractor after deducting all costs, expenses and other amounts that are to be paid to BHEL under this contract or other contracts entered into with the contractor.

It may be noted that in no case the Security Deposit shall be refunded/released prior to passing of final bill.

D. Bank Account Details for submission of EMD/ Security Deposit through electronic fund transfer mode.

NAME OF THE COMPANY	**BHARAT HEAVY ELECTRICALS LTD**
ADDRESS OF THE COMPANY	**TRANSMISSION BUSINESS GROUP,** **PLOT NO. *25*, SECTOR- 16A, NOIDA – 201301 (U.P.)**
NAME OF BANK	**STATE BANK OF INDIA**
NAME OF BANK BRANCH	**CAG-II NEW DELHI (17313)**
CITY	**NEW DELHI**
ACCOUNT NUMBER	**00000030206227732**
ACCOUNT TYPE	**CASH CREDIT**
IFSC CODE	**SBIN0017313**

E. <u>Payment terms:</u> Clause No. C.2.0 stands deleted. Now this clause shall be read as below.

(**Description of work in this section is made for payment purpose only and the scope is not limited to the activities mentioned below. Please refer technical documents for complete scope of work)**

1. No Mobilization Advance shall be paid.

2. **<u>For BOQ items – 1-18 (Complete scope of work)</u>**

2.1. 10% of the contract item price on the monthly progressive bills on pro rata basis for receipt, material including arranging crane for unloading, maintaining proper records of receipt & storage in Field Quality Plans (FQPs) and as certified by BHEL Engineer.

2.2. 60% of the contract item price on the monthly progressive bills on pro rata basis after arranging necessary calibrated tools/tackles required for erection, submitting calibration reports, qualification/experience certificates of welder/Electrician/other staff, levelling, alignment, tightening and completion of erection including maintaining proper records of installation in FQPs and as certified by BHEL, Engineer.

2.3. 10% of the contract item price on the monthly progressive bills on pro rata basis on arranging calibrated testing equipment, submission of calibration reports, testing of equipment including maintaining proper records of testing in FQPs and as certified by BHEL, Engineer. BOQ items, which are not required to be tested as per FQP, shall be qualified for release of payment on prorate basis after completion of testing of all equipment's of corresponding bay (As per SLD/ layout).

2.4. 10% of the contract item price after completion of satisfactory commissioning and submission of complete records of erection/testing/commissioning /charging protocol as per FQPs for the corresponding bay.

2.5. Last 10% of the contract item price after all test reports as per contract are jointly witnessed and signed by BHEL/customer, "As Built" changes are incorporated in relevant drawings, material reconciliation and substation is handed over to the Owner / Customer. If the contract is for more than one sub-station, then the same will be released after successful handing over of each sub-station. If for any reason, the handing over is delayed for reasons beyond the control of the contractor, in such case this payment will be released against commissioning certificate issued by the BHEL / customer and against submission of final bill of individual substation.

3. **For BOQ item: - 19 (Watch & Ward)**

3.1. 100% of the contract item price on the monthly progressive bills on pro rata basis towards watch & ward against submission of invoice and on certification of engineer in-charge of BHEL.

F. **Overall Quantity variation**-

The individual quantity can vary to any extent or may be deleted for which no compensation will be payable to the contractor and **the rates will remain firm**. Also, the rate of each item remains firm as long as the variation in the total value of work executed under the contract including extra items if any remains within plus/minus 30 percent of the contract value. In case the actual value of executed work including extra work on completion of work becomes less than 70% of the basic/original contract value than the following method shall be adopted.

The actual executed value shall be raised by 7 % (For arriving at the final payment against work executed) subject to the condition that total value of work executed plus increase by 7% as above shall be limited to 70% of the basic/original contract value. The rate quoted shall be firm irrespective of any upward variation in the contract price.

G. **OVER RUN COMPENSATION:**

Not applicable

H. **Clause No. C.30.0 "INCOME TAX/SALES TAX/WORKS TAX/VAT" stands deleted. Now this clause shall be read as below.**

I. All taxes (except GST), duties, charges, royalties, cess and any other levies by Central/ State/local authorities for the execution of the contract shall be borne by the contractor and shall not be payable extra. Any increase of the same at any stage during execution of the contract shall be borne by the contractor. Quoted price of the same shall be inclusive of all such requirements.

II. GST along with Cess (as applicable) legally leviable & payable by successful bidder as per GST Law shall be paid by BHEL, extra. Hence, bidder shall not include GST along with Cess (as applicable) in their quoted rates/ price.

III. Contractors have to make their own arrangement at their cost for completing the formalities, if required with relevant taxation authorities, for bringing their material, plant and machinery at site for the execution of the contract. Road permits / way bill, if required shall be arranged by the contractor.

Contractor shall furnish proof of GST registration with GSTN Portal covering the services under this contract. Registration should also bear endorsement for the premises from where the billing shall be done by contractor on BHEL for this project / work. However, in case contractor submits GST Registration of a state other than the state wherein the site is located, then contractor has to submit an undertaking that contractor is not liable to take registration in the state wherein the site is located as per the provision of Place of Supply under CGST/SGST/IGST Act.
BHEL will not be held responsible for any non-compliance of the Contractor in respect of GST laws as framed from time to time.

IV. Contractor shall comply with all statutory amendment/notifications in this respect

V. Contractor shall submit the tax invoice complying with GST Invoice Rules (Section 31 of GST Act & Rules referred thereunder). In case of raising any Supplementary Tax Invoice (Debit / Credit Note), contractor shall issue the same containing all the details as referred in Section 34 read with Section 31 of GST Act & Rules referred there under.
Contractor shall comply with the Time Limit prescribed under the GST Law and rules thereof for raising the Tax Invoice

VI. Goods and Service Tax (GST) will be reimbursed to the Contractor subject to the following conditions: -

a. Submission of valid GST Compliant Tax Invoice as per the GST Invoice Rules.

b. The Invoice raised by the Contractor should indicate the BHEL GST Registration Number.

c. Contractor shall upload the invoices raised on BHEL in IFF/GSTR-1 within the prescribed time as given in the GST Act

d. Invoice raised and uploaded in IFF/GSTR-1 by the Contractor should be available to BHEL in FORM GSTR-2B electronically through the common portal

e. Confirmation of payment of such GST to the Government through filing of GSTR-3B of corresponding month/quarter

VII The GST amount should get reflected within prescribed time limit in the GSTN for BHEL to avail the input credit. If the GST Credit is reversed/ denied/ delayed to BHEL due to non-receipt/delayed receipt of Services and/or tax invoice or due to expiry of timeline prescribed in GST law or due to any other factor for availing such Input Tax Credit (ITC) or for any other reason arising out of the act directly attributable to the Contractor, GST amount shall be recoverable from Contractor from any dues payable to the Contractor along with any interest levied/ leviable on BHEL.

VIII Statutory variation, if any, on account of GST will be payable by BHEL at actuals on submission of documentary evidence.

IX TDS under Income Tax Act/ GST Act shall be deducted as per applicable rates unless Exemption certificate, if applicable, from the appropriate Authority is furnished to BHEL along with the Invoice.

X **New Taxes & duties (Introduced after tender opening date):**

If any new tax or duty is levied by the Central/State Government/Municipality/Local Authority and becomes directly applicable on items specified in the Bill of Quantities, full reimbursement shall be made subject to submission of documentation as per statute.

I. <u>BOCW (TAXES, DUTIES & LEVIES):</u>

BUILDING & OTHER CONSTRUCTION WORKERS (REGULATION OF EMPLOYMENT AND CONDITIONS OF SERVICE) ACT, 1996 (BOCW Act) AND RULES OF 1998 READ WITH BUILDING & OTHER CONSTRUCTION WORKERS CESS Act, 1996 & CESS RULES, 1998.

1. In case any portion of work involves execution through building or construction workers, then compliance to the above titled Acts shall be ensured by the contractor and contractor shall obtain license and deposit the cess under the Act. In the circumstances it may be ensured as under: -

1.1. It shall be the sole responsibility of the contractor in the capacity of employer to forthwith (within a period of 15 days from the award of work) apply for a licence to the Competent Authority under the BOCW Act and obtain proper certificate thereof by specifying the scope of its work. It shall also be responsibility of the contractor to furnish a copy of such certificate of licence / permission to BHEL within a period of one month from the date of award of contract.

1.2. It shall be the sole responsibility of the contractor as employer to ensure compliance of all the statutory obligations under these act and rules including that of payment / deposit of 1% cess on gross payment made for value of work involving building or construction workers engaged by the contractor within a period of one month from the receipt of payment.

1.3. It shall be the responsibility of the sub-contractor to furnish the receipts / challans towards deposit of the cess together with the number, name and other details of beneficiaries (building workers) engaged by the sub-contractor during the preceding month.

1.4. It shall be the absolute responsibility of the sub-contractor to make payment of all statutory payments & compensations to its workers including that is provided under the Workmen's Compensation Act, 1923.

1.5. The contractor shall, however ensure before deposit of any BOCW cess, that customer is not depositing the same in order to avoid excess deposit of cess.

1.6. The contractor shall bear cost of BOCW cess either by way of deposit or through recovery by BHEL in case the same is deposited by the customer.

1.7. In case of failure in above mentioned compliances, BOCW Cess @ 1% as well as applicable penalty as specified in BOCW Act/Rules shall be deducted from the contractor

J. DELAY AND EXTENSION OF TIME:

1. If, in the opinion of the Engineer, the work is delayed:

(i) by reason of abnormally bad weather, or

(ii) by reason of serious loss or damage by fire, or

(iii) by reason of civil commotion, local combination of workmen, strike or lockout, affecting any of the trades employed on the work, or

(iv) by delay on the part of the agency or tradesman engaged by the BHEL in executing work not forming part of the contract, or

(v) By reason of any other cause which in the absolute discretion of the Engineer is beyond the contractor's control, then in any such case, the Engineer (or higher authority) may make fair and reasonable extension in the completion dates of the individual items of work of the contract as whole. Such extension which will be communicated to the contractor by the Engineer in writing shall be final and binding on the contractor. No other claim in this respect for compensation, idle labour or otherwise howsoever is admissible. Upon the happening of any such event causing delay the contractor shall immediately give notice thereof in writing to the Engineer but shall nevertheless use constantly his best endeavour to prevent or make good the delay and shall do all that may reasonably be required to the satisfaction of the Engineer to proceed with the work.

2. In case of delay in completion of work BHEL reserve the right to grant time extension under the following options depending upon the performance of the vendor:

a) Time extension without levy of LD in case it is found that delay is not attributable to the vendor

b) Time extension with deduction of applicable LD in line with Liquidity Damage clause if the delay is solely attributable to the vendor.

c) In case facts of delay is not settled, BHEL reserve the right to grant provisional time extension for delay in completion of total work or part thereof and running/ interim payments to the vendor will be released without deduction of LD subject to submission of additional Bank guarantee equivalent to maximum LD amount valid till completion of work under their scope and grant of final time extension.

During provisional time extension period ORC/ PVC shall not be payable to the contractor. The Final Delay analysis shall be prepared on completion of the work. In case of delay is not attributable to contractor as per final delay analysis the ORC/ PVC shall be released along with the final bill without any interest charges attributable to BHEL.

In case of delay attributable to contractor, LD shall be deducted for that period in line with clause "Compensation/ LD/ Penalty for delay in execution" of conditions of contract and balance ORC/ PVC (if any) shall be released along with the final bill without any interest charges attributable to BHEL.

K. LD / PENALTY FOR DELAY IN EXECUTION:

The Clause No. C.5.0 "LD / Penalty for delay in execution" of Conditions of contract for ETC works stands deleted. Now the modified clause shall be read as below:

In case the contractor fails to complete the project within the time specified in the tender specification or any extension thereof subject to force majeure condition, the contractor shall be liable to pay by way of LD/Penalty a sum equal to the half percent of the contract price, per calendar week or part thereof by which the commissioning of the project is delayed, subject to

ceiling of 10 % of the contract price. Once the maximum limit of delay is reached (i.e. 20 week of delay) BHEL may consider termination of the contract and forfeit the Security deposit without prejudice to the other remedies under the contract.

Amended/ revised contract value (excluding Extra Works, Supplementary /Additional Items) shall be considered for calculating LD/ penalty.

L. RIGHTS OF BHEL: - The Clause No. B.7.0 "RIGHTS of BHEL" of Conditions of contract for ETC works stands deleted. Now the modified clause shall be read as below: -

BHEL reserves the following rights in respect of this contract during the original contract period or its extensions if any, as per the provisions of the contract, without entitling the contractor for any Compensation

1. To withdraw any portion of work and/or to restrict/alter quantum of work as indicated in the contract during the progress of work and get it done through other agencies to suit BHEL's commitment to its customer or in case BHEL decides to advance the date of completion due to other emergent reasons/ BHEL's obligation to its customer.
   In case of inadequate manpower deployed by the contractor, BHEL reserves the right to deploy additional manpower through any other agency for expediting activities in the interest of the project. Supplied manpower shall be put on job by the contractor and payments and other statutory compliances related to manpower shall be the contractor's responsibility. In case of contractor's failure to fulfil his obligations in respect of such manpower, BHEL reserves the right to take necessary action as per contract conditions.

2. Breach of Contract, Remedies and Termination

2.1. The following shall amount to breach of contract:

I. Non-supply of material/ non-completion of work by the Supplier/Vendor within scheduled delivery/ completion period as per contract or as extended from time to time.

II. The Supplier/Vendor fails to perform as per the activity schedule and there are sufficient reasons even before expiry of the delivery/ completion period to justify that supplies shall be inordinately delayed beyond contractual delivery/ completion period.

III. The Supplier/Vendor delivers equipment/ material not of the contracted quality.

IV. The Supplier/Vendor fails to replace the defective equipment/ material/ component as per guarantee clause.

V. Withdrawal from or abandonment of the work by the Supplier/Vendor before completion as per contract.

VI. Assignment, transfer, subletting of Contract by the Supplier/Vendor without BHEL's written permission resulting in termination of Contract or part thereof by BHEL.

VII. Non-compliance to any contractual condition or any other default attributable to Supplier/Vendor.

VIII. Any other reason(s) attributable to Vendor towards failure of performance of contract. In case of breach of contract, BHEL shall have the right to terminate the Purchase Order/ Contract either in whole or in part thereof without any compensation to the Supplier/Vendor.

IX. Any of the declarations furnished by the contractor at the time of bidding and/ or entering into the contract for supply are found untruthful and such declarations were of a nature that could have resulted in non-award of contract to the contractor or could expose BHEL and/ or Owner to adverse consequences, financial or otherwise.

X. Supplier/Vendor is convicted of any offence involving corrupt business practices, antinational activities or any such offence that compromises the business ethics of BHEL, in violation of the Integrity Pact entered into with BHEL has the potential to harm the overall business of BHEL/ Owner.

Note-Once BHEL considers that a breach of contract has occurred on the part of Supplier/Vendor, BHEL shall notify the Supplier/Vendor by way of notice in this regard. Contractor shall be given an opportunity to rectify the reasons causing the breach of contract within a period of 14 days.

In case the contractor fails to remedy the breach, as mentioned in the notice, to the satisfaction of BHEL, BHEL shall have the right to take recourse to any of the remedial actions available to it under the relevant provisions of contract.

LD against delay in executed work in case of Termination of Contract:

LD against delay in executed work shall be calculated in line with relevant LD clause of GCC, for the delay attributable to contractor. For limiting the maximum value of LD, contract value shall be taken as Executed Value of work till termination of contract.

Method for calculation of "LD against delay in executed work in case of termination of contract" is given below.

i) Let the time period from scheduled date of start of work till termination of contract excluding the period of Hold (if any) not attributable to contractor = T1
ii) Let the value of executed work till the time of termination of contract= X
iii) Let the Total Executable Value of work for which inputs/fronts were made available to contractor and were planned for execution till termination of contract = Y
iv) Delay in executed work attributable to contractor i.e. T2=[1-(X/Y)] x T1
v) LD shall be calculated in line with LD clause of the Contract for the delay attributable to contractor taking "X" as Contract Value and "T2" as period of delay attributable to contractor.

2.2 **Remedies in case of Breach of Contract is established:**

i) Wherein the period as stipulated in the notice issued under clause "BREACH OF CONTRACT, REMEDIES AND TERMINATION" of GCC has expired and Contractor has failed to remedy the breach, BHEL will have the right to terminate the contract on the ground of "Breach of Contract" without any further notice to contractor.

ii) Upon termination of contract, BHEL shall be entitled to recover an amount equivalent to 10% of the Contract Value for the damages on account of breach of contract committed by the Contractor. This amount shall be recovered by way of encashing the security instruments like performance bank guarantee etc available with BHEL against the said contract. In case the value of the security instruments available is less than 10% of the contract value, the balance amount shall be recovered from other financial remedies (i.e. available bills of the contractor, retention amount, from the money due to the Contractor etc. with BHEL) or the other legal remedies shall be pursued.

iii) wherever the value of security instruments like performance bank guarantee available with BHEL against the said contract is 10% of the contract value or more, such security instruments to the extent of 10% contract value will be encashed. In case no security instruments are available or the value of the security instruments available is less than 10% of the contract value, the 10% of the contract value or the balance amount, as the case may be, will be recovered in all or any of the following manners:

iv) In case the amount recovered under sub clause (a) above is not sufficient to fulfil the amount recoverable then; a demand notice to deposit the balance amount within 30 days shall be issued to Contractor.

v) If Contractor fails to deposit the balance amount within the period as prescribed in demand notice, following action shall be taken for recovery of the balance amount:

a) from dues available in the form of Bills payable to defaulted Contractor against the same contract.

b) If it is not possible to recover the dues available from the same contract or dues are insufficient to meet the recoverable amount, balance amount shall be recovered from any money(s) payable to Contractor under any contract with other Units of BHEL including recovery from security deposits or any other deposit available in the form of security instruments of any kind against Security deposit or EMD.

c) In-case recoveries are not possible with any of the above available options, Legal action shall be initiated for recovery against defaulted Contractor.

vi) It is an agreed term of contract that this amount shall be a genuine pre-estimate of damages that BHEL would incur in completion of balance contractual obligation of the contract through any other agency and BHEL will not be required to furnish any other evidence to the Contractor for the purpose of estimation of damages.

vii) In addition to the above, imposition of liquidated damages, debarment, termination, de-scoping, short-closure, etc., shall be applied as per provisions of the contract.

Note:

1) The defaulting contractor shall not be eligible for participation in any of the future enquiries floated by BHEL to complete the balance work. The defaulting contractor shall mean and include:

(a) In case defaulted contractor is the Sole Proprietorship Firm, any Sole Proprietorship Firm owned by same Sole Proprietor.

(b) In case defaulted contractor is The Partnership Firm, any firm comprising of same partners/ some of the same partners (but not including any new partner); or sole proprietorship firm owned by any partner(s) as a sole proprietor.

2.3. In case Contractor fails to deploy the resources as per requirement informed by BHEL in writing to expedite the work, BHEL can deploy own/hired/otherwise arranged resources and recover the expenses incurred from the dues payable to contractor. Recoveries shall be actual expenses incurred plus 5% overheads or as defined in TCC.

2.4. To terminate the contract or to restrict the quantum of work and pay for the portion of work executed in case BHEL's contract with their customer are terminated for any reason, whatsoever.

2.5. Whenever any Claim or Claims for payment of any sum of money(s) arises under this or any other contract against the contractor, BHEL shall be entitled to withhold and also have a lien to retain such sum of money(s) in whole or in part from any money(s) payable to contractor and/or security deposits furnished or deducted in cash from the bills of contractor, (if any) under this contract. In the event of the securities or the amounts payable to Contractor, being insufficient to cover BHEL claims, then BHEL shall be entitled to withhold and have a lien to the extent of such claims from any sum or sums found payable or which at any time thereafter may become payable to the contractor under this or any other contract with BHEL.

a) Claim or Claims for payment of any sum of money(s) arising from the Contractor under this or any other contract against the contractor, shall mean, the sum of money(s) actually incurred by BHEL in fulfilling the contractual responsibilities of contractor under the contract, to which he has failed to fulfil plus applicable overheads (@ 5%) along with interest as applicable under the Contract on total amount (i.e. money actually incurred plus overheads)

b) It is an agreed term of the contract that, the sum or sums of money so withheld or retained under the lien by BHEL will be kept withheld or retained as such by BHEL till the claims arising

out of this or any other contract are finally adjudicated wither through Arbitration or a Court of competent jurisdiction as the case may be in accordance with the terms of contract. Intimation given by the BHEL Engineer regarding withholding of such money(s) shall be considered as sufficient and relevant date for all purposes. No Interest shall be payable on such sum(s) of money which becomes due or as the case may be adjudged to be due from BHEL to Contractor, whether under contract or otherwise.

c) Where the contractor is a partnership firm, BHEL shall be entitled to withhold and also have a lien to retain towards such claims in whole or in part, from any other money(s) payable to any partner, whether in his individual capacity or otherwise.

d) If any money(s) shall, as a result of any claim or application made under the relevant provisions of any Labour Welfare Act and/ or Rules, including but not limited to Contract Labour Regulation & Abolition Act, Minimum Wages Act, Payment of Gratuity Act, BOCW (RE&CS) Act, Provident Fund Act, Employee State Insurance Act, be directed to be paid by the BHEL, such money shall be deemed to be moneys payable to the BHEL by the Contractor.

e) Where the Contractor fails to repay to BHEL such moneys along with applicable overheads (@ 5%) and interest, as aforesaid within seven days of being demanded, BHEL shall be entitled to recover the same from Contractor's bills/ Security Deposit or any other money(s) payable to Contractor under this Contract or any other Contract with BHEL.

2.6. While every endeavor will be made by BHEL to this end, yet BHEL cannot guarantee uninterrupted work due to conditions beyond its control. The Contractor will not be normally entitled for any compensation/extra payment on this account unless otherwise specified elsewhere in the contract.

2.7. BHEL may permit or direct contractor to demobilize and remobilize at a future date as intimated by BHEL in case of following situations for reasons other than Force majeure conditions and not attributable to contractor:

i) suspension of work(s) at a Project either by BHEL or Customer,

or

ii) where work comes to a complete halt or reaches a stage wherein worthwhile works cannot be executed and there is no possibility of commencement of work for a period of not less than three months

In such cases, charges towards demobilization and remobilization shall be as decided by BHEL after successful remobilization by contractor at site, and decision of BHEL shall be final and binding on the contractor. After remobilization, all conditions as per contract shall become applicable. In case Contractor does not remobilize with adequate resources or does not start the work within the period as intimated, then BHEL reserves the right to terminate the contract and effect remedies under Clause **"Remedies in case of Breach of Contract"** In case of any conflict, BHEL decision in this regard shall be final and binding on the contractor.

2.8. In the unforeseen event of inordinate delay in receipt of materials, drawings, fronts etc. due to which inordinate discontinuity of work is anticipated, BHEL on its own or contractor's request at its discretion may consider to short close the contract in any of the following cases:

a) The balance works (including but not limited to Trial Operation, PG Test etc.) are minor vis a vis the scope of work envisaged as per the contract.
b) There has been no significant work in past 6 months OR no significant work is expected in next 6 months (example in Hydro projects or in projects where work has stopped due to reasons beyond the control of BHEL).

c) The balance works cannot be done within a reasonable period of time as they are dependent on unit shut down or on other facilities of customer or any other such reasons not attributable to the contractor.

At the point of requesting for short closure, contractor shall establish that he has completed all works possible of completion and he is not able to proceed with the balance works due to constraints beyond his control. In such a case, the estimated value of the unexecuted portion of work (or estimated value of services to be provided for carrying out milestone/stage payments like Trial Operation/PG Test etc.) as decided by BHEL, shall however be reduced from the final contract value.

Note: The Contractor shall not be eligible for any compensation on account of Quantity Variation arising out of short-closure of contract as per clause above.

M. <u>FORCE MAJEURE:</u>

Clause No. B.13.0 (FORCE MAJEURE) of Conditions of Contract for ETC Works has been modified as below:

M.1. "Force Majeure" shall mean circumstance which is:

a) beyond control of either of the parties to contract,
b) either of the parties could not reasonably have provided against the event before entering into the contract,
c) having arisen, either of the parties could not reasonably have avoided or overcome, and
d) is not substantially attributable to either of the parties
And
Prevents the performance of the contract,

Such circumstances include but shall not be limited to:

i) War, hostilities, invasion, act of foreign enemies.
ii) Rebellion, terrorism, revolution, insurrection, military or usurped power, or civil war.
iii) Riot, commotion or disorder by persons other than the contractor's personnel and other employees of the contractor and sub-contractors.
iv) Strike or lockout not solely involving the contractor's personnel and other employees of the contractor and sub-contractors.
v) Encountering munitions of war, explosive materials, ionizing radiation or contamination by radio-activity, except as may be attributable to the contractor's use of such munitions, explosives, radiation or radio- activity.
vi) Natural catastrophes such as earthquake, tsunami, volcanic activity, hurricane or typhoon, flood, fire, cyclones etc.
vii) Epidemic, pandemic etc.

M.2. The following events are explicitly excluded from Force Majeure and are solely the responsibilities of the non-performing party: a) any strike, work-to-rule action, go-slow or similar labour difficulty (b) late delivery of equipment or material (unless caused by Force Majeure event) and (c) economic hardship.

M.3. If either party is prevented, hindered or delayed from or in performing any of its obligations under the Contract by an event of Force Majeure, then it shall notify the other in writing of the occurrence of such event and the circumstances thereof within 15 (fifteen) days after the occurrence of such event.

M.4. The party who has given such notice shall be excused from the performance or punctual performance of its obligations under the Contract for so long as the relevant event of Force Majeure continues and to the extent that such party's performance is prevented, hindered or delayed. The Time for Completion shall be extended by a period of time equal to period of delay caused due to such Force Majeure event.

M.5. Delay or non-performance by either party hereto caused by the occurrence of any event of Force Majeure shall not

a) Constitute a default or breach of the Contract.

Give rise to any claim for damages or additional cost expense occasioned thereby, if and to the extent that such delay or non-performance is caused by the occurrence of an event of Force Majeure

M.6. BHEL at its discretion may consider short closure of contract after 1 year of imposition of Force Majeure in line with extant guidelines. In any case, Supplier/Vendor cannot consider deemed short-closure after 1 year of imposition of Force Majeure.

N. SETTLEMENT OF DISPUTE

Clause No. B.15.0 (Arbitration) of Conditions of Contract for ETC Works has been modified as below:

If any dispute or difference of any kind whatsoever shall arise between BHEL and the Supplier/Vendor, arising out of the contract for the performance of the work whether during the progress of contract termination, abandonment or breach of the contract, it shall in the first place referred to Designated Engineer for amicable resolution by the parties. Designated Engineer (to be nominated by BHEL for settlement of disputes arising out of the contract) who within 60 days after being requested shall give written notice of his decision to the contractor. Save as hereinafter provided, such decision in respect of every matter so referred shall forthwith be given effect to by the Supplier/Vendor who shall proceed with the work with all due diligence, whether he or BHEL desires to resolve the dispute as hereinafter provided or not.

If after the Designated Engineer has given written notice of this decision to the party and no intention to pursue the dispute has been communicated to him by the affected party within 30 days from the receipt of such notice, the said decision shall become final and binding on the parties. In the event the Supplier/Vendor being dissatisfied with any such decision or if amicable settlement cannot be reached then all such disputed issues shall be resolved through conciliation in terms of the BHEL Conciliation Scheme 2018 as per Clause “Conciliation” of GCC.

N.1. Conciliation:

Any dispute, difference or controversy of whatever nature howsoever arising under or out of or in relation to this Agreement (including its interpretation) between the Parties, and so notified in writing by either Party to the other Party (the “Dispute”) shall, in the first instance, be attempted to be resolved amicably in accordance with the conciliation procedure as per BHEL Conciliation Scheme 2018. The proceedings of Conciliation shall broadly be governed by Part-III of the Arbitration and Conciliation Act 1996 or any statutory modification thereof and as provided in - “Procedure for conduct of conciliation proceedings” (as available in www.bhel.com)).

Note: Ministry of Finance has issued OM reference No. 1/2/24 dated 03.06.2024 regarding “Guidelines for Arbitration and Mediation in Contracts of Domestic Public Procurement. In the said OM it has been recommended that Government departments/

Entities/agencies are to encourage mediation under the Mediation Act. 2023. The said Act has not yet been notified by the Government. Therefore, the clause **“Settlement of Disputes”** shall be modified accordingly as and when the Mediation Act 2023 gets notified.

N.2. ARBITRATION:

N.2.1. Except as provided elsewhere in this Contract, in case Parties are unable to reach amicable settlement (whether by Conciliation to be conducted as provided in Clause **"Conciliation"** herein above or otherwise) in respect of any dispute or difference; arising out of the formation, breach, termination, validity or execution of the Contract; or, the respective rights and liabilities of the Parties; or, in relation to interpretation of any provision of the Contract; or. in any manner touching upon the Contract (hereinafter referred to as the 'Dispute'), then, either Party may, refer the disputes to Arbitral Institution i.e. **"India International Arbitration Centre (IIAC) Delhi"** and such dispute to be adjudicated by Sole Arbitrator appointed in accordance with the Rules of said Arbitral Institution.

N.2.2. A party willing to commence arbitration proceeding shall invoke Arbitration Clause by giving notice to the other party in terms of section 21 of the Arbitration & Conciliation Act, 1996 (hereinafter referred to as the 'Notice') before referring the matter to arbitral institution. The Notice shall be addressed to the **Executive Director, TBG, BHEL, Noida**, executing the Contract and shall contain the particulars of all claims to be referred to arbitration with sufficient detail and shall also indicate the monetary amount of such claim including interest, if any.

N.2.3. After expiry of 30 days from the date of receipt of aforesaid notice, the party invoking the Arbitration shall submit that dispute to the Arbitral Institutions and that dispute shall be adjudicated in accordance with their respective Arbitration Rules. The matter shall be adjudicated by a Sole Arbitrator who shall necessarily be a Retd Judge having considerable experience in commercial matters to be appointed/nominated by the respective institution. The cost/expenses pertaining to the said Arbitration shall also be governed in accordance with the Rules of the respective Arbitral Institution. The decision of the party invoking the Arbitration for reference of dispute to a specific Arbitral institution for adjudication of that dispute shall be final and binding on both the parties and shall not be subject to any change thereafter. The institution once selected at the time of invocation of dispute shall remain unchanged.

N.2.4. The fee and expenses shall be borne by the parties as per the Arbitral Institutional rules.

N.2.5. The Arbitration proceedings shall be in English language and the seat and venue of Arbitration shall be **Delhi.**

N.2.6. Subject to the above, the provisions of Arbitration & Conciliation Act 1996 and any amendment thereof shall be applicable. All matters relating to this Contract and arising out of invocation of Arbitration clause are subject to the exclusive jurisdiction of the Court(s) situated at **Delhi**.

N.2.7. Notwithstanding any reference to the Designated Engineer or Conciliation or Arbitration herein, a. the parties shall continue to perform their respective obligations under the Contract unless they otherwise agree. Settlement of Dispute clause cannot be invoked by the Contractor, if the Contract has been mutually closed or 'No Demand Certificate' has been furnished by the Contractor or any Settlement Agreement has been signed between the Employer and the Contractor.

N.2.8. The Mechanism of resolution of disputes through arbitration shall be available only in the cases where the value of the dispute is less than Rs. 10 Crores.

N.2.9. In case the disputed amount (Claim, Counter claim including interest is Rs. 10 crores and above, the parties shall be within their rights to take recourse to remedies other than Arbitration, as may be available to them under the applicable laws after prior intimation to the other party. Subject to the aforesaid conditions, provisions of the Arbitration and Conciliation Act, 1996 and any statutory modifications or re-enactment thereof as amended from time to time, shall apply to the arbitration proceedings under this clause.

N.2.10. In case, multiple arbitrations are invoked (whether sub-judice or arbitral award passed) by any party to under this contract, then the cumulative value of claims (including interest claimed or awarded) in all such arbitrations shall be taken in account while arriving at the total claim in dispute for the subject contract for the purpose of clause N.2.9. Disputes having cumulative value of less than 10 crores shall be resolved through arbitration and any additional dispute shall be adjudicated by the court of competent jurisdiction.

In case of Contract with Public Sector Enterprise (PSE) or a Government Department, the following shall be applicable:

In the event of any dispute or difference relating to the interpretation and application of the provisions of commercial contract(s) between Central Public Sector Enterprises (CPSEs)/ Port Trusts inter se and also between CPSEs and Government Departments/Organizations (excluding disputes concerning Railways, Income Tax, Customs & Excise Departments), such dispute or difference shall be taken up by either party for resolution through AMRCD (Administrative Mechanism for Resolution of CPSEs Disputes) as mentioned in DPE OM No. 05/0003/2019-FTS-10937 dated 14-12-2022 as amended from time to time.

O. FACILITIES PROVIDED TO MSEs: -

Vide office memorandum F.No.21(8)/2011-MA dated 09.11.2016, Office of AS&DC, Ministry of MSME has issued clarification regarding definition of Goods and Services under the Public Procurement Policy of MSEs order-2012, In accordance with the Public Procurement Policy for MSEs order-2012 and OM regarding definition of Goods and Services issued by Ministry of MSME, it is clarified that benefits as envisaged in Public Procurement Policy for MSEs Order 2012 are to be provided in respect of the procurements related to the Goods and Services produced and provided by Micro and Small Enterprises (MSEs) only and **no benefits is to be given in Case of Works Contracts.**

P. CLOSING OF CONTRACTS

The Contract shall be considered completed and closed upon completion of contractual obligations and settlement of Final Bill or completion of Guarantee period whichever is later. Upon closing of Contract, BHEL shall issue a performance/ experience certificate as per standard format, based on specific request of Contractor as per extant BHEL guidelines through the online portal available at https://siddhi.bhel.in only.

Q. SUSPENSION OF BUSINESS DEALINGS

BHEL reserves the right to take action against Contractors who either fail to perform or Tenderers/Contractor who indulge in malpractices, by suspending business dealings with them in line with BHEL guidelines issued from time to time.

The offers of the bidders who are under suspension as also the offers of the bidders, who engage the services of the banned firms / principal / agents, shall be rejected. The list of banned firms is available on BHEL web site www.bhel.com.

If any bidder / supplier / contractor during pre-tendering / tendering / post tendering / award / execution / post-execution stage indulges in any act, including but not limited to, mal-practices, cheating, bribery, fraud or and other misconduct or formation of cartel so as to influence the bidding process or influence the price or tampers the tendering process or acts or omits in any manner which tantamount to an offence punishable under any provision of the Indian Penal Code, 1860 or any other law in force in India, or does anything which is actionable under the

Guidelines for Suspension of Business dealings, action may be taken against such bidder / supplier / contractor as per extant guidelines of the company available on www.bhel.com and / or under applicable legal provisions. Guidelines for suspension of business dealings is available in the webpage:

http://www.bhel.com/vender_registration/vender.php.

R. PERFORMANCE MONITORING:

The Contractors performance shall be continuously monitored during execution of work at site. In case of contractor's performance is found not satisfactory during the execution of work at site, BHEL may take alternate remedial measures and may not consider the contractor for further tenders, if the contractor performance is not improved in spite of opportunities given by BHEL.

S. MEASUREMENT OF WORK AND MODE OF PAYMENT:

a) All payments due to the contractors shall be made by e-mode only, unless otherwise found operationally difficult for reasons to be recorded in writing.

b) For progress running bill payments: - The Contractor shall present detailed measurement sheets in triplicate, duly indicating all relevant details based on technical documents and connected drawings for work done during the month/period under various categories in line with terms of payment as per contract. The basis of arriving at the quantities, weights shall be relevant documents and drawings released by BHEL. These measurement sheets shall be prepared jointly with BHEL Engineers and signed by both the parties.

c) These measurement sheets will be checked by BHEL Engineer and quantities and percentage eligible for payment under various groups shall be decided by BHEL Engineer. The abstract of quantities and percentage so arrived at based on the terms of payment shall be entered in Measurement Book by BHEL Engineers and signed by both the parties.

d) These measurement sheets will be checked by BHEL Engineer and quantities and percentage eligible for payment under various groups shall be decided by BHEL Engineer. The abstract of quantities and percentage so arrived at based on the terms of payment shall be entered in Measurement Book and signed by both the parties.

e) Based on the above quantities, contractor shall prepare the bills, along with statutory documents, in prescribed format and work out the financial value. These will be entered in Measurement Book and signed by both the parties. Payment shall be made by BHEL after effecting the recoveries due from the contractor.

f) All recoveries due from the contractor for the month/period shall be effected in full from the corresponding running bills unless specific approval from the competent authorities is obtained to the contrary.

g) Measurement shall be restricted to that portion of work for which it is required to ascertain the financial liability of BHEL under this contract.

h) The measurement shall be taken jointly by persons duly authorized on the part of BHEL and by the Contractor.

i) The Contractor shall bear the expenditure involved if any, in making the measurements and testing of materials to be used/ used in the work. The contractor shall, without extra charges, provide all the assistance with appliances and other things necessary for measurement.

j) If at any time due to any reason whatsoever, it becomes necessary to re-measure the work done in full or in part, the expenses towards such re measurements shall be borne by the

contractor unless such re measurements are warranted solely for reasons not attributable to contractor.

k) Passing of bills covered by such measurements does not amount to acceptance of the completion of the work measured. Any left out work has to be completed, if pointed out at a later date by BHEL.

l) Final measurement bill shall be prepared in the final bill format prescribed for the purpose based on the certificate issued by BHEL Engineer that entire works as stipulated in tender specification has been completed in all respects to the entire satisfaction of BHEL. Contractor shall give unqualified "No Claim" Certificate. All the tools and tackles loaned to him should be returned in satisfactory condition to BHEL. The abstract of final quantities and financial values shall also be entered in the Measurement Books and signed by both parties to the contract. The Final Bill shall be prepared and paid within a reasonable time after completion of work.

T. NO INTEREST PAYABLE TO CONTRACTOR:

Notwithstanding anything to the contrary contained in any other document comprising in the Contract, no interest shall be payable by BHEL to Contractor on any moneys or balances including but not limited to the Security Deposit, EMD, Retention Money, RA Bills or the Final Bill, or any amount withheld and/or appropriated by BHEL etc., which becomes or as the case may be, is adjudged to be due from BHEL to Contractor whether under the Contract or otherwise.

U. PROGRESSIVE PAYMENT/ FINAL PAYMENT:

1. **Running Account Bills (RA Bills)**
   - i) These are for interim payments when the contracts are in progress. The bills for such interim payments are to be prepared by Contractor in prescribed formats (RA Bill forms).
   - ii) Payments shall be made according to the extent of work done as per measurements taken up to the end of the calendar month and in line with the terms of payments described in the Tender documents.
   - iii) Recoveries on account of electricity, water, statutory deductions etc. are made as per terms of contract.
   - iv) Full rates for the work done shall be allowed only if the quantum of work has been done as per the specifications stipulated in the contract. If the work is not executed as per the stipulated specifications, BHEL may ask the contractor to redo the work according to the required specifications, without any extra cost.
   - v) The contractor shall submit his monthly RA bills with all the details required by BHEL on specified date every month covering progress of work in all respects and areas for the previous calendar month.
   - vi) Mode of payment and measurement of work completed shall be as per relevant clauses of General Conditions of Contract
   - vii) Release of payment in each running bill including ORC Bills where ever applicable will be as per stages of progressive pro rata payments.
   - viii) The contractor will be eligible for payment of RA Bills within 30 days of submission of running bill complete in all respects with all documents. It is the responsibility of the contractor to make his own arrangements for making timely payments towards labour wages, statutory payments, outstanding dues etc. and other dues in the meanwhile.

All documents like HR Clearance, Quality and Safety Compliances etc. required for processing the RA Bills should be submitted along with RA Bills.

ix) BHEL shall release payment through Electronic Fund Transfer (EFT)/RTGS. In order to implement this system, Contractor to furnish details pertaining to his Bank Accounts where proceeds will be transferred through BHEL's banker, as per prescribed formats.

x) <u>For MSMEs, at the time of submission of first RA bill, the subcontractor has to declare whether it is registered on RXIL portal and wishes to receive the proceeds through RXIL portal throughout the contract duration.</u>

xi) Note: BHEL may also choose to release payment by other alternative modes as applicable.

xii) **<u>Documents required for RA Bill:</u>**

a) GST Complied Invoice of the work done as per approved BOQ.
b) Jointly signed Measurement sheet, WAM -6 for RA Bill.
c) Material Reconciliation statement
d) Test Report of the material as per FQP
e) Power of Attorney before submission of Bill.
f) Validity of Bank Guarantees as applicable under the contract.
g) HR compliance documents:
    1) Labour Payment Certificate, Wages payment sheet
    2) Proof of PF, ESI, WC contribution submission
    3) Proof of Bonus payment as per Bonus Act if applicable.
h) Any other documents as per customer requirement/statutory requirement.

Note :

BHEL Site in charge has to certify that all the above required documents have been received and verified and documents sl no. a) to d) duly verified are to be sent to Finance along with RA bills.

2. **<u>Final Bill:</u>**

Final Bill' is used for final payment on closing of Running Account for works or for single payment after completion of works. 'Final Bill' shall be submitted as per prescribed format after completion of works as per scope, material reconciliation, removal of temporary structures, return of scrap/surplus material of BHEL. BHEL shall settle the final bills after deducting all liabilities of Contractor to BHEL.

2.1. **<u>Documents required for Final Bill:</u>**

a) GST Complied Invoice of the work done as per approved BOQ.
b) Jointly signed Measurement sheet, WAM -7, WAM-10 format (if Applicable).
c) Valid Bank Guarantees as applicable under the contract.
d) Labour Payment Certificate (if applicable)
e) 'No claim' certificate from the contractor.
f) Deviation statement showing the Executed quantities and quantities as per the contract.
g) Submission of Test reports as per FQP (if applicable)
h) Material Reconciliation statement duly approved by BHEL
i) HR compliance documents:
    i) Labour Payment Certificate, Wages payment sheet
    ii) Proof of PF, ESI, WC contribution submission
    iii) Proof of Bonus payment as per Bonus Act if applicable.

j) Submission of As Built Drawings (if applicable)
k) Compliance report from BHEL/Customer for completion of punch points
l) Final Delay Analysis.
m) Any other documents as per customer requirement/statutory requirement.

Note :

BHEL Site incharge has to certify that all the above required documents have been received and verified and document sl no. a) to f) duly verified are to be sent to Finance alongwith Completion certificate.

V. LIMITATION ON LIABILITY:

Notwithstanding anything to the contrary in this Contract or LOA or any other mutually agreed document between the parties, the maximum liability, for damages, of the contractor, its servants or agents, shall under no circumstances exceed an amount equal to the Price of the Contract or the Work Order. The Contractor shall not in any case be liable for loss of profit or special, punitive, exemplary, indirect or consequential losses whatsoever. This shall not be applicable on the recoveries made by Customer from BHEL on account of Contractor, any other type of recoveries for workmanship, material, T&P etc. due from the contractor.

W. All other terms and conditions of GCC shall remain unchanged.

INDEMNITY BOND

(To be typed and submitted in the Letter Head of the Company/Firm of Bidder)

This Indemnity Bond executed by <_____name of company> having their Registered Office at <_____> in favour of M/s Bharat Heavy Electricals Limited, a Company incorporated under the Companies Act, 1956, having its Registered Office at BHEL House, Siri Fort, Asiad, New Delhi - 110049 through its unit - TBG, 5th Floor, BHEL Sadan, Plot No. 25, Sector-16A, Noida-201301 (UP). (Hereinafter referred to as the Company)

And whereas the Company has entered into a Contract with M/s_____, the executants of this Deed (hereinafter referred to as the Contractor) as its contractor in respect of the work of "_____".

AND WHEREAS under the provisions of GCC further stipulates that the Contractor shall indemnify the Company against all claims of whatever nature arising during the course of execution of Contract including defects liability period of <_____Months > i.e till <_____>

Now this deed witness that in case the Company is made liable by any Authority including Court to pay any claim or compensation etc. in respect of all labourers or other matters at any stage under or relating to the Contract with the Contractor , the Contractor hereby covenants and agrees with the Company that they shall indemnify and reimburse the Company to the extent of such payments and for any fee, including litigation charges, lawyers' fees, etc, penalty or damages claimed against the Company by reason of the Contractor falling to comply with Central/States Laws, Rules etc, or his failure to comply with Contract (including all expenses and charges incurred by the Company).

The Contractor further indemnifies the Company for the amount which the Company may be liable to pay by way of penalty for not making deductions from the Bills of the Contractor towards such amount and depositing the same in the Government Treasury.

The Contractor further agree that the Company shall be entitled to withhold and adjust the Security Deposit and/or withhold and adjust payment of Bills of Contractor pertaining to this Contract against any payment which the Company has made or is required to make for which the Contractor is liable under the Contract and that such amount can be withheld, adjusted by the Company till satisfactory and final settlement of all pending matters and the Contractor hereby gives his consent for the same.

The Contractor further agrees that the terms of indemnity shall survive the termination or completion of this contract.

The contractor further agrees that the liability of the contractor shall be extended on actual basis notwithstanding the limitations of liability clause, in respect of :

1. breach of terms of contract by the contractor
2. breach of laws by the contractor
3. breach of Intellectual property rights by the contractor
4. breach of confidentiality by the contractor

Nothing contained in this deed, shall be construed as absolving or limiting the liability of the Contractor under said Contract between the Company and the Contractor. That this Indemnity Bond is irrevocable and the condition of the bond is that the Contractor shall duly and punctually comply with the terms and the conditions of this deed and contractual provisions to the satisfaction of the Company.

In witness where of M/s _____ these presents on the day, month and year first, above written at _____ by the hand of its signatory Mr._____.

Signed for and on behalf of
M/s _____

Witness:

1.

2.

PROFORMA OF BANK GUARANTEE (in lieu of SECURITY DEPOSIT)

In consideration of Bharat Heavy Electricals Limited (hereinafter referred to as the 'Employer' which expression shall unless repugnant to the context or meaning thereof, include its successors and permitted assigns) incorporated under the Companies Act, 1956 and having its registered office at BHEL House, Siri Fort, New Delhi-110049 through its Unit at BHEL, Transmission Business Group, Noida (name of the Unit) having agreed to exempt _____(Name of the Vendor / Contractor / Supplier) with its registered office at_____[1] (hereinafter called the said "Contractor" which term includes supplier), from demand under the terms and conditions of the Contract reference No._____ dated _____ [2] valued at Rs……[3](Rupees ……) (hereinafter called the said Contract), of Security Deposit for the due fulfilment by the said Contractor of the terms and conditions contained in the said Contract, on production of a Bank Guarantee for Rs……[4] (Rupees…….....only),

We _____(indicate the name and address of the Bank) having its Head Office at _____(address of the head Office) (hereinafter referred to as the Bank), at the request of _____ [Contractor(s)], being the Guarantor under this Guarantee, do hereby irrevocably and unconditionally undertake to forthwith and immediately pay to the Employer, an amount not exceeding Rs._____without any demur, immediately on demand from the Employer and without any reservation, protest, and recourse and without the Employer needing to prove or demonstrate reasons for its such demand

Any such demand made on the bank, shall be conclusive as regards the amount due and payable by the Bank under this guarantee. However, our liability under this guarantee shall be restricted to an amount not exceeding Rs._____.

We undertake to pay to the Employer any money so demanded notwithstanding any dispute or disputes raised by the Contractor(s) in any suit or proceeding pending before any Court or Tribunal or Arbitrator or any other authority, our liability under this present being absolute and unequivocal.

The payment so made by us under this guarantee shall be a valid discharge of our liability for payment hereunder and the Contractor(s) shall have no claim against us for making such payment.

We, further agree that the guarantee herein contained shall remain in full force and effect during the period that would be taken for the performance of the said Contract and that it shall continue to be enforceable till all the dues of the Employer under or by virtue of the said Contract have been fully paid and its claims satisfied & the Employer certifies that the terms and conditions of the said Contract have been fully and properly carried out by the said contractor(s) or acceptance of the final bill or discharge of this guarantee by the Employer, whichever is earlier. This guarantee shall initially remain in force up to and including_____[5] and shall be extended from time to time for such period as may be desired by the Employer. Unless a demand or claim under this guarantee is made on us in writing on or before the _____[6], (3 months more than the present date of validity of Bank Guarantee) we shall be discharged from all the liability under this guarantee thereafter.

We, _____ (indicate the name of the Bank) further agree with the Employer that the Employer shall have the fullest liberty without our consent and without affecting in any manner

our obligations hereunder to vary any of the terms and conditions of the said Contract or to extend time of performance by the said contractor(s) from time to time or to postpone for any time or from time to time any of the powers exercisable by the Employer against the said contractor(s) and to forbear or enforce any of the terms and conditions relating to the said Contract and we shall not be relieved from our liability by any reason of any such variation or extension being granted to the said contractor(s) or for any forbearance, act or omission on the part of the Employer or any indulgence by the Employer to the said contractor(s) or by any such matter or thing whatsoever which under the law relating to sureties would but for this provision have effect of so relieving us.

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.

This Guarantee shall not be determined or affected by liquidation or winding up, dissolution or change of constitution or insolvency of the Contractor but shall in all respects and for all purposes be binding and operative until payment of all money payable to the Employer in terms thereof. This guarantee will not be discharged due to the change in the constitution of the Bank or the Contractor(s).

We,……. BANK lastly undertake not to revoke this guarantee during its currency except with the previous consent of the Employer in writing.

Notwithstanding anything to the contrary contained hereinabove:

a) The liability of the Bank under this Guarantee shall not exceed…… [4]
b) This Guarantee shall be valid up to ……[5]
c) Unless the Bank is served a written claim or demand on or before _____[6] all rights under this guarantee shall be forfeited and the Bank shall be relieved and discharged from all liabilities under this guarantee irrespective of whether or not the original bank guarantee is returned to the Bank.

We, _____ Bank, have power to issue this Guarantee under law and the undersigned as a duly authorized person has full powers to sign this Guarantee on behalf of the Bank.

Date _____ Day of _____

for___(indicate the name of the Bank)__

(Signature of Authorised signatory)

[1] ADDRESS OF THE VENDOR /CONTRACTOR / SUPPLIER .

[2] DETAILS ABOUTTHE NOTICE OF AWARD/CONTRACTREFERENCE

[3] CONTRACT VALUE

[4] BG AMOUNTIN FIGURES AND WORDS

[5] VALIDITY DATE (At least 3 months more than completion period)

[6] DATE OF EXPIRY OF CLAIM PERIOD (At least 3 months more than the present date of validity of BG)

Notes:

1 The expiry of claim period shall be at least 3 months more than the validity date. It may be ensured that the same is in line with the agreement/ contract entered with the Vendor.

2 The BG should be on Non-Judicial Stamp paper/e-stamp paper of appropriate value as per Stamp Act prevailing in the State(s) where the BG is submitted or is to be acted upon or the rate prevailing in the State where the BG was executed, whichever is higher. The Stamp Paper/e-stamp paper shall be purchased in the name of Vendor/Contractor/Supplier /Bank issuing the guarantee.

3 In Case of Bank Guarantees submitted by Foreign Vendors:

a. From Nationalized/Public Sector / Private Sector/ Foreign Banks (BG issued by Branches in India) can be accepted subject to the condition that the Bank Guarantee should be enforceable in the town/city or at nearest branch where the Unit is located i.e. Demand can be presented at the Branch located in the town/city or at nearest branch where the Unit is located.

b. From Foreign Banks (wherein Foreign Vendors intend to provide BG from local branch of the Vendor country's Bank)

b.1 In such cases, in the Tender Enquiry/ Contract itself, it may be clearly specified that Bank Guarantee issued by **any of the Consortium Banks only** will be accepted by BHEL. As such, Foreign Vendor needs to make necessary arrangements for issuance of Counter- Guarantee by Foreign Bank in favour of the Indian Bank's (BHEL's Consortium Bank) branch in India. It is advisable that all charges for issuance of Bank Guarantee/ counter- Guarantee should be borne by the Foreign Vendor. The tender stipulation should clearly specify these requirements.

b.2 In case, Foreign Vendors intend to provide BG from Overseas Branch of our Consortium Bank (e.g. if a BG is to be issued by SBI Frankfurt), the same is acceptable. However, the procedure at sl.no. b.1 will required to be followed.

ANNEXURE TO MODEL CONCILIATION CLAUSE FOR CONDUCT OF CONCILIATION UNDER THE BHEL CONCILIATION SCHEME, 2018

BRIEF PROCEDURE FOR CONDUCT OF CONCILIATION PROCEEDINGS

1. The proceedings of Conciliation shall broadly be governed by Part-III of the Arbitration and Conciliation Act 1996 or any statutory modification thereof and as provided herein:

2. The party desirous of resorting to Conciliation shall send an invitation/notice in writing to the other party to conciliate specifying all points of Disputes with details of the amount claimed. The party concerned shall not raise any new issue thereafter. Parties shall also not claim any interest on claims/counter-claims from the date of notice invoking Conciliation till the conclusion of the Conciliation proceedings.

3. The party receiving the invitation/notice for Conciliation shall within 30 days of receipt of the notice of Conciliation intimate its consent for Conciliation along with its counter-claims, if any.

4. The Conciliation in a matter involving claim or counter-claim (whichever is higher) up to Rs 5 crores shall be carried out by sole Conciliator nominated by BHEL while in a matter involving claim or counter-claim (whichever is higher) of more than Rs 5 crores Conciliation shall be carried out by 3 Conciliators nominated by BHEL.

5. The Parties shall be represented by only their duly authorized in-house executives/officers and neither Party shall be represented by a Lawyer.

6. The first meeting of the IEC shall be convened by the IEC by sending appropriate communication/notice to both the parties as soon as possible but not later than 30 days from the date of his/their appointment. The hearings in the Conciliation proceeding shall ordinarily be concluded within two (2) months and, in exceptional cases where parties have expressed willingness to settle the matter or there exists possibility of settlement in the matter, the proceedings may be extended by the IEC by a maximum of further 2 months with the consent of the Parties subject to cogent reasons being recorded in writing.

7. The IEC shall thereafter formulate recommendations for settlement of the Disputes supported by reasons at the earliest but in any case within

15 days from the date of conclusion of the last hearing. The recommendations so formulated along with the reasons shall be furnished by the IEC to both the Parties at the earliest but in any case within 1 month from the date of conclusion of the last hearing.

8. Response/modifications/suggestions of the Parties on the recommendations of the IEC are to be submitted to the IEC within time limit stipulated by the IEC but not more than 15 days from the date of receipt of the recommendations from the IEC.

9. In the event, upon consideration, further review of the recommendations is considered necessary, whether by BHEL or by the other Party, then, the matter can be remitted back to the IEC with request to reconsider the same in light of the issues projected by either/both the Parties and to submit its recommendations thereon within the following 15 days from the date of remitting of the case by either of the Parties.

10. Upon the recommendations by the Parties, with or without modifications, as considered necessary, the IEC shall be called upon to draw up the Draft Settlement Agreement in terms of the recommendations.

11. When a consensus can be arrived at between the parties only in regard to any one or some of the issues referred for Conciliation the draft Settlement Agreement shall be accordingly formulated in regard to the said Issue(s), and the said Settlement Agreement, if signed, by the parties, shall be valid only for the said issues. As regards the balance issues not settled, the parties may seek to resolve them further as per terms and conditions provided in the contract.

12. In case no settlement can be reached between the parties, the IEC shall by a written declaration, pronounce that the Conciliation between the parties has failed and is accordingly terminated.

13. Unless the Conciliation proceedings are terminated in terms of para 22 (b), (c) & (d) herein below, the IEC shall forward his/its recommendations as to possible terms of settlement within one (1) month from the date of last hearing. The date of first hearing of Conciliation shall be the starting date for calculating the period of 2 months.

14. In case of 3 members IEC, 2 members of IEC present will constitute a valid quorum for IEC and meeting can take place to proceed in the matter after seeking consent from the member who is not available. If necessary, videoconferencing may be arranged for facilitating participation of the members. However, the IEC recommendations will be signed by all members. Where there is more than one (1) Conciliator, as a general rule they shall act jointly. In the event of differences between the Members of IEC, the decision/recommendations of the majority of the Members of IEC shall prevail and be construed as the recommendation of the IEC.

15. The Draft Settlement Agreement prepared by the IEC in terms of the consensus arrived at during the Conciliation proceedings between the Parties shall be given by the IEC to both the parties for putting up for approval of their respective Competent Authority.

16. Before submitting the draft settlement agreement to BHEL's Competent Authority viz. the Board Level Committee on Alternative Dispute Resolution (BLCADR) for approval, concurrence of the other party's Competent Authority to the draft settlement agreement shall be obtained by the other party and informed to BHEL within 15 days of receipt of the final draft settlement agreement by it. Upon approval by the Competent Authority, the Settlement Agreement would thereafter be signed by the authorized representatives of both the Parties and authenticated by the members of the IEC.

17. In case the Draft Settlement Agreement is rejected by the Competent Authority of BHEL or the other Party, the Conciliation proceedings would stand terminated.

18. A Settlement Agreement shall contain a statement to the effect that each of the person(s) signing thereto (i) is fully authorized by the respective Party(ies) he/she represents, (ii) has fully understood the contents of the same and (iii) is signing on the same out of complete freewill and consent, without any pressure, undue influence.

19. The Settlement Agreement shall thereafter have the same legal status and effect as an arbitration award on agreed terms on the substance of the dispute rendered by an arbitral tribunal passed under section 30 of the Arbitration and Conciliation Act, 1996.

20. Acceptance of the Draft Settlement Agreement/recommendations of the Conciliator and/or signing of the Settlement Agreement by BHEL shall

however, be subject to withdrawal/closure of any arbitral and/or judicial proceedings initiated by the concerned Party in regard to such settled issues.

21. Unless otherwise provided for in the agreement, contract or the Memorandum of Understanding, as the case may be, in the event of likelihood of prolonged absence of the Conciliator or any member of IEC, for any reason/incapacity, the Competent Authority/Head of Unit/Division/Region/Business Group of BHEL may substitute the Conciliator or such member at any stage of the proceedings. Upon appointment of the substitute Conciliator(s), such reconstituted IEC may, with the consent of the Parties, proceed with further Conciliation into the matter either de-novo or from the stage already reached by the previous IEC before the substitution.

22. The proceedings of Conciliation under this Scheme may be terminated as follows:
    a. On the date of signing of the Settlement agreement by the Parties; or,
    b. By a written declaration of the IEC, after consultation with the parties, to the effect that further efforts at conciliation are no longer justified, on the date of the declaration; or,
    c. By a written declaration of the Parties addressed to the IEC to the effect that the Conciliation proceedings are terminated, on the date of the declaration; or,
    d. By a written declaration of a Party to the other Party and the IEC, if appointed, to the effect that the Conciliation proceedings are terminated, on the date of the declaration.
    e. On rejection of the Draft Settlement Agreement by the Competent Authority of BHEL or the other Party.

23. The Conciliator(s) shall be entitled to following fees and facilities:

Sl No	**Particulars**	**Amount**
1	Sitting fees	Each Member shall be paid a Lump Sum fee of Rs 75,000/- for the whole case payable in terms of paragraph No. 27 herein below.
2	Towards drafting of settlement agreement	In cases involving claim and/or counter-claim of up to Rs 5crores. Rs 50,000/- (Sole Conciliator)

Sl No	Particulars	Amount
		In cases involving claim and/or counter-claim of exceeding Rs 5 crores but less than Rs 10 crores. Rs 75,000 (per Conciliator) In cases involving claim and/or counter-claim of more than Rs 10 crores. Rs 1,00,000/- (per Conciliator) Note: The aforesaid fees for the drafting of the Settlement Agreement shall be paid on Signing of the Settlement Agreement after approval of the Competent Authority or Rejection of the proposed Settlement Agreement by the Competent Authority of BHEL.
3	Secretarial expenses	Rs 10,000/- (one time) for the whole case for Conciliation by a Sole Member IEC. Where Conciliation is by multi member Conciliators –Rs 30,000/- (one time)- to be paid to the IEC
4	Travel and transportation and stay at outstation i) Retired Senior Officials of other Public Sector Undertakings (pay scale wise equivalent to or more than E-8 level of BHEL)	As per entitlement of the equivalent officer (pay scale wise) in BHEL.
	Others	As per the extant entitlement of whole time Functional Directors in BHEL.

Sl No	Particulars	Amount
		Ordinarily, the IEC Member(s) would be entitled to travel by air Economy Class.
5	Venue for meeting	Unless otherwise agreed in the agreement, contract or the Memorandum of Understanding, as the case may be, the venue/seat of proceedings shall be the location of the concerned Unit / Division / Region / Business Group of BHEL. Without prejudice to the seat/venue of the Conciliation being at the location of concerned BHEL Unit / Division / Region / Business Group, the IEC after consulting the Parties may decide to hold the proceedings at any other place/venue to facilitate the proceedings. Unless, Parties agree to conduct Conciliation at BHEL premises, the venue is to be arranged by either Party alternately.

24. The parties will bear their own costs including cost of presenting their cases/evidence/witness(es)/expert(s)on their behalf. The parties agree to rely upon documentary evidence in support of their claims and not to bring any oral evidence in IEC proceedings.

25. If any witness(es) or expert(s) is/are, with the consent of the parties, called upon to appear at the instance of the IEC in connection with the matter, then, the costs towards such witness(es)/expert(s) shall be determined by the IEC with the consent of the Parties and the cost so determined shall be borne equally by the Parties.

26. The other expenditures/costs in connection with the Conciliation proceedings as well as the IEC's fees and expenses shall be shared by the Parties equally.

27. Out of the lump sum fees of Rs 75,000/- for Sitting Fees, 50% shall be payable after the first meeting of the IEC and the remaining 50% of the Sitting Fees shall be payable only after termination of the conciliation proceedings in terms of para 22 hereinabove.

28. The travelling, transportation and stay at outstation shall be arranged by concerned Unit as per entitlements as per Serial No. 3 of the Table at para 23 above, and in case such arrangements are not made by the BHEL Unit, the same shall be reimbursed to the IEC on actuals limited to their entitlement as per Serial No. 4 of the Table at Para 23 above against supporting documents. The IEC Member(s) shall submit necessary invoice for claiming the fees/reimbursements.

29. The Parties shall keep confidential all matters relating to the conciliation proceedings. Confidentiality shall extend also to the settlement agreement, except where its disclosure is necessary for purposes of its implementation and enforcement or as required by or under a law or as per directions of a Court/Governmental authority/ regulatory body, as the case may be.

30. The Parties shall not rely upon or introduce as evidence in any further arbitral or judicial proceedings, whether or not such proceedings relate to the Disputes that is the subject of the Conciliation proceedings:
    a. Views expressed or suggestions made by the other party in respect of a possible settlement of the Disputes;
    b. admissions made by the other party in the course of the Conciliator proceedings;
    c. proposals made by the Conciliator;
    d. The fact that the other Party had indicated his willingness to accept a proposal for settlement made by the Conciliator.

31. The Parties shall not present the Conciliator(s) as witness in any Alternative Dispute Resolution or Judicial proceedings in respect of a Disputes that is/was the subject of that particular Conciliation proceeding.

32. None of the Conciliators shall act as an arbitrator or as a representative or counsel of a Party in any arbitral or judicial proceeding in respect of a Disputes that is/was the subject of that particular Conciliation proceeding.

33. The Parties shall not initiate, during the Conciliation proceedings, any arbitral or judicial proceedings in respect of a Disputes that is the subject matter of the Conciliation proceedings except that a Party may initiate arbitral or judicial proceedings where, in his opinion, such proceedings are necessary for preserving his rights including for preventing expiry of period of limitation. Unless terminated as per the provisions of this Scheme, the Conciliation proceedings shall continue

notwithstanding the commencement of the arbitral or judicial proceedings and the arbitral or judicial proceedings shall be primarily for the purpose of preserving rights including preventing expiry of period of limitation.

34. The official language of Conciliation proceedings under this Scheme shall be English unless the Parties agree to some other language.

Format 2 to BHEL Conciliation Scheme, 2018

FORMAT FOR SEEKING CONSENT FOR REFERRING THE DISPUTES TO CONCILIATION THROUGH IEC

To,

M/s. (Stakeholder's name)

Sub: Resolution of the Disputes through conciliation by Independent Expert Committee (IEC).

Ref: Contract No/MoU/Agreement/LOI/LOA& date _____.

Sir,

With reference to above referred Contract/MoU/Agreement/LOI/LOA, you have raised certain Disputes/claims. Vide your letter dated____ you have requested BHEL to refer the Disputes/claims to IEC for Conciliation.

We are enclosing herewith Format (3) for giving consent and the terms and conditions of BHEL Conciliation Scheme, 2018 governing conciliation through IEC. You are requested to give your unconditional consent to the said terms and conditions of the Scheme by returning the same duly sealed and signed on each page. On receipt of your consent, matter will be put to the Competent Authority for consideration and decision.

Please note that BHEL has also certain claims against you (if applicable). BHEL reserves its right to agree or not to agree conciliation of the said disputes through BHEL and this letter is being issued without prejudice to BHEL's rights and contentions available under the contract and law.

Yours faithfully,

Representative of BHEL

Format 3 to BHEL Conciliation Scheme, 2018

FORMAT FOR GIVING CONSENT BY CONTRACTOR/VENDOR/CUSTOMER/COLLABORATOR/CONSORTIUM PARTNERSFOR REFERRING THE DISPUTES TO CONCILIATION THROUGH IEC

To,

BHEL

.....

Sub: Resolution of Disputes through Conciliation by Independent Expert Committee (IEC).

Ref: Contract/MoU/Agreement/LOI/LOA No & date____

With reference to above referred contract, our following bills/invoices/claims submitted to BHEL are still unpaid giving rise to Disputes:

SL. no.	Claim Description	Bill submitted to BHEL (no. and date)	Amount of the bill/claim	Amount received from BHEL	Outstanding Amount

Accordingly we request you to kindly refer the Disputes in respect of above claims to IEC for Conciliation.

We hereby agree and give our unconditional consent to the terms and conditions of BHEL Conciliation Scheme, 2018 governing conciliation through IEC. We have signed the same on each page and enclosed it for your consideration.

Yours faithfully,

(Signature with stamp)

Authorized Representative of Contractor
Name, with designation
Date

Format 5 to BHEL Conciliation Scheme, 2018

STATEMENT OF CLAIMS/COUNTER CLAIMS TO BE SUBMITTED TO THE IEC BY BOTH THE PARTIES

1. Chronology of the Disputes

2. Brief of the Contract/MoU/Agreement/LOI/LOA

3. Brief history of the Disputes:

4. Issues:

5. Details of Clam(s)/Counter Claim(s):

Sl. No.	**Description of claim(s)/Counter Claim**	**Amount (in INR)Or currency applicable in the contract**	**Relevant contract clause**

6. Basis/Ground of claim(s)/counter claim(s) (along with relevant clause of contract)

Note– *The Statement of Claims/Counter Claims may ideally be restricted to maximum limit of 20 pages. Relevant documents may be compiled and submitted along with the statement of Claims/Counter Claims. The statement of Claims/Counter Claims is to be submitted to all IEC members and to the other party by post as well as by email.*

BILL OF QUANTITY CUM PRICE SCHEDULE (ANNEXURE-I)

Name of Project: 765/400/220 kV AIS Switchyard at POWERGRID KOPPAL-II & KOPPAL Extn.

Name of Work: Erection work of Structure and Stringing at 765/400/220 kV AIS Switchyard at POWERGRID KOPPAL-II & KOPPAL Extn. Project in Koppal, Karnataka.

Tender Spec. No. :TBSM/KOPPAL-II/EREC-STR/TENDER/25-26 DATE: 08.05.2025

SR_NO	Description_of_Item	UOM	Quantity	Unit Rate (Excldg. GST)	Amount (Excldg. GST)
1	GALVANISED STEEL LATTICE STRUCTURES INCLUDING HARDWARES FOR TOWERS, BEAMS - 765KV	MT	1500	₹ 5,977.50	₹ 89,66,246.40
2	GALVANISED STEEL LATTICE STRUCTURES INCLUDING HARDWARES FOR TOWERS, BEAMS - 400KV & BELOW	MT	700	₹ 5,977.50	₹ 41,84,248.32
3	AAC BULL CONDUCTOR COMPLETE WITH TEE CONNECTORS FOR DROPPERS TO EQUIPMENT CONNECTIONS, PG CLAMPS FOR BUSBAR JUMPERING, TWIN/QUAD BUNDLE RIGID/FLEXIBLE SPACERS ETC TO COMPLETE	km	72	₹ 1,11,672.00	₹ 80,40,384.00
4	ACSR BERSIMIS / MOOSE CONDUCTOR COMPLETE WITH TEE CONNECTORS FOR DROPPERS TO EQUIPMENT CONNECTIONS, PG CLAMPS FOR BUSBAR JUMPERING, TWIN/QUAD BUNDLE RIGID/FLEXIBLE SPACERS ETC TO COMPLETE	km	52	₹ 86,292.00	₹ 44,87,184.00
5	INSTALLATION OF GI STRANDED SHIELD WIRE INCLUDING TENSION CLAMP, PG CLAMP AND CLAMPING ON STRUCTURE FOR DOWN CONDUCTOR, FIXING/BOLTING WITH EARTH STRIP ETC TO COMPLETE.	km	17.5	₹ 67,003.20	₹ 11,72,556.00
6	765KV DOUBLE TENSION STRING INSULATOR INCLUDING HARDWARE WITH / WITHOUT TURNBUCKLE SUITABLE SUITABLE FOR QUAD CONDUCTOR.	No.	168	₹ 5,450.61	₹ 9,15,702.28
7	765KV DOUBLE TENSION STRING HARDWARE (INCLUDING INSULATOR) WITH / WITHOUT TURN BUCKLES SUITABLE FOR HEXA CONDUCTOR.	No.	12	₹ 5,450.61	₹ 65,407.31
8	765KV SINGLE "V" SUSPENSION STRING HARDWARE(INCLUDING INSULATOR) SUITABLE FOR QUAD CONDUCTOR BUNDLE WITH DROP / THROUGH CLAMP.	No.	60	₹ 5,735.88	₹ 3,44,152.80
9	400 KV DOUBLE TENSION HARDWARE (INCLUDING INSULATOR) WITH / WITHOUT TURNBUCKLE SUITABLE FOR QUAD CONDUCTOR.	No.	144	₹ 4,194.81	₹ 6,04,052.12
10	400 KV SINGLE SUSPENSION HARDWARE (INCLUDING INSULATOR) WITH DROP / THROUGH CLAMP SUITABLE FOR QUAD CONDUCTOR.	No.	60	₹ 3,432.39	₹ 2,05,943.47
11	220 KV DOUBLE TENSION HARDWARE (INCLUDING INSULATOR) WITH/WITHOUT TURNBUCKLE SUITABLE FOR QUAD CONDUCTOR.	No.	192	₹ 3,186.71	₹ 6,11,848.86

BILL OF QUANTITY CUM PRICE SCHEDULE (ANNEXURE-I)

Name of Project: 765/400/220 kV AIS Switchyard at POWERGRID KOPPAL-II & KOPPAL Extn.

Name of Work: Erection work of Structure and Stringing at 765/400/220 kV AIS Switchyard at POWERGRID KOPPAL-II & KOPPAL Extn. Project in Koppal, Karnataka.

Tender Spec. No. :TBSM/KOPPAL-II/EREC-STR/TENDER/25-26 DATE: 08.05.2025

SR_NO	Description_of_Item	UOM	Quantity	Unit Rate (Excldg. GST)	Amount (Excldg. GST)
12	220 KV DOUBLE TENSION HARDWARE (INCLUDING INSULATOR) WITH/WITHOUT TURNBUCKLE SUITABLE FOR TWIN CONDUCTOR.	No.	48	₹ 3,186.71	₹ 1,52,962.21
13	220 KV SINGLE SUSPENSION HARDWARE (INCLUDING INSULATOR) WITH DROP / THROUGH CLAMP SUITABLE FOR QUAD CONDUCTOR.	No.	12	₹ 2,867.94	₹ 34,415.28
14	220 KV SINGLE SUSPENSION HARDWARE (INCLUDING INSULATOR) WITH DROP / THROUGH CLAMP SUITABLE FOR TWIN CONDUCTOR.	No.	42	₹ 2,867.94	₹ 1,20,453.48
15	220 KV SINGLE SUSPENSION HARDWARE (INCLUDING INSULATOR) WITH DROP / THROUGH CLAMP SUITABLE FOR SINGLE CONDUCTOR.	No.	3	₹ 2,867.94	₹ 8,603.82
16	CUTTING AND MODIFICATION - STRUCTURAL PLATES: STRUCTURE MODIFICATION - ALL TOOLS AND TACKLES REQUIRED FOR GI STRUCTURE, ANY OTHER STEEL STRUCTURE MODIFICATION SHALL BE IN THE SCOPE OF ERECTION AGENCY. MINOR WELDING AND APPLICATION OF PROTECTIVE / ZINC RICH PAINT ON WELDED SURFACE IS ALSO INCLUDED IN THE SCOPE.	KG	1000	₹ 25.38	₹ 25,380.00
17	MODIFICATION OF EXISTING HOLE SIZES IN STRUCTURES: ALL TOOLS AND TACKLES REQUIRED FOR GI STRUCTURE, ANY OTHER STEEL STRUCTURE MODIFICATION SHALL BE IN THE SCOPE OF ERECTION AGENCY. APPLICATION OF PROTECTIVE / ZINC RICH PAINT ON MODIFIED SURFACE IS ALSO INCLUDED IN THE SCOPE.	Nos	100	₹ 123.85	₹ 12,385.44
18	DRILLING OF ADDITIONAL HOLES IN STRUCTURES : STRUCTURE MODIFICATION -ALL TOOLS AND TACKLES REQUIRED FOR GI STRUCTURE, ANY OTHER STEEL STRUCTURE MODIFICATION SHALL BE IN THE SCOPE OF ERECTION AGENCY. APPLICATION OF PROTECTIVE / ZINC RICH PAINT ON MODIFIED SURFACE IS ALSO INCLUDED IN THE SCOPE.	Nos	100	₹ 123.85	₹ 12,385.44

BILL OF QUANTITY CUM PRICE SCHEDULE (ANNEXURE-I)

Name of Project: 765/400/220 kV AIS Switchyard at POWERGRID KOPPAL-II & KOPPAL Extn.

Name of Work: Erection work of Structure and Stringing at 765/400/220 kV AIS Switchyard at POWERGRID KOPPAL-II & KOPPAL Extn. Project in Koppal, Karnataka.

Tender Spec. No. :TBSM/KOPPAL-II/EREC-STR/TENDER/25-26 DATE: 08.05.2025

SR_NO	Description_of_Item	UOM	Quantity	Unit Rate (Excldg. GST)	Amount (Excldg. GST)
19	WATCH AND WARD OF STORED / ERECTED MATERIAL AT PROJECT SITE AND STORAGE AREA OR ANY OTHER LOCATIONS AS PER INSTRUCTION OF SITE IN CHARGE. (ROUND THE CLOCK SECURITY BY AUTHORIZED SERVICE AGENCY)	Per Post Per Month	12	₹ 75,264.90	₹ 9,03,178.77
				Total Amount (Excluding GST)	**₹ 3,08,67,490**

Note: Scope of Erection work includes Unloading from truck/ trailer/ carriers and handling in store, upkeeping, shifting to & fro from store to work location/any location within site boundary, receipt & verification of material, material reconciliation, verification, record keeping, material relocating as per site / storage requirements, safe keeping, Pre-erection assembly, erection/ installation of the material/equipment as per drawings/instruction of site incharge, reconciliation after completion of Erection and handing over surplus material & Spares to BHEL/Customer. The Scope include provision of manpower, all tools & plant, testing kit required for erection work, hydra/crane, man lifter, winch and any other machinery/arrangement to be made for working at height as required for complete installation. IR test for insulator is in Erection agency scope. Preparation and taking approval of joint erection protocol with BHEL/CUSTOMER as per approved feild quality plan.

Validate Print Help

Percentage BoQ

Tender Inviting Authority: BHEL, TBG- SubContracting Department, Sector 16A Noida, UP

Name of Work: Erection work of Structure and Stringing at 765/400/220 kV AIS Switchyard at POWERGRID KOPPAL-II & KOPPAL Extn. Project in Koppal, Karnataka

Contract No: TBSM/KOPPAL-II/EREC-STR/TENDER/25-26, DATE: 08.05.2025

Name of the Bidder/ Bidding Firm / Company :						

PRICE SCHEDULE

(This BOQ template must not be modified/replaced by the bidder and the same should be uploaded after filling the relevent columns, else the bidder is liable to be rejected for this tender. Bidders are allowed to enter the Bidder Name and Values only)

NUMBER #	TEXT #	NUMBER #	TEXT #	NUMBER	NUMBER #	TEXT #
Sl. No.	Item Description	Quantity	Units	Estimated Rate in Rs.	TOTAL AMOUNT Without Taxes in Rs.	TOTAL AMOUNT In Words
1	2	4	5	6	53	55
1	Total amount as per rates in BOQ (as per Annexure-I) for "Erection work of Structure and Stringing at 765/400/220 kV AIS Switchyard at POWERGRID KOPPAL-II & KOPPAL Extn. Project in Koppal, Karnataka". - Excluding GST	1.000	Nos	30867490.00	**30867490.00**	INR Three Crore Eight Lakh Sixty Seven Thousand Four Hundred & Ninety Only
Total in Figures					**30867490.00**	INR Three Crore Eight Lakh Sixty Seven Thousand Four Hundred & Ninety Only
Quoted Rate in Figures			Select		**0.000**	INR Zero Only
Quoted Rate in Words					**INR Zero Only**	

Sl.No.	BOQ_ANNEXURE_1: STANDARD & PROJECT SPECIFIC TECHNICAL NOTES & SCOPE
1	Scope of Erection work includes Unloading from truck/ trailer/ carriers and handling in store, upkeeping, shifting to & fro from store to work location/any location within site boundary, receipt & verification of material, material reconciliation, verification, record keeping, material relocating as per site / storage requirements, safe keeping, Pre-erection assembly, erection/ installation of the material/equipment as per drawings/instruction of site incharge, reconciliation after completion of Erection and handing over surplus material & Spares to BHEL/Customer. The Scope include provision of manpower, all tools & plant, testing kit required for erection work, hydra/crane, man lifter, winch and any other machinery/arrangement to be made for working at height as required for complete installation. IR test for insulator is in Erection agency scope. Preparation and taking approval of joint erection protocol with BHEL/CUSTOMER as per approved feild quality plan.
2	Erection agency Supplied Material (as applicable) - For approved make of supply items, please visit "POWERGRID COMPENDIUM OF VENDORS" at following website address. **www.powergrid.in** Erection agency to offer items from powergrid approved make only (as applicable). Erection agency to supply material of proven design and make, which have already been extensively used and tested. Erection agency to obtain approval from BHEL Engineer incharge / Customer prior to supply. Quantity of supply items are provisional and shall be finalised during contract stage. Qty of supply item may vary upto any extent and and even may get deleted. However overall contract value may vary +/- 30%. Variation will be valid up-to contract stage.
3	All consumables required for sucessful erection of present scope of work is in Erection agencys scope, such as (not limited to) Welding Electrodes, Low hydrogen content welding electrode, Paint, bitumen compound, Zinc riched enamel paint, red oxide and zinc chromate etc. complete in all respect.
4	All pre-commissioning activities for substation equipment shall be carried out in accordance **''Pre- Commissioning procedures for Switchyard Equipments (Doc. No. D-2-01-03-01-04 or latest version)"**
5	The storage instructions of the equipment manufacturer/ Employer shall be strictly adhered to. POWERGRID Field Quality Plan shall be followed alongwith the provision of Technical Specification for storage.
6	All arc welding shall be done with **low hydrogen content electrodes** as per customer/BHEL approved specification/make.
7	All welding done at site for equipment and structures, shall be painted with zinc rich paint immediately to avoid corrosion.
8	Testing istruments (dully calibrated) have to be arranged by Erection agency at it's own cost (List is only provided for information , if any other instrument not mentioned below but required for sucessful completion of Erection work shall be in Erection agency scope). Erection agency to submit valid calibration certificate during commencement of testing works.
a	Contact Resistance Measurement kit (CRM)
b	5kV/1kV Insulation tester

BOQ_ANNEXURE_2

PROJECT SPECIFIC DRAWING & DOCUMENT LIST

Sl. No.	DRAWING / DOCUMENT NUMBER	DRAWING / DOCUMENT TITLE
1	TB-0-424-316-002-REV 04	KOPPAL II NEW S/S- ELECTRICAL LAYOUT PLAN & SECTIONAL
2	TB-0-425-316-004-REV 02	KOPPAL II NEW S/S- STRUCTURE LAYOUT PLAN & SECTION

Note: Above drawings are given for reference purpose. Latest revision of above drawings will be shared with successful bidder, which is to be followed, during contract execution stage.

BOQ_ANNEXURE_3

STANDARD DRAWING & DOCUMENT LIST

Sl.No	DRAWING / DOCUMENT NUMBER	DRAWING / DOCUMENT TITLE
1	SECTION-PROJECT-REV.00	SECTION-PROJECT. (REV.00): SSubstation Package SS-06T for Construction of 765/400/220kV Koppal-II PS under Transmission Scheme for integration of Renewable Energy Zone (Phase-II) in Koppal-II (Phase-A) in Karnataka Substation Package SS-09T for Extension of 765/400/220kV Koppal-II PS and Extension of 765kV Raichur SS under Transmission Scheme for integration of Renewable Energy Zone (Phase-II) in Koppal-II (Phase-B) in Karnataka
2	C/ENGG/SPEC/GTR (Rev.15)	SECTION-GENERAL TECHNICAL REQUIREMENTS (REV.15)
3	C / ENGG / SPEC / ERC REV. NO: 10	SECTION-SE (SWITCHYARD ERECTION (REV.10))
4	D-2-01-03-01-04	PRE COMMISSIONING PROCEDURE & FORMAT FOR SWITCHYARD ERECTION
5	Annexure-III	Specific Requirement_Rev 07 with Annexures
6	C/ENGG/SPEC/STR (REV 06)	SECTION: STRUCTURE

SECTION -PROJECT

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7.0 DIFFERENT SECTIONS OF TECHNICAL SPECIFICATION 17
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ANNEXURE –I : LIST OF DRAWINGS.
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ANNEXURE-III: SPECIFIC REQUIREMENTS (Section-Project) C/ENGG/SPEC/SEC-PROJECT/SPECIFIC REQUIREMENT Rev. No **08**

1.0 GENERAL

1.1 PREMBLE

Power Grid Corporation of India Ltd. (POWERGRID), a Govt. of India Enterprise is responsible for bulk Power transmission of electrical energy from various Central Govt. Power Projects to various utilities/beneficiaries and interconnecting regional grids, operating and maintaining the National electrical grid of India. It is established with mandate of "We will become a Global Transmission Company with Dominant Leadership in Emerging Power Markets with World Class Capabilities by:

- World Class: Setting superior standards in capital project management and operations for the industry and ourselves.
- Global: Leveraging capabilities to consistently generate maximum value for all stakeholders in India and in emerging and growing economies.
- Inspiring, nurturing and empowering the next generation of professionals.
- Achieving continuous improvements through innovation and state of the art technology.
- Committing to highest standards in health, safety, security and environment." as its mission.

1.2 Govt. of India (MoP) has identified Inter-State Transmission System for "Transmission Scheme for integration of Renewable Energy Zone (Phase-II) in Koppal-II (Phase-A & B) and Gadag-II (Phase-A) in Karnataka" through Tariff Based Competitive Bidding (TBCB) route
POWERGRID is intending to participate in the bidding process & also is intending to arrange for pre-bid tie-up(s) for the scope envisaged, as elaborated else in this document, under the transmission scheme above.

1.3 Following Transmission System is envisaged under "Transmission Scheme for integration of Renewable Energy Zone (Phase-II) in Koppal-II (Phase-A & B) and Gadag-II (Phase- A) in Karnataka" through TBCB route:

A. Transmission Scheme for integration of Renewable Energy Zone (Phase-II) in Koppal-II (Phase-A) and Gadag-II (Phase- A) in Karnataka.

B. Transmission Scheme for integration of Renewable Energy Zone (Phase-II) in Koppal-II (Phase-B) in Karnataka

The instant package involves the following scope of work

No.	Name of the Transmission Element
1	Establishment of 765/400 kV 2x1500 MVA, 400/220 kV, 2x500 MVA Koppal-II (Phase- A) Pooling Station with provision of two (2) sections of 4500 MVA each at 400 kV level and provision of four (4) sections of 2500 MVA each at 220 kV level 765/400 kV, 1500 MVA, ICTs –2 Nos. (7x500 MVA including 1 spare unit) • 765 kV ICT bays – 2 Nos. • 400 kV ICT bays – 2 Nos. • 400/220 kV, 500 MVA, ICTs – 2 Nos. • 400 kV ICT bays – 2 Nos. • 220 kV ICT bays – 2 Nos. • 765 kV line bays – 2 Nos.(at Koppal-II for termination of Koppal-II-Narendra (New) 765 kV D/c line)

	• 220 kV line bays – 4 Nos. • 220 kV Bus Coupler (BC) Bay –1 No. • 220 kV Transfer Bus Coupler (TBC) Bay – 1 No. **Future Provisions: (Including space for Phase-B)** • 765/400 kV, 1500 MVA, ICTs – 5 Nos. • 765 kV ICT bays – 5 Nos. • 400 kV ICT bays – 5 Nos. • 400/220 kV, 500 MVA, ICTs – 10 Nos. • 400 kV ICT bays – 10 Nos. • 220 kV ICT bays – 10 Nos. • 765 kV line bays – 8 Nos. (with provision for SLR) • 400 kV line bays – 14 Nos. (with provision for SLR) • 220 kV line bays – 12 Nos. • 220 kV Bus Sectionalizer: 3 sets • 220 kV Bus Coupler (BC) Bay – 3 Nos. • 220 kV Transfer Bus Coupler (TBC) Bay – 3 Nos. • 400 kV Bus Sectionalizer: 1 set
2	Koppal-II PS – Narendra (New) 765 kV D/c line with 240 MVAr SLR at Koppal-II PS end • 765 kV line bays – 2 Nos. (GIS) [at Narendra (New)] (**Covered under separate package)** • 765 kV, 240 MVAr SLR at Koppal-II PS – 2 Nos. (7x80 MVAr including 1 switchable spare unit)
3	2x330 MVAr (765 kV) & 2x125 MVAr (400 kV) bus reactors at Koppal-II PS • 765 kV, 330 MVAr Bus Reactor – 2 Nos. (7x110 MVAr including 1 switchable spare unit for both bus reactor and line reactor) • 765 kV Bus Reactor bays – 2 Nos. • 420 kV, 125 MVAr Bus Reactors – 2 Nos. • 420 kV, 125 MVAr Bus Reactor bays – 2 Nos

2.0 SCOPE

2.1 The broad scope for the substations under present scope is as follows:

(A)	**Station Name (New)**	**765/400/220 kV Koppal-II Pooling Station (New) (AIS type)**
(a)	**Voltage Level**	**765kV**
	Bus-Switching Scheme	One and a Half Breaker Scheme
	Fault level	50 kA/1sec
	Transformers	7x500MVA, (765/√3)/(400/√3)/33 kV, 1-phase transformers (1 no. as spare unit) along with its auxiliaries. These transformers are being procured through **separate package(s)** & shall be provided to the contractor(under present scope), on OSM basis, without any cost implication.
	Bus Reactors	7X110 MVAR, 765/√3kV, 1-phase reactors (1 no. as spare unit) along with its auxiliaries

		These Reactors along with NGR & 132kV LA are being procured through **separate package(s)** & shall be provided to the contractor(under present scope), on OSM basis, without any cost implication.
	Line Reactors	7X80 MVAR, 765/√3kV, 1-phase reactors for Koppal-II- Narendra(new) 765 KV D/C line (each 240 MVAR reactor with NGR, 132kV Surge Arrester & common Reactor unit as spare, along with its auxiliaries. These Reactors along with NGR & 132kV LA are being procured through **separate package(s)** & shall be provided to the contractor(under present scope), on OSM basis, without any cost implication.
	Transformer bays	02 Nos.
	Bus reactor bays	02 Nos.
	Line Reactor bays (Switchable)	2 nos. (for Koppal-II- Narendra(new) 765 KV D/C line)
	Line bays	02 Nos. (for termination of Koppal-II- Narendra(new) 765 KV D/C line)
	All associate tie bays	As per requirement of technical specification
	Provision of Future bays:	
	765/400kV ICT along with associated bays	05 Nos
	Line bays along with switchable line reactor	08 Nos
	All associated ties bays	
(a)	**Voltage Level**	**400kV**
	Bus-Switching Scheme	One and a Half Breaker Scheme
	Fault level	63kA/1sec
	Transformers	2x500 MVA, 400/220/33kV, 3-Phase, Auto Transformers These transformers are being procured through **separate package(s)** & shall be provided to the contractor(under present scope), on OSM basis, without any cost implication.
	Reactors	2 X 125 MVAr , 420 kV, 3-Phase, Bus Reactors.
	Transformer bays	04 Nos.
	Bus reactor bays	02 Nos.
	Provision of Future bays:	
	400/220kV ICT along with associated bays	10 Nos.
	ICT bays for 765/400kV ICT	05 Nos
	Line bays along with switchable line reactor	14 Nos.
	400kV Bus sectionalizer	01 No
(b)	**Voltage Level**	**220kV**
	Bus-Switching Scheme	Double Main & Transfer Scheme
	Fault level	50kA/1Sec

	Transformer bays	02 Nos.
	Line bays	04 Nos.
	Bus Coupler bays	01 Nos.
	Transfer bus coupler bays	01 Nos.
	Future bays:	
	400/220kV ICTs along with associated bays	10 Nos.
	Line bays	12 Nos.
	220kV Bus Sectionalizer	03 Set
	220kV Transfer bus coupler bays.	03 No.
	220kV Bus Coupler bays	03 No.

2.2 **400 kV & 220 kV feeder distribution in different bus section shall be as follow:**

<table>
<tr><th>400kV Bus Section-1</th><th colspan="3">400kV Bus Section-2 (future)</th></tr>
<tr><td>• 2nos. of present 1500MVA 765/400kV ICT
• 2 nos. of present 500MVA 400/220kV ICT
• 2 nos. of present 125MVAR Bus Reactor
• 2 nos. of 400kV Lines bays for Gadag-II Koppal II D/c (under separate package)
• 2 no. of future 1500MVA 765/400kV ICT
• 4 nos. of future 500MVA 400/220kV ICT
• 6 nos. of future 400kV Lines</td><td colspan="3">• 3 no. of future 1500MVA 765/400kV ICT
• 6 nos. of future 500MVA 400/220kV ICT
• 6 nos. of future 400kV Lines</td></tr>
<tr><th>220kV Bus Section-1</th><th>220kV Bus Section-2 (Future)</th><th>220kV Bus Section-3(Future)</th><th>220kV Bus Section-4 (Future)</th></tr>
<tr><td>• 4 nos. of present 220kV Line
• 2 nos. of present 500MVA 400/220kV ICT
• 1 no. of future 500MVA 400/220kV ICT</td><td>• 4 nos. of future 220kV Line
• 3 nos. of future 500MVA 400/220kV ICT</td><td>• 4 nos. of future 220kV Line
• 3 nos. of future 500MVA 400/220kV ICT</td><td>• 4 nos. of future 220kV Line
• 3 nos. of future 500MVA 400/220kV ICT</td></tr>
</table>

2.3 The following points to be taken into consideration during development of Switchyard Layout of 765/400/220kV Koppal-II PS.

i) One (1) set of bus sectionalizer for 400 kV shall comprise 2 nos. of bus sectionalizer bays with associated Circuit Breakers, Isolators and Current Transformers for both bus-I & II.

ii) One (1) set of bus sectionalizer for 220 kV shall comprise 2 nos. of bus sectionalizer bays with associated Circuit Breakers, Isolators and Current Transformers for both buses and isolator for Transfer bus.

iii) Distribution of line and transformer feeders to bus bar should be done in such a way that all power can be evacuated successfully without crossing thermal limit at any point of bus-bar.

iv) Space provisions for future elements to be kept in such that interconnection arrangement to the corresponding future bays can be done with overhead AIS type connection without any cable/ GIS duct.

2.2 The detailed scope of work of the substation package is brought out in subsequent clauses of this section.

2.2.1 765/400/220 kV Koppal-II (New) S/s.

2.2.1.1 Design, engineering, manufacture, testing at manufacturer's works, supply including transportation and insurance, unloading, storage, erection, testing and commissioning at site the following equipment/items, complete in all respects:

a) 2 x125MVAR, 420kV, 3-Ph Bus Reactors along with associated accessories.

b) 765kV Circuit Breakers, Isolators, Current Transformers, Capacitor Voltage Transformers, Wave Traps (Pedestal mounted), Bus Post Insulators (including BPI for Wave Traps) and 624kV Surge Arresters.

c) 400kV Circuit Breakers, Isolators, Current Transformers, Capacitor Voltage Transformers, Bus Post Insulators and 336kV Surge Arresters.

d) 245kV Circuit Breakers, Isolators, Current Transformers, Capacitor Voltage Transformers, Wave Traps (suspension type), Bus Post Insulators and 216kV Surge Arresters.

e) Controlled Switching device for 765kV & 400kV Circuit breakers: as per BPS

f) LT Transformer and associated equipment:

800 kVA, 33/0.433kV, LT Transformer (1st) and associated 72.5kV class Circuit Breakers, Isolators, Current Transformers, Potential Transformers, Bus Post Insulators, conductor, clamps, connectors, structures etc. complete in all respect for tertiary loading of 765/400/33kV Autotransformer.

800 kVA, 11/0.433kV LT Transformer (2nd) and associated 11kV class Isolator, HG fuse, Surge Arrestor, Bus Post Insulator, conductor, clamps, connectors, structures etc. complete in all respect for connection with DISCOM Power supply.

g) Complete control, relay and protection system as per Section–Control and Relay panels including control, monitoring and protection of LT Transformer connected to tertiary of 765/400/33kV Autotransformer.
Decentralized (distributed) type of bus bar protection system shall be provided for 765/400/220kV Koppal-II substation with the following scope:

- For all 765kV bays under present and future scope as specified at clause no.2.1.
- For 400kV bays under present and future scope connected to Section-I, as specified at clause no.2.2.
- For 220kV bays under present and future scope connected to Section-I, as specified at clause no.2.2.
- Necessary equipment, wiring etc. required for control & monitoring of 145kV Circuit Breaker(s) for NGR by-passing arrangement is also under present scope of work. The same may be located in respective line/reactor protection panel.

h) Complete Substation Automation System based on IEC-61850 as per Section Substation Automation (including hardware and software) along with associated equipment. Capacity of the Substation Automation System (SAS) shall be suitable for operation and monitoring of the complete substation including proposed future bays/elements as elaborated at Clause 2.0 above & scope shall include BCUs required (as per BPS).

BCUs for control and monitoring of substation auxiliary system shall also be included under present scope.

Necessary configuration of data at Gateway for remote operation from NTAMC, Backup NTAMC, RTAMC & supervision from RLDC (RSCC) is included in present scope. Necessary interface and integration work for transferring data to NTAMC, Backup NTAMC, RTAMC / RLDC (RSCC) /NLDC) through optical fibre based SDH communication link is also under present scope. However, no work at remote end (NTAMC, Backup NTAMC, RTAMC & RLDC /RSCC) is envisaged under present scope.

i) PLCC equipment including Analogue protection coupler, Digital Protection Coupler (suitable for interfacing with E1 port of SDH equipment), FO Boxes, gantry, signal converters, communication cables etc. for the 765kV Koppal-II PS-Narendra(new) D/C line is being considered in separate package. However a telephone exchange (PABX) of 24 lines shall be provided at KOPPAL-II(NEW) substation, as means of effective communication among various buildings of the substation, remote end substations and with control centers (RLDC/SLDC) etc.
Further, contractors are to undertake interconnection of Control signals from/to PLCC/DPC to CRP & to any other panel, as part of Service item of the associated BPS of CRP, under present scope & cost is deemed to be included therein.

j) **Fire protection System**:
- **i)** Complete Fire protection system for Koppal-II(New) substation including HVWS and hydrant system for:
  a. 2 x 420kV 125MVAr reactors under present scope:
  b. The scope shall also include FPS & HVWS for following transformers & Reactors, (provided to the contractor under present scope on OSM basis):
     i. 7 x 765/√3)/(400/√3)/33kV, 1-Phase Autotransformers
     ii. 14(7+7) x 765/√3kV, 1-Phase Reactors
     iii. 2 x 400/220/33kV, 500 MVA, 3 Phase Transformer.
- **ii)** Smoke detection, Fire Detection, alarm & annunciation System for Switchyard panel room, Control Room building. Fire-fighting system including alarm & annunciation panels shall be suitable for complete substation scope i.e. for all present and future 765kV, 400kV & 220kV bays (as detailed at Clause 2.0 above).
- **iii)** Hydrant system for control room building, FFPH, LT system etc.

k) Air Conditioning System for Control Room Building, Battery room & Switchyard Panel Rooms.

l) LT switchgear (AC/DC Distribution boards) considering all present and future bays, as detailed at Clause 2.0 above.
- AC/DC system shall be provided as per the specified scope of work, including future provisions, in line with the LT SLD drawing no. C/ENGG/STD/LTSWGR765/SLD/01 Rev-0. A
- Modules for ACDB (Board No. 2A), 220V DCDB (Board No 1D & 2D), 48V DCDB (Board No 3D & 4D) shall be designed & provided considering all bays (including 765,400 &220 kV Bays) as specified at Clause 2.0 above

m) Battery and Battery chargers:
i. The capacity of Battery Banks & Battery chargers, shall be worked out by bidder & Battery sizing calculation, considering the above requirement of 765/400/220kV substation scope (including future bays as specified at clause 2.0 above) is to be submitted for approval of the Employer.

ii. Bidder to supply "Capacity" of battery & Chargers as per Battery sizing calculation or as specified in Bid proposal Sheet (BPS), whichever is higher. However, no additional Cost shall be admissible against this account.

n) 500kVA Silent type outdoor DG Set along with AMF panel.

o) 1.1 kV grade Power & Control cables (and special cables, if any) along with complete accessories including cables for oil filtration units and cabling from common marshaling box to bay kiosks /Relay panel room /control room associated with :

a. Bays under present scope
b. 2 x 420kV 125MVAr reactors under present scope
c. The scope shall also include following transformers & Reactors, (provided to the contractor under present scope on OSM basis):
   i. 7 x 765/√3)/(400/√3)/33kV, 1-Phase Autotransformers
   ii. 14(7+7) x 765/√3kV, 1-Phase Reactors
   iii. 2 x 400/220/33kV, 500 MVA, 3 Phase Transformer.
d. Power receptacle for oil filtration unit shall also be provided under present scope of work as per BPS.

- Methodology for supply, installation & sizing of cables for all the above shall be as per Specific requirement attached as **Annexure-III** of this document.

p) 11kV HT cable along with complete accessories viz. termination kit, lugs, glands, clamps etc. for connection of LT Transformer.

q) Insulator strings and associated hardware fittings as per Bid Price Schedule (BPS).

r) **Erection Hardware:** Clamps & connectors including terminal connectors for Bus reactor (under present scope), Employer-supplied (765/√3)/(400/√3)/33kV Autotransformers, 765/√3kV Reactors and also associates, SA & NGR , 400/220/33kV Auto transformer, Conductor, Aluminum tubes, Bus bar and earthing materials, Bay marshalling box, spacers, cable sealing arrangement, insulating mats, cable supporting angles/channels, Cable Pull pit, Cable trays & covers, Guy arrangement(including insulators and hardware), **insulator & hardware for 220kV wave trap suspension as required**, Junction box, buried cable trenches etc.

The scope shall also include earthing arrangement of all the equipment (including employer supplied (765/√3)/(400/√3)/33kV & 400/220/33kV Autotransformers & 765/√3kV Reactors associated SA , NGR), cable trenches, auxiliary earthmat for isolators etc. by connecting them to the main Earthmat.

- Earthing of structures of all auxiliary buses shall also be under present scope.
- Employer supplied 1-Ph Spare unit of (765/√3)/(400/√3)/33kV Autotransformers & 765/√3kV Reactors shall also be connected to grounding system through jumper/Copper flat when they are in uncharged condition.

s) Insulator strings and associated hardware fittings under present scope shall be provided by the contractor as per Bid Price Schedule (BPS).

t) Main Earthmat (As per BPS): Main Earth Mat shall be laid & paid as per actual length under present scope.

u) LED based Lighting and illumination for the switchyard area under present scope, LED based illumination for streets, Control Room cum administrative building, Switchyard Panel Rooms, Auxiliary building, Fire Fighting Pump house, DG Set area and LT station area, security room shall be provided by the contractor.

v) Visual monitoring system for watch and ward of substation premises as per technical specifications attached at Specific requirement attached as **Annexure-III**

w) The lightning protection (DSLP) for complete switchyard is to be provided by the contractor. The contractor shall design the lightning protection by utilizing the structures being provided under present scope. In case, additional structures (Lightning Masts) are required to meet the lightning protection, the contractor shall provide the same.

- The cost for provision of lightning masts shall be payable as per relevant item(s) of BPS.
- All associated earthing materials, hardware etc. for lightning masts shall be deemed to be included under the respective BPS service item for lightning masts. The civil works shall be payable as per relevant item of BPS.

x) The following works pertaining to employer supplied (765/√3)/(400/√3)/33kV autotransformers, 765/√3kV Reactors {supply of Transformers & Reactors is covered in separate package}as per details specified in Specific requirements enclosed at **Annex-III**:

i. Civil works, all associated terminal connectors, firewalls, earthing connection to main earth mat and earth pits etc. (as required) as per technical specification .

ii. Formation of neutral bus for each bank, auxiliary bus (765kV & 145kV) for switching of spare reactors with Bus reactors and Switchable Line Reactors are in present scope of work.

Bidders to consider separate Bus for different MVAR rating of Reactors.

iii. Formation of neutral bus, Delta Bus for each bank of transformer, auxiliary bus (765kV & 400kV, neutral & Delta) for switching of spare transformer with 2 banks of 3 No. 1-Phase transformers, are in present scope of work.

iv. Overhead connection of HV, MV & LV bushings of (765/√3)/(400/√3)/33kV Autotransformers and HV & Neutral bushings of 765/√3kV Reactors to substation equipment's.

v. Overhead connection of substation equipments with 765kV & 400kV auxiliary bus of (765/√3)/(400/√3)/33kV Autotransformers.

vi. Supply, laying and termination of cables along with associated accessories from Common marshaling box of (765/√3)/(400/√3)/33kV Autotransformers & 765/√3kV Reactors to BMK /Switchyard Panel Rooms/Control Room/ auxiliary Building as per requirement.

vii. NGR Bypass arrangement for Switchable Line Reactors through 145kV Circuit Breakers, Bus Post Insulators along with associated support structures, clamps and connectors, conductors, spacers etc.

viii. 33kV neutral CT for each bank of 765 KV Class transformers and Reactors.

y) The following associated works, pertaining to employer supplied 400/220/33kV auto-transformers are envisaged under present scope.

i. Civil works for 400/220/33kV Autotransformers, all associated terminal connectors, firewalls, earthing connection to main earth mat and earth pits etc. (as required) as per technical specification.

ii. Overhead connection of HV, MV & LV bushings of 400/220/33kV Autotransformers to substation equipment.

iii. Supply, laying and termination of cables along with associated accessories from Common Marshaling box (CMB) of 400/220/33kV Autotransformers to BMK /Switchyard Panel Rooms/Control Room/ as per requirement.

2.2.2 The broad Scope of the procurement of FO based Communication Equipment shall include planning, designing, engineering, supply, transportation, insurance, delivery at site, unloading handling, storage, installation, termination, testing, training and demonstration for acceptance, commissioning and documentation for following:

a) SDH Equipment along with suitable interfaces and line cards.
b) All cabling, wiring, Digital Distribution frame patch facilities and interconnection to the supplied equipment at the defined interfaces,
c) System integration of all supplied subsystem
d) Integration with the existing communication system based on SDH and PDH of employer
e) Integration of supplied subsystem with SCADA system, PLCC equipment, PABX of RLDC/SLDC, VOIP (SIP compliant) for voice.
f) Fibre Optic Approach Cable (FOAC) along with duct and Fibre Optic Distribution Panel (FODP)
g) Integration of new Communication equipment in the existing regional NMS. All required support to existing NMS vendor for integration of new Communication equipment.

2.2.3 The broad Scope of the procurement of PMU shall include planning, designing, engineering, supply, transportation, insurance, delivery at site, unloading handling, storage, installation, termination, testing and demonstration for acceptance, commissioning and documentation for PMU as per BPS and these PMU shall support IEEE C 37.118 protocols. These PMUs shall be integrated with Phasor data Concentrator (PDC) at RLDC/SLDC for the subject project.

2.2.4 Design, engineering, manufacture, testing and supply including transportation & insurance, storage of mandatory spares at site as per BPS.

2.1.1.2 Civil works:

A. The design of foundation shall be based on the soil investigation report and other parameters as per relevant IS codes & technical specification.

B. The scope of civil work shall include but shall not be limited to the following based on **drawings developed by the contractor:**

(i) Site levelling work:

a) The item site levelling works includes Contouring of whole plot area within the boundary as per technical specification. The final area of levelling may be less than the whole plot area, which will be decided during detailed engineering.
b) The Quantity of earthwork cutting & filling borrowed earth and FGL shall be proposed by vendor for approval of POWERGRID based on the approved contour level drawing and site HFL data.
c) Mode of measurement of this item is in Cum of earthwork as per BOQ and technical specification. The contouring of the plot area in scope as per technical specification is also deemed to be included in quoted rates of this item.

(ii) Soil investigation:

a) Soil investigation needs to be conducted as per the technical specification. The necessary soil investigation layout and final soil report shall be proposed by vendor for approval of POWERGRID.
b) Mode of measurement of this item is Lumpsum as per BOQ.

(iii) Gantry tower and beam, LM Structure:

a) 765/400/220 kV Gantry tower and beam, LM Structure. Preparation of design and drawing of these structures shall be measured and paid under respective items of BPS.

(iv) Circuit-Breaker Structure: Design shall be as per recommendation of respective CB manufacturer(s).

(v) Foundations for transformers and reactors neutral and tertiary delta formation: Structure and foundation for tertiary delta formation for Transformers and neutral formation & earthing arrangement for Reactors along with associated spare unit connection arrangement.

(vi) Other miscellaneous requirements & scope:

a) Stone spreading and anti-weed treatment including PCC in the switchyard for area under present scope. Layout for the same shall be developed by the contractor.
b) Permanent water supply for Security hut, control room building, Firefighting pump house building, water tank and labor hut.
c) Laying of plumbing and external sewerage system for control room building, Security hut, labor hut.
d) Foundation for lighting poles, bay marshalling boxes, panels and control cubicles wherever required. The cost of these foundations shall deemed to be included in erection/installation of corresponding item/ equipment of BPS.
e) For all building leaving labor hut, all doors except fire escape doors, windows, glazed partitions shall be of UPVC type.

(vii) Any other item/design/drawing required for successful completion of the scope of works.

C. The scope of civil work shall include but not be limited to the following based on **drawings developed by POWERGRID:**

(i) Pre-cast RCC boundary wall:

a) Pre-Cast RCC boundary wall shall be constructed as per the POWERGRID standard drawing provided in tender. The rise/fall in boundary wall foundation shall be provided wherever the difference in ground level is more than 300mm.
b) Gratings shall be provided wherever required without any additional cost.
c) Mode of measurement of this item is in RM as per BOQ. The items Excavation, PCC, RCC, Reinforcement, Misc. Structural steel, concertina coil and all other civil works required as per technical specification and drawings for successful completion of the works are deemed to be included in quoted rates.

(ii) Security hut:

a) The drawing pertaining to Security hut is attached as a part of tender drawings.
b) Septic tank and soak pit for this building shall be paid separately as per BOQ.

(iii) Labour hut:

a) The drawings pertaining to Labor hut are attached as a part of tender drawings.
b) Cement Concrete flooring (As per DSR 2018 item no. 11.3.1) shall be done over 100 MM thk. PCC (1:4:8).

c) Exterior wall: Pre-Engineered galvanized iron 0.5mm thick both side sandwich panels with 75mm thick thermocole /glass wool insulation of density 12 Kg/m3, shall be painted with weather proof texture paint from outside and inside oil bond distemper.
d) Internal wall partition: Light gauge steel structure using 50mm galvanized sections both vertically and horizontally at a gap of 600mm. 8 mm cement fibre board both sides and 50mm glass wool insulation and joints concealed with polymer based putty and exterior side weather proof plastic emulsion paint.
e) Roofing: 0.50mm Thk GI Trapezoidal profile sheet with 8mm polynum insulation (64 cum /Kg)
f) False ceiling: 8mm thick PVC profile section with interlocking arrangement held on MS pipe framework with grid of 1200 x 1200mm.
g) Door: 32 mm thick Water proof wooden flush door with SS Hinges and locking arrangements and painted with synthetic enamel paint.
h) Window: MS tubular frame with clear float glass with locking arrangements.
i) 02 nos septic tank & soak-pit of sizes 10'x 8' x 8 ft and 8'x8'x8'ft respectively and suitable numbers of inspection chamber 600mm x600mm.
j) PVC Water tank of 2x 5000 Ltr (for every approx. 420 Sqm of Hut) on MS stand of suitable height to give sufficient water head & PVC pipe line.
k) Indian type WC pan & wash basin @ 1 set of bath & toilet per 10 labour. The toilet and bath shall be separate.
l) All plumbing fixtures such as tapes, showers etc shall be CP as per CPWD Specification.
m) Internal electrical wiring & fixtures (Fan, Tube lights, switch and sockets) of reputed make.
n) The present scope includes supply, erection, civil works, electrical works etc. with all materials, labor required to complete the building in all respect. The above requirements are minimum; the contractor can give superior / better products without any additional financial implication to POWERGRID.
o) Labor Hut is to be kept cleaned and well maintained (including repair work) till completion of the work at site under the contract without any additional financial implication to POWERGRID.
p) Mode of measurement of this item is in SQM of plinth area as per BOQ. The calculation of plinth area shall be as per IS:3861-2002. The items Excavation, PCC, RCC, Reinforcement shall be paid as per respective item of BPS. All other works are deemed to be included in plinth area rates.

(iv) Main Entrance Gate as per drawing

(v) Switchyard Gate as per drawing

(vi) Bituminous Road including Road Crossing

Bituminous Road including approach road (if any), shall be constructed as per POWERGRID standard drawings provided in tender. However, Road layout shall be prepared by vendor for approval.

(vii) Cable Trenches:

Cable trenches shall be constructed as per POWERGRID standard drawings provided in tender. However, Cable trench layout shall be prepared by vendor for approval of POWERGRID based on the standard sections.

(viii) Rain water harvesting

(ix) Drains

Drain layout including peripheral drains if any required along the boundary shall be prepared by vendor and to be submitted for approval of POWERGRID based on the standard sections.

(x) Switchyard barbed wire fencing:
Fence layout shall be prepared by vendor and to be submitted for approval of POWERGRID based on the standard sections.

(xi) Transformers and Reactors:

Foundation of all Transformers and Reactors including Rail cum road, unloading platform, jacking pad, Oil tank, pulling blocks, gratings, common oil pit etc. as per technical specification.

Transformer/reactor foundation shall have sump pit without grating and it shall be connected to the common oil collection pit by means of hume pipes. All required man holes including their covers are deemed to be included in the corresponding item of BPS.

(xii) Fire resistant walls between Transformers and Reactors

(xiii) Rail Cum Road

(xiv) Equipment Support Structures
765/400/220 kV Equipment (Except CBs) support structures.

(xv) Foundations of Equipment Support Structure:
a) 765/400/220 kV Equipment support structure foundations including 765/400/220 kV CB foundation, foundation of Tertiary and Auxiliary Transformers, DG Det Foundation, Foundation for Double pole structure, as required.
b) The foundations of these structure are including of embedment/grouting of foundation bolts.

(xvi) Foundations of 765/400/220 kV Towers and LM:
a) Foundations of 765/400/220 kV Towers and LM.
b) The foundations of these structure are including of embedment/grouting of foundation bolts.

(xvii) Control room Building: CRB shall be constructed as per POWERGRID drawings. Drawings shall be provided to the successful bidder during detailed engineering.

(xviii) Septic Tank and soak pit for CRB:
Septic tank and soak pit for CRB shall be constructed as per POWERGRID standard drawings provided in tender. Structural drawings shall be provided to the successful bidder during detailed engineering.

(xix) Firefighting pump house and Fire water tank:
The drawings pertaining to Firefighting Pump House and Fire Water Tank are attached as a part of tender drawings.

(xx) Switchyard Panel Room:
The drawings pertaining to Switchyard Panel Room are attached as a part of tender drawings. Structural drawings shall be provided to the successful bidder during detailed engineering.

D. For buildings, the complete civil works including internal and external finishing, stone soling for flooring, plinth protection, drain along plinth protection, electrical conduit and junction boxes, fan boxes, cable transit system etc. required to complete the building in all respect as per the drawing

shall be payable in the plinth area rate. However, the quantity of the earthwork (excavation, backfilling, disposal etc.), concrete (all types), reinforcement steel, shall be measured and paid under respective items under BPS.

E. LATTICE AND PIPE STRUCTURES (GALVANIZED):

a) Fabrication, proto-assembly, supply including transportation & insurance, unloading, storage, erection and commissioning of gantry structures including LM and equipment support structures including foundation bolt complete in all respect.

b) Tower, Beams, LM and Equipment support structures except CB support structure shall be provided as Employer- provided drawings.

c) CB support structure shall be as per CB manufacturer's design & shall be under scope of the contractor.

d) Proto-corrected drawings and Bill of material of all structures like towers, beams, LM and equipment's support structures etc. shall be in the scope of contractor.

e) Design and drawing of non-standard items not covered above shall be prepared and put up for approval of employer, by the Contractor during detailed engineering.

2.3 The work to be done under this specification shall include all labour, plant, equipment, material and performance of all work necessary for the complete installation and commissioning of switchyard. All apparatus, appliances, material and labour etc. not specifically mentioned or included, but are necessary to complete the entire work or any portion of the work in compliance with the requirements implied in this specification is deemed to be included in the scope of contractor.

2.4 Before proceeding with the construction work the Contractor shall fully familiarize himself with the site conditions and General arrangements & scheme etc. Though the Employer shall endeavor to provide the information, it shall not be binding for the Employer to provide the same. The bidders are advised to visit the substation sites (for existing substations) and acquaint themselves with the topography, infrastructure and also the design philosophy. The bidder shall be fully responsible for providing all equipment, materials, system and services specified or otherwise which are required to complete the construction and successful commissioning, operation & maintenance of the substation in all respects. All materials required for the Civil and construction/installation work including cement and steel shall be supplied by the Contractor. The complete design (unless specified otherwise in specification elsewhere) and detailed engineering shall be done by the Contractor based on conceptual tender drawings.

2.5 The Contractor shall also be responsible for the overall co-ordination with internal/external agencies, project management, loading, unloading, handling, moving to final destination for successful erection, testing and commissioning of the substation/switchyard.

2.6 Design of substation and its associated electrical & mechanical auxiliaries systems includes preparation of single line diagram, electrical layout, foundation & cable trench layouts (including invert levels), erection key diagrams, direct stroke lightning protection, electrical and physical clearance diagrams, Control and protection schematics, wiring and termination schedules, design of firefighting system, outdoor lighting/illumination and other relevant drawings & documents required for engineering of all facilities within the fencing to be provided under this contract, are covered under the scope of the Contractor.

2.7 Any other items not specifically mentioned in the specification but which are required for erection, testing and commissioning and satisfactory operation of the substation are deemed to be included in the scope of the specification unless specifically excluded.

2.8 Employer has standardized its technical specification for various equipments and works for different voltage levels. Items, which are not applicable for the scope of this package as per schedule of quantities described in BPS, the technical specification for the items should not be referred to.

3.0 SPECIFIC EXCLUSIONS

The following items of work are specifically excluded from the scope of the specifications

A) 765/400/220kV Koppal-II PS

(a) Employer's site office and stores.

(b) Transit camp.

(c) Supply, erection, testing & commissioning of 500 MVA, (765/√3)/(400/√3)/33kV, single phase autotransformers.

(d) Supply, erection, testing & commissioning of 110 MVAR, 765/√3 kV and 80 MVAR 765/√3 kV, single phase Bus/ Shunt reactor, NGR & 132kV LA.

(e) Supply, erection, testing & commissioning of 500MVA, 400/220/33kV three phase Auto transformer.

(f) Cabling from IMB to CMB of 765kV Transformer/Reactor

4.0 PHYSICAL AND OTHER PARAMETERS

4.1 Location of the Substation - The location of substation is indicated below:

Sr. No	Name of Substation	Name of State	Nearest Rail Head
1.	Koppal-II PS	Karnataka	Koppal

4.2 Meteorological data

The meteorological data are as below

Station Name	**765/400/220kV Koppal-II (new) PS**
Altitude	Less than 1000 meter above mean sea level (MSL)
Snow fall	NIL
Seismic Zone	As per IS 1893 (Part-1)
Wind Zone	NBC 2016
Min./Max. Ambient Temperature	0 / 50 degree centigrade
Coastal Area consideration	No

4.3 Fault level shall be considered as mentioned below:-

Sl. No.	Name of Substation	765kV	400kV	220kV
1.	765/400/220kV Koppal-II PS	50kA for 1 Sec	63kA for 1 Sec	50kA for 1 sec

5.0 SCHEDULE OF QUANTITIES

The requirement of various items/equipments and civil works are indicated in Bid price Schedules. All equipments/items, Structures and civil works for which quantities has been given in the BPS shall be payable on unit rate basis. During actual execution, any variation in such quantities shall be paid based on the unit rate under each item incorporated in Letter of award.

Wherever the quantities of items/works are indicated in Set/LOT/LS, the bidder is required to estimate the quantity required for entire execution and completion of works and incorporate their price in respective Bid price schedules. For erection hardware items, Bidders shall estimate the total requirement of the works and indicate module-wise lump sum price bay wise and include the same in relevant Bid price schedules.

No cost compensation shall be considered on account of "Set/LOT/LS" items in any case of number of bays specified in section project remains unchanged.

Bidder should include all such items in the bid proposal sheets, which are not specifically mentioned but are essential for the execution of the contract. Item which explicitly may not appear in various schedules and required for successful commissioning of substation shall be included in the bid price and shall be provided at no extra cost to Employer.

6.0 BASIC REFERENCE DRAWINGS

The substation shall be designed considering current ratings as indicated below-

Sl. No	Description of bay	765/400/220kV Koppal-II PS		
		765kV	**400kV**	**220 kV**
1.	Bus Bar	4000A	4000A	3000A
2.	Line bay	3150A	3150A	1600A
3.	ICT bay	3150A	3150A	1600A
4.	Bus Reactor Bay	3150A	3150A	-
5.	Bus Coupler bay	-	-	3000A
6.	Transfer Bus coupler bay	-	-	1600A
7.	Line Reactor bay	3150A	-	-

Following switching schemes are proposed for the substations envisaged under this specification:

Name of s/s	765kV	400 kV	220 kV
765/400/220kV Koppal-II PS	One & half breaker scheme	One & half breaker scheme	Double main & Transfer

6.1 The reference drawings, which form a part of the specifications, are given at **Annexure-I**. The bidder shall maintain the phase to earth clearance, phase to phase clearance and sectional clearances, clearances between buses, bus heights but may alter the locations of equipment to obtain the statutory electrical clearances required for the substation.

6.2 It is responsibility of contractor to develop general arrangement drawing, layout drawings, single line drawing, foundation & cable trench layout, erection key diagram & all other layout drawings for present scope of work.

6.5 INPUTS TO BE PROVIDED DURING DETAILED ENGINEERING

i) Location of identified land and Plot plan.

ii) Transmission line side conductor type & configuration of conductors for transmission lines of various voltage levels.

7.0 DIFFERENT SECTIONS OF TECHNICAL SPECIFICATION

For the purpose of present scope of work, technical specification (Vol. II) shall consist of following sections and they should be read in conjunction with each other.

1	Section-Project	Rev 00
2	Section-General Technical Requirement (GTR)	Rev 15
3	Section-Switchgear- CB	Rev 11
4	Section-Switchgear- ISO	Rev 12
5	Section-Switchgear- Instrument Transformer	Rev 11
6	Section-Switchgear-Surge Arrester	Rev 12
7	Section-Power and Control Cables	Rev 06
8	Section-Lighting System	Rev 07
9	Section-Fire Protection System	Rev 06
10	Section – LT Transformer	Rev 05
11	Section – DG Set	Rev 05
12	Section – Battery & Battery Charger	Rev 06
13	Section – LT Switchgear	Rev 05
14	Section-Air Conditioning System	Rev 04
15	Section-Switchyard Erection	Rev 10
16	Section- Structures	Rev 06
17	Section-Civil Works	Rev 11A with 5 correction slips
18	Section-Control and Relay Panels	Rev 09
19	Section-Substation Automation System	Rev 04
20	Section-PLCC	Rev 05
21	Section-Telecommunication Systems	Rev 04
22	Section – PMU	Rev 00
23	Section Shunt Reactors up to 400kV, Neutral Grounding Reactor and Surge Arrester	Rev 11

In case of any discrepancy between Section-PROJECT and Section-GTR and other technical specifications on scope of works, Section-PROJECT shall prevail over all other sections.

In case of any discrepancy between Section-GTR and individual sections for various equipment, requirement of individual equipment section shall prevail.

In case of any discrepancy between Main body of Section-Project and Annexure(s) of Section-Project, provisions specified in Main body of Section-Project shall prevail.

In case of any discrepancy between BPS and other sections, BPS shall prevail over the other sections of the technical specifications. However, for rating of the BPS items, associated Section-Project shall prevail & is to be referred to.

8.0 SPARES

The Mandatory Spares shall be included in the bid proposal by the bidder. The prices of these spares shall be given by the Bidder in the relevant schedule of BPS. The breakup of mandatory spares is enclosed at Annex-II.

The bidder is clarified that no mandatory spares shall generally be used during the commissioning of the equipment. Any spares required for commissioning purpose shall be arranged by the Contractor. The unutilized spares if any brought for commissioning purpose shall be taken back by the contractor.

Wherever spares in BPS/Technical Specification has been specified as "each type/each rating/each type & rating": If the offered spare/spares are sufficient to replace the respective main equipment of all types/ratings, then such offered spare/spares shall be acceptable. It implies that common spare/spare set fulfilling the spare requirement of all types/ratings shall also be acceptable, provided it is configurable at site itself without special assistance of OEM.

Mandatory Spares, wherever mentioned, are envisaged for the equipment/items being supplied under the main equipment heads under present scope meeting the requirements of Technical Specifications. The component/sub-component of an equipment/item specified in BPS under Mandatory Spare, which is not applicable as per the offered design of respective main equipment, shall not be referred to.

9.0 SPECIFIC REQUIREMENT

9.1 The specific requirements as mentioned at C/ENGG/SPEC/SEC-PROJECT/SPECIFIC REQUIREMENT Rev. no 08 enclosed at Annex-III and relevant/applicable clauses shall be referred for specified scope of work.

9.2 Minimum specified creepage distance for insulator string/ longrod insulators/ outdoor bushings shall be 31 mm/kV.

9.3 New clause "5.2 d" shall be added in SECTION: SWITCHGEAR – SURGE ARRESTER (REV. NO. 12)

"Type Test-Salt Fog test-For salt fog test, the test conducted on reduced size of test specimen (of LA stack) equivalent to proportionally reduced voltage stress of not less than 40kV shall also be acceptable subject to submission of calculation confirming matching or higher voltage stress per mm applied on test specimen vis-à-vis original(longest) unit."

9.4 New clause "5.2 e" shall be added in SECTION: SWITCHGEAR – SURGE ARRESTER (REV. NO. 12)
"Type Test-UV light test- UV light test report confirming IEC 62217 shall also be acceptable."

9.5 Integration of ODS (On-line Oil Drying system) based on IEC-61850, for 765/400 and/or 400/220kV Transformers being (supplied under separate package) with substation automation system is also included under present scope

9.6 For design of Gantry structures, the conductor tension shall be as per Annexure-S4. For design of gantry structure with spans, wind speed or conductor configurations other than that specified in Annexure-S4, conductor tension shall be considered based on actual requirement of present & future scope of work. Relevant design calculations for such cases shall be submitted by the contractor for employer's approval during detailed engineering.

9.7 Standalone Disturbance Recorder as mentioned at clause no. 37. I) (Line Protection Panel) of Section-CRP Rev-09 is not envisaged under present scope. (For 765kV).

9.8 In case of 220kV line bays, Numerical Distance protection relay as Main–I and Line Current differential relay (with back up distance protection feature) as Main-II shall be provided**. Further, in such case, the matching line current differential relay for remote end is not included under present scope of work.**

9.9 Each circuit of a double circuit transmission line shall be terminated in different diameters.

9.10 Transformers of same HV rating shall be placed in different diameters.

9.11 Bus reactors of same HV rating shall be placed in different diameters

9.12 Provision of space for installation of Metering arrangement with Special Energy Meters (SEMs) shall be provided at 33kV tertiary of Transformer for drawing auxiliary supply at new substation.

SECTION -PROJECT

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1.0 GENERAL

1.1 PREMBLE

Power Grid Corporation of India Ltd. (POWERGRID), a Govt. of India Enterprise is responsible for bulk Power transmission of electrical energy from various Central Govt. Power Projects to various utilities/beneficiaries and interconnecting regional grids, operating and maintaining the National electrical grid of India. It is established with mandate of "We will become a Global Transmission Company with Dominant Leadership in Emerging Power Markets with World Class Capabilities by:

- World Class: Setting superior standards in capital project management and operations for the industry and ourselves.
- Global: Leveraging capabilities to consistently generate maximum value for all stakeholders in India and in emerging and growing economies.
- Inspiring, nurturing and empowering the next generation of professionals.
- Achieving continuous improvements through innovation and state of the art technology.
- Committing to highest standards in health, safety, security and environment." as its mission.

1.2 Govt. of India (MoP) has identified the execution of "Transmission Scheme for integration of Renewable Energy Zone (Phase-II) in Koppal-II (Phase-B) in Karnataka" through Tariff Based Competitive Bidding (TBCB) route, for which POWERGRID is intending to participate in the bidding process. Further, POWERGRID is intending to arrange for pre-bid tie-up(s) for the scope envisaged under the transmission scheme above.

1.3 Following Transmission System is envisaged under "Transmission Scheme for integration of Renewable Energy Zone (Phase-II) in Koppal-II (Phase-B) in Karnataka" through TBCB route:

A. Transmission lines:

i) Koppal-II PS – Raichur 765 kV D/c line

B. Substations:

765/400/33kV Koppal-II PS (New) are being constrcuted by the developer in "Transmission Scheme for integration of Renewable Energy Zone (Phase-II) in Koppal-II (Phase-A) in Karnataka" under TBCB Route.

The subject package is for :

i) Extension of Koppal-II(New) with
   a. 2x1500 MVA, 765/400 kV ICTs
   b. 2x500 MVA 400/220 kV ICTs .
   c. 765 KV, 3 x 110 MVAR switchable Line Reactor for each circuit of 765 kV D/c line Koppal-II PS- Raichur (new)

ii) Extension of 765kV Raichur S/s for termination of 765 kV D/c line Koppal-II PS-Raichur (new).

- 765 & 400/kV Class Auto Transformers at Koppal-II (new) PS & 765 KV class Shunt Reactors at Koppal-II PS are being procured through separate package(s). However, associated Civil work etc for the above Transformers & Reactors, as elaborated elsewhere in this document, are envisaged under present scope of the contract.

2.0 SCOPE

2.1 The broad scope for Extension of 765/400/220kV Koppal-II (New) substation is as following:

(A)	**Station Name (New)**	**765/400/220 kV Koppal-II Pooling Station (New) (AIS type)**
(a)	**Voltage Level**	**765kV**
	Bus-Switching Scheme	One and a Half Breaker Scheme
	Fault level	50 kA/1sec
	Transformers	6x500MVA, (765/√3)/(400/√3)/33 kV, 1-phase transformers along with its auxiliaries. These transformers are procured through separate package(s) & shall be provided to the contractor(under present scope), on OSM basis, without any cost implication.
	Line Reactors	6 X 110 MVAR, 765/√3kV, 1-phase reactors for Koppal-II-Raichur 765 KV D/C line (each 330 MVAR reactor with NGR, 132kV Surge Arrester) along with its auxiliaries. These Reactors are being procured through separate package(s) & shall be provided to the contractor(under present scope), on OSM basis, without any cost implication.
	Transformer bays	02 Nos.
	Line Reactor bays (Switchable)	2 nos. (for Koppal-II- Raichur 765 KV D/C line)
	Line bays	02 Nos. (for termination of Koppal-II- Raichur 765 KV D/C line)
	All associate tie bays	As per requirement of technical specification
(b)	**Voltage Level**	**400kV**
	Bus-Switching Scheme	One and a Half Breaker Scheme
	Fault level	63kA/1sec
	Transformers	2x500 MVA, 400/220/33kV, 3-Phase, Auto Transformers These transformers are being procured through separate package(s) & shall be provided to the contractor(under present scope), on OSM basis, without any cost implication.
	Transformer bays	04 Nos.
	All associate tie bays	As per requirement of technical specification
(c)	**Voltage Level**	**220kV(Bus- Section-II)**
	Bus-Switching Scheme	Double Main & Transfer Scheme
	Fault level	50kA/1Sec
	Transformer bays	02 Nos.
	Line bays	04 Nos.

	Bus Coupler bay	01 Nos.
	Transfer bus coupler bay	01 Nos.
	Bus sectionaliser bays	02 Nos. (One for 220KV & Bus-I & & another for II)

2.2 The detailed scope of work of the substation package is brought out in subsequent clauses of this section.

2.2.1 Extension of 765/400/220 kV Koppal-II (New) S/s.

2.2.1.1 Design, engineering, manufacture, testing at manufacturer's works, supply including transportation and insurance, unloading, storage, erection, testing and commissioning at site the following equipment/items, complete in all respects:

a) 765kV Circuit Breakers, Isolators, Current Transformers, Capacitor Voltage Transformers, Wave Traps (Pedestal mounted), Bus Post Insulators (including BPI for Wave Traps) and 624kV Surge Arresters.

b) 400kV Circuit Breakers, Isolators, Current Transformers, Bus Post Insulators and 336kV Surge Arresters.

c) 245kV Circuit Breakers, Isolators, Current Transformers, Capacitor Voltage Transformers, Wave Traps, Bus Post Insulators(including BPI for Wave Trap) and 216kV Surge Arresters.

d) Controlled Switching device for 765kV & 400kV Circuit breakers: as per BPS

e) Complete control, relay and protection system for bays under present scope as per Section–Control and Relay panels. Augmentation of Busbar in 765kV, 400kV & 220kV (Section-1) is under present scope. Make and model of existing De-centralized type Busbar Protection in 765kV, 400kV &220kV (Section-1) of Koppal-II S/S shall be provided to successful bidder during detailed engineering.

Bay Units for following shall be available for 765kV, 420kV and 220kV

- For 765kV bays under present scope
- For 400kV bays under present scope
- For 220kV bays in Bus-Section-I under present scope, including for each Bus Sectionaliser (one side-1no)

Necessary modifications, wiring, etc. for completion of the bus bar protection scheme for bays under present scope has to be carried out by contractor and same is to be quoted under Installation item in BPS. Any modification required in the existing protection scheme is included in the present scope.

220kV New Bus Bar Protection scheme(for 220KV Bus Section II):
New 220kV Bus Bar Protection (Distributed Type) as per TS shall be provided for 220kV Bus Sections being Constructed under present scope. 4 (Four) No. Bay Units for Future use shall be supplied in addition to those required for 220kV Bays under present scope.

Necessary equipment, wiring etc. required for control & monitoring of 145kV Circuit Breaker(s) for NGR by-passing arrangement is also under present scope of work. The same may be located in respective line/reactor protection panel.

f) **Augmentation of Substation Automation System for bays as per BPS (bay as defined in technical specification, Section-Substation Automation System):**
Koppal-II (New) Substation is being equipped with substation automation system (based on IEC-61850). Make & Model of existing SAS shall be shared with the successful bidder,

during detailed engineering. Under present scope, the Bidder shall include BCUs required for bays mentioned above, including all necessary hardware & software to integrate with the existing substation automation system.

Integration of 145kV Circuit Breaker(s) for NGR by-passing arrangement is also under present scope of work.

The scope of bidder shall include but not limited to integration of IEDs under present scope of work with existing substation automation (which is based on IEC 61850) and capability enhancement of same as required, including up-dating of system database, displays, development of additional displays and reports as per requirement. Any up-gradation of hardware and software for above integration shall be in the scope of contractor including license fee (if any).

Necessary configuration of data at Gateway for remote operation from NTAMC, Backup NTAMC, RTAMC & supervision from RLDC /Backup RLDC is included in present scope. However, no work is envisaged at remote end (RLDC/ Backup RLDC /NTAMC/ Backup NTAMC/ RTAMC) under the present scope.

g) PLCC equipment including Analogue protection coupler, Digital Protection Coupler (suitable for interfacing with E1 port of SDH equipment), FO Boxes, gantry, signal converters, communication cables etc. for Koppal-II end of following lines:

   i. 765kV Koppal-II PS-Raichur D/C line

h) Extension of 415 Volt ACDB, 220 Volt DCDB and 48 Volt DCDB is not envisaged under present scope and necessary feeder modules with MCCB/MCB are available. Necessary cabling and connections for the Bays as required under present scope, is in the scope of the contractor.

i) Fire protection system:

   i) The scope shall include FPS & HVWS for following transformers & Reactors, (provided to the contractor under present scope on OSM basis):

      a. 6 x 765/√3)/(400/√3)/33kV, 1-Phase Autotransformers

      b. 6 x 765/√3kV, 1-Phase Reactors

      c. 2 x 400/220/33kV, 500 MVA, 3 Phase Transformer.

   Note : Piping for fire protection system shall be extended from nearest existing Main Header, in the switchyard. FPS Pipe Layout of 765/400/220kV Koppal-II S/S shall be provided to successful bidder during detailed engineering.

   ii) Conventional type Smoke detection, Fire alarm & Annunciation System and Fire Extinguishers for Switchyard panel Rooms under the present scope

j) Air Conditioning System for Switchyard Panel Rooms.

k) 1.1 kV grade Power & Control cables (and special cables, if any) along with complete accessories including cables for oil filtration units and cabling from common marshaling box of 765kV Transformers, Reactors, 400kV Transformer to bay kiosks /Relay panel room /control room. Power receptacle for oil filtration unit shall also be provided under present scope of work as per BPS. Methodology for supply, installation & sizing of cables shall be as per Specific requirement attached as Annexure-III of these document.

l) Insulator strings and associated hardware fittings as per Bid Price Schedule (BPS).

m) Erection Hardware: Clamps & connectors (including terminal connectors for employer supplied (765/√3)/(400/√3)/33kV Autotransformers, 765/√3kV Reactors as well as associated SA, NGR , 400/220/33kV Auto transformers), Conductor, Aluminum tubes, Bus bar and earthing materials, Bay marshalling box, spacers, cable sealing arrangement, insulating mats, cable supporting angles/channels, Cable Pull pit, Cable trays & covers, Guy arrangement (including insulators and hardware), Junction box, buried cable trenches etc.

All the Gantry support structures, equipment's (including owner supplied Transformer & Reactors), structures, cable trenches, auxiliary earthmat for isolators etc. shall be earthed by connecting them to the main Earthmat by the contractor. Earthing of structures for all auxiliary buses shall also be in the present scope. Payment against the above shall be regulated against respective item of Erection Hardware.

n) Main Earthmat (As per BPS) : Existing main earthmat shall be extended by the contractor for the area under present scope of work. Existing Grid Layout of 765/400/220kV Koppal-II(New) S/S shall be provided to successful bidder during detailed engineering. Payment shall be done as per BPS for actual length executed.

o) LED based Lighting and illumination for the switchyard area under present scope and Switchyard Panel Rooms shall be provided by the contractor.

p) Visual monitoring system for watch and ward of substation premises as per technical specifications. Details of existing VMS (being provided under separate package) shall be provided during detailed engineering. The same shall be augmented under present scope by providing 6 nos. of Color IP camera with PAN, Tilt & Zoom facility suitably located in 765kV outdoor switchyard. The scope of contractor shall include all associated items, accessories, line interface units, Fibre patch cards, Power supply units, Junction boxes, cables, Fibre optic cables, hardware and software etc. as applicable to meet functional requirements. Compatibility enhancement of VMS system, if needed, shall be done by the contractor under present scope.

q) The lightning protection (DSLP) for complete switchyard is to be provided by the contractor. The contractor shall design the lightning protection by utilizing the structures being provided under present scope. In case, additional structures (Lightning Masts) are required to meet the lightning protection, the contractor shall provide the same and cost of the same shall be payable in MT as indicated in BPS.

r) The following works associated to employer supplied (765/√3)/(400/√3)/33kV autotransformers, 765/√3kV Reactors {supply/Erection/testing & Commissioning of Transformers & Reactors is covered in separate package}as per details specified in Specific requirements enclosed at Annex-III:

i. Civil works, all associated terminal connectors, firewalls, earthing connection to main earth mat and earth pits etc. (as required) as per technical specification

ii. Formation of neutral bus for each bank, auxiliary bus (765kV & 145kV) for switching of existing spare reactor with Switchable Line Reactors are in present scope of work.

iii. Formation of neutral bus, Delta Bus for each bank of transformer, auxiliary bus (765kV & 400kV, neutral & Delta) for switching of existing spare transformer with 2 banks of 3 No. 1-Phase transformers, are in present scope of work.

iv. Overhead connection of HV, MV & LV bushings of (765/√3)/(400/√3)/33kV Autotransformers and HV & Neutral bushings of 765/√3kV Reactors to substation equipment's.

v. Overhead connection of substation equipments with 765kV & 400kV auxiliary bus of (765/√3)/(400/√3)/33kV Autotransformers.

vi. Supply, laying and termination of cables along with associated accessories from Common marshaling box of (765/√3)/(400/√3)/33kV Autotransformers & 765/√3kV Reactors to BMK /Switchyard Panel Rooms/Control Room/ auxiliary Building as per requirement.

vii. NGR Bypass arrangement for Line Reactors through 145kV Circuit Breakers, Bus Post Insulators along with associated support structures, clamps and connectors, conductors, spacers etc.

viii. 33kV neutral CT for each bank of transformers and Reactors. Technical specification of the 33kV neutral CT shall be as per ANNEXURE-IV.

s) The following associated works, associated to employer supplied 400/220/33kV auto-transformers are envisaged under present scope.

i. Civil works for 400/220/33kV Autotransformers, all associated terminal connectors, firewalls, earthing connection to main earth mat and earth pits etc. (as required) as per technical specification.

ii. Overhead connection of HV, MV & LV bushings of 400/220/33kV Autotransformers and HV & Neutral bushings of Reactors/NGRs to substation equipment's.

iii. Supply, laying and termination of cables along with associated accessories from Common Marshaling box(CMB) of 400/220/33kV Autotransformers to BMK /Switchyard Panel Rooms/Control Room/ as per requirement.

2.2.2 The broad Scope of the procurement of FO based Communication Equipment shall include planning, designing, engineering, supply, transportation, insurance, delivery at site, unloading handling, storage, installation, termination, testing, training and demonstration for acceptance, commissioning and documentation for following:

a. SDH Equipment along with suitable interfaces and line cards.

b. All cabling, wiring, Digital Distribution frame patch facilities and interconnection to the supplied equipment at the defined interfaces

c. System integration of all supplied subsystem

d. Integration with the existing communication system based on SDH and PDH of employer

e. Integration of supplied subsystem with SCADA system, PLCC equipment, PABX of RLDC/SLDC, VOIP (SIP compliant) for voice.

f. Fibre Optic Approach Cable (FOAC) along with duct, GI Pipe, GI Elbow, GI Flexible conduit and Fibre Optic Distribution Panel (FODP)

g. Integration of new Communication equipment in the existing regional NMS. All required support to existing NMS vendor for integration of new Communication equipment.

2.2.3 The broad Scope of the procurement of PMU shall include planning, designing, engineering, supply, transportation, insurance, delivery at site, unloading handling, storage, installation, termination, testing and demonstration for acceptance, commissioning and documentation for PMU as per BPS

a) The PMUs shall comply with latest version of IS 60255-118-1-2018 and IEEE C 37.118 protocols.

b) The PMUs shall be integrated with Phasor data Concentrator (PDC) at respective Regional Load Dispatch Centre (RLDC)/State Load Dispatch Centre (SLDC).

c) The Bidder shall extend technical support at local end for seamless integration of PMU with PDC at RLDC end. The integration work at RLDC/SLDC end will not be under the scope of the Bidder. The Existing PDC Software/application at RLDC/SLDC is of M/s GE make.

2.2.4 Design, engineering, manufacture, testing and supply including transportation & insurance, storage of mandatory spares at site as per BPS.

2.2.5 Civil works:

A. The design of foundation shall be based on the soil investigation report and other parameters as per relevant IS codes & technical specification.

B. The scope of civil work shall include but shall not be limited to the following based on **drawings developed by the contractor:**

(i) Site levelling work:

a) The item site levelling works includes Contouring of levelling area within the boundary as per technical specification.

b) The Quantity of earthwork cutting & filling, borrowed earth and FGL shall be proposed by vendor for approval of POWERGRID based on the approved contour level drawing and site HFL data.

c) Mode of measurement of this item is in Cum of earthwork as per BOQ and technical specification. The contouring of the plot area in scope as per technical specification is also deemed to be included in quoted rates of this item.

(ii) Soil investigation (02 Bore Holes):

a) Soil investigation needs to be conducted as per the technical specification. The necessary soil investigation layout and final soil report shall be proposed by vendor for approval of POWERGRID.

b) Mode of measurement of this item is Lumpsum as per BOQ.

(iii) Gantry tower and beam, LM Structure:

765/400/220 kV Gantry tower and beam, LM Structure. Preparation of design and drawing of these structures shall be measured and paid under respective items of BPS.

(iv) Foundations of neutral and tertiary delta formation for transformers and reactors: Structure and foundation for tertiary delta formation for Transformers and neutral formation & earthing arrangement for Reactors along with associated spare unit connection arrangement.

(v) Other miscellaneous requirements & scope:

a) Stone spreading and anti-weed treatment including PCC in the switchyard for area under present scope. Layout for the same shall be developed by the contractor.

b) Foundation for lighting poles, bay marshalling boxes, panels and control cubicles wherever required. The cost of these foundations shall deemed to be included in erection/installation of corresponding item/ equipment of BPS.

c) For all building leaving labor hut, all doors except fire escape doors, windows, glazed partitions shall be of UPVC type.

(vi) Any other item/design/drawing required for successful completion of the scope of works.

C. The scope of civil work shall include but not be limited to the following based on **drawings developed by POWERGRID:**

(i) Bituminous Road including Road Crossing
Bituminous Road including approach road (if any), shall be constructed as per POWERGRID standard drawings provided in tender. However, Road layout shall be prepared by vendor for approval.

(ii) Cable Trenches:
Cable trenches shall be constructed as per POWERGRID standard drawings provided in tender. However, Cable trench layout shall be prepared by vendor for approval of POWERGRID based on the standard sections.

(iii) Drains
Drain layout including peripheral drains if any required along the boundary shall be prepared by vendor and to be submitted for approval of POWERGRID based on the standard sections.

(iv) Transformers and Reactors:

Foundation of all Transformers and Reactors including Rail cum road, unloading platform, jacking pad, Oil tank, pulling blocks, gratings, common oil pit etc. as per technical specification.

Transformer/reactor foundation shall have sump pit without grating and it shall be connected to the common oil collection pit by means of hume pipes. All required man holes including their covers are deemed to be included in the corresponding item of BPS.

(v) Fire resistant walls between Transformers and Reactors

(vi) Rail Cum Road

(vii) Equipment Support Structures
765/400/220 kV Equipment support structures.

(viii) Foundations of Equipment Support Structure:
765/400/220 kV Equipment support structure foundations including 765/400/220 kV CB foundation, Tertiary and Auxiliary Transformer foundation, DG Det Foundation, Foundation for Double pole structure.

The foundations of these structure are including of embedment/grouting of foundation bolts.

(ix) Foundations of 765/400/220 kV Towers and LM:
Foundations of 765/400/220 kV Towers and LM.
The foundations of these structure are including of embedment/grouting of foundation bolts.

(x) Switchyard Panel Room:
The drawings pertaining to Switchyard Panel Room are attached as a part of tender drawings. Structural drawings shall be provided to the successful bidder during detailed engineering.

D. For buildings, the complete civil works including internal and external finishing, stone soling for flooring, plinth protection, drain along plinth protection, electrical conduit and junction boxes, fan

boxes, cable transit system etc. required to complete the building in all respect as per the drawing shall be payable in the plinth area rate. However, the quantity of the earthwork (excavation, backfilling, disposal etc.), concrete (all types), reinforcement steel, shall be measured and paid under respective items under BPS.

E. LATTICE AND PIPE STRUCTURES (GALVANIZED):

a) Fabrication, proto-assembly, supply including transportation & insurance, unloading, storage, erection and commissioning of towers, beams, LM and equipment support structures including foundation bolts complete in all respect shall be in scope of contractor.

b) Tower, Beams, LM and Equipment support structures except CB support structure, shall be provided as per Employer's drawings. CB support structure shall be as per CB manufacturer's

c) Proto-corrected drawings and Bill of Materials of all structures like towers, beams, LM, equipment support structures etc. shall be in the scope of the contractor.

d) The Contractor shall provide editable soft copies of drawings during detailed engineering.

2.2 The broad scope for Extension of 765kV Raichur substations is as following:

(A)	**Station Name (New)**	**765/400/kV Raichur Station (AIS type)**
(a)	**Voltage Level**	**765kV**
	Bus-Switching Scheme	One and a Half Breaker Scheme
	Fault level	50 kA/1sec
	Line bays	02 Nos. (for termination of Koppal-II- Raichur 765 KV D/C line)
	All associate tie bays	As per requirement of technical specification

2.3 The detailed scope of work of the substation package is brought out in subsequent clauses of this section.

2.3.1 Extension of 765kV Raichur S/s.

2.3.2 Design, engineering, manufacture, testing at manufacturer's works, supply including transportation and insurance, unloading, storage, erection, testing and commissioning at site the following equipment/items, complete in all respects:

a) 765kV Circuit Breakers, Isolators, Current Transformers, Capacitor Voltage Transformers, Wave Traps (Pedestal mounted), Bus Post Insulators (including BPI for Wave Traps) and 624kV Surge Arresters.

b) Complete control, relay and protection system for bays under present scope as per Section–Control and Relay panels.

Make and model of existing 765kVkV bus bar (De-centralized type) for 765KV Raichur S/S is as below:

Make: GE & Model: MICOM P741(CU) & P743(PU)

Bay Units for present scope are available. Necessary Trip Relays/Auxiliary Relays as per scheme requirement to be provided under present scope. Necessary modifications, wiring,

shifting etc. for completion of the bus bar protection scheme for bays under present scope has to be carried out by contractor and same is to be quoted under installation item available in Installation schedule of BPS. Any modification required in the existing protection scheme is included in the present scope.

c) Augmentation of Substation Automation System for bays as per BPS (bay as defined in technical specification, Section-Substation Automation System):

Raichur Substation is equipped with substation automation system (based on IEC-61850).
Make : GE - Model: 5_12_00_KU16.
Under present scope, the Bidder shall include BCUs required for bays under present scope, including all necessary hardware & software to integrate with the existing substation automation system.
The scope of bidder shall include but not limited to integration of IEDs under present scope of work with existing substation automation (which is based on IEC 61850) and capability enhancement of same as required, including up-dating of system database, displays, development of additional displays and reports as per requirement. Any up-gradation of hardware and software for above integration shall be in the scope of contractor including license fee (if any).
Necessary configuration of data at Gateway for remote operation from NTAMC, Backup NTAMC, RTAMC & supervision from RLDC /Backup RLDC is included in present scope. However, no work is envisaged at remote end (RLDC/ Backup RLDC /NTAMC/ Backup NTAMC/ RTAMC) under the present scope.

ii. PLCC equipment including Analogue protection coupler, Digital Protection Coupler (suitable for interfacing with E1 port of SDH equipment), FO Boxes, gantry, signal converters, communication cables etc. for the Raichur end of 765kV Koppal-II PS-Raichur D/C line, have already taken care in BPS items for extension of Koppal-II(New), under present scope.

d) Fire protection system: Conventional type Smoke detection, Fire alarm & Annunciation System and Fire Extinguishers for Switchyard panel Rooms under the present scope

e) Extension of 415 Volt ACDB, 220 Volt DCDB and 48 Volt DCDB is not envisaged under present scope and necessary feeder modules with MCCB/MCB are available. Necessary cabling and connections for the Bays as required under present scope, is in the scope of the contractor.

f) Air Conditioning System for Switchyard Panel Rooms.

g) 1.1 kV grade Power & Control cables (and special cables, if any) along with complete accessories. Methodology for supply, installation & sizing of cables shall be as per Specific requirement attached as Annexure-III of these document.

h) Insulator strings and associated hardware fittings as per Bid Price Schedule (BPS).

i) Erection Hardware: Clamps & connectors, Conductor, Aluminum tubes, Bus bar and earthing materials, Bay marshalling box, spacers, cable sealing arrangement, insulating mats, cable supporting angles/channels, Cable Pull pit, Cable trays & covers, Guy arrangement (including insulators and hardware), Junction box, buried cable trenches etc.

All the Gantry support structures, equipment's, structures, cable trenches, auxiliary earthmat for isolators etc. shall be earthed by connecting them to the main Earthmat by the contractor. Earthing of structures for all auxiliary buses shall also be in the present scope. Payment against the above shall be regulated against respective item of Erection Hardware.

j) Main Earthmat (As per BPS) : Existing main earthmat shall be extended by the contractor for the area under present scope of work. Grid Layout of Raichur S/S shall be provided to successful bidder during detailed engineering. Payment shall be done as per BPS for actual length executed.

k) LED based Lighting and illumination for the switchyard area under present scope and Switchyard Panel Rooms shall be provided by the contractor.

l) Visual monitoring system for watch and ward of substation premises as per technical specifications.
PELCO Make VMS is existing at site. The same shall be augmented under present scope by providing 2 nos. of Color IP camera with PAN, Tilt & Zoom facility suitably located in 765kV outdoor switchyard. The scope of contractor shall include all associated items, accessories, line interface units, Fibre patch cards, Power supply units, Junction boxes, cables, Fibre optic cables, hardware and software etc. as applicable to meet functional requirements. Compatibility enhancement of VMS system, if needed, shall be done by the contractor under present scope.

m) The lightning protection (DSLP) for complete switchyard is to be provided by the contractor. The contractor shall design the lightning protection by utilizing the structures being provided under present scope. In case, additional structures (Lightning Masts) are required to meet the lightning protection, the contractor shall provide the same and shall be payable in MT as indicated in BPS.

2.3.2. The broad Scope of the procurement of FO based Communication Equipment shall include planning, designing, engineering, supply, transportation, insurance, delivery at site, unloading handling, storage, installation, termination, testing, training and demonstration for acceptance, commissioning and documentation for following:

a. SDH Equipment along with suitable interfaces and line cards.

b. All cabling, wiring, Digital Distribution frame patch facilities and interconnection to the supplied equipment at the defined interfaces

c. System integration of all supplied subsystem

d. Integration with the existing communication system based on SDH and PDH of employer

e. Integration of supplied subsystem with SCADA system, PLCC equipment, PABX of RLDC/SLDC, VOIP (SIP compliant) for voice.

f. Fibre Optic Approach Cable (FOAC) along with duct, GI Pipe, GI Elbow, GI Flexible conduit and Fibre Optic Distribution Panel (FODP)

g. Integration of new Communication equipment in the existing regional NMS. All required support to existing NMS vendor for integration of new Communication equipment.

2.3.3 The broad Scope of the procurement of PMU shall include planning, designing, engineering, supply, transportation, insurance, delivery at site, unloading handling, storage, installation, termination, testing and demonstration for acceptance, commissioning and documentation for PMU as per BPS

a) The PMUs shall comply with latest version of IS 60255-118-1-2018 and IEEE C 37.118 protocols.

b) The PMUs shall be integrated with Phasor data Concentrator (PDC) at respective Regional Load Dispatch Centre (RLDC)/State Load Dispatch Centre (SLDC).

c) The Bidder shall extend technical support at local end for seamless integration of PMU with PDC at RLDC end. The integration work at RLDC/SLDC end will not be under the scope of the Bidder. The Existing PDC Software/application at RLDC/SLDC is of M/s GE make.

2.3.4 Design, engineering, manufacture, testing and supply including transportation & insurance, storage of mandatory spares at site as per BPS.

2.3.5 Civil works:

A. The design of foundation shall be based on the soil investigation report and other parameters as per relevant IS codes & technical specification.

B. The scope of civil work shall include but shall not be limited to the following based on **drawings developed by the contractor:**

(i) Site levelling work:

a) The item site levelling works includes Contouring of levelling area within the boundary as per technical specification.

b) The Quantity of earthwork cutting & filling, borrowed earth and FGL shall be proposed by vendor for approval of POWERGRID based on the approved contour level drawing and site HFL data.

c) Mode of measurement of this item is in Cum of earthwork as per BOQ and technical specification. The contouring of the plot area in scope as per technical specification is also deemed to be included in quoted rates of this item.

(ii) Soil investigation (02 Bore Holes):

a) Soil investigation needs to be conducted as per the technical specification. The necessary soil investigation layout and final soil report shall be proposed by vendor for approval of POWERGRID.

b) Mode of measurement of this item is Lumpsum as per BOQ.

(iii) Gantry tower and beam, LM Structure:

a) 765/400/220 kV Gantry tower and beam, LM Structure. Preparation of design and drawing of these structures shall be measured and paid under respective items of BPS.

(iv) Other miscellaneous requirements & scope:

a) Stone spreading and anti-weed treatment including PCC in the switchyard for area under present scope. Layout for the same shall be developed by the contractor.

b) Foundation for lighting poles, bay marshalling boxes, panels and control cubicles wherever required. The cost of these foundations shall deemed to be included in erection/installation of corresponding item/ equipment of BPS.

c) For all building leaving labor hut, all doors except fire escape doors, windows, glazed partitions shall be of UPVC type.

(v) Any other item/design/drawing required for successful completion of the scope of works.

C. The scope of civil work shall include but not be limited to the following based on **drawings developed by POWERGRID:**

(i) Bituminous Road including Road Crossing

Bituminous Road including approach road (if any), shall be constructed as per POWERGRID standard drawings provided in tender. However, Road layout shall be prepared by vendor for approval.

(ii) Cable Trenches:

Cable trenches shall be constructed as per POWERGRID standard drawings provided in tender. However, Cable trench layout shall be prepared by vendor for approval of POWERGRID based on the standard sections.

(iii) Drains

Drain layout including peripheral drains if any required along the boundary shall be prepared by vendor and to be submitted for approval of POWERGRID based on the standard sections.

(iv) Switchyard barbed wire fencing:

Fence layout shall be prepared by vendor and to be submitted for approval of POWERGRID based on the standard sections.

(v) Equipment Support Structures

765/400/220 kV Equipment support structures.

(vi) Foundations of Equipment Support Structure:

a) 765/400/220 kV Equipment support structure foundations including 765/400/220 kV CB foundation, Tertiary and Auxiliary Transformer foundation, DG Det Foundation, Foundation for Double pole structure.

b) The foundations of these structure are including of embedment/grouting of foundation bolts.

(vii) Foundations of 765/400/220 kV Towers and LM:

a) Foundations of 765/400/220 kV Towers and LM.

b) The foundations of these structure are including of embedment/grouting of foundation bolts.

(viii) Switchyard Panel Room:

The drawings pertaining to Switchyard Panel Room are attached as a part of tender drawings. Structural drawings shall be provided to the successful bidder during detailed engineering.

D. For buildings, the complete civil works including internal and external finishing, stone soling for flooring, plinth protection, drain along plinth protection, electrical conduit and junction boxes, fan boxes, cable transit system etc. required to complete the building in all respect as per the drawing shall be payable in the plinth area rate. However, the quantity of the earthwork (excavation, backfilling, disposal etc.), concrete (all types), reinforcement steel, shall be measured and paid under respective items under BPS.

E. LATTICE AND PIPE STRUCTURES (GALVANIZED):

a) Fabrication, proto-assembly, supply including transportation & insurance, unloading, storage, erection and commissioning of towers, beams, LM and equipment support structures including foundation bolts complete in all respect shall be in scope of contractor.

b) Tower, Beams, LM and Equipment support structures except CB support structure, shall be provided as per Employer's drawings. CB support structure shall be as per CB manufacturer's

c) Proto-corrected drawings and Bill of Materials of all structures like towers, beams, LM, equipment support structures etc. shall be in the scope of the contractor.

d) The Contractor shall provide editable soft copies of drawings during detailed engineering.

2.4 The work to be done under this specification shall include all labour, plant, equipment, material and performance of all work necessary for the complete installation and commissioning of switchyard. All apparatus, appliances, material and labour etc. not specifically mentioned or included, but are necessary to complete the entire work or any portion of the work in compliance with the requirements implied in this specification is deemed to be included in the scope of contractor.

2.5 Before proceeding with the construction work the Contractor shall fully familiarize himself with the site conditions and General arrangements & scheme etc. Though the Employer shall endeavor to provide the information, it shall not be binding for the Employer to provide the same. The bidders are advised to visit the substation sites (for existing substations) and acquaint themselves with the topography, infrastructure and also the design philosophy. The bidder shall be fully responsible for providing all equipment, materials, system and services specified or otherwise which are required to complete the construction and successful commissioning, operation & maintenance of the substation in all respects. All materials required for the Civil and construction/installation work including cement and steel shall be supplied by the Contractor. The complete design (unless specified otherwise in specification elsewhere) and detailed engineering shall be done by the Contractor based on conceptual tender drawings.

2.6 The Contractor shall also be responsible for the overall co-ordination with internal/external agencies, project management, loading, unloading, handling, moving to final destination for successful erection, testing and commissioning of the substation/switchyard.

2.7 Design of substation and its associated electrical & mechanical auxiliaries systems includes preparation of single line diagram, electrical layout, foundation & cable trench layouts (including invert levels), erection key diagrams, direct stroke lightning protection, electrical and physical clearance diagrams, Control and protection schematics, wiring and termination schedules, design of firefighting system, outdoor lighting/illumination and other relevant drawings & documents required for engineering of all facilities within the fencing to be provided under this contract, are covered under the scope of the Contractor.

2.8 Any other items not specifically mentioned in the specification but which are required for erection, testing and commissioning and satisfactory operation of the substation are deemed to be included in the scope of the specification unless specifically excluded.

2.9 Employer has standardized its technical specification for various equipments and works for different voltage levels. Items, which are not applicable for the scope of this package as per schedule of quantities described in BPS, the technical specification for the items should not be referred to.

3.0 SPECIFIC EXCLUSIONS

The following items of work are specifically excluded from the scope of the specifications

A) 765/400/220kV Koppal-II PS

(a) Employer's site office and stores.

(b) Transit camp.

(c) Supply, erection, testing & commissioning of 500 MVA, (765/√3)/(400/√3)/33kV, single phase autotransformers.

(d) Supply, erection, testing & commissioning of 110 MVAR, 765/√3 kV, single phase Bus/ Shunt reactor, NGR & 132kV LA.

(e) Supply, erection, testing & commissioning of 500MVA, 400/220/33kV three phase Auto transformer.

(f) Cabling from individual marshaling box to common marshalling box of 765kV Transformer/Reactor.

(g) Power, Control, shielded twisted pair cable for 4-20mA signal, FO & any special cable as required from Transformer & Reactor units, to cooler control cabinet /Marshalling box- Being executed under a separate(package(s).

Following items are also excluded from the scope of this specification:

i) Integration of Online insulating oil drying system with SAS and associated Ethernet switch, LIU patch cords etc.

As Ethernet switch is not included in present scope, OTI & WTI shall be integrated in SCADA through 4-20 mA signals.

B) 765/400KV RAICHUR(EXT)

Following items are also excluded from the scope of this specification:

i) Employer's site office and stores.

ii) Transit camp.

4.0 PHYSICAL AND OTHER PARAMETERS

4.1 Location of the Substation - The location of substation is indicated below:

Sr. No	Name of Substation	Name of State	Nearest Rail Head
1.	Koppal-II PS	Karnataka	Koppal
2.	Raichur SS	Karnataka	Raichur

4.2 **Meteorological data**

The meteorological data are as below

Station Name	**765/400/220kV Koppal-II (new) PS**
Altitude	Less than 1000 meter above mean sea level (MSL)
Snow fall	NIL
Seismic Zone	As per IS 1893 (Part-1)
Wind Zone	NBC 2016
Min./Max. Ambient Temperature	0 / 50 degree centigrade

Coastal Area consideration	No

4.3 Fault level shall be considered as mentioned below:-

Sl. No.	**Name of Substation**	**765kV**	**400kV**	**220kV**
1.	765/400/220kV Koppal-II PS	50kA for 1 Sec	63kA for 1 Sec	50kA for 1 sec
2.	765/400kV Raichur SS	50kA for 1Sec	-	-

5.0 SCHEDULE OF QUANTITIES

The requirement of various items/equipments and civil works are indicated in Bid price Schedules. All equipments/items, Structures and civil works for which quantities has been given in the BPS shall be payable on unit rate basis. During actual execution, any variation in such quantities shall be paid based on the unit rate under each item incorporated in Letter of award.

Wherever the quantities of items/works are indicated in Set/LOT/LS, the bidder is required to estimate the quantity required for entire execution and completion of works and incorporate their price in respective Bid price schedules. For erection hardware items, Bidders shall estimate the total requirement of the works and indicate module-wise lump sum price bay wise and include the same in relevant Bid price schedules.

No cost compensation shall be considered on account of "Set/LOT/LS" items in any case of number of bays specified in section project remains unchanged.

Bidder should include all such items in the bid proposal sheets, which are not specifically mentioned but are essential for the execution of the contract. Item which explicitly may not appear in various schedules and required for successful commissioning of substation shall be included in the bid price and shall be provided at no extra cost to Employer.

6.0 BASIC REFERENCE DRAWINGS

The substation shall be designed considering current ratings as indicated below-

Sl. No	Description of bay	765/400/220kV Koppal-II PS			765/400kV Raichur S/S
		765kV	400kV	220 kV	765kV
1.	Bus Bar	4000A	4000A	3000A	4000A
2.	Line bay	3150A	3150A	1600A	3150A
3.	ICT bay	3150A	3150A	1600A	-
4.	Bus Reactor bay	3150A	3150A	-	-
5.	Bus Coupler bay	-	-	3000A	-
6.	Transfer Bus coupler bay	-	-	1600A	-
7.	Line Reactor bay	3150A	-	-	-
8.	Bus Sectionalizer Bay	-	-	3000A	-

Following switching schemes are proposed for the substations envisaged under this specification:

Name of s/s	765kV	400 kV	220 kV

765/400/220kV Koppal-II PS	One & half breaker scheme	One & half breaker scheme	Double main & Transfer
765/400kV Raichur SS	One & half breaker scheme	-	-

6.1 The reference drawings, which form a part of the specifications, are given at **Annexure-I**. The bidder shall maintain the phase to earth clearance, phase to phase clearance and sectional clearances, clearances between buses, bus heights but may alter the locations of equipment to obtain the statutory electrical clearances required for the substation.

6.2 It is responsibility of contractor to develop general arrangement drawing, layout drawings, single line drawing, foundation & cable trench layout, erection key diagram & all other layout drawings for present scope of work.

7.0 DIFFERENT SECTIONS OF TECHNICAL SPECIFICATION

For the purpose of present scope of work, technical specification (Vol. II) shall consist of following sections and they should be read in conjunction with each other.

1	Section-Project	Rev 00
2	Section-General Technical Requirement (GTR)	Rev 15
3	Section-Switchgear- CB	Rev 11
4	Section-Switchgear- ISO	Rev 12
5	Section-Switchgear- Instrument Transformer	Rev 11
6	Section-Switchgear-Surge Arrester	Rev 12
7	Section-Power and Control Cables	Rev 06
8	Section-Lighting System	Rev 07
9	Section-Fire Protection System	Rev 06
10	Section – LT Switchgear	Rev 05
11	Section-Air Conditioning System	Rev 04
12	Section-Switchyard Erection	Rev 10
13	Section- Structures	Rev 06
14	Section-Civil Works	Rev 11A with correction slips 1,2,3&4
15	Section-Control and Relay Panels	Rev 09
16	Section-Substation Automation System	Rev 04
17	Section-PLCC	Rev 05
18	Section-Telecommunication Systems	Rev 04
19	Section – PMU	Rev 00

In case of any discrepancy between Section-PROJECT and Section-GTR and other technical specifications on scope of works, Section-PROJECT shall prevail over all other sections.

In case of any discrepancy between Section-GTR and individual sections for various equipments, requirement of individual equipment section shall prevail.

8.0 SPARES

The Mandatory Spares shall be included in the bid proposal by the bidder. The prices of these spares shall be given by the Bidder in the relevant schedule of BPS. The breakup of mandatory spares is enclosed at Annex-II.

The bidder is clarified that no mandatory spares shall generally be used during the commissioning of the equipment. Any spares required for commissioning purpose shall be arranged by the Contractor. The unutilized spares if any brought for commissioning purpose shall be taken back by the contractor.

Wherever spares in BPS/Technical Specification has been specified as "each type/each rating/each type & rating": If the offered spare/spares are sufficient to replace the respective main equipment of all types/ratings, then such offered spare/spares shall be acceptable. It implies that common spare/spare set fulfilling the spare requirement of all types/ratings shall also be acceptable, provided it is configurable at site itself without special assistance of OEM

Mandatory Spares, wherever mentioned, are envisaged for the equipment/items being supplied under the main equipment heads under present scope meeting the requirements of Technical Specifications. The component/sub-component of an equipment/item specified in BPS under Mandatory Spare, which is not applicable as per the offered design of respective main equipment, shall not be referred to.

9.0 SPECIFIC REQUIREMENT

9.1 The specific requirements as mentioned at C/ENGG/SPEC/SEC-PROJECT/SPECIFIC REQUIREMENT Rev. no 07 enclosed at Annex-III and relevant/applicable clauses shall be referred for specified scope of work.

9.2 Clause **No. 9.2 of Section GTR rev 15 is amended as:**

The reports for all type tests as per technical specification shall be furnished by the Contractor along with equipment / material drawings. However, type test reports of similar equipments/ material already accepted in POWERGRID shall be applicable for all projects with similar requirement. The type tests conducted earlier should have either been conducted in accredited laboratory (accredited based on ISO / IEC Guide 25 / 17025 or EN 45001 by the national accreditation body of the country where laboratory is located) or witnessed by POWERGRID/representative authorized by POWERGRID/representative of Utility /representative of accredited test lab/ representative of The National Accreditation Board for Certification Bodies (NABCB) certified agency shall also be acceptable.

Unless otherwise specified elsewhere, the type test reports submitted shall be of the tests conducted within the years specified below from the date of NOA. In case the test reports are of the test conducted earlier than the years specified below from the date of NOA, the contractor shall repeat these test(s) at no extra cost to the Employer:-

S. No.	Name of Equipment	Validity of type test (in years)
1	Power Transformer	5
2	LT Transformer	5
3	Shunt Reactor	5
4	OLTC	10
5	Bushing of Power Transformers/Reactors	7
6	Fittings and accessories for Power transformers &	10

	Reactors	
7	Circuit Breaker	10
8	Isolator	10
9	Lighting Arrester	10
10	Wave Trap	10
11	Instrument transformer	10
12	GIS & Hybrid GIS	15
13	LT Switchgear	10
14	Cable and associated accessories	10
15	Relays	7
16	Capacitors	10
17	Battery and Battery charger	10
18	Conductor & Earth wire	10
19	Insulators (Porcelain/Glass)	10
20	Composite Insulators	5
21	PLCC	5

Note:- For all other equipment's validity of type test shall be 10 years from date of NOA.

Further, in the event of any discrepancy in the test reports i.e. any test report not acceptable due to any design/manufacturing changes or due to non-compliance with the requirement stipulated in the Technical Specification or any/all type tests not carried out, same shall be carried out without any additional cost implication to the Employer.

The Contractor shall intimate the Employer the detailed program about the type tests atleast two (2) weeks in advance in case of domestic supplies & six (6) weeks in advance in case of foreign supplies.

9.3 The core details for 245kV, 2500A, 150% extended Current Transformer shall be as follows:

i. Primary ratio tap: 2500-1600-800/1-1-1-1-1A
ii. Class: PX, PX, 0.2S, PX, PX
iii. Core: 5
iv. Min. Knee point voltage Vk: 2500-1600-800 V for each core except metering
v. Burden: 20VA (For Metering core)
vi. Max. CT sec. winding resistance Rct (ohms): 12.5/8/4 for 2500/1600/800 tapping
vii. Max. excitation current at Vk (Imax in mA): 16/25/50 for 2500/1600/800 tapping

9.4 Standalone Disturbance Recorder as mentioned at clause no. 37. I) (Line Protection Panel) of Section-CRP Rev-09 is not envisaged under present scope. (for 765kV).

9.5 In case of 220kV line bays, Numerical Distance protection relay as Main–I and Line Current differential relay (with back up distance protection feature) as Main-II shall be provided. Further, in such case, the matching line current differential relay for remote end is not included under present scope of work.

9.6 Each circuit of a double circuit transmission line shall be terminated in different diameters.

9.7 Transformers of same HV rating shall be placed in different diameters.

9.8 Bus reactors of same HV rating shall be placed in different diameters.

9.9 Following clause in the Standard technical specification of –Power & Control Cable Rev 06 has been modified: -

S.No	**Amended Clauses**
1.	1.2.2. **XLPE Power Cables** 1.2.2.1. The XLPE (90°C) insulated cables shall be of **FRLSH type, C2** category conforming to IS: 7098 (Part-I) and its amendments read alongwith this specification. The conductor shall be stranded aluminium circular/sector shaped and compacted. In multicore cables, the core shall be identified by red, yellow, blue and black coloured strips or colouring of insulation. A distinct inner sheath shall be provided in all multicore cables. For XLPE cables, the inner sheath shall be of extruded PVC of type ST-2 of IS:5831. ***All cables shall be of armoured type***. For single core cables, the ***armouring*** shall consist of aluminium wires/strips. The outer sheath shall be extruded PVC of Type ST-2 of IS:5831 for all XLPE cables
2.	1.2.3. **PVC Power Cables** 1.2.3.1. The PVC (70°C) insulated power cables shall be of **FRLSH type, C2** category, conforming to IS: 1554 (Part-I) and its amendments read alongwith this specification and shall be suitable for a steady conductor temperature of 70°C**.** The conductor shall be stranded aluminium. The Insulation shall be extruded PVC to type-A of IS: 5831. A distinct inner sheath shall be provided in all multicore cables. ***All cables shall be of armoured type.*** For multicore armoured cables, the inner sheath shall be of extruded PVC. The outer sheath shall be extruded PVC to Type ST-1 of IS: 5831 for all cables.
3.	1.2.4. **PVC Control Cables** 1.2.4.1. The PVC (70°C) insulated control cables shall be of **FRLSH type C2** category conforming to IS: 1554 (Part-1) and its amendments, read alongwith this specification. The conductor shall be stranded copper. The insulation shall be extruded PVC to type A of IS: 5831. A distinct inner sheath shall be provided in all cables. ***All cables shall be of armoured type.*** The over sheath shall be extruded PVC to type ST-1 of IS: 5831 and shall be grey in colour.
4.	**5 TYPE TESTS** 5.1 All cables shall conform to all type, routine and acceptance tests listed in the relevant IS. 5.2 ***XLPE INSULATED POWER CABLES (For working voltages up to and***

	including 1100V):- 5.2.1 Following type tests (on one size in a contract) as per IS: 7098 (Part 1) – 1988 including its amendments shall be carried out as a part of acceptance tests on XLPE insulated power cables for working voltages up to and including 1100 V: a) Physical tests for insulation i) Hot set test ii) Shrinkage test b) Physical tests for outer sheath i) Shrinkage test ii) Hot deformation iii) Heat shock test iv) Thermal stability **c) Test for Smoke density (as per relevant IS/IEC standard)** **d) Test for halogen acid gas evolution**. **e) Flame Retardant on Single cable.** **f) Flame Retardant on bunched cable.** 5.2.2 Contractor shall submit type test reports as per clause no. 9.2 of Technical Specification, Section: GTR for the following tests a) Water absorption (gravimetric) test. b) Ageing in air oven c) Loss of mass in air oven d) Short time current test on power cables of sizes 240 sqmm and above on i) Conductors. ii) Armours. e) Test for armouring wires/strips. f) Oxygen and Temperature Index test. g) Flammability test. **h) Smoke density test (on sheathing material) (as per relevant IS/IEC standard)**
5.	5.3 ***PVC INSULATED POWER & CONTROL CABLES (For working voltages up to and including 1100V)-*** 5.3.1 Following type tests (on one size in a contract) as per IS: 1554 (Part 1) -1988 including its amendments shall be carried out as a part of acceptance tests on PVC insulated power & control cables for working voltages up to and including 1100 V: a) Physical tests for insulation and outer sheath i) Shrinkage test ii) Hot deformation iii) Heat shock test iv) Thermal stability b) High voltage test (water immersion test only a.c. test as per clause no. 16.3.1). **c) Test for Smoke density (as per relevant IS/IEC standard)** **d) Test for halogen acid gas evolution**. **e) Flame Retardant on Single cable**

	5.3.2 Contractor shall submit type test reports as per clause no. 9.2 of Technical Specification, Section: GTR for the following a) High voltage test (water immersion d.c. test as per clause no. 16.3.2 of IS: 1554 (Part 1) - 1988). b) Ageing in air oven. c) Loss of mass in air oven. d) Short time current test on power cables of sizes 240 sqmm and above on i) Conductors. ii) Armours. e) Test for armouring wires/strips. f) Oxygen and Temperature Index test. g) Flammability test **h) Flame Retardant on bunched cable** **i) Test for Specific optical density of smoke (as per relevant IS/IEC standard)**

Note:- In technical data sheet for 1.1kV XLPE/PVC Power cable & PVC control cable, wherever Type & Category of Cable is written FR & C1 shall be read as FR-LSH & C2, other details kept the same.

9.10 **CLAUSE 24 of GTR Rev.15 shall be read as below**:-

24.0 TECHNICAL REQUIREMENT OF EQUIPMENTS

Following equipment shall be offered from the **Indian Manufacturing facilities** of manufacturer(s) who meets the technical requirements as stipulated here, provided the same equipment are not covered under the Bidder's Qualifying requirement of the Bidding Documents.

Legend:

* : voltage class of respective equipment as applicable.

: **satisfactory operation** means certificate issued by the Employer/Utility certifying the operation without any adverse remark.

@ : **Circuit Breaker Bay** means a bay used for controlling a line or a transformer or a reactor or a bus section or a bus coupler and comprising of at least one circuit breaker, one disconnector and three nos. of single phase CTs / Bushing CTs

NOA: means Notification Of Award

24.1 Technical requirements for 765/400/220/132kV* Air Insulated Switchgear (AIS) Equipment*:

A) Circuit Breaker

(i) The manufacturer(s) whose 765/400/220/132kV* Circuit Breaker(s) are offered, must have, manufactured, type tested (as per IEC/IS or equivalent standard) and supplied 715/345/220/132kV* or higher voltage class Circuit Breaker(s), which are in satisfactory operation# for atleast two (2) years as on the date of NOA.

(ii) Alternatively, the manufacturer, who have established manufacturing and testing facilities in India for the offered Circuit Breaker and not meeting the requirement stipulated in (i) above, can also be considered provided that

a) 715/345/220/132kV* or higher Voltage class Circuit Breaker(s) must have been manufactured in the above Indian works & type tested (as per IEC/IS standard) and supplied as on the date of NOA.

b) In case manufacturer meets the technical requirement through clause (ii) above, warranty obligations for additional warranty of two (2) years over & above the warranty period as specified in the bidding documents shall be applicable for the entire quantity of the offered Circuit Breaker(s) to be supplied under the contract. Further, contractor shall furnish performance guarantee for an amount of 10% of the ex-works cost of the Circuit Breaker(s)* for the additional warranty period in addition to the contract performance guarantee to be submitted by the contractor.

C) Isolator, Current Transformer, Capacitive Voltage transformer, Inductive Voltage transformer, Surge Arrester and Wave Trap)

(i) The manufacturer whose 765/400/220/132kV* equipment(s) are offered, must have manufactured, type tested (as per IS/IEC or equivalent standard) and supplied 715/345/220/132kV* or higher voltage class equipment(s), which are in satisfactory operation# for at least two (2) years as on the date of NOA.

OR

(ii) The manufacturer, who have established manufacturing and testing facilities in India for the offered equipment(s) and not meeting the requirement stipulated in (i) above, can also be considered provided that:

a) 715/345/220/132kV* or higher Voltage class equipment(s) must have been manufactured in the above Indian works & type tested (as per IS/IEC standard) as on the date of NOA

b) Manufacturer has manufactured, type tested (as per IS/IEC or equivalent standard) and supplied equipment(s) of 345kV or above voltage class (applicable for 765kV* Equipment)/220kV or above voltage class (applicable for 400kV* equipment) /132kV or above voltage class (applicable for 220kV* equipment) / 66kV or higher voltage class (applicable for 132kV* equipment), which are in satisfactory operation# for at least two (2) years as on the date of NOA.

c) Warranty obligations for additional warranty of two (2) years over & above the warranty period as specified in the bidding documents shall be applicable for the entire quantity of the offered equipment(s) to be supplied under the contract. Further, contractor shall furnish performance guarantee for an amount of 10% of the ex-works cost of the equipment(s)* for the additional warranty period in addition to the contract Performance guarantee to be submitted by the contractor.

OR

(iii) The manufacturer, who have established manufacturing and testing facilities in India for the offered equipment(s) based on technological support of a parent company or collaborator and not meeting the requirement stipulated in (i) above, can also be considered provided that:

a) 715/345/220/132kV* or higher Voltage class equipment(s) must have been manufactured in the above Indian works & type tested (as per IS/IEC standard) as on the date of NOA.

b) The parent company or collaborator meets the qualifying requirements stipulated under (i) given above. A valid collaboration agreement for technology transfer / license to design, manufacture, test and supply the 765/400/220/132kV* Air Insulated Switchgear (AIS) Equipment(s)* in India, shall be submitted.

c) The parent company/collaborator shall furnish performance guarantee for an amount of 10% of the ex-works cost of such equipment(s) and this performance guarantee shall be in addition to contract performance guarantee to be submitted by the contractor

Legends:

* : voltage class of respective equipment as applicable.

: satisfactory operation means certificate issued by the Employer/Utility certifying the operation without any adverse remark.

24.9 Technical Requirement for 1.1 KV Grade PVC Control Cable

The manufacturer(s), whose PVC control cables are offered, must have designed, manufactured, tested and supplied in a single contract atleast 100 Kms of 1.1kV grade PVC insulated control cables as on the date of NOA. Further the manufacturer must also have designed, manufactured, tested and supplied atleast 1 km of 27C x 2.5 Sq.mm or higher size as on the date of NOA.

24.10 Technical Requirement for 1.1 KV Grade PVC Power Cable

The manufacturer(s), whose PVC Power Cables are offered, must have designed, manufactured, tested and supplied in a single contract atleast 100 Kms of 1.1kV or higher grade PVC insulated power cables as on the date of NOA. Further the manufacturer must also have designed, manufactured, tested and supplied atleast 1 km of 1C x 150 Sq. mm or higher size as on the date of NOA.

24.11 Technical Requirement for 1.1 KV Grade XLPE Power Cables

The manufacturer(s), whose XLPE Power cables are offered, must have designed, manufactured, tested and supplied in a single contract atleast 25 Kms of 1.1 KV or higher grade XLPE insulated power cables as on the date of NOA. Further the manufacturer must also have designed, manufactured, tested and supplied atleast 1 km of 1C x 630 Sq. mm or higher size as on the date of NOA.

24.16 Technical Requirements for Composite Long Rod Polymer Insulator (765kV & 400kV)

(i) The manufacturer whose Composite Long rod Insulator are offered, must have designed, manufactured, tested and supplied Composite Long rod Insulator of 120KN or higher electro-mechanical strength for 765kV/400kV* or higher voltage class and the same must have been in satisfactory operation[#] for at least two (2) years as on the date of NOA.

(ii) Alternatively, the manufacturer, who have established manufacturing and testing facilities in India and not meeting the requirement stipulated in (i) above, can also be considered provided that

a) The manufacturer must have designed, manufactured, type tested and supplied Composite Long rod Insulator of 120KN or above electro-mechanical strength for 765kV/400kV* or higher voltage class and the same must have been in satisfactory operation[#] as on the date of NOA.

b) Contractor shall furnish performance guarantee for an amount of 10% of the ex-works cost of the equipments(s)[*] and this performance guarantee shall be in addition to the contract performance guarantee to be submitted by the contractor.

Note: In case manufacturer meets the technical requirement through clause (ii) above, warranty obligations for additional warranty of two(2) years over & above the warranty period as specified in the bidding documents shall be applicable for the entire quantity of the offered equipment to be supplied under the contract. Further, contractor shall furnish performance guarantee for an amount of 10% of the ex-works cost of the equipments(s)* for the additional warranty period in addition to the contract performance guarantee to be submitted by the contractor.

24.17 **Technical Requirements for Control, Relay & Protection System and Sub-station Automation System**

The manufacturer whose Control, Relay & Protection System (Control & protection Intelligent Electronic Devices (IEDs)), and Sub-station Automation System (as applicable) are offered, must have designed, manufactured, tested, installed and commissioned Control, Relay & Protection system along with Sub-station Automation System which must have been in satisfactory

operation# on (i) 400 kV system [applicable for 765kV substation] & (ii) specified voltage level or above [applicable for 400kV & below substation] for atleast two (2) years as on the date of NOA.

AND

The Manufacturer or their joint venture or subsidiary company or parent company must be a manufacturer of control and protection IEDs and must have established repair, testing and integration (at least for 4 bays) facilities for Control, Relay & Protection System and Sub-station Automation System in India.

24.18 Technical Requirements for analog and digital PLCC panels (765kV, 400kV, 220kV & 132kV)

(i) The manufacturer whose PLCC panels are offered, must have designed, manufactured, tested, supplied and commissioned PLCC panels for (i) 400kV system or above [applicable for 765 kV & 400 kV substation], (ii) 220 kV System or above [applicable for 220 kV Substation] & (iii) 132 kV system or above [applicable for 132 kV substation] and the same must have been in satisfactory operation# for atleast two (2) years as on the date of NOA.

(ii) Alternatively, the manufacturer, who have established manufacturing and testing facilities in India and not meeting the requirement stipulated in (i) above, can also be considered provided that

a) PLCC panels must have been manufactured in the above Indian works based on technological support of collaborator, type tested (as per IEC/IS standard) and supplied as on the date of NOA.

b) collaborator shall furnish performance guarantee for an amount of 10% of the ex-works cost of such equipment(s) and this performance guarantee shall be in addition to contract performance guarantee to be submitted by the contractor.

c) The collaborator meets the requirements stipulated in (i) above. A valid collaboration agreement for technology transfer / license to design, manufacture, test and supply PLCC panels in India, shall be submitted.

24.19 Technical Requirement of Communication Equipment

The SDH equipment shall be offered from a manufacturer(s) who is a **"Local Supplier"** as per DPIIT PP notification & has been Manufacturing SDH equipments for the last three (3) years and SDH equipment Manufactured by such manufacturer(s) shall have been satisfactory operation in 110kV or higher voltage Power Substations for at least two (2) years as on the date of NOA

9.11 Equipment/Material/Items from a Indian manufacture who have specified transfer of technology (TOT) arrangement with an entity from a country which shares land border with India shall be accepted only if the Indian Manufacturer is complying the requirement of prevailing Guideline by Government of India under Rule 144(xi) of the General financial Rule (GFR) 2017.

9.12 The values of transfer current and recovery voltage of 220kV class bus isolators shall be specified by manufacturer & Bus Isolators shall be type tested for bus transfer current switching duty as per latest IEC62271-102. Test reports is to be submitted for the Employer's review.

9.13 Provision of space for installation of Metering arrangement with Special Energy Meters (SEMs) shall be provided at 33kV tertiary of Transformer for drawing auxiliary supply at new substation.

TECHNICAL SPECIFICATION
SECTION-SWITCHYARD ERECTION

पावर ग्रिड कार्पोरेशन आफ इन्डिया लिमिटेड

(भारत सरकार का उद्यम)

Power Grid Corporation of India Limited

(A Government of India Enterprises)

Document No.: C/ENGG/SPEC/SE (Rev.10) **April 2016**

TECHNICAL SPECIFICATION

SECTION- SWITCHYARD ERECTION
REVISION - 10

SECTION-(SE)
SWITCHYARD ERECTION

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SECTION-(SE)
SWITCHYARD ERECTION

1.0 GENERAL

This section covers erection of all equipment such as circuit breakers, isolators, current transformers, voltage transformers, surge arresters etc. This section also covers design, engineering, manufacture, testing at works, supply, insurance, handling, storage, erection, testing and commissioning of supply & erection of following items.

- String insulators and hardware
- AAC / ACSR conductor
- Galvanised Steel Earthwire
- Aluminium Tube
- Spacers
- Bus post insulators
- Earthing & Earthing materials
- Lightning protection materials
- Cabling material
- Other items

2.0 String Insulators & Hardware

The insulators for suspension and tension strings shall conform to IEC-60383 and long rod insulators shall conform to IEC-60433. Insulator hardware shall conform to IS:2486**.** Composite long rod polymer insulator shall conform to IEC:61109. Further, the contractor shall supply insulators as per details mentioned below:

A. Tension Insulator String

Sl. No.	System Voltage	Type
1.	765kV, 400kV, 220kV & 132kV (for all substations in coastal, pollution affected areas as identified in Section-Project and for all substations in Northern Region)	Composite Long Rod Polymer with 31mm/kV Creepage
2.	765kV, 400kV, 220kV & 132kV (for substations not covered in 1. above)	Composite Long Rod Polymer/Porcelain/Glass with 31mm/kV Creepage

B. Suspension Insulator String

Sl. No.	System Voltage	Type
1.	765kV, 400kV, 220kV & 132kV (for all substations)	Composite Long Rod Polymer with 31mm/kV Creepage

2.1 Construction Features (Porcelain & Glass Insulators)

2.1.1 Porcelain insulators

a) Suspension and tension insulators shall be wet process porcelain with ball and socket connection. Insulators shall be interchangeable and shall be suitable for forming either suspension or tension strings. Each insulator shall have rated strength, manufacturer's logo, month & year of manufacturing markings on porcelain printed and applied before firing.

b) Porcelain used in insulator manufacturing shall be homogeneous, 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.

c) Glazing of the porcelain shall be of uniform brown colour, free from blisters, burrs and other similar defects.

2.1.2 Glass insulators

It **shall** be made of toughened glass. Glass used for the shells shall be sound, free from defects, flows bubbles, inclusions, etc and be of uniform toughness over its entire surface. All exposed glass surfaces shall be smooth.

2.1.2.1 When operating at normal rated voltage, there shall be no electric discharge between conductor and insulator which would cause corrosion or **damage** to conductors or insulators by the formation of substances due to chemical action.

2.1.2.2 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 galvanized in accordance with the latest edition of IS: 2629. The zinc used for galvanizing shall be of grade Zn-99.95 as per IS-209. The zinc coating shall be uniform, adherent, smooth, reasonably bright, continuous and free from imperfections such as flux, ash, rust stains bulky white deposits and blisters.

2.1.2.3 Contractor shall make available data on all the essential features of design including the method of assembly of discs and metal parts, number of discs per insulator string, the manner in which mechanical stresses are transmitted through discs to adjacent parts, provision for meeting expansion stresses, results of corona and thermal shock tests, recommended working strength and any special design or arrangement employed to increase life under service conditions.

2.1.3 Hardware Fittings

2.1.3.1 Clamps for insulator strings and Corona Control rings shall be of aluminium alloy as stipulated for clamps and connectors.

2.1.3.2 Insulator hardware shall be of forged steel. Malleable cast iron shall not be accepted except for insulator disc cap. The surface of hardware must be clean, smooth, without cuts, abrasion or projections. No part shall be subjected to excessive localized pressure. The metal parts shall not produce any noise generating corona under operating conditions.

2.1.3.3 The tension Insulator hardware assembly shall be designed for minimum 21000 kg tensile load for 765kV and minimum 12000 kg tensile load for hardware

assembly below 765kV. Earth wire tension clamp shall be designed for minimum 1000 kg tensile load with a factor of safety of two (2).

2.1.3.4 The tension string assemblies shall be supplied alongwith suitable turn buckle. Sag compensation springs if required may also be provided.

2.1.3.5 All hardware shall be bolted type.

2.2 Tests

In accordance with the stipulations of the specification, the suspension and tension strings, insulator and hardware shall be subjected to the following type tests, acceptance tests and routine tests:

2.2.1 Type Tests on Insulator Strings: The test reports for following type tests shall be submitted for approval as per clause 9.0 of Section - GTR.

a) Power frequency voltage withstand test with corona control rings **(if applicable)** under wet condition as per IEC- 60383.

b) Switching surge voltage withstand test [400 kV and above class only] under wet condition as per IEC-60383.

c) Lightning Impulse voltage withstand test with corona control rings under dry condition as per IEC-60383

d) Voltage distribution test (Dry) **[applicable for disc insulator string only]**

The voltage across each insulator unit shall be measured by sphere gap method. The result obtained shall be converted into percentage. The voltage across any disc shall not exceed 6.5% for 765 kV suspension and tension insulator strings, 9% and 10% for 400KV suspension string and tension insulator string respectively, 13% for 220KV suspension and tension insulator strings, 20% and 22% for 132KV suspension and tension insulator strings respectively.

e) Corona Extinction Voltage test (Dry) [**220kV** and above class only]

The sample assembly when subjected to power frequency voltage shall have a corona extinction voltage **as specified at clause 2.3.2**. There shall be no evidence of Corona on any part of the sample. The atmospheric condition during testing shall be recorded and the test results shall be accordingly corrected with suitable correction factor as stipulated in IEC 60383.

f) RIV Test (Dry) [**220kV** and above class only]

Under the conditions as specified under (e) above the insulator string alongwith complete hardware fittings shall have a radio interference voltage as **specified in clause 2.3.2 of this section.** The test procedure shall be in accordance with IS 8263/IEC 60437.

g) Mechanical strength test: The test shall be carried out as per following procedure.

The complete insulator string alongwith its hardware fitting excluding arcing horn, corona control ring, grading ring, tension/suspension clamps shall be subjected to a load equal to 50% of the specified minimum ultimate tensile strength (UTS) which shall be increased at a steady rate to 67% of the minimum UTS specified. The load shall be held for five minutes and then removed. After removal of the load, the string components shall not show any visual deformation and it shall be possible to dismantle them by hand. Hand tools may be used to remove cotter pins and loosen the nuts initially. The string shall then be reassembled and loaded to 50% of UTS and the load shall be further increased at a steady rate till the specified minimum UTS and held for one minute. No fracture should occur during this period. The applied load shall then be increased until the failing load is reached and the value recorded.

2.2.2 Type Tests on String Insulator Units

Type test report for Thermal Mechanical Performance tests **(applicable for porcelain type insulators)** as per IEC-60575, Clause 3 shall be submitted for approval as per clause 9.2 of Section - GTR.

2.2.3 Acceptance Tests for Insulators:

a) Visual examination as per IEC-60383/ IEC-61109 clause no. 7.2 (for composite long rod insulators).

b) Verification of Dimensions as per IEC- 60383.

c) Temperature cycle test as per IEC- 60383.

d) Puncture Test as per IEC-60383 (Applicable only for porcelain insulators).

e) Galvanizing Test as per IEC- 60383.

f) Mechanical performance test as per IEC-60575 Cl. 4 / IEC-61109 clause no. 7.2 (for composite long rod insulators).

g) Test on locking device for ball and socket coupling as per IEC-60372(2).

h) Porosity test as per IEC- 60383 (Applicable only for porcelain insulators).

i) Thermal shock test as per IEC-60383 (Applicable only for glass insulators)

2.2.4 Acceptance Test on Hardware Fitting

a) Visual Examination as per Cl. 5.10 of IS: 2486 (Part-I).

b) Verification of Dimensions as per Cl. 5.8 of IS:2486 (Part-I)

c) Galvanising/Electroplating tests as per Cl. 5.9 of IS:2486 (Part-I).

d) Slip strength test as per Cl 5.4 of IS-2486 (part-I)

e) Shore hardness test **by** the Elastometer

f) Mechanical strength test for each component (including corona control rings and arcing horns).

The load shall be so applied that the component is stressed in the same way as it would be in actual service and the procedure as given in 2.2.1.(g) above should be followed.

g) Test on locking devices for ball and socket coupling as per IEC -60372(2).

2.2.5 Routine Test on Insulator

a) Visual Inspection as per IEC-60383

b) Mechanical Routine Test as per IEC-60383

c) Electrical Routine Test as per IEC-60383

2.2.6 Routine Test on hardware Fittings

a) Visual examination as per Cl 5.10 of IS:2486 (Part-I)

b) Mechanical strength Test as per Cl. 5.11 of IS:2486 (Part-I)

2.2.7 Test during manufacture on all Components as applicable on insulator

a) Chemical analysis of zinc used for galvanising: Samples taken from the zinc ingot shall be chemically analyzed as per IS: 209. The purity of zinc shall not be less than 99.95%.

b) Chemical Analysis, mechanical hardness tests and magnetic particle inspection for malleable casting:

The chemical analysis, hardness tests and magnetic particle inspection for malleable casting will be as per the internationally recognized procedures for these tests. The sampling will be based on heat number and heat treatment batch. The details regarding tests will be as discussed and mutually agreed to by the Contractor and Employer in Quality Assurance Program.

2.2.8 Test during manufacture on all components as applicable on hardware fittings:

a) Chemical analysis of zinc used for galvanising:

Samples taken from the zinc ingot shall be chemically analyzed as per IS:209. The purity of zinc shall not be less than 99.95%

b) Chemical analysis, hardness tests and magnetic particle for Forgings/ **fabricated hardware:**

The chemical analysis, hardness tests and magnetic particle inspection for forgings/fabricated hardware will be as per the internationally recognized procedures for these tests. The sampling will be based on heat number and heat treatment batch. The details regarding tests will be as discussed and mutually agreed to by the Contractor and Employer in Quality Assurance Programme.

2.3 Guaranteed technical Particular For

2.3.1 Disc Insulators

Sl. No.	Description	For 765kV	For 400/220/132kV
a)	Type of insulators	Anti Fog type	Anti Fog type
b)	Physical Size of insulator units		
(i)	Diameter of Disc	As per IEC	As per IEC
(ii)	Ball to ball spacing between discs	170 mm	145 mm
c)	Electro mechanical strength	210 kN	120 kN
d)	Minimum Creepage distance of individual insulator units	460 mm	430 mm
e)	Markings		
i)	For Porcelain insulators	Markings on porcelain	Markings on porcelain
ii)	For toughened glass insulators	Markings shall be done on initial parts	Markings shall be done on initial parts
f)	Power frequency puncture withstand voltage	1.3 times the actual wet flashover voltage	1.3 times the actual wet flashover voltage

2.3.2 INSULATOR STRING

Sl. No.	Description	765 kV	400kV	220kV	132kV
a)	Power frequency withstand voltage of the complete string with corona control ring (wet) – KV rms	870	680	460	275
b)	Lightning impulse withstand Voltage of string with corona control rings (dry) - kVp	± 2100	± 1550	± 1050	± 650
c)	Switching surge withstand voltage of string with corona control rings (wet) - kVp	± 1550	± 1050	NA	NA
d)	Minimum corona extinction voltage level of string with Corona Control rings (dry) - kV rms	508	320	156	NA
e)	Maximum RIV level in micro volts of string with Corona Control rings across 300 Ohms resistor at 1 MHz	1000 (Max) at 508 kV	1000 (Max) at 320 kV	1000 (Max) at 156 kV	NA
f)	**Minimum total creepage distance of the insulator string (mm)**	**24800**	**13020**	**7595**	**4495**
g)	**Minimum no. of discs per string (for tension string if applicable)**	**54**	**31**	**18**	**11**

h)	Electromechanical strength of Insulator Unit. (KN)	210	120	120	120

For tension application:-

Double insulator strings for 765kV, 400kV, 220kV and single insulator strings for 132 kV systems shall be used.

For suspension application:-

V-type polymer insulator string shall be used for 765kV system and single suspension polymer insulator string shall be used for 400kV, 220kV & 132 kV systems.

2.4 COMPOSITE LONG ROD POLYMER INSULATOR

Bidder shall offer composite long rod polymer insulators with suitable hardware fittings.

2.4.1 Details of Composite Long Rod Insulators

2.4.1.1 Insulators shall have sheds of the “open aerodynamic profile without any under ribs” with good self-cleaning properties. Insulator shed profile, spacing projection etc. shall be strictly in accordance with the recommendation of IEC-60815.

2.4.1.2 Ball and socket shall be 20mm designation for 120kN & 24mm designation for 210kN Insulators in accordance with the standard dimensions stated in IEC:60120/ IS:2486 (Part-II). Insulators shall be interchangeable and shall be suitable for forming either suspension or tension strings. Each insulator shall have laser markings on housings for manufacturer’s name, month & year of manufacturing, rated strength markings on each composite insulator rod unit. No negative tolerance shall be applicable to creepage distance of composite insulators

2.4.1.3 **All ferrous parts shall be hot dip galvanized as per Section-GTR with minimum weight of zinc coating as 610 gm/sq.m for normal area and 900 gm/sq.m for coastal area as specified in Section-Project.**

2.4.2 Material

2.4.2.1 **Core**

It shall be a glass-fiber reinforced (FRP) epoxy resin rod of high strength. The rod shall be resistant to hydrolysis. The rod shall be of electrical grade corrosion resistant (ECR), boron free glass and shall exhibit both high electrical integrity and high resistance to acid corrosion.

2.4.2.2 **Housing & Weathersheds**

The FRP rod shall be covered by a sheath of a silicone rubber compound of a thickness of minimum **5mm**. The housing & weathersheds should have silicon content of minimum 30% by weight. It should protect the FRP rod against environmental influences, external pollution and humidity. It shall be extruded or directly molded on the core. The interface between the housing and the core must be uniform and without voids. The strength of the bond shall be greater than the tearing strength of the polymer. The manufacturer shall follow non-

destructive technique (N.D.T.) to check the quality of jointing of the housing interface with the core.

The weathersheds of the insulators shall be of alternate shed profile. The weathersheds shall be vulcanized to the sheath (extrusion process) or molded as part of the sheath (injection moulding process) and free from imperfections. The vulcanization for extrusion process shall be at high temperature and for injection moulding shall be at high temperature & high pressure. Any seams/ burrs protruding axially along the insulator, resulting from the injection moulding process shall be removed completely without causing any damage to the housing. The track resistance of housing and shed material shall be class 1A4.5 according to IEC60587. The strength of the weathershed to sheath interface shall be greater than the tearing strength of the polymer. The composite insulator shall be capable of high pressure washing.

2.4.2.3 **End Fittings**

End fittings transmit the mechanical load to the core. They shall be made of malleable cast iron/ spheroidal graphite or forged steel. They shall be connected to the rod by means of a controlled compression technique. The manufacturer shall have in-process Acoustic emission arrangement or some other arrangement to ensure that there is no damage to the core during crimping. This verification shall be in-process and done on each insulator. The system of attachment of end fitting to the rod shall provide superior sealing performance between housing and metal connection. The gap between fitting and sheath shall be sealed by a flexible silicone rubber compound. The sealing shall stick to both housing and metal end fitting. The sealing must be humidity proof and durable with time.

End fittings shall have suitable provisions for fixing grading rings at the correct position as per design requirements.

2.4.2.4 **Grading Rings**

Grading rings shall be used at both ends of each composite insulator unit for reducing the voltage gradient on and within the insulator and to reduce TV noise to acceptable levels. The size and placement of the metallic grading rings shall be designed to eliminate dry band arcing/corona cutting/ exceeding of permissible electrical stress of material. The insulator supplier shall furnish design calculations using appropriate electric field software showing electric field at surface of housing, inside housing & core and at the interface of housing and metal fittings with the proposed placement and design of corona **rings**. Grading rings shall be capable of installation and removal with hot line tools without disassembling any other part of the insulator assembly.

The design & supply of grading rings shall be in the scope of the composite insulator supplier.

2.4.3 Tests

2.4.3.1 **Type Tests**

The test reports for following type tests on long rod units, components, materials or complete strings shall be submitted for approval as per clause 9.2 of Section - GTR.

2.4.3.1.1 **On the complete composite Long Rod Polymer Insulator String with Hardware Fittings**:-

a) Power frequency voltage withstand test with corona control rings/grading ring and arcing horns (if provided) under wet condition as per IEC:60383-1993.

b) Switching surge voltage withstand test under wet condition as per IEC:60383-1993.

c) Impulse voltage withstand test under dry condition as per IEC:60383-1993

d) Corona and RIV test under dry condition. [132kV and above class only]

The sample assembly when subjected to power frequency voltage shall have a corona extinction voltage as specified in clause 2.3.2 of this section There shall be no evidence of Corona on any part of the sample. The atmospheric condition during testing shall be recorded and the test results shall be accordingly corrected with suitable correction factor as stipulated in IEC 60383.

Under the conditions as specified above the insulator string alongwith complete hardware fittings shall have a radio interference voltage level **as** specified at specified in clause 2.3.2 of this section. The test procedure shall be in accordance with IS 8263/IEC-60437.

e) Mechanical Strength test: The test shall be carried out as per following procedure.

The complete insulator string alongwith its hardware fitting excluding arcing horn, corona control ring, grading ring, tension/suspension clamps shall be subjected to a load equal to 50% of the specified minimum ultimate tensile strength (UTS) which shall be increased at a steady rate to 67% of the minimum UTS specified. The load shall be held for five minutes and then removed. After removal of the load, the string components shall not show any visual deformation and it shall be possible to dismantle them by hand. Hand tools may be used to remove cotter pins and loosen the nuts initially. The string shall then be reassembled and loaded to 50% of UTS and the load shall be further increased at a steady rate till the specified minimum UTS and held for one minute. No fracture should occur during this period. The applied load shall then be increased until the failing load is reached and the value recorded.

f) Salt-fog pollution withstand test as per IEC: 60507. The salinity level for composite long rod insulators shall be 160 Kg/m3 NaCl.

2.4.3.1.2 **On Composite Polymer Insulator Units**

a) Tests on interfaces and connections of metal fittings as per IEC: 61109-2008.

b) Assembled core load time test as per IEC: 61109-2008.

c) Damage limit proof test and test of tightness of interface between end firings and insulator housing as per IEC: 61109-2008

d) High Pressure washing test

The washing of a complete insulator of each E&M rating is to be carried out at 3800 kPa with nozzles of 6 mm diameter at a distance of 3m from nozzles to the insulator, the washing shall be carried out for 10minutes. There shall be no damage to the sheath or metal fitting to housing interface. The verification shall be done by 1 minute wet power frequency withstand test at 680kV r.m.s for 400KV.

e) Brittle fracture resistance test

The test arrangement shall be according to Damage limit proof test with simultaneous application of 1N-HNO3 acid directly in contact with naked FRP rod. The contact length of acid shall not be less than 40mm and thickness around the core not less than 10mm.The rod shall withstand 80% of SML for 96 hours.

f) Dye penetration test as per IEC: 61109-2008

g) Water diffusion test as per IEC: 61109-2008

h) Tracking and erosion test as per IEC: 61109-2008.

i) Hardness test as per IEC: 61109-2008.

j) Accelerated weathering test as per IEC: 61109-2008.

k) Flammability test as per IEC: 61109-2008.

l) Silicone content test

Minimum content of silicone shall be 30% and the same shall be verified through FT-IR spectroscopy & TGA analysis or any other approved/ acceptable method.

m) Recovery of Hydrophobicity test

1. The surface of selected samples shall be cleaned with isopropyl alcohol. Allow the surface to dry and spray with water. Record the HC classification. Dry the sample surface.

2. Treat the surface with corona discharges to destroy the hydrophobicity. This can be done utilizing a high frequency corona tester, Holding the electrode approximately 3mm from the sample surface, slowly move the electrode over an area approximately 1" x 1". Continue treating this area for 2 – 3 minutes, operating the tester at maximum output.

3. Immediately after the corona treatment, spray the surface with water and record the HC classification. The surface should be hydrophilic, with an HC value of 6 or 7. If not, dry the surface and repeat the corona treatment for a longer time until an HC of 6 or 7 is obtained. Dry the sample surface.

4. Allow the sample to recover and repeat the hydrophobicity measurement at several time intervals. Silicone rubber should recover to HC 1 – HC 2 within 24 to 48 hours, depending on the material and the intensity of the corona treatment.

n) Torsion test

Three complete insulators of each electrical and mechanical rating shall be subjected to a torsional load of 55Nm. The torsional strength test shall be made with test specimen adequately secured to the testing machine. The torsional load shall be applied to the test specimen through a torque member so constructed that the test specimen is not subjected to any cantilever stress. The insulator after torsion test must pass the Dye Penetration Test as per IEC 61109.

o) Accelerated ageing test of 5000hrs as described in appendix-C of IEC 61109 or Test at multiple stresses of 5000 hrs as described in Annex-B of IEC - 62217

2.4.3.2 **Acceptance Tests:**

For Composite Long Rod Polymer Insulators

a.	Verification of dimensions	IEC : 61109-2008
b.	Galvanizing test	IEC : 60383
c.	Verification of end fittings	IEC : 61109-2008
d.	Recovery of Hydrophobicity	As per **Cl. 2.4.3.1.2.m)** above
e.	Verification of tightness of interface between end fittings and insulator housing and of specified mechanical load	IEC : 61109-2008
f.	Silicone content test	As per **Cl. 2.4.3.1.2.l)** above
g.	Brittle fracture resistance test	As per **Cl. 2.4.3.1.2.e)** above
h.	Dye penetration test	IEC : 61109-2008
i.	Water diffusion test	IEC : 61109-2008

In the event of failure of the sample to satisfy the acceptance test(s) specified in **2.4.3.2** above, the **re-test** procedure shall be as per IEC 61109.

2.4.3.3 **Routine Tests**

For Composite Long Rod Polymer Insulator Units

a)	Visual Examination	As per IEC:61109-2008
b)	Mechanical routine test	As per IEC:61109 -2008

2.4.4 **Guaranteed Technical Particulars for Composite Long Rod Polymer Insulators**

The technical parameters for composite long rod polymer insulator string shall be same of the insulator string specified in clause 2.3.2 of this section.

3.0 AAC / ACSR CONDUCTOR

3.1 Details of AAC Conductor

3.1.1 The Conductor shall conform to IEC: 61089/IS: 398 (Part V) - 1992 except where otherwise specified herein.

The contractor shall supply the conductor as per the standard guaranteed technical particulars enclosed in Annexure-E of the technical specification, Section – Switchyard Erection and separate approval for **guaranteed technical particulars** is not required during detailed engineering.

3.2 Details of ACSR Conductor

3.2.1 The Conductor shall conform to IEC: 61089/IS: 398 (Part V) - 1992 except where otherwise specified herein.

3.2.2 The details of the ACSR Bersimis, ACSR Moose, ACSR Zebra and ACSR Panther conductors shall be as per the standard guaranteed technical particulars enclosed in Annexure-E of the technical specification, Section – Switchyard Erection and separate approval for **guaranteed technical particulars** is not required during detailed engineering.

3.**3** Workmanship

3.3.1 The finished conductor shall be smooth, compact, uniform and free from all imperfections including kinks (**protrusion** of wires), wire cross over, over riding, looseness (wire being dislocated by finger/hand pressure and/or unusual bangle noise on tapping), material inclusions, white rust, powder formation or black spot (on account of reaction with trapped rain water etc.), dirt, grit etc.

3.3.2 All the Aluminium and steel strands shall be smooth, uniform and free from all imperfections, such as spills and splits, diemarks, scratches, abrasions, etc., after drawing.

3.3.3 The steel strands shall be hot dip galvanised and shall have a minimum zinc coating as indicated in the guaranteed technical particulars. The zinc coating shall be smooth, continuous and of uniform thickness, free from imperfections and shall withstand minimum three dips in standard Preece test. The steel wire rods shall be of such quality and purity that, when drawn to the size of the strands specified and coated with zinc, the finished strands and the individual wires shall be of uniform quality and have the same properties and characteristics as prescribed in IEC: 60888.

3.3.4 The steel strands shall be preformed and post formed in order to prevent spreading of strands in the event of cutting of composite core wire. Care shall be taken to avoid, damages to galvanisation during pre-forming and post-forming operation.

3.4 Joints in Wires

3.4.1 Aluminium Wires

3.4.1.1 During stranding, no aluminium wire welds shall be made for the purpose of achieving the required conductor length.

3.4.1.2 No joints shall be permitted in the individual wires in the outer most layer of the finished conductor. However joints are permitted in the inner layer of the conductor unavoidably broken during stranding, provided such breaks are not associated with either inherently defective wire or with the use of short lengths of aluminium wires. Such joints shall not be more than four (4) per conductor length and shall not be closer than 15 meters from joint in the same wire or in any other aluminium wire of the completed conductor.

3.4.1.3 Joints shall be made by cold pressure butt welding and shall withstand a stress of not less than the breaking strength of individual strand guaranteed.

3.4.2 Steel Wires

There shall be no joint of any kind in the finished wire **used for** the **manufacturing** of the strand. There shall also be no strand joints or strand splices in any length of the completed stranded steel core of the conductor.

3.5 Tolerances

The manufacturing tolerances to the extent indicated in the guaranteed technical particulars shall be permitted in the diameter of individual aluminium and steel strands and lay-ratio of the conductor.

3.6 Materials

3.6.1 Aluminium

The aluminium strands shall be hard drawn from electrolytic aluminium rods having purity not less than 99.5% and a copper content not exceeding 0.04%. They shall have the same properties and characteristics as prescribed in IEC:60889.

3.6.2 **Steel**

The steel wire strands shall be drawn from high carbon steel wire rods produced by either the acid or the basic open-hearth process, the electric furnace process, or the basic oxygen process and shall conform to the chemical composition indicated in the guaranteed technical particulars.

The Steel wire strands shall have the same properties and characteristics as prescribed for regular strength steel wire in IEC: 60888.

3.6.3 **Zinc**

The zinc used for galvanising shall be electrolytic High Grade Zinc of 99.95% purity. It shall conform to and satisfy all the requirements of IS:209 -1979.

3.7 **Standard Length**

3.7.1 The conductor shall be supplied as required. No joint shall be allowed within a single span of stringing, jumpers and equipment interconnection.

3.8 Tests:

3.8.1 The following type, acceptance & routine tests and tests during manufacturing shall be carried out on the conductor.

3.8.1.1 **Type Tests**

In accordance with the stipulation of specification, the following type tests reports of the conductor shall be submitted for approval as per clause 9.2 of Section -GTR.

a)	UTS test on stranded conductor.	
b)	Corona extinction voltage test (dry)	As per Annexure-A
(c)	Radio Interference voltage test (dry)	
(d)	DC resistance test on stranded conductor	

3.8.1.2 **Acceptance Tests**

a)	Visual check for joints, scratches etc. and lengths of conductor	As per Annexure - A
b)	Dimensional check on steel and aluminium strands	
c)	Check for lay ratios of various layers	-do-
d)	Galvanising test on steel strands	
e)	Torsion and Elongation test on steel strands	
f)	Breaking load test on steel and aluminium strands	
g)	Wrap test on steel and aluminium strands	As per IEC:60888 & 60889
h)	DC resistance test on aluminium strands	As per IEC:60889
i)	UTS test on welded joint of aluminium strands	As per Annexure - A

NOTE:

All the above tests except test mentioned at (a) shall be carried out on aluminium and steel strands after stranding only.

3.8.1.3 **Routine Tests**

a) Check to ensure that the joints are as per specification.

b) Check that there are no cuts, fins etc. on the strands.

c) All acceptance tests as mentioned above to be carried out on each coil/drum (as applicable).

3.8.1.4 **Tests During Manufacture**

a)	Chemical analysis of zinc used for galvanising	As per Annexure - A
b)	Chemical analysis of aluminium used for making aluminium strands	
c)	Chemical analysis of steel used for making steel strands	

4.0 Galvanised Steel Earth wire

4.1 Details of Earth wire

4.1.1 The galvanised steel earth wire shall generally conform to the specification of ACSR core wire as mentioned in IEC:60888/IS: 398 (Part-II)-1976 except where otherwise specified herein.

The contractor shall supply the earthwire as per the standard guaranteed technical particulars enclosed in Annexure-E of the technical specification, Section – Switchyard Erection and separate approval **for guaranteed technical particulars** is not required during detailed engineering.

4.2 Workmanship

4.2.1 All steel strands shall be smooth, uniform and free from all imperfections, such as spills and splits, die marks, scratches, abrasions and kinks after drawing and also after stranding.

4.2.2 The finished material shall have minimum brittleness as it will be subjected to appreciable vibration while in use.

4.2.3 The steel strands shall be hot dip qalvanised and shall have minimum Zinc coating after stranding, as stipulated in guaranteed technical particulars attached with. The zinc coating shall be smooth, continuous, of uniform thickness, free from imperfections. The steel wire rod shall be of such quality and purity that, when drawn to the size of the strands specified and coated with zinc, the finished strands shall be of uniform quality and have the same properties and characteristics as prescribed in ASTM designation B498-74.

4.2.4 The steel strands shall be preformed and post formed in order to prevent spreading of strands while cutting of composite earth wire. Care shall be taken to avoid damage to galvanisation during preforming and postforming operation.

4.2.5 To avoid susceptibility towards wet storage stains (white rust), the finished material shall be provided with a protective coating of boiled linseed oil.

4.3 Joints in Wires

There shall be no joints of any kind in the finished steel wire strand entering into the manufacture of the earth wire. There shall be no strand joints or strand splices in any length of the completed stranded earth wire.

4.4 Tolerances

The manufacturing tolerance to the extent of the limits as stipulated in guaranteed Technical Particulars attached with this specification shall only be permitted in the diameter of the individual steel strands and lay length of the earth wire.

4.5 **Materials**

4.5.1 Steel

The steel wire strands shall be drawn from high carbon steel rods and the chemical composition shall conform to the requirements as stipulated in Guaranteed Technical Particulars attached with.

4.5.2 Zinc

The zinc used for galvanising shall be electrolytic High Grade Zinc. It shall conform to and satisfy all the requirements of IS: 209 -1979.

4.6 Standard Length

4.6.1 The standard length of the earth wire shall be as stipulated in Guaranteed Technical Particulars attached with, with the specified tolerance on standard length.

4.8 **TESTS**

4.8.1 The following type, routine & acceptance tests and tests during manufacturing shall be carried out on the earthwire.

4.8.2 **TYPE TESTS**

In accordance with the stipulation of specification, the following type tests reports of the earthwire shall be submitted for approval as per clause 9.2 of Section - GTR.

a)	UTS test	)	
		)	As per Annexure - B
b)	DC resistance test	)	

4.8.3 **ACCEPTANCE TESTS**

a)	Visual check for joints, scratches etc. and length of Earthwire	)	
b)	Dimensional check	)	As per Annexure - B
c)	Galvanising test	)	
d)	Lay length check	)	

e)	Torsion test	)	
f)	Elongation test	)	
g)	Wrap test	)	IS:398 (Part-III) - 1976
h)	DC resistance test	)	
i)	Breaking load test	)	
j)	Chemical Analysis of steel	)	

4.8.4 **ROUTINE TESTS**

a) Check that there are no cuts, fins etc. on the strands.

b) Check for correctness of stranding.

4.8.5 **TESTS DURING MANUFACTURE**

a)	Chemical analysis of zinc used for galvanising	)	As per Annexure - B
b)	Chemical analysis of steel	)	

5.0 **ALUMINIUM TUBE**

5.1 **General**

Aluminium used shall be grade 63401 WP (range 2) conforming to IS:5082.

The contractor shall supply the aluminium tubes as per the standard guaranteed technical particulars enclosed in Annexure-E of **this section** and separate approval **for guaranteed technical particulars** is not required during detailed engineering.

5.2 **Constructional Features**

5.2.1 For outer diameter (OD) & thickness of the tube there shall **not** be **any negative** tolerance, other requirements being as per IS: 2678 and IS: 2673.

5.2.2 The welding of aluminium tube shall be done by the qualified welders duly approved by the Employer.

5.3 **Tests**

In accordance with stipulations of the specification, Routine tests shall be conducted on tubular bus conductors as per IS:5082. Also the wall thickness and ovality of the tube shall be measured.

5.4 **Technical Parameters**

Sl. No.	Description	3" AL. TUBE	4" AL. TUBE	4.5" AL. TUBE	5" AL. TUBE
1.	Type	3" IPS	4" IPS	4.5" IPS	5" IPS

		(EH Type)	(EH Type)	(EH Type)	(H Type)
2.	Outer diameter	88.9 mm	114.2 mm	120.00 mm	141.30 mm
3.	Thickness	7.62 mm	8.51 mm	12.00 mm	9.53 mm
4.	Cross-sectional area of aluminium	1945.76 sq.mm	2825.61 sq.mm	4071.50 sq.mm	3945.11 sq.mm
5.	Weight	5.25 kg/m	7.7 kg/m	11.034 kg/m	10.652 kg/m

Sl. No.	**Description**	**6" AL. TUBE**	**8" AL. TUBE**	**10" AL. TUBE**
1.	Type	6" IPS (H Type)	8" IPS (H Type)	10" IPS (H Type)
2.	Outer diameter	150 mm	202 mm	252 mm
3.	Thickness	10 mm	16 mm	17 mm
4.	Cross-sectional area of aluminium	4398.2 Sq mm	9349.3 sq.mm	12550.6 sq.mm
5.	Weight	11.875 kg/m	25.243 kg/m	33.887 kg/m

6.0 EARTHING CONDUCTORS

6.1 General

All conductors burried in earth and concrete shall be of mild steel. All conductors above ground level and earthing leads shall be of galvanised steel, except for cable trench earthing. The minimum sizes of earthing conductor to be used are as indicated in clause 9.4 of this Section.

6.2 Constructional Features

6.2.1 Galvanised Steel

a) Steel conductors above ground level shall be galvanised according to IS:2629.

b) The minimum weight of the zinc coating shall be **610** gm/sq.m **for normal area and 900 gm/sq.m for coastal area as specified in Section-Project** and minimum thickness shall be 85 microns.

c) The galvanised surfaces shall consist of a continuous and uniformly thick coating of zinc, firmly adhering to the surfaces of steel. The finished surface shall be clean and smooth and shall be free from defects like discoloured patches, bare spots, unevenness of coating, spelter which is loosely attached to the steel globules, spiky deposits, blistered surfaces, flaking or peeling off etc. The presence of any of these defects noticed on visual or microscopic inspection shall render the material liable to rejection.

6.3 Tests

In accordance with stipulations of the specifications galvanised steel shall be subjected to four one minute dips in copper sulphate solution as per IS : 2633.

7.0 SPACERS

7.1 General

Spacers shall conform to IS: 10162. The spacers are to be located at a suitable spacing to limit the short circuit forces as per IEC -60865. Wherever Employer's 765kV, 400 kV, 220kV & 132kV standard gantry structures are being used, the spacer span(s) for different conductor / span configurations and corresponding short circuit forces shall be as per Annexure-D. For strung buses, flexible type spacers shall be used whereas for jumpers and other connections rigid type spacers shall be used. All quad/twin conductors between equipments/ bus shall be provided with at least one spacer.

Wherever Employer's 765kV, 400 kV, 220kV & 132kV standard gantry structures are not being used, necessary spacer span calculation shall be provided by the contractor during detailed engineering for the approval of Employer.

7.2 Constructional Features

7.2.1 No magnetic material shall be used in the fabrication of spacers except for GI bolts and nuts.

7.2.2 Spacer design shall be made to take care of fixing and removing during installation and maintenance.

7.2.3 The design of the spacers shall be such that the conductor does not come in contact with any sharp edge.

7.3 Tests

Each type of spacers shall be subjected to the following type tests, acceptance tests and routine tests:

7.3.1 **Type Tests: Following type test reports shall be submitted for approval as per clause 9.2 of Section - GTR.**

a) **Clamp slip tests**

The sample shall be installed on test span of twin conductor bundle string or quadruple conductor bundle string (as applicable) at a tension of 44.2 kN. One of the clamps of the sample when subjected to a longitudinal pull of 2.5 kN parallel to the axis of the conductor shall not slip on the conductor. The permanent displacement between the conductor and the clamp of sample measured after removal of the load shall not exceed 1.0 mm. Similar tests shall be performed on the other clamps of the same sample.

b) Fault current test as per Cl 5.14.2 of IS: 10162. Alternately, the same can be carried by simulated short circuit method for which compressive forces shall be based on IEC-60865.

c) Corona Extinction Voltage Test (Dry).

This test shall be performed on 765 kV, 400 kV and 220 kV spacers as per procedure mentioned at Annexure - C, Minimum Corona Extinction voltage shall be as per clause 2.3.2.

d) RIV Test (Dry)

This test shall be performed as per procedure mentioned at Annexure - C, Maximum RIV levels shall be as per clause 2.3.2.

e) Resilience test (if applicable)

f) Tension Test

g) Log decremant test (if applicable)

h) Compression test

i) Galvanising test

7.3.2 **Acceptance Test (As per IS:10162)**

a) Visual examination

b) Dimensional verification

c) Movement test

d) Clamp slip test

e) Clamp bolt torque test (if applicable)

f) Assembly torque test

g) Compression test

h) Tension test

i) Galvanising test

j) Hardness test for neoprene (if applicable)

The shore hardness of different points on the elastometer surface of cushion grip clamp shall be measured by shore hardness meter. It shall be between 65 to 80.

k) Ultimate Tensile Strength Test

The UTS of the retaining rods shall be measured. It shall not be less than 35 kg/Sq. mm.

7.3.3 **Routine test**

a) Visual examination

b) Dimensional verification

8.0 **BUS POST INSULATORS**

The post insulators shall conform in general to latest IS: 2544, IEC-60168, IEC 60273 and IEC-60815.

SECTION - (SE)
SWITCHYARD ERECTION

8.1 **Constructional Features**

8.1.1 Bus Post 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 will be acceptable.

8.1.2 Porcelain used shall be homogeneous, free from lamination, cavities and other flaws or imperfections that might affect the mechanical or dielectric quality and shall be thoroughly vitrified, tough and impervious to moisture.

8.1.3 Glazing of the porcelain shall be of uniform brown in colour, free from blisters, burrs and other similar defects.

8.1.4 The insulator shall have alternate long and short sheds with aerodynamic profile, The shed profile shall also meet the requirements of IEC-60815 for the specified pollution level.

8.1.5 When operating at normal rated voltage there shall be no electric discharge between conductor and insulators which would cause corrosion or damage to conductors or insulators by the formation of substance produced by chemical action.

8.1.6 The design of the insulators shall be such that stresses due to expansion and contraction in any part of the insulator shall not lead to deterioration.

8.1.7 All ferrous parts shall be hot dip galvanised in accordance with the latest edition of IS: 2633, & IS: 2629. The zinc used for galvanising shall be grade Zn 99.95 as per IS: 209. The zinc coating shall be uniform, adherent, smooth, reasonably bright, continuous and free from imperfections such as flux ash, rust stains, bulky white deposits and blisters. The metal parts shall not produce any noise generating corona under the operating conditions.

8.1.8 a) Every bolt shall be provided with a hop dip galvanised steel washer under the nut so that part of the threaded portion of the bolts is within the thickness of the parts bolted together.

b) Flat washer shall be circular of a diameter 2.5 times that of bolt and of suitable thickness. Where bolt heads/nuts bear upon the beveled surfaces they shall be provided with square tapered washers of suitable thickness to afford a seating square with the axis of the bolt.

c) All bolts and nuts shall be of steel with well formed hexagonal heads forged from the solid and shall be hot dip galvanised. The nuts shall be good fit on the bolts and two clear threads shall show through the nut when it has been finally tightened up.

8.1.9 Bidder shall furnish drawings for the essential design features of assembly of shells and metal parts, and number of shells per insulator.

8.2 **Tests**

In accordance with the stipulations of the specification, the post insulators shall be subjected to type, acceptance, sample and routine tests as per IEC-60168.

8.2.1 In accordance with the stipulation of specification, the following **type tests** reports of the post insulators shall be submitted for approval as per clause 9.2 of Section - GTR.

a) Power frequency withstand test (dry & wet)

b) Lightning impulse test (dry)

c) Switching impulse test (wet) (For 420 kV and above class Insulator only)

d) Measurement of R.I.V (Dry) (As per Annexure – C)

e) Corona extinction voltage test (Dry) (As per Annexure – C)

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f) Test for deflection under load

g) Test for mechanical strength.

8.**2.2** In addition to acceptance/sample/routine tests as per IEC-60168, the following tests shall also be carried out.

a) Soundness test, metallurgical tests and magnetic particle Inspection **(MPI)** test on MCI/SGI caps as acceptance test.

b) All hot dip galvanised components shall be subjected to check for uniformity of thickness and weight of zinc coating on sample basis as an acceptance test.

c) The bending test shall be carried out at 50% minimum cantilever strength load in four directions as a routine test and at 100% minimum cantilever strength load in four directions as an acceptance test.

d) Acceptance norms for visual defects allowed at site and also at works shall be agreed in the Quality plan.

8.3 **Technical Parameters of Bus Post Insulators.**

Sl. No.	**Description**	**800 kV**	**420 kV**	**245 kV**	**145 kV**
a)	Type	Solid Core	Solid Core	Solid Core	Solid Core
b)	Voltage Class (kV)	800	420	245	145
c)	Dry and wet one minute power frequency withstand voltage (kV rms)	830	680	460	275
d)	Dry lightning impulse withstand Voltage (kVp)	±2100	±1425	±1050	±650
e)	Wet switching surge withstand voltage (kVp)	±1550	±1050	—-	—-
f)	Max. radio interference voltage (in microvolts) - **Dry**	1000 at 508 kV	500 at 305 kV	500 at 156 kV	500 at 105 kV
g)	Corona extinction voltage (kV rms) (min.)	508	320	156	105

h)	Cantilever Strength				
(i)	Total minimum cantilever strength (Kg)	800	800	800	600
i)	Minimum torsional moment	As per IEC-60273	As per IEC-60273	As per IEC-60273	As per IEC-60273
j)	Total height of insulator (mm)	5700	3650	2300	1500
k)	P.C.D Top (mm)	225	127	127	127
	Bottom (mm)	325	300	254	254
l)	No. of bolts				
	Top	4	4	4	4
	Bottom	8	8	8	8
m)	Diameter of bolt/holes (mm)				
	Top	M16	M16	M16	M16
	Bottom dia	18	18	18	18
n)	Pollution level as per IEC-60815	Heavy(III)	Heavy(III)	Heavy(III)	Heavy(III)
o)	Minimum total creepage distance for Heavy Pollution (mm)	20000	10500	6125	3165

8.3.1 If corona extinction voltage is to be achieved with the help of corona ring or any other similar device, the same shall be deemed to be included in the scope of the Contractor. Aluminium used for corona ring shall be of grade 63401 or 19501 conforming to IS:5082.

9.0 **EARTHING**

9.1 The earthing shall be done in accordance with requirements given hereunder and drawing titled 'Earthing Details' enclosed with the specification. The spacing for the main earthmat shall be provided by the Employer and the earthmat layout drawings shall be prepared by the contractor based on the spacing provided by the Employer. The resistivity of the stone for spreading over the ground shall be considered as 3000 ohm-m under wet condition. The resistivity measurement of stone (to be used for stone spreading) shall also be done by the Contractor to confirm the minimum resistivity value of stone considered in earth mat design. For measurement purpose, one sample of stones from each source (in case stones are supplied from more than one source) shall be used. The main earthmat shall be laid in the switchyard area in accordance with the approved earthmat layout.

9.2 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.

9.3 Earthing and lightning protection 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.

a) Code of practice for Earthing IS: 3043

b) Code of practice for the protection of Building and allied structures against lightning IS: 2309.

c) CEA Safety Regulations 2010 & Indian Electricity Act 2003 with latest amendments.

d) National Electricity Safety code IEEE-80.

9.4 **Details of Earthing System**

Sl. No.	Item	Size	Material
a)	Main Earthing Conductor to be buried in ground	40mm dia	Mild Steel rod as per IS:2062/ SAE1018
b)	Conductor above ground& earthing leads (for equipment)	75x12mm G.S. flat	Galvanised Steel
c)	Conductor above ground& earthing leads(for columns & aux. structures)	75x12mm G.S. flat	Galvanised Steel
d)	Earthing of indoor LT panels, Control panels and outdoor marshalling boxes, Junction boxes& Lighting Panels etc.	50x6 mm G.S. flat	Galvanised Steel
e)	Rod Earth Electrode	40mm dia, 3000mm long	Mild Steel as per IS:2062/ SAE1018
f)	Pipe Earth Electrode (in treated earth pit) as per IS.	40mm dia, 3000mm long	Galvanised steel
g)	Earthing for motors	25x3mm GS flat	Galvanised steel
h)	Earthing conductor along outdoor cable trenches	50x6mm MS flat	Mild steel as per IS:2062/ SAE1018
I)	Earthing of Lighting Poles (for lighting poles outside switchyard)	40 mm dia 3000 mm long	Mild steel rod as per IS:2062/ SAE1018
j)	Isolator MOM Box	75X12 mm GS flat & Flexible copper braid	Galvanised steel and copper braid

The sizes of the earthing conductor indicated above are the minimum sizes.

9.5 **Earthing Conductor Layout**

9.5.1 Earthing conductors in outdoor areas shall be buried at least 600 mm below finished ground level unless stated otherwise.

9.5.2 Wherever earthing conductor crosses cable trenches, underground service ducts, pipes, tunnels, railway tracks etc., it shall be laid minimum 300 mm below them and shall be circumvented in case it fouls with equipment/structure foundations.

9.5.3 Tap-connections from the earthing grid to the equipment/structure to be earthed shall be terminated on the earthing terminals of the equipment/structure as per "Standard Earthing Details – Drg No. **C/ENG/STD/EARTHINGS/09**" enclosed.

9.5.4 Earthing conductors or leads along their run on cable trench, ladder, walls etc. shall be supported by suitable welding/cleating at intervals of 750 mm. Wherever it passes through walls, floors etc., PVC sleeves shall be provided for the passage of the conductor and both ends of the sleeve shall be sealed to prevent the passage of water through the sleeves.

9.5.5 Earthing conductor around the building shall be buried in earth at a minimum distance of 1500 mm from the outer boundary of the building.

9.5.6 Earthing conductors crossing the road shall be laid 300mm below road or at greater depth to suit the site conditions.

9.5.7 Earthing conductors embeded in the concrete shall have approximately 50mm concrete cover.

9.**6** **ELECTRO-MAGNETIC FIELD CONTROL**

The contractor shall provide galvanised steel earth wire at 8m level in the area where three interconnection levels (equipment interconnection, bus & jack bus interconnection) are present at 765kV switchyard to limit electric and magnetic field within permissible limit.

9.7 **Equipment and Structure Earthing**

9.7.1 Earthing pads shall be provided for the apparatus/equipment at accessible position. The connection between earthing pads and the earthing grid shall be made by two short earthing leads (one direct and another through the support structure) 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 Employer.

9.7.2 Whether specifically shown in drawings or not, steel/RCC columns, metallic stairs etc. shall be connected to the nearby earthing grid conductor by two earthing leads. Electrical continuity shall be ensured by bonding different sections of hand-rails and metallic stairs.

9.7.3 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.

9.7.4 Metallic conduits shall not be used as earth continuity conductor.

9.7.5 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.

9.7.6 Light poles, junction boxes on the poles, 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 a minimum two points whether specifically shown or not.

9.7.7 Railway tracks within switchyard area shall be earthed at a spacing of 30m and also at both ends.

9.7.8 Earthing conductor shall be buried 2000 mm outside the switchyard fence. All the gates and every alternate post of the fence shall be connected to earthing grid.

The stone spreading shall also be done 2000 mm outside switchyard fence. The criterian for stone spreading shall be followed in line with requirement specified elsewhere in the specification

9.7.9 Flexible earthing connectors shall be provided for the moving parts.

9.7.10 All lighting panels, junction boxes, receptacles fixtures, conduits etc. shall be grounded in compliance with the provision of I.E. rules

9.7.11 A continuous ground conductor of 16 SWG GI wire shall be run all along each conduit run. The conductor shall be connected to each panel ground bus. All junction boxes, receptacles, switches, lighting fixtures etc. shall be connected to this 16 SWG ground conductor.

9.7.12 50mm x 6mm MS flat shall run on the top tier and all along the cable trenches and the same shall be welded to each of the racks. Further this flat shall be earthed at both ends and at an interval of 30 mtrs. The M.S. flat shall be finally painted with two coats of Red oxide primer and two coats of Zinc riched enamel paint.

9.7.13 One number 40 mm dia, 3000 mm long MS earth electrode with test link, CI frame and cover shall be provided to connect each down conductor of surge arresters, capacitive voltage transformers, lightning masts and towers with peak.

9.8 **Jointing**

9.8.1 Earthing connections with equipment earthing pads shall be bolted type. Contact surfaces shall be free from scale, 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.

9.8.2 Connection between equipment earthing lead and main earthing conductors and between main earthing conductors shall be welded type. For rust protections, the welds should be treated with red oxide primer and afterwards coated with two layers bitumen compound to prevent corrosion.

9.8.3 Steel to copper connections shall be brazed type and shall be treated to prevent moisture ingression.

9.8.4 Resistance of the joint shall not be more than the resistance of the equivalent length of the conductor.

9.8.5 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.

9.8.6 All arc welding with large dia. conductors shall be done with low hydrogen content electrodes.

9.8.7 The 75x12mm GS flat shall be clamped with the equipment support structures at 1000mm interval.

9.9 **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.

9.10 **Specific Requirement for Earthing Systems**

9.10.1 Each earthing lead from the neutral of the power transformer/Reactor shall be directly connected to two numbers pipe electrodes in treated earth pit (as per IS) which in turn, shall be buried in Cement Concrete pit with a ISI marked cast iron cover hinged to a cast iron frame to have an access to the joints. All accessories associated with transformer/reactor like cooling banks, radiators etc. shall be connected to the earthing grid at minimum two points.

9.10.2 Earthing terminal of each lightning arrester & capacitor voltage transformer shall be directly connected to rod earth electrode which in turn, shall be connected to station earthing grid.

9.10.3 Auxiliary earthing mat comprising of 40mm dia M.S. rods closely spaced (300 mm x 300 mm) conductors shall be provided at depth of 300mm from ground level below the operating handles of the M.O.M. Box of the isolators. M.O.M. boxes shall be directly connected to the auxiliary earthing mat. Flexible copper braid connection to be provided between MOM box and GI flat to take care of soil sagging. The size of auxiliary earthing mat shall be of 1500mmx1500mm size for 220kV and above voltage class isolators and 900mmx900mm size for 132kV and below voltage class isolators. Factory welded auxiliary earthmat is preferable.

9.11 **Insulating mats**

9.11.1 The scope covers supply and laying of insulating mats of “class A” conforming to IS: 15652-2006.

9.11.2 These insulating mats shall be laid in front of all floor mounted AC and DC switchboards and control & relay panels located in control room building/ Switchyard panel room.

9.11.3 The insulating mats shall be made of elastomer material free from any insertions leading to deterioration of insulating properties. It shall be resistant to acid, oil and low temperature.

9.11.4 Upper surface of the insulating mats shall have small aberration (rough surface without edges) to avoid slippery effects while the lower surface shall be plain or could be finished slip resistant without affecting adversely the dielectric property of the mat.

9.11.5 Insulating mat **(wherever applicable)** shall be of pastable type, to be fixed permanently on the front of the panels except for the chequered plate area which shall not be pasted as per requirement. The insulating mats shall generally be fixed and joints shall be welded as per recommendations in Annexure-A of IS: 15652.

9.11.6 Width of insulating mats shall generally be of 1.5 meters or as per site requirements. Length shall be supplied as per site requirements.

9.11.7 The insulating mats offered shall conform to IS: 15652-2006.

10.0 **Bus Bars**

The brief description of the bus switching scheme, bus bar layout and equipment connection to be adopted are indicated elsewhere in the specification. The bus bar arrangements are shown in electrical layout drawings enclosed with the bid documents.

10.1 The Contractor shall furnish supporting calculations where the design is to be done by the contractor for the bus bars/conductors to show adequacy of design parameters for:

a) Fibre-stress (applicable for aluminum tube)

b) Cantilever strength of post insulators (applicable for aluminum tube)

c) Aeolain vibrations (applicable for aluminum tube)

d) Vertical deflection of bus bars (applicable for aluminum tube)

e) Short circuit forces in bundle conductor and spacer location for each span of ACSR conductor stringing as per layout drawings.

10.1.1 The welds in the aluminium tubes shall be kept to the minimum and there shall not be more than one weld per span. The procedure and details of welding shall be subject to Employer's approval. Material for welding sleeve shall be same as that of Aluminium tube. Welding sleeve shall be of 600mm length

10.1.2 Corona bells shall be provided wherever the bus extends beyond the clamps and on free ends, for sealing the ends of the tubular conductor against rain and moisture and to reduce the electrostatic discharge loss at the end points. There shall be a small drain hole in the corona bell. The material of Corona bell shall be Aluminium alloy similar to that of clamps & connectors.

10.1.3 To minimise the vibrations in the aluminium tubes, damping conductor shall be provided inside the aluminium tubes. For this purpose, the cut pieces of ACSR conductor which otherwise are considered wastages, shall be used as damping conductor.

10.1.4 Details of past experience of the persons proposed to be employed for Aluminium tube welding and the test reports of the welded pieces to prove the electrical and mechanical characteristics shall also be furnished **to Employer**. Welding at site shall be done by adopting a qualified procedure and employing qualified welders as per ASME-Section IX.

10.1.5 Joints shall be avoided in strung bus to avoid joint failure / hot spots and hardwares to be designed accordingly.

11.0 **BAY EQUIPMENT**

11.1 The disposition of various bay equipments shall be as per single line diagrams and layout drawings.

11.2 Bay Marshalling Kiosk:-

Bay marshalling kiosk shall be fabricated from 304 grade stainless steel of minimum thickness of 1.6mm. For other constructional details, technical specification of section-GTR shall be referred. Further, for stainless steel type bay marshaling kiosk, no painting is envisaged.

One no. of bay marshalling kiosk shall be provided for each 765 kV, 400 kV, 220 kV and 132 kV bay under present scope. For one and half breaker scheme, one number bay marshalling kiosk shall be provided for each controlling feeder (Line/ transformer/ bus reactor etc) of the diameter and no bay marshalling kiosks are required to be provided for the tie bays. In addition to the requirements specified elsewhere in the specification, the bay marshalling kiosk shall have two distinct compartments for the following purpose:-

A. For 765kV , 400 kV & 220 kV Bays

(i) To receive two incoming 415V, 3 phase, 63Amps, AC supply with auto changeover and MCB unit and distribute minimum nine (9) numbers outgoing 415V, 3 phase, 16 Amps AC supplies controlled by MCB.

(ii) To distribute minimum two numbers outgoing 415V, 63Amps three phase supplies to be controlled by MCB to be drawn from above 3 phase incomers for supply to switchyard panel rooms.

(iii) To distribute minimum ten numbers outgoing 240V, 10 Amps single phase supplies to be controlled by MCB to be drawn from above 3 phase incomers.

(iv) Necessary Terminal Blocks for terminating cables from ACDB and necessary heating circuits.

B. For 132kV & 66 kV Bays

(i) To receive two incoming 415V, 3 phase, 63Amps, AC supply with auto changeover and MCB unit and distribute minimum four (4) number outgoing 415V, 3 phase, 16 Amps AC supplies controlled by MCB.

(ii) To distribute minimum six (6) numbers outgoing 240V, 10 Amps single phase supplies to be controlled by MCB to be drawn from above 3 phase incomers.

(iii) 100 nos. terminal blocks in vertical formation for interlocking facilities for substations without automation system.

(iv) Necessary Terminal Blocks for terminating cables from ACDB and necessary heating circuits.

11.**3** Further, all Bay Marshalling Kiosks shall be erected such that a minimum height of 1000mm is maintained between FGL & bottom of the marshalling box. Size of Marshalling box shall be such that cables are properly terminated and wires are dressed with provision of loop.

11.4 **BAY AND PHASE IDENTIFICATION**

11.4.1 The name plate for the bays shall be provided by the contractor as per standard drawing (Drawing no. C/ENG/STD/BAY NAME PLATE) enclosed in this technical specification.

11.4.2 All the phases are to be identified by painting the structures Red, Yellow and Blue by reflecting colour as per as built condition. Phase identification colour is to be provided around the top of the structure with colour band of 100 mm width at a height of approximately 2000mm from the finished ground level.

12.0 **LIGHTNING PROTECTION**

12.1 Direct stroke lightning protection (DSLP) shall be provided in the EHV switchyard by lightning masts and shield wires**.** The layout drawings enclosed indicate the tentative arrangement. The final arrangement shall be decided after approval of the DSLP calculations.

12.2 The lightning protection system shall not be in direct contact with underground metallic service ducts and cables.

12.3 Conductors of the lightning protection system shall not be connected with the conductors of the safety earthing system above ground level.

12.4 Down conductors shall be cleated on the structures at 2000 mm interval.

12.5 Connection between each down conductor and rod electrodes shall be made via test joint (pad type compression clamp) located approximately 1500 mm above ground level. The rod electrode shall be further joined with the main earthmat.

12.6 Lightning conductors shall not pass through or run inside G.I. conduits.

12.7 Lightning protection shall also be provided for various buildings like control building, FFPH, Township buildings as per relevant standard.

13.0 **EQUIPMENT ERECTION DETAILS**

13.1 All circuit breaker and isolator erection shall be done under the supervision of equipment manufacturer and erection of all switchyard equipments shall be done as per POWERGRID approved Field Quality Plan (FQP) and as per provision of Technical Specification.

13.2 For equipment interconnection, the surfaces of equipment terminal pads, Aluminium tube, conductor & terminal clamps and connectors shall be properly cleaned. After cleaning, contact grease shall be applied on the contact surfaces of equipment terminal pad, Aluminium tube/conductor and terminal clamps to avoid any air gap in between. Subsequently bolts of the terminal pad/terminal connectors shall be tightened and the surfaces shall be cleaned properly after equipment interconnection.

13.3 Muslin or leather cloth shall be used for cleaning the inside and outside of hollow insulators.

13.4 All support insulators, circuit breaker interrupters and other fragile equipment shall preferably be handled with cranes having suitable booms and handling capacity.

13.5 Bending of Aluminium tube and compressed air piping if any should be done by a bending machine and through cold bending only. Bending shall be such that inner diameter of pipe is not reduced.

All welding done at site for equipment and structures, shall be painted with zinc rich paint immediately to avoid corrosion.

13.6 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.

13.7 Handling of equipment shall be done strictly as per manufacturer's/supplier's

instructions/instruction manual.

13.8 Handling equipment, sling ropes etc. should be tested periodically before erection for strength.

13.9 The slings shall be of sufficient length to avoid any damage to insulator due to excessive swing, scratching by sling ropes etc.

14.0 **STORAGE**

14.1 The Contractor shall provide and construct adequate storage shed as per the Filed Quality Plan for proper storage of equipments, where sensitive equipments shall be stored indoors. All equipments during storage shall be protected against damage due to acts of nature or accidents. The storage instructions of the equipment manufacturer/Employer shall be strictly adhered to. POWERGRID approved Field Quality Plan shall be followed alongwith the provision of Technical Specification for storage.

15.0 **CABLING MATERIAL**

15.1 **CABLE TAGS AND MARKERS**

15.1.1 Each cable and conduit run shall be tagged with numbers that appear in the cable and conduit schedule.

15.1.2 The tag shall be of aluminium with the number punched on it and securely attached to the cable conduit by not less than two turns of 20 SWG GI wire conforming to IS:280. Cable tags shall be of rectangular shape for power cables and of circular shape for control cables.

15.1.3 Location of cables laid directly underground shall be clearly indicated with cable route marker made of galvanised iron plate.

15.1.4 Location of underground cable joints shall be indicated with cable **route** marker with an additional inscription “Cable joints”.

15.1.5 The **cable route** marker shall project 150 mm above ground and shall be spaced at an interval of 30 meters and at every change in direction. They shall be located on both sides of road and drain crossings as per relevant standard.

15.1.6 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 each end & turning point in cable tray/trench runs. Cable tags shall be provided inside the switchgear, motor control centres, control and relay panels etc., wherever required for cable identification, where a number of cables enter together through a gland plate.

15.2 **Cable Supports and Cable Tray Mounting Arrangements**

15.2.1 The Contractor shall provide embedded steel inserts on concrete floors/walls to secure supports by welding to these inserts or available building steel structures.

15.2.2 The supports shall be fabricated from standard structural steel members.

15.2.3 Insert plates will be provided at an interval of 750 mm wherever cables are to be supported without the use of cable trays, such as in trenches, while at all other

places these will be at an interval of 2000 mm.

15.2.4 Vertical run of cables on equipment support structure shall be supported on perforated cable trays of suitable width which shall be suitably bolted/clamped with the equipment support structure.

15.3 **Cable Termination and Connections**

15.3.1 The termination and connection of cables shall be done strictly in accordance with cable and termination kit manufacturer's instructions, drawing and/or as directed by the Employer.

15.3.2 The work shall include all clamping, fittings, fixing, plumbing, soldering, drilling, cutting, taping, heat shrinking (where applicable), connecting to cable terminal, shorting and grounding as required to complete the job.

15.3.3 Supply of all consumable material shall be in the scope of Contractor.

15.3.4 The equipment will be generally provided with undrilled gland plates for cables/conduit entry. The Contractor shall be responsible for drilling of gland plates, painting and touching up. Holes shall not be made by gas cutting.

15.3.5 Control cable inside control panel/switchgear/MCCB/MCC/ miscellaneous panels shall be neatly bunched, clamped and tied with nylon strap or PVC perforated strap to keep them in position.

15.3.6 The Contractor shall use printed ferrules for control cable cores at all terminations, as instructed by the Employer. Each cable wire shall be identified with a number and detailed cable schedule may be prepared indicating the wire numbers.

15.3.7 Spare cores shall be similarly encaped & tagged with cable numbers and coiled up with end cap.

15.3.8 All cable entry points shall be sealed and made vermin and dust proof. Unused openings shall be effectively closed.

15.3.9 Double compression type nickel plated (coating thickness not less than 10 microns) brass cable glands shall be provided by the Contractor for all power and control cables to provide dust and weather proof terminations.

15.3.10 The cable glands shall conform to BIS:6121. They shall comprise of heavy duty brass casting, machine finished and nickel plated, to avoid corrosion and oxidation. Rubber components used in cable glands shall be neoprene and of tested quality. Cable glands shall be of approved make.

15.3.11 The cable glands shall also be suitable for dust proof and weather proof termination.

15.3.12 If the cable-end box or terminal enclosure provided on the equipment is found unsuitable and requires modification, the same shall be carried out by the Contractor, as directed by the Employer.

15.3.13 Crimping tool used shall be of approved design and make.

15.3.14 Control Cable lugs shall be tinned copper solderless crimping type conforming to

IS-8309 & 8394. Aluminium Bimetallic lugs for power cables as required shall be used depending upon type of cables and terminations.

15.3.15 Solderless crimping of terminals shall be done by using corrosion inhibitory compound. The cable lugs shall suit the type of terminals provided.

15. 4 **Storage and handling of Cable Drums**

15.4.1 Cable drums shall be unloaded, handled and stored in an approved manner and 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.

16.0 **DIRECTLY BURIED CABLES**

16.1 The Contractor shall construct the cable trenches required for directly buried cables. The scope of work shall include excavation, preparation of sand bedding, soil cover, supply and installation of brick or concrete protective covers, back filling and ramming, supply and installation of route markers and joint markers.

16.2 The cable (power and control) between LT station, DG set location and fire lighting pump house and control room shall be laid in the burried cable trenches. In addition to the above, for lighting purpose also, buried cable trench can be used in outdoor area.

16.3 Power cables from Main Switchboard to colony shall be laid in burried cable trench. Location of cable termination point at colony shall be as per site condition and shall be decided in consultation with Employer's site-in-charge. Power Cables for oil filtration plant shall be laid in open cable trench or burried trench upto transformer/reactor area and can be looped from adjacent receptacles provided for power supply of oil filtration plant.

16.4 Cable route and joint markers and RCC warning covers shall be provided wherever required. The voltage grade of cables shall be engraved on the marker. Cable markers shall be grounded in a concrete base.

17.0 **INSTALLATION OF CABLES**

17.1 Cabling in the control room shall be done on ladder type cable trays for vertical runs while cabling in switchyard area shall be done on angles in the trench.

17.2 All cables from bay cable trench to equipments including and all interpole cables (both power and control) for all equipment, shall be laid in PVC pipes of minimum 50 mm nominal outside diameter of class 4 as per IS 4985 which shall be buried in the ground at a depth of 250mm below finish formation level. Separate PVC pipes shall be laid for control and power cables. Cable pull boxes of adequate size shall be provided if required. **For vertical runs on equipments, perforated cable trays shall be provided for all equipments under scope of the contract or any equipment to be provided by the owner (including for owner supplied circuit breakers)**.

17.3 Cables shall be generally located adjoining the electrical equipment through the pipe insert embedded in the floor. In the case of equipments located away from cable trench either pipe inserts shall be embedded in the floor connecting the cable trench and the equipment or in case the distance is small, notch/opening on the wall shall be provided. In all these cases necessary bending radius as

recommended by the cable manufacturer shall be maintained. Embedded pipes shall be dressed properly at the equipment termination points.

17.4 Cable racks and supports shall be painted after installation with two coats of metal primer (comprising of red oxide and zinc chromate in a synthetic medium) followed by two finishing coats of aluminium paint. The red oxide and zinc chromate shall conform to IS:2074.

17.5 Suitable arrangement should be used between fixed pipe/cable trays and equipment terminal boxes, where vibration is anticipated.

17.6 Power and control cables in the cable trench shall be laid in separate tiers. The order of laying of various cables shall be as follows, for cables other than directly buried.

a) Power cables preferably on top tiers.
b) Control instrumentation and other service cables in bottom tiers.
c) For cabling from control room to switchyard in main cable trench, cable shall be laid such that bottom tiers are preferably filled first and top tiers are kept for filling future cables as per the instructions of Engineer-In-Charge.

17.7 For Single core cables in trefoil formation shall be laid with a distance of three times the diameter of cable between trefoil centre lines. Further, for horizontal cables a minimum centre to centre distance equal to twice the diameter of the cable of higher size of cables shall be maintained.

17.8 Trefoil clamps for single core cables shall be of pressure die cast aluminium (LM-6), Nylon-6 or fibre glass and shall include necessary fixing GI nuts, bolts, washer etc. These are required at every 2 metre of cable runs.

17.9 Power and control cables shall be securely fixed to the trays/supports with self locking type nylon ties with de-interlocking facility at every 5 metre interval for horizontal run. Vertical and inclined cable runs shall be secured with 25 mm wide and 2 mm thick aluminium strip clamps at every 2m.

17.10 Cables shall not be bent below the minimum permissible limit. The permissible limits are as follows:

Table of Cable and	Minimum bending radius
Power cable	12 D
Control cable	10 D

D is overall diameter of cable

17.11 Where cables cross roads, drains and rail tracks, these shall be laid in reinforced spun concrete or steel pipes buried at not less than one metre depth. The size of hume/steel pipe shall be such that approximately 70% area is only occupied. For meeting future requirement, additional hume/steel pipe shall be laid for future bay provision.

17.12 In each cable run some extra length shall be kept at a suitable point to enable one (for LT cables)/ two (for H.T. cables) straight through joints to be made in case the cable develop fault at a later date.

17.13 Selection of cable drums for each run shall be so planned as to avoid using straight through joints. Cable splices will not be permitted except where called for

by the drawings, unavoidable or where permitted by the Employer. If straight through joints are unavoidable, the Contractor shall use the straight through joints kit of reputed make.

17.14 Control cable terminations inside equipment enclosures shall have sufficient lengths so that changing of termination in terminal blocks can be done without requiring any splicing.

17.15 Metal screen and armour of the cable shall be bonded to the earthing system of the station, wherever required by the Employer.

17.16 Rollers shall be used at intervals of about two metres while pulling cables to avoid damage.

17.17 All due care shall be taken during unreeling, laying and termination of cable to avoid damage due to twist, kinks, sharp bends, etc.

17.18 Cable ends shall be kept sealed to prevent damage. In cable vault, fire resistant seal shall be provided underneath the panels.

17.19 Inspection on receipt, unloading and handling of cables shall generally be in accordance with IS:1255 and other Indian Standard Codes of practices.

17.20 Wherever cable pass through floor or through wall openings or other partitions, GI/PVC wall sleeves with bushes having a smooth curved internal surface so as not to damage the cable, shall be supplied, installed and properly sealed by the Contractor at no extra charges.

17.21 In case the outer sheath of a cable is damaged during handling/installation, the Contractor shall repair it at his own cost to the satisfaction of the Employer. In case any other part of a cable is damaged, the same shall be replaced by a healthy cable at no extra cost to the Employer, i.e. the Contractor shall not be paid for installation and removal of the damaged cable.

17.22 All cable terminations shall be appropriately tightened to ensure secure and reliable connections. The Contractor shall cover the exposed part of all cable lugs whether supplied by him or not with insulating tape, sleeve or paint.

17.23 **Cable trays**

i) The cable trays shall be of G.S Sheet and minimum thickness of sheet shall be 2mm.

ii) The Contractor shall perform all tests and inspection to ensure that material and workmanship are according to the relevant standards. Contractor shall have to demonstrate all tests as per specification and equipment shall comply with all requirements of the specification.

a) Test for galvanising (Acceptance Test)
The test shall be done as per approved standards.

17.24 **Conduits, Pipes and Duct Installation**

17.24.1 Contractor shall supply and install all rigid conduits, mild steel pipes, flexible conduits, hume pipes etc. including all necessary sundry materials such as tees, elbows, check nuts, bushing, reducers, enlargers, coupling cap, nipples, gland

sealing fittings, pull boxes etc as required. The size of the conduit/pipe shall be selected on the basis of 40% fill criterion.

17.24.2 Contractor shall have his own facility for bending, cutting and threading the conduits at site. Cold bending should be used. All cuts & threaded ends shall be made smooth without leaving any sharp edges. Anticorrosive paint shall be applied at all field threaded portions.

17.24.3 All conduit/pipes shall be extended on both sides of wall/floor openings. The fabrication and installation of supports and the clamping shall be included in the scope of work by Contractor.

17.24.4 Installation of optical cables/ special cables:

GI pipe (light grade) of suitable size (minimum 25 mm) along with required bends, joints etc. shall be used for special cables such as cables for visual monitoring system (VMS), substation automation system (SAS). Further, single pipe can be used for laying multiple cables.

17.24.5 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 in an approved manner to prevent damage to threaded portions and entrance of moisture and foreign material.

17.24.6 All unarmoured cables shall run within the conduits from lighting panels to lighting fixtures, receptacles etc.

17.24.7 Size of conduit for lighting shall be selected by the Contractor during detailed engineering.

17.24.8 Exposed conduits shall be run in straight lines parallel to building columns, beams and walls. Unnecessary bends and crossings shall be avoided to present a neat appearance.

17.24.9 Conduit supports shall be provided at an interval of 750mm for horizontal runs and 1000mm for vertical runs.

17.24.10 Conduit supports shall be clamped on the approved type spacer plates or brackets by saddles or U- bolts. The spacer plates or brackets in turn, shall be securely fixed to the building steel by welding and to concrete or brick work by grouting or by nylon rawl plugs. Wooden plug inserted in the masonary or concrete for conduit support is not acceptable.

17.24.11 Embedded conduits shall be securely fixed in position to preclude any movement. In fixing embedded conduit, if welding or brazing is used, extreme care should be taken to avoid any injury to the inner surface of the conduit.

17.24.12 Spacing of embedded conduits shall be such as to permit flow of concrete between them.

17.24.13 Where conduits are placed alongwith cable trays, they shall be clamped to supporting steel at an interval of 600mm.

17.24.14 For directly embedding in soil, the conduits shall be coated with an asphalt-base compound. Concrete pier or anchor shall be provided wherever necessary to support the conduit rigidly and to hold it in place.

17.24.15 Conduit shall be installed in such a way as to ensure against trouble from trapped condensation.

17.24.16 Conduits shall be kept, wherever possible, at least 300mm away from hot pipes, heating devices etc. when it is evident that such proximity may reduce the service life of cables.

17.24.17 Slip joints shall be provided when conduits cross structural expansion joints or where long run of exposed conduits are installed, so that temperature change will cause no distortion due to expansion or contraction of conduit run.

17.24.18 For long conduit run, pull boxes shall be provided at suitable intervals to facilitate wiring.

17.24.19 Conduit shall be securely fastened to junction boxes or cabinets, each with a lock nut inside and outside the box.

17.24.20 Conduits joints and connections shall be made thoroughly water-tight and rust proof by application of a thread compound which insulates the joints. White lead is suitable for application on embedded conduit and red lead for exposed conduit.

17.24.21 Field bends shall have a minimum radius of four (4) times the conduit diameter. All bends shall be free of kinks, indentations of flattened surfaces. Heat shall not be applied in making any conduit bend. Separate bends may be used for this purpose.

17.24.22 The entire metallic conduit system, whether embedded or exposed, shall be electrically continuous and thoroughly grounded. Where slip joints are used, suitable bounding shall be provided around the joint to ensure a continuous ground circuit.

17.24.23 After installation, the conduits shall be thoroughly cleaned by compressed air before pulling in the wire.

17.24.24 Lighting fixtures shall not be suspended directly from the junction box in the main conduit run.

17.25 **Cable Sealing System**

Modular multi-diameter cable sealing system consisting of frames, blocks and accessories shall be installed where the underground and over ground cables enter or leave concrete bay kiosks/switchyard panel room & control rooms in the substations. Cable sealing system shall consist of multi-diameter type peel-able or adjustable blocks of different sizes to suit the various cables. It should be simple, easy and quick to assemble & re-assemble the cable sealing system. Solid blocks shall not be used on frame. Frames & stay-plate material shall be of galvanized steel and for compression, single piece wedge with galvanized steel bolts shall be used. 30% spare blocks on the frame shall be provided for expansion in future. Cable sealing system should have been tested for fire/water/smoke tightness.

Cable sealing system having earthing strip can alternately be used in place of cable gland arrangement for indoor panels such as LCC, C&R, PLCC panels etc.

18.0 LIGHTING JUNCTION BOX

The Contractor shall supply and install ISI marked junction boxes complete with terminals as required. The brackets, bolts, nuts, screws etc required for erection are also included in the scope of the Contractor.

19.0 TESTING AND COMMISSIONING

19.1 **All pre/commissioning activities and works work for substation equipment shall be carried out in accordance with Employer's "Pre- Commissioning procedures for Switchyard Equipments (Doc. No. D-2-01-03-01-03)" by the contractor. This document shall be provided to the successful contractor during detailed engineering stage. Test results in the prescribed formats shall be duly filled by the contractor and shall be submitted to the Owner in soft form (CD or Pen Drive)**

The Contractor shall arrange all equipments instruments and auxiliaries required for testing and commissioning of equipments alongwith calibration certificates.

19.2 GENERAL CHECKS

(a) Check for physical damage.

(b) Visual examination of zinc coating/plating.

(c) Check from name plate that all items are as per order/specification.

(d) Check tightness of all bolts, clamps and connecting terminals using torque wrenches.

(e) For oil filled equipment, check for oil leakage, if any. Also check oil level and top up wherever necessary.

(f) Check ground connections for quality of weld and application of zinc rich paint over weld joint of galvanised surfaces.

(g) Check cleanliness of insulator and bushings.

(h) All checks and tests specified by the manufacturers in their drawings and manuals as well as all tests specified in the relevant code of erection.

(i) Check for surface finish of grading rings (Corona control ring).

19.3 STATION EARTHING

a) Check soil resistivity

b) Check continuity of grid wires

c) Check earth resistance of the entire grid as well as various sections of the same.

d) Check for weld joint and application of zinc rich paint on galvanised surfaces.

e) Dip test on earth conductor prior to use.

19.4 **AAC/ACSR STRINGING WORK, TUBULAR BUS WORK AND POWER CONNECTORS**

a) Physical check for finish

b) Electrical clearance check

c) Testing of torque by torque wrenches on all bus bar power connectors and other accessories.

d) Millivolt drop test on all power connectors.

e) Sag and tension check on conductors.

19.5 **ALUMINIUM TUBE WELDING**

a) Physical check

b) Millivolt drop test on all joints.

c) Dye penetration test & Radiography test on 10% sample basis on weld joints.

c) Test check on 5% sample joints after cutting the weld piece to observe any voids etc.

19.**6** **INSULATOR**

Visual examination for finish, damage, creepage distance etc.

ANNEXURE "A"

(Testing Procedure for ACSR/AAC Conductor)

1.0 **UTS Test on Stranded Conductor**

Circles perpendicular to the axis of the conductor shall be marked at two places on a sample of conductor of minimum 5m length suitably compressed with dead end clamps at either end. The load shall be increased at a steady rate upto 50% of minimum specified UTS and held for one minute. The circles drawn shall not be distorted due to Relative movement of strands. Thereafter the load shall be increased at a steady rate to 100% of minimum specified UTS and held for one minute. The conductor sample shall not fail during this period. The applied load shall then be increased until the failing load is reached and the value recorded.

2.0 **Corona Extinction Voltage Test**

Two samples of conductor of 5m length shall be strung with a spacing of 450 mm between them at a height not exceeding 8.0 m above ground. This assembly shall be tested as per Annexure-C, Corona extinction voltage shall not be less than 510 kV (rms) & 320 KV (RMS) Line to ground for 765 kV & 400 kV respectively.

3.0 **Radio Interference Voltage Test**

Under the conditions as specified under (2.0) above, the conductor samples shall have radio interference voltage as indicated in the guaranteed technical particulars enclosed with. This test may be carried out with corona control rings and arcing horns. The test procedure shall be in accordance with IEC-60437.

4.0 **D.C Resistance Test on Stranded Conductor**

On a conductor sample of minimum 5 m length two contact clamps shall be fixed with a pre-determined bolt torque. The resistance shall be measured by a Kelvin double bridge by placing the clamps initially zero metre and subsequently one metre apart. The test shall be repeated at least five times and the average value recorded. The value obtained shall be corrected to the value at 20°C as per clause no. 12.8 of IS:398 (Part V)-1982. The resistance corrected at 20°C shall conform to the requirements of this specification.

5.0 **Chemical Analysis of Zinc**

Samples taken from the zinc ingots shall be chemically/spectrographically analysed. The same shall be in conformity to the requirements stated in this specification.

6.0 **Chemical Analysis of Aluminium and Steel**

Samples taken from the Aluminium ingots/coils/strands shall be chemically/ spectrographically analysed. The same shall be in conformity to the requirements stated in this specification.

7.0 **Visual Check for Joints, Scratches etc.**

Conductor drums shall be rewound in the presence of the inspector. The

inspector shall visually check for scratches, joints, etc. and that the conductor generally conform to the requirements of this specification. The length of conductor wound on the drum shall be measured with the help of counter meter during rewinding.

8.0 **Dimensional Check for Steel and Aluminium Strands.**

The individual strands shall be dimensionally checked to ensure that they conform to the requirements of this specification.

9.0 **Check for Lay-ratios of various Layers.**

The lay-ratios of various layers shall be checked to ensure that they conform to the requirements of this Specification.

10.0 **Galvanising Test**

The test procedure shall be as specified in IEC:60888. The material shall conform to the requirements of this Specification. The adherence of zinc shall be checked by wrapping around a mandrel four times the diameter of steel wire.

11.0 **Torsion and Elongation Tests on Steel Strands**

The test procedures shall be as per clause No. 10.3 of IEC:60888. In torsion test, the number of complete twists before fracture shall not be less than that indicated in the GTP. In case test sample length is less or more than 100 times the stranded diameter of the strand, the minimum number of twists will be proportioned to the length and if number comes in the fraction then it will be rounded off to next higher whole number. In elongation test, the elongation of the strand shall not be less than 4% for a gauge length of 250 mm.

12.0 **Procedure Qualification test on welded Aluminium strands**

Two Aluminium wires shall be welded as per the approved quality plan and shall be subjected to tensile load. The breaking strength of the welded joint of the wire shall not be less than the breaking strength of individual strands.

ANNEXURE "B"

(Testing procedure for Galvanised Steel Earthwire)

1. **UTS TEST**

Circles perpendicular to the axis of the earthwire shall be marked at two places on a sample of earthwire of minimum 5m length suitably compressed with dead end clamps at either end. The load shall be increased at steady rate upto 50% of UTS and held for one minute. The circles drawn shall not be distorted due to relative movement of strands. Thereafter, the load shall be increased at a steady rate to 100% of UTS and held for one minute. The earthwire sample shall not fail during this period. The applied load shall then be increased until the failing load is reached and value recorded.

2. **D.C. RESISTANCE TEST**

On an earthwire sample of minimum 5m length, two contact clamps shall be fixed with a predetermined Bolt torque. The resistance shall be measured by a Kelvin double-bridge by placing the clamps initially zero meter and subsequently one meter apart. The test shall be repeated at least five times and the average value recorded. The value obtained shall be corrected to the value at 20°C shall conform to the requirements of this specification.

3. **Visual check for joints, scratches etc. and length of earthwire**

Earthwire drums shall be rewound in the presence of the inspector. The inspector shall visually check for joints, scratches etc. and see that the earthwire generally conforms to the requirements of this specification. The length of earthwire wound on the drum shall be measured with the help of counter meter during rewinding.

4. **TORSION TEST**

The minimum number of twists which a single steel strand shall withstand during torsion test shall be eighteen for a length equal to 100 times the standard diameter of the strand. In case the test sample length is less or more than 100 times the standard diameter of the strand, the minimum number of twists will be proportionate to the length and if number comes in the fraction then it will be rounded off to next higher whole number.

5. **DIMENSIONAL CHECK**

The individual strands shall be dimensionally checked to ensure that they conform to the requirements of this specification.

6. **LAY LENGTH CHECK**

The lay length shall be checked to ensure that they conform to the requirements of this specification.

7. **GALVANISING TEST**

The test procedure shall as specified in IS:4826-1968. The material shall conform to the requirements of this specification. The adherence of zinc shall be

checked by wrapping around a mandrel four times the diameter of steel wire.

8. **CHEMICAL ANALYSIS OF ZINC USED FOR GALVANIZING**

Samples taken from zinc ingots shall be chemically/spectrographically analysed. The same shall be in conformity to the requirements stated in this specification.

9. **CHEMICAL ANALYSIS OF STEEL**

Samples taken from steel ingots/coils/strands shall be chemically/ spectrographically analysed. The same shall be in conformity to the requirements stated in this specification.

ANNEXURE-C

CORONA AND RADIO INTERFERENCE VOLTAGE (RIV) TEST

1. General

Unless otherwise stipulated, all equipment together with its associated connectors, where applicable, shall be tested for external corona both by observing the voltage level for the extinction of visible corona under falling power frequency voltage and by measurement of radio interference voltage (RIV).

2. Test Levels:

The test voltage levels for measurement of external RIV and for corona extinction voltage are listed under the relevant clauses of the specification.

3. Test Methods for RIV:

3.1 RIV tests shall be made according to measuring circuit as per International Special-Committee on Radio Interference (CISPR) Publication 16-1(1993) Part -1. The measuring circuit shall preferably be tuned to frequency with 10% of 0.5 Mhz but other frequencies in the range of 0.5 MHz to 2 MHz may be used, the measuring frequency being recorded. The results shall be in microvolts.

3.2 Alternatively, RIV tests shall be in accordance with NEMA standard Publication No. 107-1964, except otherwise noted herein.

3.3 In measurement of, RIV, temporary additional external corona shielding may be provided. In measurements of RIV only standard fittings of identical type supplied with the equipment and a simulation of the connections as used in the actual installation will be permitted in the vicinity within 3.5 meters of terminals.

3.4 Ambient noise shall be measured before and after each series of tests to ensure that there is no variation in ambient noise level. If variation is present, the lowest ambient noise level will form basis for the measurements. RIV levels shall be measured at increasing and decreasing voltages of 85%, 100% and 110% of the specified RIV test voltage for all equipment unless otherwise specified. The specified RIV test voltage for 765kV, 400kV, 220kV is listed in the detailed specification together with maximum permissible RIV level in microvolts.

3.5 The metering instruments shall be as per CISPR recommendation or equivalent device so long as it has been used by other testing authorities.

3.6 The RIV measurement may be made with a noise meter. A calibration procedure of the frequency to which noise meter shall be tuned shall establish the ratio of voltage at the high voltage terminal to voltage read by noisel meter.

4. Test Methods for Visible Corona [applicable for 400kV and above]

The purpose of this test is to determine the corona extinction voltage of apparatus, connectors etc. The test shall be carried out in the same manner as RIV test described above with the exception that RIV measurements are not required during test and a search technique shall be used near the onset and extinction voltage, when the test voltage is raised and lowered to determine their precise values. The test voltage shall be raised to 110% of RIV test voltage and maintained there for five minutes. In case corona inception does not take place at 110%, test shall be stopped, otherwise test shall be continued and the voltage will then be decreased slowly until all visible corona disappears. The procedure shall be repeated at least 4

times with corona inception and extinction voltage recorded each time. The corona extinction voltage for purposes of determining compliance with the specification shall be the lowest of the four values at which visible corona (negative or positive polarity) disappears. Photographs with laboratory in complete darkness shall be taken under test conditions, at all voltage steps i.e. 85%, 100%, and 110%. Additional photographs shall be taken at corona inception and extinction voltages. At least two views shall be photographed in each case using Panchromatic film with an ASA daylight rating of 400 with an exposure of two minutes at a lens aperture of f/5.6 or equivalent. The photographic process shall be such that prints are available for inspection and comparison with conditions as determined from direct observation. Photographs shall be taken from above and below the level of connector so as to show corona on bushing, insulators and all parts of energised connectors. The photographs shall be framed such that test object essentially, fills the frame with no cut-off.

In case corona inception does not take place at 110%, voltage shall not be increased further and corona extinction voltage shall be considered adequate.

4.1 The test shall be recorded on each photograph. Additional photograph shall be taken from each camera position with lights on to show the relative position of test object to facilitate precise corona location from the photographic evidence.

4.2 In addition to photographs of the test object preferably four photographs shall be taken of the complete test assembly showing relative positions of all the test equipment and test objects. These four photographs shall be taken from four points equally spaced around the test arrangement to show its features from all sides. Drawings of the laboratory and test set up locations shall be provided to indicate camera positions and angles. The precise location of camera shall be approved by Purchaser's inspector, after determining the best camera locations by trial energisation of test object at a voltage which results in corona.

4.3 The test to determine the visible corona extinction voltage need not be carried out simultaneously with test to determine RIV levels.

4.4 However, both test shall be carried out with the same test set up and as little time duration between tests as possible. No modification on treatment of the sample between tests will be allowed. Simultaneous RIV and visible corona extinction voltage testing may be permitted at the discretion of Purchaser's inspector if, in his opinion, it will not prejudice other test.

5. Test Records:

In addition to the information previously mentioned and the requirements specified as per CISPR or NEMA 107-1964 the following data shall be included in test report:

a) Background noise before and after test.

b) Detailed procedure of application of test voltage.

c) Measurements of RIV levels expressed in micro volts at each level.

d) Results and observations with regard to location and type of interference sources detected at each step.

e) Test voltage shall be recorded when measured RIV passes through 100 microvolts in each direction.

f) Onset and extinction of visual corona for each of the four tests required shall be recorded.

ANNEXURE – D

A. SHORT CIRCUIT FORCES AND SPACER SPAN FOR 765kV GANTRY STRUCTURE

Sl. No.	Max. Span	Conductor Configuration	Ph-Ph Spacing	Normal Tension	SCF per Phase	Spacer span
I.	**For Fault Level of 40kA/50 kA for 1 sec.**					
1.	54.0 mtr	QUAD AAC BULL	15 mtr	3.96 T	5.98 T	3.5 mtr
2.	56.0 mtr	QUAD AAC BULL	15 mtr	4.52 T	6.77 T	4.0 mtr
3.	87.9 mtr	QUAD AAC BULL	15 mtr	8.35 T	11.22 T	6.5 mtr
4.	104.0 mtr	QUAD AAC BULL	15 mtr	9.00 T	12.72 T	7.5 mtr
5.	108.61 mtr	QUAD AAC BULL	15 mtr	9.00 T	12.72 T	8.0 mtr

B. SHORT CIRCUIT FORCES AND SPACER SPAN FOR 400kV GANTRY STRUCTURE

Sl. No.	Max. Span	Conductor Configuration	Ph-Ph Spacing	Normal Tension	SCF per Phase	Spacer span
I.	**For Fault Level of 40 kA for 1 sec.**					
1.	54 mtr	QUAD ACSR	7 mtr	4 T	5.64 T	6 mtr
2.	70 mtr	TWIN ACSR	7 mtr	4 T	5.64 T	5 mtr
3.	54 mtr	QUAD ACSR	6 mtr	4 T	5.10 T	5 mtr
4.	70 mtr	TWIN ACSR	6 mtr	4 T	5.10 T	5 mtr
5.	48 mtr	QUAD ACSR	6 mtr	4 T	4.82T	5 mtr
6.	52.5 mtr	QUAD ACSR	6 mtr	4 T	4.85T	5 mtr
7.	56.5 mtr	QUAD ACSR	6 mtr	4 T	4.88T	5 mtr
8.	52.5 mtr	TWIN ACSR	6 mtr	4 T	4.97T	5 mtr
9.	56.5 mtr	TWIN ACSR	6 mtr	4 T	5.00 T	5 mtr
II.	**For Fault Level of 50 kA for 1 sec.**					
1.	48 mtr	QUAD AAC BULL	6 mtr	4 T	5.10 T	4 mtr
2.	52.5 mtr	QUAD ACSR	6 mtr	4 T	5.18 T	4 mtr
3.	56.5 mtr	QUAD ACSR	6 mtr	4 T	5.20 T	4 mtr
III.	**For Fault Level of 63 kA for 1 sec.**					
1.	48 mtr	QUAD AAC BULL	6 mtr	4 T	6.00 T	4 mtr
2.	52.5 mtr	QUAD ACSR	6 mtr	4 T	6.33 T	4 mtr
3.	56.5 mtr	QUAD ACSR	6 mtr	4 T	6.37 T	4 mtr

ANNEXURE – D

C. SHORT CIRCUIT FORCES AND SPACER SPAN FOR 220 kV GANTRY STRUCTURE

Sl. No.	Max. Span	Conductor Configuration	Ph-Ph Spacing	Normal Tension	SCF per Phase	Spacer span
I.	**For Fault Level of 40 kA for 1 sec.**					
1.	54 mtr	QUAD ACSR	4.5 mtr	4 T	5.00 T	2.5 mtr
2.	54 mtr	TWIN ACSR	4.5 mtr	2 T	3.50 T	2.5 mtr
3.	74 mtr	TWIN ACSR	4.5 mtr	4 T	5.00 T	2.5 mtr
4.	54 mtr	QUAD ACSR	4.0 mtr	4 T	5.70 T	2.5 mtr
5.	54 mtr	TWIN ACSR	4.0 mtr	2 T	3.50 T	2.5 mtr
6.	74 mtr	TWIN ACSR	4.0 mtr	4 T	5.70 T	2.5 mtr
7.	48 mtr	QUAD ACSR	4.0 mtr	4 T	5.30 T	2.5 mtr
8.	52 mtr	QUAD ACSR	4.0 mtr	4 T	5.35 T	2.5 mtr
9.	68 mtr	TWIN ACSR	4.0 mtr	4 T	5.20 T	2.5 mtr
10.	56 mtr	QUAD ACSR	4.0 mtr	4 T	5.50 T	2.5 mtr
11.	72 mtr	TWIN ACSR	4.0 mtr	4 T	5.27 T	2.5 mtr
II.	**For Fault Level of 50 kA for 1 sec.**					
1.	48 mtr	QUAD ACSR	4.0 mtr	4 T	5.41 T	2.0 mtr
2.	52 mtr	QUAD ACSR	4.0 mtr	4 T	5.50 T	2.0 mtr
3.	36 mtr	TWIN ACSR	4.0 mtr	2 T	3.50 T	2.0 mtr

NOTE: ACSR conductor as mentioned above indicates that it is suitable for both ACSR MOOSE as well as ACSR BERSIMIS conductor.

D. SHORT CIRCUIT FORCES AND SPACER SPAN FOR 132 kV GANTRY STRUCTURE

Sl. No.	Max. Span	Conductor Configuration	Ph-Ph Spacing	Normal Tension	SCF per Phase	Spacer span
I.	**For Fault Level of 31.5kA for 1 sec.**					
1.	36 mtr	Twin Moose/ Zebra ACSR	3 mtr	1 T	2.15 T	2.5 mtr
2.	31.5 mtr	Twin Moose/ Zebra ACSR	2.7mtr	1 T	2.15 T	2.5 mtr
3.	48 mtr	Single Moose/ Zebra ACSR	3 mtr	1 T	2.05 T	NA
4.	42 mtr	Single Moose/ Zebra ACSR	2.7 mtr	1 T	2.03 T	NA

ANNEXURE-E

STANDARD TECHNICAL DATA SHEETS FOR AAC/ACSR CONDUCTORS, GS EARTHWIRE AND ALUMINIUM TUBE

1.0 GENERAL

Employer has stardardised the guaranteed technical particulars for the following AAC/ACSR conductors, Galvanised steel earthwire and aluminum tube. The contractor shall supply the conductors as per the standard GTP mentioned below. Any deviation to the following GTP shall be clearly brought out by the bidder in their bid.

1.1 Guaranteed Technical Particulars (GTP) for conductors:

A. **GTP of AAC BULL and AAC TARANTULA conductor:**

Sl.	Description	Unit	AAC BULL	AAC TARANTULA
1.0	**Applicable Standard**		IS:398	
2.0	**Raw Materials**			
2.1	Steel Wire / Rods			
2.1.1	Aluminium			
a)	Minimum purity of Aluminium	%	99.50	99.50
b)	Maximum copper content	%	0.04	0.04
3.0	**Aluminum strands after stranding**			
3.1	Diameter			
a)	Nominal	mm	4.25	5.23
b)	Maximum	mm	4.29	5.28
c)	Minimum	mm	4.21	5.18
3.2	Minimum breaking load of strand			
a)	Before stranding	KN	2.23	3.44
b)	After stranding	KN	2.12	3.27
c)	Maximum D.C. resistance of strand at 20 deg. Centigrade	Ohm /KM	3.651	3.627
3.3	Maximum resistance of 1 m length of strand at 20 deg. C	Ohm	0.00203	0.001341
4.0	**AAC Conductor**			
4.1. a)	Stranding		Al – 61/4.25 mm	Al – 37/ 5.23 mm
b)	Number of Strands			
i.	1st Aluminium Layer	Nos.	1	1
ii.	2nd Aluminium Layer	Nos.	6	6

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Sl.	Description	Unit	AAC BULL	AAC TARANTULA
iii.	3rd Aluminium Layer	Nos.	12	12
iv.	4th Aluminium Layer	Nos.	18	18
v.	5th Aluminium Layer	Nos.	24	-
4.2	Sectional Area of aluminium	Sq. mm	865.36	794.80
4.3	Total sectional area	Sq. mm	865.36	794.80
4.4	Approximate Weight	Kg/m	2.4	2.191
4.5	Diameter of the conductor	mm	38.25	36.60
4.6	UTS of the conductor	kN	139 (Min.)	120 (Min.)
4.7	Lay ratio of the conductor	mm	Max Min	Max Min
a)	6 wire Aluminium layer	mm	16 10	16 10
b)	12 wire Aluminium layer	mm	16 10	16 10
c)	18 wire Aluminium layer	mm	16 10	14 10
d)	24 wire Aluminium layer	mm	14 10	- -
4.8	DC resistance of the conductor at 20°C	ohm/ km	0.03340	0.03628
4.9	Standard length of the conductor	m	1000	1000
4.10	Tolerance on Standard length	%	(+/-) 5	(+/-) 5
4.11	Direction of lay of outer layer		Right Hand	Right Hand
4.12	Linear mass of the conductor			
a)	Standard	kg/ km	2400	2192
b)	Minimum	kg/ km	2355	2150
c)	Maximum	kg/ km	2445	2234
4.13	Modulus of Elasticity	Kg/sq .mm	4709 (Initial) 5869 (Final)	4709 (Initial) 5869 (Final)
4.14	Co-efficient of Linear Expansion	Per Deg. C	$23.0x10^{-6}$	$23.0x10^{-6}$
4.15	Minimum Corona Extinction Voltage	KV (rms)	508	320
4.16	RIV at 1 Mhz	Micro volts	Less than 1000 at 508 kV (rms)	Less than 1000 at 320 kV (rms)
5.0	**Drum Dimensions**		Generally conforms to IS:1778	

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Sl.	Description	Unit	AAC BULL	AAC TARANTULA
a)	Flange Diameter	mm	1855	1855
b)	Traverse width	mm	925	925
c)	Barrel Diameter	mm	850	850
d)	Flange thickness	mm	50x50	50x50

B. GTP of ACSR BERSIMIS and ACSR MOOSE conductor:

Sl.	Description	Unit	ACSR BERSIMIS	ACSR MOOSE
1.0	**Applicable Standard**		IS:398 / IEC - 61089	
2.0	**Raw Materials**			
2.1	Aluminium			
a)	Minimum purity of Aluminium	%	99.50	99.50
b)	Maximum copper content	%	0.04	0.04
2.2	Steel wires/ rods			
a)	Carbon	%	0.50 to 0.85	0.50 to 0.85
b)	Manganese	%	0.50 to 1.10	0.50 to 1.10
c)	Phosphorous	%	Not more than 0.035	Not more than 0.035
d)	Sulphur	%	Not more than 0.045	Not more than 0.045
e)	Silicon	%	0.10 to 0.35 (Max.)	0.10 to 0.35 (Max.)
2.3	Zinc			
a)	Minimum purity of Zinc	%	99.95	99.95
3.0	**Aluminum strands after stranding**			
3.1	Diameter			
a)	Nominal	mm	4.57	3.53
b)	Maximum	mm	4.61	3.55
c)	Minimum	mm	4.53	3.51
3.2	Minimum breaking load of strand			
a)	Before stranding	KN	2.64	1.57
b)	After stranding	KN	2.51	1.49
c)	Maximum D.C. resistance of strand at 20 deg. Centigrade	Ohm/ KM	1.738	2.921
3.3	Maximum resistance of 1 m length of strand at 20 deg. C	Ohm	0.001738	0.002921

ANNEXURE-E

Sl.	Description	Unit	ACSR BERSIMIS	ACSR MOOSE
4.0	**Steel strand after stranding**			
4.1	Diameter			
a)	Nominal	mm	2.54	3.53
b)	Maximum	mm	2.57	3.60
c)	Minimum	mm	2.51	3.46
4.2	Minimum breaking load of strand			
a)	Before stranding	KN	6.87	12.86
b)	After stranding	KN	6.53	12.22
4.3	Galvanising			
a)	Minimum weight of zinc coating per sq.m.	gm	260	260
b)	Minimum number of dips that the galvanised strand can withstand in the standard preece test	Nos.	2 dips of one minute & 1 dip of half minute	2 dips of one minute & 1 dip of half minute
c)	Min. No. of twists in guage length equal 100 times the dia. of wire which the strand can withstand in the torsion test (after stranding)	Nos	16 (After stranding) 18 (Before stranding)	16 (After stranding) 18 (Before stranding)
5.0	**ACSR Conductor**			
5.1.a)	Stranding		Al -42/4.57 mm+ Steel-7/2.54 mm	Al -54/3.53 mm+ Steel-7/3.53 mm
b)	Number of Strands			
i.	Steel centre	Nos.	1	1
ii.	1st Steel Layer	Nos.	6	6
iii.	1st Aluminium Layer	Nos.	8	12
iv.	2nd Aluminium Layer	Nos.	14	18
v.	3rd Aluminium Layer	Nos.	20	24
5.2	Sectional Area of aluminium	Sq. mm	689.50	528.50
5.3	Total sectional area	Sq. mm	725.00	597.00
5.4	Approximate Weight	Kg/m	2.181	2.004
5.5	Diameter of the conductor	mm	35.05	31.77
5.6	UTS of the conductor	kN	154 (Min.)	161.20 (Min.)
5.7	Lay ratio of the conductor	mm	Max Min	Max Min

ANNEXURE-E

Sl.	Description	Unit	ACSR BERSIMIS	ACSR MOOSE
a)	Outer Steel layer	mm	24 16	18 16
b)	8/12 wire Aluminium layer	mm	17 10	14 12
c)	14/ 18 wire Aluminium layer	mm	16 10	13 11
d)	20/24 wire Aluminium layer	mm	13 10	12 10
5.8	DC resistance of the conductor at 20°C	ohm/ km	0.04242	0.05552
5.9	Standard length of the conductor	m	1800	1800
5.10	Tolerance on Standard length	%	(+/-) 5	(+/-) 5
5.11	Direction of lay of outer layer	-	Right Hand	Right Hand
5.12	Linear mass of the conductor			
a)	Standard	kg/ km	2181	2004
b)	Minimum	kg/ km	2142	1965
c)	Maximum	kg/ km	2221	2045
5.13	Modulus of Elasticity (Final State)	Kg/sq .mm		6860
5.14	Co-efficient of Linear Expansion	Per Deg. C	$21.5x10^{-6}$	$19.3x10^{-6}$
5.15	Minimum Corona Extinction Voltage	KV (rms)	320	320
5.16	RIV at 1 Mhz under dry condition	Micro volts	Max. 1000 at 320 kV (rms)	Max. 1000 at 320 kV (rms)
6.0	**Drum Dimensions**		Generally conforms to IS:1778	
a)	Flange Diameter	mm	1800	1800
b)	Traverse width	mm	950	950
c)	Barrel Diameter	mm	650	650
d)	Flange thickness	mm	50x50	50x50

C. B. GTP of ACSR ZEBRA and ACSR PANTHER conductor:

Sl.	Description	Unit	ACSR ZEBRA	ACSR PANTHER
1.0	**Applicable Standard**		IS:398 / IEC-61089	
2.0	**Raw Materials**			
2.1	Aluminium			
a)	Minimum purity of Aluminium	%	99.50	99.50

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Sl.	Description	Unit	ACSR ZEBRA	ACSR PANTHER
b)	Maximum copper content	%	0.04	0.04
2.2	Steel wires/ rods			
a)	Carbon	%	0.50 to 0.85	0.50 to 0.85
b)	Manganese	%	0.50 to 1.10	0.50 to 1.10
c)	Phosphorous	%	Not more than 0.035	Not more than 0.035
d)	Sulphur	%	Not more than 0.045	Not more than 0.045
e)	Silicon	%	0.10 to 0.35 (Max.)	0.10 to 0.35 (Max.)
2.3	Zinc			
a)	Minimum purity of Zinc	%	99.95	99.95
3.0	**Aluminum strands after stranding**			
3.1	Diameter			
a)	Nominal	mm	3.18	3.00
b)	Maximum	mm	3.21	3.03
c)	Minimum	mm	3.15	2.97
3.2	Minimum breaking load of strand			
a)	Before stranding	KN	1.29	1.17
b)	After stranding	KN	1.23	1.11
3.3	Maximum resistance of 1 m length of strand at 20 deg. C	Ohm	0.003626	0.004107
4.0	**Steel strand after stranding**			
4.1	Diameter			
a)	Nominal	mm	3.18	3.00
b)	Maximum	mm	3.24	3.06
c)	Minimum	mm	3.12	2.94
4.2	Minimum breaking load of strand			
a)	Before stranding	KN	10.43	9.29
b)	After stranding	KN	9.91	8.85
4.3	Galvanising			
a)	Minimum weight of zinc coating per sq.m.	gm	260	260
b)	Minimum number of dips that the galvanised strand can withstand in the standard preece test	Nos.	2 dips of one minute & 1 dip of half minute	2 dips of one minute & 1 dip of half minute

ANNEXURE-E

Sl.	Description	Unit	ACSR ZEBRA	ACSR PANTHER
c)	Min. No. of twists in guage length equal 100 times the dia. of wire which the strand can withstand in the torsion test (after stranding)	Nos	16 (After stranding) 18 (Before stranding)	16 (After stranding) 18 (Before stranding)
5.0	**ACSR Conductor**			
5.1.a)	Stranding		Al -54/3.18 mm+ Steel-7/3.18 mm	Al -30/3.00 mm+ Steel-7/3.00 mm
b)	Number of Strands			
i.	Steel centre	Nos.	1	1
ii.	1st Steel Layer	Nos.	6	6
iii.	1st Aluminium Layer	Nos.	12	12
iv.	2nd Aluminium Layer	Nos.	18	18
v.	3rd Aluminium Layer	Nos.	24	NA
5.2	Sectional Area of aluminium	Sq. mm	428.9	212.10
5.3	Total sectional area	Sq. mm	484.5	261.50
5.4	Approximate Weight	Kg/m	1.621	0.974
5.5	Diameter of the conductor	Mm	28.62	21.00
5.6	UTS of the conductor	kN	130.32 (Min.)	89.67 (Min.)
5.7	Lay ratio of the conductor	mm	Max Min	Max Min
a)	Outer Steel layer	mm	28 13	28 16
b)	12 wire Aluminium layer	mm	17 10	16 10
c)	18 wire Aluminium layer	mm	16 10	14 10
d)	24 wire Aluminium layer	mm	14 10	NA NA
5.8	DC resistance of the conductor at 20°C	ohm/ km	0.06868	0.140
5.9	Standard length of the conductor	m	1800	1800
5.10	Tolerance on Standard length	%	(+/-) 5	(+/-) 5
5.11	Direction of lay of outer layer		Right Hand	Right Hand
5.12	Linear mass of the conductor			
a)	Standard	kg/ km	1621	974
b)	Minimum	kg/	1589	954

ANNEXURE-E

Sl.	Description	Unit	ACSR ZEBRA	ACSR PANTHER
		km		
c)	Maximum	kg/ km	1653	993
5.13	Modulus of Elasticity	Kg/sq .mm		8158
5.14	Co-efficient of Linear Expansion	Per Deg. C	$19.3x10^{-6}$	$17.8x10^{-6}$
5.15	Minimum Corona Extinction Voltage	KV (rms)	154	92
5.16	RIV at 1 Mhz	Micro volts	Less than 1000 at 154 kV (rms)	Less than 500 at 92 kV (rms)
6.0	**Drum Dimensions**		Generally conforms to IS:1778	
a)	Flange Diameter	mm	1850	1850
b)	Traverse width	mm	925	925
c)	Barrel Diameter	mm	650	650
d)	Flange thickness	mm	50x50	50x50

1.2 Guaranteed technical particulars of Galvanised Steel Earthwire

	Description	Unit	Standard Values
1.0	**Raw Materials**		
1.1	**Steel wires / rods**		
a)	Carbon	%	Not more than 0.55
b)	Manganese	%	0.40 to 0.90
c)	Phosphorous	%	Not more than 0.04
d)	Sulphur	%	Not more than 0.04
e)	Silicon	%	0.15 to 0.35
1.2	**Zinc**		
a)	Minimum purity of Zinc	%	99.95
2.0	**Steel strands**		
2.1	**Diameter**		
a)	Nominal	mm	3.66
b)	Maximum	mm	3.74
c)	Minimum	mm	3.58
2.2.	**Minimum breaking load of strand**		
a)	After stranding	KN	10.58
2.3	**Galvanising**		
a)	Minimum weight of zinc coating per sq.m. after stranding	gms.	275
b)	Minimum number of dips that the galvanized strand can withstand	Nos.	3 dips of 1 minute and

	in the standard preece test		one dip of ½ minute
c)	Minimum number of twists in a gauge length equal to 100 times diameter of wire which the strand can withstand in the torsion test, after stranding	Nos.	18
3.0	**Stranded Earth wire**		
3.1	**UTS of Earth wire**	KN	68.4 (min.)
3.2	**Lay length of outer steel layer**		
a)	Standard	mm	181
b)	Maximum	mm	198
c)	Minimum	mm	165
3.3	**Maximum DC resistance of earth wire at 20^0 C**	Ohm/km	3.375
3.4	**Standard length of earth wire**	M	2000 or actual quantity whichever is less.
3.5	**Tolerance on standard length**	%	±5
3.6	**Direction of lay for outside layer**		Right hand
3.7	**Linear mass**		
a)	Standard	Kg/km	583
b)	Maximum	Kg/km	552
c)	Minimum	Kg/km	600
3.8	**Overall diameter**	mm	10.98

1.3 Guaranteed Technical Parameters of Aluminum Tube

A. GTP for 3" IPS & 4" IPS AL. TUBE

Sl. No.	Description	3" AL. TUBE	4" AL. TUBE
1.	Size	3" IPS (EH Type)	4" IPS (EH Type)
2.	Material	Aluminium Alloy 6101 T6 confirms to 63401 WP (range 2) of IS 5082 : 1998	
3.	Chemical Composition		
i)	Cu	0.05 Max	
ii)	Mg	0.4 to 0.9	
iii)	Si	0.3 to 0.7	
iv)	Fe	0.5 Max	
v)	Mn	0.03 Max	
Vi)	Al	Remainder	
4.	Outer diameter	88.90 mm	114.2 mm
5.	Tolerance on outer diameter	+2.2 mm, - 0.0 mm	+2.2 mm, - 0.0 mm
6.	Thickness	7.62 mm	8.51 mm
7.	Tolerance on thickness	+2.2 mm, - 0.0 mm	+2.2 mm, - 0.0 mm
8.	Cross-sectional area	1945.76 sq.mm	2825.61 sq.mm
9.	Weight	5.25 kg/m	7.7 kg/m
10.	Moment of Inertia	1621589.99 mm^4	3972577.97 mm^4
11.	Section Modulus	36481.21 mm^3	69572.29 mm^3

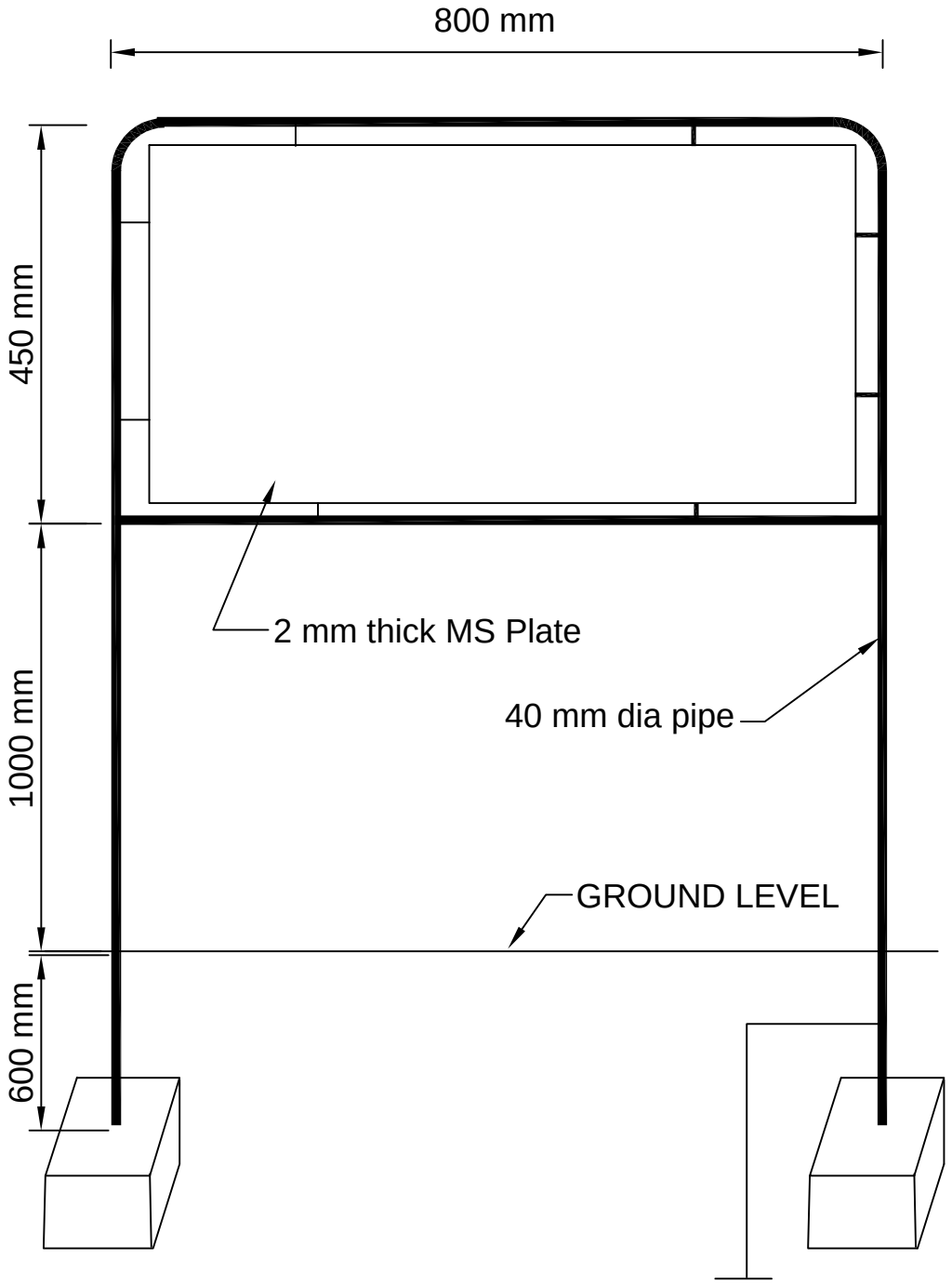
12.	Minimum Ultimate Tensile Strength	20.5 Kg/sq.mm	
13.	Temperature co-efficient of resistance	0.00364 per Deg.C	
14.	Minimum Electrical Conductivity at 20 deg.C	55% of IACS	
15.	Linear Temperature Co-efficient of Expansion (20 Deg.C -200 Deg.C)	0.000023	
16.	Modulus of Elasticity	6700 Kg/sq.mm	
17.	Minimum Elongation on 50 mm	10%	
18.	Thermal Conductivity at 100 Deg.C	0.43 Calories/sec/sq.mm/cm/deg.C	
19.	Minimum 0.2% proof stress	17.34 Kg/sq.mm	
20	Minimum Yield point	17.50 Kg/sq.mm	17.50 Kg/sq.mm
21	Minimum Breaking Strength	20.42 Kg/sq.mm	20.42 Kg/sq.mm

B. GTP for 4.5" IPS & 5" IPS AL. TUBE

Sl. No.	Description	4.5" AL. TUBE	5" AL. TUBE
1.	Size	4.5" IPS (EH Type)	5" IPS
2.	Material	Aluminium Alloy 6101 T6 confirms to 63401 WP (range 2) of IS 5082 : 1998	
3.	Chemical Composition		
i)	Cu	0.05 Max	
ii)	Mg	0.4 to 0.9	
iii)	Si	0.3 to 0.7	
iv)	Fe	0.5 Max	
v)	Mn	0.03 Max	
Vi)	Al	Remainder	
4.	Outer diameter	120.0 mm	141.3 mm
5.	Tolerance on outer diameter	+1.5 mm, - 0.0 mm	+2.8 mm, - 0.0 mm
6.	Thickness	12.0 mm	9.53 mm
7.	Tolerance on thickness	+1.0 mm, - 0.0 mm	+0.8 mm, - 0.0 mm
8.	Cross-sectional area	4071.50 sq.mm	3945.11 sq.mm
9.	Weight	10.993 kg/m	10.652 kg/m
10.	Moment of Inertia	6011958.58 mm^4	8610787.65 mm^4
11.	Section Modulus	100199.31 mm^3	121879.51 mm^3
12.	Minimum Ultimate Tensile Strength	20.5 Kg/sq.mm	
13.	Temperature co-efficient of resistance	0.00364 per Deg.C	
14.	Minimum Electrical Conductivity at 20 deg.C	55% of IACS	
15.	Linear Temperature Co-efficient of Expansion (20 Deg.C -200 Deg.C)	0.000023	
16.	Modulus of Elasticity	6700 Kg/sq.mm	
17.	Minimum Elongation on 50	10%	

ANNEXURE-E

	mm		
18.	Thermal Conductivity at 100 Deg.C	0.43 Calories/sec/sq.mm/cm/deg.C	
19.	Minimum 0.2% proof stress	17.34 Kg/sq.mm	
20	Minimum Yield point	14.50 Kg/sq.mm	17.50 Kg/sq.mm
21	Minimum Breaking Strength	17.50 Kg/sq.mm	20.42 Kg/sq.mm



NOTE : DIMENSIONS ARE INDICATIVE ONLY.
IT MAY VARY AS PER SITE REQUIREMENT.

POWER GRID CORPORATION OF INDIA LIMITED (A Government of India Enterprise) पावरग्रिड				
PROJECT :- STANDARD				
TITLE:- STANDARD BAY NAME PLATE				
KKParkar	KKParkar	18 / 02 / 2008	Drawing No.: C / ENG / STD / BAY NAME PLATE	Rev. 00
CKD BY	PRPD BY	Date		

GENERAL INSTRUCTION FOR EARTHING:

1. Location of earthing conductors / risers shown in the earthing drawing may change to suit the site condition.
2. Two different risers of one structure/equipment shall be connected to different conductors of main earthmat.
3. Earthing conductor around the building shall be burried at a minimum distance of 1500 mm from the outer boundary of the building.
4. Minimum distance of 6000 mm shall be maintained between two treated (pipe) electrode.
5. For surge arrester, earthing lead from surge counter to to main earthmat shall be shortest in length as pratically as possible. Earthing lead from surge arrester shall not be passed through any pipe.
6. No welding is allowed in the over ground earthing leads/risers if the length is less than 6m .

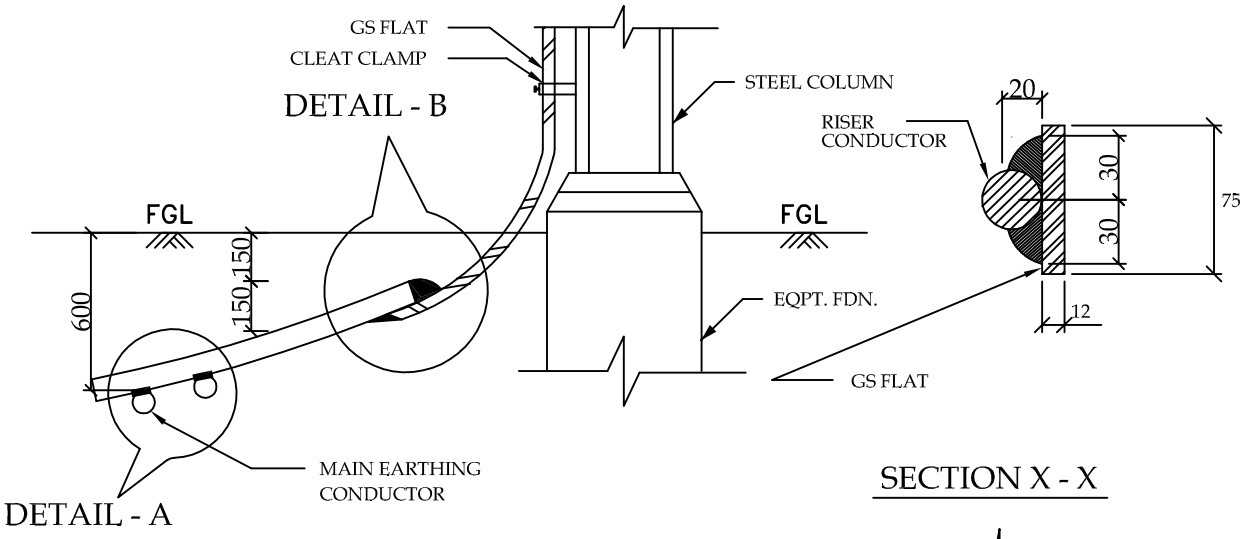
RELEASED FOR CONTRUCTION

POWER GRID CORPORATION OF INDIA LIMITED
(A Government of India Enterprise)
पावरग्रिड

PROJECT :- TECHNICAL SPECIFICATION-SWITCHYARD ERECTION

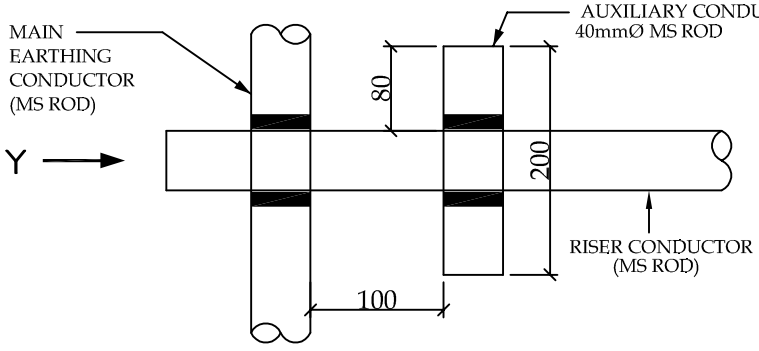
TITLE:- STANDARD EARTHING DETAILS

KKParkar	KKParkar	Dec-2013	Drawing No.: C/ENG/STD/EARTHINGS/09
CKD BY	PRPD BY	Date	SHEET # 1

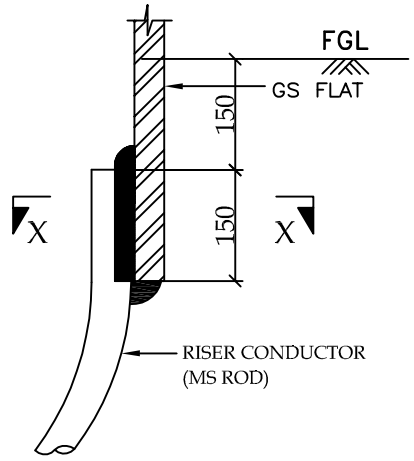


SECTION X - X

TYPICAL DETAILS OF RISER

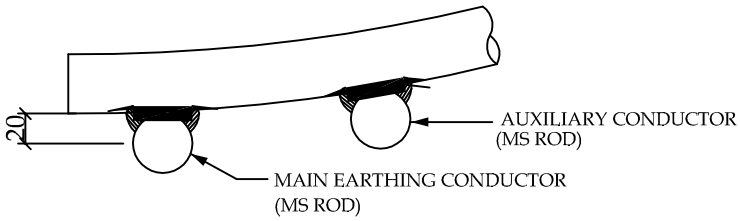


PLAN



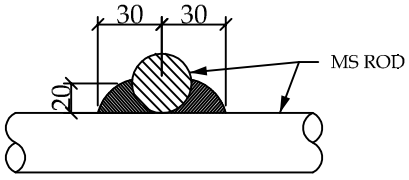
ELEVATION

DETAIL - B



ELEVATION

DETAIL - A



VIEW - Y

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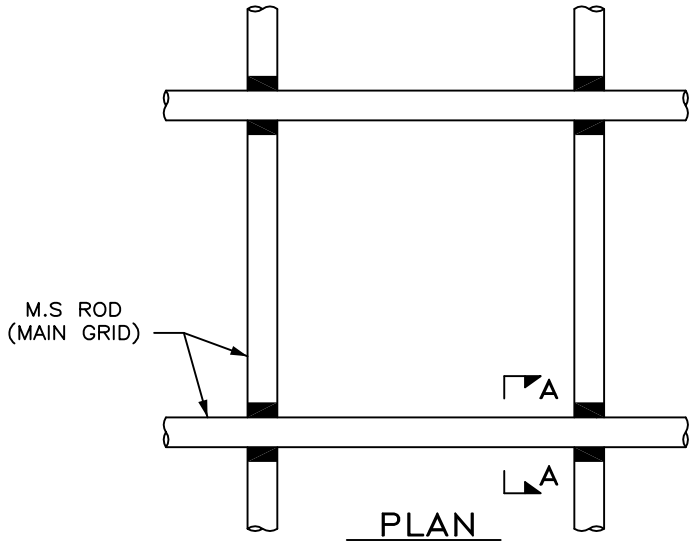
POWER GRID CORPORATION OF INDIA LIMITED
(A Government of India Enterprise)
पावरग्रिड

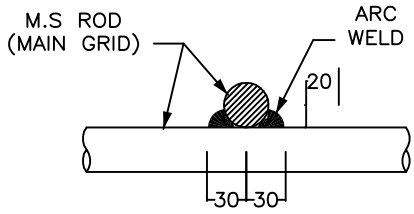
PROJECT :- TECHNICAL SPECIFICATION-SWITCHYARD ERECTION

TITLE:- STANDARD EARTHING DETAILS

KKParkar	KKParkar	Dec-2013	Drawing No.: C/ENG/STD/EARTHINGS/09
CKD BY	PRPD BY	Date	SHEET # 2

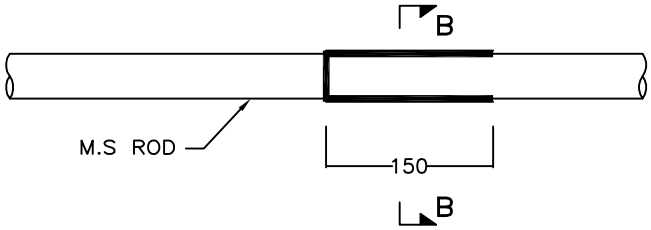


PLAN



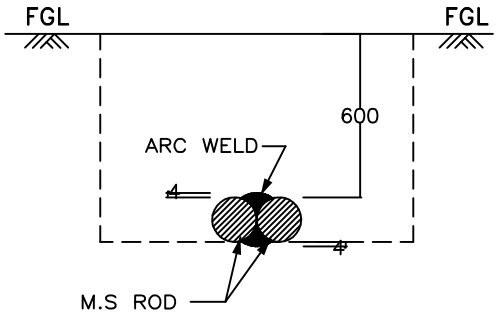
SECTION A – A

DETAIL OF CROSS JOINT

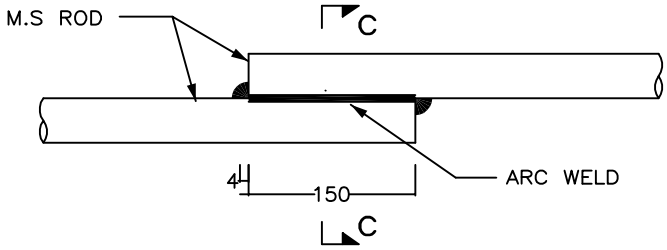


ELEVATION

(CONDUCTORS KEPT ON SIDES)

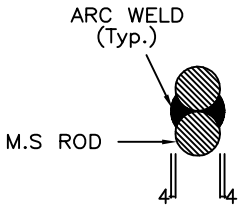


SECTION B – B



ELEVATION

(CONDUCTORS ONE ABOVE THE OTHER)



SECTION C – C

DETAIL OF LAP JOINT

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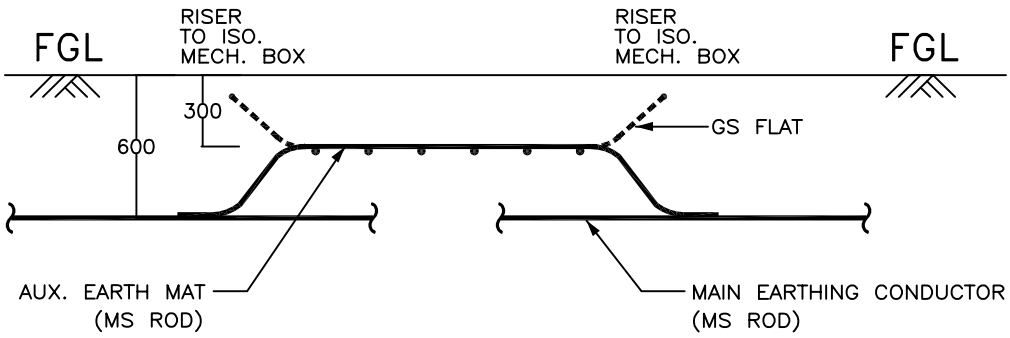
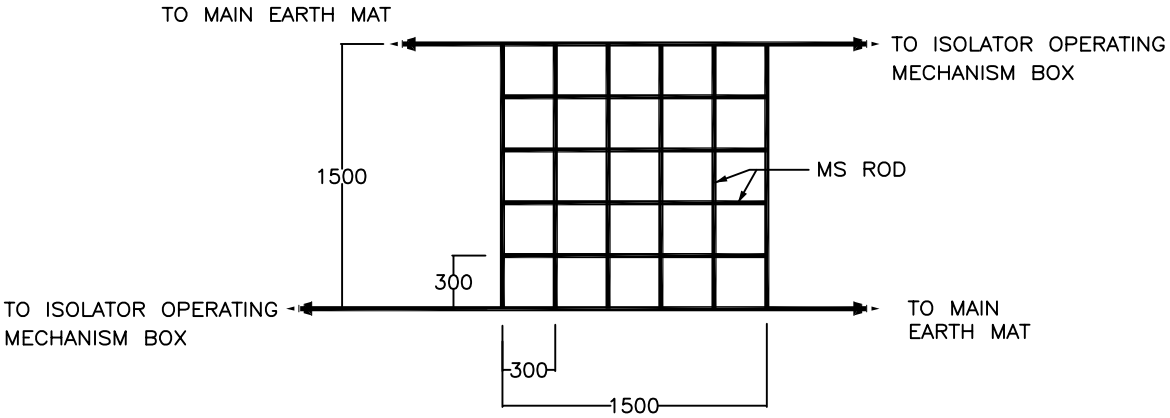
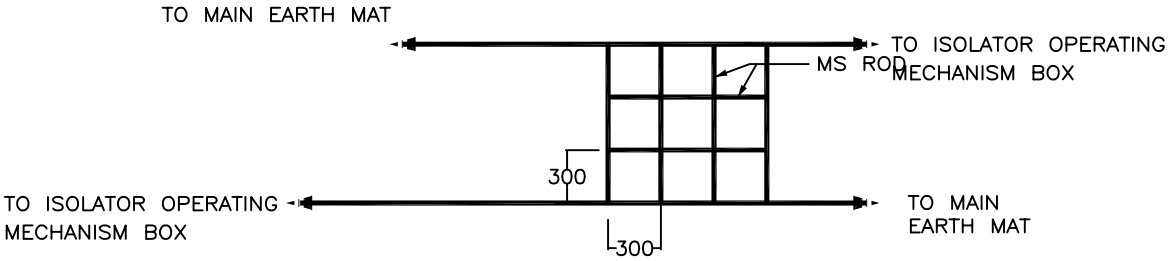
POWER GRID CORPORATION OF INDIA LIMITED (A Government of India Enterprise) पावरग्रिड			
PROJECT :- TECHNICAL SPECIFICATION- SWITCHYARD ERECTION			
TITLE:- STANDARD EARTHING DETAILS			
KKParkar	KKParkar	Dec-2013	Drawing No.: C/ENG/STD/EARTHINGS/09 SHEET # 3
CKD BY	PRPD BY	Date	



ELEVATION



PLAN (For 220kV & above class isolators)



PLAN (For 132kV & below class isolators)

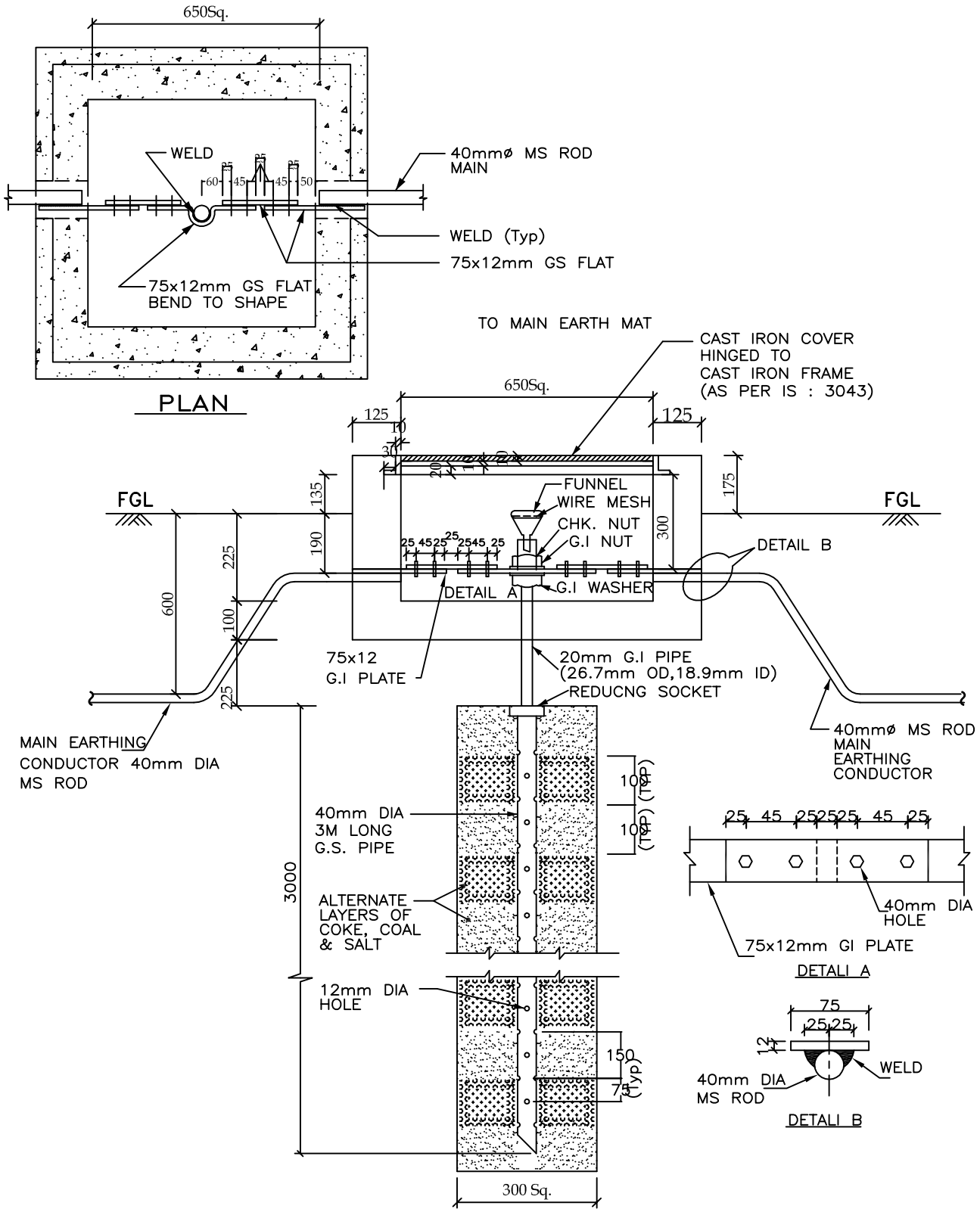
RELEASED FOR CONTRUCTION

POWER GRID CORPORATION
OF INDIA LIMITED
(A Government of India Enterprise)
पावरग्रिड

PROJECT :- TECHNICAL SPECIFICATION-
SWITCHYARD ERECTION

TITLE:- STANDARD EARTHING DETAILS

KKParkar	KKParkar	Dec-2013	Drawing No.: C/ENG/STD/EARTHINGS/09
CKD BY	PRPD BY	Date	SHEET # 4



RELEASED FOR CONTRUCTION

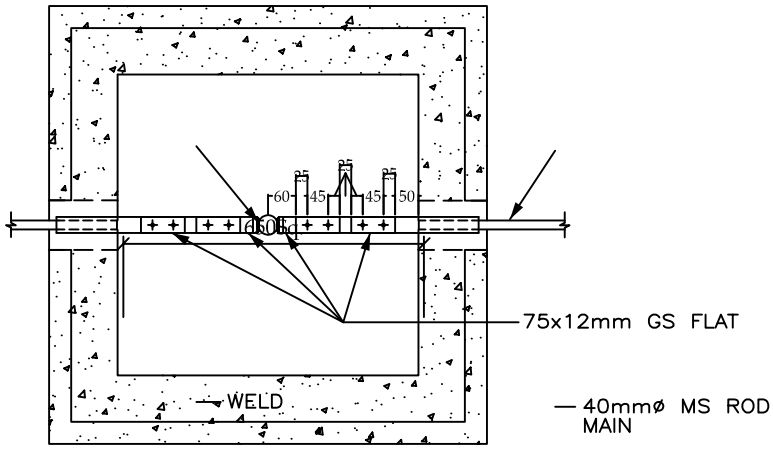
POWER GRID CORPORATION OF INDIA LIMITED
(A Government of India Enterprise)
पावरग्रिड

PROJECT :- TECHNICAL SPECIFICATION-SWITCHYARD ERECTION

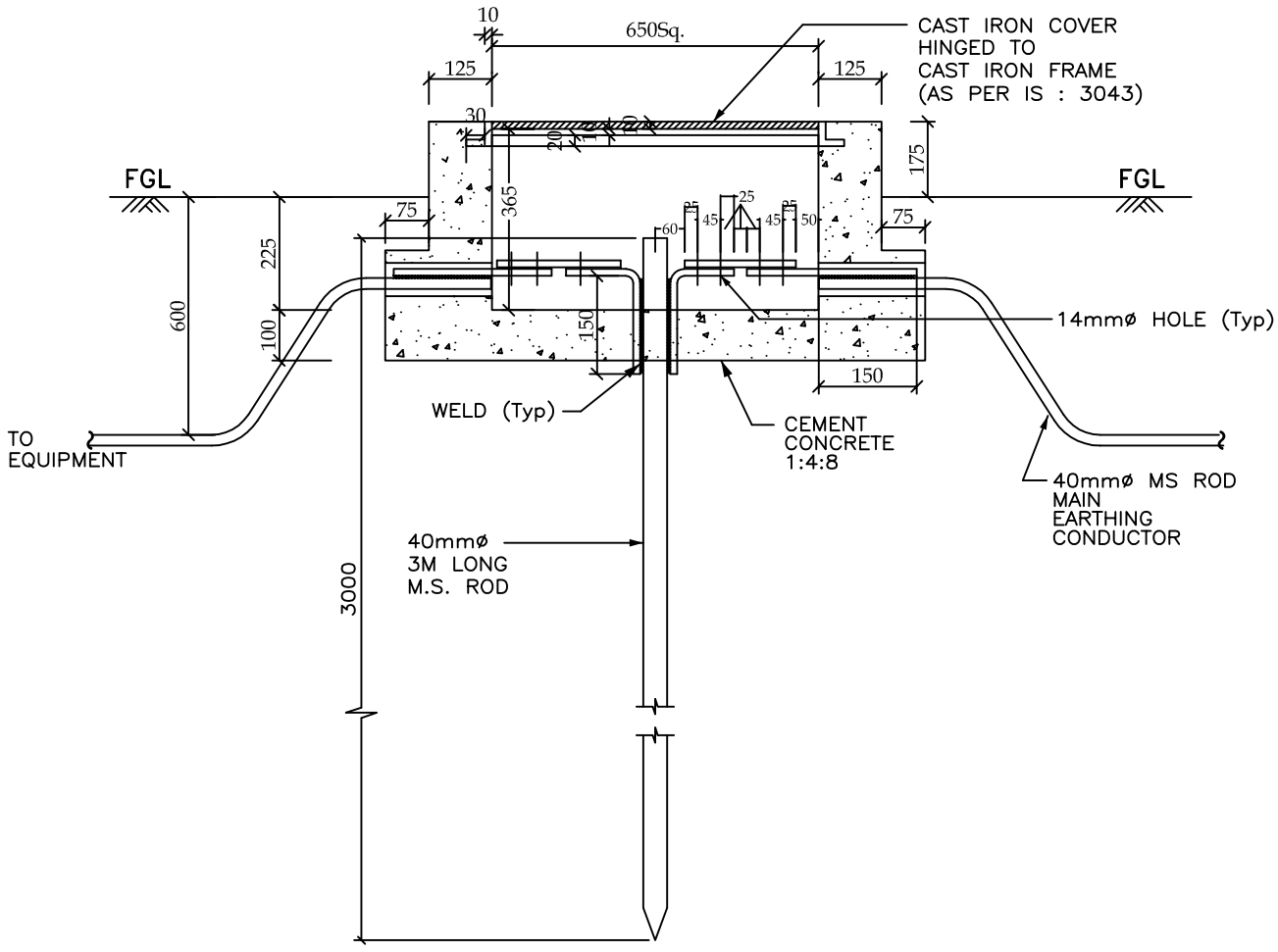
TITLE:- STANDARD EARTHING DETAILS

KKParkar	KKParkar	Dec-2013	Drawing No.: C/ENG/STD/EARTHINGS/09
CKD BY	PRPD BY	Date	SHEET # 5

ROD ELECTRODE WITH TEST LINK FOR LM, TOWER WITH PEAK, CVT, LA



PLAN



ELEVATION

RELEASED FOR CONTRUCTION

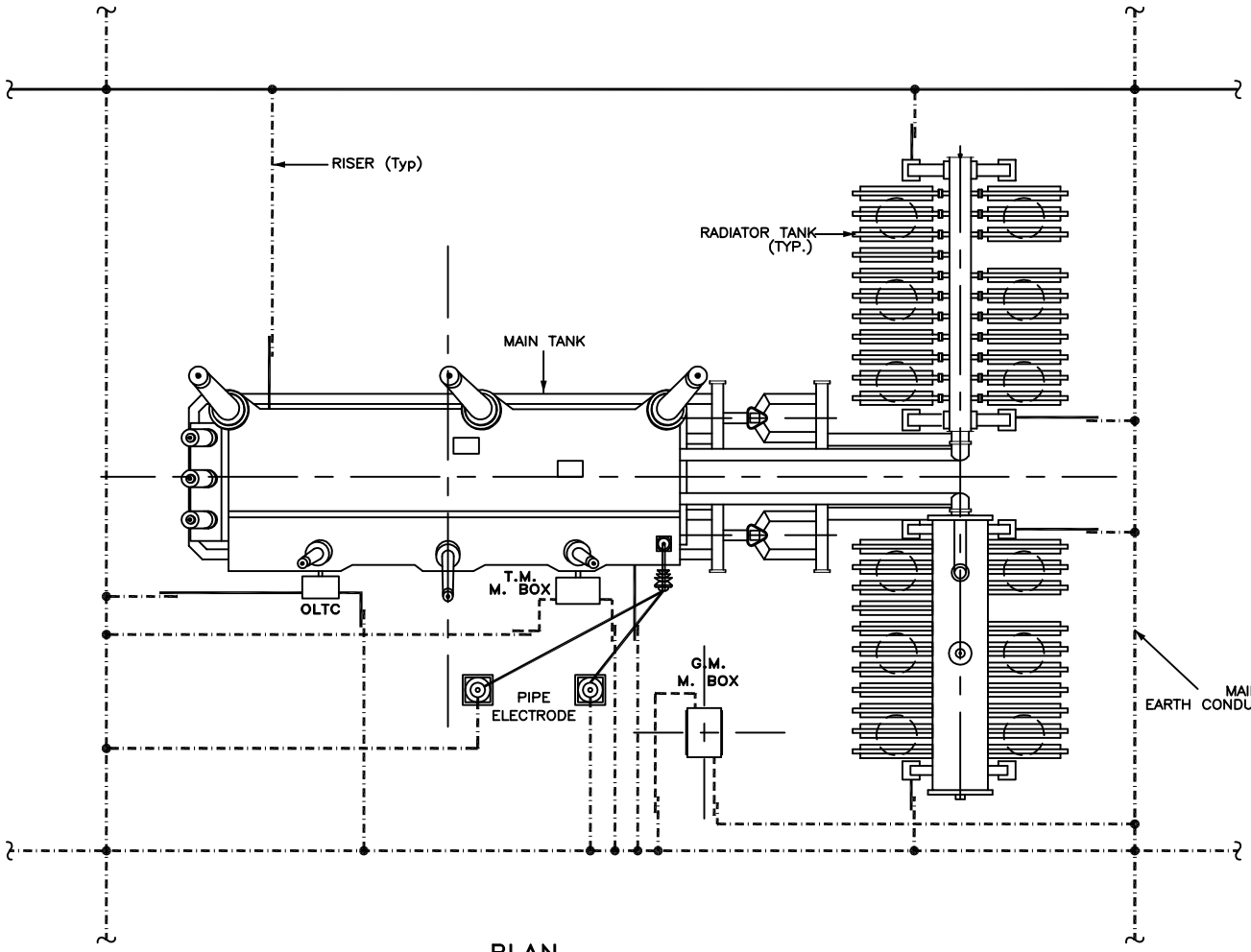
POWER GRID CORPORATION OF INDIA LIMITED
(A Government of India Enterprise)
पावरग्रिड

PROJECT :- TECHNICAL SPECIFICATION-
SWITCHYARD ERECTION

TITLE:- STANDARD EARTHING DETAILS

KKParkar	KKParkar	Dec-2013	Drawing No.: C/ENG/STD/EARTHINGS/09
CKD BY	PRPD BY	Date	SHEET # 6

EARTHING OF TRANSFORMER/ REACTOR



PLAN

LEGEND

— · — · —	40mmø MS ROD
———	75 x 12 mm GS FLAT
- - - - - - - - - -	50 x 6 mm GS FLAT

NOTES :-

1. No. OF RISERS :-

MAIN TANK	–	2 Nos.
RADIATOR TANK	–	4 Nos.
OLTC	–	2 Nos. (ICT only)
M. BOX	–	2 Nos./M. BOX
NEUTRAL EARTH ELECTRODE	–	2 Nos.

2. No. OF PIPE ELECTRODE REQUIRED = 2 Nos.
3. PYLON SUPPORTS SHALL BE EARTHED TO THE MAIN EARTHING CONDUCTOR BY GS FLAT.

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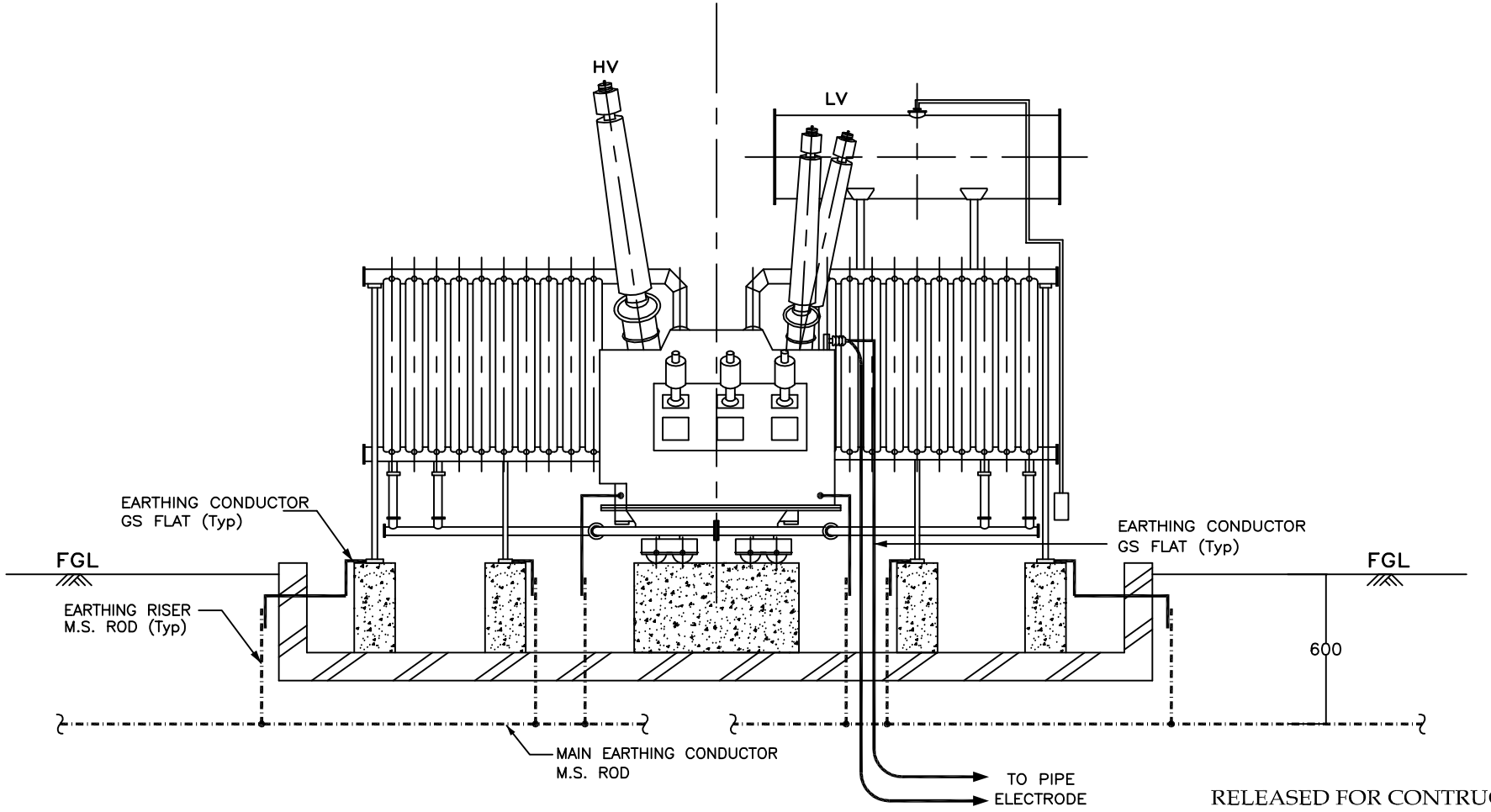
POWER GRID CORPORATION OF INDIA LIMITED
(A Government of India Enterprise) पावरग्रिड

PROJECT :- TECHNICAL SPECIFICATION- SWITCHYARD ERECTION

TITLE:- STANDARD EARTHING DETAILS

KKSarkar	KKSarkar	Dec-2013	Drawing No.: C/ENG/STD/EARTHINGS/09 SHEET # 7
CKD BY	PRPD BY	Date	

EARTHING OF TRANSFORMER/ REACTOR



RELEASED FOR CONTRUCTION

LEGEND

- 40mmø MS ROD
- 75 x 12 mm GS FLAT
- 50 x 6 mm GS FLAT

END VIEW

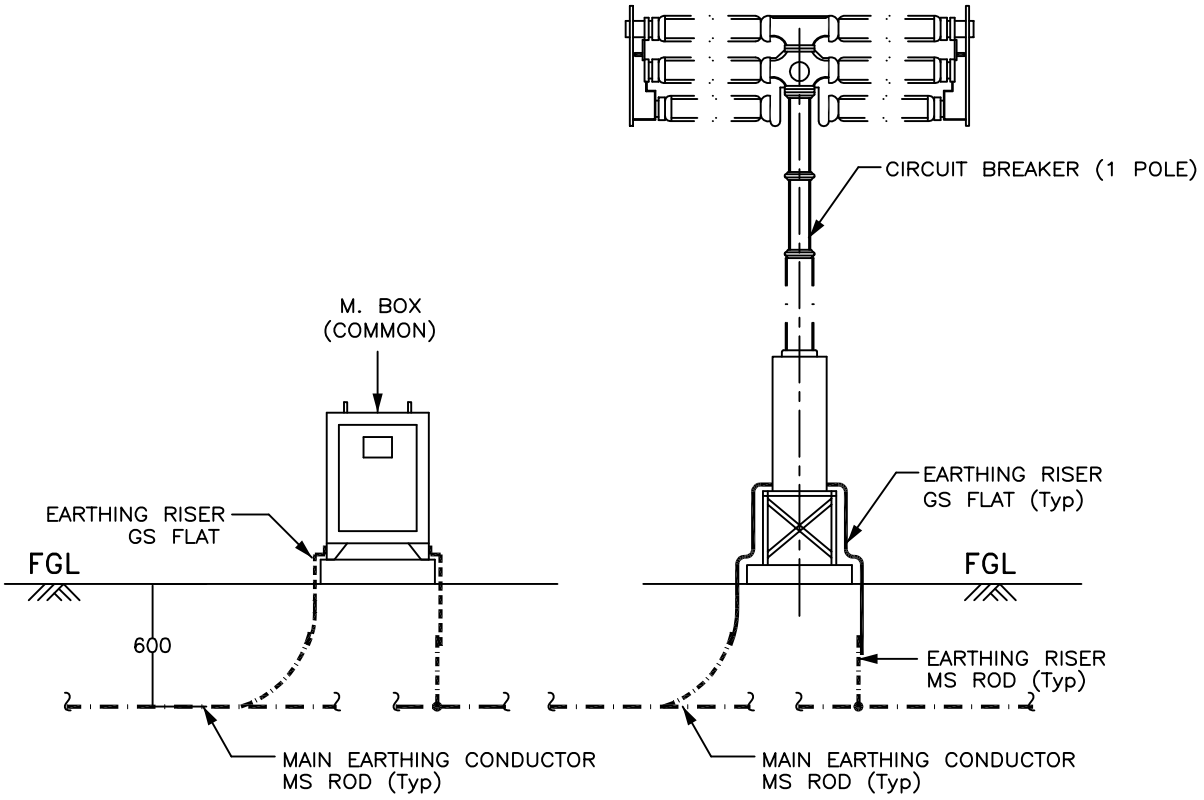
POWER GRID CORPORATION OF INDIA LIMITED
(A Government of India Enterprise)
पावरग्रिड

PROJECT :- TECHNICAL SPECIFICATION- SWITCHYARD ERECTION

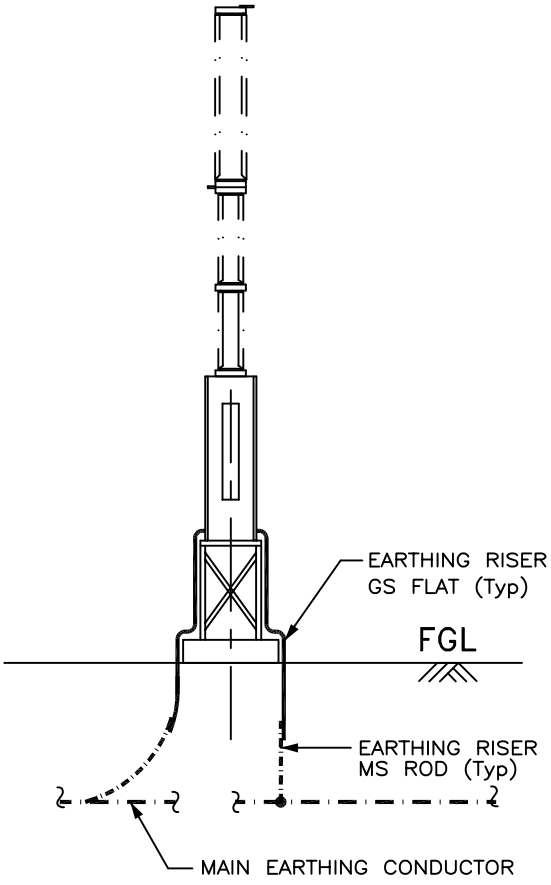
TITLE:- STANDARD EARTHING DETAILS

KKSarkar	KKSarkar	Dec-2013	Drawing No.: C/ENG/STD/EARTHINGS/09
CKD BY	PRPD BY	Date	SHEET # 8

EARTHING OF CIRCUIT BREAKER



ELEVATION



NOTES :–

1. No. OF RISERS FOR CIRCUIT BREAKER = 2 Nos. / PHASE
1. No. OF RISERS FOR LADDER (IF Applicable) = 2 Nos.
2. No. OF RISERS FOR MAR. BOX = 2 Nos.
3. CLEAT CLAMP SHALL BE PROVIDED AT 1000mm INTERVAL.

LEGEND

- 40mmø MS ROD
- 75 x 12 mm GS FLAT
- 50 x 6 mm GS FLAT

RELEASED FOR CONTRUCTION

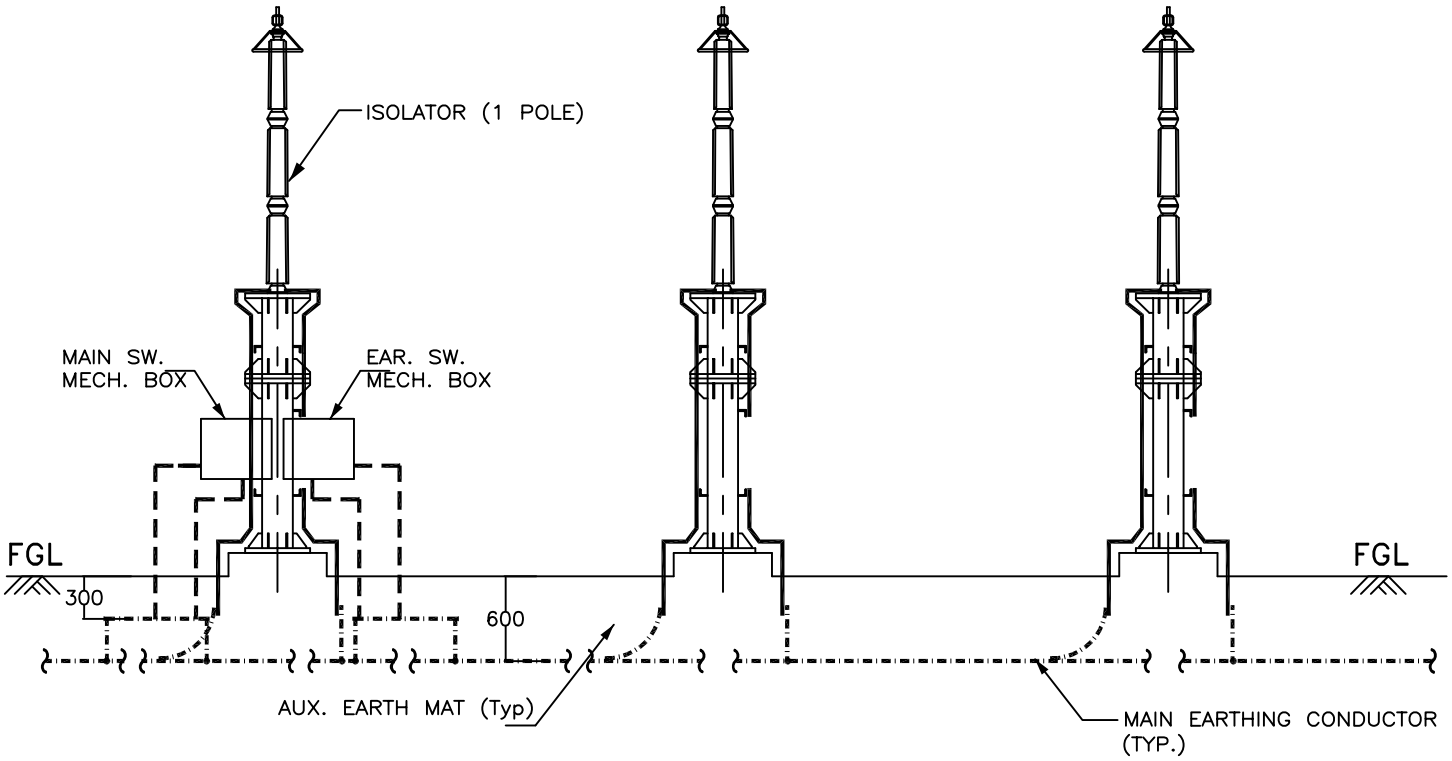
POWER GRID CORPORATION OF INDIA LIMITED
(A Government of India Enterprise)
पावरग्रिड

PROJECT :- TECHNICAL SPECIFICATION-SWITCHYARD ERECTION

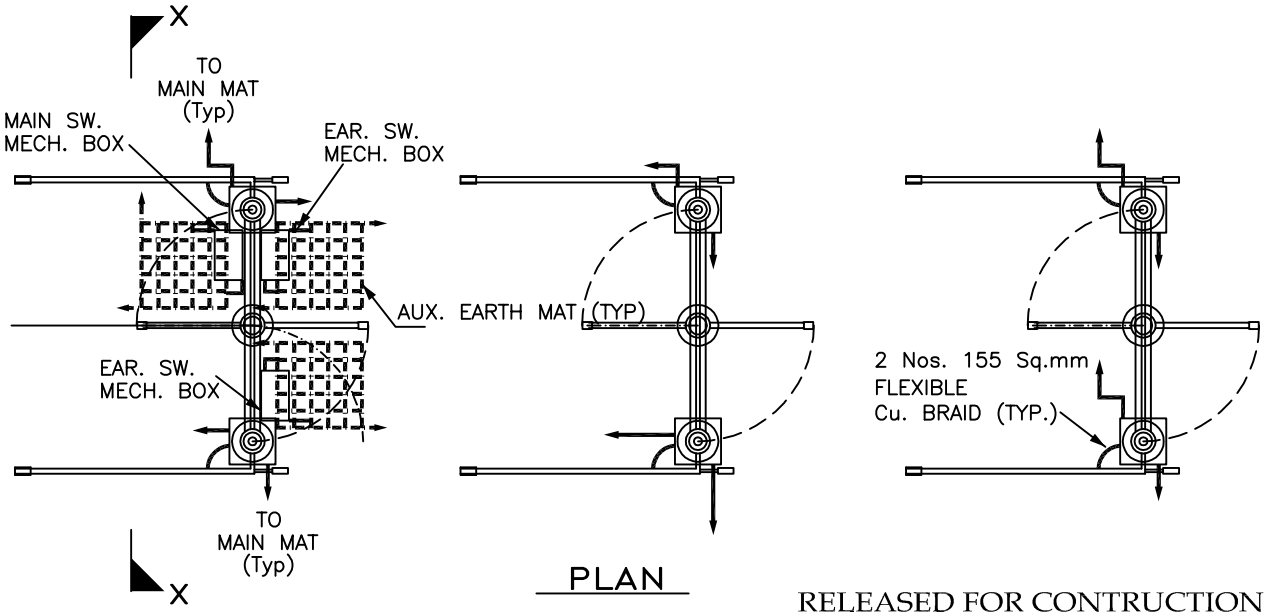
TITLE:- STANDARD EARTHING DETAILS

KKParkar	KKParkar	Dec-2013	Drawing No.: C/ENG/STD/EARTHINGS/09
CKD BY	PRPD BY	Date	SHEET # 9

EARTHING OF ISOLATOR



ELEVATION



PLAN

RELEASED FOR CONTRUCTION

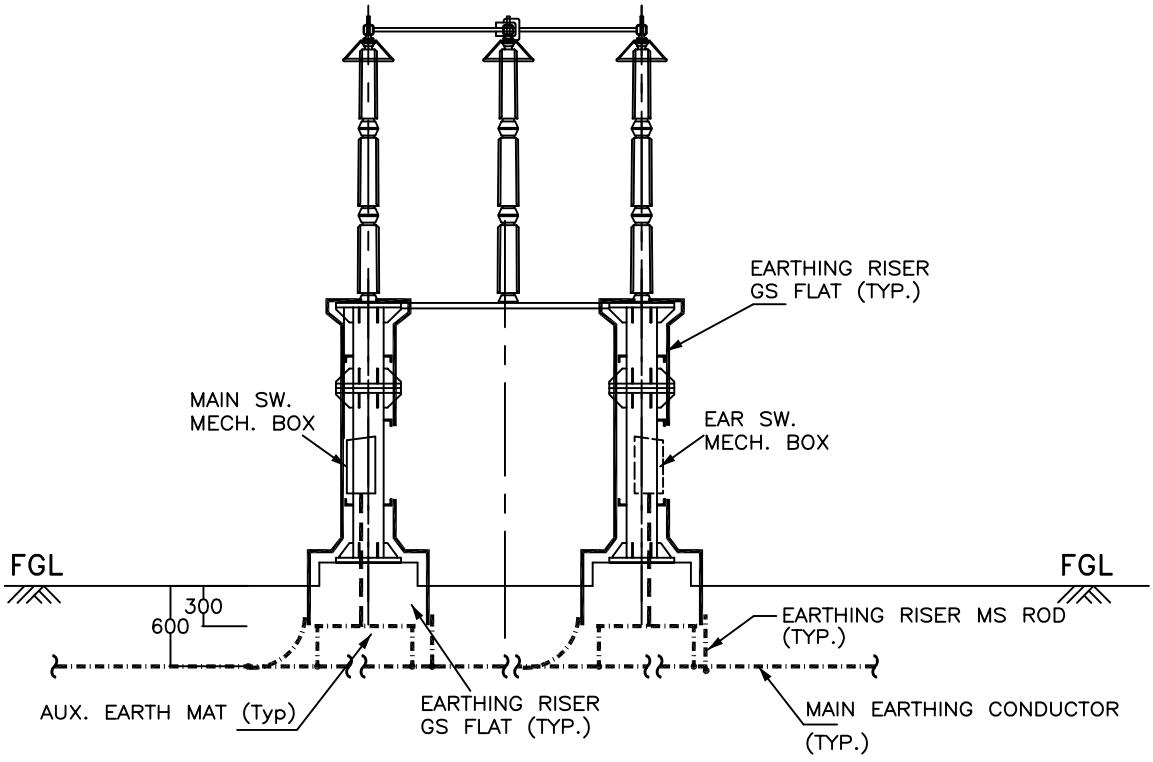
POWER GRID CORPORATION OF INDIA LIMITED
(A Government of India Enterprise)
पावरग्रिड

PROJECT :- TECHNICAL SPECIFICATION-SWITCHYARD ERECTION

TITLE:- STANDARD EARTHING DETAILS

KKParkar	KKParkar	Dec-2013	Drawing No.: C/ENG/STD/EARTHINGS/09
CKD BY	PRPD BY	Date	SHEET # 10

EARTHING OF ISOLATOR (1 PH)



VIEW – X X

LEGEND

—— · —— · ——	40mmø MS ROD
————————	75 x 12 mm GS FLAT
- - - - - - - - - - - - - - - -	50 x 6 mm GS FLAT

NOTES :–

1. No. OF RISERS FOR ISOLATOR = 4 Nos. / PHASE.
2. No. OF RISERS FOR MAIN MECH. BOX = 2 Nos.
3. No. OF RISERS FOR EARTH SW. MECH. BOX = 2 Nos. / BOX.
4. No. OF AUXILIARY EARTH MAT = 1 Nos. FOR EACH MB
5. CLEAT CLAMP SHALL BE PROVIDED AT 1000mm INTERVAL.
6. NO. OF AUX. EARTHMAT IS INDICATIVE ONLY. IT SHALL BE EXECUTED AS PER ACTUAL NUMBER/POSITION OF EARTH SWITCHES.

RELEASED FOR CONTRUCTION

POWER GRID CORPORATION OF INDIA LIMITED
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पावरग्रिड

PROJECT :- TECHNICAL SPECIFICATION-SWITCHYARD ERECTION

TITLE:- STANDARD EARTHING DETAILS

KKParkar	KKParkar	Dec-2013	Drawing No.: C/ENG/STD/EARTHINGS/09
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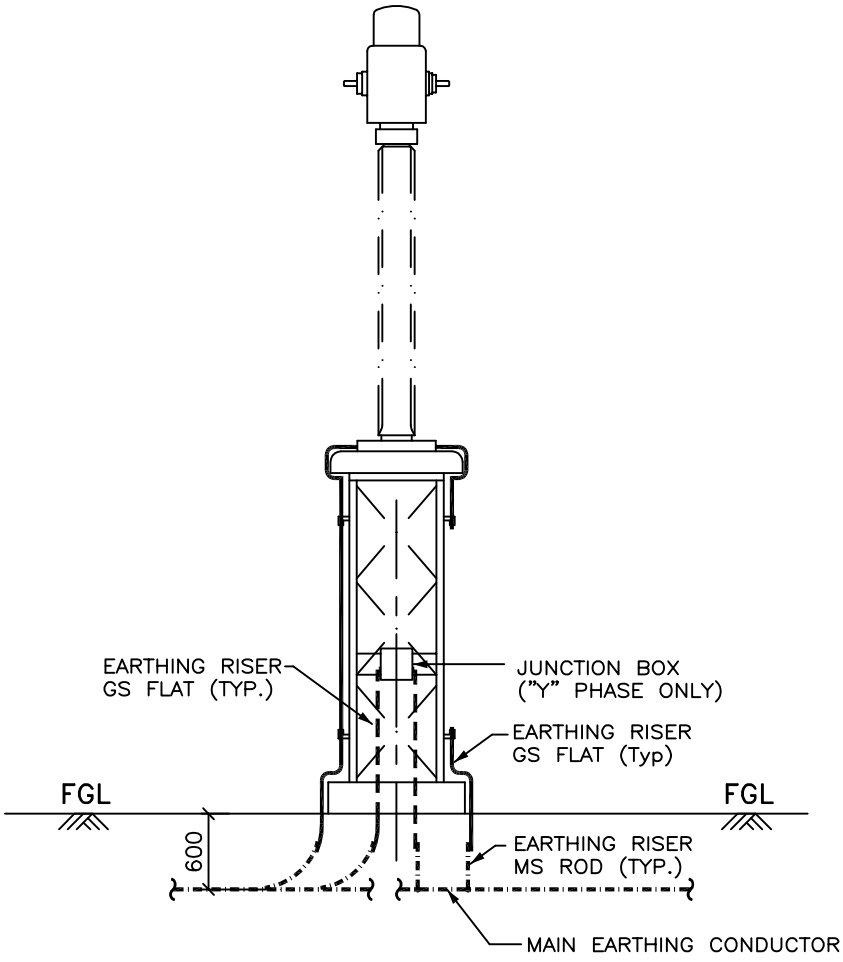
EARTHING OF CURRENT TRANSFORMER (1 PH)



ELEVATION

LEGEND

— · — · —	40mmø MS ROD
———	75 x 12 mm GS FLAT
- - - - - - - - - - - - - - - -	50 x 6 mm GS FLAT

NOTES :–

1. No. OF RISERS = 2 Nos. / PHASE.
2. No. OF RISERS FOR JUN. BOX = 2 Nos.
3. CLEAT CLAMP SHALL BE PROVIDED AT 1000mm INTERVAL.

RELEASED FOR CONTRUCTION

POWER GRID CORPORATION OF INDIA LIMITED
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PROJECT :- TECHNICAL SPECIFICATION-SWITCHYARD ERECTION

TITLE:- STANDARD EARTHING DETAILS

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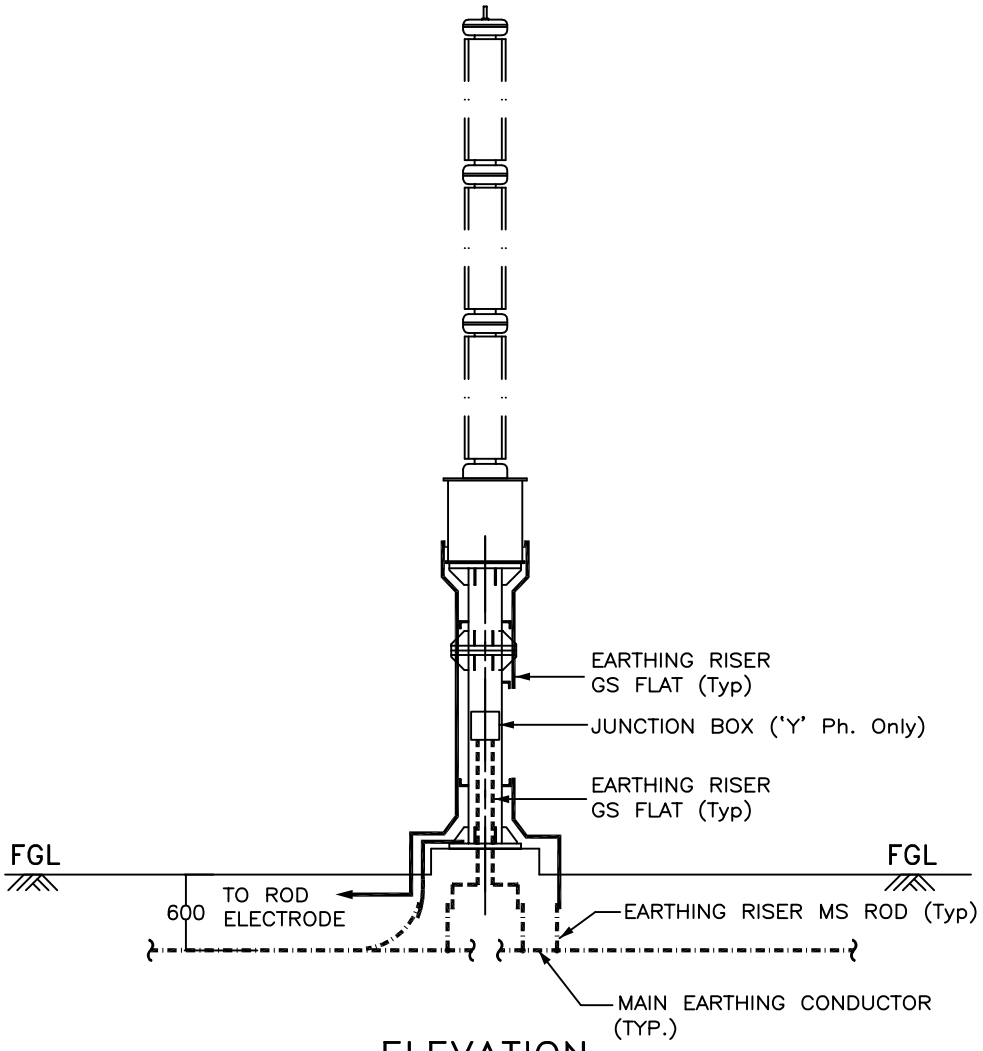
EARTHING OF CAPACITIVE VOLTAGE TRANSFORMER (1 PH)



ELEVATION

LEGEND

- 40mmø MS ROD
- 75 x 12 mm GS FLAT
- 50 x 6 mm GS FLAT

NOTES :–

1. No. OF RISERS = 3 Nos. / PHASE.
2. No. OF RISERS FOR J. BOX = 2 Nos.
3. No. OF ROD ELECTRODE REQUIRED = 1 No. / PHASE.
4. CLEAT CLAMP SHALL BE PROVIDED AT 1000mm INTERVAL.

RELEASED FOR CONTRUCTION

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पावरग्रिड

PROJECT :- TECHNICAL SPECIFICATION-SWITCHYARD ERECTION

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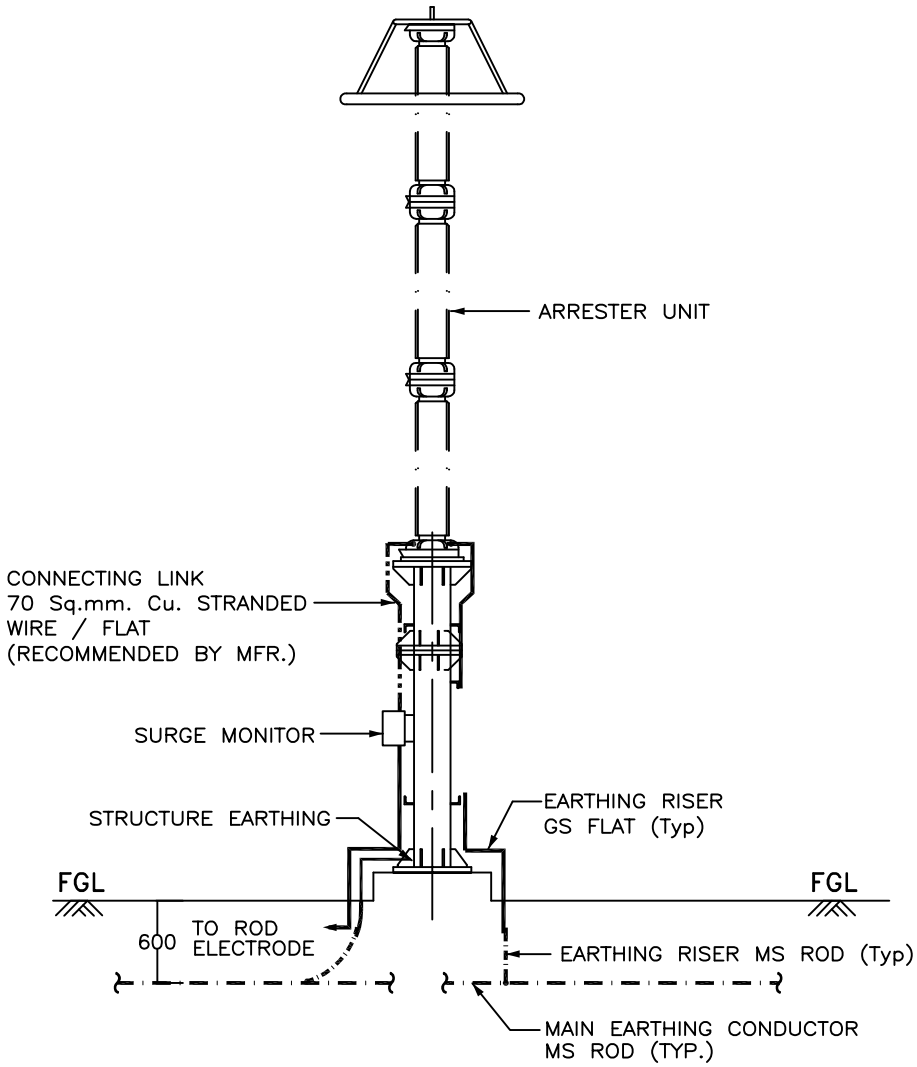
EARTHING OF SURGE ARRESTER (1PH)



ELEVATION

LEGEND

40mmø MS ROD

75 x 12 mm GS FLAT

NOTES :–

1 . No. OF RISERS = 3 Nos. / PHASE.
2 . No. OF ROD ELECTRODE REQUIRED = 1 No. / PHASE.
3 . CLEAT CLAMP SHALL BE PROVIDED AT 1000mm INTERVAL.

RELEASED FOR CONTRUCTION

POWER GRID CORPORATION OF INDIA LIMITED
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PROJECT :- TECHNICAL SPECIFICATION-SWITCHYARD ERECTION

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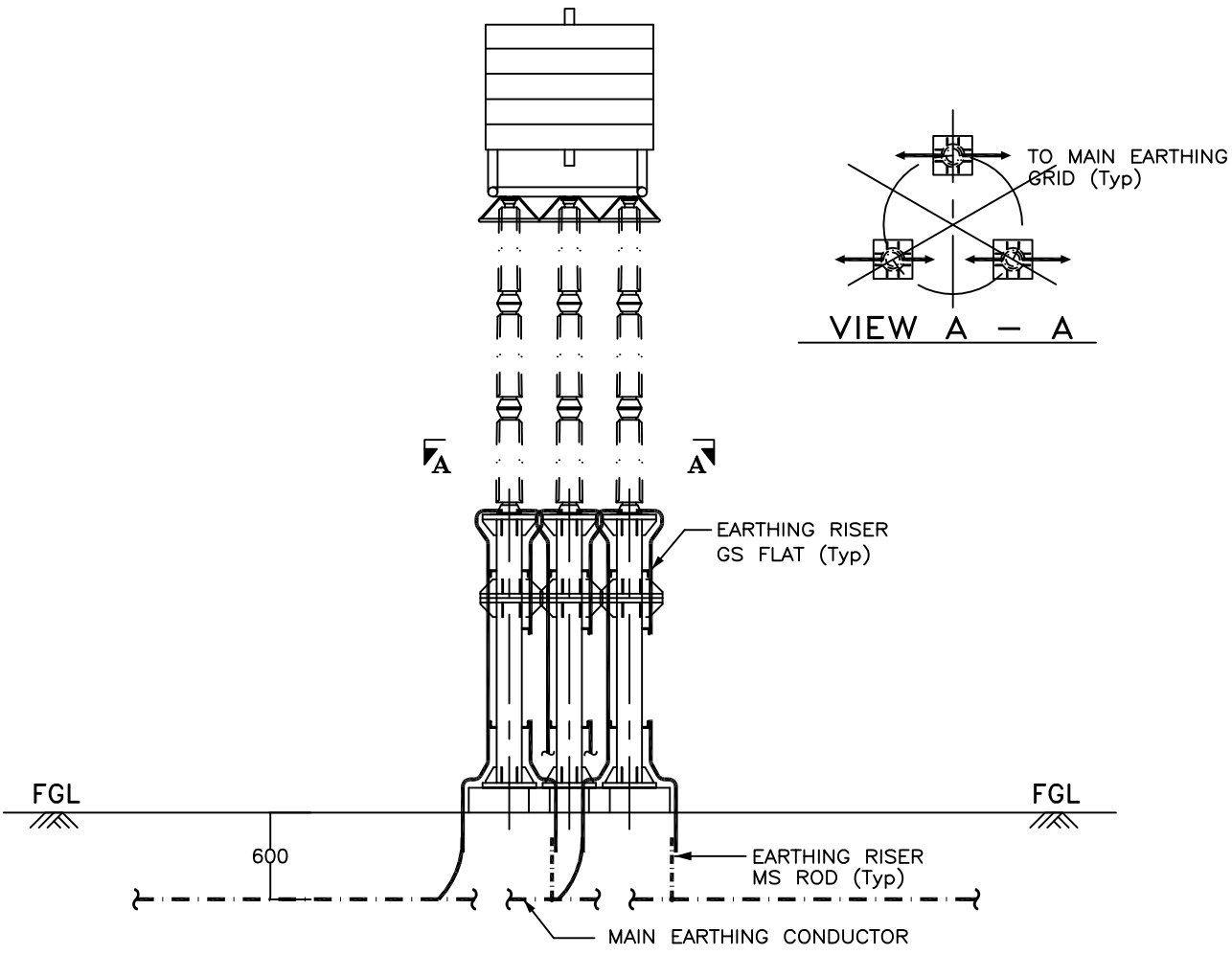
EARTHING OF WAVE TRAP (1PH)



ELEVATION

LEGEND

40mmø MS ROD

75 x 12 mm GS FLAT

NOTE :–

1. No. OF RISERS = 6 Nos. / PHASE.
2. CLEAT CLAMP SHALL BE PROVIDED AT 1000mm INTERVAL.

RELEASED FOR CONTRUCTION

POWER GRID CORPORATION OF INDIA LIMITED
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PROJECT :- TECHNICAL SPECIFICATION-SWITCHYARD ERECTION

TITLE:- STANDARD EARTHING DETAILS

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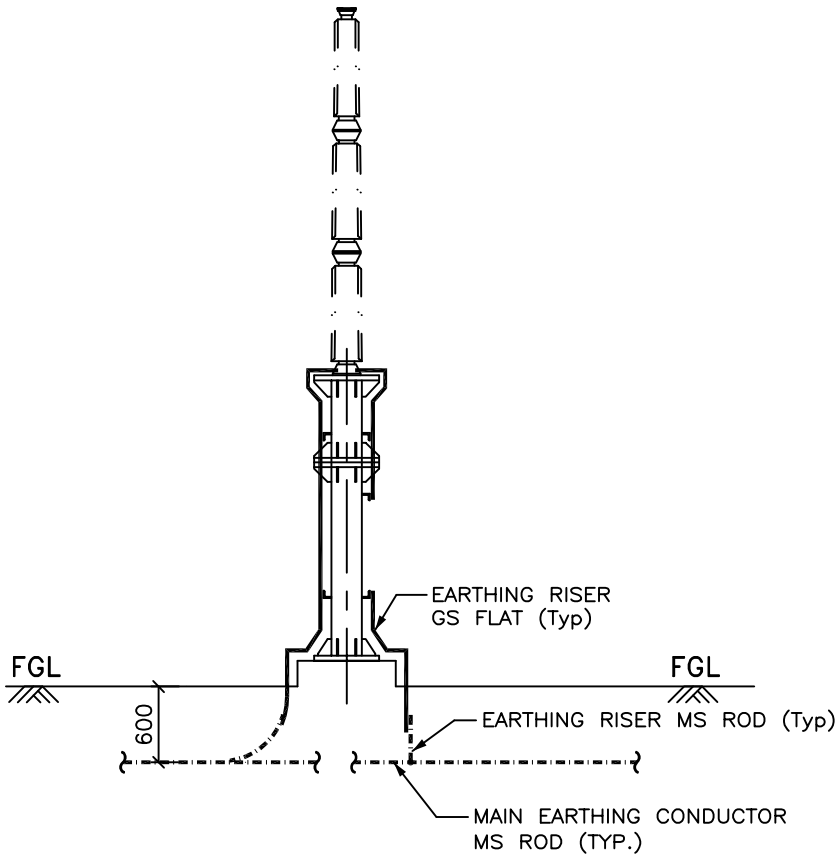
EARTHING OF POST INSULATOR (1PH)



ELEVATION

LEGEND

40mmø MS ROD

75 x 12 mm GS FLAT

NOTES :–

1. No. OF RISERS = 2 Nos. / PHASE.
2. CLEAT CLAMP SHALL BE PROVIDED AT 1000mm INTERVAL.

RELEASED FOR CONTRUCTION

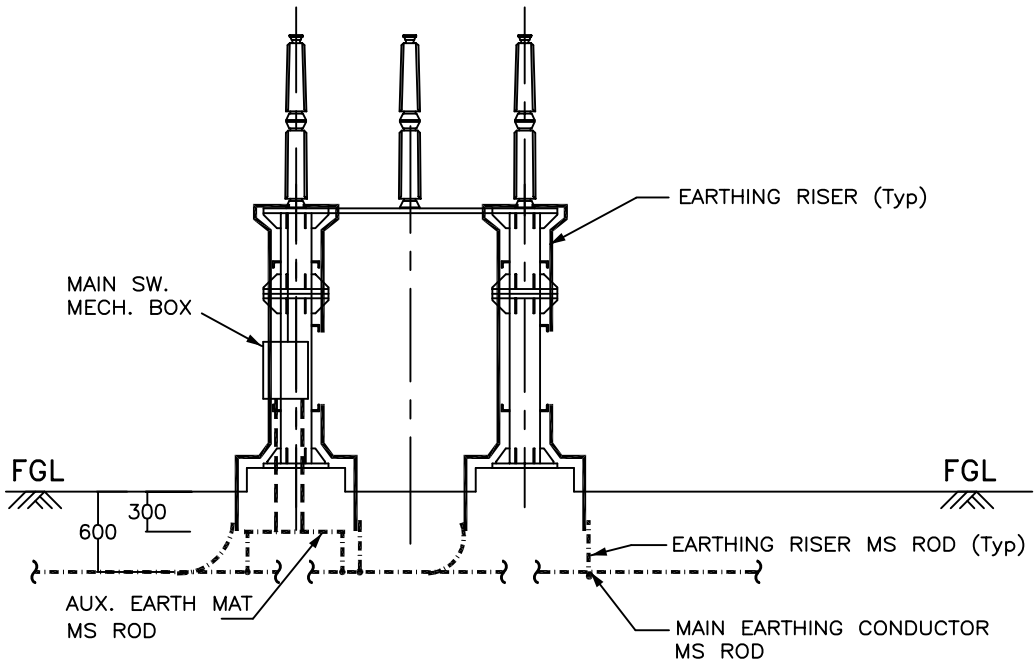
POWER GRID CORPORATION OF INDIA LIMITED
(A Government of India Enterprise)
पावरग्रिड

PROJECT :- TECHNICAL SPECIFICATION-SWITCHYARD ERECTION

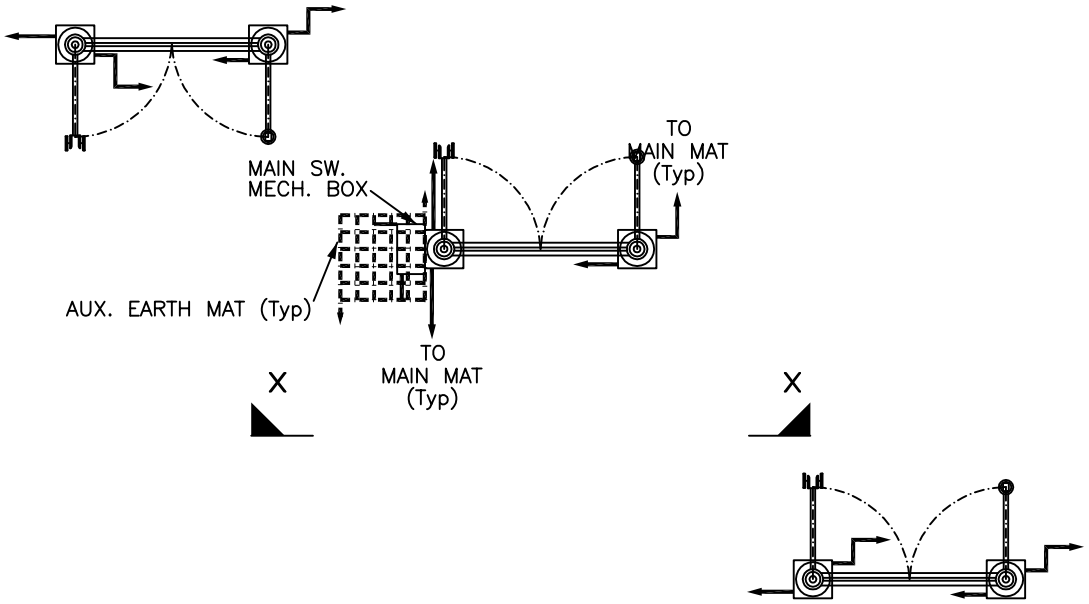
TITLE:- STANDARD EARTHING DETAILS

KKParkar	KKParkar	Dec-2013	Drawing No.: C/ENG/STD/EARTHINGS/09 SHEET # 16
CKD BY	PRPD BY	Date	

TANDEM ISOLATOR



VIEW – X X



PLAN

RELEASED FOR CONTRUCTION

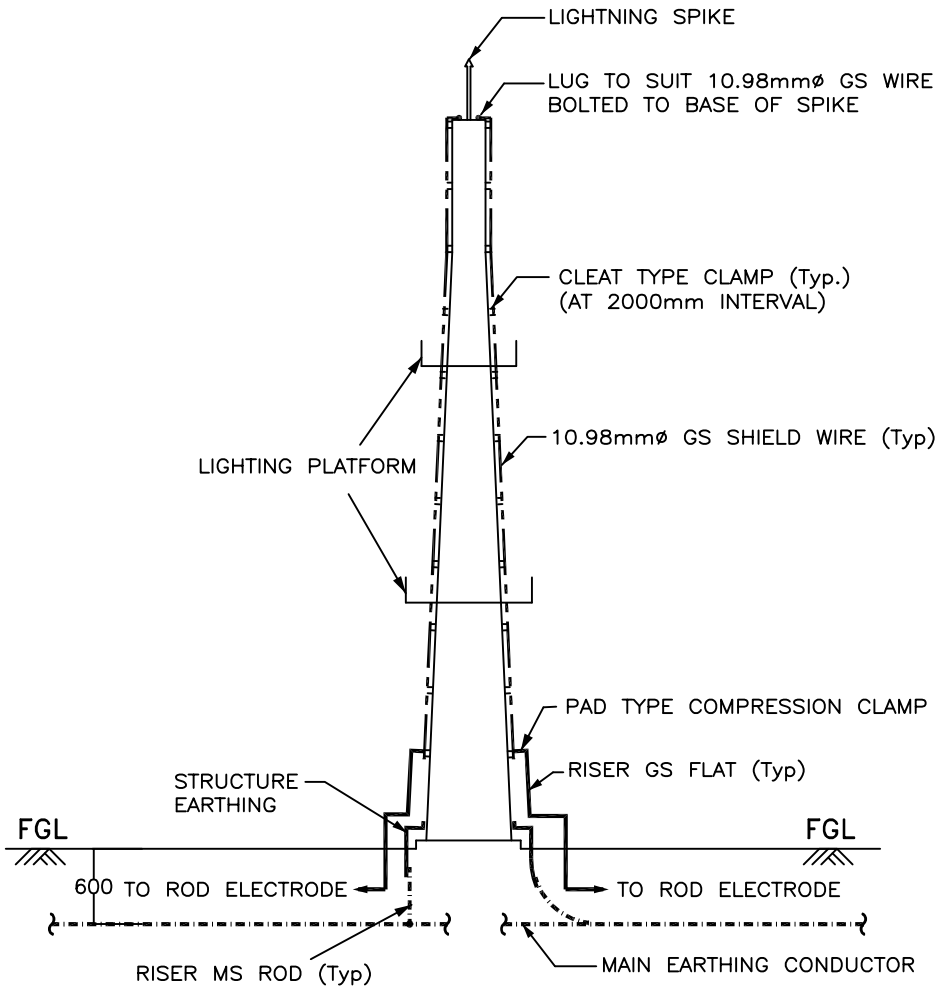
POWER GRID CORPORATION
OF INDIA LIMITED
(A Government of India Enterprise)
पावरग्रिड

PROJECT :- TECHNICAL SPECIFICATION-
SWITCHYARD ERECTION

TITLE:- STANDARD EARTHING DETAILS

KKParkar	KKParkar	Dec-2013	Drawing No.: C/ENG/STD/EARTHINGS/09
CKD BY	PRPD BY	Date	SHEET # 17

EARTHING OF LIGHTNING MAST



ELEVATION

NOTES :–

1. No. OF RISERS = 4 Nos.
2. No. OF ROD ELECTRODE REQUIRED = 2 Nos.
3. No. OF PAD TYPE CLAMP = 2 Nos.

LEGEND

40mmø MS ROD

75 x 12 mm GS FLAT

RELEASED FOR CONTRUCTION

POWER GRID CORPORATION OF INDIA LIMITED
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PROJECT :- TECHNICAL SPECIFICATION- SWITCHYARD ERECTION

TITLE:- STANDARD EARTHING DETAILS

KKParkar	KKParkar	Dec-2013	Drawing No.: C/ENG/STD/EARTHINGS/09
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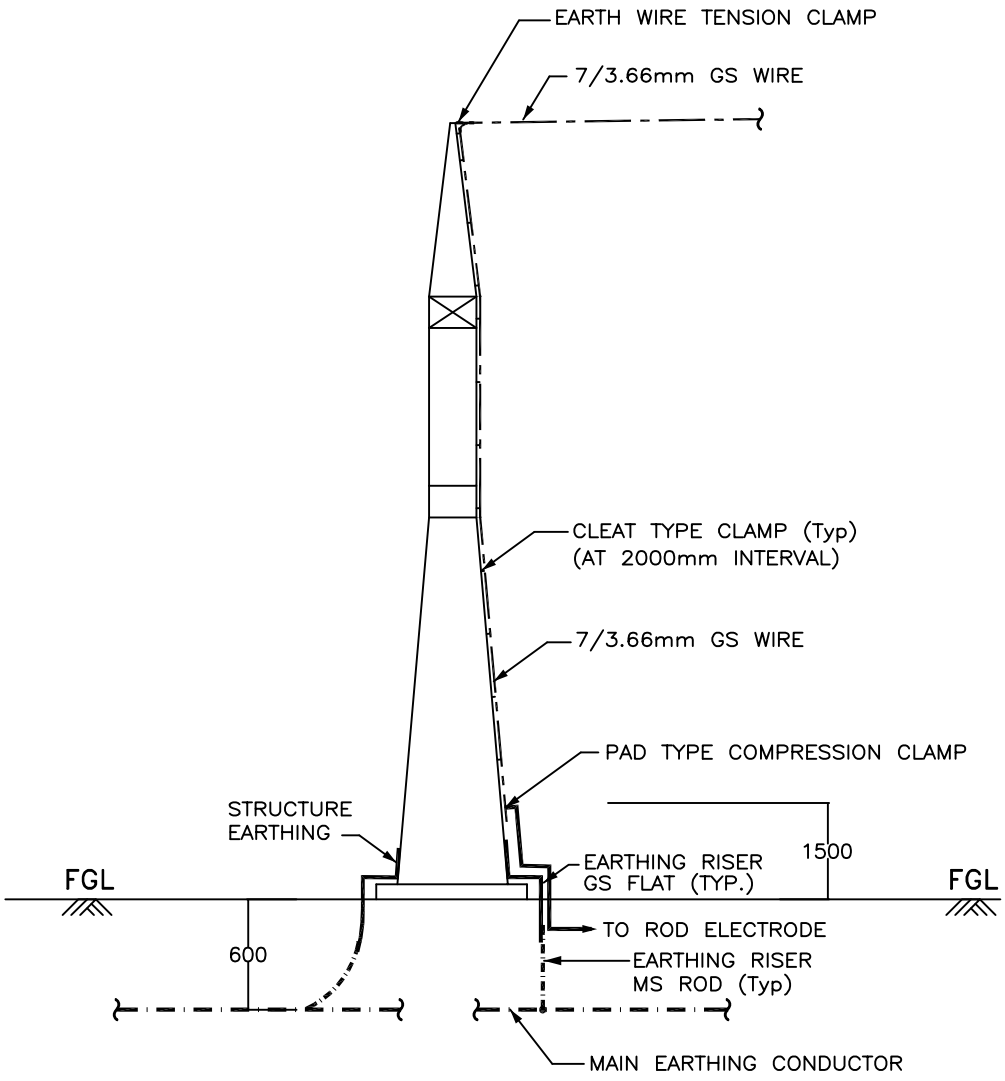
EARTHING OF TOWER WITH PEAK



ELEVATION

NOTES :–

1. No. OF RISERS = 3 Nos.
2. No. OF ROD ELECTRODE REQUIRED = 1 No.
3. No. OF PAD TYPE CLAMP = 1 No.

LEGEND

- 40mmø MS ROD
- 75 x 12 mm GS FLAT

RELEASED FOR CONTRUCTION

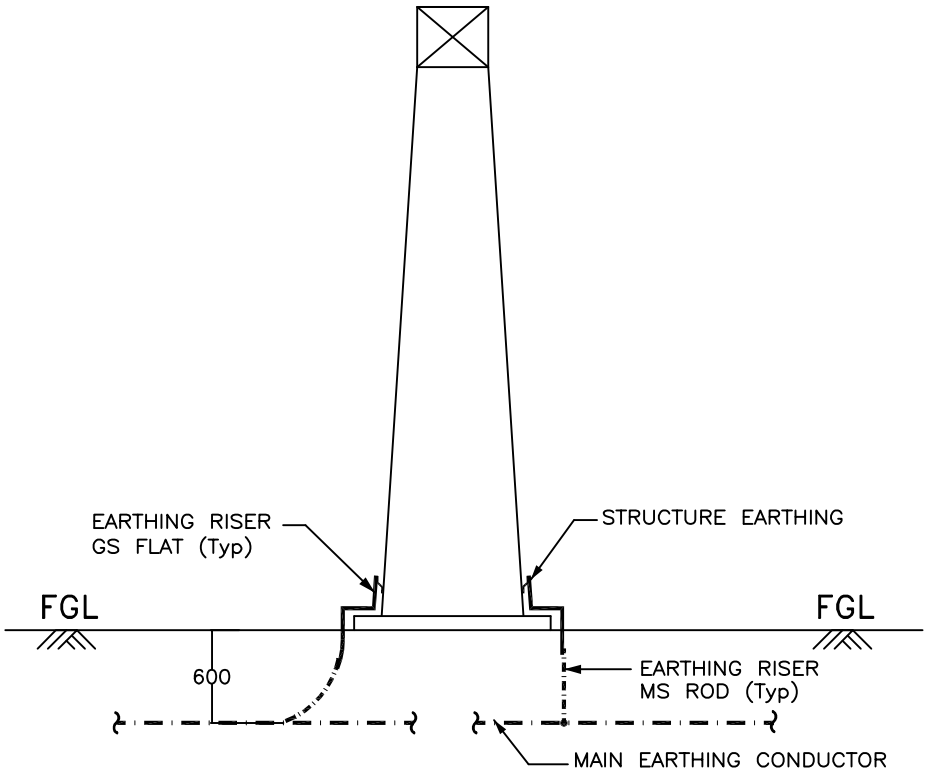
POWER GRID CORPORATION OF INDIA LIMITED
(A Government of India Enterprise)
पावरग्रिड

PROJECT :- TECHNICAL SPECIFICATION-SWITCHYARD ERECTION

TITLE:- STANDARD EARTHING DETAILS

KKParkar	KKParkar	Dec-2013	Drawing No.: C/ENG/STD/EARTHINGS/09
CKD BY	PRPD BY	Date	SHEET # 19

EARTHING OF TOWER WITHOUT PEAK



ELEVATION

LEGEND

40mmø MS ROD

75 x 12 mm GS FLAT

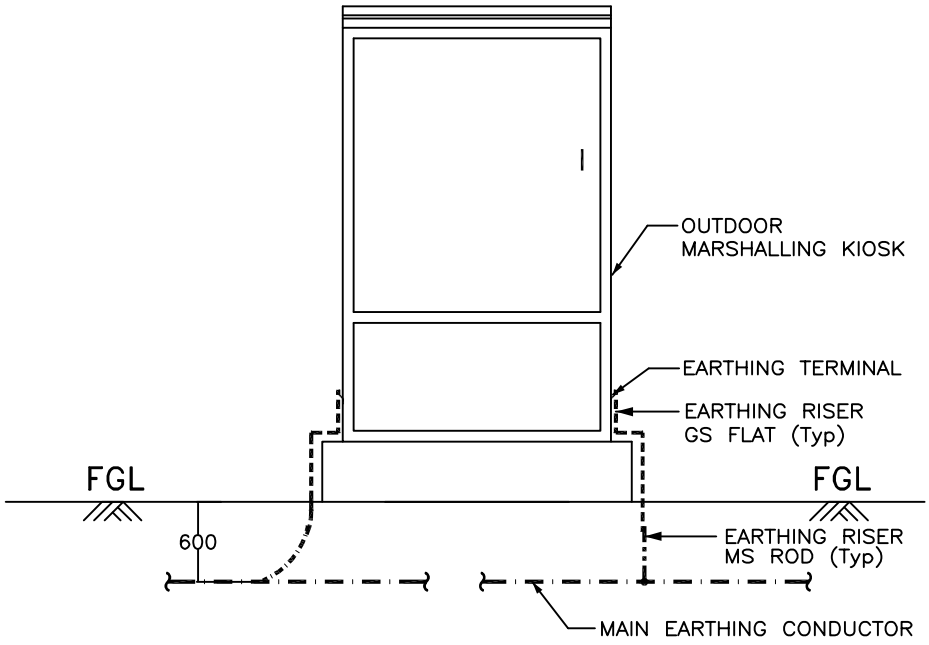
NOTES :–

1. No. OF RISERS = 2 Nos.

RELEASED FOR CONTRUCTION

POWER GRID CORPORATION OF INDIA LIMITED (A Government of India Enterprise) पावरग्रिड			
PROJECT :- TECHNICAL SPECIFICATION- SWITCHYARD ERECTION			
TITLE:- STANDARD EARTHING DETAILS			
KKParkar	KKParkar	Dec-2013	Drawing No.: C/ENG/STD/EARTHINGS/09 SHEET # 20
CKD BY	PRPD BY	Date	

EARTHING OF BAY MARSHALLING BOX



ELEVATION

LEGEND

—— · —— · ——	40mmø MS ROD
————————	75 x 12 mm GS FLAT
- - - - - - - - - - - - - - -	50 x 6 mm GS FLAT

NOTE :–

1. No. OF RISERS = 2 Nos.

RELEASED FOR CONTRUCTION

POWER GRID CORPORATION OF INDIA LIMITED
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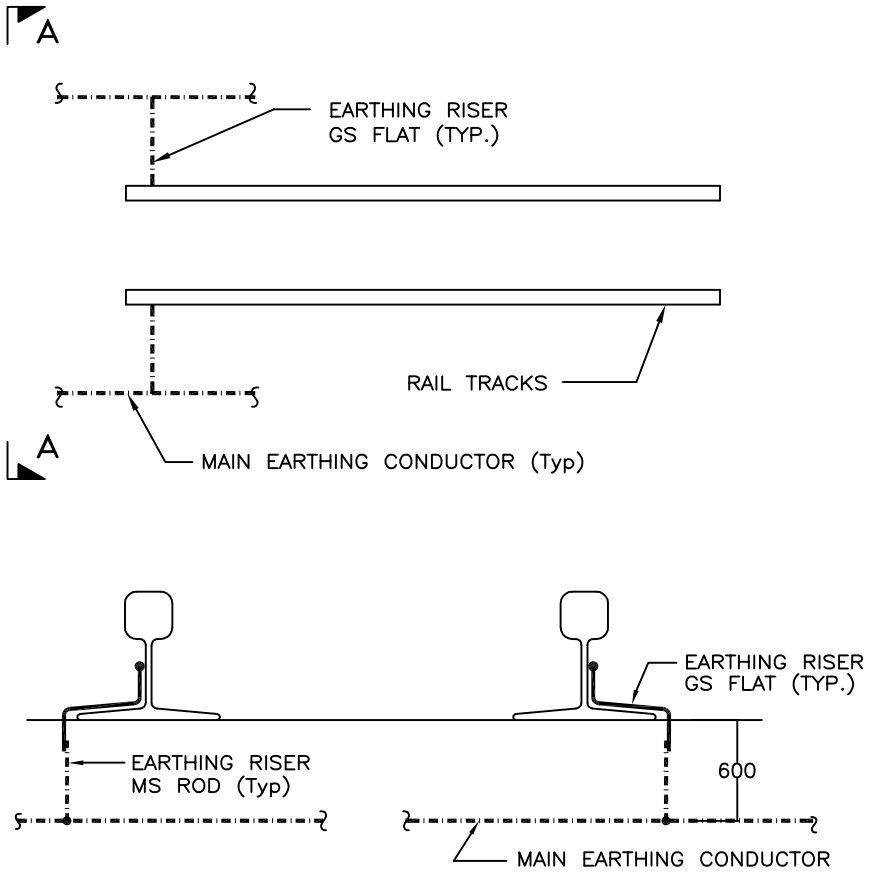
PROJECT :- TECHNICAL SPECIFICATION-SWITCHYARD ERECTION

TITLE:- STANDARD EARTHING DETAILS

KKParkar	KKParkar	Dec-2013	Drawing No.: C/ENG/STD/EARTHINGS/09
CKD BY	PRPD BY	Date	SHEET # 21

EARTHING OF RAIL TRACK



SECTION A – A

LEGEND

40mmø MS ROD

75 x 12 mm GS FLAT

NOTES :–

1. EACH RAIL SHALL BE EARTHED AT 30M INTERVAL AND ALSO AT BOTH ENDS.

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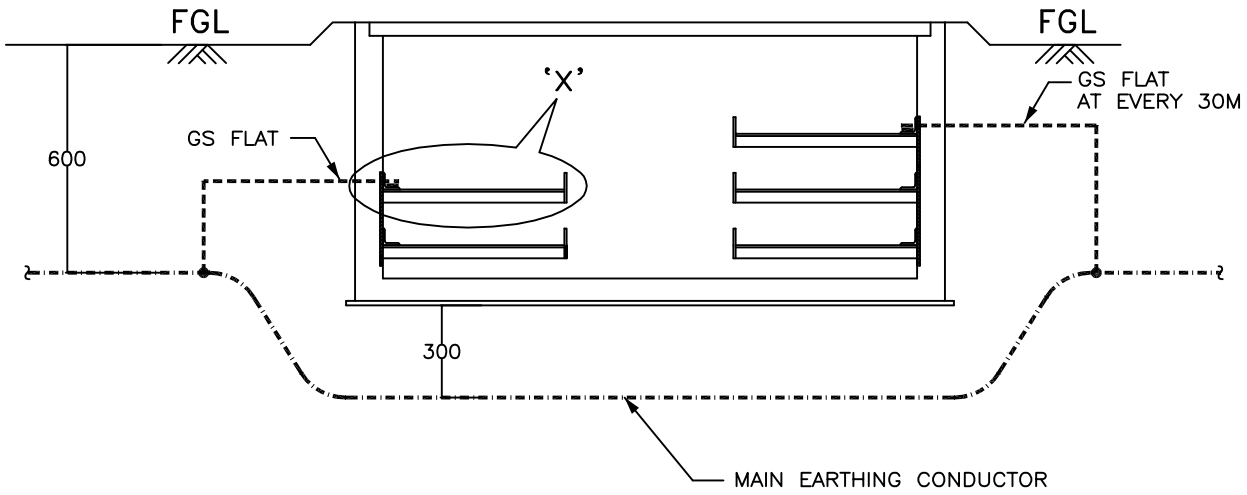
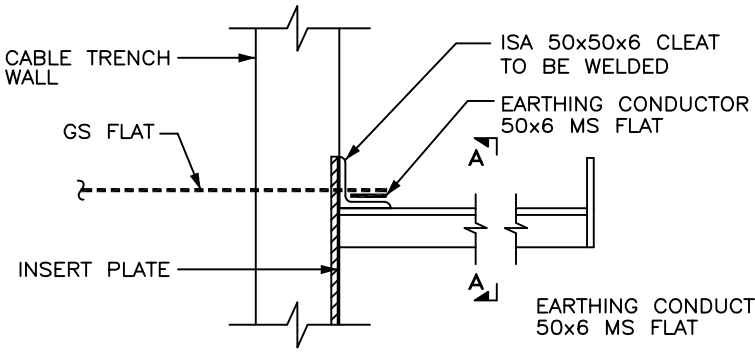
KKParkar	KKParkar	Dec-2013	Drawing No.: C/ENG/STD/EARTHINGS/09
CKD BY	PRPD BY	Date	SHEET # 22

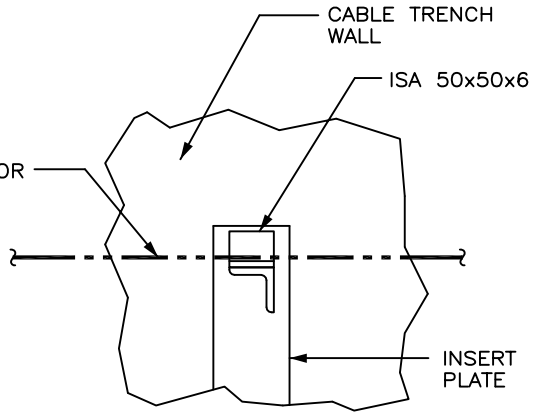
EARTHING OF CABLE TRENCH



TYPICAL CROSS SECTION OF CABLE TRENCH



DETAIL – X



SECTION A – A

NOTES :–

1. MS FLAT SHALL RUN ON TOP TIER ALL ALONG THE CABLE TRENCHES & WELDED TO EACH OF THE RACKS.
2. MS FLAT SHALL BE EARTHED AT 30M INTERVAL AND ALSO AT BOTH ENDS.

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TITLE:- STANDARD EARTHING DETAILS

KKParkar	KKParkar	Dec-2013	Drawing No.: C/ENG/STD/EARTHINGS/09
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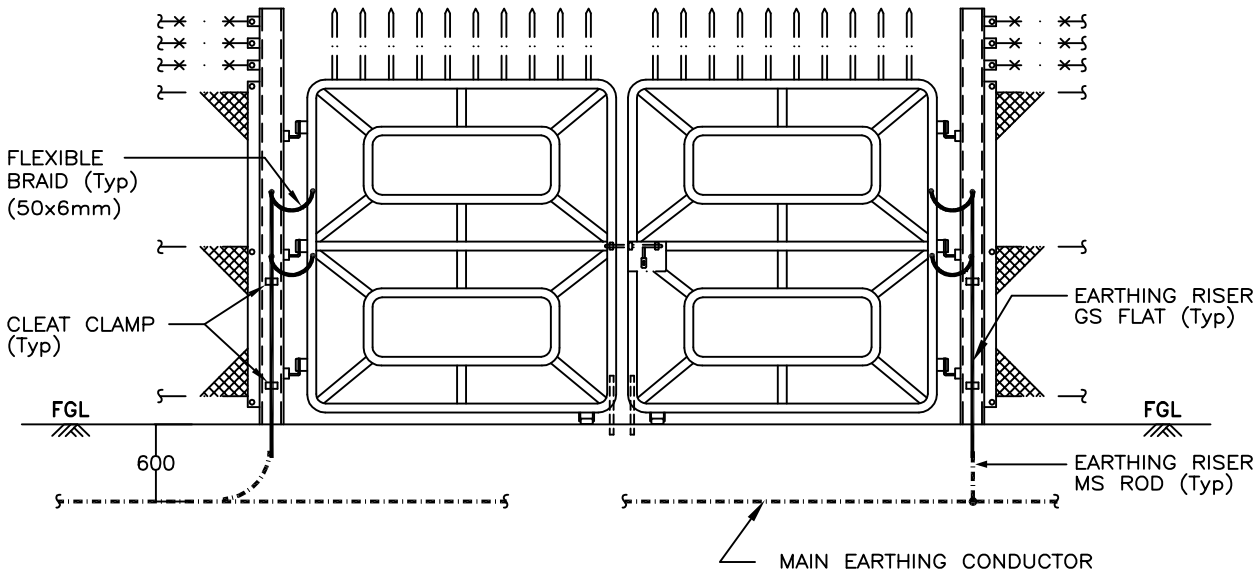
EARTHING OF GATES



MAIN GATE

LEGEND

40mmø MS ROD

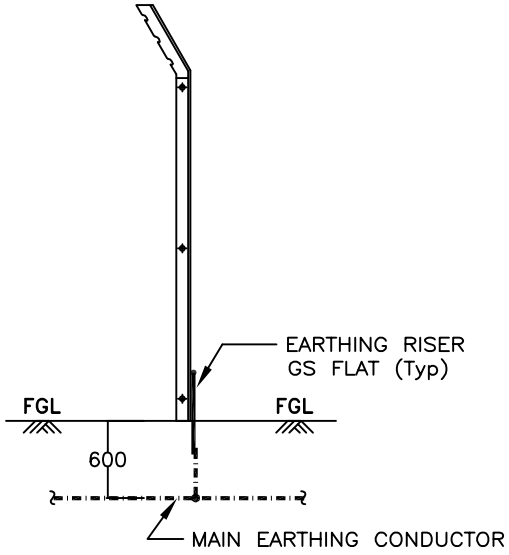
75 x 12 mm GS FLAT

50 x 6 mm MS FLAT

NOTES :–

	FENCE POST	MAIN GATE
1 . No. OF RISERS REQUIRED	1	2
2 . No. OF FLEXIBLE BRAID	–	4

3. ALL GATES & EVERY ALTERNATE FENCE SHALL BE CONNECTED TO EARTHING GRID.



FENCE POST
(ALTERNATE FENCE POST)

RELEASED FOR CONTRUCTION

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KKParkar	KKParkar	Dec-2013	Drawing No.: C/ENG/STD/EARTHINGS/09
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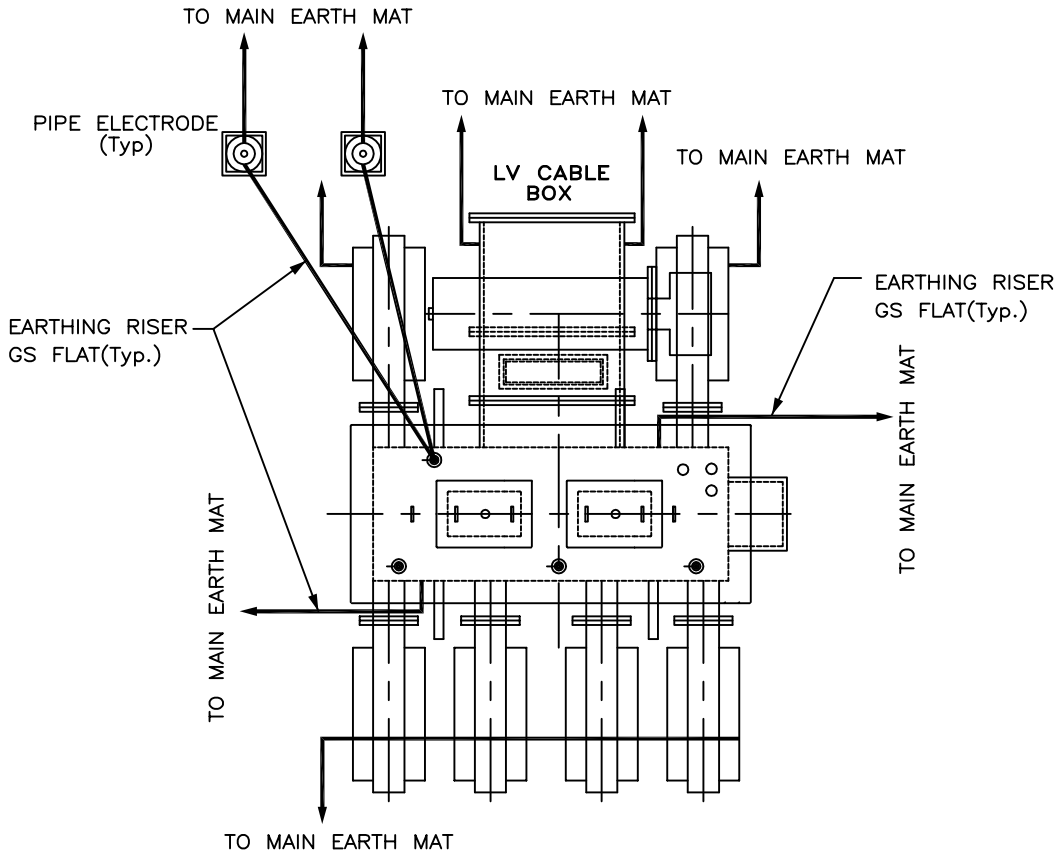
EARTHING OF LT TRANSFORMER



PLAN

LEGEND

- 40mmø MS ROD
- 75 x 12 mm GS FLAT
- 50 x 6 mm GS FLAT

NOTES :–

1. No. OF RISERS FOR MAIN TANK & T.M. MAR. BOX = 4 Nos.
2. No. OF RISERS FOR LV CABLE BOX & RADIATOR = 4 Nos.
3. No. OF RISERS FOR PIPE ELECTRODE = 2 Nos.
4. No. OF PIPE ELECTRODES REQUIRED = 2 Nos.

RELEASED FOR CONTRUCTION

POWER GRID CORPORATION OF INDIA LIMITED
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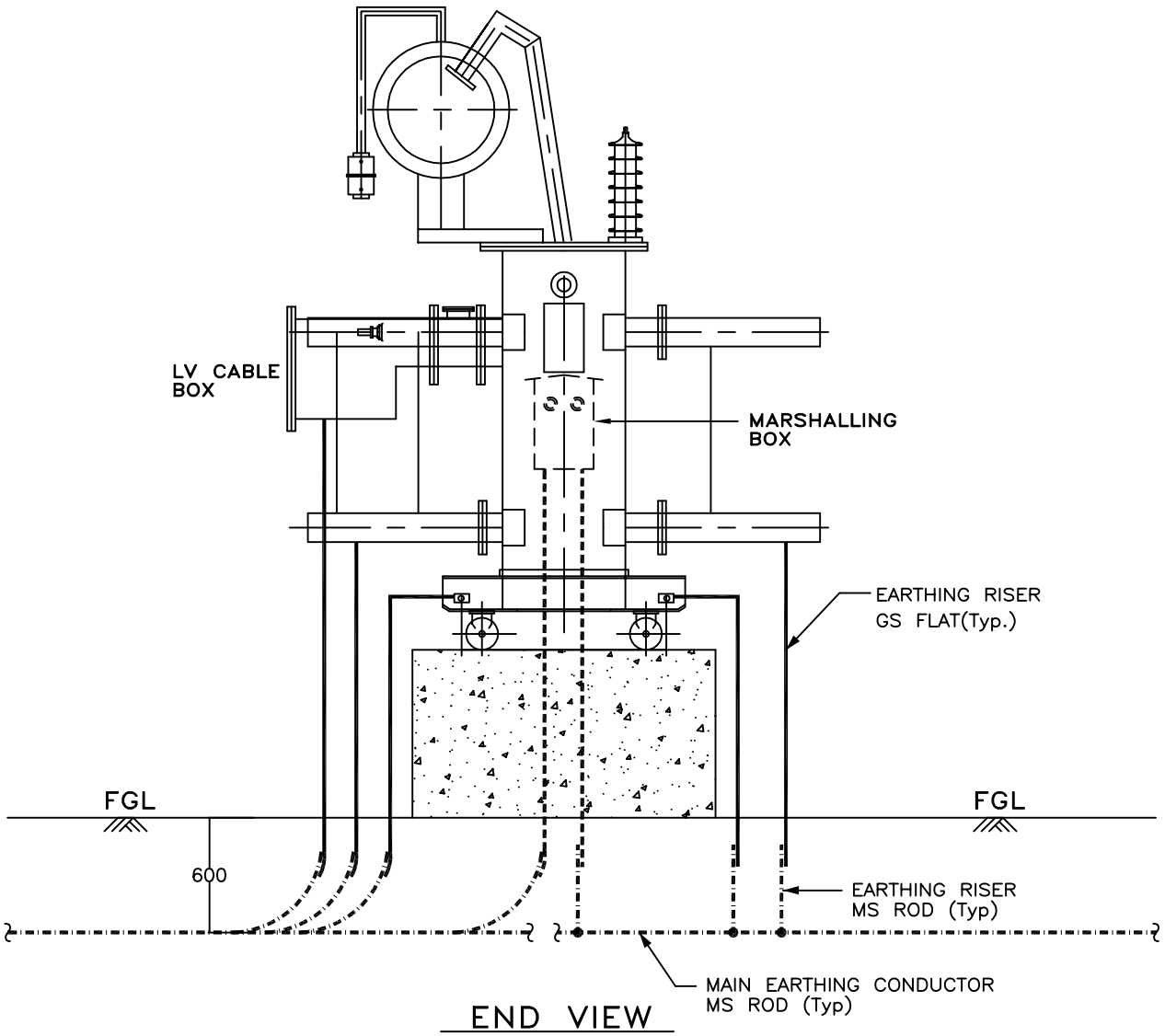
EARTHING OF LT TRANSFORMER



END VIEW

RELEASED FOR CONTRUCTION

POWER GRID CORPORATION OF INDIA LIMITED
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पावरग्रिड

PROJECT :- TECHNICAL SPECIFICATION-SWITCHYARD ERECTION

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EARTHING OF PYLON SUPPORTS

Pylon supports shall be grounded through 50x6mm GI flat to the ring around the Pylon supports of 75x12mm GI flat which in tu rn is connected to the main grid (40 mm dia MS rod) at 2 to3 points as available.

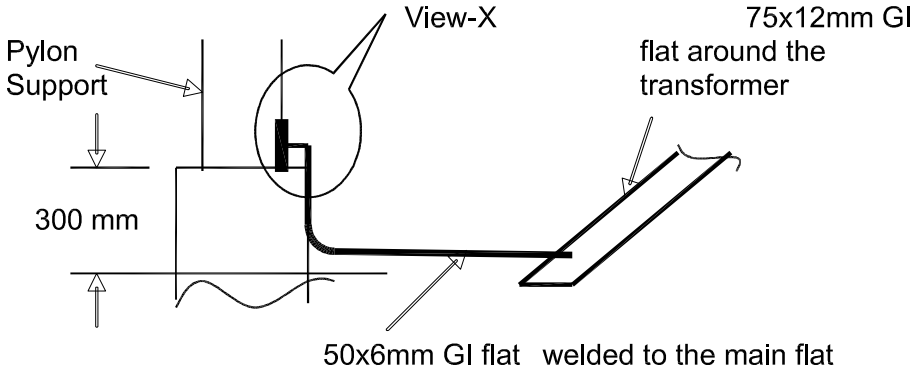

Fig.- Elevation (Earthing of Pylon Supports)

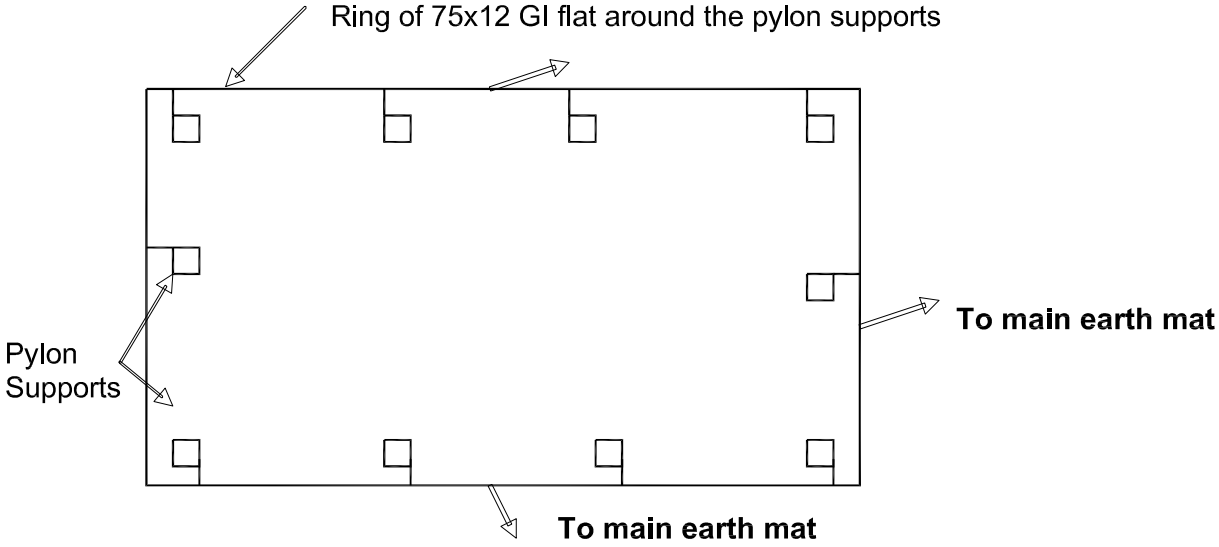

Fig.- Layout (Earthing of Pylon Supports)

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POWER GRID CORPORATION OF INDIA LIMITED (A Government of India Enterprise) पावरग्रिड			
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KKSarkar	KKSarkar	Dec-2013	Drawing No.: C/ENG/STD/EARTHINGS/09
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EARTHING OFHYDRANT/ HVW SPRAY PIPING

These pipes shall be grounded at pump house through 50x6mm GI flat connected to the main flat, 75x12mm running around the room.

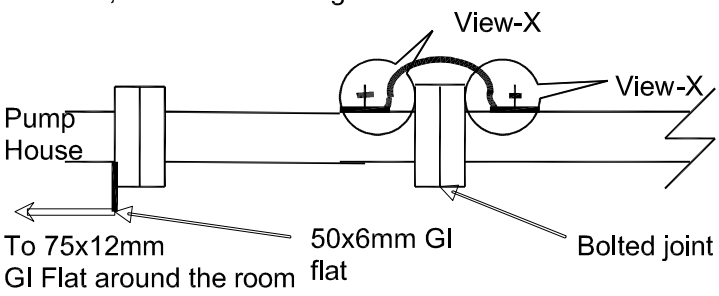

Fig.-Earthing of Hydrant / HVW Spray Piping

EARTHING OFHYDRANT POST/ HOSE BOX

A bolt shall be welded to these structures at the time of installation which can be used to connect them to the nearest riser or main 75x12mm GI flat through 50x6mm GI flat.

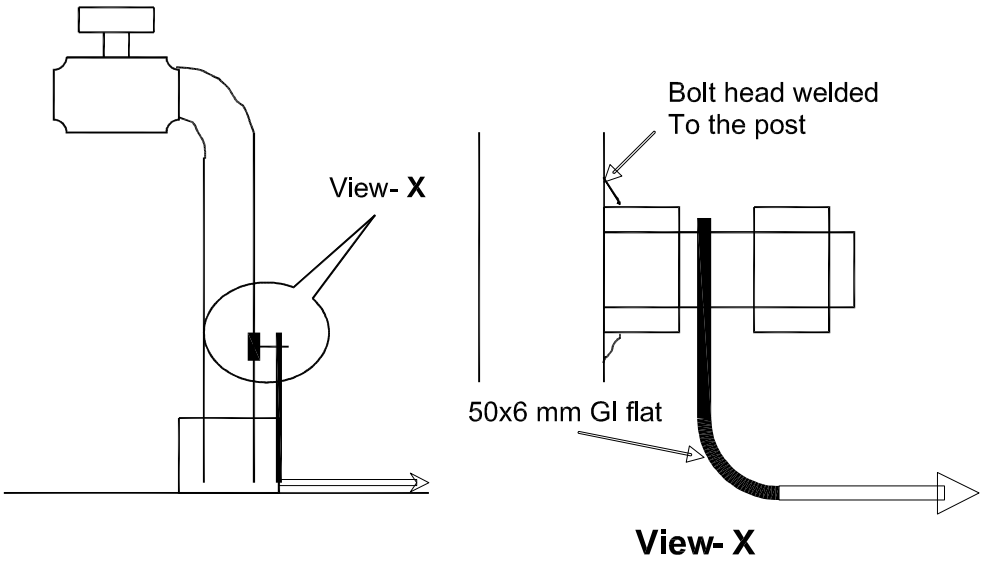

Fig.- Earthing of hydrant box / hose box

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POWER GRID CORPORATION OF INDIA LIMITED (A Government of India Enterprise) पावरग्रिड			
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TITLE:- STANDARD EARTHING DETAILS			
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CKD BY	PRPD BY	Date	SHEET # 28

<table>
<tr><td>4.</td><td>New Annexure-S2</td><td><u>Annexure S2</u> – Air Conditioning & Ventilation System for GIS Building</td></tr>
<tr><td>N.</td><td colspan="2">Section Switchyard Erection Rev 10</td></tr>
<tr><td>1.</td><td>New Clause No. 2.5</td><td>Transmission line side insulator string along with hardware for line termination shall be in the scope of substation contractor. The erection of same shall be done by associated TL contactor.</td></tr>
<tr><td>2.</td><td>Clause No. 9.4(j) & (k)</td><td>
<table>
<tr><th>S.No</th><th>Item</th><th>Size</th><th>Material</th></tr>
<tr><td>j)</td><td>Isolator MOM Box</td><td>50X6 mm GS flat & Flexible copper braid</td><td>Galvanised steel and copper braid</td></tr>
<tr><td>k)</td><td>Insulator Guy Arrangemen</td><td>75x12mm G.S. flat</td><td>Galvanised Steel</td></tr>
</table>
</td></tr>
<tr><td>3.</td><td>New Clause No. 9.5.8</td><td>For estimation of riser of new substation/switchyard, maximum spacing of Main Earthmat shall be considered as 30 M x 30 M, 24 M x 24 M, 16 M x 16 M & 12 M x 12 M for 765kV, 400kV, 220kV & 132kV switchyard respectively.

Actual spacing for main earthmat shall be finalized during detailed engineering based on soil resistivity data and payment shall be made as per actual executed quantity at site. However, no cost compensation shall be considered in case of actual spacing of main earthmat finalized during detailed engineering is less than that mentioned above.

For switchyard extensions, main earthmat spacing shall be considered same as that in the existing switchyard.</td></tr>
<tr><td>4.</td><td>Clause no 9.10.3</td><td>Auxiliary earthing mat comprising of minimum 32mm dia M.S. rods closely spaced (300 mm x 300 mm) conductors shall be provided at depth of 300mm from ground level below the operating handles of the M.O.M. Box of the isolators. M.O.M. boxes shall be directly connected to the auxiliary earthing mat. Flexible copper braid connection to be provided between MOM box and GI flat to take care of soil sagging. The size of auxiliary earthing mat shall be of 1500mmx1500mm size for 220kV and above voltage class isolators and 900mmx900mm size for 132kV and below voltage class isolators. Factory welded auxiliary earthmat is preferable.</td></tr>
<tr><td>5.</td><td>New Clause No. 10.2</td><td>Following type of conductor for Flexible or Rigid Bus bars/Switchyard Equipment Jumpers/Interconnections shall be provided subject to suitability of conductor as per specified/applicable current ratings:

<table>
<tr><th>Voltage Level</th><th>Conductor / Al .Tube Type</th></tr>
<tr><td>Voltage Level: 765kV</td><td>AAC Bull / 4.5’’ IPS Al. Tube</td></tr>
<tr><td>Voltage Level: 400kV</td><td>ACSR Bersimis / 4.5’’ IPS Al. Tube</td></tr>
<tr><td>Voltage Level: 220kV</td><td>ACSR Moose / 4.0’’ IPS Al. Tube</td></tr>
<tr><td>Voltage Level: 132kV</td><td>ACSR Moose / 3.0’’ IPS Al. Tube</td></tr>
</table>

For substation extension works, suitable clamps & connectors for interconnection with existing buses as per drawings shall be provided by the contractor under present scope.

Conductor type with higher current rating than that specified above shall also be acceptable without any additional price implication.
Note: For existing substation, existing conductor configuration may preferably be adopted in extn. S/s package.</td></tr>
</table>

6.	**New Clause no. 20.1**	**<u>Neutral formation for Transformer(s), DELTA formation and making connection arrangement to connect spare unit in place of any unit of the bank without physical shifting and Earthing Arrangement :</u>** For Spare Unit connection to form 3-ph bank of 765kV Class Transformers with isolator based switching arrangement without physical shifting of spare unit along with necessary Neutral Formation, Earthing Arrangement & Tertiary (DELTA) formation for 3-ph bank formation with 1-ph units shall be under present scope as per the details mentioned below: **i. <u>Neutral Formation including Neutral auxiliary bus and Earthing Arrangement</u>** The contractor shall connect the neutrals of three (3) 1-phase transformers by overhead connection using 3" IPS Al tube. The neutral formation shall be such that neutral winding of single-phase spare transformer can be disconnected or connected to the three phase banks. The connection from the neutral bushing to neutral bus shall be through 3" IPS Al tube and wherever flexible jumper needs to be provided, same shall be through twin conductor. All material like Bus post insulator, Aluminium tube, conductor, clamps & connectors, earthing materials, support structure, **foundation bolts,** hardware etc. required for neutral formation and connection with neutral CT and earthing of neutral shall be provided by contractor. **ii. <u>Tertiary Delta Formation including Tertiary auxiliary bus(Insulation level 52 kV) .</u>** The contractor shall connect 33kV tertiary of single-phase auto-transformers in DELTA configuration by overhead connection to operate in 3-Ph Bank. The Delta shall be formed by 3" IPS Al tube, which shall be insulated with heat shrinkage insulating sleeve of at least 52kV class and shall be supported by structure mounted bus post insulators at suitable intervals. Jumpers (twin conductors) wherever provided shall also be insulated using suitable insulation tape or sleeve at least 52kV class at site. The minimum phase to phase horizontal spacing for delta formation shall be 1.5meter. All associated materials like bus post insulators, Aluminium tube, conductor, clamps & connectors, support structures, **foundation bolts,** hardware, earthing materials etc. required for tertiary delta formation shall be provided by the contractor. **iii. <u>HV & IV Auxiliary Buses (Applicable for AIS Substation)</u>** Formation of HV & IV auxiliary buses for connection of transformer 3-Phase bank with 1-Phase Spare transformer unit is under the present scope of the bidder. All associated materials like Bus post insulators, Aluminium tube, conductors, clamps & connectors, insulator strings, hardware, earthing materials, support structures, **foundation bolts,** required for the above-mentioned arrangement shall be provided by the contractor.
7.	**New Clause no. 20.2**	**<u>Neutral formation for Reactor banks, connection to neutral grounding reactor through 132kV Surge arrester, connection to ground through neutral CTs and connection arrangement to connect spare reactor unit in place of any other units of the bank without physical shifting and Earthing Arrangement :</u>** For Spare Unit connection to 3-ph bank of 765kV Class Reactors with isolator based switching arrangement without physical shifting of spare unit along with necessary Neutral Formation, Earthing Arrangement for 3-ph bank formation with 1-ph units shall be under present scope as per the details mentioned below:

		i. <u>Neutral Formation including Neutral auxiliary bus and Earthing Arrangement</u> The contractor shall connect the neutrals of three (3) 1-phase reactors by overhead connection using 3" IPS Al tube. The neutral formation shall be such that neutral winding of single-phase spare reactor can be disconnected or connected to the three phase banks. Neutral Connections of spare unit shall be extended upto the other unit(s) by forming Neutral auxiliary bus. The connection from the neutral bushing to neutral bus shall be through 3" IPS Al tube and wherever flexible jumper needs to be provided, same shall be through twin conductor. All material like Bus post insulator, Aluminum tube, conductor, clamps & connectors, earthing materials, support structure, **foundation bolts,** hardware etc. required for neutral formation and connection with neutral CT and earthing of neutral shall be provided by contractor. Required Insulation level is 145 kV from individual reactor neutral to point of neutral formation. However after neutral formation, the insulation level is 36kV. Connection of each Line reactor bank formed under present scope to Neutral grounding reactor through 132kV Surge Arrester including NGR by passing arrangement is also under present scope. **ii.<u>HV Auxiliary Bus (Applicable for AIS Substation)</u>** Formation of HV auxiliary bus for connection of reactor 3-Phase bank with 1-Phase Spare reactor unit is under the present scope of the bidder. All associated materials like Bus post insulators, Aluminium tube, conductors, clamps & connectors, insulator strings, hardware, earthing materials, support structures, **foundation bolts,** required for the above-mentioned arrangement shall be provided by the contractor.
8.	**New Clause no. 20.3**	Supply & Laying of Power, Control Cables & Special Cables (if any) (including all cabling works for spare unit of transformer/reactor) along with accessories for power supply, alarm, trip, control & indication, status and monitoring signals & contacts made available at MB/CMB of Transformers/Reactors upto Control & Relay Panels and BCUs located in the Switchyard Panel Room/Control Room and successful integration of same with Station Control, Protection & SAS System is in the scope of the contractor.
9.	**New Clause no. 20.4**	3½Cx300 Sq. mm XLPE power cable for oil filtration units of reactors & transformers shall be provided. The cable shall be terminated at 250A receptacle near Reactor & Transformer in the switchyard. XLPE Power cables shall be looped in & out for 250A Power receptacles.
10.	**New Clause no. 20.5**	Neutral of spare transformer/reactor is to be connected to station grounding system through a jumper/copper flat. This shall be applicable for single phase transformer/reactor wherever spare unit have been provided.
11.	**New Clause no. 20.6**	Tertiary connections made for tertiary loading of LT Transformer shall be insulated using suitable insulation tape or sleeve of at least 52kV class at site
12.	**New Clause no. 20.7**	The earthing risers from terminal of Neutral Current Transformer (NCT) of bank of 1-Phase Transformer/Reactor (as applicable) shall be brought down for connection with pipe electrodes by providing suitable insulators mounted on NCT support structure (minimum 2 nos. per support). Necessary provisions on NCT support structure for mounting of insulator shall be provided. These

		insulators shall deemed to be included in corresponding Erection Hardware item for Transformer/Reactor bay (as applicable) of BPS
13.	**New Clause No. 21**	Connection arrangement of 765kV equipment's shall be done as per the conceptual drawing (Drawing No. C/ENGG/SS/CONCEPTUAL 765KV BAY CONNECTIONS, Rev-01) enclosed as **Annexure-S3** of this Section.
14.	**New Clause No. 22**	For connection to HV bushing of LT Transformer, insulated copper rod/strip of at least 75 sq.mm cross sectional area shall be used.
15.	New annexure	Refer **Annexure-S4** for SHORT CIRCUIT FORCES & SPACER SPAN FOR 765kV & 400kV GANTRY STRUCTURE
O.	**Section: Structure Rev 06**	
1.	**New Clause No. 3.2.4 Added**	POWERGRID will issue the fabrication drawings of the standard structures to the successful bidder. The contractor shall do the proto assembly of the structures as per the issued fabricated drawings. Employer may opt to witness such proto assembly. The bidder shall follow the fabrication drawing for preparing the proto assembly and do the minor adjustments, if necessary, without affecting the strength of the structure. In case of equipment support structure, the attachment of stool and fixing of MOM box etc. shall be taken care by the contractor as per the requirement of the equipment. The proto to be witnessed and Proto corrected drawings along with BOM shall be certified by the contractor. Certified drawings and BOM shall be submitted to POWERGRID for information only. The arrangement shall however not absolve the contractor from the responsibility of supply and erection of safe sound and durable structure.
2.	**New Clause no. 3.4**	Nuts, Bolts and washers for all non-standard structures shall be payable as per BPS.
P.	**Section Civil Works Rev 11A**	
1.	**New Clause No. 21.0**	The dewatering pump shall be Portable, Self Priming, Non clog, horizontal type monobloc pump. The Pump shall be driven by electric motor suitable for outdoor application with IP-55 degree of protection. Following are the major technical parameters for the pumps to be supplied as per BPS: (A) Pump Rating : 2 HP Flow Rate : 200-400 LPM Minimum Total Head : 12 Mtrs Voltage Range : 415 ± 10% Volts (Three Phase) (B) Pump Rating : 5 HP Flow Rate : 1000-1400 LPM Minimum Total Head : 10 Mtrs Voltage Range : 415 ± 10% Volts (Three Phase)
2.	**Clause 10.5.3 of Section-Civil works Rev 11A & Clause 2.8 (b) of Section-Structures Rev 06**	**Factor of safety for design of tower and equipment structures and foundations:** a. Factor of safety for design of tower, equipment structures shall be 1.5 under normal condition and 1.2 under short-circuit condition. b. Factor of safety for design of tower, equipment foundation shall be 1.5 in both normal and short circuit condition as per IS 456. c. Factor of safety for stability of tower, equipment foundation like overturning shall be 2 (without wind or seismic), 1.5 (with wind or seismic) for normal and short circuit condition as per IS 1904.
3.	**New Clause No. 22.0**	**Slope Protection Works & Retaining Walls:** Design & Drawings pertaining to slope protection works & retaining walls (if required) shall be developed by the contractor during detailed engineering for

		Employer's approval. The work shall be measured under respective line items of BPS.
4.	New Clause of Copy right in Civil Rev 11A & Structure Rev 06	a. The copyright in all drawings, documents and other materials containing data and information for such design(s) to be developed by the Contractor or through any third party under this Contract shall remain vested in the Employer for a period of 5 years from the date of Completion of the Contract. In case the Contractor intends to use these design(s) for any purpose other than for project(s) to be executed by POWERGRID prior to the period of 5 years as above, the Contractor shall obtain a written permission from POWERGRID to this effect. The permission shall be granted or otherwise by POWERGRID keeping in view the specifics of the case and POWERGRID shall be sole judge in this regard. In case any breach of the aforesaid provisions of copyright during the copyright retention period comes to the notice, POWERGRID shall take the action as deemed fit keeping inter-alia under the provisions of the Integrity Pact. b. The Contractor may also use previous structure designs and associated foundation designs meeting specification requirements, which have been designed by them for any other project of POWERGRID, having copyright retained thereof with POWERGRID, without any financial implication and without any written permission from POWERGRID as per para (a) above. c. In case the Contractor uses previously designed structure and associated foundation designs meeting specification requirements, developed by the Contractor for any other utility/developer, POWERGRID shall be free to use designs and reproduce all drawings, documents and other material for the purpose of the Contract including, if required, in its any other project and for operation and maintenance, without any financial implication. The contractor shall ensure to submit only those documents for which they hold copyright. d. Also, all the drawings indicated at (a) & (b) above shall carry the following statement and shall be displayed conspicuously on the drawing: "WARNING: THIS IS PROPRIETORY ITEM AND DESIGN RIGHT IS STRICTLY RESERVED WITH POWERGRID UNDER NO CIRCUMSTANCES THIS DRAWING SHALL BE USED BY ANYBODY WITHOUT PRIOR PERMISSION FROM POWERGRID IN WRITING"
~~**Q.**~~	~~**Section CRP Rev 09**~~	
~~**1.**~~	~~**New Para added under Clause No.5.1**~~	~~Requirement of Shrouding shall not be applicable to TB's where live parts are concealed.~~
~~**2.**~~	~~**New para added under Clause no.18.8**~~	~~Line Differential relays used as both Main –I & Main-II protection of a line, shall be of either different make & model or shall be on different hardware platform.~~
~~**3.**~~	~~**New para added under**~~	~~Directional Earth Fault Relay/Function provided shall have Carrier Aided scheme feature which shall be suitable for single phase auto re-closure schemes~~

SECTION: STRUCTURE

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SECTION: STRUCTURES

1.0 GENERAL

The scope of specification covers fabrication, proto-assembly, supply and erection of galvanised steel structures for towers, beams, lightning masts and equipment support structures. If specified in section – Project, design of steel structure shall also be in the scope of contractor. The structures shall be of pipe type or lattice type as per Bid Proposa Sheet. Lattice structures shall be fabricated from structural steel conforming to IS: 2062 (latest). All pipe structures shall be fabricated from GI pipe conforming to YST 22 or of higher grade as per IS 806.

Line diagrams of Towers, beams, Lightning masts, equipment support structures are enclosed with the tender document. The fabrication drawings along with BOMs for these structures shall be provided to the successful bidder after the award. However structure, which are to be designed at detailed engineering stage by the employer, only line diagram shall be provided by POWERGRID and fabrication drawing shall be prepared by the Contractor. Support structure for circuit breaker shall be designed by the Manufacturer. Any other structure necessary to suit the layout for a particular substation to complete the work in all respect shall be designed by the employer / contractor at detailed Engineering stage.

Equipment support structure standardization has been carried out by the employer with the provision of stool to facilitate interchangeability of equipments at a later stage. Stools shall be provided by the Contractor between the equipment and its support structure to match the bus bar height. The top of stool shall be connected to the equipment and the bottom of the stool shall be connected to the Base support structure.

The scope shall include supply and erection of all types of structures including bolts, nuts, washers, step bolts, inserts in concrete, gusset plates, equipment mounting bolts, structure earthing bolts, foundation bolts, spring washers, fixing plates and any other items as required to complete the job.

The connection of all structures to their foundations shall be with base plates and embedded anchor/foundation bolts. All steel structures including anchor/foundation bolts shall be fully galvanized. The weight of the zinc coating shall be at least 610 gm/sq.m. Zinc coating for costal areas, if defined in section – Project shall not be less than 900gm/sq.m

Suitable modification shall be carried out in the drawings of equipment support structures by the Contractor in order to suit fixation of accessories such as marshalling boxes, MOM boxes, Control Cabinets, Junction box,

surge counter, etc. in the standard structure fabrication drawings. Nothing extra shall be payable or recoverable from the contractor on account of modification in support structures.

2.0 DESIGN REQUIREMENTS FOR STRUCTURES (To be referred only for structures to be designed by the Contractor)

2.1 For design of steel structures loads such as dead loads, live loads, wind loads etc. shall be based on IS:875,Parts I to V.

2.2 For materials and permissible stresses IS: 802, Part-I, Section-2 shall be followed in general. However, additional requirements given in following paragraphs shall also be considered.

2.3 Minimum thickness of galvanized tower member shall be as follows:

Members	**Minimum thickness (mm)**
Leg members, Ground wire Peak members/Main members	5
Other members	4
Redundant members	4

Size and thickness of gusset plate, pack washer and pack plate shall be as per requirement.

2.4 Maximum slenderness ratios for leg members, other stressed members and redundant members for compression force shall be as per IS-802.

2.5 Minimum distance from hole center to edge shall be 1.5 x bolt diameter. Minimum distance between center to center of holes shall be 2.5 x bolt diameter.

2.6 All bolts shall be M16 or higher as per design requirement.

2.7 Step Bolts

In order to facilitate inspection and maintenance, the structures shall be provided with climbing devices. Each tower shall be provided with M16 step bolts 175mm long spaced not more than 450mm apart, staggered on faces on one leg extending from about 0.5 meters above plinth level to the top of the tower. The step bolt shall conform to IS: 10238.

2.8 **Design Criteria**

a) All structures shall be designed for the worst combination of dead loads, live loads, wind loads as per code IS:875, seismic forces as per code IS:1893, loads due to deviation of conductor, load due to unbalanced tension in conductor, torsional load due to unbalanced vertical and horizontal forces, erection loads, short circuit forces including "snatch" in the case of bundled conductors etc. Short circuit forces shall be calculated considering a fault level of 40 kA, 50kA, 63kA or as applicable. IEC-60865 may be followed for evaluation of short circuit forces.

b) Switchyard gantry structures shall be designed for the two conditions i.e. normal condition and short circuit condition. In both conditions the design of all structures shall be based on the assumption that stringing is done only on one side i.e. all the three (phase) conductors broken on the other side.
Factor of safety of 2.0 under normal conditions and 1.5 under short circuit condition shall be considered for the design of switchyard structures.

c) Vertical load of half the span of conductors/string and the earth wires on either side of the beam shall be taken into account for the purpose of design. Weight of man with tools shall be considered as 150 kgs. for the design of structures.

d) Terminal/line take off gantries shall be designed for a minimum conductor tension of 9 metric tonnes per phase for 765kV, 4 metric tonnes per phase for 400kV, 2 metric tonnes per phase for 220kV and 1 metric tonne per phase for 132 kV or as per requirements whichever is higher . The distance between terminal gantry and dead end tower shall be taken as 200 metres for 765/400/220kV and 100m for 132KV. The design of these terminal gantries shall also be checked considering +/- 30 deg deviation of conductor in both vertical and horizontal planes. For other gantries the structural layout requirements shall be adopted in design.

e) The beams shall be connected with towers/ columns by bolted joints.

f) All Pipe support structures used for supporting equipments shall be designed for the worst combination of dead loads, erection load. Wind load/seismic forces, short circuit forces and operating forces acting on the equipment and associated bus bars as per IS:806. The material specification shall be as per IS: 1161 read in conjunction with IS: 806.

g) If luminaries are proposed to be fixed on gantries, then the proper loading for the same shall be considered while designing. Also holes for fixing the brackets for luminaries should be provided wherever required.

h) Foundation bolts shall be designed for the loads for which the structures are designed.

i) Height of Lightning masts shall be as per approved structure layout and designed for diagonal wind condition. Lightning masts shall be provided with plateforms for mounting lighting fixtures and a structural steel ladder within its base up to the level of plateform. The ladder shall be provided with protection rings. The platforms shall also have protection railing. The details of lighting fixtures would be as per the approved drawings.

3.0 DESIGN DRAWINGS, BILL OF MATETRIALS AND DOCUMENTS

3.1 Structures, for which line diagram has already been provided along with tender documents, fabrication drawings (structure assembly drawing) along with Bill of Material shall be provided to the successful bidder after award based on which structures shall be supplied. Fabrication drawings issued to the contractor for any project shall be valid for other projects also if wind speed of the area is same. These drawings are also available on the POWERGRID web site and can be downloaded from the web site. Hard copies, if needed, can be obtained from employer. These drawings shall be good for fabrication and inspection of steel structures for any substation. Release for construction stamp for particular substation is not required. Replacing MS section with higher section or replacing MS section with HT section of same size due to non availability of particular section shall not require employer's approval and this can be done without any additional financial implication to the employer.

3.2 STRUCTURES DESIGNED DURING DETAILED ENGINEERING:

3.2.1 In case deisign of structure is to be done by employer, only line diagram of the structure shall be provided to the contractor and fabrication drawing shall be prepared by contractor based on line diagram and submitted for approval.

3.2.2 In case design of structure is covered in the scope of contract, the contractor shall submit design alongwith line diagram for approval and based on approved line diagram, fabrication drawing shall be prepared and submitted for employers'approval. The line diagram should indicate not only profile, but section, numbers and sizes of bolts and details of typical joints.

3.2.3 The fabrication drawings to be prepared and furnished by the Contractor shall be based on line diagram provided by employer or the design approved by the employer. These fabrication drawings shall indicate complete details of fabrication and erection including all erection splicing details and typical fabrication splicing details, lacing details, weld sizes and lengths. Bolt details and all customary details in accordance with standard structural engineering practice whether or not given by the employer. The fabrication drawings and bill of material based on fabrication drawing shall be submitted to the employer for approval. Approved bill of material prepared based on fabrication drawing shall be the basis for payment.

3.3 Such approval shall, however, not relieve the Contractor of his responsibility for the safety and durability of the structure and good connections and any loss or damage occurring due to defective fabrication, design or workmanship shall be borne by the Contractor.

4.0 FABRICATION AND ERECTION

4.1 The fabrication and erection works shall be carried out generally in accordance with IS 802. A reference however may be made to IS 800 in case of non-stipulation of some particular provisions in IS 802. All materials shall be completely shop fabricated and finished with proper connection material and erection marks for ready assembly in the field.

4.2 The component parts shall be assembled in such a manner that they are neither twisted nor otherwise damaged and shall be so prepared that the specified camber, if any, is provided. In order to minimize distortion in member the component parts shall be positioned by using the clamps, clips, dogs, jigs and other suitable means and fasteners (bolts and welds) shall be placed in a balanced pattern. If the individual components are to be bolted, paralleled and tapered drifts shall be used to align the part so that the bolts can be accurately positioned.

4.3 Sample towers, beams, lightning masts and equipment support structures may be trial assembled in fabrication shop in order to ensure fitment of various members and to avoid problems during erection.

4.4 The Contractor should arrange on his own all plant and equipment, welding set, tools and tackles, scaffolding, trestles equipments and all other accessories and ancillaries required for carrying out erection without causing any stresses in the members which may cause deformation and permanent damage. Minor modification, if any, required during erection shall be done at site with the approval of Engineer – in- charge.

5.0 BOLTING

i) Every bolt shall be provided with a washer under the nut so that no part of the threaded portion of the bolt is within the thickness of the parts bolted together.
ii) In case of fasteners, the galvanizing shall confirm to IS-1367(Part 13). The spring washer shall be electro galvanized as per Grade IV of IS-1573.

6.0 WELDING

The work shall be done as per approved fabrication drawings which shall clearly indicate various details of joints to be welded, type of weld, length and size of weld, Symbols for welding on erection and shop drawings shall be

according to IS:813. Welding shall be carried out in accordance with IS:816.

7.0 FOUNDATION BOLTS

7.1 Foundation bolts for the towers and equipment supporting structures shall be embedded in first stage concrete while the foundation is cast. The Contractor shall ensure the proper alignment of these bolts to match the holes in the base plate.

7.2 The Contractor shall be responsible for the correct alignment and leveling of all steel work on site to ensure that the towers/structures are plumb.

7.3 All foundation bolts for lattice structure, pipe structure are to be supplied by the Contractor.

7.4 All foundation bolts shall be provided with two no. standard nuts of class 5 confirming to IS:1363/1367/6639, one check nut of class 4 confirming to IS:1364, one anchore plate at the bottom of foundation bolt and one plain washer.

7.5 All foundation bolts shall conform to IS 5624, however, the material, shall be MS conforming to IS:2062/ SAE:1018.

8.0 STABILITY OF STRUCTURE

The Contractor shall be responsible for the stability of the structure at all stages of its erection at site and shall take all necessary measures by the additions of temporary bracings and guying to ensure adequate resistance to wind and also to loads due to erection equipment and their operations.

9.0 GROUTING

The method of grouting the column bases shall be subject to approval of employer and shall be such as to ensure a complete uniformity of contact over the whole area of the steel base plate. No additional payment for grouting shall be admissible.

10.0 GALVANISING

All structural steel works, equipment support structures and foundation bolts shall be galvanized after fabrication. The galvanization shall be done as per requirement of IS 4579. Purity of zinc to be used shall be 99.95% as per IS:209.

11.0 TOUCH-UP PAINTING

Minor defects in hot dip galvanized members shall be repaired by applying

zinc rich primer and two coats of enamel paint to the satisfaction the employer before erection.

12.0 INSPECTION BEFORE DISPATCH

Each part of the fabricated steel work shall be inspected as per approved quality plans and certified by the employer or his authorized representative as satisfactory before it is dispatched to the erection site. Such certification shall not relieve the Contractor of his responsibility regarding adequacy and completeness of fabrication.

13.0 TEST CERTIFICATE

Copies of all test certificates relating to material procured by the Contractor for the works shall be submitted during inspection.

14.0 SAFETY PRECAUTIONS

The Contractor shall strictly follow at all stages of fabrication, transportation and erection of steel structures, raw materials and other tools and tackles, the stipulations contained in Indian Standard Code for Safety during erection of structural steel work-IS:7205.

15.0 All tests mentioned in standard field quality plans shall have to be carried out and conformity of materials and workmanship shall be ascertained.

संदर्भ/Ref : CC-ENGG-TB202362-1002345-SC3510-ELECT-LAYOUT **Date :** 17/04/2025

From : Somiran Das
Senior GM

To : Bharat Heavy Electricals Limited
Plot No.-7, Sector-142 Noida 201305
201305

Cc : CGM PROJECTS, SR-II

Subject : Establishment of 765/400/22kV KOPPAL-II (New) Pooling Station including 400kV Class Bus Reactors
LOA Ref : CC/T/W-AIS/DOM/A10/23/11023/NOA-1/24-103435/01 & NOA-2/24-103435/02 Dated 12/03/2024

Please find enclosed following drawings/ documents for necessary action at your end.

Vendor Drg. No. :		TB-0-425-316-002_R4
Orgn. Drg. No.	:	TB202362-1002345-SC3510-ELECT-LAYOUT
Revision No.	:	04
Drg. Title	:	KOPPAL II NEW S/S- ELECTRICAL LAYOUT PLAN & SECTION
App. Category	:	CAT-II
Release Date	:	17/04/2025

Scan to verfiy

Comments : Comments marked on the document

अनुमोदित श्रेणी/App. Category:

I. फेब्रिकेशन/निर्माण/टाइप टेस्टिंग हेतु जारी।
Approved/released for fabrication/construction.

II. फेब्रिकेशन/निर्माण/टाइप टेस्टिंग हेतु अनुमोदित/जारी बशर्ते दिए गए टिप्पणियाँ एवं आशोधनों की सम्मिलित किया जाये। कृपया रिवाइजड दस्तावेज अनुमोदनार्थ प्रस्तुत करें।
Approved/released for fabrication/ construction subject to incorporation of comments and modification as noted. Revised drawing required for approval.

III. टिप्पणियाँ सम्मिलित करने के उपरांत दस्तावेज को अनुमोदनार्थ प्रस्तुत करें।
To be resubmitted for approval after incorporating the comments.

IV. सूचनार्थ एवं रिकार्ड हेतु।
For information and record.

CATREL/ REL-CON निर्माण हेतु जारी।
Released for construction.

नोट/Note:

1. Approval/Comments conveyed herein neither relieve the contractor of his contractual obligations and his responsibilities, weights, quantities, design details assemble fits, performance particulars and conformity of the supplies with the Indian Statutory Laws as may be applicable, nor does it limits the purchaser's right under the contract.
2. The approval conveyed vide this letter does not cover the approval of make for sub-vendor items.

INVENTORY NO	SIGN. AND DATE	REF. DRG. NO.	COMPUTER DRG. PATH NAME :

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DRG. NO. TB-0-425-316-002

NOTE:
220 KV & 765 KV LINE SIDE EQUIPMENT ON HOLD FOR FINALIZATION OF DEAD END COORDINATES

1. DEAD END TOWER ERECTION AND OUTGOING STRINGING OF LINE CONDUCTOR & SHIELD WIRE ARE NOT IN BHEL SCOPE BUT CONNECTION OF EQUIPMENT TOWARDS LINE SIDE SHALL BE DONE BY BHEL. SUPPLY OF TENSION INSULATOR STRING ON LINE SIDE OF TAKE OFF GANTRY IS IN BHEL SCOPE OF WORK INCLUDING TENSION CLAMP FOR EARTHWIRE.
2. SUPPLY ERECTION, TESTING, COMMISSIONING OF 765KV REACTOR & 400KV TRAFO INCLUDING (OLTC) & (NGR, 120kV LA), IS NOT IN BHEL SCOPE. HOWEVER, FORMATION OF HV, LV, TERTIARY, NEUTRAL & AUXILIARY BUSES ALONG WITH BPI & ITS STRUCTURE EARTHING AND ASSOCIATED CIVIL WORKS IS COVERED IN SCOPE OF WORK AS PER TS SECTION PROJECT.
3. FIRE RESISTANT WALL BETWEEN 765kv TRANSFORMER UNITS AND 765kV REACTORS UNITS ARE IN BHEL SCOPE.
4. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED
5. LOCATION OF WT SHOWN IS INDICATIVE ONLY. EXACT LOCATION SHALL BE FINALIZED DURING ERECTION COMMISSIONING STAGE BASED ON LINE PARAMETERS. FOUNDATION FOR WAVE TRAP SHALL BE CONSTRUCTED FOR ALL THREE PHASES.
6. DETAILS OF BMK, CTJB, CVT JUNCTION BOX & SWITCHYARD PANEL ROOM (SPR) LOCATION SHALL BE SHOWN IN CABLE TRENCH LAYOUT DRAWING.
7. PLINTH HEIGHT OF FOUNDATION WILL BE MIN. 300MM FROM FINISHED GROUND LEVEL (F.G.L.).
8. LOCATION OF LT TRANSFORMER AND 72.5KV EQUIPMENTS SHALL BE DECIDED IN CONSULTATION WITH POWERGRID.
9. LOCATION OF LINE SIDE EQUIPMENT SHOWN HERE IS TENTATIVE. THE LOCATION OF SAME SHALL BE FINALIZED AFTER FINALISATION OF DEAD END TOWERS.'
10. 765/400KV TRANSFORMER ARRANGEMENT LAYOUT WITH DELTA & NEUTRAL FORMATION ALONG WITH 72.5kV TERTIARY LOADING ARRANGEMENT LAYOUT WILL BE SUBMITTED SEPARATELY FOR APPROVAL. 765KV REACTOR ARRANGEMENT LAYOUT WITH AUXILIARY BUS WILL BE SUBMITTED SEPARATELY FOR APPROVAL.
11. LA PRESSURE RELIEF VALVE SHALL NOT BE TOWARDS TRANSFORMER SIDE/ANY EQUIPMENT KEPT NEAR LIGHTNING ARRESTER
12. LOCATION OF TEMPORARY OPEN/CLOSE STORE, LBOUR HUT, SEB FEEDER CORRIDOR ETC HAS SHOWN AS TENTATIVE AND SHALL BE DECIDED AS PER CONSULATION WITH PG SITE I/C.
13. DEAD END TOWER LOCATION IS INDICATIVE. THE SAME SHALL BE CONFIRMED BY POWERGRID.
14. 765/400/220KV LINE SIDE CONDUCTOR TO BE INFORMED BY POWERGRID.
15. ALL THE ROAD SHOWN IN THE LAYOUT ARE OF 3.75M WIDTH.
16. LINE SIDE EQUIPMENT LOCATION TO BE FINALISED AFTER CONFIRMATION OF DEADEND TOWER LOCATION.
17. LINE CONDUCTOR TO BE INFORMED BY POWERGRID FOR ALL PRESENT SCOPE LINE CONNECTIONS (FOR FINALISING THE CLAMP & CONNECTORS)

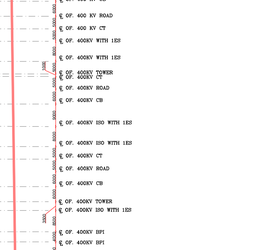
LEGENDS:–

- UNDER PACKAGE–SS09T
- LEVELLING LINE
- BOUNDARY LINE
- FUTURE SCOPE
- FENCE

KOPPAL PS BOUNDARY CORDINATES (DMS)

Sr No.	Point	Latitude	Longitude	E(X)	N(Y)
1	P1	15°34'3.63"N	76° 7'2.74"E	619815.5900	1721428.540
2	P2	15°34'1.47"N	76° 7'2.58"E	619811.1600	1721362.140
3	P3	15°33'56.76"N	76° 7'0.58"E	619752.3500	1721217.120
4	P3a	15°33'56.47"N	76° 7'1.73"E	619786.5200	1721208.470
5	P4	15°33'49.15"N	76° 7'0.48"E	619750.5900	1720983.240
6	P5	15°33'45.66"N	76° 6'59.58"E	619724.3400	1720875.830
7	P6	15°33'45.37"N	76° 7'1.91"E	619793.8000	1720867.300
8	P7	15°33'42.00"N	76° 7'1.37"E	619778.2500	1720763.670
9	P8	15°33'41.78"N	76° 7'3.39"E	619838.4600	1720757.240
10	P9	15°33'40.31"N	76° 7'3.16"E	619831.8400	1720711.960
11	P10	15°33'37.87"N	76° 7'2.79"E	619821.2200	1720636.890
12	P11	15°33'29.47"N	76° 7'1.53"E	619785.0300	1720378.600
13	P12	15°33'28.85"N	76° 7'4.92"E	619886.1200	1720360.100
14	P13	15°33'26.74"N	76° 7'5.06"E	619890.6300	1720295.290
15	P14	15°33'24.07"N	76° 7'19.49"E	620320.9200	1720215.460
16	P15	15°33'26.01"N	76° 7'19.87"E	620331.9200	1720275.150
17	P16	15°33'29.03"N	76° 7'20.39"E	620346.9300	1720368.050
18	P17	15°33'38.86"N	76° 7'22.15"E	620397.7700	1720670.340
19	P18	15°33'42.39"N	76° 7'22.98"E	620421.9200	1720779.000
20	P19	15°33'46.04"N	76° 7'23.97"E	620450.8200	1720891.330
21	P20	15°33'52.31"N	76° 7'25.26"E	620488.2400	1721084.240
22	P21	15°33'58.78"N	76° 7'26.89"E	620505.9500	1721283.030
23	P22	15°34'0.42"N	76° 7'26.14"E	620513.1600	1721333.520

TYP. 220KV TANDEM ISO.
(APPLICABLE FOR ALL TANDEM ISOLATORS,TOWERS AT ALL 4 CORNERS IS INDICATIVE TO SHOW CLEARANCE FOR RESPECTIVE AREA AS APPLICABLE)



REV.	DATE	ALTERED	CHECKED	APPROVED
ZONE				
04	15.04.25	AS	RD	SKS
ZONE	LAYOUT UPDATED AS PER POWERGRID COMMENTS			
03	1.04.25	AS	RD	SKS
ZONE	LAYOUT UPDATED AS PER POWERGRID COMMENTS			

NOA NO. : CC/TW-AIS/DOM/A10/23/11023/NOA-1/24-10343S/01 dated 12.03.2024

ADDITIONAL INFORMATION
W.O.No.

STATUS OF DRAWING

DISTRIBUTION OF PRINTS

NAME OF CUSTOMER: Koppal II Gadag II Transmission Limited
NAME OF CLIENT: POWERGRID CORPORATION OF INDIA LIMITED
NAME OF PROJECT: Substation Package SS-06T for Establishment of 765/400/220 KV Koppal-II (New) Pooling Station (AIS type) including 125MVAR, 420kV, 3 phase Bus Reactors under "Transmission Scheme for integration of Renewable Energy Zone (Phase-II) in Koppal-II (Phase-A) and Gadag-II (Phase-A) in Karnataka" through Tariff Based Competitive Bidding (TBCB)

BHARAT HEAVY ELECTRICALS LTD.
TRANSMISSION BUSINESS GROUP

	नाम /NAME	हस्ता./SIGN.	दि./DATE
DRAWN	AS	-SGD-	16.11.24
CHECKED	RD	-SGD-	16.11.24
APPROVED	SKS	-SGD-	16.11.24

POWERGRID DRAWING NO. TB202362-1002345-SC3510-ELECT-LAYOUT

KOPPAL II NEW S/S- ELECTRICAL LAYOUT PLAN & SECTION

TB-0-425-316-002 | 04

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM.)

TB202362-1002345-SC3510-ELECT-LAYOUT/04/CAT-II/Page: 2 of

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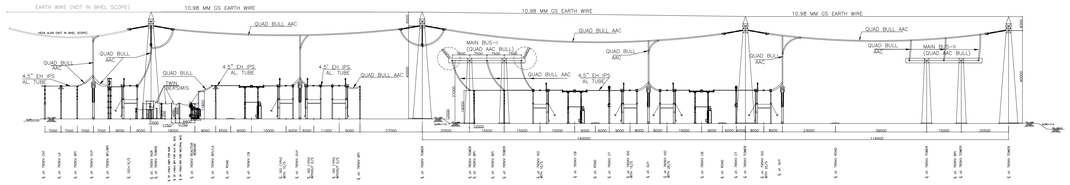
COMPUTER DRG. PATH NAME :

REF. DRG. NO.

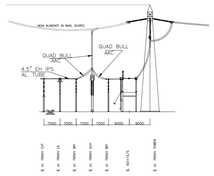
SIGN. AND DATE

INVENTORY NO

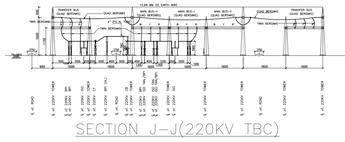
DRG. NO. TB-0-425-316-002



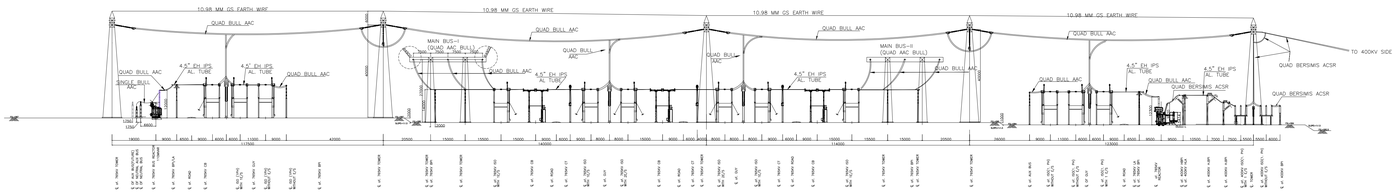
SECTION A–A (765KV–NARENDRA LINE(WITH SW LR)–TIE–FUTURE LINE)



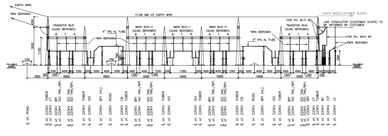
765KV LINE WITHOUT WAVE TRAP (TYPICAL SECTION)



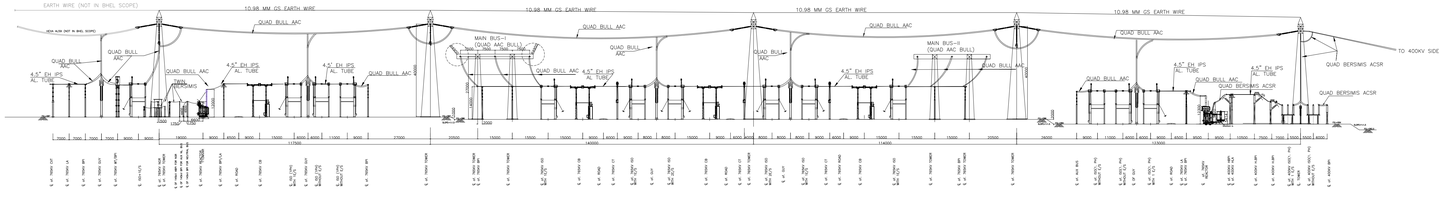
SECTION J–J(220KV TBC)



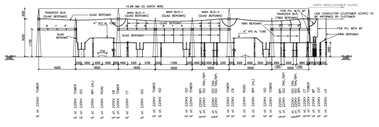
SECTION B–B (765KV–BUS REACTOR–TIE–ICT#1)



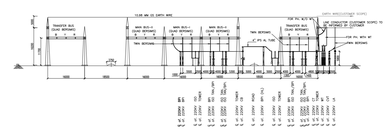
SECTION K–K (220KV ICT–LINE)



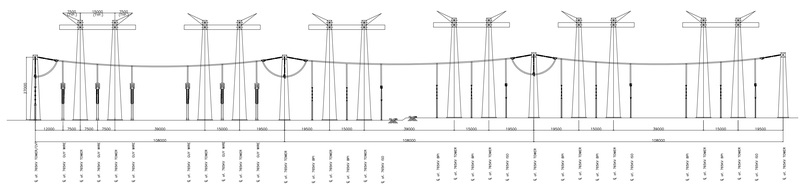
SECTION C–C (765KV–RAICHUR LINE (WITH SW LR)–TIE–ICT#3)



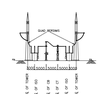
SECTION L–L (220KV B/C–LINE)



SECTION M–M (220KV ICT(F)–LINE)

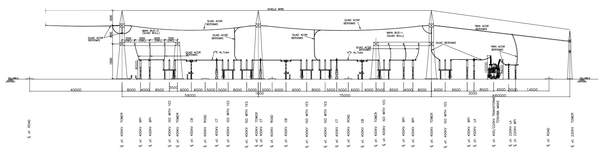


SECTION D–D(765KV MAIN BUS–I)

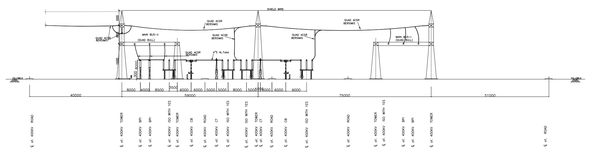


SECTION N–N(220KV B/S)

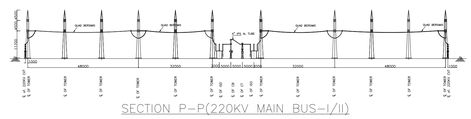
SEC–O (220KV BUS CVT SECTION)



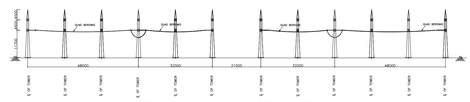
SECTION E–E (765/400KV ICT#1–TIE–400/220KV ICT#1)



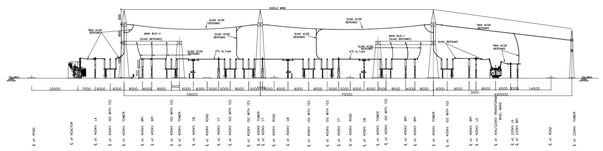
SECTION G–G (765/400KV ICT#3–TIE–400/220KV ICT#5(F))



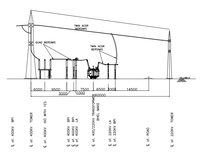
SECTION P–P(220KV MAIN BUS–I/II)



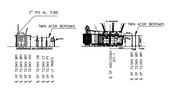
SECTION Q–Q(220KV TRANSFER BUS–I/II)



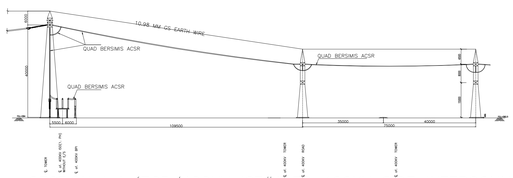
SECTION F–F (400KV BUS REACTOR–TIE–400/220KV ICT#3)



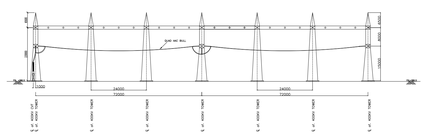
SECTION F1–F1 (400/220kV ICT#4)



LT TRANSFORMER–2 CONNECTION



SECTION I–I (765/400KV ICT#1 TO 400KV SIDE INTERCONNECTION)



SECTION H–H(400KV MAIN BUS)

REV.	DATE	ALTERED / CHECKED / APPROVED
ZONE		

REV.	DATE	ALTERED / CHECKED / APPROVED
ZONE		

REV.	DATE	ALTERED / CHECKED / APPROVED
04	15.04.25	AS / RD / SKS
ZONE		

REV.	DATE	ALTERED / CHECKED / APPROVED
03	01.04.25	AS / RD / SKS
ZONE		

NOA NO. : CC/T/W-AIS/DOM/A10/23/11023/NOA-1/24-103435/01 dated 12.03.2024

ADDITIONAL INFORMATION W.O.No.

STATUS OF DRAWING

DISTRIBUTION OF PRINTS

NAME OF CUSTOMER: Koppal II Gadag II Transmission Limited
NAME OF CLIENT: POWERGRID CORPORATION OF INDIA LIMITED
NAME OF PROJECT: Substation Package SS-06T for Establishment of 765/400/220 kV Koppal-II (New) Pooling Station (AIS type) including 125MVAR, 420kV, 3 phase Bus Reactors under "Transmission Scheme for integration of Renewable Energy Zone (Phase-II) in Koppal-II (Phase-A) and Gadag-II (Phase-A) in Karnataka" through Tariff Based Competitive Bidding (TBCB)

BHEL — भारत हेवी इलेक्ट्रिकल्स लिमिटेड
BHARAT HEAVY ELECTRICALS LTD.
TRANSMISSION BUSINESS GROUP

	नाम /NAME	हस्ता./SIGN.	दि./DATE
बनाया DRAWN	AS	–SGD–	16.11.24
जांचा CHECKED	RD	–SGD–	16.11.24
स्वीकृत APPROVED	SKS	–SGD–	16.11.24

विभाग DEPT. | कोड CODE | अनुपात / SCALE | कार्ड कोड CARD CODE

POWERGRID DRAWING NO.: TB202362–1002345–SC3510–ELECT–LAYOUT

शीर्षक/TITLE: KOPPAL II NEW S/S- ELECTRICAL LAYOUT PLAN & SECTION

ड्राईंग क्र./DRAWING NO.: TB–0–425–316–002 | पुनः/REV.: 04

पृष्ठ क्र./SHEET No. 2 | अगला पृष्ठ /NEXT SHEET 3

DRG. NO. TB-0-425-316-002

BILL OF QTY. FOR 765kV MAIN EQUIPMENTS:

SL.NO.	DESCRIPTION	RATING	S. C. RATING	KOPPAL–SS06T QTY. (NO.) As Per NOA	KOPPAL–SS06T QTY. (NO.) As Per LAYOUT	KOPPAL–SS09T QTY. (NO.) As Per NOA	KOPPAL–SS09T QTY. (NO.) As Per LAYOUT	SYMBOL	SCOPE OF SUPPLY	LEGEND	MAKE
1	500 MVA, (1–PH) AUTOTRANSFORMER	765/400/33kV	50 KA FOR 1 S.	–	7	–	6		POWERGRID	T	BHEL
2	80MVAR LINE REACTOR (1–PH)	765KV	50 KA FOR 1 S.	–	7	–	–		POWERGRID	LR	BHEL
3	110MVAR LINE REACTOR (1–PH)	765KV	50 KA FOR 1 S.	–	–	–	6		POWERGRID	LR	BHEL
4	110MVAR BUS REACTOR (1–PH)	765KV	50 KA FOR 1 S.	–	7	–	0		POWERGRID	BR	BHEL
5	NGR(600/500ohm) FOR REACTOR	145KV	NA	–	2	–	2		POWERGRID	NGR	BHEL
6	SF6 CIRCUIT BREAKER WITH CR, WITH CSD (3–PH)	3150A	50 KA FOR 1 S.	2	0	2	2		BHEL	52	GE
7	SF6 CIRCUIT BREAKER WITH CR,WITHOUT CSD (3–PH)	3150A	50 KA FOR 1 S.	4	4	2	2		BHEL	52	GE
8	SF6 CIRCUIT BREAKER WITHOUT CR,WITH CSD (3–PH)	3150A	50 KA FOR 1 S.	4	6	2	2		BHEL	52	GE
9	SF6 CIRCUIT BREAKER WITHOUT CR,WITH CSD (3–PH) FOR 1PH SWITCHING	3150A	50 KA FOR 1 S.	2	2	2	2		BHEL	52	GE
10	SF6 CIRCUIT BREAKER WITHOUT CR,WITH CSD (1–PH) PROVISION	3150A	50 KA FOR 1 S.	2	2	NA	NA		BHEL	52	GE
11	ISOLATOR WITH ONE E/S (3 PH) VERTICAL KNEE TYPE	3150A	50 KA FOR 1 S.	12	12	10	10		BHEL	89/89E	S&S
12	ISOLATOR WITH TWO E/S (3 PH) VERTICAL KNEE TYPE	3150A	50 KA FOR 1 S.	10	10	4	4		BHEL	89/89E1 89E2	S&S
13	ISOLATOR WITH ONE E/S (1 PH) VERTICAL KNEE TYPE	3150A	50 KA FOR 1 S.	21	21	12	12		BHEL	89/89E1	S&S
14	ISOLATOR WITHOUT E/S (1 PH.) VERTICAL KNEE TYPE	3150A	50 KA FOR 1 S.	33	33	24	24		BHEL	89	S&S
15	CURRENT TRANSFORMER (1 PH.) WITH 120% EXTENDED CURRENT RATING.	3000A	50 KA FOR 1 S.	30	30	18	18		BHEL	CT	GE
16	CVT (1 PH.)	8800pF	NA	12	12	6	6		BHEL	CVT	BHEL
17	SURGE ARRESTER (1 PH.)	624 kV	NA	27	27	18	18		BHEL	LA	LAMCO
18	WAVE TRAP (1 PH.) PEDESTAL TYPE.	1mH, 3150A	50 KA FOR 1 S.	04	04	04	04		BHEL	WT	GE
19	765KV POST INSULATOR–8KN	765KV	–	57	44	40	32		BHEL	BPI	MODERN
20	GUY INSULATOR	765KV	–	LOT	48	LOT	30		BHEL	–	BHEL

BILL OF QTY. FOR 400kV MAIN EQUIPMENTS (BHEL'S SCOPE):

SL.NO.	DESCRIPTION	RATING	S. C. RATING	SYMBOL	KOPPAL–SS06T NOA QTY. (NO.)	KOPPAL–SS06T LAYOUT QTY. (NO.)	KOPPAL–SS09T NOA QTY. (NO.)	KOPPAL–SS09T LAYOUT QTY. (NO.)	LEGEND	MAKE
1	125MVAR BUS REACTOR (3–PH)	420 kV	63 KA FOR 1 S.		2	2	NA	NA	BR	BHEL
2	SF6 CIRCUIT BREAKER WITHOUT CR WITH CSD (3–PH)	3150A	63 KA FOR 1 S.		8	8	4	4	52	CG
3	SF6 CIRCUIT BREAKER WITHOUT CR,WITHOUT CSD (3–PH)	3150A	63 KA FOR 1 S.		2	2	2	2	52	CG
4	ISOLATOR WITH ONE E/S (3 PH) DOUBLE BREAK TYPE	3150A	63 KA FOR 1 S.		22	22	14	14	89/89E	ELEKTROLITE
5	ISOLATOR WITH TWO E/S (3 PH) DOUBLE BREAK TYPE	3150A	63 KA FOR 1 S.		2	2	NA	NA	89/89E1 89/89E2	ELEKTROLITE
6	ISOLATOR WITH ONE E/S (1 PH) DOUBLE BREAK TYPE	3150A	63 KA FOR 1 S.		7	7	6	6	89/89E	ELEKTROLITE
7	ISOLATOR WITHOUT E/S (1 PH) DOUBLE BREAK TYPE	3150A	63 KA FOR 1 S.		5	5	6	6	89	ELEKTROLITE
8	CURRENT TRANSFORMER (1 PH.) WITH 120% EXTENDED CURRENT RATING.	3000A	63 KA FOR 1 S.		30	30	18	18	CT	BHEL
9	CVT (1 PH.)	4400pF	NA		6	6	NA	NA	CVT	BHEL
10	SURGE ARRESTER (1PH)–LA	336 kV	NA		19	12	12	6	LA	CG
11	SURGE ARRESTER (1PH)–HLA	336 kV	NA			7		6	LA	CG
12	400KV POST INSULATOR–8KN (8000MM HIGH)	400 KV	NA		35	18	30	17	BPI	BHEL
13	400KV POST INSULATOR–8KN (9500MM HIGH)	400 KV	NA			6		6	BPI	BHEL
14	400KV POST INSULATOR–8KN (12500MM HIGH)	400 KV	NA			12		12	HBPI	BHEL
15	400KV GUY INSULATOR	400 KV	NA		–	6	–	6	–	BHEL

BILL OF QUANTITY FOR 220kV EQUIPMENTS (BHEL SCOPE)

ITEM CODE	DESCRIPTION	SYMBOL	KOPPAL–SS06T NOA QTY. (NOS.)	KOPPAL–SS06T LAYOUT QTY. (NOS.)	KOPPAL–SS09T NOA QTY. (NOS.)	KOPPAL–SS09T LAYOUT QTY. (NOS.)	LEGEND	MAKE
1	245KV, 1600A, 50kA/1s CIRCUIT BREAKER (3–Ph)		7	7	7	7	52	CG
2	245KV, 3150A, 50kA/1s CIRCUIT BREAKER (3–Ph)		01	01	01	01	52	CG
3	245KV, 1600A, 50kA/1s HDB ISOLATOR WITH 2E/S (3–Ph)		7	7	7	7	89/89E1 /89E2	ELEKTROLITE
4	245KV, 1600A, 50kA/1s HDB ISOLATOR WITH 1E/S (3–Ph)		7	7	7	7	89/89E1	ELEKTROLITE
5	245KV, 1600A, 50kA/1s HDB TANDEM ISOLATOR WITHOUT E/S (3–Ph)		13	13	13	13	89	ELEKTROLITE
6	245KV, 3150A, 50kA/1s HDB ISOLATOR WITH 2E/S (3–Ph)		2	2	2	2	89/89E1 /89E2	ELEKTROLITE
7	245KV, 3150A, 50kA/1s HDB ISOLATOR WITH 1E/S (3–Ph)		NA	NA	4	4	89/89E1	ELEKTROLITE
8	245KV, 1600A (120%), 50kA/1s CURRENT TRANSFORMER (1–Ph)		21	21	21	21	CT	BHEL
9	245KV, 2500A (120%), 50kA/1s CURRENT TRANSFORMER (1–Ph)		03	03	09	09	CT	BHEL
10	245KV CAPACITIVE VOLTAGE TRANSFORMER (4400 pF) (1–Ph)		18	18	18	18	CVT	BHEL
11	216KV SURGE ARRESTER (1–Ph)		18	18	18	18	LA	CG
12	220KV, 1600A, 0.5mH, 50kA/1s LINE TRAP (1–Ph)		08	08	04	04	WT	GE
13	220KV POST INSULATOR–8KN		90	52	75	56	BPI	BHEL
14	220KV POST INSULATOR–8KN–HIGH LEVEL(HL)			24		24	BPI	BHEL
15	220KV POST INSULATOR–8KN–FOR WAVE TRAP		NA	24#	12	12	BPI	BHEL

220KV BPI FOR WAVE TRAP IS ADDITIONAL SCOPE SUBJECT TO COMMERCIAL SETTLEMENT.

SUSPENSION MOUNTING OF WAVE TRAP WAS ENVISAGED UNDER SS06T PKG

765KV STRING INSULATOR

Sl.No.	DESCRIPTION	SYMBOL	KOPPAL–SS06T NOA QTY. (NO.)	KOPPAL–SS06T LAYOUT QTY. (NO.)	KOPPAL–SS09T NOA QTY. (NO.)	KOPPAL–SS09T LAYOUT QTY. (NO.)
1	765KV DOUBLE TENSION STRING INSULATOR & HARDWARE WITH TURN BUCKLE FOR QUAD BULL CONDUCTOR		54	54	30	30
2	765KV DOUBLE TENSION STRING INSULATOR & HARDWARE WITHOUT TURN BUCKLE FOR QUAD BULL CONDUCTOR		54	54	30	30
3	765KV SUSPENSION STRING(V–TYPE) INSULATOR & HARDWARE DROP TYPE FOR QUAD BULL CONDUCTOR		12	12	6	6
4	765KV SUSPENSION STRING(V–TYPE) INSULATOR & HARDWARE THROUGH TYPE FOR QUAD BULL CONDUCTOR		24	24	18	18
5	765KV DOUBLE TENSION STRING INSULATOR & HARDWARE WITH TURN BUCKLE FOR HEXA CONDUCTOR		6	6	6	6

400KV STRING INSULATOR

Sl.No.	DESCRIPTION	SYMBOL	KOPPAL–SS06T NOA QTY. (NO.)	KOPPAL–SS06T LAYOUT QTY. (NO.)	KOPPAL–SS09T NOA QTY. (NO.)	KOPPAL–SS09T LAYOUT QTY. (NO.)
1	400KV DOUBLE TENSION STRING INSULATOR & HARDWARE WITH TURN BUCKLE FOR QUAD CONDUCTOR		54	48	30	24
2	400KV DOUBLE TENSION STRING INSULATOR & HARDWARE WITH TURN BUCKLE FOR QUAD CONDUCTOR		54	48	30	24
3	400KV SINGLE SUSPENSION STRING INSULATOR & HARDWARE DROP TYPE FOR QUAD CONDUCTOR		24	24	12	12
4	400KV SINGLE SUSPENSION STRING INSULATOR & HARDWARE THROUGH TYPE FOR QUAD CONDUCTOR		24	18	12	12

220KV STRING INSULATOR

Sl.No.	DESCRIPTION	SYMBOL	KOPPAL–SS06T NOA QTY. (NO.)	KOPPAL–SS06T LAYOUT QTY. (NO.)	KOPPAL–SS09T NOA QTY. (NO.)	KOPPAL–SS09T LAYOUT QTY. (NO.)
1	220KV DOUBLE TENSION STRING INSULATOR & HARDWARE WITH TURN BUCKLE FOR QUAD CONDUCTOR		27	48	24	48
2	220KV DOUBLE TENSION STRING INSULATOR & HARDWARE WITHOUT TURN BUCKLE FOR QUAD CONDUCTOR		27	48	24	48
3	220KV DOUBLE TENSION STRING INSULATOR & HARDWARE WITH TURN BUCKLE FOR TWIN CONDUCTOR		39	18	18	18
4	220KV DOUBLE TENSION STRING INSULATOR & HARDWARE WITHOUT TURN BUCKLE FOR TWIN CONDUCTOR		27	6	18	6
5	220KV SINGLE SUSPENSION STRING INSULATOR & HARDWARE DROP TYPE FOR QUAD CONDUCTOR		NA	0	9	12
6	220KV SINGLE SUSPENSION STRING INSULATOR & HARDWARE DROP TYPE FOR TWIN CONDUCTOR		24	24	21	18
7	220KV SINGLE SUSPENSION STRING INSULATOR & HARDWARE THROUGH TYPE FOR TWIN CONDUCTOR		12	0	NA	0
8	220KV SINGLE SUSPENSION STRING INSULATOR & HARDWARE DROP TYPE FOR SINGLE CONDUCTOR		NA	0	9	0

CLEARANCE TABLE AS PER POWERGRID SPECIFICATION:–

Sl.No.	DESCRIPTION	765kV SYSTEM	400kV SYSTEM	220kV SYSTEM	66kV SYSTEM
1	PHASE TO PHASE FOR CONDUCTOR–CONDUCTOR CONFIGURATION FOR ROD–CONDUCTOR CONFIGURATION	7600mm 9400mm	4000mm 4200mm	2100mm 2100mm	750mm 750mm
2	PHASE TO EARTH FOR CONDUCTOR–CONDUCTOR STRUCTURE FOR ROD–CONDUCTOR CONFIGURATION	4900mm 6400mm	3500mm 3500mm	2100mm 2100mm	630mm 630mm
3	SECTIONAL CLEARANCE	10300mm	6500mm	5000mm	3100mm
4	VERTICAL DISTANCE BETWEEN LOWEST PART OF INSULATOR TO PLINTH	2550mm	2550mm	2550mm	2550mm

CONDUCTOR & STRINGING DETAILS –765kV

SL.NO.	DESCRIPTION	LEVEL FROM PLINTH	SUB–CONDUCTOR	TENSION INSULATOR STRING/PHASE
1.	MAIN BUS–I & II	(AT 27M HEIGHT)	QUAD AAC BULL CONDUCTOR WITH 450MM SUB–CONDUCTOR SPACING	DOUBLE TENSION 210 kN COMPOSITE LONG ROD INSULATOR
2.	JACKBUS	(AT 40M HEIGHT)	QUAD AAC BULL CONDUCTOR WITH 450MM SUB–CONDUCTOR SPACING	DOUBLE TENSION 210 kN COMPOSITE LONG ROD INSULATOR
3.	DROPPERS/JUMPERING	–	QUAD AAC BULL CONDUCTOR WITH 450MM SUB–CONDUCTOR SPACING	SINGLE SUSPENSION 210 kN COMPOSITE LONG ROD INSULATOR
4.	EQUIPMENT INTERCONNECTION	(AT 14M HEIGHT)	4.5" IPS AL. TUBE (112mm OD)/QUAD AAC BULL CONDUCTOR WITH 450MM SPACING	
5.	EARTHWIRE	(AT 43M HEIGHT)	7/3.66mm GI WIRE (10.98mm DIA)	
6.	INTERCONNECTION BETWEEN 765/400kV TRAFO TO 400kV SUB–STATION		QUAD BERSIMIS ACSR CONDUCTOR WITH 450MM SUB–CONDUCTOR SPACING/4.5" IPS AL. TUBE	
7.	EQUIPMENT INTERCONNECTION NEAR 765/400kV ICT AREA FOR HIGH BP&@HGH SA	(AT 12M HEIGHT)	QUAD BULL/BERSIMIS ACSR CONDUCTOR WITH 450MM SUB–CONDUCTOR SPACING/4.5" IPS AL. TUBE	

CONDUCTOR & STRINGING DETAILS –400kV

SL.NO.	DESCRIPTION	LEVEL FROM PLINTH	SUB–CONDUCTOR	TENSION INSULATOR STRING/PHASE
1.	MAIN BUS–I & II	(AT 15M HEIGHT)	QUAD ACSR BERSIMIS CONDUCTOR WITH 450MM SUB–CONDUCTOR SPACING	DOUBLE TENSION 120 kN COMPOSITE LONG ROD INSULATOR
2.	JACKBUS	(AT 23M HEIGHT)	QUAD BERSIMIS ACSR CONDUCTOR WITH 450MM SUB–CONDUCTOR SPACING	DOUBLE TENSION 120 kN COMPOSITE LONG ROD INSULATOR
3.	DROPPERS/JUMPERING	–	QUAD BERSIMIS ACSR CONDUCTOR WITH 450MM SUB–CONDUCTOR SPACING	SINGLE SUSPENSION 120 kN COMPOSITE LONG ROD INSULATOR
4.	EQUIPMENT INTERCONNECTION	(AT 8M HEIGHT)	4.5" IPS AL. TUBE /QUAD ACSR BERSIMIS CONDUCTOR WITH 450MM SPACING	
5.	EARTHWIRE	(AT 29M HEIGHT)	7/3.66mm GI WIRE (10.98mm DIA)	
6.	INTERCONNECTION BETWEEN 400/220kV TRAFO TO 220kV SUB–STATION		TWIN BERSIMIS ACSR CONDUCTOR WITH 450MM SUB–CONDUCTOR SPACING	
7.	BUS CVT, CVT & SA IN LINE BAYS	–	TWIN BERSIMIS ACSR CONDUCTOR WITH 450MM SUB–CONDUCTOR SPACING	

CONDUCTOR & STRINGING DETAILS –220kV

SL.NO.	DESCRIPTION	LEVEL FROM PLINTH	SUB–CONDUCTOR	TENSION INSULATOR STRING/PHASE
1.	MAIN BUS–I & II	(AT 11.7M HEIGHT)	QUAD ACSR BERSIMIS CONDUCTOR WITH 250MM SUB–CONDUCTOR SPACING	DOUBLE TENSION 120 kN COMPOSITE LONG ROD INSULATOR
2.	TRANSFER BUS	(AT 11.7M HEIGHT)	TWIN ACSR BERSIMIS CONDUCTOR WITH 250MM SUB–CONDUCTOR SPACING	DOUBLE TENSION 120 kN COMPOSITE LONG ROD INSULATOR
3.	JACKBUS	(AT 16.2M HEIGHT)	QUAD/TWIN MOOSE ACSR CONDUCTOR WITH 250MM SUB–CONDUCTOR SPACING	DOUBLE TENSION 120 kN COMPOSITE LONG ROD INSULATOR
4.	DROPPERS/JUMPERING	–	QUAD/TWIN MOOSE ACSR CONDUCTOR WITH 250MM SUB–CONDUCTOR SPACING	SINGLE SUSPENSION 120 kN COMPOSITE LONG ROD INSULATOR
5.	EQUIPMENT INTERCONNECTION	(AT 5.9M HEIGHT)	4.0" IPS AL. TUBE /TWIN ACSR BERSIMIS CONDUCTOR WITH 250MM SPACING	
6.	BUS CVT, CVT & SA IN LINE BAYS	–	TWIN MOOSE ACSR CONDUCTOR WITH 250MM SUB–CONDUCTOR SPACING	

BILL OF QTY. OF BUS POST INSULATORS FOR 765KV SPARE ICT AND REACTOR CONNECTION ARRANGEMENT

SL.NO.	DESCRIPTION	PKG SS06T BPS QTY.	PKG SS06T LAYOUT QTY.	PKG SS09T BPS QTY.	PKG SS09T LAYOUT QTY.	SCOPE OF SUPPLY
i)	765KV 8KN BUS POST INSULATOR FOR 765/400KV SPARE ICT CONNECTION ARRANGEMENT	02 LOT	15 NO.	02 LOT	8 NO.	BHEL
ii)	765KV 8KN BUS POST INSULATOR FOR 765KV SPARE REACTOR CONNECTION ARRANGEMENT	04 LOT	25 NO.	02 LOT	9 NO.	BHEL
iii)	400KV 8KN BUS POST INSULATOR FOR 765/400KV SPARE ICT CONNECTION ARRANGEMENT	02 LOT	11 No.(BPI) 03 No.(HBPI)	02 LOT	8 NO.(BPI)	BHEL
iv)	145KV 6KN BUS POST INSULATOR FOR 765KV SPARE REACTOR NEUTRAL BUS AND AUX NEUTRAL BUS ARRANGEMENT	04 LOT	9 No.(BPI) 23 No.(HBPI)	02 LOT	6 No.(BPI) 13 No.(HBPI)	BHEL
v)	52KV 6KN BUS POST INSULATOR FOR 765KV SPARE ICT DELTA CONNECTION AND DELTA FORMATION	02 LOT	111 NO.	02 LOT	92 NO.	BHEL
vi)	33KV 6KN BUS POST INSULATOR FOR 765KV SPARE ICT NEUTRAL CONNECTION AND NEUTRAL BUS FORMATION	02 LOT	51 NO.	02 LOT	45 NO.	BHEL

BILL OF QTY. FOR 132 & 33kV MAIN EQUIPMENTS:

SL.NO.	DESCRIPTION	RATING	SYMBOL	KOPPAL–SS06T QTY.(NO) As per BPS	KOPPAL–SS06T QTY.(NO) As per SLD	KOPPAL–SS09T QTY.(NO) As per BPS	KOPPAL–SS09T QTY.(NO) As per SLD	SCOPE OF SUPPLY
1	SURGE ARRESTER (1 PH.)	132 kV, 10 KA 5 KJ/KV		2	2	2	2	POWERGRID
2	CT. (1 PH.) FOR TRANSFORMER NEUTRAL	33kV		2	2	2	2	BHEL
3	CT. (1 PH.) FOR REACTOR NEUTRAL	33kV		2	2	2	2	BHEL
4	145kV CIRCUIT BREAKER (1–PH) FOR NGR BY–PASSING ARRANGEMENT	145kV, 1250A,31.5KA		2	2+#	0	0	BHEL
5	145kV CIRCUIT BREAKER (3–PH) FOR NGR BY–PASSING ARRANGEMENT.	145kV, 1250A,31.5KA		NA	NA	2	0	BHEL
6	145kV BPI, 6KN (1–PH)	–		4	4	4	4	BHEL

2 Nos. 145kV, 1ph CB shall be supplied for SS09T package. This is additional scope for package SS06T.

BILL OF QTY. FOR LT SUPPLY

SL.NO.	DESCRIPTION	NOA QTY.	LAYOUT QTY.	SYMBOL	SCOPE OF SUPPLY
1	72.5KV, 1250A, 25KA FOR 1 SEC, 3PH CIRCUIT BREAKER	01	02		BHEL
2	72.5KV, 630A, 25KA FOR 1 SEC, 3PH DOUBLE BREAK ISOLATOR W/O ES	01	02		BHEL
3	72.5KV CURRENT TRANSFORMER, 50A Ith=120% 25KA FOR 1 SEC.	03	06		BHEL
4	72.5KV VOLTAGE TRANSFORMER	03	06		BHEL
5	72.5KV 6KN BUS POST INSULATOR	09	14		BHEL
6	800kVA, 33kV/0.433kV 3PH LT TRANSFORMER	01	02		BHEL

NOA NO. : CC/T/W-AIS/DOM/A10/23/11023/NOA-1/24-103435/01 dated 12.03.2024

NAME OF CUSTOMER: Koppal II Gadag II Transmission Limited
NAME OF CLIENT: POWERGRID CORPORATION OF INDIA LIMITED
NAME OF PROJECT: Substation Package SS-06T for Establishment of 765/400/220 kV Koppal-II (New) Pooling Station (AIS type) including 125MVAR, 420kV, 3 phase Bus Reactors under "Transmission Scheme for integration of Renewable Energy Zone (Phase-II) in Koppal-II (Phase-A) and Gadag-II (Phase-A) in Karnataka" through Tariff Based Competitive Bidding (TBCB)

ADDITIONAL INFORMATION
W.O.No.
STATUS OF DRAWING
DISTRIBUTION OF PRINTS

BHARAT HEAVY ELECTRICALS LTD.
TRANSMISSION BUSINESS GROUP

	नाम /NAME	हस्ता./SIGN.	दि./DATE
बनाया DRAWN	AS	–SGD–	16.11.24
जांचा CHECKED	RD	–SGD–	16.11.24
स्वीकृत APPROVED	SKS	–SGD–	16.11.24

REV.	DATE	ALTERED / CHECKED / APPROVED
04	15.04.25	ALTERED AS / CHECKED RD / APPROVED SKS
03	01.04.25	ALTERED AS / CHECKED RD / APPROVED SKS

विभाग DEPT. | कोड CODE | अनुपात / SCALE | कार्ड कोड CARD CODE

POWERGRID DRAWING NO. TB202362-1002345-SC3510-ELECT-LAYOUT

शीर्षक/TITLE: KOPPAL II NEW S/S- ELECTRICAL LAYOUT PLAN & SECTION

ड्राईंग क्र./DRAWING NO. TB-0-425-316-002 | पुनः/REV. 04

पृष्ठ क्र./SHEET No. 3 | अगला पृष्ठ /NEXT SHEET —

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COMPUTER DRG. PATH NAME :
REF. DRG. NO.
SIGN. AND DATE
INVENTORY NO

संदर्भ/Ref : CC-ENGG-TB202362-1002345-SC3510-STR-LAYOUT **Date :** 29/04/2025

From : Somiran Das
Senior GM

To : Bharat Heavy Electricals Limited
Plot No.-7, Sector-142 Noida 201305
201305

Cc : CGM PROJECTS, SR-II

Subject : Establishment of 765/400/22kV KOPPAL-II (New) Pooling Station including 400kV Class Bus Reactors
LOA Ref : CC/T/W-AIS/DOM/A10/23/11023/NOA-1/24-103435/01 & NOA-2/24-103435/02 Dated 12/03/2024

Please find enclosed following drawings/ documents for necessary action at your end.

Vendor Drg. No. :		TB-0-425-316-004_R2
Orgn. Drg. No.	:	TB202362-1002345-SC3510-STR-LAYOUT
Revision No.	:	02
Drg. Title	:	KOPPAL II NEW S/S- STRUCTURE LAYOUT PLAN & SECTION
App. Category	:	CAT-II
Release Date	:	29/04/2025

Scan to verfiy

Comments : Comments marked on the document

अनुमोदित श्रेणी/App. Category:

I. फेब्रिकेशन/निर्माण/टाइप टेस्टिंग हेतु जारी।
Approved/released for fabrication/construction.

II. फेब्रिकेशन/निर्माण/टाइप टेस्टिंग हेतु अनुमोदित/जारी बशर्ते दिए गए टिप्पणियाँ एवं आशोधनों की सम्मिलित किया जाये। कृपया रिवाइजड दस्तावेज अनुमोदनार्थ प्रस्तुत करें।
Approved/released for fabrication/ construction subject to incorporation of comments and modification as noted. Revised drawing required for approval.

III. टिप्पणियाँ सम्मिलित करने के उपरांत दस्तावेज को अनुमोदनार्थ प्रस्तुत करें।
To be resubmitted for approval after incorporating the comments.

IV. सूचनार्थ एवं रिकार्ड हेतु।
For information and record.

CATREL/ REL-CON निर्माण हेतु जारी।
Released for construction.

नोट/Note:

1. Approval/Comments conveyed herein neither relieve the contractor of his contractual obligations and his responsibilities, weights, quantities, design details assemble fits, performance particulars and conformity of the supplies with the Indian Statutory Laws as may be applicable, nor does it limits the purchaser's right under the contract.
2. The approval conveyed vide this letter does not cover the approval of make for sub-vendor items.

INVENTORY NO	SIGN. AND DATE	REF. DRG. NO.	COMPUTER DRG. PATH NAME :

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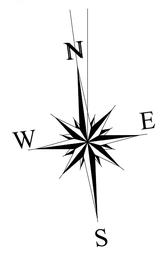
DRG. NO. TB-0-425-316-004

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM.)



LEGENDS:-
- SCOPE UNDER PACAKGE SS06T
- SCOPE UNDER PACKAGE SS09T
- LEVELLING LINE AS PER SITE LEVELLING PLAN
- SITE BOUNDARY
- FUTURE

400KV TOWER DETAILS					
TOWERS DESIGNATION	STR. HEIGHT DETAIL ABOVE PLINTH (m)	SPAN	TYPE	QUANTITY (NOS.) SS06T	QUANTITY (NOS.) SS09T
4TA	15M	72M	END	6	NA
4TB	15+8+6.5M(P)=29.5M	59/75M	MIDDLE	6	NA
4TC	23+6.5M(P)=29.5M	59/75M	MIDDLE	6	2
4TD	23+6.5M(P)=29.5M	59/75M	CORNER	5	2
4TG	23+6.5M(P)=29.5M	109.5/75M	MIDDLE	3	3
	NO. OF TOWERS			26	7

400KV BEAM DETAILS					
BEAM TYPE	HEIGHT ABOVE PLINTH (M)	BEAM LENGTH (M)	QUANTITY (NOS.) SS06T	QUANTITY (NOS.) SS09T	CONDUCTOR DEVIATION
4G1	15	24	6	NA	±0°
4G2	23	24	6	4	±30°
4G3	23	24	6	2	±0°
4GT	23	24	2	2	±30°
	NO. OF BEAMS		20	8	

220KV TOWER DETAILS				
TOWERS DESIGNATION	STR. HEIGHT DETAIL ABOVE PLINTH (m)	TYPE	QUANTITY (NOS.) SS06T	QUANTITY (NOS.) SS09T
2TF1	11.7+4.5(P)=16.2M	END	6	6
2TD2	11.7+4.5(P)=16.2M	MIDDLE	6	6
2TA2	11.7+4.5+4.5(P)=20.7M	MIDDLE	10	10
2TJ2	11.7+4.5+4.5(P)=20.7M	CORNER	10	10
2TI3	11.7+4.5+4.5(P)=20.7M	MIDDLE/CORNER	2	2
	NO. OF TOWERS		34	34

220KV BEAM DETAILS						
BEAM TYPE	HEIGHT ABOVE PLINTH (M)	BEAM LENGTH(M)	PH-PH SPACING(M)	CONDUCTOR	QUANTITY (NOS.) SS06T	QUANTITY (NOS.) SS09T
2G1	11.7	16	4	QUAD BERSIMIS	22	22
2G3#	16.2	16	4/4.5	QUAD BERSIMIS/ TWIN BERSIMIS	6	6
NO. OF BEAMS					28	28

PH-PH SPACING FOR BEAM 2G3 SHALL BE 4m FOR QUAD CONDUCTOR ON ONE SIDE OF BEAM AND 4.5m FOR TWIN CONDUCTOR ON OTHER SIDE OF BEAM.

LOADING DETAILS :-

NOTATION	NO. & TYPE OF COND\SHIELD WIRE PER PHASE	NORMAL TENSION PER PHASE	SPACER SPACING (meter)	S/C TENSION PER PHASE	PH-PH SPACING	CONDUCTOR DEVIATION	REMARKS
7a	QUAD AAC BULL SPAN = 108M /108M	8 T	6 M	9.75 T	15 MTR	±1°(Approx.)	765KV MAIN BUS
7b	QUAD AAC BULL SPAN = 114M/140M/117.5M	9.5 T	6 M	11.26 T	15 MTR	±1°(Approx.)	JACK BUS
7c	QUAD AAC BULL SPAN = 110M/120M	9.5 T	6 M	11.26 T	15 MTR	±30°	JACK BUS
7x	ALS9 HEXA ZEBRA SPAN=200M (MAX)	8 T	.	NA	-	±30°	SLACK SPAN OUTGOING CONDUCTOR AT 765KV LINE
4a	QUAD AAC BULL SPAN = 72M	5 T	4 M	7.32 T	6.5 MTR	±0°	400kV MAIN BUS
4b	QUAD ACSR BERSIMIS SPAN = 59M & 75M	5 T	4 M	7.36 T	6.5 MTR	±0°	400kV JACK BUSES
4c	QUAD ACSR BERSIMIS SPAN = 75/110M	5 T	4 M	7.36 T	6.5 MTR	±30°	400kV JACK BUSES FOR 765/400KV ICT SIDE
2a	QUAD ACSR BERSIMIS SPAN = 324M	4 T	2 M	5.41 T	4 MTR	±0°	220KV MAIN & TRANSFER BUS
2b	QUAD ACSR BERSIMIS SPAN = 34.5 & 48M	4 T	2 M	5.41 T	4 MTR	±0°	JACK BUS FOR B/C AND B/T
2c	TWIN ACSR BERSIMIS SPAN = 60M	4 T	2 M	5.41 T	4.5 MTR	±30°	FOR 400/220KV ICT SPAN
2x	CONDUCTOR TO BE INFORMED BY POWERGRID=200M (MAX)	4 T	2 M	5.41 T	4.5 MTR	±30°	FOR 220KV OUTGOING LINE
s	SHIELD WIRE	0.8 T	-	NA	-	±30°	-

765KV TOWER DETAILS

TYPE	DESIGNATION	PEAK	TOTAL HEIGHT OF TOWER (MTR)	PEAK HEIGHT (MTR.)	BEAM ATTACHMENT FOR CONDUCTOR	BEAM ATTACHMENT FOR SHIELD WIRE	BEAM LEVEL FOR CONDUCTOR	BEAM LEVEL FOR SHIELD WIRE	SUPPORTING BEAM FOR CONDUCTOR	SUPPORTING BEAM FOR SHIELD WIRE	QUANTITY (NOS.) SS06T	QUANTITY (NOS.) SS09T
1.	7TA	WITHOUT PEAK	28	-	3	-	27	-	7GAA & 1 NOS. 7GAB 2 NOS.	-	12	4
2.	7TC	WITH PEAK	46	6.0	3	2	40	46	7GCA & 1 NOS. 7GCB 2 NOS.	7TCGW 2 NOS.	24	12
3..	7ACC	WITH PEAK	46	6.0	3	2	40	46	7ABF & 1 NOS. 7ABG 2 NOS.	7AGWCC 2 NOS.	12	8
										TOTAL	48	24

765KV BEAM FOR CONDUCTOR

TYPE	DESIGNATION	CENTER TO CENTER SPAN OF BEAM	DEVIATION	QUANTITY (NOS.) SS06T	QUANTITY (NOS.) SS09T
1.	7GAA	15 MTR	±0°	6	2
2.	7GAB	7.5 MTR	±0°	12	4
3.	7GCA	15 MTR	±0°	12	6
4.	7GCB	7.5 MTR	±0°	24	12
5.	7ABF	15 MTR	±30°	6	4
6.	7ABG	7.5 MTR	±30°	12	8
			TOTAL	72	36

765KV BEAM\X-ARM FOR SHIELD WIRE

TYPE	DESIGNATION	CENTER TO CENTER SPAN OF BEAM	DEVIATION	QUANTITY (NOS.) SS06T	QUANTITY (NOS.) SS09T
1.	7TCGW	7.5-MTR	WITHOUT DEVIATION	24	12
2.	7AGWCC	7.5-MTR	±30° DEVIATION	12	8
			TOTAL	36	20

comments : sectional drawing shall also be submitted

REV.	DATE	ALTERED	CHECKED	APPROVED
02	23.04.25	AS	RD	SKS
REVISED AS PER POWERGRI COMMENTS DT. 03.01.2025.				

ADDITIONAL INFORMATION
W.O.No.

STATUS OF DRAWING

DISTRIBUTION OF PRINTS

NOA NO. : CC/TW-AIS/DOM/A10/23/11023/NOA-1/24-103435/01 dated 12.03.2024

NAME OF CUSTOMER Koppal II Gadag II Transmission Limited
NAME OF CLIENT POWERGRID CORPORATION OF INDIA LIMITED
NAME OF PROJECT Substation Package SS-06T for Establishment of 765/400/220 KV Koppal-II (New) Pooling Station (AIS type) including 125MVAR, 420kV, 3 phase Bus Reactors under "Transmission Scheme for integration of Renewable Energy Zone (Phase-II) in Koppal-II (Phase-A) and Gadag-II (Phase-A) in Karnataka" through Tariff Based Competitive Bidding (TBCB)

BHARAT HEAVY ELECTRICALS LTD.
TRANSMISSION BUSINESS GROUP

KOPPAL II NEW S/S- STRUCTURE LAYOUT PLAN & SECTION

	NAME /नाम	SIGN. /हस्ता.	DATE /दि.दि.
DRAWN	AS	-SGD-	21.12.24
CHECKED	RD	-SGD-	21.12.24
APPROVED	SKS	-SGD-	21.12.24

POWERGRID DRAWING NO. TB202362-1002345-SC3510-STR-LAYOUT

DRG. NO. TB-0-425-316-004

SHEET No. 01 / NEXT SHEET 02

REV. 02