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

RECEIPT OF EQUIPMENT/ MATERIAL AT SITE, UNLOADING, RECONCILIATION, INSPECTION, VERIFICATION, STORAGE, UP-KEEPING DURING STORAGE, ERECTION, TESTING, COMMISSIONING AND HANDING OVER OF 400 KV GIS & 400 KV AIS AND ASSOCIATED SYSTEMS/EQUIPMENT AT ARUN-3 HYDRO ELECTRIC PROJECT AND RECONCILIATION AND HANDING OVER SURPLUS MATERIALS TO BHEL FOR 4X225 MW SJVN ARUN-3 POWER DEVELOPMENT COMPANY (P) LTD. IN NEPAL.

CUSTOMER

M/S SJVN ARUN-3 POWER DEVELOPMENT COMPANY (P) LTD. (SAPDC), A COMPANY PROMOTED BY SJVN LTD.

TENDER SPEC. NO.: TBSM/ARUN-3/NEPAL/ETC/TENDER/23-24

DATE: 10.04.2023

TRANSMISSION BUSINESS GROUP

SUBCONTRACTS MANAGEMENT

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BHARAT HEAVY ELECTRICALS LIMITED

TRANSMISSION BUSINESS GROUP

PLOT NO. 25, SECTOR-16A, NOIDA -201301

e-mail: tbsm@bhel.in

NOTICE INVITING TENDER

REF.: TBSM/ARUN-3/NEPAL/ETC/TENDER/23-24 **DATE: 10.04.2023**

SUB: TENDER FOR "Receipt of equipment/ material at site, unloading, reconciliation, inspection, verification, storage, up-keeping during storage, erection, testing, commissioning and handing over of 400 KV GIS & 400 KV AIS and associated systems/equipment at Arun-3 Hydro Electric Project and reconciliation and handing over surplus materials to BHEL for 4X225 MW SJVN Arun-3 Power Development Company (P) Ltd. in Nepal".

Dear Sirs,

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

NAME OF WORK	TIME OF COMPLETION	EARNEST MONEY DEPOSIT (Rs.)	TENDER SUBMISSION DATE AND TIME	TENDER OPENING DATE & TIME
Receipt of equipment/ material at site, unloading, reconciliation, inspection, verification, storage, up-keeping during storage, erection, testing, commissioning and handing over of 400 KV GIS & 400 KV AIS and associated systems/equipment at Arun-3 Hydro Electric Project and reconciliation and handing over surplus materials to BHEL for 4X225 MW SJVN Arun-3 Power Development Company (P) Ltd. in Nepal	10 Months from the date of issue of LOI	NPR 14,24,267/- As per Annexure to conditions of contract for ETC works	On or before 26.04.2023 14.30 hrs.	26.04.2023 15.30 hrs. (Technical bid only)

*EMD should be in either INR or NPR. (1INR = 1.6 NPR)

*Bidders shall quote Prices in NPR only for all the items of BOQ.

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 (eg. 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.)

TENDER SPEC. NO.: TBSM/ARUN-3/NEPAL/ETC/TENDER/23-24, DATE: 10.04.2023
TO,

Dipak Kumar Mandal
AGM (TBSM)
BHARAT HEAVY ELECTRICALS LIMITED,
TRANSMISSION BUSINESS GROUP,
Plot No.- 25, Sector-16A,
Noida, Distt. Gautambudh Nagar, UP-201301
TELEPHONE: 0120-6748134, 99111 63182
E-mail: dipak.mandal@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 all the techno-commercially qualified bidders.

   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 sealed envelope 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-01 Date 22.10.2021. 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 erection works' and 'Conditions of contract for erection works', the 'Annexure to conditions of contract for erection 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 erection 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. The Bidders are advised to visit Site to have better understanding of job.

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.

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

1.1. 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.

1.2. Commitment by Bidder/ Supplier/ Contractor:

1.2.1. The bidder/ supplier/ contractor commit 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.

1.2.2. 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.

1.2.3. 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".

18. 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.

19. 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."

20. 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.

21. The evaluation currency for this tender shall be **NPR.**

22. 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.

23. 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.

24. 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. Bidders representative may be present during technical bid opening for technical discussion, if required. 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. 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".

25. 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.

26. **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: - Dipak Kumar Mandal Department: - TBG, Subcontracting Address: - BHEL/ TBG, Noida Phone: - 01206748134 E mail:- dipak.mandal@bhel.in	2) Name: - Ashok Kumar Meena Department: - TBG, Subcontracting Address: - BHEL/ TBG, Noida Phone: - 01206748545 E mail:- akmeena@bhel.in

27. 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.

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

29. 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.

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.

Thanking you,

Yours faithfully,
For and on behalf of BHEL,

(Dipak Kumar Mandal)
AGM /TBSM

TO BE FILLED BY TENDERER OVER THEIR LETTERHEAD

REF.: TBSM/ARUN-3/NEPAL/ETC/TENDER/23-24 **DATE: 10.04.2023**

SUB: TENDER FOR "Receipt of equipment/ material at site, unloading, reconciliation, inspection, verification, storage, up-keeping during storage, erection, testing, commissioning and handing over of 400 KV GIS & 400 KV AIS and associated systems/equipment at Arun-3 Hydro Electric Project and reconciliation and handing over surplus materials to BHEL for 4X225 MW SJVN Arun-3 Power Development Company (P) Ltd. in Nepal".

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

Authorization of representative who will participate in the on line 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	

BHARAT HEAVY ELECTRICALS LIMITED
TRANSMISSION BUSINESS GROUP, NOIDA

PRE-QUALIFYING REQUIREMENTS

Tender Ref. No.: TBSM/ARUN-3/NEPAL/ETC/TENDER/23-24 **DATE: 10.04.2023**

SUB: TENDER FOR "Receipt of equipment/ material at site, unloading, reconciliation, inspection, verification, storage, up-keeping during storage, erection, testing, commissioning and handing over of 400 KV GIS & 400 KV AIS and associated systems/equipment at Arun-3 Hydro Electric Project and reconciliation and handing over surplus materials to BHEL for 4X225 MW SJVN Arun-3 Power Development Company (P) Ltd. in Nepal".

Sealed Tenders (Under two part bid system) are invited from competent civil contractors for subject civil 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 in a sealed envelope 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	Vendors should have a minimum average annual turnover of NPR 2,13,64,012/- for last three financial Years (2018-19, 2019-20 & 2020-21 **OR** 2019-20, 2020-21 & 2021-22) and should submit audited balance sheet and Profit & Loss Account Sheet of these years. In case audited balance sheet is not available due to turnover being less than statutory requirement of audit, bidder should furnish self-certified copies of Balance Sheet, Profit & Loss account along with income tax returns and form 26 AS of these years.
B	Profit	Vendor should have earned profit in at least one year during last three financial years as mentioned in A above.
C	Similar Work	Vendor should have successfully **executed similar* jobs (Refer NOTE below)** during last seven years ending on 28.02.2023 and should be either of the following **i. Three similar jobs executed costing (except service tax/GST) not less than NPR 2,84,85,349/- each (or equivalent).** **OR** **ii. Two similar jobs executed costing (except service tax/GST) not less than NPR 3,56,06,686/- each (or equivalent).** **OR** iii. **One similar job executed costing (except service tax/GST) not less than NPR 5,69,70,698/- (or equivalent).**

NOTE:

1. **Similar* job shall mean:**

i. **Bidder should have experience of successful execution of installation of at least 5 bays of 220 kV or above GIS along with other allied works and at least one number 220 kV or above Transformer/ Reactor.**

OR

ii. **Bidder should have experience of successful execution of installation of at least 5 bays of 220 kV or above AIS works along with other allied works and at least one number 220 kV or above Transformer/ Reactor.**
The Bidder should also have experience of successful execution of installation of at least 2 bays of 220 kV or above GIS.

2. The word 'executed' means the bidder should have achieved the criteria specified in the PQR even if the total contract has not been completed or closed. Executed value of erection portion of work order shall be considered for evaluation against PQR.

3. In order to qualify technically in this tender, bidder should meet all criteria i.e. A, B & C mentioned above.

4. If the job is executed in the last seven years period, as specified above (job mentioned at Sl. No. C), even if it has been started earlier, the same will also be considered meeting the qualifying requirements.

5. The bidder shall submit the Contract Agreement/ Work Order/LOI, BOQ and performance/ completion/ execution certificate issued by Customer/ Contractor along with technical bid in support of qualification.

6. **Consortium/ JV bidding is not allowed under this NIT.**

7. Any cost of exchange variation in currency will be borne by bidder.

8. 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.

9. BHEL shall not be responsible for any delay, loss, damage for bids sent by post.BHEL shall not be liable for any expenses incurred by bidder in preparation of bid irrespective of whether it is accepted or not.

10. Quotations received from bidders who do not fulfil the PQR shall be summarily rejected without any further evaluation and information to bidders.

11. 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.

12. 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.

13. 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.

14. 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/ BHEL's Contacts

1.0 CUSTOMER:

SJVN Arun-3 Power Development Company (P) Ltd. (SAPDC), a company promoted by SJVN Ltd.

2.0 PROJECT LOCATION AND DETAILS:

Arun-3 HEP is proposed to be Run of River with Pondage scheme on river Arun. The underground Power House site is located on left bank of river Arun in Sankhuwasabha Districts in Eastern Nepal at a distance of 50 km from Khandbari, the headquarters of Sankhuwa Sabha District of Nepal. It is about 240 km from Biratnagar and about 740 km from Kathmandu. The project area can be reached by flight from Katmandu to Tumlingtar of about 660 km and then by road from Tumlingtar to Site of about 68 km. The Power House is accessible via Biratnagar from Jogbani, which is 800 km from Kolkata by rail route & 600 km by road route. From Jogbani, the road distance to projects sites via Biratnagar and Hile is about 300 km.

3.0 CONTACT PERSON: FOR CONTRACTUAL ISSUES

DIPAK KUMAR MANDAL
AGM (TBSM)
SUBCONTRACTS MANAGEMENT,
BHARAT HEAVY ELECTRICALS LIMITED,
TRANSMISSION BUSINESS GROUP,
Plot no.: - 25A, Sector-16 A, Noida,
Distt. Gautam Buddh Nagar, UP-201301

PHONE: 0120-674-8134/ 99111 63182
E-mail: **dipak.mandal@bhel.in**

CONTACT PERSON: FOR ENGINEERING ISSUES

Jai Kumar
Sr. Manager (TBEM)
BHARAT HEAVY ELECTRICALS LIMITED,
TRANSMISSION BUSINESS GROUP,
Plot no.: - 25A, Sector-16 A, Noida,
Distt. Gautam Buddh Nagar, UP-201301

PHONE: 0120-674- 8534/ 9214448521
E-mail: jaik@bhel.in

CONTACT PERSON: FOR CONTRACT EXECUTION ISSUES

Lakshman Sarkar
GM (TBES, TBNS & Overseas Projects)
BHARAT HEAVY ELECTRICALS LIMITED,
TRANSMISSION BUSINESS GROUP,
Plot no.: - 25A, Sector-16 A, Noida,
Distt. Gautam Buddh Nagar, UP-201301

PHONE: 0120-674-8620 / 96500 26888
E-mail: **lakshman@bhel.in**

HSE CONDITIONS

at a GLANCE (for bidders)



Health Safety and Environment Management

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

	Prepared by	Checked by	Approved and Issued for use by
Name	Sanjeev Sharma	Arvind Kumar Pandey	Anindya Chakraborty
Designation	Addl. Engineer	Engineer	Adl. General Manager
Signature	-sd-	-sd-	-sd-
Date	22.10.2021	22.10.2021	22.10.2021

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

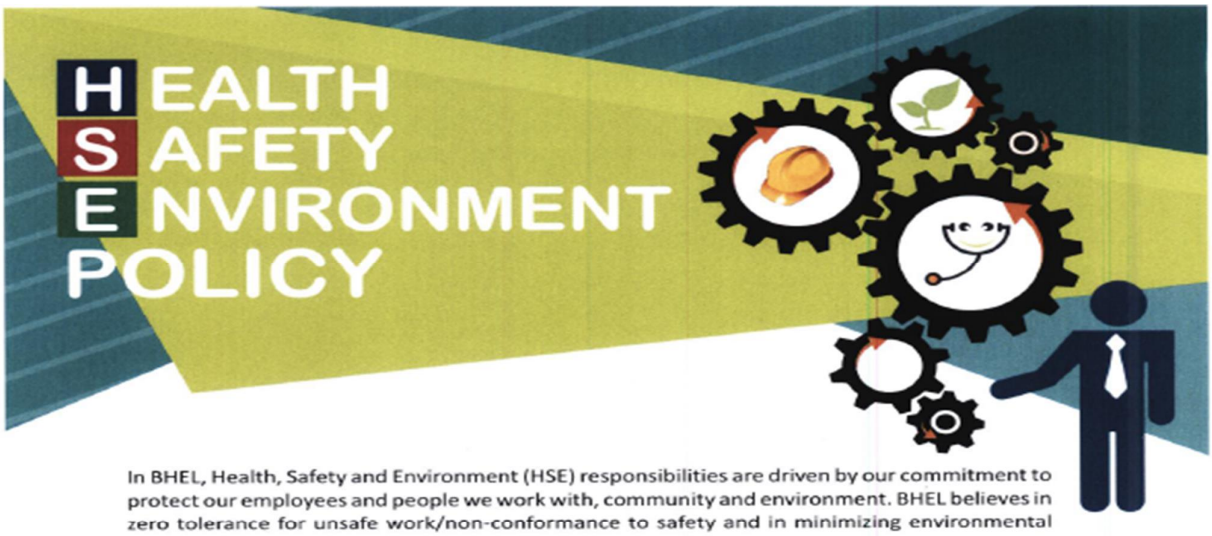
	Name	Designation	Signature
Issued to :			
Issued by :			

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 at least one full time qualified safety officer having qualification and experience as specified in Schedule-VIII of BOCW Act-1996. He shall not be assigned any duty/work other than assisting in upliftment of safety practices. He shall perform his duties in accordance with the requirements of Schedule-VIII of BOCW-1996. He shall ensure daily TBT, induction training, health check-up and other such compliances as per HSEP-14 on regular basis. In case of non-appointment, agency shall be penalized as per provisions in clause no. 7.0 of HSEP-14 (HSE Plan for Site Operations (subcontractors)) **(Rev-01)**

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 Equipments.

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 draw 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 vehicles 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	

-: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

SECTION - E

SCOPE OF WORK AND COMPLETION SCHEDULE

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.

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.

1. **Condition of Contract for Erection works (DOC. NO. – TB-ETC-GCC, REV.-02, 20th June, 2005):**

A. EARNEST MONEY DEPOSIT

(Bidder may please note that the amounts mentioned in this document - 6.0 Annexure to GCC is to be read in INR, bidder may calculate its equivalent NPR; 1 INR= 1.6 NPR)

Every tender must be accompanied by the prescribed amount of Earnest Money Deposit (EMD) mentioned in NIT.

1. 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) In case total EMD amount is more than INR. 2 Lakh, the amount in excess of INR 2 lakh may be accepted in the form of Bank Guarantee from scheduled bank. The Bank Guarantee in such cases shall be valid for at least six months.

B. No other form of EMD remittance shall be acceptable to BHEL.

1. 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.

2. 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.

3. In the case of unsuccessful bidders, the Earnest Money will be refunded to them within a reasonable time after award of work.

4. EMD shall not carry any interest.
5. EMD of successful bidder shall be retained as part of Security Deposit.
6. **Bidders may please note that "One Time EMD" provision stands deleted. Hence, bidders who have deposited INR 2 Lakh as 'One Time EMD' with BHEL are also required to submit the requisite amount of EMD.**
7. 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.

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).

(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) 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.

iii) 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. <u>Conditions for acceptance of bank guarantees</u>

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 networth 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 as per ANNEXURE-J, 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, 5th FLOOR, PLOT NO. 25, SECTOR-16 A, 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. Payment terms: Clause No. C.2.0 stands deleted. Now this clause shall be read as below.

1. For all BOQ items (Except item no. 48, 58-59, 65, 89-107, 109-110 & 130-132) - Complete scope of work

1.1 No Mobilization Advance shall be paid.

1.2 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. In case of power transformer/ reactors, 5% amount shall be paid after unloading and 5%

after dragging main tank in position on foundation. The sub-items mentioned in transformer/ reactor shall be consider for payment with main item.

1.3 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.

1.4 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)

1.5 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.

1.6 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.

2 **For BOQ item no. 48, 58-59, 65, 89-107, 109-110 (Supply in contractor's scope)**

2.1 70% of the contract item price on the monthly progressive bills on prorate basis after supply, receipt of the material at site, unloading, proper storage and as certified by site in charge.

2.2 10% of the contract item price on the monthly progressive bills on prorate basis after material erection as certified by BHEL site In-charge on pro-reta basis after erection.

2.3 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.

2.4 Last 10% payment shall be released as per 1.6 above.

3 **For BOQ item Sr. No. 130-131 (For Civil Works):**

3.1 80% of the contract item price on the monthly progressive bills on prorate basis after supply, receipt of the material at site, unloading, proper storage, making of foundations or grouting of foundations and as certified by site in charge

3.2 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.

3.3 Last 10% payment shall be released as per 1.6 above.

4 **For BOQ item no. 132 (Watch & Ward- Material Security)**

4.1 100% 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. Clause No. C.17.0 "Over-run Charges" Over-run Charges" stands deleted. Now this clause shall be read as below.

If the contract is extended beyond 12 months from the date of actual start (including grace period) for any reason (including due to extra work/additional quantity) other than those attributable to the contractor or force majeure conditions, the contractor will be compensated by payment of over-run charges at the rate of 0.2 percent (point two percent) of the executed contract value per month after the expiry of grace period. Executed value as on last day of respective month(s) will be taken for purpose of calculation of overrun compensation.

The overrun compensation will be payable for the eligible period of time extension on account of reasons attributable to BHEL only. No overrun will be payable for the extension on account of reasons attributable to contractor and/or force majeure conditions.

Part of Extension attributable to the contractor, if any, in total contract extension shall be exhausted first i.e. immediately after end of grace period. This shall be followed by Extension on account of force majure conditions, if any and lastly on account of BHEL.

The compensation will be payable for the extended eligible period in months and days as applicable.

Payment of ORC amount shall be further regulated as follows:

I. 50% of the ORC is allocated for deployment of matching resources agreed as per the joint programme.

II. 50% of ORC is allocated for achieving of planned progress agreed as per the joint programme

In case execution is on HOLD (Other than Force Majeure), No ORC shall be payable to contractor for the period of HOLD if contractor is permitted to demobilize from site and to re-mobilize after lifting of HOLD.

ORC shall not be applicable for following activities

I. Area cleaning, removal of temporary structures and return of scrap.

II. Punch list points / pending points liquidation pending due to reasons attributable to contractor

III. Submission of "As built Drawing"

IV. Material Reconciliation

V. Completion of Contract Closure formalities like HR Clearance/ No dues from various dept./ Statutory Authorities etc.

Any compensation paid to the contractor against over run charges during the eligible extended period of the project will be recovered from the contractor or any payment on this account payable to the contractor will be cancelled if further extension is required due to the reasons attributable to the contractor or situation of risk & cost arises due to failure of the contractor to complete the work.

If the delay is attributable to the contractor LD will be imposed as per the provision in the contract.

Total Over Run Compensation shall be limited to 10% of the executed contract value as certified in Final Bill. For this purpose executed contract value excludes PVC, ORC, Supplementary/Additional Items and Extra Works done.

Grace period- The grace period will be defined in the Tender Document based on the calculation as one month for every six month (or part thereof) of the contract period. The prices quoted by the contractor will remain firm till the contract period plus the grace period including extended period if any.

G. Clause No. B.16.3 shall be read in conjunction with the following:

Extra works - Extra works that arise on account of contractor's fault will have to be carried out by the contractor free of cost including the supply of consumables etc.

After eligibility of extra works is established and finally accepted by BHEL Engineer/Designer, payment will be decided on the following rates.

Man-day rate for eligible extra works:

Single man-day rate (for Skilled manpower & un-skilled manpower) for carrying out rework/repairs/rectification/fabrication and other such works for a man-day of 8 hours as may arise during the course of erection will be limited to minimum wages of skilled/ un-skilled manpower prevailing at the time of execution of the extra work as notified by the Government. Contractor has to submit notification published by the concerned Government regarding minimum wage applicable for the period of execution of the extra work.

The above man day rate includes overtime if any, other site expenses and incidentals, consumables, tools and tackles etc.

As mentioned above, no payment will be made if an item of work lasts less than eight man hours.

H. 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.

I. Clause No. C.30.0 "INCOME TAX/SALES TAX/WORKS TAX/VAT" stands deleted. Now this clause shall be read as below.

1. TAXES & DUTIES ETC:

1.1.0 IMPORT DUTIES

Taxes & Duties

1.1. Price quoted should be inclusive of all applicable Taxes/charges but Excluding Value Added Tax (VAT) in Nepal. The Contractor shall be responsible to pay all other taxes, fees, royalty, commission etc. that may be levied on the contractor in executing the contract as per prevalent laws at Nepal and compliance to all local regulations. In case BHEL is forced to pay any of such taxes, it shall be recovered from Contactor's bills or otherwise as deemed fit.

1.2. **Value Added Tax (VAT)** in Nepal shall be payable extra as per followings: -

1.2.1 The Contractor is required to get registered with Tax Authorities of Nepal and shall submit to BHEL documentary evidence for such registration.

1.2.2 The Contractor has to submit VAT compliance invoice as per prevalent VAT laws in Nepal. Any denial of input credit to BHEL or arising of any tax liability on BHEL due to non-compliance of VAT Laws of Nepal by the contractor in any manner, will be recovered along with liability on account of interest and penalty (if any) from the payments due to the contractor.

1.2.3 The Contractor may be required to submit documentary evidence for deposit of VAT@*13%* with tax authorities as per prevalent laws in Nepal.

1.2.4 The Contractor shall be solely responsible for discharging his VAT liability as per prevalent VAT laws in Nepal and BHEL will not entertain any claim of VAT/Interest/penalty or any other liability on account of failure of contractor in complying the provisions of VAT laws in Nepal or discharging the VAT liability in a manner laid down thereunder.

1.2.5 The Contractor shall obtain prior written consent of BHEL before billing the amount towards such taxes. Where prevalent VAT laws in Nepal permit more than one option or methodology for discharging the liability of tax/levy/duty; the contractor shall approach BHEL before choosing any option to discharge his tax liability. BHEL shall have the right to direct the contractor to adopt the appropriate option considering the amount of tax liability on BHEL/Client as well as procedural simplicity with regard to assessment of the liability. The Option chosen by BHEL shall be binding on the contractor for discharging the obligation of BHEL in respect of the tax liability to the contractor.

1.3 TDS / Withholding Tax or any other deduction as applicable as per prevalent Laws in Nepal shall be deducted. *1.5% Tax Deducted at Source (TDS) of the subcontractor's price will be deducted from the subcontractor's payments made by BHEL and the same will be deposited in his PAN name with the Tax Authorities in Nepal. The subcontractor can claim tax credit subsequently while filing his annual Income Tax return.*

1.4 For plant and equipment manufactured inside Nepal, all taxes and duties as applicable for destination site/state on all items of supply from Contractor are included in the Contract price.

1.5 Octroi /Custom (Bhansar) /entry tax/ as applicable for destination site on all items of supply including bought-out finished items, which shall be dispatched directly from the sub-vendor's works (within or outside Nepal) to the Project site is included in the Contract price.

1.6 In case of local supplies, all Customs duties/Bhansar and Levies, Excise Duties, Sales Tax payable on raw materials, components, sub-assemblies and any other items used for their consumption or dispatched directly to the BHEL / Customer from their sub-Contractor (i.e. sale-in-transit) is included in the Contract price and any such taxes, duties, levies additionally payable will be to Contractor's account and no separate claim on this behalf will be entertained by the BHEL.

1.7 If any plant and equipment required to complete the facilities, is manufactured outside Nepal, the Contractor shall be entirely responsible for all taxes, stamp duties, license fees, and other such levies imposed outside the Nepal.

In such case, Customs duties/ Bhansar on the equipment and materials covered in the Contract to be imported into Nepal against BHEL / Customer's Import License and which will become the property of the BHEL / Customer under the Contract, shall be to the contractor's account and shall be paid directly by the Contractor to Government of Nepal or concerned authorities.

1.8 Except as otherwise specifically provided in the Contract, the Contractor shall bear and pay all taxes, duties, levies and charges assessed on the Contractor, its Sub-Contractors or their employees by all municipal, state or national government authorities in connection with the plant and equipment supplied in and outside of the country where the Site is located.

1.9 If any tax exemptions, reductions, allowances or privileges may be available to the Contractor in the country where the Site is located, BHEL / Customer shall use its best endeavors to enable the Contractor to benefit from any such tax savings to the maximum allowable extent. However, in the event of failure on part of the contractor same shall not be compensated on this account by BHEL.

1.10 For payment/reimbursement of Value Added Tax or any other tax included in the contract price, in respect of dispatches made directly from Contractor's Works, invoices raised by the Contractor shall be accepted as documentary evidence.

1.11 Any upward variation in VAT in Nepal shall be considered for reimbursement provided supply of goods or /and services are made within schedule date stipulated in the contract or approved extended schedule for the reason solely attributable to BHEL. However downward variation shall be subject to adjustment as per actual VAT applicability in Nepal.

In case the Government of Nepal imposes any new levy/tax on the output service/goods after price bid opening, the same shall be reimbursed by BHEL at actual. The reimbursement under this clause is restricted to the direct transaction between BHEL and its contactor only and within the contractual delivery period only.

In case any new tax/levy/duty etc. becomes applicable after the date of Bidder's offer but before opening of the price Bid, the Bidder/Contractor must convey its impact on his

price duly substantiated by documentary evidence in support of the same before opening of price bid. Claim for any such impact after opening the price bid will not be considered by BHEL for reimbursement of tax or reassessment of offer.

These variations / adjustments would be applicable to direct transactions between BHEL and the Contractor as well as on finished bought-out items (Sale-in-transit) supplied directly by the sub-vendor to BHEL but shall not be applicable on procurement of raw materials, intermediary components etc. by the sub-vendor and Contractor. Such adjustment in tax liability will only be with respect to the values and rates quoted by the bidder in relevant Schedules.

1.12 The Contractor shall be solely responsible for the taxes that may be levied on the Contractor's persons or on earnings of any of his employees and shall hold BHEL indemnified and harmless against any claims that may be made against BHEL / Customer. BHEL does not take any responsibility whatsoever regarding taxes under the Income Tax Act of Nepal, for the Contractor or his personnel. If it is obligatory under the provisions of the Income Tax Act of Nepal, deduction of Income Tax at source shall be made by the BHEL.

1.13 The admissibility of VAT, taxes and duties referred in this chapter or elsewhere in the contract is limited to direct transactions between BHEL & its Contractor. BHEL is not responsible for any liability that may arise due to any transaction beyond the direct transaction between BHEL & its contractor.

1.14 The contractor should submit its invoices in such a manner enabling BHEL for availing of Input Tax Credit of all the taxes whether included or excluded in the contract price, wherever applicable. Any denial of input credit to BHEL or arising of any tax liability on BHEL due to non-compliance of any Applicable Tax Laws in Nepal by the contractor in any manner, will be recovered along with liability on account of interest and penalty (if any) from the contractor.

The above information is indicative and is subject to change, as per amendments and rules in Nepal issued from time to time. The subcontractor is requested to verify the applicability of the above regulations and shall not hold BHEL liable for any loss (actual / notional) on account of the above information, whether to the subcontractor or otherwise.

J. DELAY AND EXTENSION OF TIME:

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.

(vi) 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.

PVC/ ORC shall be governed by respective clauses in the NIT.

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 along with applicable GST (if any) on LD. 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. If the contract is for more than one sub-station and the substations are completed and taken over by customer in stages, then the delays if any by the contractor for the substation completed and handed over may be accounted for the individual substation and LD leviable shall be computed based on the contract value of individual substation.

Amended/ revised contract value (excluding ORC, Extra Works, Supplementary/Additional Items and PVC) shall be considered for calculating LD/ penalty.

L. <u>Model Conciliation Clause For Conducting Conciliation Proceedings Under The BHEL Conciliation Scheme, 2018</u>

The Parties the if at any time (whether before, during or after the arbitral or judicial proceedings), any Disputes (which terms shall means and include any dispute, difference, question or disagreement arising in connection with construction, meaning, operation, effect, interpretation or breach of the agreement, contract or the Memorandum of Understanding (delete whichever is inapplicable), which the parties unable to settle mutually), arise inter-se the Parties, the same may, be refereed by either party to conciliation to be conducted through Independent Experts Committee to be appointed by competent authority of BHEL from the BHEL Panel of Conciliators.

Notes:

1. No serving or a retired employee of BHEL/Administrative Ministry of BHEL shall be included in the BHEL Panel of Conciliators.

2. Any other person(s) can be appointed as Conciliator(s) who is/are mutually agreeable to both the parties from outside the BHEL Panel of Conciliators.

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 Annexure-A*** to this GCC.

The Annexure-A together with it's appendices will be treated as if the same is part and parcel hereof and shall be as effectual as if set out herein in these GCC."

M. Guidelines for settlement of claims for compensation on accidents

The amount of compensation paid by BHEL under its guidelines on Settlement of claims for compensation on accidents as applicable for BHEL, **i.e. ` 10,00,000/- (Rs Ten Lakh) in the event of death or permanent disability resulting from Loss of both limbs and ` 7,00,000/-(Rs Seven Lakh) in the event of permanent disability:** shall be recoverable in full from the contractor, agency or firm, if the accident is attributable to negligence of contractor, agency or firm or any of its employees, except in case of work/ service contract etc. being of less than ` 5,00,000/- value, in which case the entire amount of compensation shall be borne by BHEL.

N. The Clause No. B.15.0 "Arbitration" of Conditions of contract for ETC works stands deleted. Now the modified clause shall be read as below:

(i) Except where otherwise provided for in the contract all questions & disputes relating to the meaning of the specification designs, drawings and instruction herein before mentioned and as to the quality of workmanship or materials used on the work or as

to any other question, claim, right, matter or thing whatsoever in any way arising out of or relating to the contract, designs, drawings specifications, estimates, instructions, orders of these conditions or otherwise concerning the works, of the execution or failure to execute the same whether arising during the progress of the work or after the completion or abandonment thereof shall be referred to the sole arbitration of the Head TBG, BHEL, Noida and if the Head TBG is unable or unwilling to act, to the sole arbitration of some other person appointed by the Head TBG willing to act as such arbitrator.

A party wishing to commence arbitration proceeding shall invoke Arbitration Clause by giving 60 days notice to the other party. The notice invoking arbitration shall specify all the points of disputes with details of the amount claimed to be referred to arbitration at the time of invocation of arbitration and not thereafter.

There will be no objection if the arbitrator so appointed is an employee of BHEL and he had to deal with the matters to which the contract relates, in the course of his duties. The arbitrator to whom the matter is originally referred being transferred or vacating his office or being unable to act for any reason such Head TBG as aforesaid at the time of such transfer vacation of office or inability to act shall appoint (see note) another person to act as arbitrator in accordance with the terms of the contract such person shall be entitled to proceed with the reference from the stage at which it was left by his predecessor. It is also a term of this contract that no person other than a person appointed by such Head TBG as aforesaid should act as arbitrator and if for any reason that is not possible the matter is not to be referred to arbitration at all, in all cases where the amount of the claim dispute is Rs. 50,000/- (Rupees fifty thousand) and above the arbitrator shall give reasons for the award.

The provisions of Indian Arbitration and Conciliation Act 1996 or any statutory modification or re-enactment thereof and the rules made thereunder and the time being in force shall apply to the arbitration proceeding under this clause.

It is a term of the contract that the party involving arbitration shall specify the dispute or disputes to be referred to arbitration under this clause together with the amounts claimed in respect of each dispute.

The arbitrator may from time to time with consent of the parties enlarge the time for making and publishing the award.

The work under the contract shall, if reasonably possible, continue during the arbitration proceedings and no payment due or payable to the contractor shall be withheld on account of such proceedings.

The Arbitrator shall be deemed to have entered on the reference on the date he issues notice to both the parties fixing the date of the first hearing.

The Arbitrator shall give a separate award in respect of each dispute or difference referred to him.

The Venue of arbitration shall be at New Delhi.

The award of the arbitrator shall be final, conclusive and binding all parties to this contract, subject to the provisions of the Arbitration and Conciliation Act, 1996.

Laws governing the Contract:

The contract shall be governed by the Indians Laws for the time being in force.

NOTE:-The Authority appointing the arbitrator should not be lower in rank than the Authority accepting the Agreement.

(ii) In case of Contract with Public Sector Enterprise (PSE) or a Government Department through Permanent Machinery of Arbitrators (PMA) in the department of Public Enterprises, the following shall be applicable:

In the event of any dispute or difference relating to the interpretation and application of the provisions of the Contract, such dispute or difference shall be referred to by either party to the arbitration of one of the arbitrators in the department of public enterprises. The award of the arbitrator shall be binding upon the parties to the dispute, provided, however, any party aggrieved by such award may make further reference for setting aside or revision of the award to the Law Secretary, Department of Legal Affairs, Ministry of Law and Justice, Government of India. Upon such reference the dispute shall be decided by the Law Secretary or the Special Secretary or Additional Secretary when so authorized by the Law Secretary, whose decision shall bind the parties hereto finally and conclusively.

(iii) The cost of arbitration shall be equally by the parties.

(iv) Neither party shall be entitled for any interest including pre-reference or pendent-lite interest on its claims and any claim for such interest made by any party shall be void.

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. All other terms and conditions of tender shall remain unchanged.

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 Customer: SJVN Arun-3 Power Development Company (P) Ltd. (SAPDC), a company promoted by SJVN Ltd

Name of Work: Receipt of equipment/ material at site, unloading, reconciliation, inspection, verification, storage, up-keeping during storage, erection, testing, commissioning and handing over of 400 KV GIS & 400 KV AIS and associated systems/equipment at Arun-3 Hydro Electric Project and reconciliation and handing over surplus materials to BHEL for 4X225 MW SJVN Arun-3 Power Development Company (P) Ltd. in Nepal

Tender Spec. No.: TBSM/ARUN-3/NEPAL/ETC/TENDER/23-24, Date: **10**.04.2023

Sl. No.	Description of Item	Quantity	UoM	Unit rate (NPR)	Total rate (NPR)
1	400kV, 80MVAR 3-Phase Bus / Line Reactor complete in all respect along with Radiator Bank and its cooling arrangement, Conservator, Cooler Control Cabinet/Marshalling Kiosk, accessories and insulating oil. Work includes Installation of 2X10m Rail, Inserts & bolts on reactor foundation, erection of all auxiliaries viz turrets, bushings, terminal connectors, associated earthing works (excluding riser connections to main earthmat), laying of cable from Reactor auxiliaries to MK, complete reactor insulating oil filtration, filling of oil, hot oil circulation, continues DRY AIR purging, dry out by N2 / associated heating method, Oil testing etc as required to complete the installation of Reactor. Dragging on rail cum road. Note:- (1) Charges for Oil filtration including Particle count test, filtration unit with NAS filter, dry air, dry out by N2 and heating, filling of oil, hot oil circulation, oil sample testing at approved Lab etc for first time commissioning of Reactor are deemed to be covered under this cope as per technical specification and IEC-60296 from an accredited laboratory. (2) Please refer Chapter 13: Shunt Reactor ED/TS/ARUN/01.06.17 & other technical requirement for detail	3	Nos	33,92,000.00	1,01,76,000.00
2	Dragging/ shifting of main tank of above mentioned Reactor (1 No.) if required to do on bare land (Not on rail cum road)	30	Meter	3,200.00	96,000.00
3	On line Dissolved Gas (Multigas) & Moisture analyser for Reactor	3	Nos	6,400.00	19,200.00
4	On line insulating oil drying system (Cartridge type) for Reactor	3	Nos	6,400.00	19,200.00
5	Repeat oil tests as per IEC-60296 & DGA from accredited laboratory, after 24 hours of test-service period (for compare of results with before energization value). (BDV, PPM, Resistivity & Tan delta etc as per Customer specification) for Reactor insulating oil	3	Set	76,800.00	2,30,400.00
6	Oil Testing (BDV, PPM, Resistivity & Tan delta etc as per Customer specification) for Reactor insulating oil (as if supplied in drums, if applicable) at accredited laboratory. arrangement of sampling bottle, sampling syringe etc for OIL TESTING is in the scope of the bidder. Bidder's scope covers all supports for sampling, safely delivery and submission of test sample to accredited laboratory, getting it tested and submission of test report to BHEL. Customer laboratory charges shall in the scope of bidder. 1 set equals to one number of successful oil sample test.	20	Set	32,000.00	6,40,000.00
7	Charges for repetition of oil filtration - (if required due to reasons not attributed to the bidder) This item is executed only if repetition of Reactor oil filtration is required by BHEL. Scope includes successful repetition of oil filtration complete in all respect excluding oil testing at accredited laboratory.	50	KL	64,000.00	32,00,000.00
8	Charges for repetition of Heating and Dry out of wet winding of Reactor/reactor by application of vacuum, N2 filling - N2 gas Cylinders for complete dry out of Reactor by vacuuming/ N2 filling/ purging and heating. Mode of measurement shall be number of gas cylinder of 50 kg N2 gas, on pro-rata basis. (Empty gas cylinder shall be returned back) (if required due to reasons not attributed to the bidder)	10	Nos	19,200.00	1,92,000.00

Bill of Quantity Cum Price Schedule (Annexure-I)

Name of Customer: SJVN Arun-3 Power Development Company (P) Ltd. (SAPDC), a company promoted by SJVN Ltd

Name of Work: Receipt of equipment/ material at site, unloading, reconciliation, inspection, verification, storage, up-keeping during storage, erection, testing, commissioning and handing over of 400 KV GIS & 400 KV AIS and associated systems/equipment at Arun-3 Hydro Electric Project and reconciliation and handing over surplus materials to BHEL for 4X225 MW SJVN Arun-3 Power Development Company (P) Ltd. in Nepal

Tender Spec. No.: TBSM/ARUN-3/NEPAL/ETC/TENDER/23-24, Date: **10**.04.2023

Sl. No.	Description of Item	Quantity	UoM	Unit rate (NPR)	Total rate (NPR)
9	GIS - Fully equipped 400kV, SF6 GIS Bay Module: Fully equipped Generator Transformer Bay / Bus Reactor Bay / Line Reactor Bay / Line Bay / Bus Coupler Bay. Work include Erection, Testing and commissioning of 400kV GIS Bay including all the work / services required for completion including SF6 Gas handling / filling / top-up etc complete in all respect for successful installation & commissioning of GIS. Arrangement of tool & tackles, instruments shall be part of bidder's scope such as and not limited to Annexure_T&P_GIS_ETC. The following activities are in GIS supplier scope (1) Supervision of GIS Installation, (2) Testing of GIS, (3) Arrangement of special T&P & testing kit as per Annexure_T&P_GIS_OEM shall be arranged by GIS manufacturer which includes SF6 Gas handling plant & HV Test Kit.	10	Set	21,12,000.00	2,11,20,000.00
10	GIS - ALL OTHER PARTS OF GIS SUCH AS AND NOT LIMITED TO BUSBAR MODULE, VOLTAGE TRANSFORMER BAY, SURGE ARRESTOR, BUS EXTENSION MODULE, CSD, INTERFACING GIS MODULE EXTRA TO COMPLETE THE INSTALLATION OF GIS SYSTEM AS PER DRAWING & SLD.	1	Lot	8,32,000.00	8,32,000.00
11	Gas Insulated Bus Duct (GIB) - 400kV Phase Isolated, SF6 gas-insulated metal enclosed single phase bus duct from GIS Bay module take-off to SF6 to Air/Oil Bushing. Work includes complete installation of GIB including respective cabling.	342.3	Meter	3,584.00	12,26,803.20
12	GIS - 400kV, 1 phase SF6 Interfacing GIS Module near GT in GT Cavern Area, complete in all respects and comprising of following but not limited to a) CT, SF6 gas insulated Surge Arrestors, High speed grounding switch, approx 7 m GIB, SF6 to Cable Connection Module etc complete with group operated manual and motor driven operating mechanisms for each phase, Gas monitoring system etc complete AS PER DRAWING AND SLD	12	Set	32,000.00	3,84,000.00
13	GIS - SF6 to Air Bushing module complete	6	Nos	32,000.00	1,92,000.00
14	GIS - SF6 to Oil Bushing complete	21	Nos	32,000.00	6,72,000.00
15	GIS - SF6 to Cable Connection Module complete	24	Nos	32,000.00	7,68,000.00
16	LCC - Local Control Cubical Panel with GIS Internal cabling and GIS to respective LCC cabling	10	Nos	76,800.00	7,68,000.00
17	LCC - mini Local Control Cubical Panel for 3x1 Phase Interfacing GIS Module, scope includes Internal cabling and GIS to respective LCC cabling	4	Nos	76,800.00	3,07,200.00
18	Structure Work for Installation of GIS including Support Structure for GIS, GIB (bus duct), SF6 to Air Bushings, Supports, Platforms, Ladders, Foundation Bolts, Embedded Parts in floors etc. complete in all respect, which are required for installation of GIS system as per the specification	45	MT	22,400.00	10,08,000.00
19	Grounding/ Earthing for GIS (Including GIS interface module system at GT cavern) complete including Gas Insulated Bus duct, LCC, SF6 to air bushing, SF6 to Cable, SF6 to Oil modules etc.. using braided Cu wire (insulated/ non-insulated)/ earth strip (Cu/Al/GI flat). Work includes cutting, lug crimping , bolting , fixing etc. and connecting with riser/earth strip (GI/AL /Cu flat) complete in all respect. Grounding Material will be supplied by GIS Supplier /BHEL.	1	Lot	9,60,000.00	9,60,000.00

Bill of Quantity Cum Price Schedule (Annexure-I)

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Tender Spec. No.: TBSM/ARUN-3/NEPAL/ETC/TENDER/23-24, Date: **10**.04.2023

Sl. No.	Description of Item	Quantity	UoM	Unit rate (NPR)	Total rate (NPR)
20	400KV, CONTINUOUS ONLINE MONITORING AND DIAGNOSTIC SYSTEM INCLUDING REMOTE MONITORING AND SUPERVISION STATION - This includes online PD Monitoring system for complete GIS including Sensors, Panels i.e. radial control cabinet, radial distribution cabinets, OCU Panel, cable laying & termination, FO (approx .75km) / Special Cable (approx 1km) , Work Station, Ethernet switch etc complete in all respect. Please refer TB-405-317-10-50 & 1MNS500745-SAA	1	Lot	76,800.00	76,800.00
21	SF6 Gas Filling/Recovery/Re-filling Cycle. The cycle of the gas filling/recovery/re-filling will be followed multiple time till the Completion of the HV test. Gas processing and filling unit (DILO machine) shall be in the scope of BHEL/manufacturer.	1	Lot	7,68,000.00	7,68,000.00
22	HV Test for GIS - HV test kit shall be arranged by GIS Supplier. Test shall also be conducted by GIS supplier. All necessary support i.e. unloading, shifting, minor assembling of HV test kit, cabling, support for complete HV Test, dismantling & loading on carrier. Complete in all respect.	1	Lot	5,76,000.00	5,76,000.00
23	FIRE FIGHTING SYSTEM (ETC & Material Handling) - Receipt of material, unloading, proper storage, material reconciliation, safe keeping, erection, testing & commissioning, handing over to BHEL, proper record keeping etc to complete. Refer Annexure-ETC_FFS.	1	Lot	10,00,000.00	10,00,000.00
24	AIR CONDITIONING & VENTILATION SYSTEM (ETC & Material Handling) - Receipt of material, unloading, proper storage, material reconciliation, safe keeping, erection, testing & commissioning, handing over to BHEL, proper record keeping etc to complete. Refer Annexure-ETC_ACVS.	1	Lot	6,00,000.00	6,00,000.00
25	EOT Crane (ETC & Material Handling) - Receipt of material, unloading, proper storage, material reconciliation, safe keeping, erection, testing & commissioning, handing over to BHEL, proper record keeping etc to complete. Refer Annexure-ETC_EOT.	1	Lot	10,00,000.00	10,00,000.00
26	LCB FOR 400kV SWITCHYARD (LOCAL CONTROL BOARD OF SWITCHYARD) THIS INCLUDES LOCAL HMI PANEL, ELECTRONIC PANEL, RELAY PANEL & CONTROL AND METERING PANEL,SET OF 4 PANELS. REF DRAWING 3-694-00-00-836	1	SET	1,02,400.00	1,02,400.00
27	Computer Set - Dual Monitor Operator workstation at 400KV Switch yard	1	Nos	12,800.00	12,800.00
28	Generator Transformer PROTECTION Panel (400KV SIDE), SET OF 1 PANEL	4	SET	38,400.00	1,53,600.00
29	LINE REACTOR PROTECTION Panel, SET OF 2 PANELS	2	SET	51,200.00	1,02,400.00
30	BUS REACTOR PROTECTION Panel, SET OF 2 PANELS	1	SET	51,200.00	51,200.00
31	LINE PROTECTION Panel, SET OF 2 PANELS	2	SET	51,200.00	1,02,400.00
32	BUS COUPLER PROTECTION Panel, SET OF 1 PANELS	1	SET	51,200.00	51,200.00
33	BUS BAR PROTECTION Panel, SET OF 2 PANELS	1	SET	51,200.00	51,200.00
34	336kV, 1 Phase, Gapless type Metal Oxide Surge Arrester complete with surge counter, leakage current meter, insulating base, connecting cable/strip and terminal connectors. without support structure.	6	Nos	57,600.00	3,45,600.00
35	400kV, 1 Ph., 8kN, BPI (Solid core Bus Post insulator) with corona ring complete with terminal connectors without support structure.	4	Nos	38,400.00	1,53,600.00
36	400kV, 1 Ph., CVT (Capacitive Voltage Transformer) with complete with terminal connectors without support structure.	6	Nos	57,600.00	3,45,600.00

Bill of Quantity Cum Price Schedule (Annexure-I)

Name of Customer: SJVN Arun-3 Power Development Company (P) Ltd. (SAPDC), a company promoted by SJVN Ltd

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Tender Spec. No.: TBSM/ARUN-3/NEPAL/ETC/TENDER/23-24, Date: **10**.04.2023

Sl. No.	Description of Item	Quantity	UoM	Unit rate (NPR)	Total rate (NPR)
37	400kV, 1 Ph., WT (Wave Trap / Line Trap) with complete with terminal connectors without support structure.	4	Nos	57,600.00	2,30,400.00
38	145kV Grade Neutral Grounding Reactor (NGR)	3	Nos	96,000.00	2,88,000.00
39	145kV Grade Surge Arrestor near NGR	3	Nos	19,200.00	57,600.00
40	GI Lattice Structures including hardware for Towers, beams, LM & Equipments support AND OTHER SYSTEMS	65	MT	25,600.00	16,64,000.00
41	415V AC DISTRIBUTION BOARD (ACDB), COMPLETE SET OF PANELS	1	SET	51,200.00	51,200.00
42	DCDB - 220V DC DISTRIBUTION BOARD, COMPLETE SET OF PANELS	1	SET	28,800.00	28,800.00
43	DCDB - 48 V DC DISTRIBUTION BOARD, COMPLETE SET OF PANELS	1	SET	9,600.00	9,600.00
44	220V DC EMERGENCY LIGHTING BOARD (DC ELDB), COMPLETE SET OF PANELS	1	SET	28,800.00	28,800.00
45	DRY TYPE LT TRANSFORMER - 3150KVA, 33KV/11KV CAST RESIN DRY TYPE TRANSFORMER INDOOR INCLUDING DRAGGING TO PLINTH.	2	LOT	2,56,000.00	5,12,000.00
46	33KV SWITCHGEAR - POT HEAD YARD 33 KV SWITCHBOARD AS PER REFERENCE DRAWING 3-521-00-5-6540	10	No	60,000.00	6,00,000.00
47	11KV SWITCHGEAR - POT HEAD YARD 11 KV SWITCHBOARD AS PER REFERENCE DRAWING 3-521-00-5-6517	8	No	28,000.00	2,24,000.00
48	Supply of Equipment fixing hardware (hot dip galvanized) including nut, bolt and plain /spring washer as per Site requirement (Erection shall be covered with respective equipment support structure) 1. Bolts - Class 5.6 of IS:1367 (part 3) - 1991 (M12-M33, 30-145 mm lg. & fully threaded). 2. Nuts - Class 5 of IS:1367 (part 6) - 1980. 3. Plain Washers - A type conforming to IS: 2016-1967. 4. Spring Washer - Type B of IS: 3063-1972 Note - Size of hardware shall be suitable for Equipments /box/JB, and same shall be decided at site.	100	kg	960.00	96,000.00
49	400KV Single Suspension Stringing Hardware - with through / drop type clamp, 1 number Polymer Long Rod Insulator, suitable for quad conductor.	6	Set	10,240.00	61,440.00
50	ACSR Moose Conductor complete with Tee connectors for droppers to equipment connections, PG clamps for Busbar jumpering with Twin/Quad bundle rigid/flexible spacers etc to complete	5	Km	1,20,000.00	6,00,000.00
51	Installation of 7/9 SWG GI Stranded Shield wire including tension clamp, PG clamp and clamping on structure for down conductor, fixing/bolting with earth strip etc to complete.	100	Meter	128.00	12,800.00
52	BMK - Bay Marshalling Kiosks (Outdoor type, Floor / Trench mounted)	1	Nos	6,400.00	6,400.00
53	CVTJB - Junction Box (on CVT structure)	2	Nos	6,400.00	12,800.00
54	Installation of Prefabricated Cable Rack Assembly Structure (GI Lattice Structures including hardware) - work includes bolting, installation of anchor fastener, on cable trench floor / walls. Cable rack assembly shall be of 1/2/3/4 tier as applicable.	38	MT	20,800.00	7,90,400.00

Bill of Quantity Cum Price Schedule (Annexure-I)

Name of Customer: SJVN Arun-3 Power Development Company (P) Ltd. (SAPDC), a company promoted by SJVN Ltd

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Tender Spec. No.: TBSM/ARUN-3/NEPAL/ETC/TENDER/23-24, Date: **10**.04.2023

Sl. No.	Description of Item	Quantity	UoM	Unit rate (NPR)	Total rate (NPR)
55	Installation of Prefabricated Cable Rack Assembly Structure (GI Lattice Structures including hardware) at height about 12 to 17 meter from nearest available floor - work includes bolting, installation of anchor fastener, on cable trench floor / walls. Cable rack assembly shall be of 1/2/3/4 tier as applicable. Scope is inclusive of scaffolding / crane as per requirement	5	MT	25,600.00	1,28,000.00
56	Fabrication & Installation of Cable Rack Assembly - work includes cutting, welding, drilling of mounting holes and fabrication of cable racks with MS angles 50X50X6 & MS Flat (for wall mounting as well for continues run) on inserts/ anchor of cable trench walls, anchor fastener. Cable rack assembly shall be of 1/2/3/4 tier as applicable. 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. (supply of consumable is in scope of bidder)	22	MT	25,600.00	5,63,200.00
57	Fabrication & Installation of Cable Rack Assembly at height about 12 to 17 meter from nearest available floor - work includes cutting, welding, drilling of mounting holes and fabrication of cable racks with MS angles / MS Box Pipe & MS Flat (for wall mounting as well for continues earthing run) on inserts/ anchor of cable trench walls, anchor fastener. Cable rack assembly shall be of 1/2/3/4 tier as applicable. 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. (supply of consumable is in scope of bidder)	5	MT	28,800.00	1,44,000.00
58	Supply and installation of Rock Bolts (approx 2.5 m, 32 mm dia) for Cable Rack Structure installation at height above 12 to 17 meter Height from nearest available floor. Work includes all necessary T&P required for installation of rock bolt.	30	Nos	7,366.67	2,21,000.00
59	Supply & Installation of Panel Supporting Angles / Channel etc on cable trench, Vertical support for cables etc. 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. (supply of paint is in scope of bidder)	0.2	MT	1,68,000.00	33,600.00
60	Installation of Cable Trench Material - Ladder type cable tray - 600 mm wide (Standard supply length of 2.5m) - Cable Trench Material Bolted Type, following works deemed included in the scope and not being payable separately - installation of cantilever arms, back plate, angle fitting, clamp for single / double channel, base plate for single / double channel, beam clamp, tray fixing clamp, screw, nut bolt, anchor bolt, floor / ceiling / beam / columns support, Side runner for cable tray, side coupler, pvc end cap, earthing clamp, tray clamp etc. Bolted type Cable Rack/Tray material/Hardware , Nut Bolt, fasteners shall be free issued by BHEL. Cutting , drilling, punching, minor civil works also included in the scope. Minor welding and application of protective / zinc rich paint on welded surface is also included in the scope. Mode of measurement shall be running length of 600W Cable Tray	300	Meter	384.00	1,15,200.00
61	Installation of 450 / 600 mm wide (Standard supply length of 2.5m) G.S. steel ladder type cable trays with coupler plates, hardware, fixing and clamping arrangement on cable rack assembly / support structure etc to complete including cutting & jointing to suitable length. Fixing, tag welding, clamping hardware required for fixing of perforated tray on structure/ rack assembly shall be in ETC contractor scope.	2700	Meter	208.00	5,61,600.00

Bill of Quantity Cum Price Schedule (Annexure-I)

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Tender Spec. No.: TBSM/ARUN-3/NEPAL/ETC/TENDER/23-24, Date: **10**.04.2023

Sl. No.	Description of Item	Quantity	UoM	Unit rate (NPR)	Total rate (NPR)
62	Earthing work with 50X12, 50X6, 25X3 GI Flat - Installation of GI Flat including cutting, bending, welding with GI Flat / MS Rod, supply and application of paint, clamping to structure/building wall etc. to complete in all respect. All arc welding shall be done with low hydrogen content electrodes. the welds should be treated 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.	13	MT	32,000.00	4,16,000.00
63	Earthing work with 50X6 GI Flat / MS Flat - Installation of Flat including cutting, bending, welding with Flat / MS Rod, supply and application of paint, clamping to structure/building wall etc. to complete in all respect. All arc welding shall be done with low hydrogen content electrodes. the welds should be treated 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.	6	MT	32,000.00	1,92,000.00
64	(27.5) Earthing material- Pipe Electrode (to be driven - 3.0 Mtr) including following works: - excavation - installing the pipe electrode. - pipe electrodes in treated earth pit (as per IS) such as alternate layers of coke/ charcoal and salt or bentonite clay. - Backfilling and compaction - Cement Concrete pit with a ISI marked cast iron cover hinged to a cast iron frame to have an access to the joints. - any other work necessary to complete the work Remark :- Pipe Electrode assembly i.e. GI Pipe, Nuts, Bolts & Washers and funnel with wire mesh will be supplied by BHEL.	20	Nos	7,680.00	1,53,600.00
65	Supply & Installation of Hot Dip Galvanised Anchor Fastener of M08 to M20 of required lengths with nut, Plane washer & Spring Washer	500	KG	960.00	4,80,000.00
66	INSTALLATION OF 100 mm GI Pipe. Which shall be buried in the ground at a depth of 300 mm below FGL. Work includes excavation, backfilling, making trench holes and repairing of cable trench walls, cutting, fixing of sockets, bends & tee where required etc. complete. Both ends of conduits shall be closed by plastering. (Payment will be made for the as erected pipe length)	600	Meter	128.00	76,800.00
67	INSTALLATION OF 110 mm dia PVC Pipe. Which shall be placed as floor cut out / trench. Work includes placement of the same ahead of floor concreting, binding, fixing in reinforcement, making trench holes and repairing of cable trench walls, cutting, fixing of sockets/ bends where required etc. complete. Both ends of PVC conduits shall be closed by plastering. (Payment will be made for the as erected pipe length)	900	Meter	128.00	1,15,200.00
68	INSTALLATION OF 25/32 MM DIA. HDPE PIPE in cable trench, trays, hanger, supports, STRUCTURE, through wall etc	100	Meter	64.00	6,400.00
69	INSTALLATION OF 25/32 MM DIA. HDPE PIPE buried in the ground at a depth of 300 mm below FGL. Work includes excavation, backfilling, making trench holes and repairing of cable trench walls, cutting, fixing of sockets/ bends where required etc. complete. (Payment will be made for the as erected pipe length)	50	Meter	144.00	7,200.00
70	INSTALLATION of FIBBER OPTIC CABLE in GI Pipe / HDPE Pipe along with connectors for SAS & Busbar Protection / VMS. Splicing and Termination shall be in supplier's scope.). Installation of GI / HDPE Pipe is covered in separate BOQ line item.	300	Meter	128.00	38,400.00

Bill of Quantity Cum Price Schedule (Annexure-I)

Name of Customer: SJVN Arun-3 Power Development Company (P) Ltd. (SAPDC), a company promoted by SJVN Ltd

Name of Work: Receipt of equipment/ material at site, unloading, reconciliation, inspection, verification, storage, up-keeping during storage, erection, testing, commissioning and handing over of 400 KV GIS & 400 KV AIS and associated systems/equipment at Arun-3 Hydro Electric Project and reconciliation and handing over surplus materials to BHEL for 4X225 MW SJVN Arun-3 Power Development Company (P) Ltd. in Nepal

Tender Spec. No.: TBSM/ARUN-3/NEPAL/ETC/TENDER/23-24, Date: **10**.04.2023

Sl. No.	Description of Item	Quantity	UoM	Unit rate (NPR)	Total rate (NPR)
71	INSTALLATION of CO-AXIAL CABLE, CAT 6 CABLE, SHIELDED TWISTED PAIR - STP, UTP CABLE, SPECIAL purpose CABLES IN GI Pipe / HDPE Pipe along with connectors / TERMINATION. Installation of GI / HDPE Pipe is covered in separate BOQ line item.	100	Meter	64.00	6,400.00
72	ETC of LV CABLE 1 CORE X 70SQMM UNARMOURED AUX POWER CABLE	6200	Meter	91.71	5,68,602.05
73	ETC of LV CABLE 2 CORE X 10SQMM UNARMOURED AUX POWER CABLE	700	Meter	27.17	19,020.80
74	ETC of LV CABLE 2 CORE X 2.5SQMM UNARMOURED AUX POWER CABLE	2100	Meter	25.71	53,986.14
75	ETC of LV CABLE 4 CORE X 10SQMM UNARMOURED AUX POWER CABLE	1500	Meter	27.17	40,758.86
76	ETC of LV CABLE 2 CORE X 4SQMM UNARMOURED AUX POWER CABLE	300	Meter	27.17	8,151.77
77	ETC of LV CABLE 1 CORE X 400SQMM UNARMOURED AUX POWER CABLE	11000	Meter	325.99	35,85,871.61
78	ETC of LV CABLE 4 CORE X 4SQMM UNARMOURED AUX POWER CABLE	1700	Meter	27.17	46,193.37
79	ETC of LV CABLE 2 CORE X 6SQMM UNARMOURED AUX POWER CABLE	1000	Meter	27.17	27,172.57
80	ETC of LV CABLE 4 CORE X 16SQMM UNARMOURED AUX POWER CABLE	1500	Meter	27.17	40,758.86
81	ETC of LV CABLE 3.5 CORE X 70SQMM UNARMOURED AUX POWER CABLE	1200	Meter	53.25	63,901.97
82	ETC of LV CABLE 3.5 CORE X 35SQMM UNARMOURED AUX POWER CABLE	1500	Meter	36.73	55,087.90
83	ETC of LV CABLE 4 CORE X 6SQMM UNARMOURED CONTROL CABLE	27000	Meter	28.35	7,65,412.34
84	ETC of LV CABLE 4 CORE X 4SQMM UNARMOURED CONTROL CABLE	3000	Meter	35.45	1,06,338.22
85	ETC of LV CABLE 5 CORE X 2.5SQMM UNARMOURED CONTROL CABLE	12000	Meter	27.54	3,30,527.41
86	ETC of LV CABLE 10 CORE X 2.5SQMM UNARMOURED CONTROL CABLE	17000	Meter	27.54	4,68,247.16
87	ETC of LV CABLE 14 CORE X 2.5SQMM UNARMOURED CONTROL CABLE	16500	Meter	36.73	6,05,966.91
88	ETC of LV CABLE 19 CORE X 2.5SQMM UNARMOURED CONTROL CABLE	7000	Meter	49.85	3,48,931.30
89	Supply of CABLE GLAND suitable for 1 CORE X 70SQMM	40	No	480.00	19,200.00
90	Supply of CABLE GLAND suitable for 2 CORE X 10SQMM	20	No	480.00	9,600.00
91	Supply of CABLE GLAND suitable for 2 CORE X 2.5SQMM	70	No	480.00	33,600.00
92	Supply of CABLE GLAND suitable for 4 CORE X 10SQMM	50	No	480.00	24,000.00
93	Supply of CABLE GLAND suitable for 2 CORE X 4SQMM	10	No	400.00	4,000.00
94	Supply of CABLE GLAND suitable for 1 CORE X 400SQMM	40	No	640.00	25,600.00
95	Supply of CABLE GLAND suitable for 4 CORE X 4SQMM	50	No	480.00	24,000.00
96	Supply of CABLE GLAND suitable for 2 CORE X 6SQMM	40	No	480.00	19,200.00
97	Supply of CABLE GLAND suitable for 4 CORE X 16SQMM	50	No	480.00	24,000.00
98	Supply of CABLE GLAND suitable for 3.5 CORE X 70SQMM	40	No	800.00	32,000.00

Bill of Quantity Cum Price Schedule (Annexure-I)

Name of Customer: SJVN Arun-3 Power Development Company (P) Ltd. (SAPDC), a company promoted by SJVN Ltd

Name of Work: Receipt of equipment/ material at site, unloading, reconciliation, inspection, verification, storage, up-keeping during storage, erection, testing, commissioning and handing over of 400 KV GIS & 400 KV AIS and associated systems/equipment at Arun-3 Hydro Electric Project and reconciliation and handing over surplus materials to BHEL for 4X225 MW SJVN Arun-3 Power Development Company (P) Ltd. in Nepal

Tender Spec. No.: TBSM/ARUN-3/NEPAL/ETC/TENDER/23-24, Date: **10**.04.2023

Sl. No.	Description of Item	Quantity	UoM	Unit rate (NPR)	Total rate (NPR)
99	Supply of CABLE GLAND suitable for 3.5 CORE X 35SQMM	50	No	640.00	32,000.00
100	Supply of CABLE GLAND suitable for 4 CORE X 6SQMM	300	No	400.00	1,20,000.00
101	Supply of CABLE GLAND suitable for 4 CORE X 4SQMM	100	No	400.00	40,000.00
102	Supply of CABLE GLAND suitable for 5 CORE X 2.5SQMM	400	No	400.00	1,60,000.00
103	Supply of CABLE GLAND suitable for 10 CORE X 2.5SQMM	300	No	480.00	1,44,000.00
104	Supply of CABLE GLAND suitable for 14 CORE X 2.5SQMM	300	No	480.00	1,44,000.00
105	Supply of CABLE GLAND suitable for 19 CORE X 2.5SQMM	200	No	480.00	96,000.00
106	Supply & Installation of Insulation Rubber mats (Class-A suitable for 1.1 kV as per IS: 15652) in front of Panels	16	Sq.m	1,200.00	19,200.00
107	Supply & Mounting of Phase Colour Discs, Danger Plate and Identification Plates for bays & Equipments as per IS:2551; 1982 & IS:5; 1978.	1	Lot	12,000.00	12,000.00
108	PHASE IDENTIFICATION - Painting the structures in Red, Yellow and Blue by reflecting Colour is to be provided around the top of the structure with Colour band of 100 mm width.	1	Lot	12,000.00	12,000.00
109	Supply & Installation of BAY IDENTIFICATION - Bay Name Plate for outdoor	5	Nos	1,200.00	6,000.00
110	Supply & Installation of Cable Tag & Danger Plate - 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.	1	Lot	60,000.00	60,000.00
111	ILLUMINATION SYSTEM - MAIN LIGHTING DISTRIBUTION BOARD (MLDB) WITH ONE 100kva LIGHTING TRANSFORMER	1	Nos	28,000.00	28,000.00
112	ILLUMINATION SYSTEM - EMERGENCY LIGHTING DISTRIBUTION BOARD (Eldb) with ONE 50kva LIGHTING TRANSFORMER	1	Nos	16,000.00	16,000.00
113	ILLUMINATION SYSTEM - DC LIGHTING DISTRIBUTION BOARD	1	Nos	12,000.00	12,000.00
114	ILLUMINATION SYSTEM - INDOOR LIGHTING NORMAL PANEL	8	Nos	9,600.00	76,800.00
115	ILLUMINATION SYSTEM - INDOOR EMERGENCY LIGHTING PANEL	3	Nos	9,600.00	28,800.00
116	ILLUMINATION SYSTEM - OUTDOOR LIGHTING PANEL	4	Nos	12,000.00	48,000.00
117	ILLUMINATION SYSTEM - STREET LIGHTING PANEL	2	Nos	12,000.00	24,000.00
118	ILLUMINATION SYSTEM - 25M HIGH MAST LIGHTING POLE WITH FEEDER PILLAR (WITHOUT FIXTURES) COMPLETE IN ALL RESPECT	4	Nos	2,00,000.00	8,00,000.00
119	ILLUMINATION SYSTEM - STREET LIGHTING POLE 6 METER WITH LIGHT FIXTURES, WIRING, JB ETC COMPLETE IN ALL RESPECT	10	Nos	12,000.00	1,20,000.00
120	ILLUMINATION SYSTEM - SOLAR BASED STREET LIGHTING POLE 6 METER WITH SOLAR ASSEMBLY, CONTROLLER, LIGHT FIXTURES, WIRING, JB ETC COMPLETE IN ALL RESPECT	10	Nos	20,000.00	2,00,000.00
121	ILLUMINATION SYSTEM - 4.5M HIGH LIGHTING POLE FOR POST-TOP LANTERN WITH LIGHT FITTINGS, WIRING, JB ETC COMPLETE IN ALL RESPECT	5	Nos	12,000.00	60,000.00
122	ILLUMINATION SYSTEM - LIGHTING FIXTURE - RECESSED MOUNTED / SURFACE MOUNTED / DC LED BULKHEAD / DC LED DOWN LIGHTER	245	Nos	1,760.00	4,31,200.00
123	ILLUMINATION SYSTEM - LED INDOOR HIGH BAY FITTINGS TYPE IHB	30	Nos	1,760.00	52,800.00
124	ILLUMINATION SYSTEM - FLOOD LIGHT LED TYPE LIGHTING FIXTURE WITH ACCESSORIES	80	Nos	1,760.00	1,40,800.00

Bill of Quantity Cum Price Schedule (Annexure-I)

Name of Customer: SJVN Arun-3 Power Development Company (P) Ltd. (SAPDC), a company promoted by SJVN Ltd

Name of Work: Receipt of equipment/ material at site, unloading, reconciliation, inspection, verification, storage, up-keeping during storage, erection, testing, commissioning and handing over of 400 KV GIS & 400 KV AIS and associated systems/equipment at Arun-3 Hydro Electric Project and reconciliation and handing over surplus materials to BHEL for 4X225 MW SJVN Arun-3 Power Development Company (P) Ltd. in Nepal

Tender Spec. No.: TBSM/ARUN-3/NEPAL/ETC/TENDER/23-24, Date: **10**.04.2023

Sl. No.	Description of Item	Quantity	UoM	Unit rate (NPR)	Total rate (NPR)
125	ILLUMINATION SYSTEM - OUTDOOR POWER RECEPTACLE FOR OIL FILTRATION UNIT (250A)	2	Nos	2,000.00	4,000.00
126	ILLUMINATION SYSTEM - 20 / 25mm GI Conduits / Flexible conduits on Lattice/ Pipe Stucture/ Vertical wall / Structure including clamping, fixing of sockets/ bends as required etc. complete. (Payment will be made for the as erected conduit length).	2000	Meter	40.00	80,000.00
127	ILLUMINATION SYSTEM - 20 / 25 / 30 mm PVC Conduits, heavy-duty type. Installation on slab / Lattice/ Pipe Stucture/ Vertical wall / Structure including clamping, fixing of sockets/ bends as required etc. complete. (Payment will be made for the as erected conduit length).	2000	Meter	40.00	80,000.00
128	GI / MS Hardware / Accessories for Illumination System - With and without Hot dip galvanized / PVC i.e. 3 / 4 way JB, 90 degree GI normal / inspection bend, tees, bushings, reducers, enlargers, coupling caps, nipples, solid bend, spacer, circular boxes (with gasket as applicable), closer, socket, saddle, saddle base, Fan box, mounting hardwares, nut, lock nut, bolt, washer, screw, reducer, U clamp, earth clip/clamp, anchor fastener, etc complete material required for complete installation of Illumination system.	2	MT	96,000.00	1,92,000.00
129	ILLUMINATION SYSTEM - ERECTION OF SWITCH & SOCKET, JUNCTION BOX, RECEPTACLES, LIGHT LEVEL SENSORS, OCCUPANCY SENSOR, ACCESSORIES, TEMPERATURE TRANSDUCER, TELEPHONE SOCKET, TELEPHONE JB, LAN CABLE , TELEPHONE CABLE, WALL FAN , EXIT SIGN BOARD, CEILING FAN, POINT WIRING & (1.5, 2.5, 4 SQ. MM CU / AL WIRE ETC.) COMPLETE IN ALL RESPECT UPTOTHE FULL COMMISSIONING OF ILLUMINATION SYSTEM AS APPLICABLE FOR INDOOR CRB, GIS HALL & OUTDOOR SWITCHYARD	1	LOT	24,000.00	24,000.00
130	CIVIL WORK FOR Illumination System - M25 CONCRETE FOR OUTDOOR Equipment foundations, panel foundation and other civil work including supply of cement, steel and other material as per relevant drawings and specification clauses shall be provided by the Contractor.	20	Cubic meter	23,040.00	4,60,800.00
131	CIVIL Work - Grouting underside of base plates of Towers & Equipment support structures including supply of non shrinking grouting material, admixtures, cement and other material as applicable M30 grade concrete	10	Cubic meter	23,040.00	2,30,400.00
132	Watch and ward of stored / erected material at project site as per instruction of site in charge. (round the clock security by authorized service agency)	20	Per Post Per Months	1,53,600.00	30,72,000.00
			Grand Total (in NPR)		**7,12,13,372.43**

Validate Print Help

Percentage BoQ

Tender Inviting Authority: BHEL, TBG- SubContracting Department, Sector 16 A, Noida, UP

Name of Work: Receipt of equipment/ material at site, unloading, reconciliation, inspection, verification, storage, up-keeping during storage, erection, testing, commissioning and handing over of 400 KV GIS & 400 KV AIS and associated systems/equipment at Arun-3 Hydro Electric Project and reconciliation and handing over surplus materials to BHEL for 4X225 MW SJVN Arun-3 Power Development Company (P) Ltd. in Nepal.".

Contract No: TBSM/ARUN-3/NEPAL/ETC/TENDER/23-24 DATE 10.04.2023

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 #
Sl. No.	Item Description	Quantity	Units	Estimated Rate in NPR.	TOTAL AMOUNT Without Taxes in NPR.
1	2	4	5	6	53
1	Total amount as per rates in BOQ (as per Annexure-I) for "Receipt of equipment/ material at site, unloading, reconciliation, inspection, verification, storage, up-keeping during storage, erection, testing, commissioning and handing over of 400 KV GIS & 400 KV AIS and associated systems/equipment at Arun-3 Hydro Electric Project and reconciliation and handing over surplus materials to BHEL for 4X225 MW SJVN Arun-3 Power Development Company (P) Ltd. in Nepal."- Including all taxes except VAT	1.000	Nos	**71213372**	**71213372.00**
Total in Figures					**71213372.00**
Quoted Rate in Figures			**Select**		**0.000**

Package Work Indent Item

Sr. No.	Description Of Item	SAC Code	Quantity	Unit	Unit Rate	AMOUNT
1	400kV, 80MVAR 3-Phase Bus / Line Reactor complete in all respect along with Radiator Bank and its cooling arrangement, Conservator, Cooler Control Cabinet/Marshalling Kiosk, accessories and insulating oil. Work includes Installation of 2X10m Rail, Inserts & bolts on reactor foundation, erection of all auxiliaries viz turrets, bushings, terminal connectors, associated earthing works (excluding riser connections to main earthmat), laying of cable from Reactor auxiliaries to MK, complete reactor insulating oil filtration, filling of oil, hot oil circulation, continues DRY AIR purging, dry out by N2 / associated heating method, Oil testing etc as required to complete the installation of Reactor. Dragging on rail cum road. Note:- (1) Charges for Oil filtration including Particle count test, filtration unit with NAS filter, dry air, dry out by N2 and heating, filling of oil, hot oil circulation, oil sample testing at approved Lab etc for first time commissioning of Reactor are deemed to be covered under this cope as per technical specification and IEC-60296 from an accredited laboratory. (2) Please refer Chapter 13: Shunt Reactor ED/TS/ARUN/01.06.17 & other technical requirement for detail		3.00	Nos	3392000.00	10176000.00
2	Dragging/ shifting of main tank of above mentioned Reactor (1 No.) if required to do on bare land (Not on rail cum road)		30.00	Meter	3200.00	96000.00
3	On line Dissolved Gas (Multigas) & Moisture analyser for Reactor		3.00	Nos	6400.00	19200.00
4	On line insulating oil drying system (Cartridge type) for Reactor		3.00	Nos	6400.00	19200.00
5	Repeat oil tests as per IEC-60296 & DGA from accredited laboratory, after 24 hours of test-service period (for compare of results with before energization value). (BDV, PPM, Resistivity & Tan delta etc as per Customer specification) for Reactor insulating oil		3.00	Set	76800.00	230400.00
6	Oil Testing (BDV, PPM, Resistivity & Tan delta etc as per Customer specification) for Reactor insulating oil (as if supplied in drums, if applicable) at accredited laboratory. arrangement of sampling bottle, sampling syringe etc for OIL TESTING is in the scope of the bidder. Bidder's scope covers all supports for sampling, safely delivery and submission of test sample to accredited laboratory, getting it tested and submission of test report to BHEL. Customer laboratory charges shall in the scope of bidder. 1 set equals to one number of successful oil sample test.		20.00	Set	32000.00	640000.00
7	Charges for repetition of oil filtration - (if required due to reasons not attributed to the bidder) This item is executed only if repetition of Reactor oil filtration is required by BHEL. Scope includes successful repetition of oil filtration complete in all respect excluding oil testing at accredited laboratory.		50.00	KL	64000.00	3200000.00
8	Charges for repetition of Heating and Dry out of wet winding of Reactor/reactor by application of vacuum, N2 filling - N2 gas Cylinders for complete dry out of Reactor by vacuuming/ N2 filling/ purging and heating. Mode of measurement shall be number of gas cylinder of 50 kg N2 gas, on pro-rata basis. (Empty gas cylinder shall be returned back) (if required due to reasons not attributed to the bidder)		10.00	Nos	19200.00	192000.00

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9	GIS - Fully equipped 400kV, SF6 GIS Bay Module: Fully equipped Generator Transformer Bay / Bus Reactor Bay / Line Reactor Bay / Line Bay / Bus Coupler Bay. Work include Erection, Testing and commissioning of 400kV GIS Bay including all the work / services required for completion including SF6 Gas handling / filling / top-up etc complete in all respect for successful installation & commissioning of GIS. Arrangement of tool & tackles, instruments shall be part of bidder's scope such as and not limited to Annexure_T&P_GIS_ETC. The following activities are in GIS supplier scope (1) Supervision of GIS Installation, (2) Testing of GIS, (3) Arrangement of special T&P & testing kit as per Annexure_T&P_GIS_OEM shall be arranged by GIS manufacturer which includes SF6 Gas handling plant & HV Test Kit.		10.00	Set	2112000.00	21120000.00
10	GIS - ALL OTHER PARTS OF GIS SUCH AS AND NOT LIMITED TO BUSBAR MODULE, VOLTAGE TRANSFORMER BAY, SURGE ARRESTOR, BUS EXTENSION MODULE, CSD, INTERFACING GIS MODULE EXTRA TO COMPLETE THE INSTALLATION OF GIS SYSTEM AS PER DRAWING & SLD.		1.00	Lot	832000.00	832000.00
11	Gas Insulated Bus Duct (GIB) - 400kV Phase Isolated, SF6 gas-insulated metal enclosed single phase bus duct from GIS Bay module take-off to SF6 to Air/Oil Bushing. Work includes complete installation of GIB including respective cabling.		342.30	Meter	3584.00	1226803.20
12	GIS - 400kV, 1 phase SF6 Interfacing GIS Module near GT in GT Cavern Area, complete in all respects and comprising of following but not limited to a) CT, SF6 gas insulated Surge Arrestors, High speed grounding switch, approx 7 m GIB, SF6 to Cable Connection Module etc complete with group operated manual and motor driven operating mechanisms for each phase, Gas monitoring system etc complete AS PER DRAWING AND SLD		12.00	Set	32000.00	384000.00
13	GIS - SF6 to Air Bushing module complete		6.00	Nos	32000.00	192000.00
14	GIS - SF6 to Oil Bushing complete		21.00	Nos	32000.00	672000.00
15	GIS - SF6 to Cable Connection Module complete		24.00	Nos	32000.00	768000.00
16	LCC - Local Control Cubical Panel with GIS Internal cabling and GIS to respective LCC cabling		10.00	Nos	76800.00	768000.00
17	LCC - mini Local Control Cubical Panel for 3x1 Phase Interfacing GIS Module, scope includes Internal cabling and GIS to respective LCC cabling		4.00	Nos	76800.00	307200.00
18	Structure Work for Installation of GIS including Support Structure for GIS, GIB (bus duct), SF6 to Air Bushings, Supports, Platforms, Ladders, Foundation Bolts, Embedded Parts in floors etc. complete in all respect, which are required for installation of GIS system as per the specification		45.00	MT	22400.00	1008000.00
19	Grounding/ Earthing for GIS (Including GIS interface module system at GT cavern) complete including Gas Insulated Bus duct, LCC, SF6 to air bushing, SF6 to Cable, SF6 to Oil modules etc.. using braided Cu wire (insulated/ non-insulated)/ earth strip (Cu/Al/GI flat). Work includes cutting, lug crimping , bolting , fixing etc. and connecting with riser/earth strip (GI/AL /Cu flat) complete in all respect. Grounding Material will be supplied by GIS Supplier /BHEL.		1.00	Lot	960000.00	960000.00
20	400KV, CONTINUOUS ONLINE MONITORING AND DIAGNOSTIC SYSTEM INCLUDING REMOTE MONITORING AND SUPERVISION STATION - This includes online PD Monitoring system for complete GIS including Sensors, Panels i.e. radial control cabinet, radial distribution cabinets, OCU Panel, cable laying & termination, FO (approx .75km) / Special Cable (approx 1km) , Work Station, Ethernet switch etc complete in all respect. Please refer TB-405-317-10-50 & 1MNS500745-SAA		1.00	Lot	76800.00	76800.00
21	SF6 Gas Filling/Recovery/Re-filling Cycle. The cycle of the gas filling/recovery/re-filling will be followed multiple time till the Completion of the HV test. Gas processing and filling unit (DILO machine) shall be in the scope of BHEL/manufacturer.		1.00	Lot	768000.00	768000.00
22	HV Test for GIS - HV test kit shall be arranged by GIS Supplier. Test shall also be conducted by GIS supplier. All necessary support i.e. unloading, shifting, minor assembling of HV test kit, cabling, support for complete HV Test, dismantling & loading on carrier. Complete in all respect.		1.00	Lot	576000.00	576000.00

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23	FIRE FIGHTING SYSTEM (ETC & Material Handling) - Receipt of material, unloading, proper storage, material reconciliation, safe keeping, erection, testing & commissioning, handing over to BHEL, proper record keeping etc to complete. Refer Annexure-ETC_FFS.		1.00	Lot	1000000.00	1000000.00
24	AIR CONDITIONING & VENTILATION SYSTEM (ETC & Material Handling) - Receipt of material, unloading, proper storage, material reconciliation, safe keeping, erection, testing & commissioning, handing over to BHEL, proper record keeping etc to complete. Refer Annexure-ETC_ACVS.		1.00	Lot	600000.00	600000.00
25	EOT Crane (ETC & Material Handling) - Receipt of material, unloading, proper storage, material reconciliation, safe keeping, erection, testing & commissioning, handing over to BHEL, proper record keeping etc to complete. Refer Annexure-ETC_EOT.		1.00	Lot	1000000.00	1000000.00
26	LCB FOR 400kV SWITCHYARD (LOCAL CONTROL BOARD OF SWITCHYARD) THIS INCLUDES LOCAL HMI PANEL, ELECTRONIC PANEL, RELAY PANEL & CONTROL AND METERING PANEL,SET OF 4 PANELS. REF DRAWING 3-694-00-00-836		1.00	SET	102400.00	102400.00
27	Computer Set - Dual Monitor Operator workstation at 400KV Switch yard		1.00	Nos	12800.00	12800.00
28	Generator Transformer PROTECTION Panel (400KV SIDE), SET OF 1 PANEL		4.00	SET	38400.00	153600.00
29	LINE REACTOR PROTECTION Panel, SET OF 2 PANELS		2.00	SET	51200.00	102400.00
30	BUS REACTOR PROTECTION Panel, SET OF 2 PANELS		1.00	SET	51200.00	51200.00
31	LINE PROTECTION Panel, SET OF 2 PANELS		2.00	SET	51200.00	102400.00
32	BUS COUPLER PROTECTION Panel, SET OF 1 PANELS		1.00	SET	51200.00	51200.00
33	BUS BAR PROTECTION Panel, SET OF 2 PANELS		1.00	SET	51200.00	51200.00
34	336kV, 1 Phase, Gapless type Metal Oxide Surge Arrester complete with surge counter, leakage current meter, insulating base, connecting cable/strip and terminal connectors. without support structure.		6.00	Nos	57600.00	345600.00
35	400kV, 1 Ph., 8kN, BPI (Solid core Bus Post insulator) with corona ring complete with terminal connectors without support structure.		4.00	Nos	38400.00	153600.00
36	400kV, 1 Ph., CVT (Capacitive Voltage Transformer) with complete with terminal connectors without support structure.		6.00	Nos	57600.00	345600.00
37	400kV, 1 Ph., WT (Wave Trap / Line Trap) with complete with terminal connectors without support structure.		4.00	Nos	57600.00	230400.00
38	145kV Grade Neutral Grounding Reactor (NGR)		3.00	Nos	96000.00	288000.00
39	145kV Grade Surge Arrestor near NGR		3.00	Nos	19200.00	57600.00
40	GI Lattice Structures including hardware for Towers, beams, LM & Equipments support AND OTHER SYSTEMS		65.00	MT	25600.00	1664000.00
41	415V AC DISTRIBUTION BOARD (ACDB), COMPLETE SET OF PANELS		1.00	SET	51200.00	51200.00
42	DCDB - 220V DC DISTRIBUTION BOARD, COMPLETE SET OF PANELS		1.00	SET	28800.00	28800.00
43	DCDB - 48 V DC DISTRIBUTION BOARD, COMPLETE SET OF PANELS		1.00	SET	9600.00	9600.00
44	220V DC EMERGENCY LIGHTING BOARD (DC ELDB), COMPLETE SET OF PANELS		1.00	SET	28800.00	28800.00
45	DRY TYPE LT TRANSFORMER - 3150KVA, 33KV/11KV CAST RESIN DRY TYPE TRANSFORMER INDOOR INCLUDING DRAGGING TO PLINTH.		2.00	LOT	256000.00	512000.00
46	33KV SWITCHGEAR - POT HEAD YARD 33 KV SWITCHBOARD AS PER REFERENCE DRAWING 3-521-00-5-6540		10.00	No	60000.00	600000.00
47	11KV SWITCHGEAR - POT HEAD YARD 11 KV SWITCHBOARD AS PER REFERENCE DRAWING 3-521-00-5-6517		8.00	No	28000.00	224000.00
48	Supply of Equipment fixing hardware (hot dip galvanized) including nut, bolt and plain /spring washer as per Site requirement (Erection shall be covered with respective equipment support structure) 1. Bolts - Class 5.6 of IS:1367 (part 3) - 1991 (M12-M33, 30-145 mm lg. & fully threaded). 2. Nuts - Class 5 of IS:1367 (part 6) - 1980. 3. Plain Washers - A type conforming to IS: 2016-1967. 4. Spring Washer - Type B of IS: 3063-1972 Note - Size of hardware shall be suitable for Equipments /box/JB, and same shall be decided at site.		100.00	kg	960.00	96000.00

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49	400KV Single Suspension Stringing Hardware - with through / drop type clamp, 1 number Polymer Long Rod Insulator, suitable for quad conductor.		6.00	Set	10240.00	61440.00
50	ACSR Moose Conductor complete with Tee connectors for droppers to equipment connections, PG clamps for Busbar jumpering with Twin/Quad bundle rigid/flexible spacers etc to complete		5.00	Km	120000.00	600000.00
51	Installation of 7/9 SWG GI Stranded Shield wire including tension clamp, PG clamp and clamping on structure for down conductor, fixing/bolting with earth strip etc to complete.		100.00	Meter	128.00	12800.00
52	BMK - Bay Marshalling Kiosks (Outdoor type, Floor / Trench mounted)		1.00	Nos	6400.00	6400.00
53	CVTJB - Junction Box (on CVT structure)		2.00	Nos	6400.00	12800.00
54	Installation of Prefabricated Cable Rack Assembly Structure (GI Lattice Structures including hardware) - work includes bolting, installation of anchor fastener, on cable trench floor / walls. Cable rack assembly shall be of 1/2/3/4 tier as applicable.		38.00	MT	20800.00	790400.00
55	Installation of Prefabricated Cable Rack Assembly Structure (GI Lattice Structures including hardware) at height about 12 to 17 meter from nearest available floor - work includes bolting, installation of anchor fastener, on cable trench floor / walls. Cable rack assembly shall be of 1/2/3/4 tier as applicable. Scope is inclusive of scaffolding / crane as per requirement		5.00	MT	25600.00	128000.00
56	Fabrication & Installation of Cable Rack Assembly - work includes cutting, welding, drilling of mounting holes and fabrication of cable racks with MS angles 50X50X6 & MS Flat (for wall mounting as well for continues run) on inserts/ anchor of cable trench walls, anchor fastener. Cable rack assembly shall be of 1/2/3/4 tier as applicable. 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. (supply of consumable is in scope of bidder)		22.00	MT	25600.00	563200.00
57	Fabrication & Installation of Cable Rack Assembly at height about 12 to 17 meter from nearest available floor - work includes cutting, welding, drilling of mounting holes and fabrication of cable racks with MS angles / MS Box Pipe & MS Flat (for wall mounting as well for continues earthing run) on inserts/ anchor of cable trench walls, anchor fastener. Cable rack assembly shall be of 1/2/3/4 tier as applicable. 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. (supply of consumable is in scope of bidder)		5.00	MT	28800.00	144000.00
58	Supply and installation of Rock Bolts (approx 2.5 m, 32 mm dia) for Cable Rack Structure installation at height above 12 to 17 meter Height from nearest available floor. Work includes all necessary T&P required for installation of rock bolt.		30.00	Nos	7366.67	221000.00
59	Supply & Installation of Panel Supporting Angles / Channel etc on cable trench, Vertical support for cables etc. 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. (supply of paint is in scope of bidder)		0.20	MT	168000.00	33600.00
60	Installation of Cable Trench Material - Ladder type cable tray - 600 mm wide (Standard supply length of 2.5m) - Cable Trench Material Bolted Type, following works deemed included in the scope and not being payable separately - installation of cantilever arms, back plate, angle fitting, clamp for single / double channel, base plate for single / double channel, beam clamp, tray fixing clamp, screw, nut bolt, anchor bolt, floor / ceiling / beam / columns support, Side runner for cable tray, side coupler, pvc end cap, earthing clamp, tray clamp etc. Bolted type Cable Rack/Tray material/Hardware , Nut Bolt, fasteners shall be free issued by BHEL. Cutting , drilling, punching, minor civil works also included in the scope. Minor welding and application of protective / zinc rich paint on welded surface is also included in the scope. Mode of measurement shall be running length of 600W Cable Tray		300.00	Meter	384.00	115200.00

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61	Installation of 450 / 600 mm wide (Standard supply length of 2.5m) G.S. steel ladder type cable trays with coupler plates, hardware, fixing and clamping arrangement on cable rack assembly / support structure etc to complete including cutting & jointing to suitable length. Fixing, tag welding, clamping hardware required for fixing of perforated tray on structure/ rack assembly shall be in ETC contractor scope.		2700.00	Meter	208.00	561600.00
62	Earthing work with 50X12, 50X6, 25X3 GI Flat - Installation of GI Flat including cutting, bending, welding with GI Flat / MS Rod, supply and application of paint, clamping to structure/building wall etc. to complete in all respect. All arc welding shall be done with low hydrogen content electrodes. the welds should be treated 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.		13.00	MT	32000.00	416000.00
63	Earthing work with 50X6 GI Flat / MS Flat - Installation of Flat including cutting, bending, welding with Flat / MS Rod, supply and application of paint, clamping to structure/building wall etc. to complete in all respect. All arc welding shall be done with low hydrogen content electrodes. the welds should be treated 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.		6.00	MT	32000.00	192000.00
64	(27.5) Earthing material- Pipe Electrode (to be driven - 3.0 Mtr) including following works: - excavation - installing the pipe electrode. - pipe electrodes in treated earth pit (as per IS) such as alternate layers of coke/ charcoal and salt or bentonite clay. - Backfilling and compaction - Cement Concrete pit with a ISI marked cast iron cover hinged to a cast iron frame to have an access to the joints. - any other work necessary to complete the work Remark :- Pipe Electrode assembly i.e. GI Pipe, Nuts, Bolts & Washers and funnel with wire mesh will be supplied by BHEL.		20.00	Nos	7680.00	153600.00
65	Supply & Installation of Hot Dip Galvanised Anchor Fastener of M08 to M20 of required lengths with nut, Plane washer & Spring Washer		500.00	KG	960.00	480000.00
66	INSTALLATION OF 100 mm GI Pipe. Which shall be buried in the ground at a depth of 300 mm below FGL. Work includes excavation, backfilling, making trench holes and repairing of cable trench walls, cutting, fixing of sockets, bends & tee where required etc. complete. Both ends of conduits shall be closed by plastering. (Payment will be made for the as erected pipe length)		600.00	Meter	128.00	76800.00
67	INSTALLATION OF 110 mm dia PVC Pipe. Which shall be placed as floor cut out / trench. Work includes placement of the same ahead of floor concreting, binding, fixing in reinforcement, making trench holes and repairing of cable trench walls, cutting, fixing of sockets/ bends where required etc. complete. Both ends of PVC conduits shall be closed by plastering. (Payment will be made for the as erected pipe length)		900.00	Meter	128.00	115200.00
68	INSTALLATION OF 25/32 MM DIA. HDPE PIPE In cable trench, trays, hanger, supports, STRUCTURE, through wall etc		100.00	Meter	64.00	6400.00
69	INSTALLATION OF 25/32 MM DIA. HDPE PIPE buried in the ground at a depth of 300 mm below FGL. Work includes excavation, backfilling, making trench holes and repairing of cable trench walls, cutting, fixing of sockets/ bends where required etc. complete. (Payment will be made for the as erected pipe length)		50.00	Meter	144.00	7200.00
70	INSTALLATION of FIBBER OPTIC CABLE in GI Pipe / HDPE Pipe along with connectors for SAS & Busbar Protection / VMS. Splicing and Termination shall be in supplier's scope.). Installation of GI / HDPE Pipe is covered in separate BOQ line item.		300.00	Meter	128.00	38400.00
71	INSTALLATION of CO-AXIAL CABLE, CAT 6 CABLE, SHIELDED TWISTED PAIR - STP, UTP CABLE, SPECIAL purpose CABLES IN GI Pipe / HDPE Pipe along with connectors / TERMINATION. Installation of GI / HDPE Pipe is covered in separate BOQ line item.		100.00	Meter	64.00	6400.00
72	ETC of LV CABLE 1 CORE X 70SQMM UNARMOURED AUX POWER CABLE		6200.00	Meter	91.71	568602.05
73	ETC of LV CABLE 2 CORE X 10SQMM UNARMOURED AUX POWER CABLE		700.00	Meter	27.17	19020.80

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74	ETC of LV CABLE 2 CORE X 2.5SQMM UNARMOURED AUX POWER CABLE		2100.00	Meter	25.71	53986.14
75	ETC of LV CABLE 4 CORE X 10SQMM UNARMOURED AUX POWER CABLE		1500.00	Meter	27.17	40758.86
76	ETC of LV CABLE 2 CORE X 4SQMM UNARMOURED AUX POWER CABLE		300.00	Meter	27.17	8151.77
77	ETC of LV CABLE 1 CORE X 400SQMM UNARMOURED AUX POWER CABLE		11000.00	Meter	325.99	3585871.61
78	ETC of LV CABLE 4 CORE X 4SQMM UNARMOURED AUX POWER CABLE		1700.00	Meter	27.17	46193.37
79	ETC of LV CABLE 2 CORE X 6SQMM UNARMOURED AUX POWER CABLE		1000.00	Meter	27.17	27172.57
80	ETC of LV CABLE 4 CORE X 16SQMM UNARMOURED AUX POWER CABLE		1500.00	Meter	27.17	40758.86
81	ETC of LV CABLE 3.5 CORE X 70SQMM UNARMOURED AUX POWER CABLE		1200.00	Meter	53.25	63901.97
82	ETC of LV CABLE 3.5 CORE X 35SQMM UNARMOURED AUX POWER CABLE		1500.00	Meter	36.73	55087.90
83	ETC of LV CABLE 4 CORE X 6SQMM UNARMOURED CONTROL CABLE		27000.00	Meter	28.35	765412.34
84	ETC of LV CABLE 4 CORE X 4SQMM UNARMOURED CONTROL CABLE		3000.00	Meter	35.45	106338.22
85	ETC of LV CABLE 5 CORE X 2.5SQMM UNARMOURED CONTROL CABLE		12000.00	Meter	27.54	330527.41
86	ETC of LV CABLE 10 CORE X 2.5SQMM UNARMOURED CONTROL CABLE		17000.00	Meter	27.54	468247.16
87	ETC of LV CABLE 14 CORE X 2.5SQMM UNARMOURED CONTROL CABLE		16500.00	Meter	36.73	605966.91
88	ETC of LV CABLE 19 CORE X 2.5SQMM UNARMOURED CONTROL CABLE		7000.00	Meter	49.85	348931.30
89	Supply of CABLE GLAND suitable for 1 CORE X 70SQMM		40.00	No	480.00	19200.00
90	Supply of CABLE GLAND suitable for 2 CORE X 10SQMM		20.00	No	480.00	9600.00
91	Supply of CABLE GLAND suitable for 2 CORE X 2.5SQMM		70.00	No	480.00	33600.00
92	Supply of CABLE GLAND suitable for 4 CORE X 10SQMM		50.00	No	480.00	24000.00
93	Supply of CABLE GLAND suitable for 2 CORE X 4SQMM		10.00	No	400.00	4000.00
94	Supply of CABLE GLAND suitable for 1 CORE X 400SQMM		40.00	No	640.00	25600.00
95	Supply of CABLE GLAND suitable for 4 CORE X 4SQMM		50.00	No	480.00	24000.00
96	Supply of CABLE GLAND suitable for 2 CORE X 6SQMM		40.00	No	480.00	19200.00
97	Supply of CABLE GLAND suitable for 4 CORE X 16SQMM		50.00	No	480.00	24000.00
98	Supply of CABLE GLAND suitable for 3.5 CORE X 70SQMM		40.00	No	800.00	32000.00
99	Supply of CABLE GLAND suitable for 3.5 CORE X 35SQMM		50.00	No	640.00	32000.00
100	Supply of CABLE GLAND suitable for 4 CORE X 6SQMM		300.00	No	400.00	120000.00
101	Supply of CABLE GLAND suitable for 4 CORE X 4SQMM		100.00	No	400.00	40000.00
102	Supply of CABLE GLAND suitable for 5 CORE X 2.5SQMM		400.00	No	400.00	160000.00
103	Supply of CABLE GLAND suitable for 10 CORE X 2.5SQMM		300.00	No	480.00	144000.00
104	Supply of CABLE GLAND suitable for 14 CORE X 2.5SQMM		300.00	No	480.00	144000.00
105	Supply of CABLE GLAND suitable for 19 CORE X 2.5SQMM		200.00	No	480.00	96000.00
106	Supply & Installation of Insulation Rubber mats (Class-A suitable for 1.1 kV as per IS: 15652) in front of Panels		16.00	Sq.m	1200.00	19200.00
107	Supply & Mounting of Phase Colour Discs, Danger Plate and Identification Plates for bays & Equipments as per IS:2551; 1982 & IS:5; 1978.		1.00	Lot	12000.00	12000.00
108	PHASE IDENTIFICATION - Painting the structures in Red, Yellow and Blue by reflecting Colour is to be provided around the top of the structure with Colour band of 100 mm width.		1.00	Lot	12000.00	12000.00
109	Supply & Installation of BAY IDENTIFICATION - Bay Name Plate for outdoor		5.00	Nos	1200.00	6000.00
110	Supply & Installation of Cable Tag & Danger Plate - 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.		1.00	Lot	60000.00	60000.00
111	ILLUMINATION SYSTEM - MAIN LIGHTING DISTRIBUTION BOARD (MLDB) WITH ONE 100kva LIGHTING TRANSFORMER		1.00	Nos	28000.00	28000.00
112	ILLUMINATION SYSTEM - EMERGENCY LIGHTING DISTRIBUTION BOARD (Eldb) with ONE 50kva LIGHTING TRANSFORMER		1.00	Nos	16000.00	16000.00
113	ILLUMINATION SYSTEM - DC LIGHTING DISTRIBUTION BOARD		1.00	Nos	12000.00	12000.00
114	ILLUMINATION SYSTEM - INDOOR LIGHTING NORMAL PANEL		8.00	Nos	9600.00	76800.00
115	ILLUMINATION SYSTEM - INDOOR EMERGENCY LIGHTING PANEL		3.00	Nos	9600.00	28800.00
116	ILLUMINATION SYSTEM - OUTDOOR LIGHTING PANEL		4.00	Nos	12000.00	48000.00

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117	ILLUMINATION SYSTEM - STREET LIGHTING PANEL		2.00	Nos	12000.00	24000.00
118	ILLUMINATION SYSTEM - 25M HIGH MAST LIGHTING POLE WITH FEEDER PILLAR (WITHOUT FIXTURES) COMPLETE IN ALL RESPECT		4.00	Nos	200000.00	800000.00
119	ILLUMINATION SYSTEM - STREET LIGHTING POLE 6 METER WITH LIGHT FIXTURES, WIRING, JB ETC COMPLETE IN ALL RESPECT		10.00	Nos	12000.00	120000.00
120	ILLUMINATION SYSTEM - SOLAR BASED STREET LIGHTING POLE 6 METER WITH SOLAR ASSEMBLY, CONTROLLER, LIGHT FIXTURES, WIRING, JB ETC COMPLETE IN ALL RESPECT		10.00	Nos	20000.00	200000.00
121	ILLUMINATION SYSTEM - 4.5M HIGH LIGHTING POLE FOR POST-TOP LANTERN WITH LIGHT FITTINGS, WIRING, JB ETC COMPLETE IN ALL RESPECT		5.00	Nos	12000.00	60000.00
122	ILLUMINATION SYSTEM - LIGHTING FIXTURE - RECESSED MOUNTED / SURFACE MOUNTED / DC LED BULKHEAD / DC LED DOWN LIGHTER		245.00	Nos	1760.00	431200.00
123	ILLUMINATION SYSTEM - LED INDOOR HIGH BAY FITTINGS TYPE IHB		30.00	Nos	1760.00	52800.00
124	ILLUMINATION SYSTEM - FLOOD LIGHT LED TYPE LIGHTING FIXTURE WITH ACCESSORIES		80.00	Nos	1760.00	140800.00
125	ILLUMINATION SYSTEM - OUTDOOR POWER RECEPTACLE FOR OIL FILTRATION UNIT (250A)		2.00	Nos	2000.00	4000.00
126	ILLUMINATION SYSTEM - 20 / 25mm GI Conduits / Flexible conduits on Lattice/ Pipe Stucture/ Vertical wall / Structure including clamping, fixing of sockets/ bends as required etc. complete. (Payment will be made for the as erected conduit length).		2000.00	Meter	40.00	80000.00
127	ILLUMINATION SYSTEM - 20 / 25 / 30 mm PVC Conduits, heavy-duty type. Installation on slab / Lattice/ Pipe Stucture/ Vertical wall / Structure including clamping, fixing of sockets/ bends as required etc. complete. (Payment will be made for the as erected conduit length).		2000.00	Meter	40.00	80000.00
128	GI / MS Hardware / Accessories for Illumination System - With and without Hot dip galvanized / PVC i.e. 3 / 4 way JB, 90 degree GI normal / inspection bend, tees, bushings, reducers, enlargers, coupling caps, nipples, solid bend, spacer, circular boxes (with gasket as applicable), closer, socket, saddle, saddle base, Fan box, mounting hardwares, nut, lock nut, bolt, washer, screw, reducer, U clamp, earth clip/clamp, anchor fastener, etc complete material required for complete installation of Illumination system.		2.00	MT	96000.00	192000.00
129	ILLUMINATION SYSTEM - ERECTION OF SWITCH & SOCKET, JUNCTION BOX, RECEPTACLES, LIGHT LEVEL SENSORS, OCCUPANCY SENSOR, ACCESSORIES, TEMPERATURE TRANSDUCER, TELEPHONE SOCKET, TELEPHONE JB, LAN CABLE , TELEPHONE CABLE, WALL FAN , EXIT SIGN BOARD, CEILING FAN, POINT WIRING & (1.5, 2.5, 4 SQ. MM CU / AL WIRE ETC.) COMPLETE IN ALL RESPECT UPTOTHE FULL COMMISSIONING OF ILLUMINATION SYSTEM AS APPLICABLE FOR INDOOR CRB, GIS HALL & OUTDOOR SWITCHYARD		1.00	LOT	24000.00	24000.00
130	CIVIL WORK FOR Illumination System - M25 CONCRETE FOR OUTDOOR Equipment foundations, panel foundation and other civil work including supply of cement, steel and other material as per relevant drawings and specification clauses shall be provided by the Contractor.		20.00	Cubic meter	23040.00	460800.00
131	CIVIL Work - Grouting underside of base plates of Towers & Equipment support structures including supply of non shrinking grouting material, admixtures, cement and other material as applicable M30 grade concrete		10.00	Cubic meter	23040.00	230400.00
132	Watch and ward of stored / erected material at project site as per instruction of site in charge. (round the clock security by authorized service agency)		20.00	Per Post Per Months	153600.00	3072000.00

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LIST OF TECHNICAL WRITE-UP, DRAWING & DOCUMENTS

SL	TITLE	REFERENCE BUMBER
1	TECHNICAL NOTES & BIDDER'S SCOPE	Technical Writeup 01 to Bid Price Schedule
2	STANDARD TECHNICAL NOTES & BIDDER'S SCOPE	Technical Writeup 02 to Bid Price Schedule
3	SCOPE MATRIX FOR MATERIAL HANDLING	
4	SCOPE MATRIX FOR GIS INSTALLATION	
5	SCOPE MATRIX FOR MECHANICAL PACKAGE	
6	SCOPE MATRIX FOR ILLUMINATION PACKAGE	
7	Annexure GIS_BIDDER'S_SCOPE	
8	Annexure GIS_HITACHI_SCOPE	
9	FIRE FIGHTING SYSTEM (ETC & Material Handling)	Annexure-ETC_FFS
10	AIR CONDITIONING & VENTILATION SYSTEM (ETC & Material Handling)	Annexure-ETC_ACVS
11	EOT Crane (ETC & Material Handling)	Annexure-ETC_EOT
12	Technical Specification of ETC Tender	
14	SWITCHYARD (POTHEAD YARD) LAYOUT	TB-3-405-316-001
13	CONCEPTUAL CONTROL ROOM BUILDING LAYOUT	TB-3-405-316-021
15	GT HALL (GT CAVERN) LAYOUT	TB-405-317-10-23
17	400KV LINE / BUS REACTOR	3 469 00 01991

16	LT Transformer OGA	34730052489
18	400KV, CONTINUOUS ONLINE MONITORING AND DIAGNOSTIC SYSTEM INCLUDING REMOTE MONITORING AND SUPERVISION STATION - online PD Monitoring system for complete GIS including Sensors, Panels i.e. radial control cabinet, radial distribution cabinets, OCU Panel, cable laying & termination	TB-405-317-10-50 PDA
		1MNS500745-SAA

Sl.	PROJECT SPECIFIC TECHNICAL NOTES & BIDDER'S SCOPE
1	Brief scope of Erection, Testing & Commissioning (ETC) work includes Material handling at Project Site / Project area, receipt of material, unloading from truck/ trailer/ carriers, proper construction site storage, reconciliation, verification, record keeping, handling, safe keeping, Pre-erection assembly, erection / installation, testing, pre-commissioning and commissioning including trial run (as per BHEL / Customer FQP) of 400kV GIS, 400kV AIS and associated systems/equipment at ARUN-3 HEP of the project and reconciliation after completion of ETC & handing over surplus material to BHEL/SAPDC/Material. The Scope also include all T&P including all testing and commissioning equipment (except exclusion mentioned in specification), hydra/crane, man lifter etc as required for complete installation, testing & commissioning of the system.
2	Brief area of Erection, Testing & Commissioning (ETC) is follows 1. 400KV GIS at Switchyard 2. 400kV GIS interface unit at GT Cavern area 3. 400KV REACTORS 4. POTHEAD YARD 5. CONTROL & PROTECTION SYSTEMS 6. LT AC DC SYSTEM 7. 33KV & 11 KV SWITCHGEAR 8. DRY TYPE TRANSFORMER 9. EOT CRANE 10. Fire Detection and Fire-Fighting System: 11. AC & VENTILLATION SYSTEM 12. ILLUMINATION SYSTEM 13. ASSOCIATED ASSOCIATED SYSTEM AND EQUIPMENTS
3	Arun-3 HEP site is located on river Arun in Sankhuwasabha Districts in Eastern Nepal at a distance of 50 km from Khandbari (an district headquarter). Nearest airport is Tumlingtar Airport, Khandbari 56900, Nepal

Sl.	PROJECT SPECIFIC TECHNICAL NOTES & BIDDER'S SCOPE
4	Climatic Conditions: Average maximum temperature: 30 degree C Average minimum temperature: 20 degree C Maximum river water temperature: 25 degree C Minimum river water temperature: 10 degree C
5	Transportation Limitation: The transport limitation by road from Jagbani to the project site is the governing factor for determining permissible package size and weight. The existing road allow the transport of the package of following size and weight. Size (in mm) (l x b x h) 9700 x 6000 x 6000, Weight (Tonnes) - 70R
6	Please refer annexures 1. SCOPE MATRIX FOR MATERIAL HANDLING 2. SCOPE MATRIX FOR GIS INSTALLATION 3. SCOPE MATRIX FOR MECHANICAL PACKAGE 4. SCOPE MATRIX FOR ILLUMINATION PACKAGE 5. GIS_BIDDER'S_SCOPE 6. GIS_HITACHI_SCOPE for details of scope break-up between different contractors / suppliers
7	The term Contractor mentioned in technical specification may please be referred as Successful Bidder for the services under scope
8	Please note, Supply of Structure steel, Foundation Bolt, Anchor Bolts, anchor fasteners, Inserts & Embedded material shall be as per Bid Price Schedule only. This shall over rule scope of supply mentioned in elsewhere the technical specification for these items.
9	Installation of Inserts & Embedded material, bolts, anchor fastner with & without chemical grouting is deemed inclusive of bidder's scope of service under respective main item etc works

Sl.	PROJECT SPECIFIC TECHNICAL NOTES & BIDDER'S SCOPE
10	The Contractor has to do all the work related to assembly, erection, testing and commissioning complete in all respects. All necessary tools, plants, labour, materials including consumables for performing installation, testing and pre-commissioning shall be provided by the Contractor. The Contractor shall install the concrete inserts/embedment; support steels and/or components for foundation/supports purpose as per approved erection drawings and coordinate the activities with civil contractors to keep his activities in synchronism with civil work. All installation for foundation shall be verified and accepted by the Engineer. The Contractor shall use anchor fasteners for installation of fixtures, mountings, conduits, cabling, panels etc. Chipping of concrete and/or taking support from reinforcement bars shall not be allowed.
11	SCAFFOLDING - Bidder to ensure arrangement of scaffolding / lifting machines etc for work at high level in GT Cavern area as well scaffolding and dust / mosture proof cover for outdoor GIB installation. Cost of the same is deemed inclusive in bidder's scope.
12	Installation procedure The Contractor shall submit detailed programs and the procedures to be adopted for erection / installation, testing and commissioning, before start of erection activities/ installation, for information of the BHEL/SAPDC The installation procedure shall also have a section “site quality assurance plan” containing erection data sheets for various components. These sheets should specify site measurements/ inspections required to be made for ensuring proper installation.
13	PERFORMANCE TESTING If nothing unusual has been observed in load run and load rejection tests, the test service period of 72 hours shall follow. During this test service period, the unit must operate continuously at rated condition without any interruption except of those beyond the control of the Contractor. However, such interrupted period shall not be counted for in the test service period. There should be one month reliability run of the concerned unit bay along with other associated bays for evacuation of power reckoned from the date of taking over by BHEL/SAPDC During reliability run, machine shall be operated by employer and any problem observed during this run shall be attended by the contractor including replacement of components and providing requisite manpower.

Sl.	PROJECT SPECIFIC TECHNICAL NOTES & BIDDER'S SCOPE
14	Construction power- Construction power shall be provided at one point on chargeable basis by main EPC contractor. The Contractor shall pay the other contractor / SAPDC at the applicable tariff as per NEA plus overheads, if any, for such use. In case of such supplies are not available initially on the site, the Contractor shall make his own arrangement for provisions of such supplies project execution requires. Suitable no. of DG sets shall also be installed for extending uninterrupted power supplies at work area. Payment of electricity consumption, Maintenance of lighting, distribution boards of Switchyard at suitable working areas & Providing of the consumables such as sockets, switches, MCCB, bulbs etc in Bidder's scope. The bidder shall have to arrange diesel, lubricants & consumables for the DG sets as above cost of the same deemed inclusive
15	The contractor while drawing construction power supply from Distribution Board should strictly adhere to following points. a) All electrical installations should be as per Electricity rules. b) All distribution Boards installed by the contractor should be constructed with fire proof materials viz. Steel frames, Bakelite sheets etc. c) Connection for single phase should be taken from phase and neutral. Nowhere the connection should be taken with earth as neutral. d) All electrical connections should be made through connectors, nuts and bolts, switches, plug and sockets. Loose connections or hooking up of wires shall not be permitted. e) Contractor have to make their own Earthing arrangement for their equipment / DB Earthing. f) All electrical equipment / tools and plants should be properly earthed. DBs to be earthed diagonally opposite at two points. g) Contractor should use “MCCB” and “ELCB” either on incoming or outgoing connections to the DBs (if any). h) Contractor should ensure that all the CBs / TPNs/ Fuses/ MCCB / ELCB cables etc. should be of adequate rating/ capacity (if any). I) BHEL will not be responsible for any delay in work and loss or damage to the contractor’s equipment because of variation in voltage or frequency or interruptions in power supply.
16	Temporary Lighting- The work relating to all temporary lighting and power facilities required for the installation work shall be carried out by the contractor under this contract and shall be included by the bidders in their offer.

Sl.	PROJECT SPECIFIC TECHNICAL NOTES & BIDDER'S SCOPE
17	(GTS 1.9.2 Welding & NDT- 1.9.2.1) Preparation of base material -- Members to be joined by welding may be cut to shape and size by mechanical means such as shearing, machining, grinding, or by gas or arc cutting, to suit the conditions. Edges shall be shaped according to ASME requirements. Design of welded joints and selection of weld filler metal shall be in accordance with approved standards and shall allow thorough penetration and good fusion of the weld with the base metal. The edges of surfaces to be welded shall be sound metal free of visible defects such as laminations or defects caused by cutting operation at least 30 mm back from the edge of the weld, and free from rust, oil, grease, and other foreign matter.
18	(GTS 1.9.2.2 WPS & WPQR)- The establishment of welding procedures, welder's qualifications shall conform to the requirements of the ASME Boiler and Pressure Vessel Code Section VIII and IX. The approved copy of the WPS & WPQR in accordance with the ASME requirements shall be submitted to the purchaser for review and record.
19	(GTS 1.19.5) Detailed inputs for As built drawing is to be provided incorporating changes made during erection, testing and commissioning.
20	(GTS 1.20.2.5) The Field Quality Assurance Plans shall detail out the various tests/inspection to be carried out in conformity with relevant latest IEC/IS/ISO, quality practices and procedures etc. to be followed by the contractor's / sub-contractor's site Quality Control during various stages of site activities from receipt of material/equipment at site till final commissioning/ acceptance/handover.
21	(GTS 1.20.2.19) SAPDC/Consultant reserves the right to carry out quality audit and quality surveillance of the system and procedures of the contractor / or their sub-vendor. The contractor shall provide all necessary assistance to enable SAPDC/Consultant to carry out such details & surveillance including Quality Manuals, if required by SAPDC/Consultant.
22	(GTS 1.20.2.20) All welding and brazing shall be carried out as per procedure drawn and qualified in accordance with requirement of ASME section-VIII/IX or other International equivalent standard acceptable to SAPDC/Consultant. All welding/brazing procedures shall be submitted to SAPDC/Consultant for review / verification prior to carrying out the welding/brazing. However, wherever required by the SAPDC/Consultant, tests shall be conducted in presence of SAPDC's authorized representative.

Sl.	PROJECT SPECIFIC TECHNICAL NOTES & BIDDER'S SCOPE
23	(GTS 1.20.2.21) All Brazers, Welders and welding operators employed on any part of the contract either in Contractor/his sub-vendor's works or at site or elsewhere shall be qualified as per ASME section-VIII/IX or other equivalent International Standards acceptable to SAPDC/Consultant.
24	(GTS 1.20.2.25) Contractor shall submit Field Welding Schedule for field welding activities like field welding location, numbers, welding procedure to be used, requirements, codes and NDT requirement along with all supporting documents, like welding procedures, heat treatment procedures, NDT procedures, etc. to SAPDC/Consultant for review at least ninety days before schedule start of erection work at site.
25	(GTS 1.20.2.29) Only calibrated testing & measuring instruments shall be used while performing tests during erection, testing & commissioning at site by the contractor. Copy of the calibration certificates will be submitted to SAPDC/Consultant by the contractor during inspection as an evidence.
26	(GTS 1.21.1) Safety of personnel- All equipment and services provided under this contract shall abide by international standards commonly accepted in the hydroelectric utility industry for safety of personnel whether involved with operation or maintenance.
27	(Cl.18.7.3) Field tests for Cabling - Before commissioning of complete system, all cabling system shall be checked as per cable schedule and complete report shall be prepared by Contractor and shall be submitted. Field test shall include: • Continuity checking, • IR testing • Verification of phase order in power cables • Visual checking in respect of tagging, laying, dressing, glanding, earthing of complete cable system.
28	(Cl.19.7.3.3) Field Tests Tests on DC Distribution Board: Following Field / Acceptance Tests shall be carried out at site. i. Insulation resistance measurement ii. Checking of continuity and operation of equipment iii. Check for control, protection and annunciation systems including the interlocks. iv. Operational and functional tests

Sl.	PROJECT SPECIFIC TECHNICAL NOTES & BIDDER'S SCOPE
29	(Cl.19.7.4) Tests on DC System UPS / Inverter - Field Tests Following Field / Acceptance Tests shall be carried out at site. i. Balanced load test ii. Restart test iii. Output overvoltage test iv. Periodic output voltage variation test v. Frequency variation test vi. Earth fault test vii. On-site ventilation test viii. Operational and functional test
30	(Cl.20.7.3.1) LT AC System - Tests during installation and pre commissioning At least following inspections/ tests shall be performed during installation and pre commissioning: • Functional and operational tests, • Measurement of the insulating resistance of the different power and control circuits, including cables, instruments and apparatus, against earth, • Adjustment of the protection equipment, • Calibration of releases, • Contact resistance measurement of circuit breaker, • Verification of interlocks: ensure that interlocks are correctly installed and that access is prevented to live portions of the system when interlocks are in place and that access is permitted when interlocks are removed, 20.7.3.2 Commissioning tests At least following verifications shall be performed before and during energization: • Insulation resistance measurement of each phase, • Verification of component temperatures, • Final adjustment of the protection equipment.

Sl.	PROJECT SPECIFIC TECHNICAL NOTES & BIDDER'S SCOPE
31	Chapter 21:MV System 21.7.3.1 Tests during installation and pre commissioning At least following inspections/ tests shall be performed during installation and pre commissioning: • Functional and operational tests, • Measurement of the insulating resistance of the different power and control circuits, including cables, instruments and apparatus, against earth, • Adjustment of the protection equipment, • Calibration of releases, • Contact resistance measurement of circuit breaker, • Verification of interlocks: ensure that interlocks are correctly installed and that access is prevented to live portions of the system when interlocks are in place and that access is permitted when interlocks are removed, 21.7.3.2 Commissioning tests At least following verifications shall be performed before and during energization: • Insulation resistance measurement of each phase, • Verification of component temperatures, • Final adjustment of the protection equipment.
32	Watch & ward of stored / erected / commissioned material at storage area, project site, erection area or any other locations as per material safety requirement and instruction of site in-charge complete in all aspect is deemed included in the scope.
33	The Contractor shall be responsible for providing all necessary facilities like residential accommodation, transport, electricity, water, medical facilities etc. at his own cost as required under various labour laws and statutory rules and regulations framed there under to the personnel employed by him. (As per GoI & GoN).
34	On completion of work or as and when required by BHEL, all the temporary buildings, structures etc. shall be dismantled and leveled and debris shall be removed as per instruction of BHEL by the contractor.
35	Bidder to arrange Firefighting equipment’s like buckets, extinguishers etc. at construction Site

Sl.	PROJECT SPECIFIC TECHNICAL NOTES & BIDDER'S SCOPE
36	Illumination System Accessories: Installation of all accessories for successful installation of Illumination System are deemed included in the scope such as and not limited to 3 / 4 way JB, 90 degree GI normal / inspection bend, Solid bend, Spacer, Circular boxes (with gasket as applicable), closer, socket, saddle, saddle base, Fan box, mounting hardwares, nut, lock nut, bolt, washer, screw, reducer, U clamp, earth clip/clamp, anchor fastener, screw, welding electrodes, paint etc complete material required for complete installation of Illumination system. Supply and installation of other erection material as per technical specification are deemed inclusive of the scope such as and not limited to Nylon grips, wooden screw, machine screw, pvc bush, pvc sleeve, anchor fastener, ferrules etc.
37	Exposed conduit/pipe shall be adequately supported by racks, clamps, straps or by other approved means. Conduits /pipe support shall be installed square and true to line and grade with an average spacing between the supports as given below, unless specified otherwise Conduit /pipe size (dia) v/s Spacing Up to 40 mm - 1 M 50 mm - 2.0 M 65-85 mm - 2.5 M 100 mm - 3.0 M
38	All conduits/pipes shall have their ends closed by caps until cables are pulled. After cables are pulled, the ends of conduits/pipes shall be sealed with Glass wool/Cement Mortar/Putty to prevent entrance of moisture and foreign material. Supply of such material are deemed inclusive in scope.
39	ETC of all Panels is including installation of accessories / mounting hardwares / anchor fastener / foundation bolt etc complete in all respect.
40	ETC of Lighting Luminaires - including installation of accessories i.e. mounting hardwares, anchor fastener, screw, nut bolt, mounting brackets for wall , ceiling, false ceiling, structure, street light pole, lighting mast, hanger pipe / chain etc complete in all respect.
41	The bidder shall quote for ETC of items/ equipment/ system, including activities pertaining to minor civil works of lighting panels, cable termination & earthing against each item, as applicable.
42	Civil/ structure works such outdoor lighting panels, lighting poles, receptacles etc. shall be done by the bidder. Wherever cable is to be laid in buried trench, the excavation, backfilling, compaction to original state are deemed included in the offer.

Sl.	PROJECT SPECIFIC TECHNICAL NOTES & BIDDER'S SCOPE
43	After commissioning of system, Bidder to also submit field modifications (if any done during project execution) to BHEL for preparation of AS-BUILT drawings
44	Illumination System installation includes installation of JUNCTION BOXES, support structure, mounting hardwares / anchor fastener etc complete in all respect.
45	Civil work related to indoor and outdoor lighting system is in scope of bidder including civil supplies. Construction of cable trenches for the burying of cables is also covered under scope of bidder.
46	For outdoor installation (lighting poles, tower mast, lighting panel etc.), civil work in respect of excavation, refilling, disposal of excavated mud, equipment foundation, panel foundation and civil work including supply of cement, steel, sands, aggregate, bricks and other material as per specification & any other civil work not specifically mentioned shall be done by the contractor. The Contractor shall make the cable trenches for burying cables for lighting poles and lighting mast and other areas as per the specification requirements. The Contractor shall perform all excavation and back fillings required for ground connections and casting foundations. The Contractor shall make use of his own arrangements for pumping out any water that may be accumulated in the excavation. All excavation shall be backfilled to the original level with good consolidation.

Sl.	STANDARD TECHNICAL NOTES & BIDDER'S SCOPE
1	All safety rules and codes applied by the Client/BHEL at site shall be observed by the contractor without exception. The contractor shall be responsible for the safety of the equipment/material and works to be performed by him and shall maintain all light, fencing guards, slings etc. or other protection 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. Due precautions shall be taken against fire hazards and atmospheric conditions. 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 work under this contract.
2	The ETC instructions of the equipment manufacturer/ Employer shall be strictly adhered to. Field Quality Plan shall be followed alongwith the provision of Technical Specification for storage.
3	Automatic Relay Test Kit along with Laptop and Testing engineer is to be arranged by contracrtor. Supervision of testing and commissioning of Relay / Protection / SAS / Automation / Bus Bar Panles (as applicable) is in the scope of BHEL/ panel supplier. Necessary manpower support, tools, tackles, wiring, BUS wiring and testing equipment to be in scope of ETC contractor
4	All consumables required for sucessful erection testing & commissioning of present scope of work is in bidders scope, such as (not limited to) Welding Electrodes, Low hydrogen content welding electrode, Ferruls, Cable Lug, cable ties, , Paint, bitumen compound, Zinc riched enamel paint, red oxide and zinc chromate paint ..etc complete in all respect.

Sl.	STANDARD TECHNICAL NOTES & BIDDER'S SCOPE
5	ETC of Power / Control / Instrument Cable: Scope includes Cable Laying tagging , dressing, ferruling, lugging, installation of cable gland ,soldering, tapping, jointing, crimping, termination, and drilling/ cutting holes in cable gland plates- laying can be either on trays, hanger, supports, underground, buried in ground or through GI/PVC pipe over/under ground, through wall etc. All erection materials viz. Cable Lug, ferrules, cable ties / straps, Al. tags, route markers, GI / PVC wall sleeves with rubber / nylon bushes etc shall be supplied by bidder. excluding supply of Cable Gland which are covered separately (as a separate BOQ item / free supply by BHEL). Machine ferruling shall be adopted.
6	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.
7	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. Tray shall be supplied by BHEL.
8	All welding done at site for equipment and structures, shall be painted with zinc rich paint immediately to avoid corrosion.
9	Installation of Cable Trench Material include all miscellaneous activity including minor fabrication, welding, cutting, drilling holes, bolting, anchor bolting, etc. complete in all respect. BHEL supplied material is modular type cable tray & racks. Where as fabrication is required 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.

Sl.	STANDARD TECHNICAL NOTES & BIDDER'S SCOPE
10	Bidder to offer items from SAPDC approved make only (as applicable). Bidder to supply material of proven design and make, which have already been extensively used and tested. Bidder 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 extend and and even may get deleted.
11	CABLE LUG: Supply of cable lug is in bidders scope. cable lugs shall be tinned copper solderless crimping type conforming to IS-8309 & 8394 for all control Cables and cables with copper wire. For Aluminium Bimetallic lugs for power cables as required shall beused depending upon type of cables and terminations. Solderless crimping of terminals shall be done by using corrosion inhibitory compound. The cable lugs shall suit the type of terminals provided. The bidder shall cover the exposed part of all cable lugs whether supplied by him or not with insulating tape, sleeve. Bidder to supply cable lug from manufacturer's authorised representative / dealer. Make of cable lug is to be approved by SAPDC i.e. DOWELLS /COMET/ JAIN ELECTRONICS/ JAICO ELECTRIC/ SI METAL WORKS / SAPDC approved make etc.

Sl.	STANDARD TECHNICAL NOTES & BIDDER'S SCOPE
12	Cable TAGS & Markers - Bidder to supply and install cable tag & markers. 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. 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.
13	Cable Gland: Tin/ Nickel, Nichel/chromium - Plated (coating thickness not less than 10 microns) SAPDC approved / Sunil & Co. / Arup/ Comet / QPIE make brass cable glands, double compression heavy-duty type complete with necessary armour clamp & tapered washer etc. Bidder to offer the gland from authorised representative of manufacturer. Cable gland shall be subject to customer approval prior to dispatch. Cable glands shall match with the sizes of different HT/LT/Control cables. After installation of cabling work balance galnd holes are to be sealed by bidder with suitable aluminium sheeth, cost of addisive and aluminium sheet are deemed inclusive in the bidders scope.
14	Supply & installation of Fire sealing / barrier material to be provided for all entry/ exit opening (of wall/floor) for cables. Cost of the same is deemed inclusive in bidders scope. Cable/cable tray openings in walls and floors or through pipe sleeves from one area to another or from one elevation to another within the unit shall be seated by a fire proof sealing system (FPSS). The FPSS shall effectively prevent the spread of fire from the flaming to non-flaming side of a fire. Wherever the cables/cable trays pass through walls/floors, fire proof cable penetration seals rated for one hour shall be provided. This shall be by silicon RTV foaming system. The system offered shall be of proven type as per BS: 476 (Part-20) or equivalent standard. In order to prevent fire propagation through cable penetrations, after laying, dressing & clamping of cables, all the openings shall be properly sealed by using Fire Stop Mortar Seal and Fire Retardant Cable coating compound. Also the cable runs both before and after the fire scale shall be suitably sprayed with anti-fire propagation liquid.

Sl.	STANDARD TECHNICAL NOTES & BIDDER'S SCOPE
15	Insulating Rubber Mats - The scope covers supply and laying of insulating mats of class-A conforming to IS: 15652-2006. These insulating mats shall be laid in front of all floor mounted ACDB, CRP, SAS (As applicable under present scope) in control room building/ Switchyard panel room. 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. 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. The Insulating mat 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. Width of insulating mats shall generally be of 1.5 meters or as per site requirements. Length shall be supplied as per site requirements.
16	Cable ends shall be kept sealed to prevent damage. In cable vault, fire resistant seal shall be provided underneath the panels. 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	Completete ETC package is under the scope of bidder. All T&P required to complete the job including oil filterating machine, cranes, forklift etc. shall be provided by bidder. Bidder to arrange MAN LIFTER for equipment erection & testing as per requirement. Height of manlifter shall be 8m approach for 400KV Yard. Forklift should be suitable for Indoor installation of panels & GIS equipments.
18	Quoted rates are deemed to be inclusive of all miscellaneous works viz erection of mounting hardwares, clamp-connectors, etc complete in all respect. example Equipment erection (say Surge Arrestor) means complete erection, metallics, connectors (expansion/rigid tubular for Al.Tube / single/double/quadraple conductor), connection to the next in line (if connected to overhead busbar or droppers) including PG clamps/Tee connectors etc.

Sl.	STANDARD TECHNICAL NOTES & BIDDER'S SCOPE
19	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.
20	Equipment and tower erection would include supply and erection of miscellanneous items , viz Phase colour discs , labels painting of equipments , phase colour painting , phase marking , bay identification board , danger plates , rubber mats , device number marking on the equipment, keyboard etc as per site requirements. Supply & Mounting of phase color discs & Danger plates shall be as per IS-2551; 1982 & IS 5; 1978.
21	Attached Panel drawings, LT & MV Board drawings / document i.e. .... etc are provisional and subject to revision during contract stage. BOQ rate shall remain unchanged.
22	All arc welding shall be done with low hydrogen content electrodes for all earthing works i.e. MS Rod, GI Flat & MS Flat
23	The welds on MS Rod should be treated with red oxide primer and afterwards coated with two layers bitumen compound to prevent corrosion.
24	MS / GI flat shall run on the top tier and all along the cable trenches and the same shall be bolted / welded to each of the racks. Further this flat shall be earthed at both ends and at an interval of 30 mtrs.
25	The welds involving GI Flat should be treated with zinc chromate primer and coated with zinc rich paint. Equipment bolted connections after being tested and checked shall be painted with anti corrosive paint/compound.
26	MS Welding - The M.S. flat/angle/channel shall be finally painted with two coats of Red oxide primer and two coats of Zinc rich enamel paint.
27	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. All arc welding with large dia. conductors shall be done with low hydrogen content electrodes.
28	The continuous conductor of specified GI wire shall be run all along each illumnation conduit run. The conductor shall be connected to each panel ground bus. All junction boxes, receptacles, switches, lighting fixtures etc. shall be connected to specified GI wire.

Sl.	STANDARD TECHNICAL NOTES & BIDDER'S SCOPE
29	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.
30	Grouting: Cost of Supply and placement of grouting is deemed inclusive in bidder's scope of work. i) Non-shrink flowable grout shall be used for under pinning work below base plate of columns. Non-shrink cum plasticiser admixture shall be added in the grout. ii) Minimum grade of grout shall be M30. iii) Nominal thickness of grouting shall be approx 80 mm for Tower Structure & approx 60 mm for equipment support strutrue.
31	All final adjustment of foundation levels, chipping and dressing of foundation surfaces, setting and grounding of anchor bolts, sills, inserts and fastening devices shall be carried out by the contractor including minor modification of civil works as may be required for erection. Cost of the same is deemed inclusive in the scope.
32	Any cutting of masonry / concrete work, Wall openings at suitable locations for ventilation fans, Civil works such as grouting, filling up of crevices/ cut outs etc. during installation of equipments, modification of civil foundations, making holes in the trenches/ control room building, fixing of trench material shall be done by the bidder and shall be made good including supply and installation of chicken wire mess to match the original work. Any other damage caused to civil works during ETC work of the equipment/ system shall be made good to the original finish. Cost of the same is deemed inclusive in the scope.
33	Individual item may vary up-to any extent and even may get deleted, however overall contract value may vary +/- 30%. Variation will be valid up-to contract stage.
34	HV Test for GIS - HV test kit shall be arranged by GIS Supplier. Test shall also be conducted by GIS supplier. All necessary support i.e. unloading, shifting, minor assembling of HV test kit, cabling, support for complete HV Test, dismantling & loading on carrier, complete in all respect shall be in the scope on bidder.
35	General purpose & structural frame work welding rods shall be arranged by contractor at his own cost. Electrodes for BOP work like FF system, HVAC, EOT, illumination system etc. to be use for pipeline joint welding & structural fabrication shall be arrange by Vendor within the quoted rates.

Sl.	STANDARD TECHNICAL NOTES & BIDDER'S SCOPE
36	NDT: NDT (RT/UT/DPT/MPI) test of all weld joints shall be done in accordance to the drawings. If any permission from the Nepal authority/Local authority is required for conducing Radiography Testing, it is to be taken by the contactor at his own cost. If required, BHEL will assist contractor for getting permission from Nepal Authority.
37	All the tests including NDT, mentioned in the drawings, scope of work as well as routine tests to be conducted during Erection, Testing & Commissioning, are in the scope of the bidder. Permission from Nepal/local authorities' along with hiring/purchase of the suitable rating test equipment/kit/ external agency (if required) for conductance of these tests is included in the scope of contract within the quoted price.
38	The equipment and piping shall be erected in conformity with the provision of standard/ specification and as may be directed by BHEL. The method of welding (Arc, gas, TIG or other method) may be indicated in the detailed drawing/ schedules. BHEL engineer will have option of changing the method of welding as per site requirements.
39	Painting may also be required on embedded / foundation parts prior to concreting etc. including oil, water, air pipeline and touch-up painting of panels/equipments. Paints for such painting shall be supplied by BHEL.
40	Scope include arrangement of 10 meter Man lift that shall be required for HV connection from HV test kit to bushing & heigh level equipment connections, checking & testing
41	Reactor oil filteration includes all works i.e. as not limited to Hot Oil Circulations, Particle Reduction and Particle Counting (NAS filtration etc.), Hot air purging in addition to Nitrogen purging, testing of Dissolved Gas Analysis (DGA) after charging of Transformer and Rectors.
42	Testing instruments (duly calibrated) have to be arranged by ETC Contractor at it's own cost on returnable basis (List is only provided for information , if any other instrument not mentioned below but required for successful completion of ETC work shall be in ETC contractor's scope. Bidder to review complete BOQ for possible requirements of instruments)
42.01	Tools for GIS erection annexure GIS_Bidder's_SCOPE
42.02	OMICRON or equivalent kit for Numerical relay testing, Automatic Relay Test Kit along with Laptop
42.03	DCRM (Dynamic Contact Resistance Measurement kit) OPERATIONAL ANALYZER
42.04	CRM (Contact Resistance Measurement kit)

Sl.	STANDARD TECHNICAL NOTES & BIDDER'S SCOPE
42.05	Relay test kit
42.06	Capacitance and Tan delta measurement Kit
42.07	Dew Point Measurement kit
42.08	5kV & 1kV Insulation tester
42.09	Primary current Injection Kit
42.10	Secondary current/Voltgae Injection kit
42.11	1Ph Variac
42.12	Multimeters
42.13	Clamp on meter
42.14	14/16 ton Hydra with lifting tools (Shackle, slings etc) for GIS Bay & accessories shifting from store to GIS room
42.15	Power supply sockets with extension board near GIS area Qty-1 nos.
42.16	Necessary numbers of fire extinguisher
42.17	Hand Pallet Trolley Qty-2 for GIS modules & accessories boxes shifting
42.18	Power supply sockets with extension board inside GIS room Qty-2 nos.
42.19	Vacuum cleaner machine for GIS room cleaning Qty-2 nos.
42.20	All T&P, testing Instruments required for Reactor installation, testing & commissioning.

1. SCOPE MATRIX FOR MATERIAL HANDLING

Sr	BIDDERS SCOPE	NOT IN BIDDER'S SCOPE
	BIDDERS SCOPE OF MATERIAL HANDING AT SITE	**FOLLOWING SERVICES ARE NOT IN BIDDER'S SCOPE**
1	**Material handling at Project Site is under scope of bidder** complete in all respect includes receipt of material, unloading from truck/ trailer/ carriers, transportation within ARUN-3 HEP site, proper site storage, verification, record keeping, handling, safe keeping, erection, testing & commissioning, reconciliation after completion of Erection and Commissioning of the project and handing over surplus material to BHEL/SAPDC/Material handling contractor.	Material handling at **Intermediate / transit stores** **is in the scope of a separate contractor (Material Handling Contractor) appointed by BHEL.** **Material Handiling contractor shall perform all necessory services at Intermediate / transit store i.e.** unloading, verification , record keeping, repacking, storage, handling e.t.c
2		**Onward Shipment from intermediate store to Site is also in the scope of Material handling contractor:** On receipt of demand for material from BHEL erection site, loading of material on truck/ trailer/ carriers, transporting the same to ARUN-3 HEP Site.
3		**Return of outgoing materials is in the scope of Material handling contractor:** Scope of Material handling contractor also includes handling of excess/redundant/ scrap materials returned to stores by Bidder (BHEL construction & Erection Contractor), handling and loading of outgoing materials and **handing over of spares** & surplus material to BHEL/Customer, material reconciliation after completion of Erection and Commissioning of the project.

Note: Material handling contractor is separately appointed by BHEL

2. SCOPE MATRIX FOR GIS INSTALLATION

Sr	BIDDERS SCOPE	HITACHI / GIS MANUFACTURER'S SCOPE
1	Please refer annexure GIS_Bidder's_SCOPE for man, material and T&P scope etc.. of Bidder. Arrangements of all T&P shall be on returnable basis. Bidder to read the document carefully.	Please refer annexure **GIS_HITACHI_SCOPE** for man, material and T&P scope of GIS manufacturer M/s Hitachi. This list of tools shall be arranged by GIS supplier [M/s HITACHI (ABB)] on returnable basis. Use of the same shall be as per directives of manufacturers supervision only and for GIS Installation, Testing & Commissioning Purpose.
2	All services required for successful installation of GIS (Excluding GIS manufacturer's scope (GIS_HITACHI_SCOPE) shall remain in the scope of Bidder.	1. Supervision of unloading of GIS & its accessories at site. 2. Supervision of material Reconciliation, guidance for storage 3. Supervision of Erection of complete GIS 4. HV Test kit along with operator shall be arranged by M/s HITACHI 5. SF6 Gas Service Cart shall be arranged by M/s HITACHI 6. Commissioning and Installation Tools as indicated in GIS_HITACHI_SCOPE
3	Supports required as per annexure GIS_Bidder's_SCOPE is under scope of bidder	TESTING & COMMISSIONING OF GIS and arrangements of returnamble tools as per annexure GIS_HITACHI_SCOPE are in scope of M/s HITACHI

3. SCOPE MATRIX FOR MECHANICAL PACKAGE

Sr	BIDDERS SCOPE	MANUFACTURER'S SCOPE
1	Mechanical Packages i.e. EOT CRANE, Fire Detection and Fire-Fighting System, AC & VENTILATION SYSTEM are to be quoted lot wise. Please refer annexures. ANNEXURE-ETC_ACVS ANNEXURE-ETC_EOT ANNEXURE-ETC_FFS Successful Bidder to also appoint experienced & skilled Supervisor for all mechanical packages who shall take care of supervision works in full compliance to technical requirement.	For limited days, Additional Supervision of ETC works may be provided by BHEL appointed Manufacturer

4. SCOPE MATRIX FOR ILLUMINATION PACKAGE

Sr	BIDDERS SCOPE	MANUFACTURER'S SCOPE
1	Complete work of illumination system in full compliance to technical specification & bid price schedule. Bidder to ensure completeness of system commissioning. Any work required to get the system commission is under the scope of bidder. Cost of the same deemed inclusive. Successful Bidder to also appoint experienced & skilled Supervisor for illumination package who shall take care of supervision works in full compliance to technical requirement.	For limited days, Additional Supervision of ETC works may be provided by BHEL appointed Manufacturer

ETC BOQ - T DOUBLE GIRDER EOT CRANE FOR ARUN-
PRO ECT: x MW ARUN-III, HYDRO ELECTRIC PRO ECT, NEPAL
CUSTOMER: S VN ARUN-III POWER DEVELOPMENT COMPANY (P) LTD. (SAPDC)

Complete Erection, Testing and Commissioning of below mentioned 10T Double Girder EOT Crane shall be in BHEL TBG ETC Contractor's Scope including
a) Receipt of equipment / material at site, unloading, handling, transportation to storage area.
b) Conservation / maintenance / up-keeping of the equipment / item in the store.
c) Storage of Mandatory Spares and Tools & Tackles.
d) Temporary lighting in stores and construction area wherever required for their work.
e) Safety / Security of equipment / material.
f) Transportation of equipment / material / test load from store to erection site, erection of equipment / material in line with the drawings / instructions, testing, commissioning including PG test (if applicable) and handing over.
g) Maintenance of associated equipment till handing over & any other activity necessary for completion of the job but not specifically mentioned in this specification.
h) Laying and termination of power/control cables for all equipmnet supplied under this BOQ.
i) Earthing of all installations (to the nearest earth mat/ earthing pad) supplied under this BOQ.
Any Tools and Machinery required for ETC work shall be arranged by ETC contractor.
Supervision for ETC work of EOT crane is under M/s Shiva Ferrous (EOT Crane contractor) scope for limited period.

EOT Crane ETC Philosophy

UN-LOADING: Before unloading the crane, be sure that enough clear level space is available. Avoid stacking parts such as walk plates, railings, ladders, bridge cross shafting, etc. The crane parts have been shop fitted and aligned. Unloading should therefore be carefully done so that this alignment is maintained. Major items should be placed on sound blocking material. They should not be set directly on the ground.

STORAGE:
The following storage procedures are arranged in order of preference to minimize deterioration:
1. The entire crane should be stored indoors in a building. This will minimize condensation in the gear cases, bearing housings, electrical equipment and other enclosed areas.
2. If complete indoor storage is not practical, at least the entire trolley should be stored indoors. The bridge motor, control panels, drive machinery, and end trucks should be removed from the girders and also stored indoors. The girders may then be stored outdoors but should be covered to protect paint.
3. If none of the material can be stored indoors, the user should investigate the possibility of renting an air-building or similar type of temporary enclosure. If this cannot be done, the crane must be well protected from the weather with tarpaulins, or similar protection. Some form of space heating equipment should be installed underneath those tarpaulin which protect electrical equipment and machinery. Blocking must be used under all components, including girders and other structural members.

The crane should not be stored outdoors for more than 30 days without protection as the effects of dust, condensation, and weather erosion can greatly reduce the ultimate reliability of the crane. Even a crane stored outdoors on an open runway should be operated for at least 5 minutes each month to distribute the lubricants or, where motive power is not available, should be protected against condensation by space heating equipment.

INSTALLATION:

RUNWAY: The runway dimensions should be verified with the crane drawings, and compass directions checked. If the runway rails and the runway conductors have not been installed, a suggested procedure would be the following:
1. The runway conductors should be properly installed before the runway rails. The horizontal and vertical alignment of the conductors should be straight and level within a tolerance of plus or minus 6mm.
2. The runway rail adjacent to the runway conductors would be installed next. This rail should be properly aligned with the runway conductors, not with the center of the runway beam.
3. Install the opposite runway rail and align to correct span and straightness with the first rail. The runway rails should be straight, parallel, level and at the same elevation. The distance center to center and the elevation of the rails should be as shown on the erection drawings within a tolerance of plus or minus 3mm.
4. Bolt or weld the rail sections together. The rail joints must be tight and at the same elevation to provide a smooth running surface. Rail joints must be welded and ground smooth if the crane is equipped with rail clamps or overturning lugs which extend under the rail head.
5. After being certain that alignment is correct, securely fasten the rails to the runway beams.

RAILS SHOULD BE HELD FIRMLY IN ALL DIRECTIONS.

Crane runway end stops may be installed before crane is placed on runway. Faces of the two end stops at each end of the runway must form a line perpendicular to the runway rails. After crane is placed on runway, make certain that both bridge bumpers contact the end stops at precisely the same instant.

GENERAL PROCEDURE: If runway clearances allow, and if capacity of lifting equipment is adequate, assemble the entire bridge except cab on the ground. When ground assembly is not practical, it may be necessary to proceed with piece-by-piece assembly at runway elevation.

Arrangements for unloading and erecting the crane on the runway should be made well in advance. The steel contractor on new projects usually does this work. A local rigging contractor or steel erector should be contacted for cranes to be installed in existing buildings. It is recommended that this work be done under the supervision of the crane builder's supervisor. The contractor will place the crane on the runway and make all connections, the supervisor will check all work before placing the crane in service.

BRIDGE: If the truck ends cannot be attached to the drive girder at ground level, they are placed on the runways first. The drive girder with its machinery and foot walk is raised and attached to the truck ends. Next the idler girder is placed on the truck ends and all bolts are put in and tightened.

Truck end connections are fastened with tolerance-body bolts which maintain the square ness of the bridge. In aligning bolt holes, a size-on-size barrel pin should be used. Tapered drift pins are not recommended since they will offset the advantage gained by using tolerance body bolts.

Do not use standard bolts in those holes requiring tolerance body bolts. These holes are marked with a tag bearing precautionary instructions. Field bolts should be checked before starting erection to be sure of proper sizes and quantities. DO NOT SUBSTITUTE.

Connections using tolerance body bolts are designated as "bearing type connections". They are NOT "friction-type connections" and should not be considered as such.

The tolerance body bolts are usually furnished with lock washers rather than hardened cut washers. The nuts should be tightened only to that point where the lock washer is compressed solid. The "Calibrated Wrench Tightening" method should not be used as it may cause bolt or washer failure.

Next, attach the cab to the crane structure.

If a hydraulic foot brake is used, install hydraulic tubing from master cylinder to brake. The tubing must rise slightly along the girder from the cab to the brake to prevent air from being trapped in the hydraulic line. If an electric bleeder is used, it must be located at the highest point of the system. Fill the reservoir with hydraulic brake fluid and bleed the system to be certain that all air has been removed. Air in the system will result in a "soft" pedal. Adjust the brake shoes if needed.

Motors, brakes and drive cases which have been removed for shipment, with their respective supports, must be reinstalled. The units are aligned with use of tolerance body bolts. Check the alignment of any flexible couplings which were disconnected for shipment. If any cross shaft was removed for shipment, it must be reinstalled using any special bolts provided for the couplings.

It may be necessary to jack-up an end truck to turn a wheel for coupling alignment. Field connected couplings should be match marked.

TROLLEY: Trolleys up to 4m overall width are usually shipped assembled except for hoist drums, ropes, blocks, current collectors and possibly limit switches. For greater widths the major components of trolleys are disassembled for shipment and usually consist of end trucks and main load member. The load members and trucks are usually fastened with tolerance body bolts. If possible, assemble the entire trolley on the ground except for the rope(s), block(s) and collector pole(s). When the size and / or weight of the complete trolley will not permit assembly on the ground, a similar procedure as outlined for bridge erection should be followed.

The assembled trolley is hoisted above the bridge rail level and the bridge moved under the suspended trolley. The trolley is then lowered onto the bridge rails and secured in place. The bridge should be moved into a convenient location for electrical assembly and secured in place.

HOO : Installation of crane hook.

Check the complete crane for lubrication as to location, type and oil level. Refer to lubrication charts furnished by the crane manufacturer. Be sure that all grease lines are re-connected and grease fittings are clean.

After erection of crane, marred, scratched, and abraded areas should be re-coated.

CONTROL PANEL: One each for MH, CT and LT to be intalled and located on bridge platform.

ELECTRICAL: In general, the following work must be performed or checked.
1. Install loose conduit on bridge and trolley.
2. Install wiring in conduits.
3. Install bridge cross conductors.
4. Install trolley collector pole and collectors (if used). Check alignment.
5. Connect all trolley wiring, including trolley feed wires to collectors.
6. Connect wires from operator's cab to control cabinets.
7. Connect wires from control cabinets to bridge cross conductors.
8. BE SURE MAIN RUNWAY CONDUCTOR POWER SUPPLY IS TURNED OFF. Throw a chain, cable or other conducting member across the runway conductors to short out conductors in case they should be inadvertently energized.
9. Install main line collector pole and collectors. Check alignment.
10. Connect wiring to runway collectors.
11. Check that disconnect switch(es) is in OFF or OPEN position and that master switches are in neutral position.
12. Check electrical connections at terminal boards, control cabinets, motors, brakes, limit switches, etc. for tightness.
13. Check relays and contractors to make sure that shipping blocks have been removed.
14. Set timers to approximately 1½ to 2 second interval.
15. Check electric brakes for proper adjustment.
16. Check that guards are in place and securely fastened.
17. Remove tools debris, or other loose objects which could fall for cause injury to personnel or damage to equipment.
18. Remove shorting member from runway conductors.

EOT Crane (ETC & Material Handling) - Receipt of material, unloading, proper storage, material reconciliation, safe keeping, erection, testing & commissioning, handing over to BHEL, proper record keeping etc to complete.

Sl. No.	Item Description	Quantity	UOM
	T Double Girder EOT alongwith all accessories.		**Set**

MANDATORY SPARES - Q: EOT Crane Spare & Tools material handling

Sl. No.	Item Description	Quantity	UOM

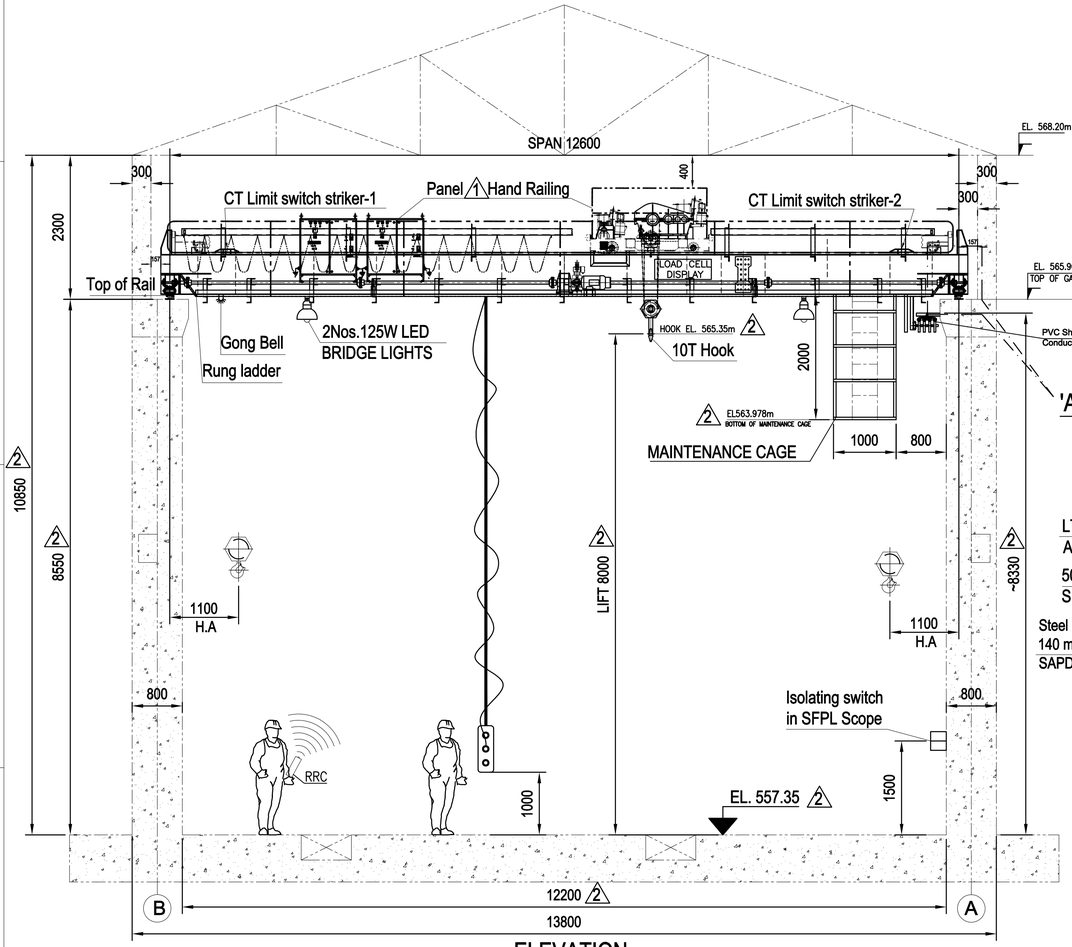
	Special Tools & Tackles		**Set**
i.	Complete set of ring spanners	1	Set
ii.	Complete set of screwdrivers	1	Set
iii.	Adjustable Spanner	1	No.
iv.	Insulated plier	1	No.
v.	Wrench spanner	1	No.
vi.	Hand Lamp	1	No.
vii.	Line tester	1	No.
	Mandatory Spares		**Set**
i.	Pair of brake shoe with lining for each size of brake used viz. D.C. operated E.M, or Hydraulic thruster operated.	2	Set
ii.	Pair of brake linings with rivets for each size of brake used.	2	Set
iii.	Main springs for each size of brake used.	2	Nos.
iv.	Brake coils for each size of brake used.	2	Set
v.	Thruster of each size used.	1	No.
vi.	Pair of oil seals for each gear box used on crane.	2	Set
vii.	Contactors of each size used.	2	Set
viii.	Fixed & moving contacts of each size contactor used.	2	Set
ix.	3 Nos. Coils for each size of contactor used.	1	Set
x.	Overload relay for each motor.	1	No.
xi.	3 No. fuse links of each sizes used on crane	2	Set
xii.	1 Printed circuit breaker of each size and type	1	Set
xiii.	Complete set of lamps for lightning and signals	1	Set
xiv.	Fuse links of each size used	2	Set
xv.	Segment of DSL including fitting, jointing, clamping etc. equivalent to 1 phase installed length for each location	1	Set
xvi.	LT Bearings	1	Set
xvii.	CT Bearings	2	Nos.
xviii.	Motor of each type and rating	1	No.
xix.	Flood light illumination	1	Set
xx.	Load cell	1	Set
xxi.	Indication lamp of DSL	1	Set
xxii.	MCCB and Fuses	1	Set
xxiii.	Auxiliary relay, contactor and timers	5	Set
xxiv.	Communication Card/cable	1	Set
xxv.	I/O Card	1	Set
xxvi.	Processors	1	Set
xxvii.	Indicating lamps	1	Set
xxviii.	VVVF Drive	1	Set

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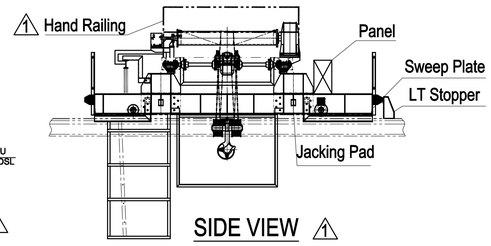
FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

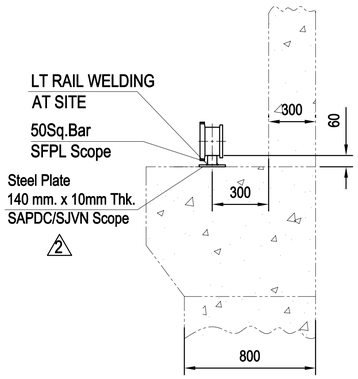
DRG. NO.



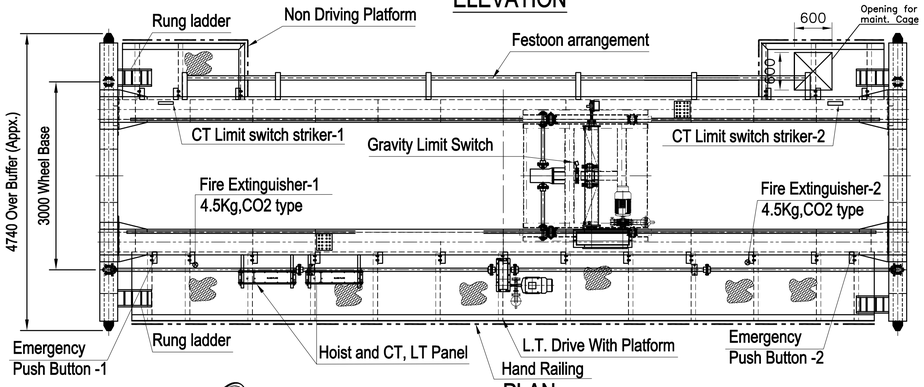
ELEVATION



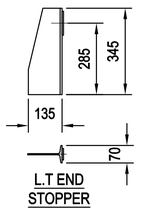
SIDE VIEW 1



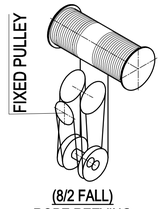
DETAIL AT 'A'



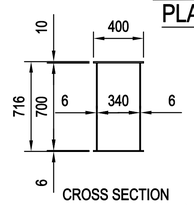
PLAN



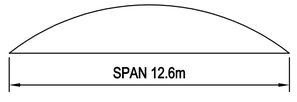
L.T END STOPPER DETAIL (4 NOS.)



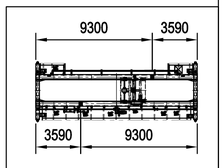
(8/2 FALL) ROPE REEVING ARRANGEMENT



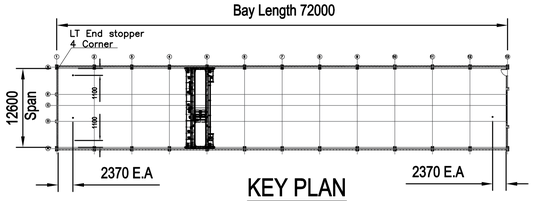
CROSS SECTION OF BRIDGE BOX GIRDER 1



DEFLECTION - <Span/750 (16.8mm)
CAMBER - 10mm 1

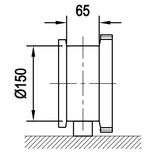


Splice Joint Detail

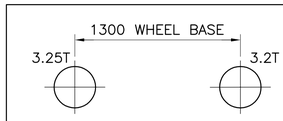


KEY PLAN
Scale 1:100

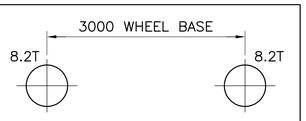
L.T WHEEL
DOUBLE FLANGE WHEEL
TO SUIT RAIL - 50Sq.Bar



C.T WHEEL
DOUBLE FLANGE WHEEL
TO SUIT RAIL - 40/32 Bar



CT Wheel Load
3.25T APX. WITHOUT IMPACT
4.29 APX. WITH IMPACT



LT Wheel Load
8.2T APX. WITHOUT IMPACT
10.824T APX. WITH IMPACT

NOTE :-
1. ALL DIMENSIONS ARE IN MM. DRAWING TO THE SCALE .
2. THIS IS A GENERAL ARRANGEMENT DRG. SHOWING MAJOR WORKING DIMENSIONS AND MAY HAVE MINOR CHANGE DURING FINAL DESIGN.
3. GANTRY GIRDER/ RUNWAY BEAM FOR LONG TRAVEL SHALL BE IN SJVN SCOPE
4. REFERENCE DRAWING NO. SY-C2-AR3-C31 to C32

CRANE CHARACTERISTICS				
Area		GIS' AREA (Indoor)		
Span		12.6m		
Lift		8		
Power Supply		415V ±10%, 3 phase, 4 wire, 50 Hz ±3%		
Control		RRC,Pendent Push Button		
Ambirnt Temperature		40°C		
Bridge Structure Design		Double Box Girder		
Mechanism		Hoist	M.H-Cross Travel	M.H-Long travel
Capacity (Ton)		10		
Duty Class		M5 ,IS: 3177-1999 (reaffirms 2006) & IS 807		
Full Speed (M/min)		3	3	10
Acceleration			Acceleration –7 cm/s² (As per IS 3177)	Acceleration – 7 cm/s² (As per IS 3177)
Creep speed M/Min		5% of operating speed(thru' VVVF drives)		
Wire Rope	No.of Falls	8		
	Dia (mm)	11		
	Construction	6 x 36		
	Type	6X36 Const. IWRC. Steel core , Gr.1770 N/mm^2		
	Make	Usha Martin		
Motor	Type	Sq.Cage	Sq.Cage	Sq.Cage
	Frame KW	7.3	0.55	0.55
	Duty	S4-40% CDF 300 Starts / Hr. ,Ambient-50°C	S4-40% CDF 150 Starts / Hr. ,Ambient-50°C	
	Protection	IP 55	IP 55	IP 55
	Make	BBL/Marathon/CGL/Siemens		
	Qty	1	1	1
Drum	Drum Dia	219		
	Material	Seamless pipe ASTM -106 Gr. B		
Sheave	Sheave Dia	200		
	Material	Fe 410 WA IS: 2062 Gr. B / CS Gr. 280-520 IS: 1030		
Gear Box	Qty	1	1	1
	Type	HC-500	VC-250	HC-250
	Material	Pinion- En24 Gear - En19		
	Hardness	Pinion- 280±10% Gear - 250±10%		
Brake per Motor	Type	EHT + DCEM	EHT + DCEM	EHT + DCEM
	Drum Dia (mm)	150+FDB-20	100+FDB-8	100+FDB-8
	Qty	1+1	1+1	1+1
	Make	ELECTROMAG/SOC/EMCO/PETHE		
Coupling	Type	Half Geared	Half Geared	Half Geared
	Qty Input	1	1	1
	Type	Half Geared	Half Geared	Half Geared
	Qty Output	NA	4	6
Wheel	Qty Total/Driving	NA	4/2	4/2
	Tread Dia (mm)	NA	150	150
	Max Wheel Load (t) with	NA	3.25	8.2
Crab Weight (t)		3		
Crane Weight (t) Approx		12		
Rail Size			40X32 bar	50 Sq, bar
Buffer Type			Rubber	Rubber
	Qty.		4	4
Limit Switch	Qty	1+1	1	1
	Type	Rotary gear + Gravity	Lever Type/Two way	Lever Type/Two way
	Make	SOC/ELECTROMAG		

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

CONTRACTOR: SHIVA FERROUS PVT. LTD.
Works: NH2, Delhi Road ,
Vill: Bhadua, Dist.- Hooghly, PIN- 712 250

PROJECT: ARUN–3 HYDRO ELECTRIC PROJECT (NEPAL)
(4 x 225 MW)

CUSTOMER: SJVN ARUN–3 POWER DEVELOPMENT COMPANY PVT. LTD. (SAPDC LTD.)

CONSULTANT: SJVN LTD.
(A JOINT VENTURE OF GOVT OF INDIA AND GOVT OF HP)

BHARAT HEAVY ELECTRICALS LTD.
TRANSMISSION BUSINESS GROUP
NOIDA

	NAME	SIGN.	DATE
DRN.	B.B		25.08.2022
CHD.	S.D		25.08.2022
APPD.	N.S		25.08.2022

DEPT. TBG | CODE | SCALE NTS | CARD CODE

TITLE: GENERAL ARRANGEMENT OF 10T DOUBLE GIRDER EOT CRANE OF GIS BUILDING OF 4x225MW ARUN–3 HEP

DRG.NO. TB–405–563–220 2

SHT. No | NO. OF SHT.

SIZE–A3

PRODUCED BY AN AUTODESK EDUCATIONAL PRODUCT

ETC BOQ - FIRE FIGHTING SYSTEM SYSTEM FOR ARUN-III
PRO ECT: x MW ARUN-III, HYDRO ELECTRIC PRO ECT, NEPAL
CUSTOMER: S VN ARUN-III POWER DEVELOPMENT COMPANY (P) LTD. (SAPDC)

Complete Erection, Testing and Commissioning of below mentioned Main Supply equimpment for Fire Fighting System shall be in BHEL TBG ETC Contractor's Scope including
a) Receipt of equipment / material at site, unloading, handling, transportation to storage area.
b) Conservation / maintenance / up-keeping of the equipment / item in the store.
c) Storage of Mandatory Spares.
d) Temporary lighting in stores and construction area wherever required for their work.
e) Safety / Security of equipment / material.
f) Transportation of equipment / material from store to erection site, erection of equipment / material in line with the drawings / instructions, testing, commissioning including PG test (if applicable) and handing over.
g) Maintenance of associated equipment till handing over & any other activity necessary for completion of the job but not specifically mentioned in this specification.
h) Laying and termination of power/control/FO cables for all equipmnet supplied under this BOQ.
i) Earthing of all installations (to the nearest earth mat/ earthing pad) supplied under this BOQ.
Any Tools and Machinery required for ETC work shall be arranged by ETC contractor.
** e u ntt e fu n ed n t e e e e mn de n on e e c n e u ntt t on u d do n d u to of tot cont ct ue du n e ecut on of cont ct*
Supervision for ETC work of Fire Fighting System is under M/s Flogain (FFS contractor) scope for limited period.

FFS ETC Philosophy

1	Welding Procedure Specification, or WPS shall be submitted. Qualified vendors shall be engaged.
2	MS, GI Piping involves Welding of Pipes, Valves, and Fittings, Routing Location, Elevation, Supporting of Pipes Location, Spacing, Cleaning & preparation of pipes Verticality, NDT of root run of butt weld (DPT after back gouging/ grinding of root run) & final run of all welds: DPT, RT of welds, Hydro testing of pipes except piping of Inert Gas system), Pneumatic testing of piping of Inert Gas system, Check for preparation and cleaning of pipes, Painting & labelling: Shade & DFT for above ground pipes, Wrapping coating for underground pipe : Holiday detection & Adhesion test.
3	Instruments - Installation, location identification Tag nos. of instruments, Check for Range & Calibration.
4	Check Proper Operation of Louvers.
5	DVLCP, FAP- Identification, Positioning & Levelling, Checking Earthing, Insulation, Continuity Test. Cable Connection
6	Smoke detectors - identification, proper installation, location, wiring, Cabling - identification, proper cabling installation, location, Megger value etc.
7	Performance & Demonstration of the system.

Provision of adequate no. of Welding machines, welding electrode, Tools, tackles, scaffolding, safety kit shall be provided by the contractor as a part of his scope of works.

Contractor shall submit measurement sheet, Erection protocol, Commissioning & Testing protocol for vetting by site incharge & end client.

FIRE FIGHTING SYSTEM (ETC & Material Handling) - Receipt of material, unloading, proper storage, material reconciliation, safe keeping, erection, testing & commissioning, handing over to BHEL, proper record keeping etc to complete.

Sl. No.	Item Description	Quantity	UOM
1	MS PIPE 200NB (FE410 GRADE) (As per IS 3589 Gr 410)	200	Meter
2	MS ERW PIPE 150NB (MEDIUM GRADE) (As per IS: 1239 (Part-I))	400	Meter
3	MS ERW PIPE 100NB (MEDIUM GRADE) (As per IS: 1239 (Part-I))	80	Meter
4	MS ERW PIPE 80NB (MEDIUM GRADE) (As per IS: 1239 (Part-I))	30	Meter
5	WRAPING & COATING MATERIAL	10	SqMtr

6	SINGLE HEADED HYDRANT VALVE	13	Nos.
7	HOSE BOX	13	Nos.
8	HOSE PIPE - 15M LONG	26	Nos.
9	HOSE REEL - 30 METER LONG WITH DRUM	1	Nos.
10	BRANCH PIPE WITH NOZZLE	13	Nos.
11	AIR RELEASE VALVE	1	Nos.
12	GATE VALVE 200NB	2	Nos.
13	GATE VALVE 150NB	2	Nos.
14	GATE VALVE 100NB	11	Nos.
15	GATE VALVE 80NB	2	Nos.
16	BUTTERFLY VALVE - 100NB	1	Nos.
17	DELUGE VALVE - 100NB	4	Nos.
18	Y-TYPE STRAINER - 100NB	4	Nos.
19	SOLENOID VALVE	4	Nos.
20	Q.B DETECTOR	78	Nos.
21	HVW SPRAY NOZZLE	177	Nos.
22	MVW SPRAY NOZZLE	70	Nos.
23	PRESSURE SWITCH	8	Nos.
24	PRESSURE GAUGE	8	Nos.
25	LOCAL CONTROL PANEL FOR DELUGE VALVE	4	Nos.
26	PYLON PIPE 50NB (MEDIUM GRADE)	198	Meter
27	GI PIPE 100NB (MEDIUM GRADE) (As per IS: 1239 (Part-I), Galvanized as per IS 4736)	42	Meter
28	GI PIPE 80NB (MEDIUM GRADE) (As per IS: 1239 (Part-I), Galvanized as per IS 4736)	18	Meter
29	GI PIPE 65NB (MEDIUM GRADE) (As per IS: 1239 (Part-I), Galvanized as per IS 4736)	45	Meter
30	GI PIPE 50NB (MEDIUM GRADE) (As per IS: 1239 (Part-I), Galvanized as per IS 4736)	132	Meter
31	GI PIPE 40NB (MEDIUM GRADE) (As per IS: 1239 (Part-I), Galvanized as per IS 4736)	198	Meter
32	GI PIPE 32NB (MEDIUM GRADE) (As per IS: 1239 (Part-I), Galvanized as per IS 4736)	72	Meter
33	GI PIPE 25NB (MEDIUM GRADE) (As per IS: 1239 (Part-I), Galvanized as per IS 4736)	329	Meter
34	CO2 TYPE EXTINGUISHER -4.5 KG	5	Nos.
35	CO2 TYPE EXTINGUISHER - 22.5 KG (Trolley Mounted)	1	Nos.
36	DRY CHEMICAL POWDER TYPE EXTINGUISHER - 6 KG	3	Nos.
37	DRY CHEMICAL POWDER TYPE EXTINGUISHER - 25 KG (Trolley Mounted)	1	Nos.
38	MECHANICAL FOAM TYPE EXTINGUISHER - 9 LITER	2	Nos.
39	MECHANICAL FOAM TYPE EXTINGUISHER - 60 LITER (Trolley Mounted)	1	Nos.
40	SAND BUCKET (Each set comprises of two sand buckets with stand)	4	Set
41	IGES PIPE 80NB	22	Meter
42	IGES PIPE 50NB	76	Meter
43	IGES PIPE 40NB	22	Meter
44	IGES PIPE 25NB	76	Meter
45	IG-541 -CYLINDERS 140 LTRS. 300 BAR	40	Nos.
46	IG-541 CYLINDERVALVE (IG-541) -CYLINDERS VALVE	40	Nos.
47	6 CYLINDER -MANIFOLD 300 BAR M400 (140 LITRE CYLINDER)	5	Nos.
48	5 CYLINDER -MANIFOLD 300 BAR M400 (140 LITER CYLINDER)	2	Nos.
49	IGES PRESSURE RELIEF DAMPER	4	Nos.
50	IGES HOSE	40	Nos.
51	IGES CHECK VALVE	40	Nos.
52	IGES CONTACT PRESSURE GAUGE (Contact pressure gauge cum Switch)	40	Nos.
53	IGES RELEASE DEVICE ELECTRICAL	6	Nos.
54	IGES RELEASE DEVICE MANUAL	6	Nos.
55	IGES RELEASE DEVICE PNEUMATIC	36	Nos.
56	IGES ADAPTER	76	Nos.
57	IGES PILOT PIPES CYLINDER RACK BAS STRAIGHT	36	Nos.
58	IGES SAFETY VALVE	6	Nos.
59	IGES PNEUMATIC LIMIT SWITCH	3	Nos.

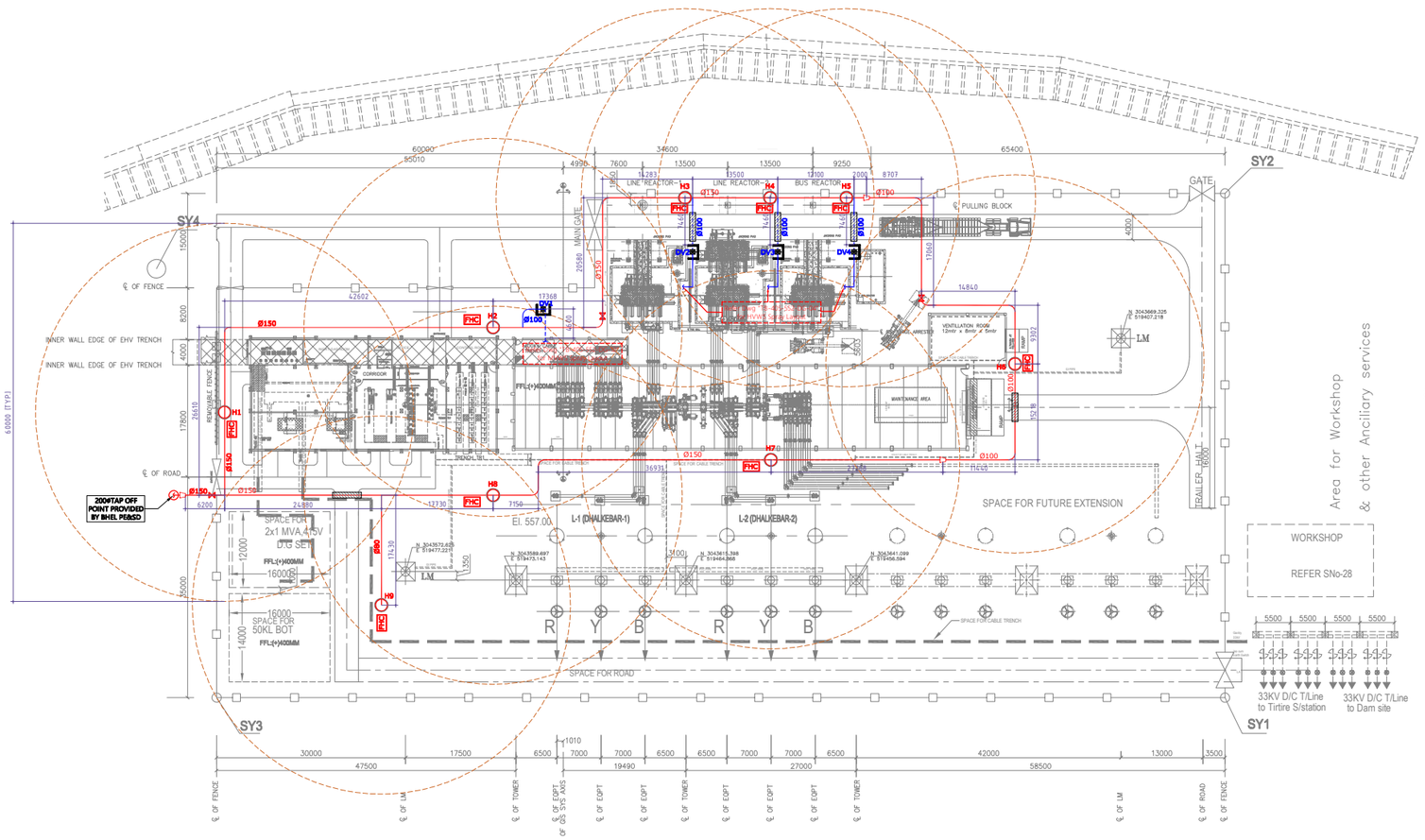
60	IGES NOZZLES	43	Nos.
61	MULTI SENSOR DETECTOR	35	Nos.
62	HEAT DETECTOR	2	Nos.
63	AIR SAMPLING DETECTION ASSEMBLY (Complete with sampling pipe network, detectors, detector control assembly chart recorder/data log output, remote annunciation display panel, spares and tools etc.)	3	Set
64	BEAM DETECTOR SET	8	Nos.
65	HOOTER CUM STROBE	3	Nos.
66	RESPONSE INDICATOR	8	Nos.
67	MONITOR MODULE	18	Nos.
68	CONTROL MODULE	15	Nos.
69	MANUAL CALL POINT	6	Nos.
70	LHS CABLE (Digital LHS Cable along with interface modules)	80	Meter
71	EXIT SIGN	10	Nos.
72	MANUAL ABORT SWITCHES	3	Nos.
73	MANUAL RELEASE SWITCHES	3	Nos.
74	DISCHARGE INDICATOR	3	Nos.
75	PRE DISCHARGE INDICATORS	3	Nos.
76	IGES GAS RELEASE PANEL	1	Nos.
77	DETECTION CABLE 2C X 1.5 SQ.MM	600	Mtrs
78	FO CABLE	100	Mtrs
79	SAFETY KIT	1	Set
80	ADDRESSABLE FIRE ALARM PANEL	1	Nos.
81	FIRE DETECTION SYSTEM ACCESSORIES	1	Set
82	IGES ACCESSORIES	1	Set
83	PIPE FITTINGS & ACCESSORIES	1	Set

MANDATORY SPARES - M: Fire Fighting System Spare material handling			
Sl. No.	**Item Description**	**Quantity**	**UOM**
1	MULTI SENSOR DETECTOR	4	Nos.
2	HEAT DETECTOR	1	Nos.
3	BEAM DETECTOR SET	1	Nos.
4	Q.B DETECTORS	8	Nos.
5	LHS CABLE (Digital LHS Cable along with interface modules)	8	Meter
6	MANUAL CALL POINT	1	Nos.
7	HOOTER CUM STROBE	1	Nos.
8	HVW SPRAY NOZZLE	18	Nos.
9	MVW SPRAY NOZZLE	7	Nos.
10	EXIT SIGN	1	Nos.
11	Y-TYPE STRAINER - 100NB	1	Nos.
12	MS PIPE 200NB (FE410 GRADE)	20	Meter
13	MS ERW PIPE 150NB (MEDIUM GRADE)	40	Meter
14	MS ERW PIPE 100NB (MEDIUM GRADE)	8	Meter
15	MS ERW PIPE 80NB (MEDIUM GRADE)	3	Meter
16	PYLON PIPE 50NB (MEDIUM GRADE)	20	Meter
17	GI PIPE 100NB (MEDIUM GRADE)	5	Meter
18	GI PIPE 80NB (MEDIUM GRADE)	2	Meter
19	GI PIPE 65NB (MEDIUM GRADE)	5	Meter
20	GI PIPE 50NB (MEDIUM GRADE)	14	Meter
21	GI PIPE 40NB (MEDIUM GRADE)	20	Meter
22	GI PIPE 32NB (MEDIUM GRADE)	8	Meter
23	GI PIPE 25NB (MEDIUM GRADE)	33	Meter
24	IGES PIPE 80NB	3	Meter
25	IGES PIPE 50NB	8	Meter
26	IGES PIPE 40NB	3	Meter
27	IGES PIPE 25NB	8	Meter
28	PIPE FITTINGS & ACCESSORIES	1	Set
29	GATE VALVE 200NB	1	Nos.
30	GATE VALVE-150NB	1	Nos.
31	GATE VALVE-100NB	1	Nos.
32	GATE VALVE-80NB	1	Nos.
33	BUTTERFLY VALVE-100NB	1	Nos.

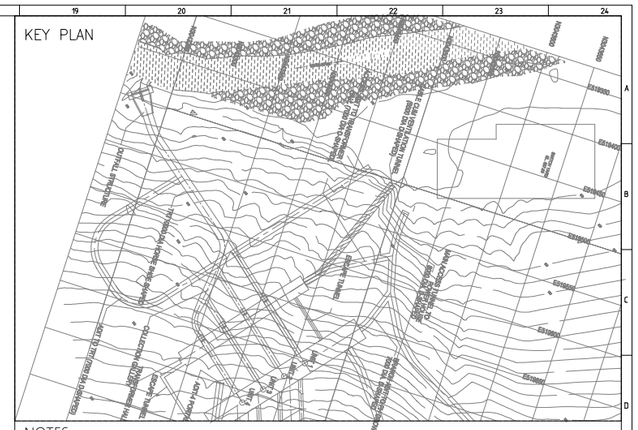
34	DELUGE VALVE-100NB	1	Nos.
35	EXPANSION JOINTS	4	Nos.
36	SINGLE HEADED HYDRANT VALVE	2	Nos.
37	HOSE PIPE CONNECTOR	3	Nos.
38	AIR RELEASE VALVE	1	Nos.
39	HOSE PIPE - 15M LONG	3	Nos.
40	BRANCH PIPE WITH NOZZLE	2	Nos.
41	KITS FOR FILLING UP PORTABLE FIRE EXTINGUISHERS	5	Nos.
42	CARDS (All type of cards used in FACP & Air Sampling System)	1	Set
43	IGES GAS CYLINDER	4	Nos.
44	IGES RELEASE DEVICE ELECTRICAL	1	Nos.
45	IGES RELEASE DEVICE MANUAL	1	Nos.
46	IGES RELEASE DEVICE PNEUMATIC	4	Nos.
47	IGES CYLINDER VALVE WITH SAFETY PRESSURE RELIEF DEVICE	4	Nos.
48	IGES NOZZLES	5	Nos.
49	INERT GAS RELEASE PUSH BUTTON	1	Nos.
50	PRESSURE SWITCH	1	Nos.
51	PRESSURE GAUGE	1	Nos.
52	SOLENOID VALVE	1	Nos.

FIRST ANGLE PROJECTION

DRAWING NO : TB-405-552-DG-03



KEY PLAN



NOTES:

1. All dimensions are in mm, elevations & co-ordinates are in meter otherwise mentioned.
2. All civil and masonry works shall be done by SJVN.
3. Over ground pipe shall be supported on RCC pedestal provided by SJVN.
4. Span of RCC pedestal shall be 3.5m (CL to CL).
5. All pipe sizes are in mm and nominal dia only.
6. All Pipes are MS ERW Black medium (IS:1239, Part-1) upto ϕ150 and IS:3589 for ϕ200 & above (FE 410 Grade).
7. Each Hydrant Valve shall be provided with individual fire hose cabinet (FHC) containing 2 nos. Ø63 mm x 15m long RRL Type-A Hoses pipe as per IS 636, one branch pipe with nozzle & one spanner.
8. Hydrant shall be placed at interval of 60m (max.)
9. The routing of fire water piping shown in the drg. may be slightly modified to suit site condition to avoid fouling with underground or above facilities/services etc.
10. Hume pipe as per IS:458 Class-NP-3 shall be provided for road crossing and Class-NP-4 shall be provided for rail crossing. Supply and laying scope shall be in SJVN.
11. Hydro & Holiday test etc. shall be as per approved Field Quality Plan(FQP).
12. Minor modifications on the location of deluge valves may be carried out to suit site condition.
13. All U/G pipes shall be provided with anti-crossive tape (wrapping-coating of approved thickness.
14. All A/G pipes shall be painted as per Annexure-3 to document no. PY-SZ-4-M-110-8315-01.
15. All U/G pipes shall be laid keeping top of pipe at least 1.2m below local ground level.
16. Hydrants shall be located at min. 2m & max. 15m from the protected building.
17. Method of joints of all MS pipes shall be welded.

LEGEND & BILL OF QUANTITY (BOQ)

S.No.	Legend	Item Description		Quantity	Remark, if any
1.	○	Hydrant Valve (Single Headed)		9 No's.	
2.	FHC	Fire Hydrant Cabinet/Hose Box		9 No's.	
3.	--	RRL Hose Pipe (15m Long)		18 No's.	
4.	--	Branch Pipe with Nozzle		9 No's.	
5.	DV	Deluge Valve, Ø100		4 No's.	
6.	⋈	Gate Valve, Ø150		2 No's.	
		Gate Valve, Ø100		1 No's.	
7.		MS Pipe	Ø150	306 Mtrs.	
			Ø100	78 Mtrs.	
			Ø80	30 Mtrs.	
8.		Hume Pipe (SJVN Scope)	Ø300	25 Mtrs.	
9.	--	Wrapping & Coating	--	16m2	

ABBREVIATION:

H	: HYDRANT	TYP	: TYPICAL
FHC	: FIRE HYDRANT CABINET	ϕ	: DIAMETER IN MM
DV	: DELUGE VALVE	A/G	: Above Ground
GV	: GATE VALVE	U/G	: Under Ground

REFERENCE DOCUMENT/DRAWING NO.:

1. TB-3-405-316-001 : ELECTRICAL LAYOUT PLAN & SECTION OF 4x225M ARUN-3 HEP

Rev.	Rev. Date	Description	Altered by	Checked by	Approved by
1	21/01/2023	Second Submission for Approval	BS	RA	VKV
0	01/10/2022	First Submission for Approval	BS	RA	VKV

PROJECT:

ARUN-III HYDRO ELECTRIC PROJECT (NEPAL)
(4x225 MW)

CUSTOMER:

SJVN ARUN-3 POWER DEVELOPMENT COMPANY (P) LTD. (SAPDC LTD.)

CONSULTANT:

SJVN LIMITED
(A Joint Venture of Government of India & Government of Himachal Pradesh)

MAIN CONTRACTOR:

BHARAT HEAVY ELECTRICAL LIMITED
(Transmission Business Group, Noida)

SUB-CONTRACTOR:

FLOWGAIN ENGINEERING PVT. LTD.
B-313, 2nd Floor, Okhla Phase-I
Industrial Area Okhla, New Delhi-110 020, India
Tele: +91-11-4181 2266

	Name	Sign	Date
Drawn	RS		21/01/2023
Checked	RV		21/01/2023
Approved	VKV		21/01/2023

Dept. : TBG
CODE

Scale 1:450 | Paper A1 | Card CODE --

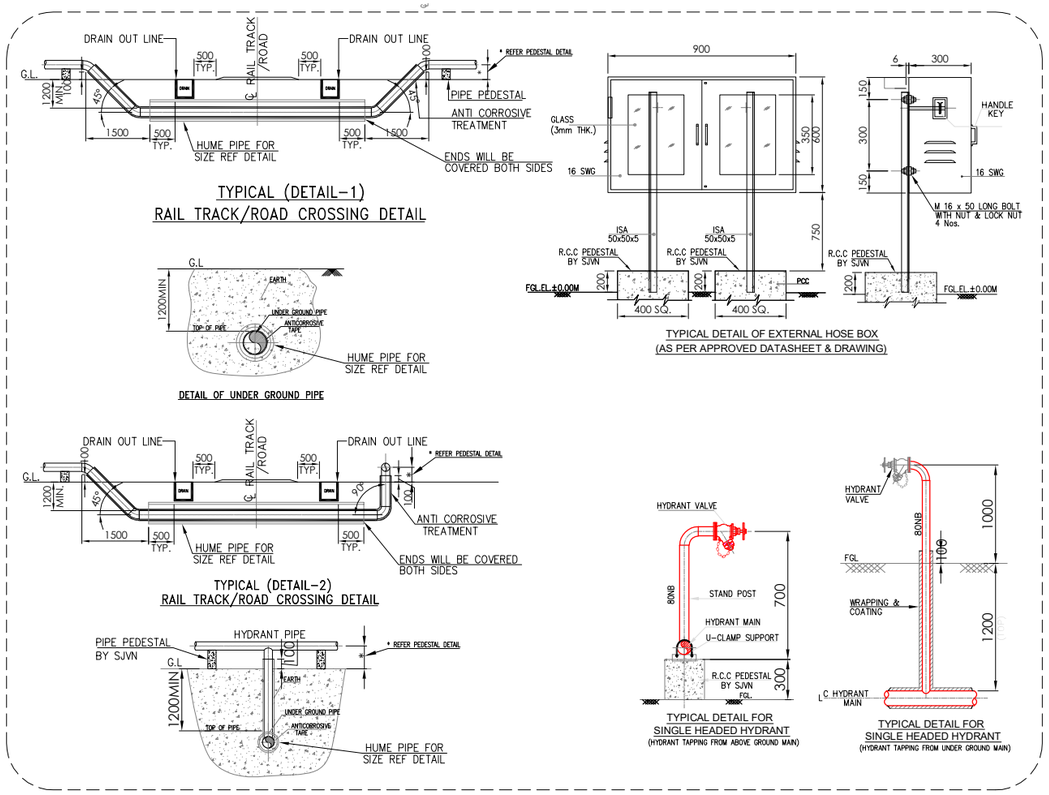
VENDOR'S DRAWING NO.: --

TITLE:
FIRE WATER PIPING LAYOUT FOR SWITCHYARD AREA

DRAWING NO.: TB-405-552-DG-03 | REV 0

Sheet No.: 1 of 2 | No. of Sheet: 2

SIZE-A1



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ETC - AIR-CONDITIONING & VENTILATION SYSTEM FOR ARUN-III
PRO ECT: x MW ARUN-III, HYDRO ELECTRIC PRO ECT, NEPAL
CUSTOMER: S VN ARUN-III POWER DEVELOPMENT COMPANY (P) LTD. (SAPDC)

Complete Erection, Testing and Commissioning of below mentioned Main Supply equimpment for Air-Conditionig and Ventilation System shall be in BHEL TBG ETC Contractor's Scope including
a) Receipt of equipment / material at site, unloading, handling, transportation to storage area.
b) Conservation / maintenance / up-keeping of the equipment / item in the store.
c) Storage of Mandatory Spares.
d) Temporary lighting in stores and construction area wherever required for their work.
e) Safety / Security of equipment / material.
f) Transportation of equipment / material from store to erection site, erection of equipment / material in line with the drawings / instructions, testing, commissioning including PG test (if applicable) and handing over.
g) Maintenance of associated equipment till handing over & any other activity necessary for completion of the job but not specifically mentioned in this specification.
h) Laying and termination of power/ control/ instrumentation/ FO cables for all equipmnet supplied under this BOQ. Lugs and glands for cable laying shall be supplied by ETC contractor.
i) Earthing of all installations (to the nearest earth mat/ earthing pad) supplied under this BOQ.
j) Fixing of Centrifugal Fans on its foundation.
k) Fabrication of Ventilation Duct wherever required.
n oo nd c ne e u ed fo E o e n ed E cont cto
Supervision for ETC work of AC & Ventilation is under M/s Flogain (ACVS contractor) scope for limited period.

ACVS ETC Philosophy

1	FABRICATION, ERECTION, TESTING & INSULATION OF DUCTS Marking, Cutting & Folding of Sheet, Drilling of Flanges Check for Hole Dia, pitch & No of Hole, Final Forming of Duct Piece - Dimensional Check, Lifting-Checking of Size of Duct, Location, Orientation, Elevation, Application of duct sealant, gaskets, Supporting of Duct. Location, Spacing, Verticality, Leak Tightness test/ smoke gun, Insulation and Aluminium Foil : Types, Thickness, Fixing Arrangement, if applicable
2	GRILLES / DIFFUSERS, FILTERS Location, Elevation, Levelling & Orientation, Filter frame fabrication, total installation.
3	Instruments - Check Location, Identification, Range & Calibration of all Instruments viz. Flow Switch, Pressure switch etc.
4	Fire Damper - Location, Elevation. Dimension, Orientation.
5	LT MOTOR Checking of Rating, Levelling .Alignment With Driven Equipment, Checking of IR Value, Cable Termination & Earthing.
6	FAN Identification, Orientation, Levelling, Positioning, Cable Connection (Power & Controls) & Operation, Painting for all equipment: Touch-up, Shade, labelling & Marking, as applicable.
7	Cassette/ Split AC units Installation of IDU, ODU, check w.r.t Lighting Fixtures, FF nozzles, detectors, Refrigerant/ drain piping, vacuuming, nitrogen filling, final commissioning.
8	Commissioning of the system.
9	Performance Test of the system.

Provision of adequate no. of Welding machines, welding electrode, Tools, tackles, scaffolding, safety kit, nitrogen, sealant etc shall be provided by the contractor as a part of his scope of works.

Contractor shall submit measurement sheet, Erection protocol, Commissioning & Testing protocol for vetting by site incharge & end client.

AIR CONDITIONING & VENTILATION SYSTEM (ETC & Material Handling) - Receipt of material, unloading, proper storage, material reconciliation, safe keeping, erection, testing & commissioning, handing over to BHEL, proper record keeping etc to complete.

Sl. No.	Item Description	Quantity	UOM

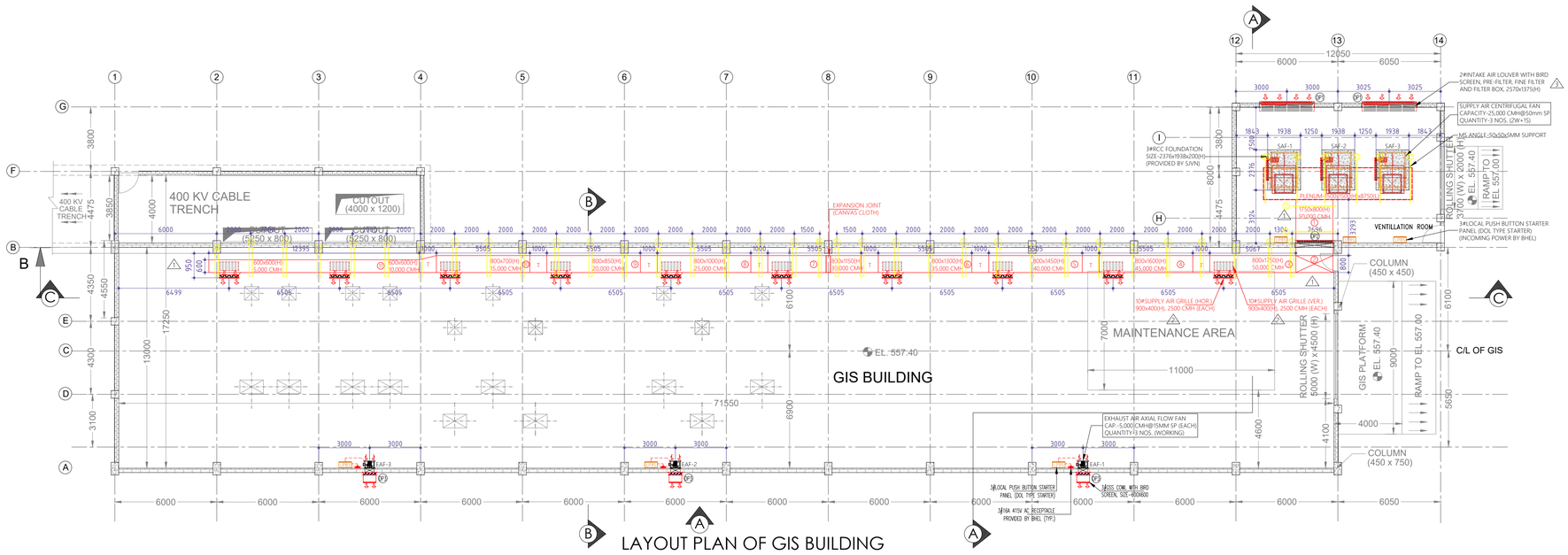
1	CENTRIFUGAL FAN WITH MOTOR - 25000 CMH (Supply air type Centrifugal fan (2W+1S) with motor, V-belt drive, pulley, casing alongwith fixing hardware and all accessories)	3	No.
2	SPLIT AC UNIT - 2 TR (High wall type split unit of 2TR capacity each complete with outdoor condensing units, compressor and high wall type indoor evaporator unit with cordless remote controller, power cables between outdoor and indoor units and to power supply switch, copper refrigerant piping between indoor & outdoor unit, PVC drain piping from indoor units, voltage stabilizer, and first charge of refrigerant.)	4	No.
3	CASATTE AC UNIT - 3TR (Cassette AC unit of 3TR capacity each complete with outdoor condensing units, compressor and indoor evaporator unit with cordless remote controller, power cables between outdoor and indoor units and to power supply switch, copper refrigerant piping between indoor & outdoor unit, PVC drain piping from indoor units, voltage stabilizer, and first charge of refrigerant)	3	No.
4	PRE FILTER (size 610X610x50mm for GIS Ventilation System through centrifugal fans)	16	No.
5	FINE FILTER (size 610X610x305mm for GIS Ventilation System through centrifugal fans)	16	No.
6	GSS DUCT SHEET-24G-VENTILATION SYSTEM (Pre fabricated Ducting fabricated from GSS having zinc coating as per class 275 of IS 277 complete with hangers, supports, joints/ washers.)	40	SqMtr
7	GSS DUCT SHEET-22G-VENTILATION SYSTEM (Pre fabricated Ducting fabricated from GSS having zinc coating as per class 275 of IS 277 complete with hangers, supports, joints/ washers.)	210	SqMtr
8	GSS DUCT SHEET-20G-VENTILATION SYSTEM (Pre fabricated Ducting fabricated from GSS having zinc coating as per class 275 of IS 277 complete with hangers, supports, joints/ washers.)	120	SqMtr
9	GSS DUCT SHEET-18G-VENTILATION SYSTEM (Pre fabricated Ducting fabricated from GSS having zinc coating as per class 275 of IS 277 complete with hangers, supports, joints/ washers.)	70	SqMtr
10	SUPPLY AIR GRILL WITH VCD (20 nos. of size 900x400)	7.2	SqMtr
11	VOLUME CONTROL DAMPER (3 nos. of size 800x800)	1.92	SqMtr
12	MOTORIZED FIRE DAMPER (1 no. of size 1750x800, excluding actuator with fire rating of 90min)	1.4	SqMtr
13	MOTORIZED ACTUATOR FOR FIRE DAMPER (with control panel)	1	No.
14	NON RETURN DAMPER (3 nos. 800x800; 2 nos. 650x650; 2 nos. 600x600; 2 nos. 450dia)	6.16	SqMtr
15	AIR INTAKE LOUVERS (2 nos. 2570x1375; 1 no. 2000x2000; 1 no. 600x400)	11.31	SqMtr
16	GRAVITY LOUVERS (1 no. of size 400x400, for Exhaust Air)	0.16	SqMtr
17	AXIAL FLOW SUPPLY FANS - 4000CMH (Supply Air Axial Flow Fan, 4000 m3/hr, 20mm WC SP with motor, pre filter, fine filter, GI rain protection cowl with bird screen, DOL Starter with local push button)	2	No.
18	AXIAL FLOW EXHAUST FANS - 5000CMH (Exhaust Air Axial Flow Fan, 5000 m3/hr, 15mm WC SP with motor, GI rain protection cowl with bird screen, DOL Starter with local push button)	3	No.
19	AXIAL FLOW EXHAUST FANS - 6000CMH (Exhaust Air Axial Flow Fan, 6000 m3/hr, 15mm WC SP with motor, GI rain protection cowl with bird screen, DOL Starter with local push button)	5	No.
20	AXIAL FLOW EXHAUST FANS - 1000CMH (Exhaust Air Axial Flow Fan, 1000 m3/hr, 15mm WC SP with Flame proof motor, GI rain protection cowl with bird screen, DOL Starter with local push button)	2	No.
21	STRUCTURE STEEL DUCT SUPPORT (ISMC/ISA/MS Plate etc)	1.5	MT

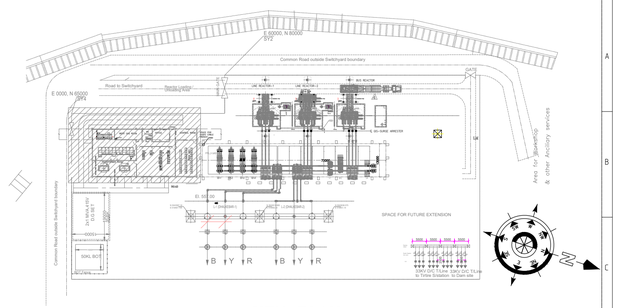
MANDATORY SPARES - N: Air-Conditioning & Ventilation System Spare material handling			
Sl. No.	**Item Description**	**Quantity**	**UOM**
1	PRE FILTERS	4	No.

2	FINE FILTERS	4	No.
3	V-BELTS OF EACH TYPE FOR CENTRIFUGAL FANS	4	Set
4	BLOWER BEARING SETS OF EACH TYPE FOR CENTRIFUGAL FANS	2	Set
5	AXIAL FLOW SUPPLY FANS - 4000 CMH (Supply Air Axial Flow Fan, 4000 m3/hr, 20mm WC SP with motor, pre filter, fine filter, GI rain protection cowl with bird screen, DOL Starter with local push button)	2	No.
6	AXIAL FLOW EXHAUST FANS - 5000 CMH (Exhaust Air Axial Flow Fan, 5000 m3/hr, 15mm WC SP with motor, GI rain protection cowl with bird screen, DOL Starter with local push button)	1	No.
7	AXIAL FLOW EXHAUST FANS - 6000 CMH (Exhaust Air Axial Flow Fan, 6000 m3/hr, 15mm WC SP with motor, GI rain protection cowl with bird screen, DOL Starter with local push button)	1	No.
8	AXIAL FLOW EXHAUST FANS - 1000 CMH (Exhaust Air Axial Flow Fan, 1000 m3/hr, 15mm WC SP with Flame proof motor, GI rain protection cowl with bird screen, DOL Starter with local push button)	1	No.
9	SUPPLY AIR GRILL WITH VCD (2 no. of size 900x400)	0.72	SqMtr
10	VOLUME CONTROL DAMPER (1 no. of size 800x800)	0.64	SqMtr
11	MOTORIZED FIRE DAMPER (1 no. of size 1750x800, excluding actuator with fire rating of 90min)	1.4	SqMtr
12	MOTORIZED ACTUATOR FOR FIRE DAMPER (with control panel)	1	No.
13	NON RETURN DAMPER (1 no. of size 800x800)	0.64	SqMtr
14	AIR INTAKE LOUVERS (1 no. of size 2570x1350)	3.47	SqMtr
15	GRAVITY LOUVERS (1 no. of size 400x400, for Exhaust Air)	0.16	SqMtr
16	INDUSTRIAL TYPEVACUUM CLEANER SUITABLE FOR CLEANING OF FILTER BANKS OF VENTILATION SYSTEM	1	Set
17	POWER CONTACTORS AND FUSES (Power contractor 25A & 18A, HRC Fuse 32A & 16A.)	1	Set
18	ANEMOMETER	1	No.
19	BEARING HEATING DEVICES SUITABLE FOR REPLACEMENT OF BEARING (preferably of induction type)	1	Set
20	BEARING PULLER OF SUITABLE SIZE FOR FACILITATING BEARING REPLACEMENT OF COUPLING SHAFT ETC.	1	Set

FIRST ANGLE PROJECTION

DRAWING NO : TB-405-553-DG-02





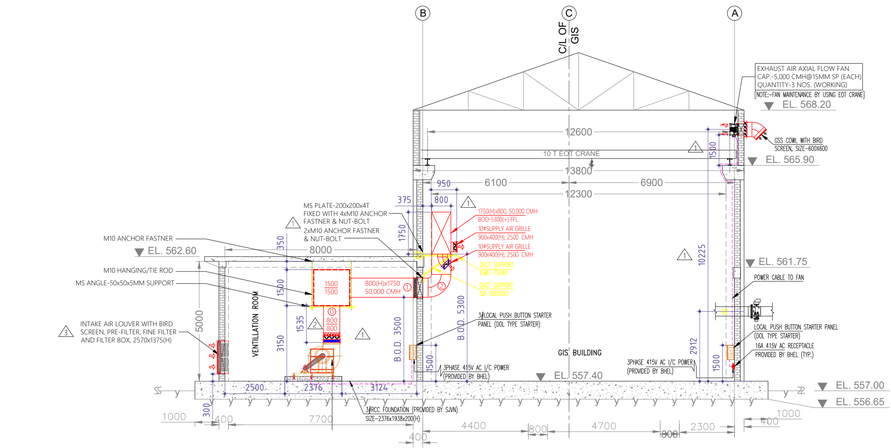
KEY PLAN

NOTES:

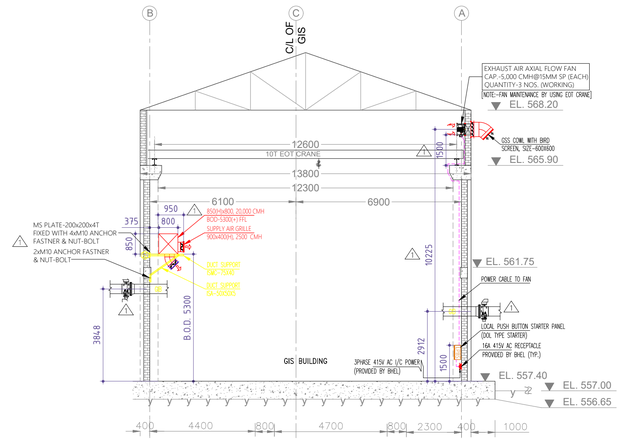
1. All dimensions are in mm and all levels are in meter.Do not scale. follow written dimensions only.
2. All civil and masonry works shall be provided by SJVN.
3. Direct Incoming Power Supply to each supply air Centrifugal Fan's LPBS shall be provided by BHEL.
4. Three Phase 415V AC 16A Receptacles near to each Ex. air Axial Fan's LPBS shall be provided by BHEL.
5. All supply air grille shall be provided with collar damper.
6. Duct support (S1/S2) arrangement may change to suit site condition in co-ordination with other services.
7. Duct shall be made of galvanized cold rolled steel sheets having galvanization coating of 275GSM as per IS:277.
8. The minimum thickness of GI sheets shall be as follows:
   a) Up to 750mm : 24G (0.60mm)
   b) 751 - 1500mm : 22G (0.80mm)
   c) 1501 - 2250mm : 20G (1.00mm)
   d) Above 2251mm : 18G (1.20mm)
9. Finished circular opening of required size for each axial flow fan shall be provided by SJVN.
10. All Supply of receptacles, earthing, cable tray etc shall be in scope of BHEL.
11. Necessary cabling from receptacles to each fan's 3-phase DOL local starter shall be supplied by the FLOWGAIN
12. Duct Support shall be painted with one coat of red oxide+one coat enamel paint.

LEGEND & BILL OF QUANTITY (BOQ)

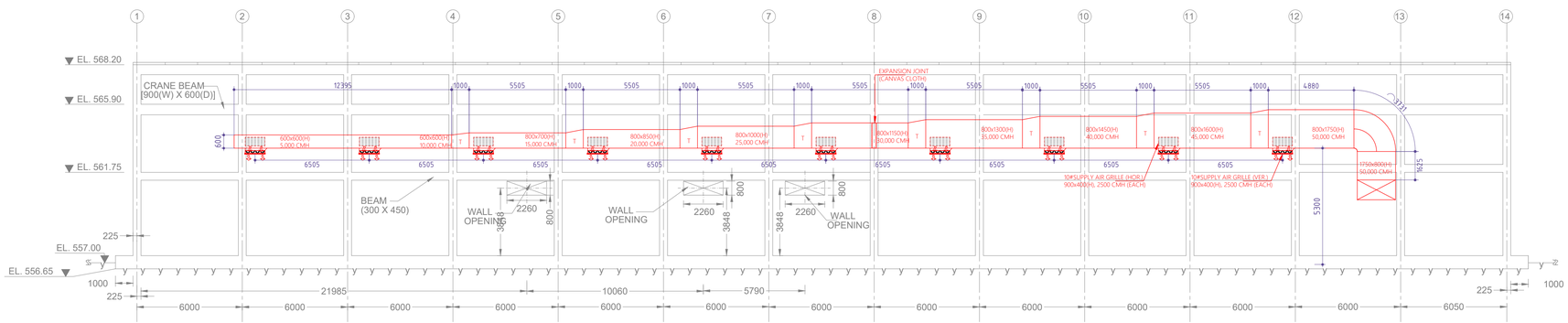
S.No.	Legend	Item Description	Capacity/Rating	Quantity	Make/Manufacturer
1.		Supply Air DIDW Centrfugal Fan	25,000 CMH, 50mm Static Pressure	3 No's. (2W+1S)	Nicotra
2.		Exhaust Air Axial Flow Fan	5,000 CMH, 15mm Static Pressure	3 No's. (Working)	Flaktwood
3.	LPBS	Local Push Button Starter (DOL)	-----	6 No's.	L&T/C&S/Havells/CGL
4.		GI Ducting (275GSM Galv. coating as per IS: 277)	24 Gauge (0.6mm)	40 m2	△ App. Vendor
			22 Gauge (0.8mm)	210 m2	
			20 Gauge (1.0mm)	120 m2	
			18 Gauge (1.2mm)	70 m2	
5.		Non-Return Damper (NRD)	800x800(H)	3 No's.	△ App. Vendor
			600x600(H)	3 No's.	
6.		Volume Control Damper	800x800(H)	3 No's.	
7.		Louver with Bird Screen	2570x1375(H) △	2 No's.	
8.		Supply Air Grille (With Collar Damper)	900x400(H)	20 No's.	
9.		Fire Damper (Motorized Type)	1750x800(H)	1 No's.	△
10.		Pre & Fine Filter With Filter Box	8x610x610x50mm 8x610x610x305mm	2 Set's.	App. Vendor
11.		MS Channel Support/Structure	75x40mm	45 Mtr's	△ ISI Marked
12.		MS Angle Support/Structure	50x50x5mm	85 Mtr's	
13.		MS Plate	200x200x4mm	40 No's.	App. Vendor
14.		Expansion Joint (Canvas Cloth)	800x1150x150L	1 No.'s.	App. Vendor



SECTION: A-A △



SECTION: B-B △



SECTION: C-C △

REFERENCE DOCUMENT/DRAWING NO.: △

1. TB-3-405-316-020 : Layout of GIS Building of 4x225M ARUN-3 HEP
2. SY-C2-AR3-C31 : Power House Complex Switchyard GIS Building Layout Plan & Section
3. TB-405-317-10-2 : GIS General Arrangement Layout for 400kV SF6-SWITCHGEAR ELK-3/420 (1HYG900079-2_AB_02112021)

Rev.	Rev. Date	Description	Altered by	Checked by	Approved by
3	23/01/2023	Third Submission for Approval	RS	RA	VKV
2	18/11/2022	Second Submission for Approval	RS	RA	VKV
1	01/11/2022	Second Submission for Approval	RS	RA	VKV
0	15/09/2022	First Submission for Approval	BS	RA	VKV

PROJECT:
ARUN-III HYDRO ELECTRIC PROJECT (NEPAL)
(4x225 MW)

CUSTOMER:
SJVN ARUN-3 POWER DEVELOPMENT COMPANY (P) LTD. (SAPDC LTD.)

CONSULTANT:
SJVN LIMITED
(A Joint Venture of Government of India & Government of Himachal Pradesh)

MAIN CONTRACTOR:
BHARAT HEAVY ELECTRICAL LIMITED
(Transmission Business Group, Noida)

SUB-CONTRACTOR:
FLOWGAIN®
FLOWGAIN ENGINEERING PVT. LTD.
B-313, 2nd Floor, Okhla Phase-I
Industrial Area Okhla, New Delhi-110 020, India
Tele: +91-11-4181 2266

	Name	Sign	Date
Drawn	RS		18/11/2022
Checked	RV		18/11/2022
Approved	VKV		18/11/2022

Dept. : TBG
CODE

Scale 1:125 | Paper A1 | Card CODE

VENDOR'S DRAWING NO.: FLG-1146-HVAC-DWG-02

TITLE:
VENTILATION EQUIPMENT & DUCTING LAYOUT FOR GIS BUILDING

DRAWING NO.: TB-405-553-DG-02 | REV 2

Sheet No.: 1 of 2 | No. of Sheet: 2

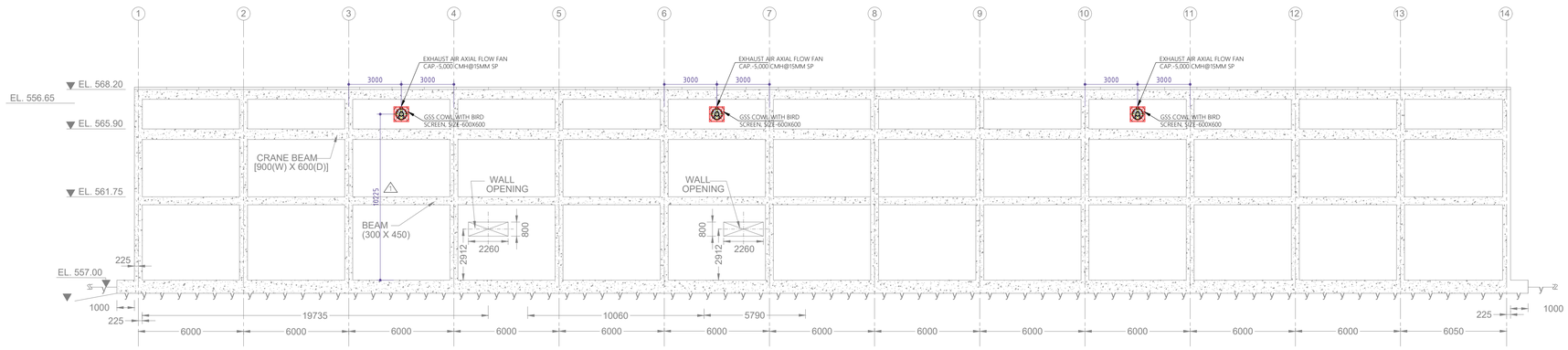
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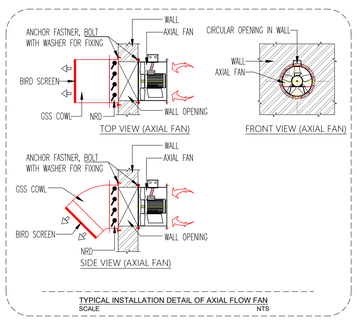
FIRST ANGLE PROJECTION

THE INFORMATION ON THIS DOCUMENT IS THE PROPERTY OF BHARAT HEAVY ELECTRICALS LIMITED. IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO THE INTEREST OF THE COMPANY

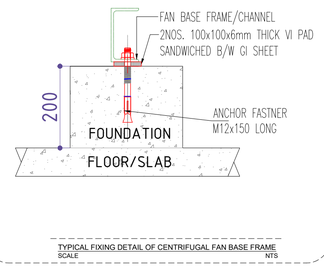
DRAWING NO : TB-405-553-DG-02



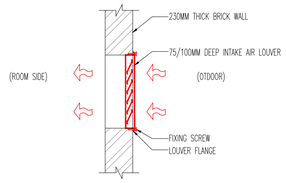
ELEVATION-A



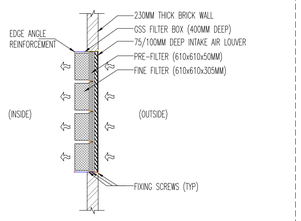
TYPICAL INSTALLATION DETAIL OF AXIAL FLOW FAN
SCALE NTS



TYPICAL FIXING DETAIL OF CENTRIFUGAL FAN BASE FRAME
SCALE NTS



TYPICAL INSTALLATION DETAIL OF WALL MOUNTED INTAKE AIR LOUVER
SCALE NTS

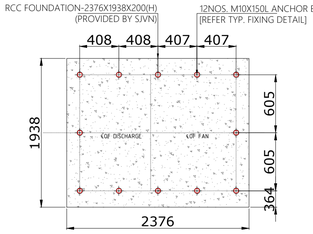


TYPICAL INSTALLATION DETAIL OF FILTER BOX WITH PRE & FINE FILTER
SCALE NTS

⚠ DUCT SIZING CONFIGURATION

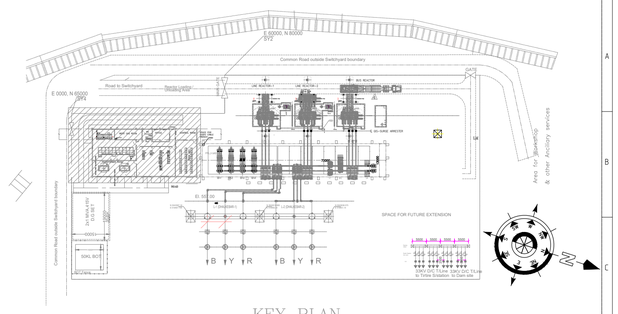
Duct ID	Air Flow (m3/hr)	Air Flow (L/sec)	Length (m)	Width (mm)	Height (mm)	Sheet Thicness (Gauge)	Ev. Dia (mm)	Velocity (m/Sec.)	Fricion Rate Pam/m	Head Loss Pam	Velocity Pressure Pa	Flo Area m2	Aspect Ratio	Renolds Numer	Tpe of Duct Piece
0	25,000	6,944	1.584	800	800	22	874.53	10.991	1.265	1.435	74.7461	0.6007	1.00	5,98,235	Fan Outlet Piece
1	50,000	13,889	3.534	1750	800	20	1268.10	10.996	0.837	0.832	67.6425	1.2630	0.46	8,25,211	Straight Duct
2	50,000	13,889	0.850	800	1750	20	1268.10	10.996	0.837	0.832	67.6425	1.2630	2.19	8,25,211	Straight Duct
3	50,000	13,889	6.604	800	1750	20	1268.10	10.996	0.837	0.832	67.6425	1.2630	2.19	8,25,211	Straight Duct
4	45,000	12,500	5.204	800	1600	20	1218.20	10.725	0.837	0.832	64.3399	1.1655	2.00	7,73,143	Straight Duct
5	40,000	11,111	5.204	800	1450	22	1164.70	10.429	0.837	0.833	60.8367	1.0654	1.81	7,18,784	Straight Duct
6	35,000	9,722	5.204	800	1300	22	1106.90	10.102	0.837	0.833	57.0919	0.9623	1.63	6,61,755	Straight Duct
7	30,000	8,333	5.204	800	1150	22	1043.80	9.738	0.837	0.833	53.0450	0.8557	1.44	6,01,507	Straight Duct
8	25,000	6,944	5.204	800	1000	22	973.80	9.323	0.837	0.833	48.6211	0.7448	1.25	5,37,259	Straight Duct
9	20,000	5,556	5.204	800	850	22	894.60	8.839	0.837	0.833	43.6979	0.6286	1.06	4,67,908	Straight Duct
10	15,000	4,167	5.204	800	700	22	802.00	8.249	0.837	0.833	38.0544	0.5052	0.88	3,91,452	Straight Duct
11	10,000	2,778	4.958	600	600	24	662.50	8.060	1.010	1.005	36.3301	0.3447	1.00	3,15,952	Straight Duct
12	5,000	1,389	4.958	600	600	24	658.20	4.082	0.280	0.280	9.3189	0.3403	1.00	1,58,980	Straight Duct
X	2,500	694	0.300	900	400	22	642.90	2.138	0.80	0.085	2.7466	0.3246	0.44	92,471	Grille Collar

DUCT SIZING CALCULATION
SCALE NTS



TYPICAL FOUNDATION DETAILS OF CENTRIFUGAL FAN
SCALE NTS ⚠

WALL OPENING SCHEDULE					
S.No.	Op. No.	Opening Size	Bottom of Op.	Qty.	Purpose
⚠ 1.	OP1	2600x1400(H)	(+)0.300m FFL.	2 Nos.	Intake Air Louver
2.	OP2	1850x900(H)	(+)3.450m FFL.	1 Nos.	Supply Air Duct
3.	OP3	450Ø	(+)10.00m FFL.	3 Nos.	Exhaust Air Fan



KEY PLAN

NOTES:

1. All dimensions are in mm and all levels are in meter.Do not scale. follow written dimensions only.
2. All civil and masonry works shall be provided by SJVN.
3. Direct Incoming Power Supply to each supply air Centrifugal Fan's LPBS shall be provided by BHEL.
4. Three Phase 415V AC 16A Receptacles near to each Ex. air Axial Fan's LPBS shall be provided by BHEL.
5. All supply air grille shall be provided with collar damper.
6. Duct support (S1/S2) arrangement may change to suit site condition in co-ordination with other services.
7. Duct shall be made of galvanized cold rolled steel sheets having galvanization coating of 275GSM as per IS:277.
8. The minimum thickness of GI sheets shall be as follows:
   a) Up to 750mm : 24G (0.60mm)
   b) 751 - 1500mm : 22G (0.80mm)
   c) 1501 - 2250mm : 20G (1.00mm)
   d) Above 2251mm : 18G (1.20mm)
9. Finished circular opening of required size for each axial flow fan shall be provided by SJVN.
10. All Supply of receptacles, earthing, cable tray etc shall be in scope of BHEL.
11. Necessary cabling from receptacles to each fan's 3-phase DOL local starter shall be supplied by the FLOWGAIN.
12. ⚠ Duct Support shall be painted with one coat of red oxide+one coat enamel paint.

Rev.	Rev. Date	Description	Altered by	Checked by	Approved by
3	23/01/2023	Third Submission for Approval	RS	RA	VKV
2	18/11/2022	Second Submission for Approval	RS	RA	VKV
1	01/11/2022	Second Submission for Approval	RS	RA	VKV
0	15/09/2022	First Submission for Approval	BS	RA	VKV

PROJECT:
ARUN-III HYDRO ELECTRIC PROJECT (NEPAL)
(4x225 MW)

CUSTOMER:
SJVN ARUN-3 POWER DEVELOPMENT COMPANY (P) LTD. (SAPDC LTD.)

CONSULTANT:
SJVN LIMITED
(A Joint Venture of Government of India & Government of Himachal Pradesh)

MAIN CONTRACTOR:
BHARAT HEAVY ELECTRICAL LIMITED
(Transmission Business Group, Noida)

SUB-CONTRACTOR:
FLOWGAIN® FLOWGAIN ENGINEERING PVT. LTD.
B-313, 2nd Floor, Okhla Phase-I
Industrial Area Okhla, New Delhi-110 020, India
Tele: +91-11-4181 2266

	Name	Sign	Date
Drawn	RS		18/11/2022
Checked	RV		18/11/2022
Approved	VKV		18/11/2022

Dept. : TBG
CODE
Scale 1:125
Paper A1
Card CODE
VENDOR'S DRAWING NO.: FLG-1146-HVAC-DWG-02

TITLE:
VENTILATION EQUIPMENT & DUCTING LAYOUT FOR GIS BUILDING

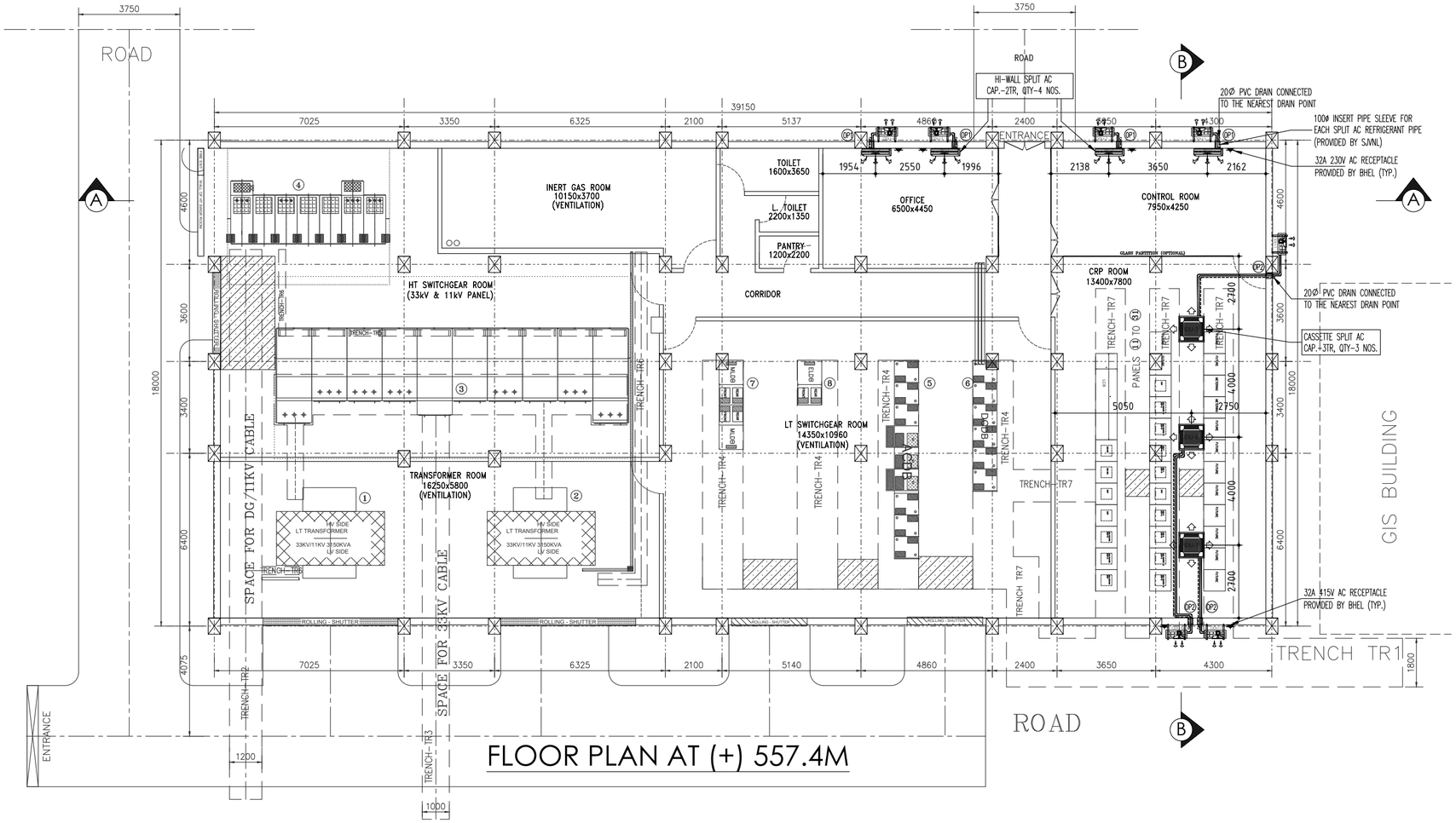
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REV 2
Sheet No.: 2 of 2
No. of Sheet: 2

SIZE-A2

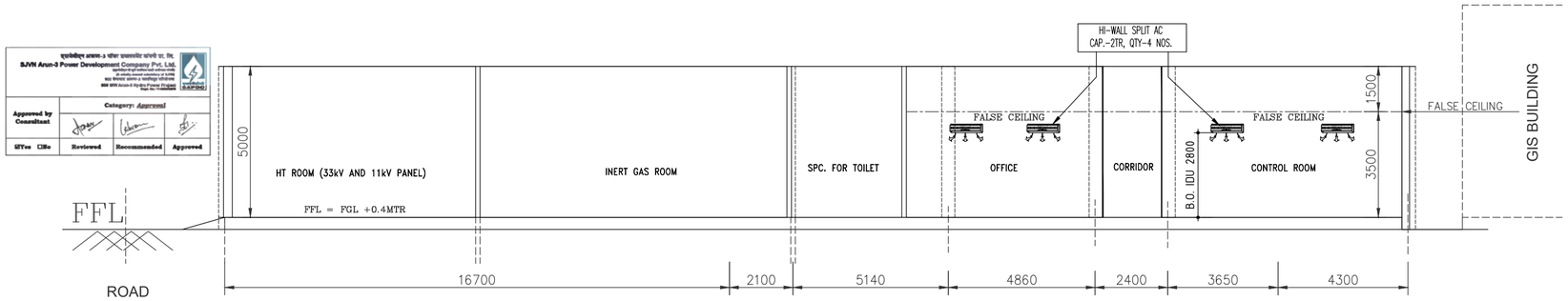
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FIRST ANGLE PROJECTION

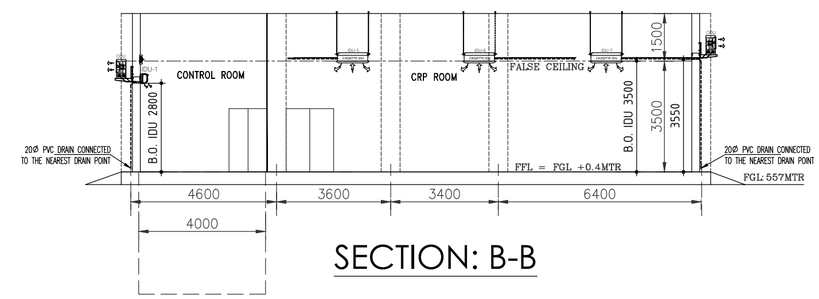
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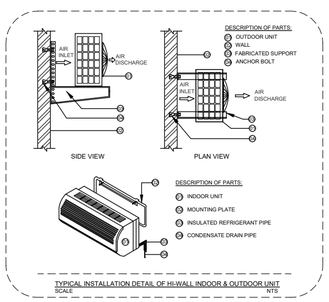
FLOOR PLAN AT (+) 557.4M



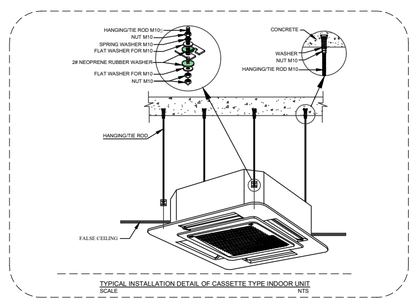
SECTION: A-A



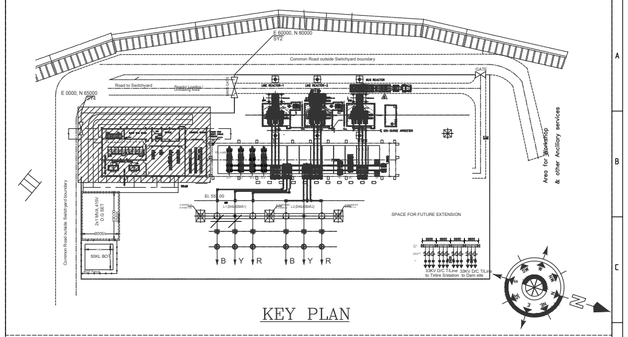
SECTION: B-B



TYPICAL INSTALLATION DETAIL OF HI-WALL INDOOR & OUTDOOR UNIT
SCALE NTS



TYPICAL INSTALLATION DETAIL OF CASSETTE TYPE INDOOR UNIT
SCALE NTS



KEY PLAN

NOTES:

1. All dimensions are in mm and all levels are in meter.Do not scale. follow written dimensions only.
2. All civil and masonry works shall be provided by SJVNL.
3. Single Phase 230V AC 32A Receptacles near to each Hi-Wall Split AC shall be provided by BHEL.
3. 3 Phase 415V AC 32A Receptacles near to each Cassette Type Split AC shall be provided by BHEL.
4. 100Ø Pipe Sleeve shall be provided for each AC pipe penetration by SJVNL.
5. Connection cable from AC to receptacles/switch including plug top shall be supplied by FLOWGAIN.
6. All interconnection cabling between the indoor unit and outdoor unit shall be supplied by FLOWGAIN.

LEGEND & BILL OF QUANTITY (BOQ)

S.No.	Legend	Item Description	Capacity/Rating	Quantity	Make/Manufacturer
1.		Hi-Wall Split Air Conditioner	2TR	4 Nos. (Working)	Voltas
2.		Cassette Type Split Air Conditioner	3TR	3 Nos. (Working)	Voltas

WALL OPENING SCHEDULE

S.No.	Op. No.	Opening Size	Bottom of Op.	Purpose
1.	OP1	100Ø	(+)2.85m FFL.	Split AC Pipe
2.	OP2	150Ø	(+)3.55m FFL.	Cassette AC Pipe

REFERENCE DOCUMENT/DRAWING NO.:

1. TB-3-405-316-021_R06 : Conceptual Layout of CRP Room in Switchgear Building of 400kV Switchyard of Arun-III HEP

3					
2					
1	28/10/2022	Second Submission for Approval	RS	RA	VKV
0	26/08/2022	First Submission for Approval	BS	RA	VKV
Rev.	Rev. Date	Description	Altered by	Checked by	Approved by

PROJECT:
ARUN-III HYDRO ELECTRIC PROJECT (NEPAL)
(4x225 MW)

CUSTOMER:
SJVN ARUN-3 POWER DEVELOPMENT COMPANY (P) LTD. (SAPDC LTD.)

CONSULTANT:
SJVN LIMITED
(A Joint Venture of Government of India & Government of Himachal Pradesh)

MAIN CONTRACTOR:
BHARAT HEAVY ELECTRICAL LIMITED
(Transmission Business Group, Noida)

SUB-CONTRACTOR:
FLOWGAIN ENGINEERING PVT. LTD.
B-313, 2nd Floor, Okhla Phase-I
Industrial Area Okhla, New Delhi-110 020, India
Tele: +91-11-4181 2266

	Name	Sign	Date
Drawn	RS		28/10/2022
Checked	RV		28/10/2022
Approved	VKV		28/10/2022

Dept. : TBG
CODE
Scale 1:135
Paper A2
Card CODE
VENDOR'S DRAWING NO.: FLG-1146-HVAC-DWG-01

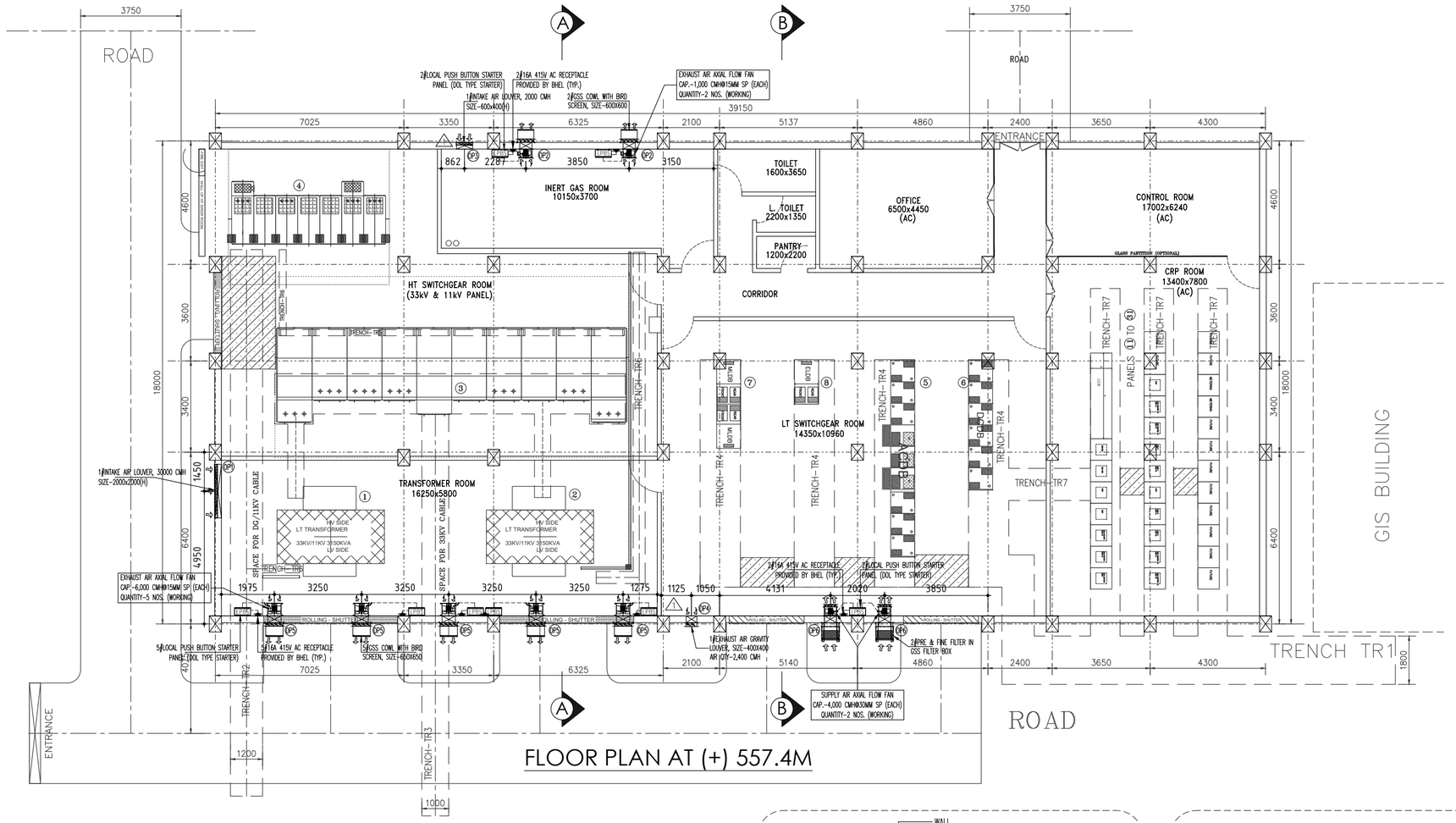
TITLE:
AC EQUIPMENT LAYOUT FOR GIS CONTROL BUILDING

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REV 1
Sheet No.: 1
No. of Sheet: 1

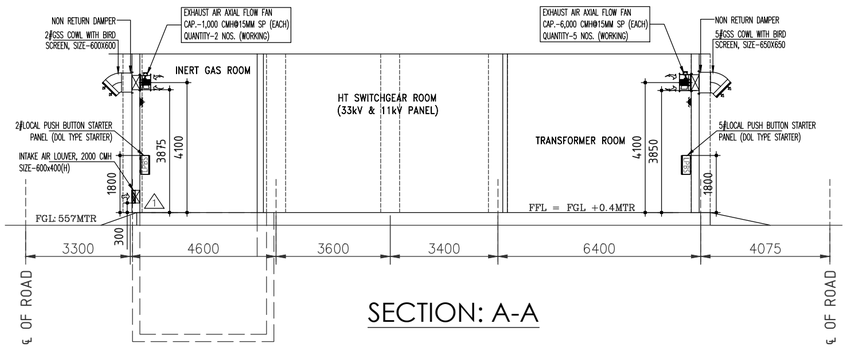
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FIRST ANGLE PROJECTION

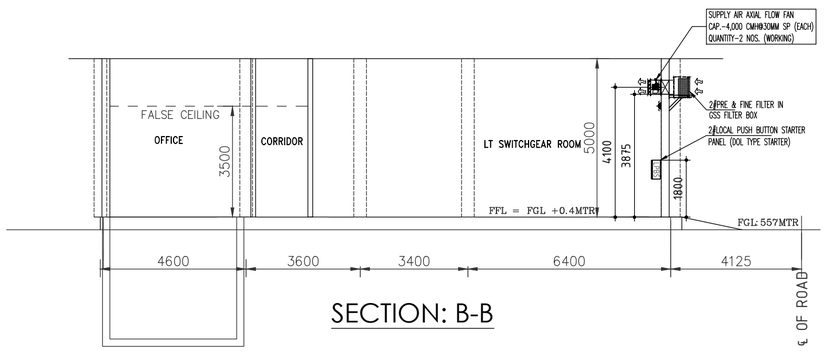
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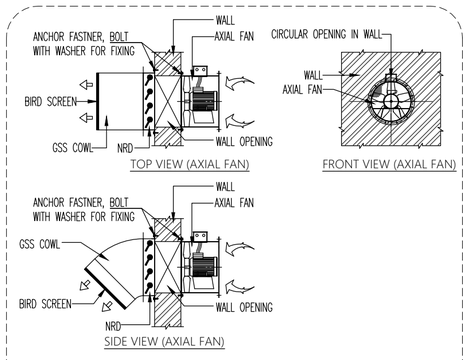
FLOOR PLAN AT (+) 557.4M



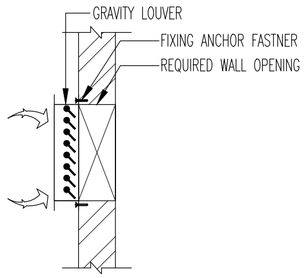
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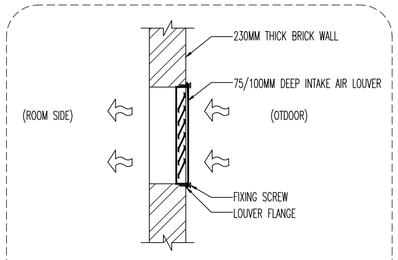
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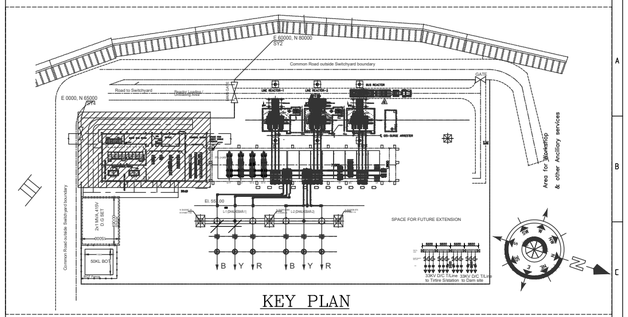
TYPICAL INSTALLATION DETAIL OF AXIAL FLOW FAN
SCALE NTS



TYPICAL INSTALLATION DETAIL OF WALL MOUNTED GRAVITY LOUVER
SCALE NTS



TYPICAL INSTALLATION DETAIL OF WALL MOUNTED INTAKE AIR LOUVER
SCALE NTS



KEY PLAN

NOTES:

1. All dimensions are in mm and all levels are in meter.Do not scale. follow written dimensions only.
2. All civil and masonry works shall be provided by SJVN.
3. Three Phase 415V AC 16A Receptacles near to each Ventilation Fan shall be provided by BHEL.
4. Duct shall be made of galvanized cold rolled steel sheets having galvanization coating of 275GSM as per IS:277.
5. The minimum thickness of GI sheets shall be as follows:
   a) Up to 750mm : 24G (0.60mm)
   b) 751 - 1500mm : 22G (0.80mm)
   c) 1501 - 2250mm : 20G (1.00mm)
   d) Above 2251mm : 18G (1.20mm)
6. Finished circular opening of required size for each axial flow fan shall be provided by SJVN.
7. All Supply of receptacles, earthing, cable tray etc shall be in scope of BHEL.
8. Necessary cabling from receptacles to each fan's 3-phase DOL local starter shall be supplied by the FLOWGAIN.

LEGEND & BILL OF QUANTITY (BOQ)

S.No.	Legend	Item Description	Capacity/Rating	Quantity	Make/Manufacturer
1.		Supply Air Axial Flow Fan	4,000 CMH, 30mm Static Pressure	2 No's. (Working)	Flaktwood
		Exhaust Air Axial Flow Fan	6,000 CMH, 15mm Static Pressure	5 No's. (Working)	Flaktwood
		Exhaust Air Axial Flow Fan	1,000 CMH, 15mm Static Pressure	2 No's. (Working)	Flaktwood
2.	LPBS	Local Push Button Starter (DOL)	-----	9 No's.	L&T/C&S/Havells/CGL
3.		Louver with Bird Screen	2000x2000(H)	1 No.	App. Vendor
			600x400(H)	1 No.	
4.		Gravity Louver	400x400(H)	1 No.	
5.		Non-Return Air Damper (For Supply/Exhaust Air Fan)	600x600(H)	2 No's.	
			650x650(H)	5 No's.	
			450Ø	2 No's.	
6.		Pre-Filter (90% down to 10 mic.)	610x610x50mm	2 No's.	
7.		Fine Filter (95% down to 5 mic.)	610x610x305mm	2 No's.	

WALL OPENING SCHEDULE

S.No.	Op. No.	Opening Size	Bottom of Op.	Purpose
1.	OP1	2025x2025(H)	(+)0.300m FFL.	Intake Air Louver
2.	OP2	450Ø	(+)3.875m FFL.	Exhaust Air Fan
3.	OP3	625x425(H)	(+)0.300m FFL.	Intake Air Louver
4.	OP4	400x400(H)	(+)3.850m FFL.	Ex. Air Gravity Louver
5.	OP5	500Ø	(+)3.850m FFL.	Exhaust Air Fan
6.	OP6	450Ø	(+)3.875m FFL.	Supply Air Fan

REFERENCE DOCUMENT/DRAWING NO.:

1. TB-3-405-316-021_R06 : CONCEPTUAL LAYOUT OF CRP ROOM IN SWITCHGEAR BUILDING OF 400kV SWITCHYARD OF ARUN-3 HEP

Rev.	Rev. Date	Description	Altered by	Checked by	Approved by
2					
1	28/10/2022	Second Submission for Approval	RS	RA	VKV
0	26/08/2022	First Submission for Approval	BS	RA	VKV

PROJECT:
ARUN-III HYDRO ELECTRIC PROJECT (NEPAL)
(4x225 MW)

CUSTOMER:
SJVN ARUN-3 POWER DEVELOPMENT COMPANY (P) LTD. (SAPDC LTD.)

CONSULTANT:
SJVN LIMITED
(A Joint Venture of Government of India & Government of Himachal Pradesh)

MAIN CONTRACTOR:
BHARAT HEAVY ELECTRICAL LIMITED
(Transmission Business Group, Noida)

SUB-CONTRACTOR:
FLOWGAIN ENGINEERING PVT. LTD.
B-313, 2nd Floor, Okhla Phase-I
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	Name	Sign	Date
Drawn	RS		28/10/2022
Checked	RV		28/10/2022
Approved	VKV		28/10/2022

SJVN Arun-3 Power Development Company Pvt. Ltd.

Approved by Consultant	Category: Approval		
GTwo Cliko	Reviewed	Recommended	Approved

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TITLE:
VENTILATION FAN LAYOUT FOR GIS CONTROL BUILDING

DRAWING NO.: TB-405-553-DG-04
REV 1

Sheet No.: 1
No. of Sheet: 1

SIZE-A2

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0	26/11/2022	RS	RA	VKV	First Submission for Review/App.	IFA
Rev No.	**Date**	**Altered**	**Checked**	**Approved**	**Revision Description**	**Status**

PROJECT	**4x225MW ARUN-3 (HEP), NEPAL**
OWNER	**SJVN ARUN-3 POWER DEVELOPMENT COMPANY (P) LTD. (SAPDC)**
CONSULTANT	**SJVN LIMITED**
PURCHASER	**BHARAT HEAVY ELECTRCIALS LIMITED (BHEL)** (Transmission Business Group) Plot No. C-20, 1A/1,10th Floor, Joy Tower, Sector-62, Noida, Uttar Pradesh (India)
SUB-CONTRACTOR	**FLOWGAIN ENGINEERING PVT. LTD.** B-313, 2nd Floor, Okhla Phase-I Industrial Area Okhla, New Delhi-110 020, India
PACKAGE	**AIR CONDITIONING & VENTILATION SYSTEM FOR SWITCHYARD AREA**
DOCUMENT TITLE	**ERECTION PROCEDURE FOR AIR CONDITIONING AND VENTILATION SYSTEM**

		BHEL's Document No	**Flowgain's Document No**	**Total Sht.**	**Sheet No.**	**Rev No.**
A4		TB-405-553-DC-05	FLG-1146-HVAC-DOC-05	27	1 of 27	0

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1.0 INTRODUCTION

The purpose of this method statement is to provide various procedures which explains and covers the installation of AC & Ventilation system like fans, air conditioner, supply air duct, supply grille, dampers, fire dampers etc for GIS Building of Project name as **"4x225MW Arun-3 (HEP), Nepal"**

2.0 PURPOSE

Purpose of this procedure is to define the sequence and methodology for all critical installation activity pertaining to HVAC air distribution system for Switchgear and GIS building with scope of work, applicable standards, and drawings.

This method statement identifies the general steps, arrangements and precautions which shall be followed in the Installation of the AC & Ventilation system. It includes movement of the material inside the site area, Duct erection, & AC & Ventilation Installation within prescribed time schedule.

3.0 DEFINITIONS

The following words and expressions shall have the meanings assigned hereby to them, except where the context requires otherwise.

- "Sub Station" means **4x225MW Arun-3 (HEP), Nepal**.
- "Customer/Owner/Employer" means **SAPDC.**
- "Consultant" means **SJVN Ltd.**
- "Purchaser/Main Contractor" means **BHEL**
- "Manufacturer/Sub-contractor/Supplier" means **Flowgain Engineering Pvt Ltd. (FEPL)** who is assigned to execute the works as defined by the scope of supply, described hereunder
- TS means "Technical Specification" refers to document Owner Technical Specification. All amendments to the Technical Specification shall form part of Technical Specification.
- "Standards" means the codes need to meet the system requirement.
- All correspondence shall be in English.
- Any deviation to this Technical Specification requires written consent from the Owner/Consultant/Contractor.

4.0 ABBREVIATIONS

ABBREVIATIONS & DESCRIPTIONS			
GIS	Gas Insulated Switchgear	DIDW	Double Inlet Double Width
S/S	Sub Station	ITP	Inspection and Testing Plan
SYD	Switchyard	MSDS	Material Safety Data Sheets
HVAC	Heating Ventilation and Air-conditioning	VCD	Volume Control Damper
AC	Air Conditioner	PPE	Personal Protective Equipment
GFC	Good for Construction	MSDS	Material Safety Data Sheet
FD	Fire Damper	HSE	Health Safety and Environment
AHU	Air Handling Unit	QA	Quality Assurance
VU	Ventilation Unit	QC	Quality Control

5.0 SCOPE OF WORK

Ventilation Scope: Ventilation Fan connected with ductworks, grills, dampers, fire damper, louvers, pressure release damper filter and other installation accessories.

Air Conditioning Scope: Hi-wall type split air conditioner units connected with copper refrigerant pipe, condensate drainpipe, inter-connecting cable and other installation accessories.

Electrical Scope: Ventilation Fan DOL starter, cabling etc.

Application / Installation procedures described below are based on the preliminary information available during the preparation of this document. In case of any change in any product, Scope of work or specification at a later stage, necessary updating to be carried out relevant sections of this method statement with reference to corresponding manufacturer instructions.

This Erection Procedure covers all the critical installation activities of systems within the scope of work.

6.0 TOOLS AND EQUIPMENT

Common tools required to carry out this project are: - ladders, drill machines, grinders and toolbox contain general tools like: Hammer, Duct sealant gun, Measuring Tape, Nylon Rope, Rivet gun, Spanner set, Screw Drivers, Spirit Level Indicators, Markers, Scissors, Grip Plier, and other tools not referred here may be indicated under appropriate section of this document.

7.0 MATERIAL HANDLING

All construction material specification together with the relevant certificates shall be submitted to client/consultant for approval prior to proceed with the material order.

Need to identify a safe and clean designated storage shelter if the material needs to be stored at site prior to installation on its final location. Material needs to be properly stacked on pallets and preserved as per the manufacturer instructions. Check, manufacturer protection is sufficient enough for the storage and transportation and if required, provide additional protection. Ensure the protection is not disturbed until the material opened for inspection / installation.

Any flammable material and chemicals shall be stored as instructed by Material Safety Data Sheets. Material safety data sheet (MSDS) shall be kept at easily accessible location of the storage spaces containing chemical solvents, powders etc. All the material shall be preserved based on the manufacturer recommendation. Material inspection shall be carried out by QC personnel.

Defective & nonconformity material will be stored separately in a designated area. These materials shall be immediately replaced or repaired/disposed by respective Department as per the instruction provided by Procurement division.

8.0 SITE PLANNING AND PREPARATION

8.1 ACCESS ROUTES & STORAGE SPACE

Site management shall decide temporary material storage area and control the safe accessible route to the storage area for entry / exit. Storage area shall be barricaded and labeled properly. Entry into this area shall be restricted to authorized persons only. Critical material handling activity shall be done in presence of Modular safety officer and the concerned supervisor.

8.2 WORKING AT HEIGHT

Site shall arrange necessary scaffolding as per the request. Scaffolding shall be inspected & tagged prior to release for use. Dismantling and modifications also shall be done by as per site requests.

Any work at more than 2-meter height shall be in accordance with Yard HSE procedure and at least below notes shall be educated / reminded to the personnel who all are working at height.

- All personnel shall be secured with safety harness wherever the possibilities of a fall exist
- Make sure safety harness rope is securely anchored; safety harness should be double hook type and tie to be two different locations.
- Always anchor safety harness rope to a fixed object never to moving load or to equipment that may move.
- Barricade the area
- Ensure that area below you, are clear of all unnecessary material
- Never use scaffolding and ladders which have not been inspected.
- Handrails for personnel shall be installed on all scaffolds guardrails and toe boards must be installed.
- Scaffolds must be fully planked, properly supported and properly tied off
- Rolling scaffolds shall not be removed with anyone on it. Remove or secure all tools and material before moving
- Wheels of rolling scaffolds must be locked
- Access ladders must be provided on scaffolds and securely lashed.

9.0 RESPONSIBILITIES

This project's fulltime key roles and responsibilities are indicated in below sections. There are many other important positions directly or indirectly involves in this project may not be appearing in the list below.

9.1 PROJECT MANAGER

Project manager responsibilities pertaining to projects are:

- Collaboration with Division Manager and stakeholders, effectively communicate project deliverables & objectives to team members and stakeholders in a timely and clear, Liaise with project stakeholders on an on-going basis.
- Arrange meetings internally and with client/consultant representatives
- Manage, update and distribute project scope of work and project documents as relevant.
- Liaise closely with functional department in-charges to ensure all aspects of the project are controlled and executed in a safe and timely manner.
- Identify and resolve issues and conflicts within the project team, Determine the frequency and content of status reports from the project team, analyse results and troubleshoot problem areas, proactively manage

changes in project scope, identify potential crises, devise contingency plans and approval of all project documents.

- Liaise with client/consultant for day-to-day business related to the execution of Modular scope of work
- Where required, negotiate with other department managers for the acquisition of required personnel from within the company, Delegate tasks and responsibilities to appropriate personnel.

9.2 PROJECT/SITE ENGINEER

Project/Site engineers are responsible for directing and managing all activities associated with the project from initiation to close out. He/She is directly reporting and discussing the project plans, issues, progress etc. with Project manager. His/Her responsibilities includes but not limited to,

- Review, monitor and control project progress and schedule with planning, monitoring and control team
- Hold regular progress status review meetings with Client and project personnel
- Promote QHSE at all activities of projects
- Review, monitor and control project costs and variation with the help of Commercial department
- Follow up and updating the construction schedule to the project manager.
- Follow up and update the status of material availability and status of material procurement.
- Manage all authority requirement and approval required at site.
- Manage supervisors/foreman by giving target and monitor the performance.
- Verify as built drawing provided by supervisor/foreman in site, send to engineering upon verification for the final documentation.

9.3 SUPERVISOR / FOREMAN

Supervisor shall be directly responsible for scheduling day-to-day activities on the site related to his trade. He ensures that the work is executed as per project specifications and project quality requirements.

- Follow up and updating the construction schedule and report to the project engineer.
- Supervisor is responsible for managing their work together with the other discipline teams and supporting project engineer to ensure that the project is delivered on time with the approved quality standards.
- Update the status of material availability to project engineer.
- Responsible for resolving any quality issues raised during QC site inspections and assists Quality Control department to ensure the timely closeout of the comments raised.
- To make sure the maintenance access on the installation as per site condition requirement.
- Prepare as built drawing as per installation and submit to project engineer for verification.

9.4 QUALITY CONTROL/QUALITY ASSURANCE ENGINEER

QA/QC personal shall be directly responsible for Ensures the proper implementation on Quality system and monitor overall quality of the work is maintained.

- Conduct inspection and monitor tests, Determine and report any non-conformance and recommend corrective actions.
- Ensure that all personnel are aware of the quality requirement. Ensures, necessary training for operatives provided as and when required.
- Ensuring the work is executed according to the Contract Specifications and project documents. Ensuring full compliance of the works with quality procedures.

- Provide necessary instructions to Supervisor of any specific requirements related to the work quality and all inspections and tests required to be conducted at every stage of work and prior to proceed on to next stage.

9.5 HSE ADVISOR / SAFETY OFFICER

Safety officers shall be responsible for HSE requirement and procedures implementation. Ensuring the usage of proper tools and equipment to maintain safety and periodically verifies certifications of equipment and their adherence to safety regulations.

- Reporting of any unsafe work or stopping work that does not comply with HSE procedures. Advise for Health & Safety requirements and monitor the Hazard controls implemented on site based on Risk assessment.
- Advice Health & Safety requirements and shall monitor the Hazard controls are implemented on site as per the Method Statement / Risk assessment.
- Ensure that LUX levels are monitored to ensure that sufficient lighting is being provided at work site. Ensure adequate ventilation in the work area. Ensure proper housekeeping at every shift change in the work area.
- Inform regarding the heavy lifts, radiography, pressure tests etc. to the workforce well in advance to provide a safe working atmosphere. Ensure that necessary precautionary measures are implemented at the planning stage of any night shift activities.

10.0 MATERIAL RECEIVING INSPECTIONS

10.1 PROCURED ITEMS INSPECTION

- Purchased products are verified through proper inspection methods. On case-to-case basis, inspection will be carried out based on supplier delivery note or FLOWGAIN order confirmation.
- Material receiving Inspection shall be done complying with requirements.
- Material inspection shall take place against purchase order, drawings, Data sheet, any other reference documents and specifications.
- Material that does not meet requirements for the characteristics inspected shall be rejected.
- Any non-compliance, non-conformity shall be intimated to the Supplier/ Manufacturer and appropriate Corrective and Preventive actions should be taken without any delay.
- No material is released for fabrication/installation or into storage facility until all the required inspections/tests are completed and the certificates/test reports applicable/required are reviewed and accepted by all parties

10.2 RECORDS

- Inspection report
- Non-conformance report

11.0 EXECUTION METHODOLOGY

11.1 HI-WALL SPLIT AIR CONDITIONER

11.1.1. STORAGE

On the receipt of the units and accessories at the site necessary precaution shall be taken for unloading shifting and storage are as follows:

- Ensure all civil works are completed for the area of installation i.e., plastering/waterproofing etc, and clearance is obtained from respective parties to proceed further.
- Check the coordination with other MEP services for piping and header location, ensure that there is no interference between each service and ensure reasonable access is available to do installation and maintenance works.
- The units will be carefully unpacked and transported to the site.
- All the materials & equipment i.e., units received at the site will be inspected before accepting and any discrepancies or damages should be notified and reported to the concerned authority for further action i.e. rejection or concession etc. Any materials found not complying with the specification should be immediately reported.
- A competent technician should be allowed to work on site and necessary training should be done before starting the work.
- Unloading and storage of units shall be done carefully by using necessary manpower/shifting or lifting machinery/equipment to ensure that no damage is caused to the equipment.

11.1.2. PREPARATION

- Submit MIR of the received indoor units for installation.
- Necessary approval to be obtained prior to the unit installation and all materials to be inspected and approved on arrival.
- Check if the area is released for HVAC works. Execution of MEP works follows on trades must be adhered to.
- Check and verify the actual condition for Indoor unit locations and check on the approved issued shop/design drawings.
- Coordinate with the other vendors if there are any concerned issues related to the work location.
- Check required approved shop /design drawings before commencing the activities. It shall be latest & stamped with issued for construction.
- Site Engineer will instruct tradesmen regarding the execution of the works and will distribute all necessary approved construction drawings of the latest revision.
- Prepare all materials, equipment, and tools required for the work and check the entire materials conformance with method statement and approved material specifications.
- Before starting any installation activity, the area of installation shall be inspected by the Safety Engineer and he will make sure that the work environment is suitable for installations.

11.1.3. INSTALLATION

- Ensure that installation is carried out in accordance with OEM standard guidelines.
- Before installing the unit check whether proper space is available for unit servicing, installing, removing air-filter & accessing control boards or not.

- Proper marking shall be done for unit location & support as per approved shop drawing, ensure the unit model & location shall be same as indicated in the approved shop drawing.
- Mark & drill the holes as per the dimension. Insert the threaded rods using anchor bolts.
- The indoor units shall be suspended from the ceiling on the threaded rods/gripple.
- Fit & tightened the nuts at the loose end of each threaded rods/gripple.
- Level the indoor unit. Clearance around the indoor units shall be checked as per the manual.
- IR to be raised thereof for further installation approvals.
- Unit shall be cleaned & checked for any damage before offering final inspection.

11.1.4. POST INSTALLATION

- Make sure that visual inspection of Indoor unit installation has been completed and approved by the client.
- After completion of the installation of indoor units, refrigerant piping, power & control wiring connections shall be installed/fixed properly as per the requirement of the equipment.
- Ductwork shall be connected to Indoor units with flexible duct connectors as per approved material.
- Indoor unit supply side shall be covered with plastic until ready for connection.
- Every worker must ensure proper housekeeping before leaving the area of work; keep/return all tools in proper place and secure the installation and materials from deterioration or damage.
- All the installation should be checked as per the checklist and to be recorded. Points to be checked and recorded are as follows:
  - ✓ Check the amperes of the outdoor unit.
  - ✓ Check the amperes of the indoor unit.
  - ✓ Check for remote operations.
  - ✓ Check that 230V or 415V +/- 10% incoming 3 phase or 1 Phase, power is available to AC system from electrical Panel to ODU and 3 core 1 phase 230 +/- 10% for IDU. Frequency between 49.5 & 50.5 Hz
  - ✓ Check the entire copper piping route is insulated fully.
  - ✓ Check drain slope and that there is no leakage.
  - ✓ Check the potential difference between earth / neutral and phases.
  - ✓ Check that the indoor and outdoor alignment is ok and installation plate is properly tight with necessary screws

11.1.5. INSPECTION & TESTING

The scopes and objectives of these QA/QC guidelines are as follows:

- Describe the quality program and organization to be implemented so that the project is constructed in accordance with the contract requirements, industry standards, and best practices and in compliance with the requirements.
- Describe guidelines for inspection and documentation of construction activities.
- Provide reasonable assurance that the completed work will meet or exceed the requirements of the construction drawings and specifications.
- Describe how any unexpected changes or conditions that could affect the construction quality will be detected, documented, and addressed during construction.
- This document does not intend to replace project specific requirements and specifications but rather to be read in conjunction with them.

11.2 FRESH AIR AND EXHAUST FANS

11.3.1. PRE-INSTALLATION CHECKS

Before any material to be installed, ensure that these have been inspected at site and have been approved as required by the approved Inspection & Test Plan.

- Inspect all materials and verify that they are undamaged
- Ensure that, all materials specifications are Approved by Client
- Ensure that, all installations procedures are in accordance with the Manufacturer Instructions and or in accordance with the project specifications.
- Ensure all certificates are available as required and in accordance with the regulatory requirements and specifications.
- Choose a dry storage site that is reasonably level and sturdy to prevent undue stress and damage.
- Cover entire unit with tarpaulin or heavy-duty plastic coverall. Secure cover with adequate tie Downs
- Inspect the area where works to be carried to ensure that the area is in a condition to commence the installation.
- Follow approved drawings, project specifications and Manufacturer Instructions for the installation.

11.3.2. INSTALLATION

- Only a qualified technician should be allowed to carry out installation.
- Where necessary, prepare detailed layout for unit installation and obtain customers approval.
- Clean the area where the unit is to be installed.
- Inspect the foundations/support for its correctness against approved drawings
- Install unit on the foundation/support as per GFC drawing. Provide vibration pad underneath the unit to suit the operating weight as per manufacturer recommendation.
- Provide adequate clearance for unit service access.
- Install all necessary wiring and necessary components in accordance with the manufacturer instructions and job requirements.
- Connect associated ducting with the unit. Provide flexible connector between the unit and the ducts if required.
- Tags with description to be provided for unit, cables, ducts etc.

11.3.3. INSPECTION AND TESTING

- Ensure that all the installations are as per the approved shop drawings.
- Ensure that the installed fan unit is free from damages.
- Ensure that the connections to the fan as per the approved shop drawings.
- Ensure that the installed accessories are free from damages.
- Ensure that all the accessories are installed as per the approved drawing and as per manufactures instructions.
- Ensure the maintenance accessibility.
- Ensure all other functional tests according to the Mechanical completion inspection test and start-up / commissioning procedure.
- Each fan shall be mechanically run tested at designed speed for a minimum period of 60 minutes. The measured parameter shall be recorded. Air performance data shall be documented.

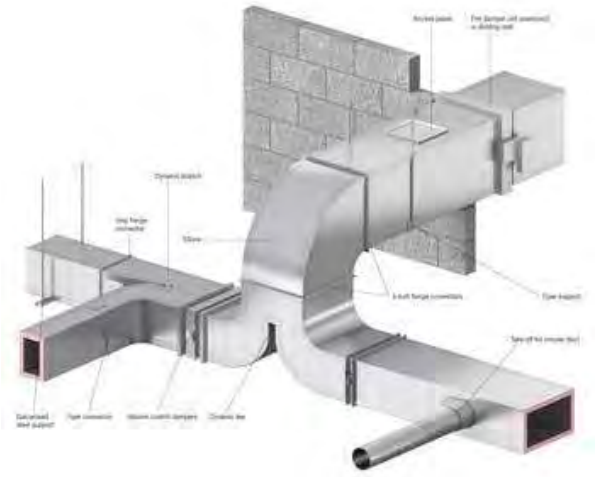
- As a minimum, following measurements shall be recorded for each fan:
- Flow rate, static pressure, and fan speed. Electrical load for all fans shall be recorded at full fan load.

11.3 DUCTING

11.5.1. SUPPORT INSTALLATION

- Support shall be fabricated and installed with proper guidance and manufactures recommendation.
- All the accessories and fitting shall be used as per the SMACNA/IS-655 standard and project requirement.
- Duct support shall be installed as per the details in approved ducting layout and manufacture recommendation.
- All material shall be inspected and verified prior to install.
- Material shall be free from physical damage, impurities, and proper cleaning to be done.
- Mark the location of support as per the approved drawing.
- Install the fabricated support as per the approved layout.
- Distance between hangers shall be as per approved drawing based on SMACNA/IS-655 standard.





11.5.2. DUCT INSTALLATION

- Ensure horizontal ductwork is adequately supported at equal distances in accordance with construction drawings with all brackets fixed to the vertical face of ribbed beams of the structure.
- Care will be taken during setting out, that ductwork runs between ceiling module lines so as to maintain maximum flexibility for any future relocation of lighting fixtures or other services.
- Ductwork supports unless otherwise indicated will be installed to provide a minimum space of 15mm between finished covering and adjacent work, and 100mm clearance from suspended ceiling.
- Supports or hangers will be placed within 300mm of any 45° – 90° bend.
- Screwed drop rods will have thread adjustment in either direction available after levelling of ductwork, and associated plenum boxes.
- As indicated on relevant approved construction drawings where more than one duct can be supported on one hanger – the size of the hanger will be assessed on the sum of the maximum widths.
- Ductwork passing through non fire rated walls and floors will be adequately supported on either side. Supervisor to ensure that there are no dents, distortion or buckling of ducting during installation being aware that damaged sheet metal work will be rejected.

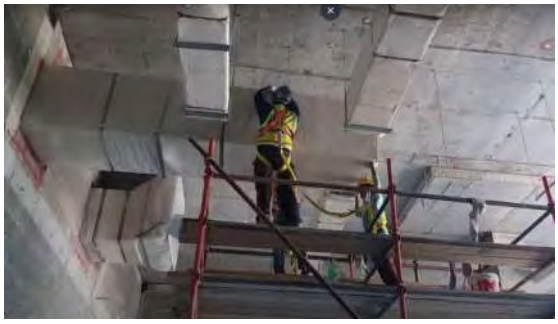
 **Height Risk**	✓ Barricade the work area to restrict unauthorized entry of persons ✓ Follow the Scaffolding Safe Work Method Statement. (SE/GP/T/SO/SMWS/07). ✓ Ensure no person stands below the suspended material while lifting it ✓ No person shall climb on the railings of man lifter /scaffolding while lifting and/or installing fixtures. ✓ Use mandatory PPEs, Helmet, safety Harness, Safety shoes and hand gloves. ✓ Loose material/tools shall not be stored on the working platform. Tool-restrainer shall be used for tools and loose material to be kept in specified bags. ✓ Three point of contact is to be maintained while climbing the ladder ✓ The ladder to be inspected as per the Inspection checklist before use. Ladder to be secured from top & bottom with the help of clamp. Ladder must only be used for access. Ensure Continuous supervision to prevent working while standing on the ladder. ✓ A-type ladder is not allowed at the site. ✓ Usage of mobile scaffolding for height work to be ensured.





- All locknuts should be tightened correctly, and all open ends should be cleaned from debris and then covered with suitable material to prevent any ingress of debris, vermin, or moisture.
- Supports are to be fixed at correct levels checking the bracket material is compatible with the installation and the correct method used for thermal insulation.
- Ducting to be installed allows sufficient space for expansion/contraction and thermal insulation.
- Fixing flanges to ductwork will be by the approved details and in compliance with the specification requirements. Continuously check horizontal and vertical alignment of ductwork and compliance with contractor's drawings and specification requirements by using spirit level plumb or another suitable instrument. Clean both flange faces to be joined. Add gasket jointing material to flanges to be mated. Using only undamaged rust-free bolts nuts and washers join mating flanges together and tighten bolts. Clean any excess jointing material from flanges.
- In line equipment is to be independently supported from main structure and not block work walls or sub-structure.
- All receiving inspection shall be completed as per approved drawing and specification.
- All ductwork, fittings and equipment shall be cleaned before erection and ensured for cleanliness.
- All manufacturer protective covers on equipment shall be left in place as long as possible during erection.
- All open ends of HVAC Ductwork shall be covered with dust blind to avoid construction debris deposit.
- All ductwork thickness, dimensions and reinforcement shall be verified as per standard, Scope of work and approved drawing.
- Provide acoustic insulation to prevent noise transmission and improve comfort wherever required.
- Install the fabricated ducts on the support as per the approved layout.

	✓ Ensure usage of proper hand gloves and eye protection gears. ✓ Ensure use of full body harness when doing height activity. ✓ The cutting wheel shall be inspected for valid expiry date and branded Make as per RFQ requirement. RPM rating of the wheel to be above the max RPM of the machine. ✓ The job to be secured while being cut on the cutting machine, with correct cutting technique. ✓ The blade and other rotating parts shall be guarded with an adjustable guard. ✓ It must be ensured that the operator does not engage in multiple jobs at the same time. ✓ PPE's as per the work to be worn such as goggles, hand gloves. ✓ Cutting area to be levelled and compacted. ✓ All portable machines shall be inspected using the approved inspection checklist established at regular intervals. All portable machines shall be tagged "safe" or "unsafe" for usage and unsafe machines shall be stored separately in a labelled area or shall be removed



- Duct shall be connected to equipment by using flexible connection.
- Joint the duct by proper method (Ex: G clamp, cleat and nut bolt) and proper gaskets.
- Duct seams shall be sealed with proper sealant.
- All joints and seams in ductwork and casing are to be thoroughly sealed to prevent air leakage.
- Flexible duct shall not be assembled to obtain longer runs.
- Install all inline accessories including all dampers (Fire Dampers, Volume Control Dampers, Pressure relief dampers etc.) heaters, sound attenuator as per the approved shop drawings and manufacturer's instructions.
- Ensure that the ductwork and damper flange are carefully matched, with the specified sealing material used during installation.
- Check damper for damage caused by mishandling or poor transportation. Visually inspect the integrity of the dampers: blades, frames, corner brackets, interconnecting blade linkages, bearings and pivots, operational drives or quadrants and blade seals.
- Check the blade operation by opening and closing the blade(s) via the manually operated quadrant drive spindle/shaft. Clamps, pliers, or other mechanical attachments may be required.
- Heating elements shall be installed on removable terminal plate to permit easy withdrawal for inspection, cleaning and replacing. An isolator and hazard warning sign, which clearly indicates the operating voltage, shall be fitted immediately adjacent to the heater access opening.
- The heating coil shall be clearly marked with an arrow to indicate direction of airflow and another arrow to indicate mounting position.
- Ensure that all devices are installed with airflows and pressures conforming to the test data as detailed in the design documents.
- All installations must be carried out in accordance with the relevant specifications and GFC drawing requirements.

- Supports shall be according to the detail drawings and specification. Apply approved gasket to mating flanges and position damper. Bolt damper using Manufacturer instructed sizes of fasteners.
- The damper must be installed square and true. Any distortion of the casing may cause jamming during operation.
- Wherever the damper and heater are installed above a ceiling or any location, an inspection/access hatch shall be provided for the accessibility for tests, service and/or maintenance.
- On wall and floor crossing, damper shall be installed by using sleeve.
- Fire dampers, volume control dampers & other plant items will be installed as per shop drawings and will be supported adequately.
- Supervisor to check before the end of work every day that: The correct type of supports are installed, supports are adequately supporting the ductwork and associated plant equipment.
- Ensure terminal equipment is installed as specified.

11.4 AIR DISTRIBUTION PRODUCT

11.6.1. STORAGE

On the receipt of the ADPs at the site necessary precaution shall be taken for unloading shifting and storage are as follows:

- Ensure all civil works are completed for the area of installation i.e., false ceiling, grid etc, and clearance is obtained from respective parties to proceed further.
- Check the coordination with other MEP services for piping and header location, ensure that there is no interference between each service and ensure reasonable access is available to do installation and maintenance works.
- The material will be carefully unpacked and transported to the site.
- All the materials & equipment i.e., units received at the site will be inspected before accepting and any discrepancies or damage should be notified and reported to the concerned authority for further action i.e., rejection or concession etc. Any materials found not complying with the specification should be immediately reported.
- A competent technician should be allowed to work on site and necessary training should be done before starting the work.
- Unloading and storage of material shall be done carefully by using necessary manpower/shifting or lifting machinery/equipment to ensure that no damage is caused to the equipment.

11.6.2. PREPARATION

- All materials, drawings, and other documentation relevant to a particular section of works will be checked by the Construction Department prior to the commence of work ensuring that these are of the correct type as reviewed by the Client.
- Before commencing any construction works, pre-inspections will be carried out on all materials prior to them leaving the storage area.
- Prior to the commencement of any construction works, areas and access will be inspected by the Construction Team to ensure that they are in a suitable condition for construction works to commence. The Client will be invited to attend this inspection at his discretion.

- Close coordination with other trades will be carried out on site prior to commencing work.
- Check required approved shop /design drawings before commencing the activities. It shall be the latest & stamped with issued for construction.
- Prepare all materials, equipment, and tools required for the work and check the entire materials conformance with method statement and approved material specifications.

11.6.3. INSTALLATION

a) DAMPER

- Before installation checks any physical damages on the dampers.
- Determine the position of the damper to be fixed on the duct from the construction drawing and check site conditions.
- Fix the damper in available space by flange or nut/bolt and apply duct sealant.
- Examine the location for the requirement of installation tolerances and clearances as specified in the drawings.
- Manually move the damper to the desired position in a way that damper channel frame matches the duct flange.

b) MOTORIZED FIRE DAMPERS

- Before installation check any physical damages on the dampers
- Determine the position of the Damper to be fixed on the duct from the construction drawings.
- Fix the damper with flange or nut /bolt and apply duct sealant.
- Examine the location for the requirement of installation tolerances and clearances as specified in the drawings.
- Provide duct access doors for internal access to all dampers.
- All fire dampers Installed will be as per applicable local and international standards.
- Actuator to operate before installation to check the working and opening of the damper.
- Opening and closing of damper time to be noted down.

c) GRILLS AND DIFFUSER

- Before installation check for any physical damages on the grills.
- Determine the position of the grills to be fixed on the duct from the construction drawing and check site conditions.
- Fix the grill in available space by flange or nut/bolt and apply duct sealant.
- Examine the location for the requirement of installation tolerances and clearances as specified in the drawings.
- Manually move the collar damper to the desired position in a way that required air flow is achieved.

11.6.4. POST INSTALLATION

- Supervisor to ensure that all completed installations look neat and tidy and that there is adequate spacing between ductwork and in line equipment allowing access for operation and ease of maintenance, to approved drawings and manufacturer's recommendations.

- The supervisor in charge shall continuously monitor the activities to ensure that all components indicated on the approved shop drawings have been installed and that the installation is in accordance with the contract requirements and specifications.
- Airflow at every grill is to be recorded and noted properly.
- MFD opening and closing time to be checked and recorded.
- VFD to be operated manually to check the proper working of it.

11.6.5. INSPECTION

The scopes and objectives of these QA/QC guidelines are as follows:

- Describe the quality program and organization to be implemented so that the project is constructed in accordance with the contract requirements, industry standards, and best practices and in compliance with the requirements.
- Describe guidelines for inspection and documentation of construction activities.
- Provide reasonable assurance that the completed work will meet or exceed the requirements of the construction drawings and specifications.
- Describe how any unexpected changes or conditions that could affect the construction quality will be detected, documented, and addressed during construction.
- This document does not intend to replace project specific requirements and specifications but rather to be read in conjunction with them.

11.5 ELECTRICAL CONTROL PANEL & CABLE

11.9.1. STORAGE

- Control Panel and Accessories shall be unloaded with care to avoid any damage. If they are shipped in packs or pallets, each pack of pallet shall be lifted individually with suitable lifting equipment.
- Every precaution shall be taken to preserve their cleanliness before installation. Store in accordance with manufacturer's instructions, properly protected from construction activities and weather conditions.
- Housekeeping pads or pertinent structure are complete and levelled by the civil contractor, for all plinth sizes. Site supervisor to carry out pre-Installation Inspection of switch-gear panels' plinth prior to offloading and positioning in accordance with.

11.9.2. PREPARATION

- Prior to the commencement of any works, access and installation areas will be inspected to confirm they are in a suitable condition to commence installation.
- The construction department will ensure temporary protection shall provide to protect the openings during installation and until the final connections are made to the control panel.
- We will check the equipment schedule for correct location and reference for the switchgear and panels.
- If the switchgear or panels cannot be installed immediately, then the same shall be stored in a clean, dry and properly ventilated location.
- When the switchgear or panels are shipped in more than one module, it will be necessary to bolt in an individual section together, in the presence of manufacturer/supplier representative.
- Construction drawings will indicate the relative positions of each section being supplied and shipped.
- All connections will be torque to the required figure as per data from the manufacturer.

11.9.3. INSTALLATION

a) PANEL

- Fully crated switchgear or panels shipped on a timber sub-base will only be listed under the subbase, in between the bearers, using soft sling's (Nylon webbing) with spreader bars on the topside of the crate.
- When transferring to a forklift, or unloading with a forklift, the mast shall be as close as possible to the face of the crate. Forks shall be fully protected under the crate.
- Lift switchgear or panels squarely, and then tilt back towards the forklift before moving.
- When the switchgear or panels will be moving to its destination, it will be un-crated, unpacked and removed from its timber base.
- Lower switchgear or panels onto lengths of steel conduit or skate (rolling devices), for movement to the final location.
- Care will be taken to ensure the switchgear, or a panel does not overbalance whilst being moved to its final location.
- Once in its final location on the "Housekeeping Pad", rolling devices will be removed from under the switchgear or panels. Again, caution will be exercised against overbalancing, while the panels are being moved.
- Finally, the panels should be free-standing, self-supporting assembly, and will be bolted to the "Housekeeping Pad" with anchor bolts ensuring the assembly is horizontal and vertically in alignment as detailed on the construction shop drawings.
- To make sure that the entire installation is in conformance and in accordance with the design intent of the project for the Electrical and Low Voltage System in addition to the specification and as per approved shop drawings and comply with local and International Standards.
- All the switchboards shall be fabricated at the manufacturer's works.
- Before beginning installation in any area, examine all parts of the adjoining works into which applicable work is to be placed. Should any condition be found, which will prevent the proper execution of the work, the installation shall not proceed in that area until such conditions are corrected by the contractor.
- Fix all equipment independently of the wiring system. Use cadmium of zinc electroplated bolts, nuts, washers, and screw.
- Mount surface mounted control panel at 1800mm from finish floor level to the top of equipment, unless shown otherwise on drawing/schedules.
- Ensures that clearance in front of switchgear is not less than 0.8m, or as indicated.
- Number terminals, cables, and component parts to correspond with manufacturer have certified drawings.
- Terminate PVC, SWA PVC and MICS cables inside the enclosure by securing cables to switchboards with gland bracket, an enclosure with grinding plates or fabricated steel extension boxes.
- For flush installation, DB's all conductors shall terminate behind the board in an adaptable box.
- For surface mounting, trunking shall be fixed between the board and ceiling or floor level, or conduit run directly into trunking which prevents correct installation of the trunking lid. Adequate earth continuity shall be made between the various components.

b) CABLES

- The switchgear or control panels shall be provided with terminals for both power and control cables. The terminal will be positioned in such manner as to facilitate optimum access to suit the specified type of entry. As detailed in the construction/shop drawing.
- Operate all components (i.e., fuse switches, circuit breakers, contactors, relays etc) by hand to ensure that there is no damage to the moving parts.
- A thorough inspection will be carried out to determine that no foreign matter (tools etc) has been left in the panels after field installation is completed.
- Particular attention will be given to the Bus bar compartment, ensuring it is free of debris and moisture. All compartments shall be thoroughly cleaned.
- All busbar and circuit connections shall be checked carefully to find these are tightened and torque from the factory, as it is possible for connections to vibrate loose during shipments.
- All connections are checked for tightness/torque prior to energization in accordance with the manufacturer's recommendation.
- All components/door interlocks should be adjusted correctly and must operate freely.
- After the above operations, all doors are closed and locked, and keys should be maintained by the supervisor until the panel is ready to handover to the commissioning team.

11.9.4. POST-INSTALLATION

- Install the connector into the panel and install a locknut to hold it in place. If you're using metal pipe, place a plastic bushing over the connector threads.
- Using fish tape, pull the electrical feeder wires through the feeder pipe. Leave enough wire to get to the opposite side of the panel. That way, there will be plenty of wire to make the connection anywhere in the electric panel.
- Bend the two black wires to shape them for easy installation to the main breaker. In this photo, the main breaker is located at the top right of the panel. Strip the wire only enough to make the connection to the main breaker terminal lugs.
- Connect the neutral wire to the neutral bus. The neutral bus is located on either side of the breakers. It is a silver-colored bar with many smaller screws and connection points. It also has a larger hole for the feeder neutral wire. The neutral wire is the wire marked with white phasing tape.
- To install branch circuit wires, use fish tape to pull in the wires. If you are installing NM wiring, install NM connectors to the electrical panel and secure the wires with the two screws on the straps. Strip the outer sheathing to expose the conductors.
- Connect all the green and bare copper wires to the ground bus bar. Connect the white neutral wires to the neutral bus. If you bend the wires ahead of time, you'll have a nice, neat wire installation that looks uniform.
- Next, install the circuit feeds to the branch circuit breakers. The black and red wires are the feeder wires in this photo with the black wires being one of the hot feeds and the red wires being the other. Connect the appropriately sized wire to the correctly rated breaker. Bend the wires so that they keep a neat appearance when the installation is complete.
- Check that isolation of supply will not initiate an alarm and that isolation does not interfere with safety circuits or cause "danger" to others.

- Place a rubber mat on the floor in front of the equipment to be worked on and ensure that adequate lighting is available. Also, ensure that you have a clear area to work in (a minimum of 1m is required).
- Place warning notices and barriers, Shield or isolate (by removing fuses) any exposed power conductors.
- Proof-test your test instrument on a known live source immediately before and after testing.
- Test for dead any exposed power conductors or terminals
- When work is complete, ensure that any shields or protection guards removed are replaced. Close and lock panel doors. After work is complete check all items isolated are operating.
- Remove warning notices and barriers.
- Ensure the work area is clear of any obsolete equipment, fuses, etc. Complete permit to work if required. Report back to the responsible person.
- Megger tests on the medium voltage bus shall be applied to each phase separately and ground with other phases tied to ground.
- All breakers shall be racked out. Each breaker shall be given a megger test in the racked-out and closed position. Megger tests shall be applied to each phase to ground and to each other phase.
- A suitable motor driven, or electronic megger shall be used. Each test shall be held until a constant reading is obtained.
- All test readings shall be recorded.
- All circuit breakers shall be operated through at least three (3) open-close-open cycles in both the rack-in and test positions by manual operation and by control circuits from each control point.
- All indication lights, annunciators, alarms, and targets shall be observed to determine correct operation and breaker mechanism shall be observed for correct alignment, freedom of binding and good contact.
- All breakers shall be checked for ease of rack-in and rack-out and checked to determine that the breaker cannot be moved out of operation position while the breaker is closed.
- The interchangeability of the circuit breakers shall be demonstrated. PT and CT data shall be recorded, and PT and CT circuits shall be checked with a multitester.
- Protective relays shall be adjusted and calibrated with an injection type test arrangement (multiamp or equal). Results shall be recorded, and the coordination of the protective relaying shall be proved. After initial energization, switchgear shall be checked for correct phase sequence.

11.9.5. INSPECTION

The scopes and objectives of these QA/QC guidelines are as follows:

- Describe the quality program and organization to be implemented so that the project is constructed in accordance with the contract requirements, industry standards, and best practices and in compliance with the requirements.
- Describe guidelines for inspection and documentation of construction activities.
- Provide reasonable assurance that the completed work will meet or exceed the requirements of the construction drawings and specifications.
- Describe how any unexpected changes or conditions that could affect the construction quality will be detected, documented, and addressed during construction.
- This document does not intend to replace project specific requirements and specifications but rather to be read in conjunction with them.

12.0 ENVIRONMENTAL, SAFETY AND HEALTH

12.1 RISK ASSESSMENT

Risks, at each stage are evaluated, utilizing the matrices defined separately as to determine the level of significance in terms of likelihood of occurrence and severity of hazard based on the allocated numerical values.

12.2 GENERAL PRECAUTIONS

- A Competent Site Supervisor shall be deputed during the erection.
- Toolbox talk shall be conducted on daily basis for manual understanding of the workers involved in the work.
- Identified hazards and control measures shall be explained to the team/work men through toolbox talks every day in the morning before the start of the activity till the completion of job.
- Risk assessment shall be done well in advance by site engineer/supervisor and the same shall be reviewed & approved by Safety officer, Site in charge / Client.
- Work permit to be obtained before starting any activity.
- Unauthorized person shall not be allowed to enter the work area during the work.
- Crane is to be checked before starting erection activity. All lifting tools & crane certificates are to be checked prior starting the job.
- The Crane should be positioned on a compact ground.
- Crane should be earthed properly to avoid induction.
- Crane shall be guided by a signalman.
- All lifting tools & tackles shall be inspected visually for safe use.
- Supervisor shall ensure no workmen is standing or working in the vicinity of the Frrana shifting the material.
- Appropriate PPE's such as full body harness, helmet, cotton gloves, and safety shoes shall be used.
- Conduct regular or daily check of the equipment.
- Work area to barricade.
- Conduct regular medical fitness of all workers.
- Only trained and competent persons shall be deployed for working at height.
- Working area to be barricaded with warning tape around to avoid the entry of unauthorized persons.
- The area around the FSC platform to be barricaded. No worker shall be allowed beneath the structure.

12.3 MONSOON PREPARATION

- Gum Boots shall be used for while working on wet ground.

12.4 LIST OF TYPICAL TASK INVOLVES RISK

- Hot works
- Bolt Tensioning and Torqueing
- House Keeping (General)
- Pressure test using air.
- Equipment Installations
- Leak Testing
- Manual Handling
- Material handling using forklifts

- Pneumatic Testing
- Portable Electric Hand Tools
- Working at Heights, scaffoldings, ladders
- Working in Fabrication Areas (General)

12.5 SPECIFIC EMERGENCY PROCEDURES

A Certified First Aider shall be on site at all times whilst a First Aid Clinic shall be available for treatment of light injuries.

In the event of an emergency, all workers shall assemble at an area which shall be allocated by a post sign and wait for further instructions. This point shall be marked with a sign as "MUSTER POINT". The Project/site Engineer and the HSE officers can assist employees and point them to the assembly point.

Employees shall be made familiar with the locations of "Muster Stations" through Safety Induction and regular Toll Box Meetings.

12.6 TOOL BOX TALK

Modular Supervisors and foremen shall carry out regular and scheduled toolbox talks. Subjects for these talks are pre-determined and planned as per Toolbox Talk subjects.

Toolbox talks are also used prior to the commencement of critical activities to reinforce policies and procedures specific to the activity, communicating 'lessons learnt' from hazards / incidents and reviewing Job Hazard Analysis. Safety officer shall conduct toolbox talks for complex activities which require extra precautions. Attendance at toolbox talks is closely monitored to ensure all employees receive regular and appropriate.

12.7 PERSONAL COMMITMENT

- I shall wear my PPE at all times.
- I shall do my best to prevent pollution damage to the environment.
- I shall use the welfare facilities provided for me.
- I shall protect the safety of my fellow workers.
- If I work safely each day, I shall go home each day.

12.8 PERSONAL PROTECTIVE EQUIPMENT

Following are the basic personal protective equipment (PPE) those are always used during construction activities to ensure safety of the personnel at construction site:

Protective Clothing: Protective clothing protects the body of the construction staff from hazardous substance.

Helmet: The most important part of the human body is the head. It needs utmost protection which is provided by a hard plastic helmet.

Safety Shoes: Maximum of the working space is occupied with machinery, construction materials which are made of hard metal, and which make it clumsy for construction staff to walk around. Safety shoes ensure that nothing happens to the feet while working or walking at site.

Safety Hand gloves: Different types of hand gloves are provided. All these are used in operations wherein it becomes imperative to protect one hands. Some of the gloves provided are heat resistant gloves to work on hot surface, cotton gloves for normal operation, welding gloves, chemical gloves etc.

Goggles: Eyes are the most sensitive part of the human body and in daily operations chances are very high for having an eye injury. Protective glass or goggles are used for eye protection, whereas welding goggles are used for welding operation which protects the eyes from high intensity spark.

Earmuff/plug: Noisy construction environment is very high for human ears to bear. Even few minutes of exposure can lead to headache, irritation and sometimes partial or full hearing loss. An earmuff or ear plug is used during construction activities which dampens the noise to a bearable decibel value.

Safety harness: To avoid a fall from heightened area, full body safety harness is used. Safety harness is donned by the operator at one end and tied at a strong point on the other end.

PP Rope: To hold the equipment, PP rope shall be used.

Insulated Tools: All the tools which will be use in electrical works shall be properly insulated.

Face mask: Working on insulation surface, painting or cleaning involves minor hazardous particles which are harmful for human body if inhaled directly. To avoid this, face mask is provided which acts as shield from hazardous particle.

Fire Extinguishers: Keep at all the times while performing brazing activity at the site

12.9 DO'S & DON'T

Do's

- Always wear a PPE while Working. Wear dry, insulated gloves in good condition and protective clothing.
- Follow Instructions from Supervisor and Safety Personnel.
- Proper Access shall be provided for work area.
- No Supervision, No Work.
- Observe the alertness on the construction site.
- Check the tools and tackles before use.
- Use the proper and appropriate tools and tackles.
- Always use guy ropes while lifting and dismantle.

Don'ts

- Enter the site without proper PPE's
- Move in the Erection area during Lifting.
- Dump the debris near the site and working area.
- Conduct any unsafe action.
- Tools and materials shall not be thrown from ground to men working at height. And neither person working at height shall throw tools or materials down.
- Do not touch an energized electrode with your bare hands.

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TABLE 1: TOOL BOX TALK SHEET

	TOOLBOX TALK RECORD

Project:	**Talk Location:**	
Work Location:	**Date:**	**Time**
Disciplines:		
Conducted by:	**Signature:**	
Attendees:		

S.No.	Name	Signature		S.No.	Name	Signature
01				11		
02				12		
03				13		
04				14		
05				15		
06				16		
07				17		
08				18		
09				19		
10				20		

Work activity / talk topic (attach details if required):

General comments / observations / feedback on Toolbox Talk effectiveness and workforce feedback.

Comments:

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TABLE 2: MANPOWER PLANNING

	MANPOWER PLANNING

Project:			**Location:**			
Work Location:			**Date:**		**Time**	
Disciplines:						
Conducted by:			**Signature:**			
Attendees:						
S.No.	**Type of Manpower**	**Name of Manpower**	**S.No.**	**Type of Manpower**	**Name of Manpower**	
01	Supervisor		11			
02	Skilled Fitters		12			
03	Riggers		13			
04	Unskilled		14			
05	Helper		15			
06			16			
07			17			
08			18			
09			19			
10			20			
Work activity / talk topic (attach details if required):						
General comments / observations / feedback on Toolbox Talk effectiveness and workforce feedback.						
Comments:						

13.0 GENERAL INSTALLATION TOOLS & TACKLE

To the best installation practice, following recommended tools-tackle & machinery should be readily available at site by HVAC installation contractor.

- Power Distribution Board for Construction Purposes of below configuration:

S.NO.	ITEM DESCRIPTION	UOM	QTY.
1	**Distribution Board**		
	Distribution Board having 3Ph 415V AC incomer provision, comprising of Outgoing feeders for construction equipment (like welding m/c, drill, grinder etc) and IP-55 enclosure made of 1.6mm thick steel sheet duly powder coated complete with indicating lights, incoming/outgoing MCBs, RCCB, female Socket etc complete as per following		
(A)	**Incomer**		
1	TPN (4P) MCCB, 100A, 25kA S/C with Al. Spreader	No's.	1
2	Phase Indicating Lamp (Red, Yellow, Blue)	No's.	3
(B)	**Outgoing**		
1	TPN (4P) MCB, 32A, 10kA S/C	No's.	2
2	DP (2P) MCB, 16A, 10kA S/C	No's.	2
3	Industrial Grade Plug & Socket (Male-Female), 3Phase 5Pin, 32A	Set's	2
4	Industrial Grade Plug & Socket (Male-Female), 1Phase 5Pin, 16A	Set's	2
(C)	**Enclouser**	No's.	1
1	CRCA Sheet, made of 1.6mm Thick, Min. Size-400(W)x500(H)x400(D)	No's.	1
(D)	**Power Cable**		
1	Power Cable, 4Cx16mm2 Al PVC	Meter's	100
2	Power Cable, 3Cx2.5mm2 Cu PVC	Meter's	100

- Portable Lamp with Stand (at least 100W Flood Lamp)
- Welding Machine of suitable rating.
- Drill Machine (Rotary Hammer type)
- Crane/Hydra (Sharing Basis) will be required for equipment lifting and shifting.
- Grinder
- Nylon Rope
- Metal Hammer (min 1lbs)
- Wooden/Dead Blow Hammer
- Cutting/Nosing Tools
- Duct Stretcher
- Duct Crimping Tool
- Sheet Cutting Scissor
- Pop Revit Tool
- Duct Seaming & Folding Tool
- Duct Knife
- Set of Screwdriver
- Tester
- Set of Spanner
- Adjustable Wrench
- Combination wrench
- Socket wrench with multiple sockets
- Insulated Plier
- Refrigerant charging manifold/adapter
- Grease Gun, 100ml
- Measuring Tape
- Sprit Level Gauge
- Clamp Meter
- Multi-meter

All tools shall be kept in proper toolbox to have good housekeeping during the complete period of installation.

14.0 AUTHORIZATION

The Site In charge is responsible person for installation and commissioning of the equipment. The Site Engineer will be responsible for all construction/installation activities at the site and will directly supervise through erection supervisor / skilled workmen the work at site and will also be responsible for controlling the testing activities. Site Manager is responsible for the overall (i.e., supply, erection, and testing) quality of the work carried out.

I confirm that I understand the contents of this Work Method Statement and Risk Assessment, and I will apply the measures and requirements stated.

**********END OF DOCUMENT**********

SECTION-1

GENERAL TECHNICAL SPECIFICATION

1.0 General

Arun-III Hydro-Electric Project in Nepal is contemplated for generation of hydro power with design energy of 3924 MU per annum in 90% dependable year. Project is proposed to be Run of River with Pondage Scheme.

1.1 Site Specific Information

1.1.1 Project Name

- Project Title:……..ARUN-III HEP
- Capacity:…….4 X 225MW
- Owner:……..SAPDC

1.1.2 Location

The proposed project site is located at a distance of 50 km from Khandbari, the headquarters of Sankhuwa sabha District of Nepal. It is at about 240 km from Biratnagar and about 740 km from Kathmandu. The location details of the proposed project site are as indicated below:

- Latitude ……. .27º-30'N – 27 º -35'N
- Longitude …….. ...87º -12'E – 88 º-20'E
- Distance from Tumlingtar (domestic airport) town is…….About 68 km
- Distance of Kathmandu (international airport) from Tumlingtar…..About 660.km

1.1.3 Climatic Condition

Average max temp	:	30º C
Average Minimum Temp	:	20º C
Maximum river water temperature	:	25ºC
Minimum river water temperature	:	10ºC

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Heaviest package to be transported with suitable number of axle for safe transportation of consignment for 70R bridge capacity.

* Height from the ground

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1.9.2 Welding & NDT

1.9.2.1 Preparation of base material

Members to be joined by welding may be cut to shape and size by mechanical means such as shearing, machining, grinding, or by gas or arc cutting, to suit the conditions. Edges shall be shaped according to ASME requirements. Design of welded joints and selection of weld filler metal shall be in accordance with approved standards and shall allow thorough penetration and good fusion of the weld with the base metal. The edges of surfaces to be welded shall be sound metal free of visible defects such as laminations or defects caused by cutting operation at least 30 mm back from the edge of the weld, and free from rust, oil, grease, and other foreign matter.

1.9.2.2 WPS & WPQR

The establishment of welding procedures, welder's qualifications shall conform to the requirements of the ASME Boiler and Pressure Vessel Code Section VIII and IX. The approved copy of the WPS & WPQR in accordance with the ASME requirements shall be submitted to the purchaser for review and record..

1.9.2.3 Welded construction and stress relieving

Weld-fabricated pressure-containing parts shall be designed, fabricated, stress relieved inspected and tested, unless otherwise specified, in accordance with ASME-VIII.

1.9.2.4 Non-Destructive Testing

Examination of Welds

Combination of NDT techniques i.e RT, UT, MPI, DPT shall be used to ensure the soundness of the weldments depending upon the requirement and geometry of the welds in accordance with the provisions of the ASME. The acceptance criteria for various NDT, NDT personnel shall be as per ASME-V/VIII/IX.

The Contractor's Drawings shall indicate the type and extent of non-destructive examination as it applies to each component or weld. Distinct notations shall be used on the drawings to differentiate shop and site welding.

Examination of Casting

All cast material including Turbine Runner etc. shall be given complete non-destructive examination including radiographic examination of the most critical areas. The Contractor shall submit Quality Sheets (Specification for inspection of steel casting for hydraulic machines), with his recommendation and specify special precautions to be taken of the casting of the turbine runner and other important casting components. The Quality Sheets submitted shall define the area and extent of the various non-destructive examinations to be performed on castings. The examination of castings shall be in accordance with the provisions of CCH-70.

Examination of Forging

Shafts, stems and coupling bolts made of forgings shall be given complete ultrasonic examination and other applicable non-destructive test, to determine that they are sound. Non-destructive examination of other forgings shall be in accordance with accepted good practice to assure their soundness. The structure of forgings shall be homogeneous and free from excessive non-metallic inclusions. An excessive concentration of impurities or separation of alloying elements at critical points in a forging will be a cause for its rejection.

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1.9.2.5 Field welding

Filler material required for field-welded joints shall be furnished by the Contractor. The Contractor shall perform all welding work at site in accordance with the applicable WPS. Only qualified welders shall be used for undertaking welding as per the applicable WPS.NDT shall be performed as per the approved drawings.

Preparation for field welding

All cutting, chamfering, and other shaping of metals necessary for the field connection shall be done as far as possible in the shop. Adequate temporary bolted field connections shall be provided to hold the assemblies rigidly and in proper alignment during shop and field assembly.

To ensure proper alignment during field erection, a minimum of two dowels shall be provided for each field connection between subassemblies. The holes shall be drilled and the dowels fitted at shop assembly after the subassemblies have been satisfactorily aligned. All stipulations for welding, structural work and other, shall be applied to fieldwork as well as to shop work, except where otherwise stated.

1.9.3 Painting

All the equipment furnished and installed by the Contractor shall be completely painted for final use, with the exception of those parts or surfaces that are expressly designated as unpainted. Surfaces to be painted shall receive the preparatory treatment and required number of coats. The Contractor shall perform all painting work in the shop, before shipment, followed by a final coat of paint at site after installation as per the standard procedure.

All materials, supplies, and articles furnished shall be the standard products of recognized reputable manufacturers.

Colour schedule of equipment supplied shall be finalized during detailed design stage.

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1.13 Tools and Spares

Contractor shall bring his own tools, devices, testing instruments/ equipments to site in order to erect and install the complete equipment delivered under this section.

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13.7.6 Receipt and storage checks

a) Check and record condition of each package, visible part of the Reactor etc. for any damage.

b) Dew point measurement and assessment of Residual paper moisture assessment for each Reactor, as and when received at site.

c) Handing over of log sheet record of nitrogen gas pressure maintained during transportation.

d) Visual checks for wedging of core and coils before filling up with oil and also checks for conditions of core and winding in general.

e) Check and record reading of impact recorders on receipt and verify the allowable limits as per manufacturer's recommendation.

f) Measurement of capacitance and tan delta of the bushings and windings before fixing/connecting to the Reactor. Supplier shall furnish these values for site reference.

g) Measurement of the winding resistance.

13.7.7 Installation checks

a) Check the whole assembly for tightness.

b) Oil leakage tests.

13.7.8 FIELD TESTS

All field tests including tests during installation, pre-commissioning, commissioning, performance and field acceptance tests shall be conducted by the Contractor, in the presence of representative of the customer.

Procedure to be adopted for conducting the operational, pre- commissioning, commissioning, performance and field acceptance tests shall be submitted well in advance.

13.7.8.1 Tests during installation and pre commissioning

At least the following inspections/tests shall be performed on each Reactor after erection:

a) SFRA Test.

b) FDS Test and total insulation system moisture assessment. Frequency Domain Spectroscopy

c) Check Oil leakages if any.

d) Core grounding test.

e) Check of leakages.

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f) Visual inspection of inside of Reactor at the time of winding and bushing connection.

g) Correct functioning of Buchholz relay (alarm and tripping)

h) Correct functioning of the various protection systems and automatic systems (protection etc.) and correct operation of following protection devices and alarms.

i) Buchholz relay

ii) Excessive winding temperature

iii) Excessive oil temperature

iv) Low oil flow

v) Low oil level indication

i) Calibration of sudden pressure relay and all types of gauges.

j) Inspection of the insulation to earth of the various parts of the Reactors

k) Test on Bushing current Transformers:

i) Insulating resistance value,

ii) Magnetizing current.

iii) Check the bushings for conformity of connection to the line

iv) 2kV for one minute test between neutral bushing CT terminal and earth

l) Measurement of insulation of all the auxiliary circuits (marshalling box etc.) and Insulation resistance measurements for:

i) Control Wiring

ii) Main winding

iii) Neutral bushing current transformer

13.7.8.2 Commissioning tests

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At least the following verifications shall be performed during commissioning of all Reactors:

a) Measurement of the magnetizing current.

b) Measure vibration and noise level.

c) Measurement of impedance at low voltage.

d) Testing of on line moisture monitoring systems and verification and calibration of various sensors.

e) Final IR values between windings and earth

f) Check of the following:-

i. Earthing of main tank, Marshalling Box,

ii. Neutral Earthing,

iii. Calibration of WTI and OTI,

iv. Earthing of Bushing test tap,

v. Shorting of unused CTs,

vi. All valves for their correct opening and close sequence.

g) Reactor operation for 24 hours (voltage, no load current, temperature measurement and noise)

h) Loading of Reactor and measurement of the temperature and noise level including DGA Test from accredited lab.

13.7.8.3 Performance testing

If nothing unusual has been observed after energization of Reactor, the test service period of 24 hours shall follow. During this test service period, the Reactor must operate continuously at rated condition without any interruption except of those beyond the control of the Contractor. However, such interrupted period shall not be counted for in the test service period.

13.7.8.4. Acceptance tests on each Reactor

Oil tests as per IEC-60296 & DGA from accredited laboratory. After 24 hours of test service period and results shall be compared with before energization value.

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13.9 SITE INSTALLATION AND COMMISSIONING

The Contractor shall follow the requirements of installation elaborated in General Technical Specification (Reactor) chapter.

The Contractor has to do all the work related to assembly, erection, testing and commissioning complete in all respects. All necessary tools, plants, labour, materials including consumables for performing installation, testing and pre-commissioning shall be provided by the Contractor.

The contractor shall make all necessary arrangements such as canopy etc. for least exposure of oil/winding to atmosphere during any site inspection/site modification required.

The Contractor shall submit the necessary data/information, layout and foundation/support drawings well in advance.

The Contractor shall provide and install the concrete inserts/embedment, support steels and/or components for foundation/supports purpose as per approved erection drawings and coordinate the activities with civil contractors to keep his activities in synchronism with civil work. All installation for foundation shall be verified and accepted by the Engineer.

The Contractor shall use anchor fasteners for installation of fixtures, mountings, conduits, cabling, panels etc. Chipping of concrete and/or taking support from reinforcement bars shall not be allowed.

Supply of inserts/embedment, support steels and/or components for foundation/supports purpose are in the scope of BHEL. However few supplies may be required as per Bid Price Schedule.

13.9.1 Drying and filling of oil

Reactors shall be dried out by an appropriate method at site after erection. The Contractor shall furnish complete details of method, tests etc. recommended for drying at site after erection.

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Oil filling shall be done under vacuum better than 1200 m m of Hg after Reactors have been dried out to the recommended dew point with treated oil. The new oil supplied in drums shall be treated to acceptable limit (BDV>70kV, moisture<10ppm & oil temperature 70 ^{o}C)of various properties before the same is filled in the Reactor. The oil quality shall be tested after prescribed resting period and values of various parameters shall be as specified above specified clause.

13.10 TOOLS AND INSTRUMENTS

13.10.1 Tools for erection and Installation.

The Contractor shall bring his own tools, devices, testing instruments / equipments to site in order to erect and install the complete equipment delivered under this section. These shall remain the property of the Contractor unless

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SECTION 2

INSTALLATION

2. INSTALLATION

2.1 RECEPTION AND ASSEMBLING OF TRANSFORMER / REACTOR DESPATCHED PARTLY DISMANTLED AND FILLED WITH NITROGEN.

To ensure that a Transformer will function satisfactorily it is important that handling, lifting, storing and assembling are carried out with great care and cleanliness by experienced personnel who know the various working operations very well.

This section gives instructions how handling, lifting, storing and assembling should be carried out. For large Transformers it is recommended that the work is done by BHEL or is under supervision by experts from BHEL.

2.1.1 INSPECTION

In connection with receiving and unloading at site, and at the final storing place before assembling, the transformers shall be inspected carefully. External visible damages as dents, paint damages etc. may imply that the transformer has been subjected to careless handling during transport and/or re-loadings, and a careful investigation is therefore justified.

After the arrival of the material at receiving points, the customer should, in case of possible damage/loss of any component, make the necessary claims with the contractors representatives under intimation to BHEL so that such claims can be registered with the transport agents. Before unloading, the condition of packing and of the visible parts should be checked and possible traces of leaks verified (condenser bushings). If necessary, appropriate statements and claims should be made.

Drums containing oil which have been dispatched separately should be examined carefully for leaks or any sign of tampering. All drums are dispatched filled up to their capacity and any shortage should be reported.

In order to protect the active part against moisture, the transformer tank is filled with nitrogen during transport at an over pressure of 0.17 kg/ sq.cm (2.5 psi) approximately at room temperature.

Check immediately the gas pressure at the arrival. A positive pressure indicates that the tank and the transformer components respectively are tight, and that the active part including the insulation materials is dry.

If there is no positive gas-pressure, transformer should be immediately filled with dry Nitrogen gas at a pressure of 0.17 kg/cm^2 (2.5 psi) without loss of time as per instructions given para 1.2.3

Otherwise, it should be checked if the core isolation is satisfactory and that accessories packed separately have not been damaged during the transport. Instructions for checking of the core isolation are given in clause 2.10

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2.1.2 UNLOADING

Typical unloading arrangement of the transformer is shown in fig 2.1.

Whenever rollers/trolleys are supplied with transformer, movement of transformer at site is carried out by mounting these rollers/trolleys. For mounting of rollers refer roller mounting drawing included in Vol.I.

Alternatively for movement of transformer from loading bay to actual site of the equipment, skidding on greased rails etc. can also be resorted to.

2.1.3 STORING

Dismantled equipment and components are packed to be protected against normal handling and transport stresses. The instructions for lifting given on the packages, must be complied with to avoid damages. Goods stored outdoors must not be placed directly on the ground, and should be covered carefully with tarpaulin or similar material. Oil drums should be stored in horizontal (lying) position with both the bungs also in horizontal position.

2.1.4 LIFTING

Lifting devices on the transformer tank are dimensioned for lifting of the complete transformer filled with oil. The positioning of the lifting devices, permissible lifting angles, minimum height to crane hook and transformer weight, appear from the OGA drawings. Check at lifting of complete transformer that the lifting wires/ropes are not in contact with bushing or other components on the cover. For lifting with hydraulic jacks, the transformer is provided with jacking pads dimensioned for lifting of complete transformer filled with oil. The positions of the pads appear on the OGA drawings. If active part is to be lifted refer instructions given in clause 2.7.

2.1.5 LOCATION AND SITE PREPARATION

a) Reactor shall always be placed on concrete plinth without rollers as per foundation plan drawing whereas transformer may be even placed with rollers. Therefore it is very important to refer foundation drawing before placing the transformer/reactor on final location.

b) Transformer/reactor should be placed on the foundation so that easy access is available all around and diagram plates, thermometers, valves, oil gauges, etc. can be easily reached or read. Adequate electrical clearances are also to be provided from various live points of the transformer to earthed parts.

c) ONAN type transformers/reactors depend entirely upon the surrounding air for carrying away the heat generated due to losses. For indoor installation, therefore, the room must be well ventilated so that the heated air can escape readily and be replaced by cool air . Air inlets and outlets should be of sufficient size and number to pass adequate air to cool the transformer. The inlets should be as near the floor as possible and outlets as high as the building will allow. Where necessary, exhaust fans can be installed for the purpose.

d) The transformers should always be separated from one another and from all walls and partitions to permit free circulation of air. In this connection reference is also drawn to IS: 10028 (Part II).

e) Where rollers are not fitted, level concrete plinth with bearing plates of sufficient size and strength can be adopted for outdoor transformers. To prevent the formation of rust, it is essential to avoid presence of air and water in the space between the plinth and the base of the transformer by use of cretex or similar bituminous compound.

f) Where rollers are fitted, suitable rails or tracks should be used and the wheels locked to prevent accidental movement of the transformer. Where walls are provided, it should be ensured that the transformer gets a good ventilation as mentioned above for indoor transformers. Provision should be made for the emergency drainage of the oil from the transformers (e.g. in case of fire in neighboring apparatus or bushing or the transformer tank), by surrounding the transformer plinth with sump filled with small pebbles.

2.1.6 INTERNAL INSPECTION AND CHECK POINTS FOR ASSEMBLING THE TRANSFORMER/REACTOR

(a) Check-points before starting assembly:

1. Conditions of leads.
2. Bracing, clamping of leads.
3. Connections.
4. Tap changer checks.
5. General conditions of insulation.
6. Core check that it has not moved in transit.
7. Core-ground; this is checked with the megger after removing earth connection.
8. CTs, including the secondary leads and their passage through metal parts.
9. Check that shipping frame for bushings have been removed.
10. Check that coil position has not moved in transit.
11. Check for dirt, metal swarf, moisture.
12. Check that the bushing leads set without being too close to ground or other points of different potential.

(b) Check-points during Assembly

By means of the Part list and the transformer/reactor OGA, the assembling of a fully completed transformer is carried out according to the following instructions. The following precautions are to be taken:

1. Fire-fighting equipment shall be available at the oil-treatment equipment as well as at work on and adjacent to the transformer.
2. Welding work on or adjacent to the transformer shall be avoided, but if this is not possible, the work shall be supervised by fire-protection personnel.
3. Smoking on or near the transformer shall not be allowed.
4. Transformer tank, control cabinet etc. as well as assembling and oil treatment equipment shall be connected with the permanent earthing system of the station.
5. Check that there is no overpressure in the transformer when blanking plates or connection lids are to be opened.
6. All loose objects, tools, screws, nuts etc., shall be removed from the transformer cover before opening the connection and blanking lids.
7. All loose objects (tools, pencils, spectacles etc.,) shall be removed from the boiler-suit pockets etc. before starting the work through man holes.
8. Tools to be used inside the transformer/reactor -e.g. for tightening of screw-joints- shall be fastened to the wrist or another fixed point by means of cotton tape or string.
9. Tools with loose sleeves and tools with catches must not be used at work inside the transformer.
10. Greatest possible cleanliness shall be observed at work inside the transformer/reactor, and at handling of parts to be mounted inside the transformer.
11. Fibrous cleaning material should not be used as it can deteriorate oil when mixed with it.
12. All components dispatched separately should be cleaned inside and outside before being fitted.
13. A transformer/reactor is best protected from damp hazard by circulating warm, dry, de-aerated oil through it until it temperature is 5 °C to 100 °C above ambient. This should be done before allowing external excess to the interior of the tank. The warm oil should be circulated all the time transformer is open to atmosphere,
14. Oil pump & all joints in the oil pipe work should be airtight to avoid entrance of air through leakage joints.

15. The active part (core and winding) should be exposed to the surrounding air as short time as possible. Open therefore only one blanking plate or connection lid at a time for remounting of bushings, valves etc.
16. Objects which-despite all precaution are dropped inside transformer/reactor, must absolutely be brought up from the equipment.
17. Check that the oxygen content inside the transformer tank is minimum 20% if a person is to enter the tank.

2.1.7 ASSEMBLY OF WHEELS

Mounting of wheels under reactor/transformer is to be done as per roller arrangement drawing. The reactor however in service, is to be placed on plinth with anti-earthquake fastening without rollers. Transformer placement can be with or without rollers as per applicable OGA/foundation drawing.

2.1.8 ASSEMBLY OF BUSHINGS

In case the bushings are mounted on turrets on the transformer/reactor cover, they are either delivered mounted on their turret or -in case of large bushings dismantled from the turrets. The turrets are often individually adapted; check therefore that they are re-mounted in correct places, which appear from the OGA drawing and ,part list.

Assembling of bushings is carried out according to bushings installation manual available. In case of draw rod / lead connection of bushing with transformer lead, half connector joint to be insulated with 3 layers of crepe paper after making proper connection.

2.1.9 ASSEMBLY OF VALVES

Valves which may affect the loading gauge, or will be subjected to damages, should be dismounted before delivery. Re-mount the valves as per the positioning appear from the OGA drawing and part list. The gasketting surfaces shall be cleaned well and new gaskets fitted. Check that all valves are closed.

2.1.10 ASSEMBLY OF COOLING DEVICES

Valves which are not dismantled like shut-off valves for radiators, coolers and possible headers shall be provided with blanking plates during the transport. Remove the blanking plates when the assembling of the coolers is to be started. Check first that the valves are closed. Check that each radiator and possible header is assembled in the correct positions according to OGA drawing. In case of OFAF or OFWF cooler mounting shall be done as per the relevant leaflet given in Vol.I

The shut-off valves against the transformer tank shall be closed until the oil-filling is started.

2.1.11 ASSEMBLY OF OIL CONSERVATOR

The conservator, which may be with or without aircell is assembled either on the transformer, or on a separate frame. Before the conservator is assembled it shall be checked that belonging equipment -e.g. Oil-level indicator -functions satisfactorily.

The breather is connected to the oil conservator, and it is very important that joints and couplings in the pipe between breather and conservator are air tight. Refer Clause 2.6 for detailed instruction for oil filling.

2.1.12 ASSEMBLY OF PIPE WORK

Pipes with flanges for connection of conservator, radiators, as well as pipes for equalizing of turrets etc. are mostly delivered completely ready for assembling according to OGA & part list. In certain cases -e.g. at a separately assembled oil conservator –certain fitting and welding of pipes and flanges on site is however required. Instruction for such assembly of external pipes is given in Clause 2.3. Before assembly, all associated pipework for cooler system/radiators to be physically inspected for the presence of any dirt/dust etc. and all visible dirt/dust to be thoroughly cleaned with clean cloth. Individual radiator/cooler and pipework to be flushed with compressed air followed by carrying out Pressure test on individual radiator/cooler Bank to check any leakages/damages before start of Erection at site

2.1.13 FLANGES, BLANKING PLATES

When re-mounting blanking plates, connection flanges etc., the gasketting surface shall be cleaned well and new gaskets fitted.

2.1.14 ACCESSORIES

Accessories like cooling fans, pumps, OLTC and components for supervision and control, oil-level indicator, flow indicators, gauges, Buchholz relay, PRV, thermometers etc. are assembled according to leaflet/description valid for the components (refer Vol. I).

2.1.15 CONTROL CABLING

Re-assemble the control cables according to the drawing of wiring system and connect the cable ends to terminal blocks in instruments, terminal boxes, junction boxes and control cabinets according to valid connection diagram.

2.1.16 GASKETS

The sealing system normally used against oil and gas in BHEL's transformers and belonging components has rubber gaskets in grooves and nitrile rubber bonded cork gaskets at other places. Refer clause 2.8 for general information and assembly instructions for gasket mounting.

2.1.17 OIL FILLING

The completely mounted Transformer is oil-filled according to directions in Clause 2.5 & 2.6. The oil shall be treated according to Clause 2.4. The lower and upper shut-off valves for radiators/coolers and possible headers shall be open during evacuation and oil-filling. If coolers are placed on suspension beams, which are mounted at right angle to the tank, the suspension beams shall be supported against the ground during the evacuation. Also radiators mounted on the tank wall shall be supported in a similar way. The hose for filling of oil is connected to the bottom valve of the transformer which must not be opened until the hose has been de-aerated and completely filled with oil.

2.1.18 CLEANING & PAINTING

The transformer and its equipment are cleaned carefully from dirt, oil, lubricating grease, and damaged surfaces are touch-up painted with the primer paints and finish paints delivered as per clause 2.11.

2.1.19 EXCHANGE OF BUSHING

When it is required at site to replace the Bushing (HV/ IV/ LV/ Neutral) due to reasons associated with the deviation in test results from the standard acceptable values or any other reason, following process to be adopted –

Close the Gate valve and Butterfly valve provided in the pipeline (80 NB) between Transformer / Reactor Main Tank and Conservator .

Drain out the oil from Transformer Main tank into the storage Tank up to the level of stress shield.

Fill the Transformer Tank with Dry Nitrogen, UHP grade of Dew point less than -50 or better, if the replacement is not planned to be carried out immediately after draining out of oil from Main Tank up to the required level.

While carrying out the replacement, release the filled in Dry Nitrogen inside the Main Tank (as mentioned in step 3 of replacement procedure). During replacement of Bushing keep the Transformer tank pressurized from continuous flow of Dry air of UHP grade of Dew point less than -50 or better in order to avoid the ingress of moisture.

Before replacement of the Bushing, carry out IR, Tan Delta and capacitance measurement test on the new Bushing's to be replaced. Replacement of the bushing shall be carried out after clearance of pre-erection test results from concerned Division.

Carry out the replacement of bushing as per BHEL standard procedure, in case of replacement of 400 KV HV bushing having half connector joint between bushing and winding lead at Turret level care shall be taken that hardware used should be of appropriate length and after connection the bolt used in connection shall not be protruded from profile of half connector.

During replacement the half connector joint between Bushing and winding lead shall be wrapped by three layer of Crepe paper with half overlap.

Carry out the profile inspection of winding lead entering inside the bottom of stress shield of Bushing replaced. Also take the photographs of winding lead profile after replacement for record purpose. In case of any doubt during bushing replacement contact concerned Service division.

All Nitrile rubber cord of the inspection cover opened during the bushing replacement needs to be replaced by new Nitrile rubber cord.

After replacement of bushing, apply vacuum in the Main Tank and start filling the filtered oil (as per BHEL standard) in the main Tank under vacuum .

Equalize the Main Tank and Conservator after opening the valves in the pipeline between Main tank and Conservator of Transformer (as mentioned in step 1 of the process).

Carry out the de aeration from Turrets, Bushing and Main Tank, cooler bank and if required carry out conservator commissioning as per site requirement.

After replacement carry out the Tan Delta and Capacitance measurement of the bushing replaced and provide the test results to BHEL.

2.2 STORING OF TRANSFORMER/REACTOR DESPATCHED FILLED WITH NITROGEN

2.2.1 STORING BEFORE COMPLETE ASSEMBLING

The storing place should be easily accessible for inspection and maintenance of the transformer. The bedding for the equipment should be larger than its bottom surface and dimensioned for the load. The transformer is placed on boardings or beams so that good ventilation is obtained underneath the transformer bottom.

Before storing, the transformer is inspected according to directions in Clause 2.1 "Reception and assembling of transformer/reactors dispatched partly dismantled and filled with nitrogen".

A transformer without remarks may be stored up to 6 months after arrival at the site without oil-filling. During the storing time, the inert gas (nitrogen) filling shall be maintained and pressure regulated, so that exposure of active part to atmosphere is avoided. If the storage time is judged to exceed 6 months, the transformer should be provided with oil conservator including oil-level indicator and breather, and oil-filled according to Clause 2.5. "Oil filling under vacuum". Certain valves must be re-mounted to enable the oil-filling being carried out. Furthermore, at the time at oil-filling of a completely assembled transformer, certain rules in Clause 2.5 & 2.6 must be complied with absolutely.

The oil quality should also be periodically monitored. If for some reason, oil filling cannot be carried out after a storage period longer than 6 months, the nitrogen pressure shall be maintained and supervised carefully. If the storage time without oil exceeds 18 months BHEL should be consulted about measures to be taken.

Wherever it is desired to keep the transformer energized at a low voltage so that its temperature is higher than the ambient temperature, the low voltage may be applied to LV winding with other winding in open circuit or short circuit conditions depending upon the current to be fed. However, before energizing the transformer, protection system of transformer (including electrical protection) must be checked. It may also be ascertained whether partial cooling is required in this case.

2.2.2 STORING OF COMPONENTS AND ACCESSORIES BEFORE COMPLETE ASSEMBLING

Independent of the duration of the storing time, the directions below apply for dismounted components and accessories, as well as for material to be used in connection with the assembling work.

(a) Storing indoors

In such a room, the following articles should be stored:

1. Insulation material as paper, pressboard, Bakelite, wood, cotton tape etc.
2. Insulated details as paper-insulated conductors, pressboard insulated shielding bodies etc.
3. Chemicals as solvents, glues, varnishes, hardeners etc.
4. Breathers, drying agents.
5. Terminal boxes, connection boxes, control cabinets.
6. Gas relays, oil-level indicators, thermometers, pressure valves etc.
7. M Box, OLTC motor drive, Fans, Pumps, Instruments & fittings. (Heating elements provided shall be connected to supply)
8. Online DGA, Online moisture removal system, sudden pressure relay, Conservator isolation valve

(b) Storing outdoors

The below components may be stored outdoors. They should be placed above ground and covered with tarpaulin etc.

1. Oil-conservator with blanking plates for all openings.
2. Radiators and coolers with blanking plates for all openings.
3. Structures, A frames, Pipe supports, Supports for oil-conservators, radiators, control cabinets etc.

2.2.3 SUPERVISION

During the storing time, the storing place, transformer/reactor components and accessories are inspected regularly. Tap changer if provided should be operated at 6 monthly intervals. Two or three runs from one end of the range to the other and back are sufficient. Observations, readings, measures and dates should be noted and BHEL should be contacted for directions about possible measures. Check at even intervals -and further more at weather changes as rain, storm, frost or thawing the foundation material (boardings, beams etc.) and the condition of the ground.

Inspect the transformer/reactor periodically with regard to possible external faults and/or rust-damage.

Check also that screws and nuts in sealing joints (covers, lids etc.) are tightened. Check every second week that the connected-in heating elements in control cabinets function.

If the Transformer is inert gas filled, one shall check every second week the overpressure or inert gas consumption.

2.3.7 RADIATORS/COOLERS

The positioning of the radiators/coolers is indicated on OGA drawing. These are positioned so that the highest point of the oil-pipe system is always positioned below the bottom level of the conservator.

The pipe system is provided with filter valves at the start and finish to enable pumping the oil through the system.

All places where air may be collected are provided with air release plugs/ valves.

2.3.8 RADIATORS/COOLERS PIPES

The pipe having dimensions as per OGA drawing and may be provided with weld-flanges, expansion joints. No pipe part is allowed to be so long that internal inspection and cleaning will be difficult.

The pipes shall be placed so that air release plugs will be positioned at the highest point of the pipe part. The pipes shall be painted internally with a yellow, oil-resistant paint and externally according to the paint as per specification.

2.3.9 SHORTING LINKS / EARTHING STRIPS

All shorting links on tanks, turrets and fittings to be provided as per OGA

Note – 2: The documents, relevant to Oil, are prepared based on the IEC standard applicable as on October-2016. If user wants to refer the latest standard applicable, the confirmation shall be obtained from manufacturer.

Note - 3: For Mixing of oil, please refer IEC: 60296. Please ask the OEM, before mixing the oil.

2.4.3 HANDLING

Transformer oil should be carefully handled at site to ensure satisfactory service. Drums used for transport and storage should be kept under cover. In practice owing to contamination in the containers, difficulty may be experienced in maintaining the purity of the oil when it is transferred from one vessel to another, and once a vessel or drum has been filled with moist oil it is extremely difficult to clean. Drums should be clearly marked to indicate whether they are for clean or for dirty oil and should be reserved for the type indicated.

Oil drums should be stored at site preferably on pallets or Bricks layer, in horizontal position, with both the bung closures horizontally opposite (in 3 & 9 o'clock position) so that ingress of moisture is prevented. It is always recognized that storage of oil in drums is not always satisfactory, particularly when oil is stored in drums which have been bent or otherwise damaged in transit or storage, and the transfer of oil from such containers to electrical equipment should normally be through a suitable treatment plant.

In substations with fixed oil handling equipment like oil storage tank, the pipe work from the clean oil tank to the electrical apparatus should be kept clean and free from moisture. Where portable oil handling equipment is used, flexible pipe work and hand pump should be carefully inspected to ensure that they are free from dirt and water and should be flushed with clean oil before use. If the clean oil is being used from drums, it should have been recently tested and filling orifices of the drums should be clean. Hoses used for clean oil and dirty oil should be clearly marked and provided with plugs for sealing the ends when not in use.

Special care must be taken for oil filtration machine, which is used during treatment of oil. It is to be ensured that there is on residual quantity of oil left in oil filtration machine. The paper filters or centrifuges used with filtration machine shall be cleaned or replaced periodically as per supplier's recommendation. The pipe/hoses used with filtration machine should be properly blanked after use.

Before using oil tankers and filtration plant for handling of oil, the internals/chambers need to be thoroughly cleaned using good transformer oil so that the residual of earlier used chemical/oil is removed totally.

2.4.4 RECONDITIONING

Transformer oil is usually contaminated during handling, transport and storage due to ingress of moisture and solid impurities. Hence, oil shall be vacuum filtered separately at 50^0C to 60^0C using a suitable filtration machine and a spare clean tank before filling in the transformer. Details of filtration are given in Clause 11 of IEC: 60422-2013. Oil treatment shall be terminated when the following parameters are attained.

Table 2.1

Sl. no.	KV Class of the transformer	Recommended Permissible limit	
		Electrical strength (BDV) in kV (min)	Moisture content ppm (Max)
1	Upto 170 kV	65	15
2	245	70	10
3	420 to 765 kV	70	05

Storage Tank oil shall be tested for Electrical strength (BDV)/ Moisture content and Tan delta from NABL accredited lab / CPRI / ERDA/NETRA . Test Results carried out on Units mounted on filtration Machine will not be acceptable. Storage tank shall be as per typical arrangement shown in Fig 2.2 Electric strength and moisture content shall be determined following the test procedure of IEC: 60296-2012.Final oil test also needs to be carried out through NABL accredited lab / CPRI / ERDA

2.4.5 Evaluation of mineral insulating oil in new equipment

After reconditioning, Insulating Oil is filled into Transformer/ Reactor. As the oil comes into contact with insulating and other materials, it can no longer be considered as “unused oil” as defined in IEC 60296-2012. Therefore its properties are regarded as those applicable to oil in service, even though the electrical equipment itself may not have been energized. Oil properties should be appropriate to the category and functions of the equipment (see Annexure- 4.3).

The extent of the changes in properties may vary with the type of equipment due to the different types of material and ratios of liquid-to-solid insulation, and should be within the limits of Annexure- 4.3. Properties not included in Annexure- 4.3 (with the exception of oxidation stability for which no in-service limits have been established) should be within the limits of IEC 60296-2012.

2.5 OIL FILLING UNDER VACUUM

2.5.1 APPLICATION

Transformers and Reactors with vacuum-proof tanks shall be filled with oil according to this method.

2.5.2 STORING TIME

Generally it applies that Transformers and reactors which during transport are filled with dry nitrogen on arrival at the site shall be evacuated and oil filled. Before storing, the equipment shall be inspected according to the directions given in Clause 2.1 "Reception and assembling of transformer/reactor dispatched partly dissembled and filled with nitrogen". During the storing time, overpressure shall be maintained, and nitrogen consumption checked according Clause 2.2.

2.5.3 FLOW CHART FOR HANDLING

In Annexure 2.1 is given a flow chart of handling procedures. The pressure should be measured at different times. The pressure is OK if it is maintained according to instructions given in Clause 2.2. Reference is also drawn to para 9.0 of IS: 1866 regarding handling and filling of oil.

2.5.4 UNITS

Annexure 2.1 gives the relation between different units.

2.5.5 PROCEDURE OF DRY OUT BY N2 / ASSOCIATED HEATING METHOD

For effective and faster removal of moisture from Transformer / Reactor, method of dry out by vacuuming followed by N2 filling and if required heating is to be adopted. The detail procedure are as under

2.5.5.1 FIRST CYCLE

(i) Blank all the openings on the Transformer / Reactor Main Tank. Transformer / Reactor Main Tank is than subjected to vacuum up to 1.00 torr (1 mm of Hg) to be pulled and maintained for 72 hrs duration. During this first dry out cycle leakages if any observed in the system to be attended and rectified in this cycle.

(ii) After vacuum cycle Dry Nitrogen of dew point more than -60°C or of UHP grade (purity 99.9999%) to be pushed in Main Tank under vacuum till Min. pressure of 2.0 psi is achieved in Transformer Main tank. The Transformer Tank is to be kept pressurized for a duration of 24 hrs.

(iii) At the end of Nitrogen pressure cycle of 24 hrs, measure dew point values and recorded as dry out values of first dry out cycle. Moistened N2 inside transformer tank will be removed during second dry out vacuuming cycle.

2.5.5.2 SECOND CYCLE

(i) Again start vacuuming of Transformer Main Tank up to 1.00 torr (1 mm of Hg) and vacuum is to be maintained for 48 hrs in second dry out cycle.

(ii) Dry Nitrogen of dew point more than -60°C dew point or nitrogen of UHP grade (purity 99.9999%) is again pushed inside Main Tank under vacuum till pressure of Min. 2.0 psi is achieved in Transformer Main Tank. The Transformer Tank is to be kept pressurized for a duration of 24 hrs.

(iii) Measure dew point after 24 hrs in second N2 cycle and record these dew point values as dew point values of second dry out cycle and refer these values with BHEL standard norms or contact concerned Services Deptt..

(iv) If the dew point values of second cycle is in line with the BHEL Standard norms, Transformer is cleared for further vacuuming followed by filling of filtered oil under vacuum and carrying out Hot Oil Circulation process.

(v) In case desired value of dew point is not achieved than Transformer tank is to be again subjected for vacuum pulling for 24 hrs, followed by N2 filling for duration of 24 hrs. After each dry out cycle measure the Dew point values and compare with BHEL standard norms.

As per BHEL standard norm's minimum 2 Dry out cycle of Transformer has to be carried out before filling of filtered oil under vacuum in Transformer Main Tank.

Note: If the dew point values were not achieved as per BHEL standard norms in 2 dry out cycle and higher content of moisture was noticed as per Dry out process carried out in 2 cycle, than further Dry out process shall be carried out in consultation with BHEL Transformer Services Deptt.

However for improving Dry out values it is suggested that Nitrogen Dry out cycle associated with heating cycle shall be carried out. In this process after vacuuming cycle pressurized Dry Nitrogen in Main Transformer Tank shall be heated externally to raise the temperature of Transformer upto 55-65°C during 24 hours duration followed by measurement of Dew point after completion of heated Nitrogen Dry out process. These Dew point values shall be compared with BHEL standard norms and the process of vacuum followed by insertion of Dry Nitrogen and heating is to be repeated till the dew point values were not achieved as per BHEL standards.

The equipment required for vacuum treatment and oil-filling under vacuum should generally be as per Annexure 2.2. The transformer tank and electrical terminals shall be earthed for safety reasons.

No electrical test on the Transformer is permitted during the evacuation.

Fig. 2.3 shows a typical example of pipe work and valve positioning.

2.5.6 OIL FILLING

2.5.6.1 OIL QUALITY

The transformer/reactor shall be filled under vacuum with oil which has been purified and degassed according to Clause 2.4

2.5.6.2 OIL FILLING IN MAIN TANK

For main tank, the oil shall be heated to a temperature of 50°- 60°C measured at the filter outlet valve. The pressure during the filling shall be max. 1 torr. During the oil-filling, a transparent plastic tube (5) can be used as an oil-level gauge. The tube which

should be a wall thickness of 5-8 mm, may be connected to a top and a bottom valve on the transformer.

Oil-filling of the tank is done through valve (12) at a low level on the transformer and at a maximum rate of 4-5 kL/hour. The pressure in the oil pipes shall be kept positive and shall be checked by a manometer 13 (if provided).Oil filling to be done as per cl. 2.6.9.

For oil filling in diverter switch assembly of an OLTC refer leaflet (Vol.1).

Separate vacuum-proof cooler system/radiators can be evacuated for about 1-2 hours and filled separately with purified and degassed oil. The oil is then circulated through the vacuum filter at least twice via drain valves as near as possible to the transformer. Oil circulation is considered completed until the oil parameters as per table 2.3 is achieved. Care should be taken to keep all air release plugs and valves open to allow escape of trapped air during oil filling operation. These valves/plugs should be closed after completion of oil filling.

2.5.7 HOT OIL CIRCULATION/ DRYING OUT, OIL RINSING, PARTICLE REDUCTION AND PARTCLE COUNTING

To facilitate oil-penetration and absorption of possible gas bubbles, the temperature of transformer shall-after completed oil-filling-be increased by circulating the oil through the vacuum filter and with circulation direction according to Fig. 2.4.

The oil will be circulated through a high vacuum filter machine at 57 °C to 60 °C of transformer oil temperature for minimum 3 days. The start time for hot oil circulation is considered after achieving the stabilized temperature of oil i.e. Inlet and out let oil temp difference should not be more than 3 degree and the Oil temperature to be achieved in the process is between 57- 60 degree centigrade and record the IR value at an interval of 4 hrs after achieving the stabilized oil temperature values. Also record the IR value along with temperature, vacuum of M/c & IR value till oil parameter achieved as per table 2.3. Polarisation Index should be preferably more than 1.75. Other than this limit please refer the case to BHEL Bhopal.

TABLE 2.3

kV Class of Transformer	Recommended Permissible Limits			
	Electric Strength (BDV) in kV (min)	Moisture Content ppm (Max)	Resistivity * at 90°C (Ohm-cm)	Tan delta* at 90°C
Upto 170	60	15	$1x10^{12}$	0.005
245	70	10	$1x10^{12}$	0.005
420 & above	70	5	$1x10^{12}$	0.005

* Subject to availability of testing facility at site.

Method of test for Electric Strength and moisture content shall be as per IS: 335. / IEC-60296

CAUTION:

The temperature during oil circulation should not increase beyond 70°C otherwise this may cause oxidation of oil.

For transformer & reactor of 400 kV class or above, after completion of the hot oil circulation in main tank and cooler/radiator system separately, the valves between main tank and cooler/radiator system to be opened to allow the mixing of oil. The oil rinsing shall be carried out by connecting transformer/reactor to the oil rinsing plant connected with particle counter. Initially the oil inlet is connected to the lower portion of the tank and the outlet to the upper portion and start rinsing plant for circulation and creating turbulence of oil for approx. 1 hour. Thereafter the connection to be reversed (Oil inlet to the top of tank and oil outlet to the bottom of tank) and start rinsing plant. This process to be continued till the 3 consecutive readings at the interval of 1 hour of particle content of the insulation oil is achieved as per below:

If measured with particle counter which works on ISO 4402 and ISO 4406:1987	≥ 2 microns cumulative particle count should be <10000 particle/litre
If measured with particle counter which works on ISO 11171 and ISO 4406:1999	≥ 4 microns cumulative particle count should be <15000 particle/litre

Relevant ISO count for 4 Micron particle is in the range of 10.

2.5.7.1 SAMPLING

Oil sampling at various stages shall be done in accordance with IS: 6855 / IEC-60475. When samples are taken from transformer tank, oil will be drawn from Top & bottom of the tank. When it is desired to know gas content and composition of dissolved gases in transformer oil before commissioning for reference purposes (required for interpretation of Dissolved Gas Analysis results during service), sampling shall be done as per IS 9434 / IEC: 60567.

2.5.8 STANDING TIME

Standing time is the time between 'finished oil circulation' and 'energization'. The time appears from table 2.2.

2.5.9 FINAL OIL FILLING OF TRANSFORMERS/REACTORS DESPATCHED OIL FILLED.

Smaller transformers/reactors are often factory-filled with degassed oil up to about 10% below the cover and transported in this condition. The final filling up to the correct level in the conservator is made at site.

2.5.9.1 TRANSFORMERS / REACTORS WITH SYSTEM VOLTAGE < 36 KV

Previously degassed oil (e.g., at the factory) stored in tight drums may be used for the filling. Check the dielectric strength of the oil which should be as per Clause 2.4.4. If accepted, the oil is pumped into the conservator and in this way fed into the transformer / reactor. To prevent any free water in the drums from entering the

transformer / reactor the opening of the suction tube must lie 0.1 m above the lowest point in the drum. A suitable valve on the cover and/or valves or upper tightening nuts at the bushings have to be opened for complete removal of air below the cover and in the bushings. When the oil is seeping out at these points, shut the valves and tighten the nuts at the bushings.

2.5.9.2 TRANSFORMERS/REACTORS WITH SYSTEM VOLTAGE > 36 KV

The filling is performed as described above, but at least a paper filter must be used for drying the oil.

2.6 OIL FILLING INSTRUCTIONS FOR CONSERVATORS WITH AIR CELL

2.6.1 INTRODUCTION

In all transformers specially in high voltage class, maintenance of insulating oil notably its dielectric property forms one of the determining factors of reliability of equipment in service. Oxidation and contamination of transformers/reactor oil can be avoided in a simple and effective way by use of above oil preservation system. The complete system is known as "Conservator with Air Cell". In this oil preservation system a flexible air cell made of oil resistant

Nitrile rubber is placed inside the conservator and floats on the oil surface. The air cell inflates or deflates as the oil level in the conservator falls or rises depending on the ambient temperature and load on the reactor. The inside of the rubber bag (Air Cell) is put into communication with atmosphere by means of a silica gel breather which ensures dry atmosphere inside the air cell. In addition to the above this system provides following advantages.

i. It avoids saturation of absorbed gases.

ii. As no gas is used in this system, which operates at constant pressure, this formation of gas bubbles at low ambient temperature and load is eliminated. The system thus preserves the oil quality particularly its dielectric properties.

The conservator with air cell is provided with a magnetic oil gauge having one electrical contact. The indication shown on the dial physically corresponds to the oil level in the conservator which is due to balance of static pressure between the oil of the conservator and the atmospheric air inside the air cell. This system is also provided sometimes with a set of pressure and vacuum valves. These valves operate to pass either oil or air in the event of over filling or under filling the conservator during installation.

When oil is to be filled by taking vacuum through conservator refer section 2.6.9 whereas when conservator is to be isolated during oil filling in transformer refers section 2.6.2. For deciding the applicability of either process consult OGA drawing / BHEL representative

2.6.2 DESCRIPTION OF OPERATION

Figure 2.5 indicates the general arrangement of oil preservation system. The oil connection between conservator and transformer tank is made through Buchholz relay and valves are provided in between.

The flexible air cell is connected to the top of the conservator through gasket joint. Under normal condition air cell is completely surrounded by oil and floats in the conservator. The air cell inflates/deflates as the oil volume changes. The float of the MOG which is always in contact with under side of the air cell moves up and down and indicates the oil level. The cell will sink in the remote event if it is damaged and MOG alarm will operate. The conservator then functions as a conventional conservator without affecting the performance of the transformers/reactor.

2.6.3 INSTALLATION

This system is shipped separately from main tank. The air cell is shipped fitted in the conservator. A low positive pressure of less than .07 kg/sq.cm (1 psi) is maintained to avoid excessive movement of air cell in the conservator during transit. MOG is also shipped fitted on the conservator. Install the conservator and associate parts except breather as per transformers/reactor outline drawings and assemble oil pipe work.

2.6.4 OIL FILLING

The following procedure is recommended.

i. Close and blank the valve (14) to isolate the conservator from main tank. Fill the oil in transformer under vacuum upto Buchholz level as per instructions given elsewhere. '

ii. After filling the oil in transformer and breaking the vacuum, oil can be filled in the conservator either through reactor or by drain valve (4).

iii. Remove the inspection cover (11) provided on the side of the conservator and check the air cell assuring that it is inflated. The air cell must remain in fully inflated condition during oil filling operation. If the air cell is found deflated fit the inspection cover and inflate the air cell with dry air/nitrogen gas to 0.035 kg/sq.cm max. through connection (8). A gauge may be put by removing plug (10). After filling close these connections.

iv. Remove air release plugs (5) (6) and (7) provided on top of the conservator.

v. Slowly pump the oil through the main reactor/drain valve (4). Temporarily stop filling operation when oil starts coming from opening (5) and (6) after ensuring that no air bubbles come out through these air release holes. Fit the two air release plugs.

vi. Continue oil filling till oil start coming from air release plug (7) stop oil after ensuring that no air bubbles come out. Fit the plug (7).

vii. Now release the air pressure held inside the air cell from point (8) and continue oil filling until magnetic oil gauge (3) indicates 35°C level.

viii. Remove oil pump and connect air cell to breather (9) from point (8). Also remove pressure gauge and put plug (10).

ix. The system is now properly filled. Air release plugs (5), (6) and (7) are fitted in normal operation.

2.6.5 PRECAUTIONS

i. Oil filling in the conservator and also draining whenever required must be done very slowly. During oil filling, pressure in the air cell should not exceed 0.1kg/sq.cm (1.5 psi).

ii. If a pressure or vacuum is ever applied to the main reactor tank the conservator must be disconnected and a blanking plate fitted on shut off valve.

iii. Do not weld on conservator to avoid damage to the air cell.

iv. Once all the air has been driven out during oil filling in the conservator do not remove air release plugs (5), (6) and (7). Otherwise air will be sucked inside the conservator.

2.6.6 MAINTENANCE

Little maintenance work will normally be required except routine visual inspection. However, it is desirable to check the breather opening to ensure it is not blocked. Further silica gel should be regenerated/replaced when its colour changes from blue to pink.

2.6.7 AIR CELL

Air cell is made from Nylon fabric coated with Nitrile rubber, In the event it becomes necessary to replace or test the air cell for leaks the following method is recommended.

i. De-energise the transformers/reactor.

ii. Isolate the conservator by closing the valves (14).

iii. Drain the oil from the conservator through the valve (4) by removing air release plugs (5) and (6).

iv. Remove inspection cover (11) if necessary, Install the pressure gauge on point (10).

v. Pressurize the air cell (2) by dry air/nitrogen to a max. pressure of 1.5 psi and seal. Check the pressure for 6 hours.

vi. If leaks are found, air cell to be repaired by patching or replaced by a new air cell.

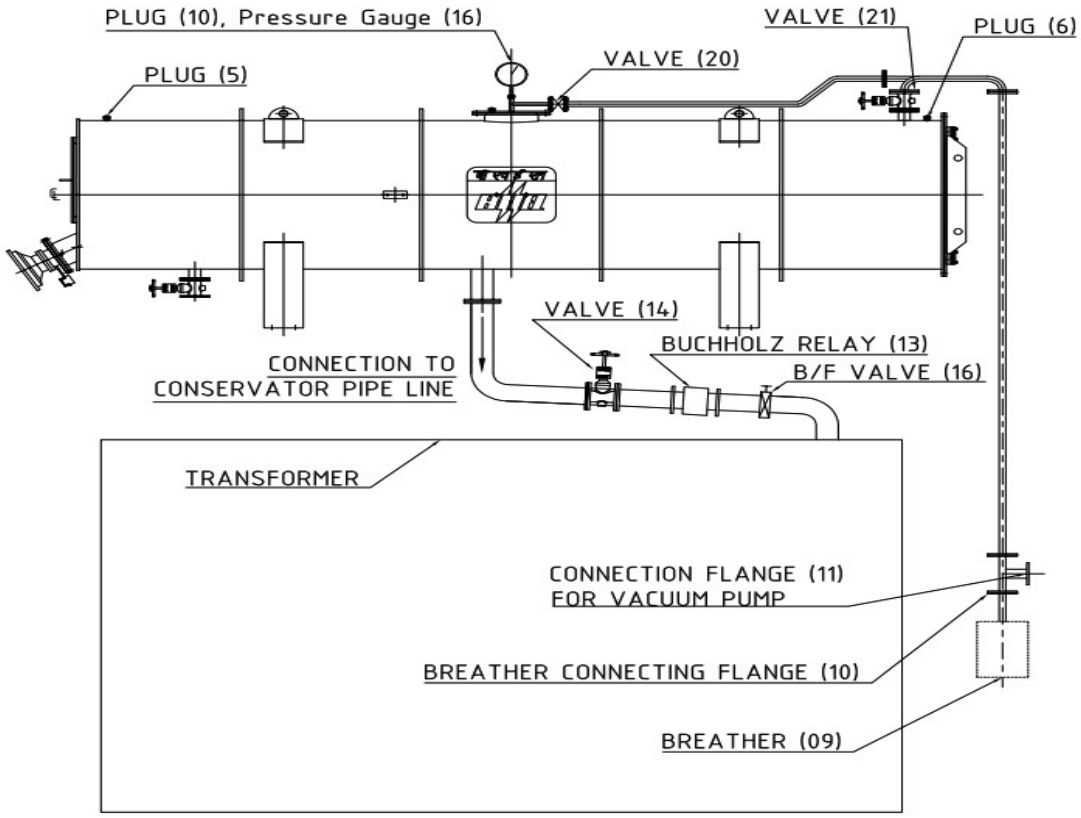
vii. For taking out the air cell from conservator, remove the air cell flange and loops from hooks provided on inside of the conservator top. Collapse the air cell slowly and fold, remove it from conservator very carefully.

viii. In the event air cell is not available immediately, conservator may be used as a conventional conservator.

2.6.8 OIL PRESSURE TEST

Oil pressure test on fully erected Transformer / Reactor to be conducted as per annexure 2.3 before hot oil circulation.

2.6.9 INSTRUCTION FOR EVACUATING OF THE TRANSFORMER / REACTOR VIA THE CONSERVATOR FOR FILLING OIL.



1. Release the overpressure in the Air cell by unscrewing the Plug (10). Open the plug (5) and (6) on the top of the conservator and blow dry compressed air for a short while, to relieve the air cell from the walls of the conservator. Wait for at least an hour to allow the Air cell to collapse completely. Tighten the plug (10) and close plug (5) and (6).
2. Remove the breather (09) and blank the flange (10).
3. Open the shut off valve (14) and (16) between conservator and transformer. Open the bypass pipe valve (20) between conservator and Air cell and valve (21). Connect the Vacuum pump to pipe flange (11) hanging down from conservator.
4. Filling of the oil through the tank can start when vacuum has reached below 1 torr. When the oil level reaches the Buchholz relay in the pipe between tank and conservator, the Shut off valve (14) located in same pipe to be closed.
5. End the vacuum and close the bypass pipe valve (20) between conservator and Air cell and open the plug 5 and 6 on top of conservator.

6. Open the Plug (10) provided on top of conservator.
7. Mount the pressure gauge (16) in position of plug (10) and close the valve (21).
8. Fill the Air in Air cell by opening valve (20) up to 1.5 PSI and close the Valve (20) when pressure reached.
9. Open the Shut off valve (14) between conservator and transformer and press up oil slowly.
10. Continue the Oil flow until oil flows from the plug (5) and (6).
11. Close the Shut off valve (14) and the plug (5) and (6), open the valve (20) and breather flange (9) to release air from Air cell.
12. When the pressure in the Air cell has decreased to atmospheric pressure, the pressure gauges (16) shows no detection open the Shut off valve (14) again and continue oil filling until the oil level specified has been reached and MOG shows 35 °C reading.
13. Connect the Breather (09) to flange (10) and blank flange (11) .

Note: The above Oil Filling under Vacuum to be followed for 765 kV & above transformers /reactors in case of specific requirement.

2.7 UNTANKING OF ACTIVE PART

2.7.1 GENERAL

If for some reason it becomes necessary to un-tank the active part (core and windings) of a large reactor/transformer, it ought to be done under supervision by BHEL erectors. Universal instruction for the un tanking procedure cannot be given, as the design practices of large equipment vary. The following general directions are, however, applicable in most cases.

The un tanking must be done indoors. If there is no suitable hall available, lifting can be done in the temporarily arranged room. e.g. a tent. The oil & the internal parts of the transformer must not in any case be exposed to rain or humidity.

In case of bell shaped transformer, only bell cover is lifted for access to active part.

2.7.2 OIL DRAINAGE

Drain off the oil from the transformers/reactor either partly or completely.

2.7.3 DISCONNECTING

Open all inspection covers for observation. Disconnect leads to bushings, current transformers, winding temperature devices, Oil temperature devices and earthing leads (common CC-CL-G) between active part and cover or tank side from earthing terminal board and any other connections like fiber optic probes from feed through plate welded on tank wall. Disconnections mentioned above can usually be made through hand holes in cover or tank side.

2.7.4 REMOVAL

Remove all large bushings, tank cover or top tank mounted conservator, lightning arrestors (if provided), thermo siphon (if provided), PRV pipe work, heavy gate valves (150 NB, 200 NB, 250 NB), neutral grounding arrangement : post insulator, copper strips & connectors (if provided). Break all connections between tank cover or top tank and tank-piping to oil conservator and cooler thermometers etc.

Remove the cover bolts. If the cover is welded to the tank flange, free the cover according to directions given in Clause 2.9.

2.7.4.1 COVER OR TOP TANK

Before lifting tank cover or top tank, refer the instructions given in outline general arrangement and on lifting bollard on tank wall. When lifting the cover or top tank use the cover-lifting eyes or lifting bollard which are designed for a minimum angle of 60 degrees between sling branches and the horizontal plane. The length of the sling should therefore be sufficient for at least this angle. Wall shunts with press board barriers (if provided) and tap changer should be properly mounted on tank wall and on tap changer mounting bracket welded on end frame or stool locked on bottom tank respectively. HV, IV, tapping & neutral leads should be properly clamped with supporting cleats provided with Terminal gear. to avoid damage.

Place the cover on suitable wooden supports and in such a way that thermometer pockets, small bushing etc. underneath the cover are not damaged.

No grinding or cleaning up of the tank flange is to be carried out before the active part is lifted out of the tank.

2.7.4.2 UNTANKING

Loosen locking devices, if any, between top core clamps and tank side.

Refer instructions given in outline general arrangement before lifting. Lift the active part by means of lifting eyes or lifting lugs provided on the top core clamps. To avoid damages on the active part it is important that it is centered carefully in the tank during lifting procedure.

After un-tanking, place the active part on a horizontal foundation.

2.7.5 RE-TANKING

Grinding or/and cleaning up of the tank flange has to be done before the active part is lowered into the tank. Check that the tank inside is free from contaminations.

Re-tanking is then done in the reverse order that is outlined above. Note that guiding pins or blocks are welded to the tank bottom to prevent the active part from moving in the tank. When lowering the active part, check that it fits exactly the guiding pins or blocks.

2.7.6 REASSEMBLING

Wipe the underside of the cover free from any dirt or foreign matter before lifting it into correct position above the reactor tank. Lower the cover the last few inches exactly into position without sliding on the gaskets.

Reassemble bolts nuts of supporting devices. Weld the cover when the welded construction is used. Reassemble Bushings, conservator etc., and reconnect pipings, leads to bushings, current transformers, etc. Reassemble inspection covers.

After the transformer is completely assembled, it may be necessary to dry it before oil fining- see clause 2.5.

2.8 MOUNTING OF GASKETS

2.8.1

The gaskets have a circular/flat cross-section and are made of oil and heat- resistant synthetic nitrile rubber/nitrile rubber bonded cork. For small gaskets, O-rings are used with diameter 3,5.0 or 8.0 mm, while round rubber cords with diameters 8,12 or 19 mm are used for large gaskets.

The groove is normally milled or turned, but for large flanges the groove is created by means of steel bars welded on top of the flange. The width of the groove is slightly smaller than the cross-section diameter of the gasket in order to keep the gasket in position during the assembling work.

Opened sealing joints may be sealed again using the new gasket. When handling and lifting flange, cover etc. with gasket grooves, care should be taken when using tools and lifting devices to avoid that the grooves getting damaged or deformed.

Before assembling of groove gaskets, it is checked that the grooves and contact-surface in the joint are free from foreign particles and that the paint is free from thick coatings, trickles and drops.

When assembling the rubber cord in the groove, the cord length shall be continuous. The gasket is given a small surplus length to compensate for shrinkage.

The gasket is pressed down into the groove without stretching or slackening.

To prevent the gasket from falling from the groove on vertical surfaces, the gasket may necessarily be spot-glued to the bottom of the groove.

The screws in the sealing joint shall be tightened so that an even pressure is obtained on the gasket. This is obtained preferably by means of a moment spanner. Rubber gaskets in grooves need not normally be re-tightened.

Above description is followed generally for turrets, inspection cover etc. For main tank rim joint, LV turrets of Generator Transformers where metallic stops are provided, nitrile rubber bonded cork is used, for which following instructions shall apply.

2.8.2

i. Gaskets when supplied loose, have no bolt holes in them. They are usually cut to the size and shape required, although they may be supplied as straight, angled pieces from which complete gaskets can be built up.

ii. Scarfed joints should be used. A 40 mm scarf in 5 mm thick material is recommended. Joints should be located away from corners and bolt holes, and should be well bonded, smooth and free from local thickening. Neoprene solution is used as an adhesive for joints.

iii. Gaskets are best stored in hermetically sealed containers in a cool place. They must be protected from damp, oil and grease-

iv. To make a gasket joint, first clean the metal surfaces by thinner to ensure that they are free from oil, rust, scale etc. Using one of the flanges as a template, punch the necessary bolt holes. Insert the bolts and tighten the bolts sequentially, a little every time so that uniform pressure is exerted on the gasket until the gasket is compressed to about 2/3 of its original thickness. Joints should not be subjected to pressure until tightening is complete. If care is taken in making joints, and in handling the gasket, it is possible to break and remake a joint several times, using the same gasket.

v. For making leak proof and good gasket joints, it is necessary that uniform pressure is achieved all over the gasket after matching rims/ flanges have been clamped with bolts/studs.

Following instructions be followed for proper tightening of bolts/studs.

a) Tighten lightly the bolts/studs diagonally in the sequence as shown in the fig. 2.6.

b) Tighten again bolts/studs in the same sequence with the torque given below :

Bolt Stud Size	Max Toque in Kg.m		
	IS 1367 Cl. 4.6	IS 1367 Cl. 8.8	IS 1367 Cl. 12.9
M 10	3	5	8
M 12	5	9	14
M 16	12	23	35
M 20	12	47	69
M 24	17	81	119
M 27	23	117	172
M 30	28	160	234

In case of metallic stoppers tighten until metal to metal contact is achieved.

c) Do not overtighten, otherwise gasket will get crushed.

2.9 WELDED COVER (IF APPLICABLE)

In order to obtain a good sealing between the transformer tank and the cover a welded joint is recommended. The welding is performed in a certain way to permit opening and new welding repeated a number of times. The chiselling up and re-welding will take about the same time as dismantling and reassembling of bolted cover.

If the welded cover for any reason has to be removed proceed as follows:

2.9.1 OPENING THE COVER

When opening the cover the welding joint should be removed by a suitable grinding wheel. The cover should be clamped to the frame by means of G-clamps to prevent iron chips from penetrating into the tank. Any parts of the weld which may possibly remain on the tank flange should be removed by a chisel to enable a good result of the re-welding.

2.9.2 RE-ASSEMBLY

When fitting the cover again cork-rubber gaskets, 25 x 5 or as specified are fitted on the tank flange, see fig. 2.7.

The gaskets are kept in the correct position with glue base on rubber base. The cover should be clamped to the tank flange by means of G-clamps evenly distributed along the flange with about 600 mm spacing. Tack welding is carried out with about 100 mm spacing. An extra G-clamp is used during the tack welding and is moved along the flange during the progress of the work. The continuous weld is then applied. Finally the weld should be cleaned and painted.

WARNING

When welding, a fire-extinguishing equipment should be available, and the work supervised by fire-protection personnel.

2.10 EARTHING OF ACTIVE PART AND CORE INSULATION TEST

2.10.1 REACTORS

The ground-connection terminals for the reactor active part are located in a box at the tank end, close to the bottom. Please see fig. 2.8.

The terminals are protected by a cover. The cover can be removed with the tank oil-filled.

The terminal box contains a terminal block with three terminals.

- The terminal marked CL is connected to the core laminations.
- The terminal marked CC is connected to the core clamps.
- The terminal marked G is connected to ground (the tank).

For the core-insulation test, remove the cover. Disconnect the closing link that connects the two terminals CL-G. Use preferably 1000V mega direct voltage between CL and CC + G. The tank shall be grounded during the test. The insulation value after

1 min. test- time shall be minimum 1000 k-ohms. There is no general requirement on the insulation level CC-G .

2.10.2 TRANSFORMERS

For checking core insulation in case of transformers refer Fig. 2.9 for connection details.

2.11 TOUCH-UP PAINTING

2.11.1 PURPOSE

A basic principle at touch-up painting should be to restore a damaged paint coat on a surface to the same quality and finish as of the surrounding surface. The touch-up painting should be limited to a surface as small as possible.

2.11.2 CLEANING

Both damaged and surrounding surface should be cleaned so that all grease, dust and other impurities will be removed.

2.11.3 GRINDING OF DAMAGES

Large damages and defects are ground by means of a coarse abrasive paper, e.g. No.100. The surface is then ground with a finer paper in connection with the damage, e.g. 150 or 180. Damages that are limited to the paint coat only should be ground off completely at which glazing can be avoided.

2.11.4 FINISHING PAINT

Two coats of finishing paint should be applied as per specification which is generally light grey shade No.631 of IS: 5. Please refer Table 2.4 for suppliers reference.

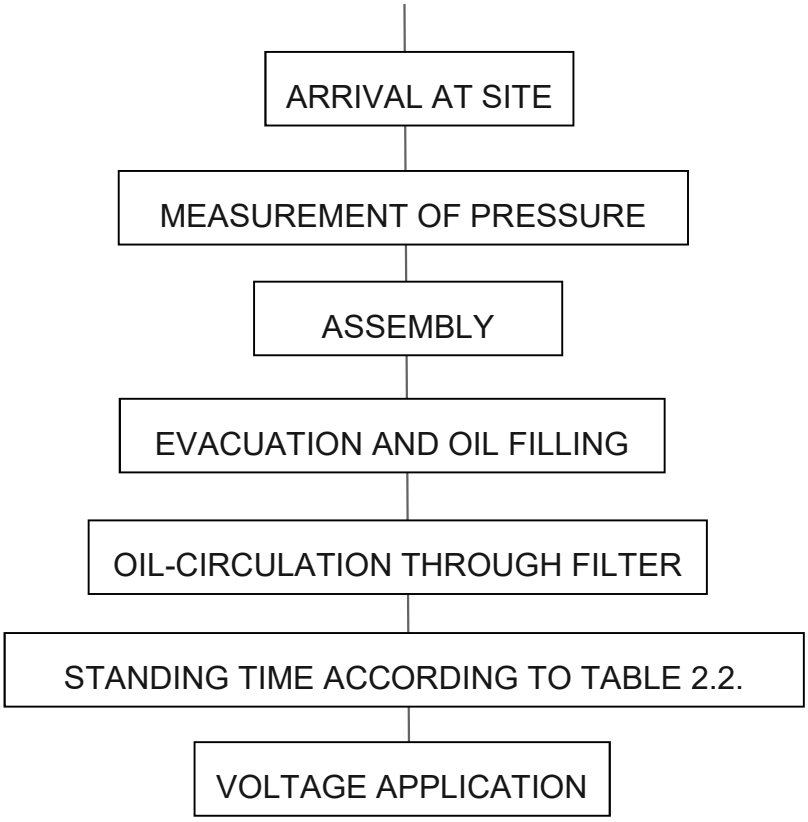
TABLE 2.4

Paint Make	Internal Surface	External Surface		
Asian	APCODUR CF699 WHITE	APCODUR RAPID RECOAT ZP PRIMER GRAY	APCODUR RAPID RECOAT HB MIO	APCOTHANE CF678
Akzo Nobel	INTERLINE 1012 WHITE	INTERGUARD 251	INTERGUARD 966	INTERTHANE 990
Jotun	PENGUARD HB WHITE	PENGUARD HSP ZP	PENGUARD MID COAT MIO	HARD TOP XP
Ching	CHING EP EMC 182 WHITE	CHING EP PRIMER EMD 183	CHING EP MIO EMD 30	CHING EP TOP COAT ADD47

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ANNEXURE 2.1

FLOW CHART FOR HANDLING



Relationship between different units

1 bar = 10^5 Pa = 750 Torr = 14.5 psi = 1.02 kg/sq.cm

1 Torr = 1.33 mbar = 0.133 kPa

1 kPa = 10^3 Pa = 10 mbar = 7.501 Torr

1 MPa = 10^6 Pa

Force

1 kp = 9.807 N

Volume

1Liter = 0.26 US gallons

1 US gallon = 3.781Liters

1Liter = 0.22 Imp gallons

1 Imp gallon = 4.551Litres

Temperature

C = 5 x (F-32)/9

F = 9 x (C+32)/5

ANNEXURE 2.2

EQUIPMENT FOR OIL-FILLING UNDER VACUUM

i. High-vacuum 2 stage oil filtration plant provided with thermostat controlled

ii. oil heaters and vacuum-proof hoses with independent vacuum pumping system for tank evacuation. Capacity: 6000 LPH

iii. Oil-storage tanks provided with silica-gel breathers and inlet/outlet valves for oil circulation. Recommended capacity 20 kL -30 kL (Clause2.4)

iv. Vacuum gauges provided in filtration plant.

v. Equipment for measurement of electric strength (BDV) of oil- 100 kV set.

vi. Equipment for moisture content of oil.

vii. Equipment for measurement of Resistivity and Tan delta at 90°C .

viii. Oil-sampling cans or bottles.

ix. Transparent vacuum-proof tubes for checking of oil-level during oil filling.

x. Valves, fittings, gaskets etc.

xi. Dry nitrogen cylinders.

1) HAULAGE HOLE
2) JACKING LUG
3) JACK
4) RLY. WELL WAGON
5) 90 LB. RAIL - 90
6) SUPPORTS TO PREVENT SLIPPING
7) GROUND LEVEL
8) THESE SLEEPERS WILL BE PUT AT SITE AT THE TIME OF UNLOADING

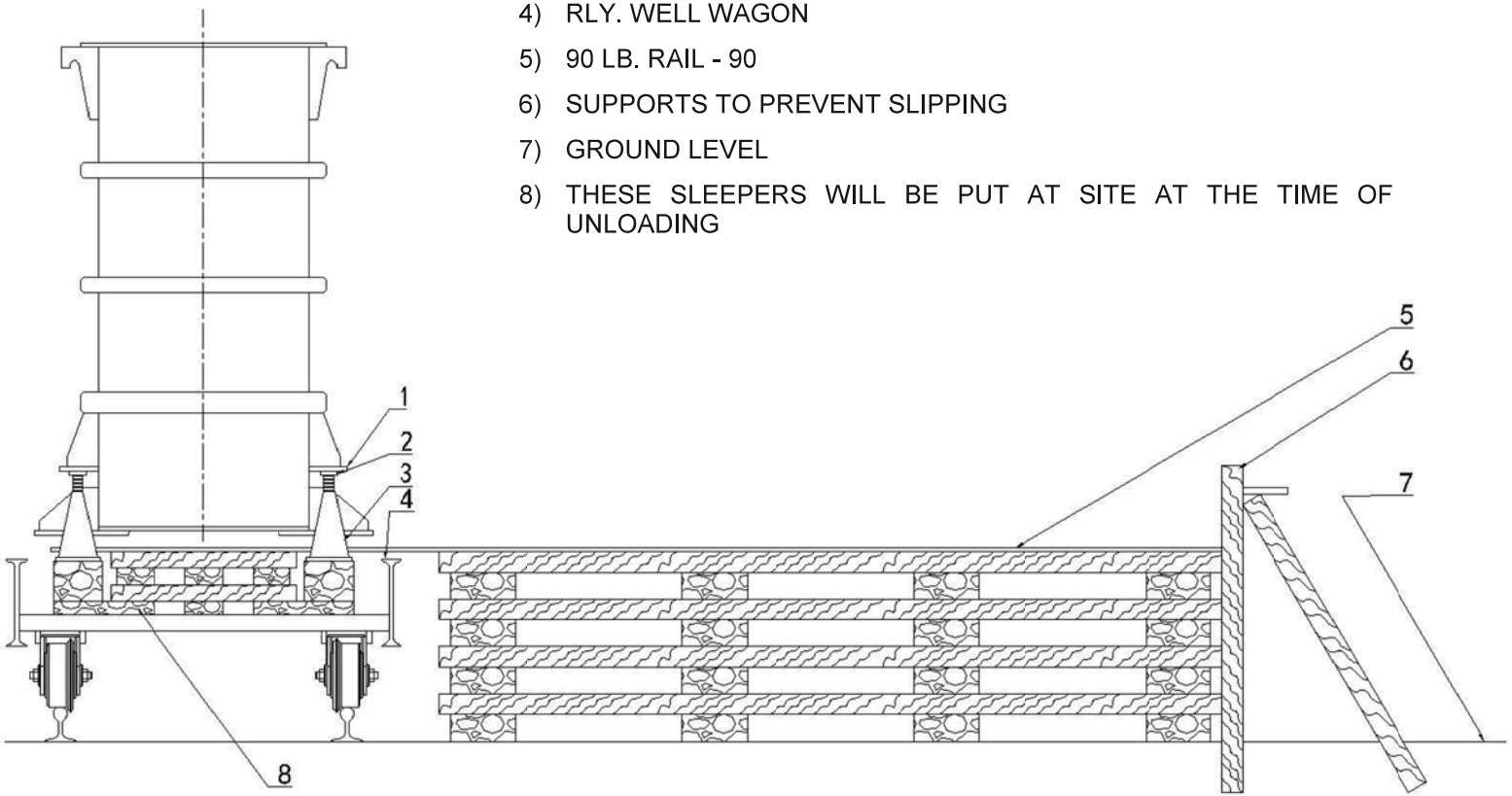


Fig. 2.1 Typical Unloading Arrangement of the Transformer

14.7.3 Field Tests

All field tests including tests during installation, pre-commissioning, commissioning, performance and field acceptance tests shall be conducted by the Contractor, in the presence of representative of the Employer.

Procedure to be adopted for conducting the operational, pre-commissioning, commissioning, performance and field acceptance tests shall be submitted well in advance, at least six (6) months before start of relevant testing.

14.7.4 Tests during installation and pre commissioning & Commissioning

At least following tests shall be performed by the Contractor:

- Correctness of interconnections between CTs, CVTs and PTs as well as CT groups and associated relays,
- Testing, calibration and adjustment of protection relays,
- Check of functional characteristics of each of the electrical protections,
- Check of tripping sequence,

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- Check of orders issued by each of the protections with respect to the corresponding tripping sequence,
- The systematic testing of the operation of each chain forming the protection, the associated tripping sub-assembly, the links to the connected systems and all fault simulations by test kit for which the system is to react,
- The co-ordination of protection and relay setting,
- The testing of the protection system behavior during failure of one of its components,
- The testing of the protection system behavior in the event of failure of one of the connected system to which it is connected,
- Analysis of information consistency and of alarms supplied by protection system.
- Manual Injection System
- The final co-ordination of protection and final relay setting

Checks shall be made after the protection systems have been commissioned to ensure that all connections and test links have been replaced and test leads removed and relay setting has been done, as well as to confirm the integrity of the current transformer circuits. Where necessary, voltage readings shall be taken at the terminals on each relay to ensure that loop connections between the relays are complete.

14.7.5 Performance testing

If nothing unusual has been observed in load run and load rejection tests, the test service period of 72 hours shall follow. During this test service period, the unit must operate continuously at rated condition without any interruption except of those beyond the control of the Contractor. However, such interrupted period shall not be counted for in the test service period. There should be one month reliability run of the complete unit reckoned from the date of taking over by employer. During reliability run, machine shall be operated by employer and any problem observed during this run shall be attended by the contractor including replacement of components and providing requisite manpower.

14.8 PACKAGING, HANDLING AND SITE STORAGE

The Contractor shall pack all the consignment in sea worthy packaging strong enough to withstand rough handling during transit. Machine surface shall be suitably protected against scratches, corrosion, shocks, impact etc. Packages shall be suitably and distinctly identified for type of handling and kind of storage.

Electronic equipment shall be packaged, shipped and stored in anti-static packing. All packages shall be stored indoor. Packages containing electronic equipment shall be stored in humidity controlled environment.

14.9 SITE INSTALLATION AND COMMISSIONING

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14.9.1 General

The Contractor has to do all the work related to assembly, erection, testing and commissioning complete in all respects. All necessary tools, plants, labour, materials including consumables for performing installation, testing and pre-commissioning shall be provided by the Contractor.

The Contractor shall submit the necessary data/information, layout and foundation/support drawings well in advance. The Contractor shall provide and install the concrete inserts/embedment; support steels and/or components for foundation/supports purpose as per approved erection drawings and coordinate the activities with civil contractors to keep his activities in synchronism with civil work. All installation for foundation shall be verified and accepted by the Engineer.

The Contractor shall use anchor fasteners for installation of fixtures, mountings, conduits, cabling, panels etc. Chipping of concrete and/or taking support from reinforcement bars shall not be allowed.

The Contractor shall supply sufficient number of erection and commissioning spares based on their experience so that erection, testing and commissioning work progresses smoothly and is not hampered for want of such spares. These spares shall be in addition to the spare parts described under clause "Spare Parts".

14.10 TOOLS AND INSTRUMENTS

14.10.1 Tools for erection and Installation.

The Contractor shall bring his own tools, devices, testing instruments / equipments to site in order to erect and install the complete equipment delivered under this section. These shall remain the property of the Contractor unless otherwise agreed to take over any / all of these at mutually agreed conditions.

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15.7.3 Field Tests

15.7.3.1 After installation at site and after finishing all cabling works, the contractor shall verify all process signals and process interface. All control commands shall be executed and real process contacts and variables shall be checked.

15.7.3.2 Once all above checks (dry tests) have been realized, all system tests/functional tests shall be repeated with units, switchgear etc. in operation.

15.7.4 Performance testing

If nothing unusual has been observed in load run and load rejection tests, the test service period of 72 hours shall follow. During this test service period, the unit must operate continuously at rated condition without any interruption except of those beyond the control of the Contractor. However, such interrupted period shall not be counted for in the test service period. There should be one month reliability run of the complete unit reckoned from the date of taking over by employer. During reliability run, machine shall be operated by employer and any problem observed during this run shall be attended by the contractor including replacement of components and providing requisite manpower.

15.8 PACKAGING, HANDLING & SITE STORAGE

The Contractor shall pack all the consignment in sea worthy packaging strong enough to withstand rough handling during transit. Machine surface shall be suitably protected against scratches, corrosion, shocks, impact etc. Packages shall be suitably and distinctly identified for type of handling and kind of storage.

Electronic equipment shall be packaged, shipped and stored in anti-static packing. All packages shall be stored indoor. Packages containing electronic equipment shall be stored in humidity controlled environment.

The Bidder shall indicate the number of packages of consignment together with the size (LxWx H) and weight for transporting the equipment in the Bidding Document.

15.9 SITE INSTALLATION & COMMISSIONING

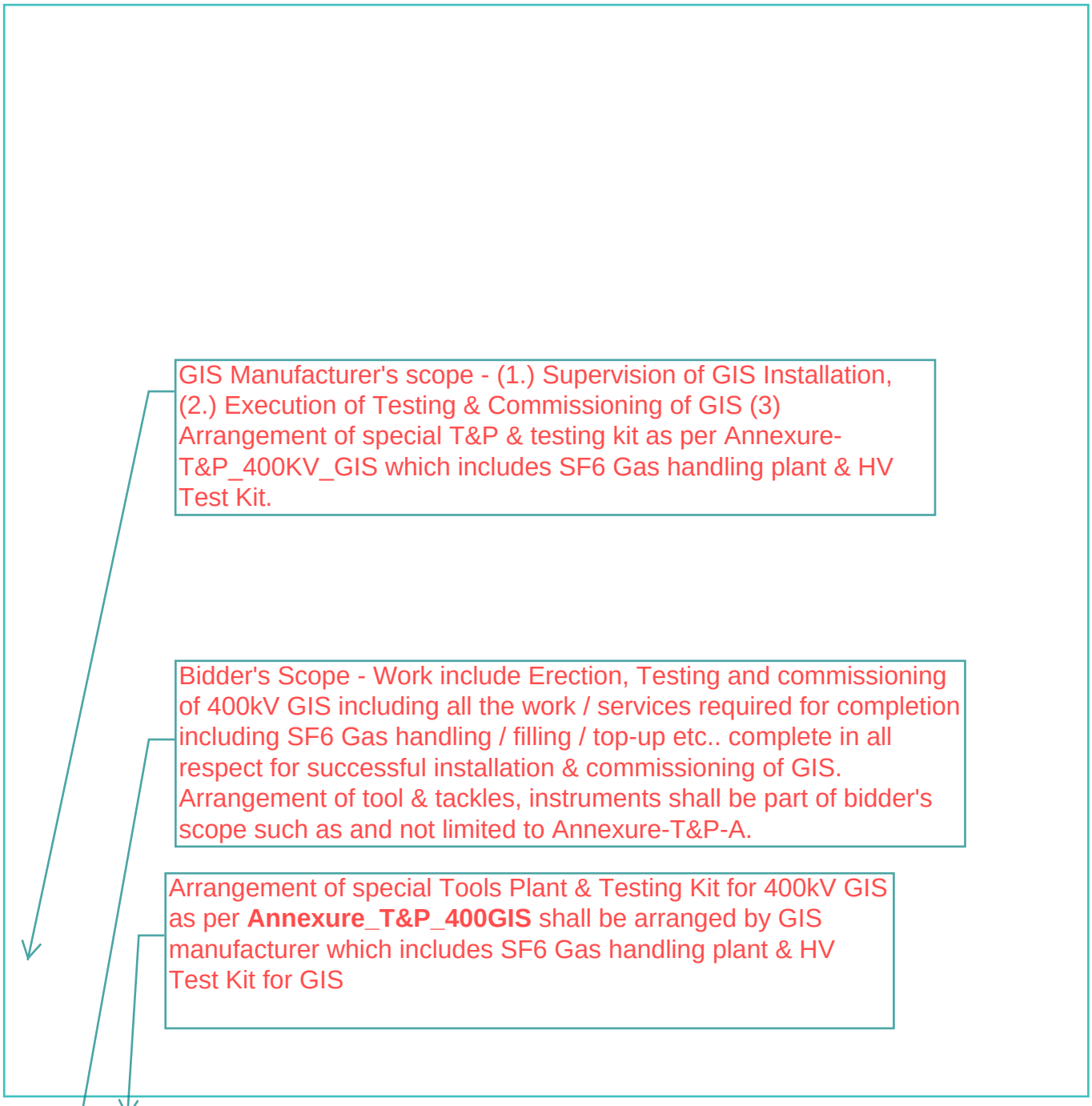
15.9.1 General

The Contractor has to do all the work related to assembly, erection, testing and commissioning complete in all respects. All necessary tools, plants, labour, materials including consumables for performing installation, testing and pre-commissioning shall be provided by the Contractor.

The Contractor shall submit the necessary data/information, layout and foundation/support drawings well in advance.

The Contractor shall provide and install the concrete inserts/embedment, support steels and/or components for foundation/supports purpose as per approved erection drawings and coordinate the activities with civil contractors to keep his activities in synchronism with civil work. All installation for foundation shall be

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16A.7.4 **Field Tests**

From time to time at various stages of erection, tests of sub-assemblies of the equipment shall be carried out as instructed by the purchaser. The Manufacturer shall make records of all measurements and shall make corrections or adjustments as required. A record of all stage tests shall be embodied in a report. These tests shall include, but not be limited to, the following:-

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a) Continuous testing of the properties of SF6 gas through the entire filling period.

b) Testing of all current carrying and ground connections to all conductors and terminal pad, to determine that full clamping pressure is applied to all contact surfaces and all bolted connections are tightly secured with lock washers; testing of all flexible connections to ensure that sufficient slack is available for expansion.

c) Individual inspection of pressure relief devices, density/pressure gauges and all other auxiliary devices to determine their conditions.

d) Check of cabling between apparatus by the Contractor, prior to acceptance tests. Random checks shall be made in the presence of the Engineer.

e) Measurement of the insulation resistance to earth of the various measuring and control circuits. Including cables, instruments and apparatus wherever practical and feasible.

f) Check of all relay settings shall be in accordance with the calculated values and afterwards primary inspection tests by introducing fault artificially wherever feasible, otherwise testing with testing apparatus (simulated method). Primary checking of all tripping circuits.

g) Operating checks of all control, signaling, measurement, metering, recording and interlocking equipment to confirm complete conformity with designed data.

Prior to commencement of these tests, the contractor shall submit a detailed programme. Detailed records, including all details of tests performed and results obtained shall be prepared by the Contractor.

16A.7.5 **Commissioning Tests**

1 On completion of the erection and installation to its satisfaction, the Manufacturer shall give the purchaser a written certificate stating that the equipment has been erected and installed in accordance with the specifications and approved drawings, thus giving notice of readiness to carry out the commissioning tests. The tests, which shall be carried out before the equipment is placed into regular service, shall demonstrate that all guarantees have been met by Manufacturer and, in addition, the entire equipment, including all auxiliary equipment and accessories, are properly erected, installed and correctly adjusted.

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2 The following commissioning tests shall be performed as agreed between Manufacturer and purchaser as per relevant IEC.

a) "High voltage tests for the main circuit and GI bus ducts for one minute power frequency withstand voltage". If any special arrangement is required for performance of this test, the manufacturer shall make such suitable arrangements accordingly.

b) Voltage tests for the auxiliary and control circuits.

c) Tests to verify the resistance of the main circuits.

d) Operation tests for various components.

e) Gas leakage tests.

f) Calibration of SF6 gas pressure/density switches.

g) Measurement of moisture.

h) Evacuation & vacuum risk leak test of all flange connections for GI bus ducts.

i) Partial discharge measurement test.

3 After erection, a test shall be made to prove the absence of dangerous voltages in the enclosure and other metal parts such as pipes and framework

4 Except as otherwise provided hereunder, responsibility for apparatus and test equipment and the control thereof shall be exercised by Manufacturer subject to the overriding control of the purchaser.

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22.1.1.6 Civil works

i) For indoor lighting system (normal / emergency) minor civil works like chipping, drilling etc. shall be in the scope of the contractor. The Contractor shall install the concrete inserts/embedment; support steels and/or components for foundation/supports purpose as per approved erection drawings and coordinate the activities with civil contractors to keep his activities in synchronism with civil work.

ii) For outdoor installation (lighting poles, tower mast, lighting panel etc.), civil work in respect of excavation, refilling, disposal of excavated mug, equipment foundation, panel foundation and other civil work including supply of cement, steel, sands, aggregate, bricks and other material as per specification clause 22.5.10 & any other civil works not specifically mentioned shall be done by the contractor. Further, Design and erection of civil works for outdoor lighting shall also be in the scope of contractor.

22.5.10 Foundation and other Civil Works

Equipment foundations, panel foundation and other civil work including supply of cement, steel and other material as per relevant drawings and specification clauses shall be provided by the Contractor. It shall be the responsibility of the Contractor to check the foundations before commencement of erection to ensure their suitability. All final adjustment of foundation levels, chipping and dressing of foundation surfaces, setting and grouting of anchor bolts, sills, inserts and fastening devices shall be carried out by the Contractor including minor modification of civil work as may be required for erection. Any cutting of masonry/ concrete work, which is necessary, shall be made good to match the original work.

The Contractor shall make the cable trenches for burying cables for lighting poles and lighting mast and other areas as per the specification requirements. The trenches shall be made as per relevant normal standard practices. ~~The Contractor shall submit the drawings showing trench arrangement during detailed engineering for review and approval.~~

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The Contractor shall obtain approval of the Employer before proceeding with any cutting of masonry/ concrete work. The Contractor shall perform all excavation and back fillings required for ground connections and casting foundations. The Contractor shall make use of his own arrangements for pumping out any water that may be accumulated in the excavation. All excavation shall be backfilled to the original level with good consolidation.

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22.7.3 Commissioning Tests

At least following tests shall be performed:

- Verification of electrical continuity between exposed conductive parts and the general earth circuit.
- Blank operational, tests, in co-ordination with other Contractors.
- Testing of main and auxiliary circuit insulation.
- Complete functional testing of illumination system.
- Lux level test in various areas.
-

22.7.4 Performance Testing

After completion of commissioning tests and commissioning of complete system ,the test service period of thirty (30) days shall follow after taking over. During this test service period, the system / installations must perform satisfactorily & if any defects are observed , same shall be rectified by contractor without any financial implication to employer.

Excluding supply of illumination items

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23.7.2 Field test

All field tests including tests during installation. Pre-commissioning, commissioning, performance & field acceptance tests shall be conducted by the contractor, in presence of representatives of the employer.

Test on Rails

i) Leveling and alignment of sole plates
ii) Measurement of span, diagonally, straightness, waviness, (horizontal and vertical) as per approved drawings.

B No-Load Static Tests

i) Checking of gears, bearings, couplings and rotating parts for proper oil level or lubrication and hydraulic brakes for brake fluid

ii) Checking of the controller for each motion to ensure that hook and travel motions is in accordance with marked controller directions.

iii) Checking of satisfactory operation and to determine if lamp fixtures on each bridge walkway are operable and convenient for relamping.

iv) Measurement of throat openings of the hooks &, checking with respect to dimensions furnished by the supplier.

v) Overall inspection & verification of crane dimensions, clearances, hook reaches & other important items.

vi) Verification of insulation resistance for electrical equipment and wiring circuits.

vii) Operational tests on each controller, switch, contactor, relay and other control devices including limit switches.

viii) Operational tests on all protective devices.

ix) Tests for checking correctness of all circuits, interlocks and sequences of operation.

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C No Load Operation Tests

i) Each hoist will be run in both the hoisting and lowering direction for the full length of the hook lift until the limit switches stops travel. Both upper and lower limit switches will be checked for proper setting (for resulting hook elevation and amount of rope remaining on drum after switch stops travel) and operation. The additional liver travel limit switches will also be checked by temporarily by-passing the action of the normal upper limit switch. Each hoist will be checked to determine whether the hooks operate within the specified maximum speed ranges. At least two (2) complete raising and lowering operations will be made for EOT hoist at maximum speed. Proper alignment, quiet operation and any major tendency toward overheating of motors, hearings und gear drives will be checked. Hoist brakes will be checked to determine whether they are functioning properly.

ii) All hook approaches, both the side approaches to the rails and the end approaches to the end walls, will be checked for conformance to approved shop drawings and the requirements of these specifications. The limit switches shall allow the specified hook approaches or better approaches.

iii) The trolley will be run in each direction of travel for at least four (4) complete cycles of trolley travel to disclose any tendency towards noisy operation and misalignment at bearings, gearing or motor. The trolley shall be checked to determine whether the trolley travels at the required speed. The motion of the trolley upon setting the controller to the "off" position shall he checked to determine whether the travel brake correctly stops the trolley.

iv) The bridge drive shall he run in both directions of travel for the full available length of runway. The test will consist of a check for quite operation as well as a check of both the electric and hydraulic brakes. The bridge shall be run at full speed in both directions to determine whether the drive operates within the specified maximum speed range. The electric brake and drift points shall be checked for smooth and effective operation.

D Rated Load Tests

a) Hoist

i) With each hoist loaded with its rated load to tests outlined under *'No-Load Operation Tests"* above shall be repeated except for the additional block-operated over travel limit switch operation need not be rechecked. The operation of the electric hoist brake shall be carefully checked. All components shall he checked for overheating, Operating speed on the maximum speed point shall be checked and recorded. The maximum lowering speed will he checked to ensure that it is not more than 125% of the no-load hoisting speed. The control system will be checked for proper

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operation. The first speed point shall he checked to ensure that it does not exceed 5% of the no-load hook speed in the lowering direction and 25% in either direction. The entire hoist shall be checked for overheating after completing the hoist and lowering cycle with the test load.

ii) The loaded hoist shall be checked to determine whether the hoist control and the solenoid brake satisfactorily control the handling of the load. The hoist must demonstrate its ability to raise, lower and hold the rated load in any position.

b) Trolley Travel

The tests outlined in "No-Load Operation Test- iv)" above shall be repeated for the trolley with the hoists loaded with their rated load.

c) Bridge Travel

The tests outlined in *"No-Load Operation Tests*- iv)" above shall be repeated for the main hoist loaded with their rated load.

E **Overload Tests**

a) Hoists

With each hoist loaded with 125% of rated load, the hoist will be checked to determine whether it can raise, lower or hold the overload in all speed positions without a drift. Each hoist will be checked to determine that the load shall not lower on any hoisting position. The throat openings of all hooks will be remeasured and recorded after the overload test and compared to the initial measurements to be checked for deformation.

b) Bridge

The: bridge structure shall be checked for excessive deflection while loaded with125% of their rated capacity with the trolley at the center of the crane span.

c) Travel

No trolley or bridge travel shall be required during overload tests.

F **Test Load Frames**

a) The supplier shall design, submit shop drawing, manufacture and deliver suitable cradle or a test load frame and all required slings to be used for the rated load and overload tests on each of the cranes to be furnished. The test loads will be made up of steel test weights or any other suitable material and shall be arranged by the contractor including all logistics and transportation. Standard sizes of semi finished steel ingots or slabs can be used as test weights.

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b) The powerhouse crane shall be completely tested as described above, including the rated load test and the overload test. Test load frames shall be provided for all the Load test required such as the testing of the tangs of sister hooks and centre pin holes in sister hooks. Each crane shall have its hooks tangs tested first for the rated load test.

c) The test load frames shall be designed to support a sufficient quantity of steel or concrete test weights for the required load tests. The design of the frames shall make allowances for varying heights as well as for other possible deviations in the overall dimensions of the steel test weights, The test load frames shall he designed at the same stress levels us the crane structure.

d) All pins or other devices for attaching the frames to the hooks and slings and other required accessories for all required tests shall be provided.

e) The test load frames shall be shop assembled to assure proper fit during field erection

f) All structural components of the test load frames shall be cleaned and painted with one coat of primer.

g) The following tests shall be carried at site in addition to the tests indicated above

A **De-Energized Tests:**

i) During commissioning at site

B **Deflection Test**

Deflection of girders with full loads on all cranes to be determined using theodolite or other optical instrument after load has been applied for 15 minutes.

C Tandem operation test for Power house crane including anti-collision test.

i) Electrical and mechanical interlock checking
ii) Movement checking with tandem beam

23.7.4 Performance testing

After completion of commissioning tests and commissioning of respective cranes, these shall remain in the contractor's custody for erection activities till the commissioning of last generating unit. The contractor shall be responsible for maintenance (providing manpower, consumable, spares etc.) of EOT Cranes including rails and operator during this period.

The contractor shall make good any damages and do the capital maintenance

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of cranes at the time of commissioning of the last unit.

If nothing unusual is observed after capital maintenance, the test service period of seven days shall follow. During the test service period, the cranes must perform satisfactorily.

The contractor is responsible for the equipment during the test service and also for the way it is operated. However, Employers' personnel shall operate the equipment under the guidance during the test service period

During this test service period, the system / installations must perform satisfactorily & if any defects are observed , same shall be rectified by contractor without any financial implication to employer.

23.8 PACKAGING, HANDLING & SITE STORAGE

The contractor shall be liable for all packing, handling and site storage of all the equipment till the installation is handed over to the Engineer in charge.

23.9 SITE INSTALLATION AND COMMISSIONING

23.9.1 General

The Contractor has to do all the work related to assembly, erection, testing and commissioning complete in all respects. All necessary tools, plants, labour, materials including consumables for performing installation, testing and pre-commissioning shall be provided by the Contractor.
The Contractor shall ~~provide and~~ install the concrete inserts/embedment; support steels and/or components for foundation /supports purpose, shall do any chipping / leveling works , denting / painting etc.

23.10 TOOLS AND INSTRUMENTS

23.10.1 Tools for erection and Installation.

The Contractor shall bring his own tools, devices, testing instruments / equipments to site in order to erect and install the complete equipment delivered under this section. These shall remain the property of the Contractor ~~unless otherwise agreed to take over any / all of these at mutually agreed conditions.~~

23.11 SPARE PARTS

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24.7.4 **Field Tests**

All field tests including tests during installation, pre-commissioning, commissioning, performance and field acceptance tests shall be conducted by the Contractor, in the presence of representative of the Employer. The field tests shall be in accordance with, but not limited to, NFPA Standards. If the system shall be tested in sections, the same applies for each section. Any defects or leaks disclosed in the tests shall be duly mended/ repaired to meet the desired function.

24.7.5 **Tests during installation and pre commissioning**

The tests at site should at least include the following. The tests for the piping system shall be completed prior to installation of the equipment in the pipes:

- Hydrostatic pressure tests of the whole piping system,
- Pressure-flow tests on water distribution system and supplies,
- Leakage test,
- Test for value of insulation as per relevant Indian/ international standards,
- Test for sensitivity range of all types of sensors/detectors,
- Calibration of the aspirator/ air sampling type smoke detectors and other detectors,

Technical Specification of Arun 3 ETC Tender

- Circuits and equipments shall be properly protected against the possibility of induced transients,
- The power supply shall be equipped with locking mechanism and marked in red with proper identification,
- Before installation all system components shall be checked for cleanliness and after installation, the systems shall be effectively flushed out with clean water and filled up for testing before the nozzles and discharge horns are fitted.

24.7.6 Commissioning tests

Powerhouse functions that shall be initiated or controlled during a fire alarm condition and shall have, but shall not be limited to, the following operations in accordance with relevant safety and installation codes/standards:

- Verification of performance of suppression system, detectors of all types including aspirator type smoke detectors, notification devices, control system etc. for the specification intended,
- Elevator operation/recall,
- Operation of exit doors and release of fire and smoke dampers,
- Monitoring and initiation of self-contained automatic fire extinguishing systems and equipment,
- Control of powerhouse HVAC equipment to provide smoke control,
- Control of process, data processing and similar equipment as necessary during fire alarm conditions.

The power plant fire alarm system must be in any case, ready for operation prior to the commissioning of the first generating unit.

24.7.7 Performance testing

After completion of commissioning tests and commissioning of complete system ,the test service period of thirty (30) days shall follow before taking over. During this test service period, the system / installations must perform satisfactorily & if any defects are observed , same shall be rectified by contractor without any financial implication to employer.

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25.7.3 Field tests

25.7.3.1 Test during installation and pre commissioning

At least following tests shall be conducted during installation and pre commissioning:

i) Dielectric and insulation resistance on all electrical circuits

ii) Tests to verify electrical ratings

iii) Functional tests on panels

iv) Checking of various sizes of ducts (dimensional checks)

v) Fixing of ducts supports as per drawing.

25.7.3.2 Commissioning tests

At least following tests shall be conducted during commissioning:

i) General running test
ii) Leakage test
iii) Checking of air velocity at different locations
iv) Checking for abnormal noise and vibration
v) Capacity rating test
vi) Power consumption test
vii) Functional test of Air Conditioner in respect of temperature and humidity.

25.7.4 Performance Testing

After completion of commissioning tests and commissioning of complete system (ventilation and air conditioning), the test service period of thirty (30) days shall follow before taking over. During this test service period , the system / installations must perform satisfactorily & if any defects are observed , same shall be rectified by contractor without any financial implication to employer.

Technical Specification of Arun 3 ETC Tender

Bidder's Scope of Arrangement, Manpower & Tools for GIS

Required Things from PGHV- Services on Day one at Site

- All approved Drawings
- Tool Container equipped with all tools in working conditions as per packing List

A) GIS Hall Checking's—Bidder scope

- Lockable Doors (2 no's one for personnel's/manpower & another for GIS equipment Entry)
- All checking's as per acceptance of Building and yard foundations
- All cable trench has to be covered with clean checker plates.
- All cutouts/ wall openings inside the GIS Hall has to be covered.
- All earthing riser as per GIS earthing layout.
- X-axis and Y-axis marked on floor as per GIS civil drawing.
- Overhead Cranes (EOT) ready with Load test report, operation check for all directions complete.
- Illumination of GIS hall ready as per check list (200 Lux)
- AC Supply should ready and DG set for Backup Power Supply only.
- Rotary Crane (with Load Test certificate).
- Hydra (with Load Test Certificate).

B) Materials Required for GIS Supervisor for working at site - Lockable Office. by Bidder

- Office Chairs - 2 no's
- Visitors Chairs - 4 no's
- Office Tables with drawer - 2 no's
- Water bottles – 4 no's
- Water container – 2 no's (one for GIS supervisor and another for Manpower)
- Door mat – 4 no's
- Metallic Rack (3.5mx2.5mx3m) – 4 no's
- Lockable Selfes (Godrej) – 2 no's
- Metallic rack (900cm x 250cm) – 2 no's
- Work table – 2 no's big
- Work table – 1 no small
- Work table for bending tool- 1 no
- Box for hardware parts – 2 no's

C) Manpower, Tools, Equipment and accessories requirement from Bidder

- Man power – as per schedule for each site (1foreman, skilled person, semi-skilled, electrician & helpers. Separate scaffolding gang all as per schedule)
- Pallet Trolley – 2 no (1.5 to 2 tons capacity)
- Clean scaffolding with steel grill platforms as per site requirement.
- Grinding M/c – 1 no (as per requirement)
- Cutting M/c for Earthing strip – 1 no (as per requirement)
- Stand Drill m/c with bits 4mm to 16mm– 1no (as per requirement)
- Vacuum cleaner normal for coupling job – 2 no's
- Iso Propyl Alcohol – as per required

- Cleaning cloth roll – 50metrs * 1metr – 1 no.
- Tarpaulin – As per requirement
- Nails – 1, 1.5 & 2 inch for making some temporary wood support
- Mini Hydraulic crane jack – 2 no's
- Box opening tools & wood saw
- Bench Vice - 1 Nos
- Nitrogen gas in bottles – 100kg
- Plastic Bucket – 4 no's for carrying tools
- Plumb & thread – 4 no's

D) Requirement Inside GIS Hall. by Bidder.

- First Aid box – 1no.
- Fire extinguisher.
- Stickers indicating first aid box and fire extinguisher
- Floor vacuum cleaner high capacity – 1 no.
- Wet mop cleaner – 1 no's
- Insect repellent – spray & Mat
- Washing powder / Buckets & cleaning rags.
- Emergency light – 1 No.
- Floor mat for de-dusting shoes – 2 No's
- Pedestal fans / Room heaters – 2 no's.
- 63amps Industrial power socket – 2 no's. or as per requirement
- 5amps & 15amps power socket- 4 no's. or as per requirement

E) GIS –Tools to be arranged by Bidder

- 3 ton jack hydraulic/screw type - 2 Nos.
- Sledge hammer - 2 Nos
- Claw hammer - 2 Nos
- Hammer 5 KG - 1 Nos
- Wrecking bar long - 2 Nos
- 12 mm screw driver - 4 Nos
- 8 mm screw driver - 4 Nos
- 10 mm long Allen key - 2 Nos
- 8 mm long Allen key - 2 Nos
- 1.5 to 12mm Allen key - 2 set
- 5mm to 30mm open spanner - 2 set
- 5mm to 30mm ring spanner - 2 set
- Wood saw - 2 Nos
- Hack saw frame – 2 Nos
- Hack saw blade - 12 Nos
- Floor drilling machine with bits 4mm to 12mm - 1 Nos
- Metal drilling machine with bits 4mm to 16mm - 1 Nos
- Files round all size - 1 set
- Files Flat - 1 set
- Files Half round - 1 set
- Nose pliers - 2 Nos

- Cutting pliers - 2 Nos
- Box spanner ratchet set from 8mm to 30mm - 2 set
- Measurement tape 5 meters - 4 Nos
- Measurement tape 50 meter - 2 Nos
- Screw drivers
- Crimping tools
- Soldering iron
- Ferule printing machine
- Hole lever (tammy rod) - 4 Nos
- Wire brush - 4 Nos
- Knifes - 4 Nos
- Scissors - 2 Nos
- Side cutter - 2 Nos
- Monkey pliers - 2 Nos
- Rechargeable Torch light - 2 Nos
- Bench Vice - 1 Nos
- Cir clip pliers inner and outer small and big each one
- Right angle/Try square small - 1
- Right angle/Try square big - 1
- Tap & Die set - 1 full set from 10 to 16 MM.
- Curved jaw locking pliers - 2 Nos
- Mason level – 1 no.
- 0.75, 1.5 & 3 Ton chain block – each 2 numbers.

Verification before handing over of GIS building

A) Safety: -

- Health and Safety Checkings
- Approved Method statements
- Approved Risk Assessments
- EOT crane Test load Certificate
- Hydra checklist
- Hydra Load Test certificate
- Rotary Crane Check list
- Rotary crane Load Test Certifiacte
- First Aid Kit
- Fire Extinguisher
- Organizations Charts
- Emergency contact Numbers
- All Slings Calibrations Reports
- Work Permits

B) Storage Conditions: -

- Ensure Availability of all boxes (Check all boxes physically as per packing list)
- All Bay/GIS modules boxes needs to be stored in shed hall
- Ensure there should not enter any water/moisture contents inside the storage area
- Steel Support structure can be stored in outdoor ground
- Check the Shock indicators conditions on VT/CB/GIS Bus duct (if any)

Bidder's Scope of Arrangement, Manpower & Tools for GIS

- Accessories/customer data/ spares boxes conditions

C) Tools: -

- Availability of all tools inside the tool container as per tool container packing list
- Availability of product specific special tools
- Availability of all tools as per above points **GIS**
- Calibration of all slings provided
- Calibration of Jacks provided
- Calibration of any kits provided

D) GIS Building

- Compact and secured Road Access from storage area to GIS Building
- If storage area is far away from GIS Building Required to arrange trailer for shifting (Shifting is in customers scope)
- GIS Building shutter Dimensions must be as per Drawing
- All cutouts/ wall openings inside the GIS Hall as per drawing and covered
- All earthing riser as per GIS earthing drawing.
- X- Axis and Y- axis as per civil drawings.
- Overhead Cranes with Load test report and Proper movements in all Directions(up, down, north, south, east & west)
- Sufficient Lights in GIS hall (200 Lux as per check list)
- AC Supply available and DG set for Backup Power Supply.
- Epoxy Coating complete.
- GIS Hall Cleaning (At least 2 person will all time dedicated do the cleanings)
- Customer Provided C-Channels dimensions and positions should be as per drawing.
- Customers C-channels levels should have Zero-zero level
- Customers Cable Trench positions and dimensions should be as per drawing
- Building Dimensions should be as per Drawing
- 2 no's of Door with proper lockable

General Tools to be arranged by ETC Contractor (Bidder)

General Electrical Loose tools

sl.	Tools details	quantity
1	Crosss-slot screwdriver s."Ph"0	4
2	Crosss-slot screwdriver s."Ph"1	4
3	Crosss-slot screwdriver s."Ph"2	4
4	Crosss-slot screwdriver s."Ph"3	4
5	Screwdriver SZS 0.6 X2.5	4
6	Voltage tester	4
7	Screwdriver insulated PB105-0	4
8	Screwdriver insulated PB105-1	4
9	Screwdriver insulated PB105-2	4
10	Screwdriver insulated PB105-3	4
11	Screwdriver insulated PB105-4	4
12	Screwdriver insulated PB105-5	4
13	Screwdriver insulated PB105-6	4
14	Crosss-slot screwdriver s."Ph"0	4
15	Crosss-slot screwdriver s."Ph"1	4
16	Crosss-slot screwdriver s."Ph"2	4
17	Crosss-slot screwdriver s."Ph"3	4
18	Crosss-slot screwdriver s."POZ"0	4
19	Crosss-slot screwdriver s."POZ"1	4
20	Crosss-slot screwdriver s."POZ"2	4
21	Crosss-slot screwdriver s."POZ"3	4
22	Bit holder PB6510 A-20	4
23	Bit holder PB6510 A-100	4
24	Crosss-slot screwdriver s."POZ"2	4
25	Crosss-slot screwdriver s."POZ"3	4
26	Offset screwdriver 2	4
27	Offset screwdriver 3	4
28	Offset screwdriver 4	4
29	Offset screwdriver 5	4
30	Offset screwdriver 6	4
31	Screwdriver short 3	4
32	Screwdriver short 4	4
33	Screwdriver short 5	4
34	Cable knife 180/60	4
35	Sheating	4
36	Cable knife "Jokari 28H/G"	4
37	Cable knife "COSSONAY"	4
38	Testbuzzer "QUICKTEST"	1
39	Batteries1.5V "LR6"	2
40	Test lead "ML100" Black	2
41	Test lead "ML100" Red	2
42	Test pick KLEPS 250 Black	2
43	Test pick KLEPS 250 Red	2
44	Alligator clip 4mm Black	2
45	Alligator clip 4mm RED	2
46	Testing rod PRUEF 2S Black	2
47	Testing rod PRUEF 2S red	2
48	Digital Multimeter	2
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	General Mechanical Loose Tools	
sl.	Tools details	quantity
1	Compass"200"	2
2	Scissor "180mm"	4
3	Scriber with exchanged point	2
4	Inspection mirror "20" small with extension	2
5	Flat brush 25	2
6	Watchmakers- screwdriver 115	2
7	Ball -point hex key 4	2
8	Ball -point hex key 5	2
9	Ball -point hex key 6	2
10	Ball -point hex key 8	2
11	Ball -point hex key 10	2
12	Precision square 150X100	2
13	Precision square with stop	2
14	Measuring tape 50M	2
15	Vernier Caliper 150mm(1/20)	2
16	Folding rule	2
17	Measuring tape 5M	4
18	Rule of stainless steel "300"	2
19	Aluminium Level "400"	2
20	Thickness gauge 0.05-1mm	2
21	Set of allen keys 1.5-10mm(Standard)	2
22	Set of allen keys 1.5-10mm(Ball Type)	2
23	Setof allen keys "TORX" T 7-25	2
24	Hex key bit 1/2" K-Inbus 5mm	2
25	Hex key bit 1/2" K-Inbus 6mm	2
26	Hex key bit 1/2" K-Inbus 8mm	2
27	Hex key bit 1/2" K-Inbus 10mm	2
28	Hexagonhead socket wrench 6	2
29	Hexagonhead socket wrench 8K	2
30	Hexagonhead socket wrench 10	2
31	Set of extractors "1-5"	2
32	Wood chisel "BAHCO" 25mm	2
33	Scraper 30	2
34	File handle Gr.5	2
35	Plain Scraper HM 300X20mm	2
36	Pointed chisel 250mm	2
37	Three squer hollow scraper	2
38	Rachet tap wrench 85-19	2
39	Rachet tap wrench 100-25	2
40	Parallel pin pun 1- 10mm	2
41	Center punch 2 (100-40)	2
42	Center punch 2 (125-65)	2
43	Flat Chisel 120-10	2
44	Flat Chisel 125-18	2
45	Flat Chisel 250-28	2
46	Sharpening stone 150X50X25mm	2
47	Solder wire pocket pack 1.3mm	2
48	Countersink head Zyl.90' 23	2
49	Drilling tool UNIBIT 6-18mm	2
50	Drilling tool UNIBIT 20-34mm	2

51	Circular grease "ZINKOL"	**2**
52	Hexagon- die M16	**2**
53	Hand taps M16	**2**
54	**Marking line 30M**	**2**
55	**Powdered marking chalk Blue"3**	**2**
56	Set of Stone drills 4-12	**2**
57	Parallel pin punch set PB755-B	**2**
58	Combination wrench 17	**4**
59	Combination wrench 18	**4**
60	Combination wrench 19	**4**
61	Combination wrench 22	**4**
62	Combination wrench 24	**4**
63	Combination wrench 27	**4**
64	Combination wrench 5.5	**4**
65	Combination wrench 6	**4**
66	Combination wrench 7	**4**
67	Combination wrench 8	**4**
68	Combination wrench 9	**4**
69	Combination wrench 10	**4**
70	Combination wrench 11	**4**
71	Combination wrench 12	**4**
72	Combination wrench 13	**4**
73	Combination wrench 14	**4**
74	Combination wrench 15	**4**
75	Combination wrench 16	**4**
76	Double open -end spanner 12 X13	**4**
77	Double open -end spanner 14 X15	**4**
78	Double open -end spanner 17 X19	**4**
79	Double open -end spanner 16X18	**4**
80	Double open -end spanner 18 X21	**4**
81	Double open -end spanner 22 X24	**4**
82	Double open -end spanner 27 X30	**4**
83	Double open -end spanner 30 X32	**4**
84	Open ring wrench 22/24	**2**
85	Rachet spanner "RG"16mm	**4**
86	Rachet spanner "RG"17mm	**4**
87	Rachet spanner "RG"18mm	**4**
88	Rachet spanner "RG"19mm	**4**
89	Rachet spanner "RG"10mm	**4**
90	Rachet spanner "RG"13mm	**4**
91	Ring wrench 18mm	**4**
92	Ring wrench 19mm	**4**
93	Ring wrench 24mm	**4**
94	Ring wrench 30mm	**4**
95	Ring wrench 36mm	**4**
96	Taper sleeve I 1/4"-A 3/8"	**4**
97	Taper sleeve I 3/8"-A 1/4"	**4**
98	Taper sleeve I 3/8"-A 1/2"	**4**
99	Taper sleeve I 1/2"-A 3/8"	**4**
100	Taper sleeve I 1/2"-A 3/4"	**4**

101	Taper sleeve I 3/4"-A 1/2"	**4**
102	Open -end wrench 18mm	**4**
103	Open -end wrench 19mm	**4**
104	Open -end wrench 24mm	**4**
105	Socket wrench long 1/2" 18 mm	**4**
106	Socket wrench long 1/2" 19 mm	**4**
107	Socket wrench long 1/2" 24 mm	**4**
108	Socket wrench long 1/2" 30 mm	**4**
109	Socket wrench long 3/4" 36 mm	**4**
110	Socket wrench long 3/4" 40 mm	**4**
111	Adjustable wrench 150mm/6"	**4**
112	Adjustable wrench 250mm/10"	**4**
113	Adjustable wrench 300mm/12"	**4**
114	Square file HS 250	**4**
115	Three square file HS 250	**4**
116	Rasp"Half round "250mm	**4**
117	Rasp" round "250mm	**4**
118	File handle Gr.5	**4**
119	File brush 25	**4**
120	Set of 12 needle- files 180mm	**4**
121	Round file S 150	**4**
122	Round file Hs 200	**4**
123	Round file B 250	**4**
124	Half round file HS 200	**4**
125	Flate file S 200	**4**
126	Flat file HS 250	**4**
127	Flat file B 250	**4**
128	Flat round nose plier 160mm	**1**
129	Flat nose plier 160mm	**1**
130	Cobination plier 160mm	**1**
131	Side cutting plier 160mm isol.	**1**
132	Round nose plier 160mm	**1**
133	Flat round nose plier 200mm	**1**
134	Crimping - plier "ABIKO 50"	**1**
135	Pincer 210mm	**1**
136	Plumb bob of steel 400g	**4**
137	Plumbline 20m	**4**
138	Stripping tong "STRIPAX"	**2**
139	Cable cutter "KT-45R"	**1**
140	Square wrench	**1**
141	Retaining ring Plier set	**1**
142	Crimping tool "PZ4"	**1**
143	Crimping tool "PZ16"	**1**
144	Crimping tool "CTI 6"	**1**
145	Tin snip "M3"	**1**
146	Multi -grip plier 250	**1**
147	Vise -grip wrench 250mm	**2**
148	Butan gas soldring tool "GL1300" or equivanlent	**1**
149	Ele. Soldrind tool	**1**
150	**Tap and die set M3-M12**	**1**

151	Adjustable tap wrench	**1**
152	**Tapping drill hole manual**	**1**
153	socket wrench set 1/4"drive	**1**
154	socket wrench set 1/2" 8-34/4-14	**1**
155	Safety glasses "UVEX 9130"	**1**
156	Safety glasses "Helico"	**1**
157	Pocket lamp bright light/flash light/Torch	**4**
158	Battery 9v	**1**
159	Spray rost protection SWF 609	**1**
160	Hand saw 400mm	**1**
161	Hack-saw frame "S+B"	**1**
162	Pry bar"Hazet 400"	**2**
163	Hacksaw blade 300mm "24Z"	**10**
164	C-Clamp "GTW"160	**2**
165	Pull and pry bar "SUPERBAR"	**1**
166	Bolt cutter 457/6	**1**
167	Fitter's hammer"300"	**1**
168	Engineers hammer "800"	**1**
169	Nylon hammer d 40mm	**1**
170	Lead hammer "2.5 kg"	**1**
171	Wire scrach brush "ST"2	**1**
172	Brush 280	**1**
173	Combination wrench 30	**1**
174	Combination wrench 32	**1**
175	Combination wrench 36	**1**
176	Open end wrench 41mm	**1**
177	Open end wrench 46 mm	**1**
178	Open end wrench 50 mm	**1**
179	Open end wrench special 27 mm	**1**
180	Open end wrench special 38 mm	**1**
181	Open end wrench special 41 mm	**1**
182	Open end wrench special 50 mm	**1**
183	Rotary hammer drill "SBE 850 I"	**1**
184	Steel wire brush d 60mm/15mm	**1**
185	Drill bit set "1-13mm/KL	**1**
186	Twist drill "HSS" 13mm	**1**
187	Fish tape 15 M	**1**
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	Geranal Installation Tools	
sl.	**Tools details**	quantity
1	**4M ladder**	**2**
2	**4 step Ladder**	**2**
3	**3 step ladder**	**2**
4	**12 step ladder**	**2**
5	**40T Crane for Bay Liftinh and Sfifting**	**As per site Requirement**
6	**Farana carne for Material shifhting**	
7	**EOT Crane in Builing**	
8	**illumination min 200Lux**	
9	**Tarpauline cover for GIS coupling**	
10	**Scafolding arrangment**	
11	**GIS Builing Cleaning Material**	
12	Torque Wrench "730R/5" (8-60Nm 3/8")	**2**
13	Torque Wrench "730R/20" (40-200Nm 1/2")	**2**
14	Torque Wrench "730R/40" (80-400Nm 3/4")	**2**
15	Combination wrench 19	**2**
16	Combination wrench 24	**4**
17	Box end wrench 24 (offset ring end spanner 24mm)	**2**
18	Extension tube 24-30	**2**
19	Socket wrench long 1/2" 19mm	**2**
20	Socket wrench long 1/2" 24mm	**2**
21	Socket wrench long 1/2" 30mm	**1**
22	Socket wrench long 3/4" 30mm	**1**
23	Socket wrench long 3/4" 36mm	**1**
24	Open end wrench 19	**1**
25	Open end wrench 24	**1**
26	Ratchet spanner "RG" 19mm	**2**
27	Ratchet spanner "RG" 17mm	**2**
28	Ratchet spanner "RG" 24mm	**2**
29	Polyester roundsling "1M/V"	**6**
30	Polyester roundsling "2M/V" or 2M/G	**6**
31	Polyester strap belt 50mm/5M	**6**
32	Polyester ratchet strap belt 50mm/8M	**6**
33	Polyester ratchet strap belt with buckle 50mm/8M	**6**
34	Polyester roundsling "6M/Y"	**6**
35	3ph 63Amp Power board "7800" (with extra socket)	**1**
36	1ph Power board with extension	**5**
37	Polyester roundsling "6M/G"	**6**
38	Polyester roundsling "4M/y"	**6**
39	Vacuum cleaner	**4**
40	Cable reel "220VAC/20M" power extension board	**5**
41	Polyester roundsling "2M/G"	**6**
42	Polyester roundsling "3M/G"	**6**
43	Polyester ratchet strap belt 50mm/6M	**1**
44	Polyester ratchet strap belt 50mm/8M	**1**
45	Polyester roundsling "4M/G"	**6**
46	Pallet trolley 3T	**2**
47	Ladder 0.6m (3 step)	**1**
48	Ladder 0.68 (4 step)	**1**
49	Ladder "TELESTEPS-KOMBI 2.3M"	**2**
50	Shaft for transit level "NA724" + scale in MM	**1**

51	Shakle 2.0 TO	**4**
52	Shakle 3.25 TO	**4**
53	Shakle 4.75 TO	**4**
54	I Bolt with nut M10	**4**
55	I Bolt with nut M12	**4**
56	I Bolt with nut M16	**4**
57	PPE for engineers(Helmat, reflecting jecket, SF6 Ppe its)	**2**
58	SF6 cylinder heater	**2**
59	Power supply connection Cables	**as required**
60	Voltage stabilizer	
61	airblower	**2**
62	fall arrester	**2**
63	Bending device "HB20" for earthing Flat	**2**
64	Puller 1.5T "CM-PULLER"	**2**
65	Puller 0.75T "CM-PULLER"	**2**
66	Diamond head drill "DD EC-1/VCU40"	**2**
67	Rotary/Hammer Drill "HILTI TE30"	**2**
68	Rotary/Hammer Drill "HILTI TE70"	**2**
69	Setting tool for bolts M16-24	**2**
70	3 ton jack hydraulic/screw type	**1**
71	**Sledge hammer**	**as required**
72	Claw hammer	
73	Hammer 5 KG	
74	Wrecking bar long	
75	Nitrogen gas in bottles -100Kg	
76	Mini Hydraulic crane jack	
77	Wood saw	
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1. The GIS material shall be stored under a covered roof, to avoid rain and direct sunlight.
2. The floor of the storage area shall :
    a. be suitably elevated above the ground level and with a gradient to prevent water stagnation / flow across the storage in case of heavy rains
    b. be firm, flat, hard and durable to allow movement of mobile cranes/ forklifters with lifting capacity up to 5tons
    c. be dry and prevent accumulation of moisture
3. Access / drive ways inside the storage area shall be of sufficient strength and width to allow movement of the forklifters with the biggest crate size stored in that corridor
4. Storage & Access/drive ways shall be clearly identified and marked with yellow line.
5. Storage areas shall be subdivided and each sub area, identified to record and retrieve the stored materials.
6. Access ramps from outside roads shall have sufficient gradient to allow safe movement of the mobile cranes / forklifters
7. Must be enclosed with walls / fences upto height of the roof to keep the storage area safe
8. The entry doors shall be wide and possible to open from both directions.
9. The stacking of the crates shall be such that the heaviest and the biggest crate is placed at the bottom.
10. Do not stack more than 3 crates over each other.

Annexure: GIS_Bidder's_Scope (Bidder's Scope for GIS)

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Bidder's Scope - minimum deployment of Manpower for Installation of GIS – as per requirement for each site (1 foreman, 8 skilled person, 4 electrician & 4 helpers. Separate for Material shifting Loading and unload, scaffolding gang all as per requirements. PPE for above Manpower

A. Note for Subcontractor

- Should have at least 10years of experience in large construction projects
- Should have a good safety record
- Basic knowledge about Industrial installation
- Must be willing to enforce **clean, dust free and dry surroundings**.
- Must be willing to follow the rules in a serious manner.
- Must be willing to provide manpower willing to work as a team
- Must be willing to provide decent & hygienic accommodation, food and water so his people feel good to work at project site.
- Must be willing to properly compensate his manpower for the normal and extra hours that they work at project site
- We propose that in order to motivate the team to keep up the project milestones should be willing to provide some kind of bonus/incentives.
- Should be able to provide safety equipment (safety shoes, belts, helmets, gloves and protective clothing)
- Should able to organize and provide scaffolding material for safe working at heights

B. Foreman

- Must be able to properly communicate in English as well as the local language.
- Should be able to communicate with the customer personnel on behalf of ABB
- Must be able to **keep the surroundings clean, dust free and dry**.
- Should be able to motivate & lead a team of Skilled Mechanics/Electricians and unskilled laborers.
- Should be able to organize & care for his team (accommodation, food, transport etc.,)
- Ability to read, interpret and explain drawings (Layouts, Assembly drawings and building / civil work drawings)
- Should be aware of safety & health instructions and enforce the rules.
- Should be able to plan manpower and monitor the progress
- Should be able to do minor book keeping as necessary for his role. (Time sheets, fees….etc.,)
- Should be able to organize small purchases (consumables, screws etc.,)
- Preferably has previous experience in using tools and machines in a construction site to explain to the team.
- Should be a qualified **Fitter** with education from a **reputed ITI** and have successfully completed apprenticeship
- Preferably has at least 5 years of experience in such roles with at least few years of GIS site experience.

Annexure: GIS_Bidder's_Scope (Bidder's Scope for GIS)

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C. Skilled Mechanics

- Basic knowledge in handling aluminum, steel and packing materials.
- Must be able to **keep the surroundings clean, dust free and dry**.
- Must be willing to follow the rules in a serious manner.
- Good knowledge in precise mounting and assembling of large machine parts and pipes.
- Must be willing to take instructions from Foreman and willing to learn from the assigned tasks. (use the right tools for the right work)
- Must be able to work in a team
- Must be able to lead a small team of unskilled labors.
- Should be a qualified **Fitter** with education from a **reputed ITI** and have successfully completed apprenticeship
- Preferably at least 2years of experience in large construction projects

D. Skilled Electrician

- Basic knowledge about Industrial electrical installation
- Must be able to **keep the surroundings clean, dust free and dry**.
- Must be willing to follow the rules in a serious manner.
- Good knowledge in installation of cables, cable trays, termination
- Must have basic knowledge to test the installation
- Must be able to support & trouble shoot the equipments (like Cranes, Drilling machines, light fittings etc.,) in the GIS hall
- Must be willing to take instructions from Foreman and willing to learn from the assigned tasks. (use the right tools for the right work)
- Must be able to work in a team
- Must be able to lead a small team of unskilled labors.
- Should be a qualified **Electrician** with education from a **reputed ITI** and have successfully completed apprenticeship
- Preferably at least 2years of experience in large construction projects

E. Un Skilled labor

- Preferably at least 2years of experience in large construction projects
- Basic knowledge about Industrial installation
- Must be able to **keep the surroundings clean, dust free and dry**.
- Must be willing to follow the rules in a serious manner.
- Must be willing to take instructions from the team leader and willing to learn.
- Must be able to work in a team

Annexure: GIS_Bidder's_Scope (Bidder's Scope for GIS)

Site readiness to start the GIS Installation

E pected at site

All opening to be secured GIS building must be complete dust free





Illumination to be operational with 200Lu and all windows/doors properly closed.





GIS floor epo y coated and earthing risers must be as per civil wor , loading plan approved drawing.

Initial floor



Final floor



Crane load tested and certified for safe use



<u>site to be ready as shown in reference picture</u>

All civil work completed GIS hall with wall opening & floor covered.

Floor finished & clean. EOT crane operational.

Illumination available. Subcontractor tools & office available as per offer.

GIS Unloading platform as per requirement.

Requirements for HV testing & HV Kit erection:

1. HV Test kit container needs to be shifted **using trailer (not by hydra/farana)** to desired location for installation with crane having load capacity ≥ 35'000 kg only.

2. Ground clearances for shifting of HV test kit in approx. 10 feet height container on trailer to installation area to be checked & confirmed.

3. Installation of HV test kit with required clearances w.r.t 5 Meter equipment height erection by Crane along with height access & crane approach clearances to be checked & confirmed.

4. If non-fluctuating/uninterrupted/independent power source is not available separate DG is to be arranged with a capacity of minimum 100 kVA for smooth and non-fluctuating power supply during HV testing.

5. The value of earth pit/ earthing from where the connection to HV test kit has to be taken must not be greater than 0.5 ohm

6. **The distance between parts of the test set on high voltage and earthed or conducting objects (as ground, walls, pieces of installation, crane) has to be greater than 5 meters.** Any conducting object near the test set must be properly earthed.

7. **The distance between live lines & bushings/HV Kit under test must be greater than or equal to 10 meters. Otherwise shut down has to be taken for adjacent bays or busbar.**

8. For Installation & dismantling of HV test kit 5 no. of skilled persons are required.

9. Proper height approach with scaffolding having proper platform is required for all PD sensors during Sensitivity check & HV testing.

10. Man lift required for HV connection from HV test kit to bushing.

11. Pallet Trolley is required with load capacity of 2'000 kg

12. Required size and length of Nylon ropes to be arranged by client for holding Aluminium Corona tube/foil to any tower/structure if required.

13. For installation of HV test kit ground base shall be levelled & compressed in order to take a center load of 10 Ton required before installation of kit.

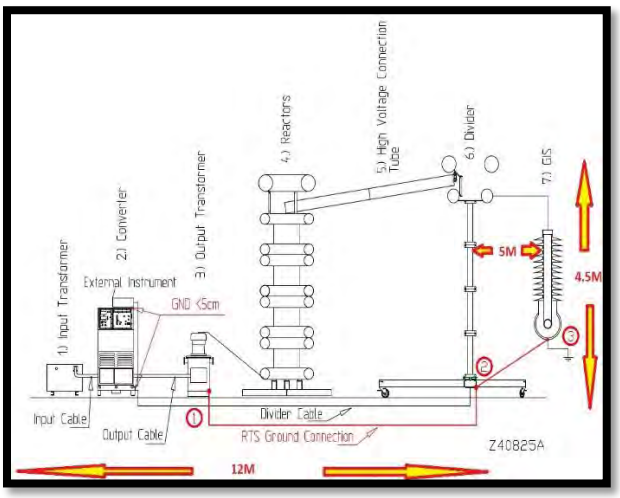
14. For implementation of all above points, any kind of equipment dismantling, material shifting and re-erection will be required is to be done by client.

15. No AIS equipment or structure shall be erected in place of HV Kit erection in front of the SF6 to air bushing of Bay ‘’C01.407 Dhalkebar-1’’.

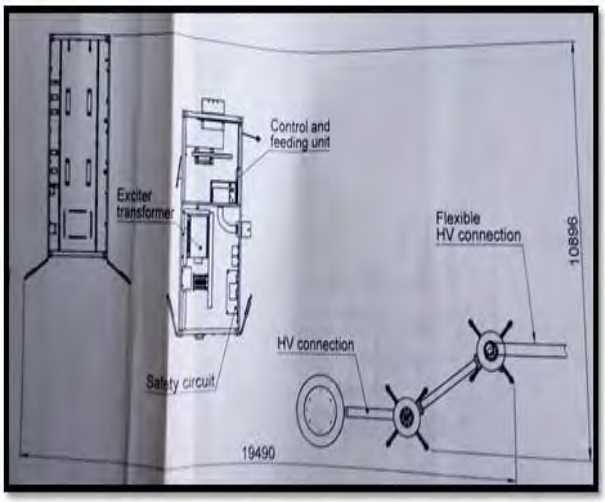
Requirements for HV testing & HV Kit erection:

16. Below is the general erection view for HV Test Kit set up (positioning of parts can be changed depending on site situation).

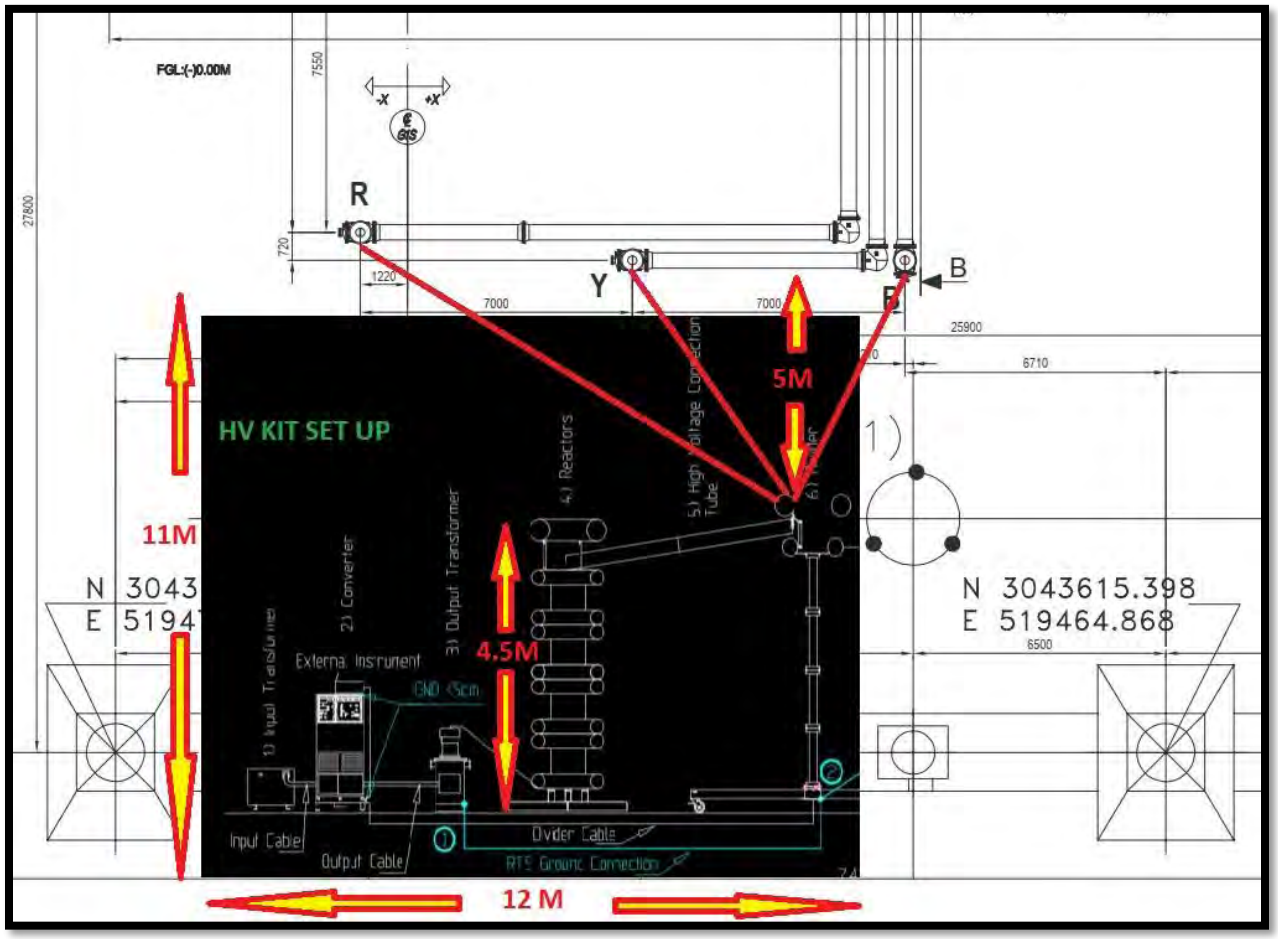
Bernasconi HV Test Kit Set up



High Volt HV Test Kit Set up



Onsite HV Test Kit Erection Plan



Annexure: GIS_Bidder's_Scope (Bidder's Scope for GIS)



Annexure: GIS_Bidder's_Scope (Bidder's Scope for GIS)

Annexure: GIS_HITACHI_SCOPE

GIS Manufacturer (M/s Hitachi) SCOPE

Following are scope of GIS Manufacturer (M/s Hitachi) for Site supervision, execution of testing & commissioning of GIS and arrangement of specific returnable tools i.e. HV Test Kit, SF6 Gas Service Kart and others.

1. Supervision of unloading of GIS & its accessories at site.
2. Supervision of material Reconciliation, guidance for storage & up keeping of materials, instructions/ training to site persons for long storage.
3. Supervision of Erection of complete GIS
4. TESTING & COMMISSIONING OF GIS IS UNDER SCOPE OF GIS MANUFACTURER M/S Hitachi.
5. HV Test kit along with operator shall be arranged by the M/s HITACHI
6. SF6 Gas Service cart shall be arranged by the M/s HITACHI
7. Commissioning and Installation Tools as attached in next page shall be arranged by GIS Manufacturer for GIS use only

Note: Please refer Annexure "GIS_Bidder's_SCOPE" for bidder's scope of supply & services regarding GIS installation, testing & commissioning

Annexure: GIS_HITACHI_SCOPE

HITACHI / GIS Manufacturer's Scope

Commissioning and Installation Tools List to be arranged by GIS Manufacturer for ArunIII GIS only

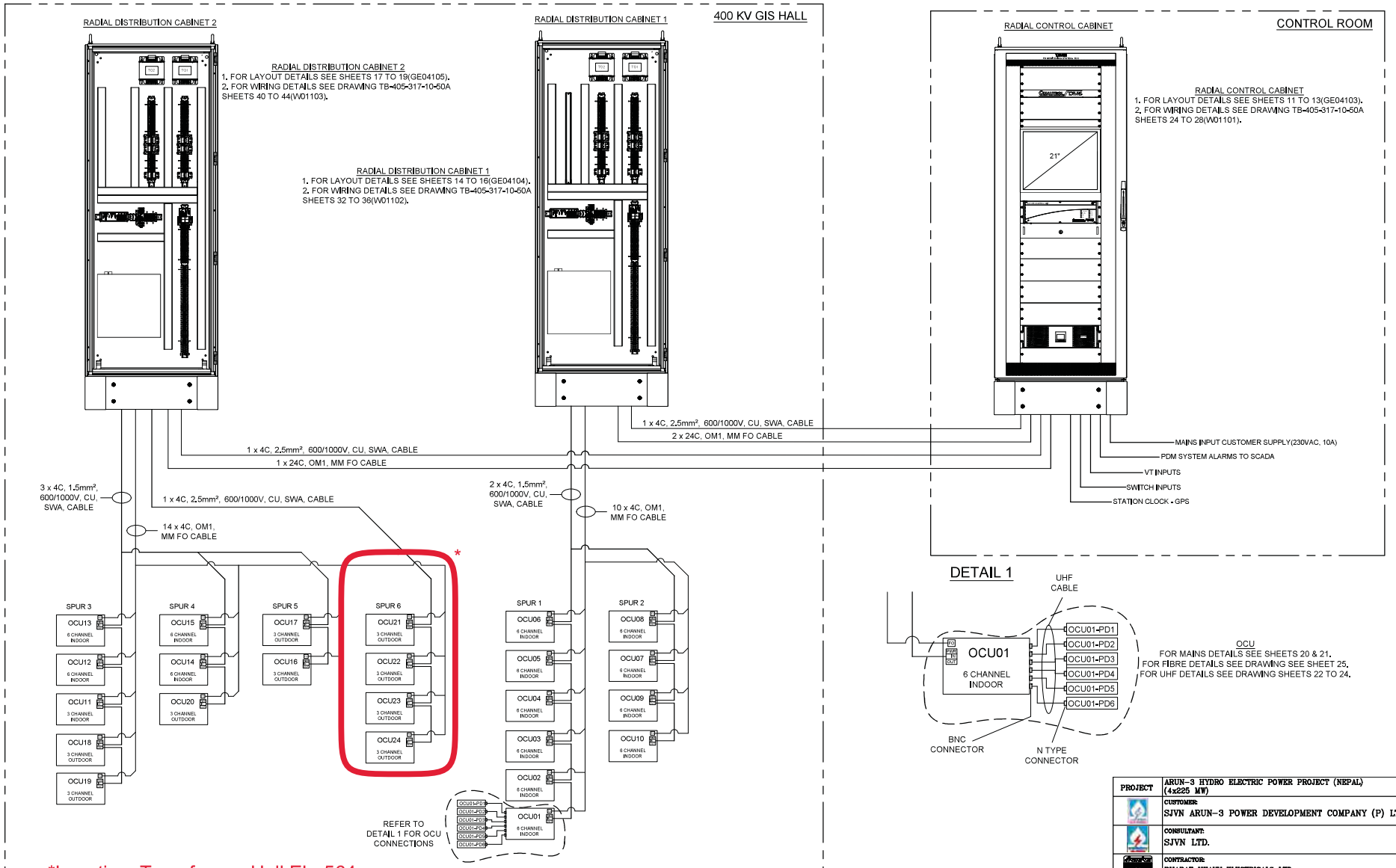
SL.	Testing and Commissioning Kit	qnty	Remarks
1	Multimeter Fluke	1	LV circuit
2	DC/AC clamp on meter	1	LV current
3	IR Tester upto 10kV megger	1	IR
4	CT analyzer Omicrom	1	CT
5	CPC 100	1	VT
6	CPC cable accessaries	1	VT
7	Micro Ohmmeter/CRM Test Kit	1	CRM
8	Micro Ohmmeter cable accessaries	1	CRM
9	TM1800-CB Timimg Test Kit complete set	1	CB
10	SDRM-with complete set of cables	1	DCRM
11	Transdurcer Set HMB4/8	1	Travel
12	Bendo scope	1	Visual
13	Density Monitor Test Set	1 set	

SL. No.	Installation Special Tools	qnty	
1	**HS48820_FIELD TRANSPORT SET "ELK-3/420C BASIS"**	1 set	Wooden box
2	**ELK-3 Bay Lifting Tools**	1set	Wooden box
3	**Dlio Machine/SF6 gas Hanlding UNIT with accessaries & Hose pipes**	1 set	
4	**Y car**	6	Loose
5	**Tool Set " ELK3-420-NM08" box**	1set	
6	**Special Tools Container with Installation Tools**	1	Steel container
7	Consumables	1Set	
8	Stationary	1Set	

Above kits shall be arranged by GIS Manufacturer (M/s HITACHI). All necessary support i.e. unloading, shifting, minor assembly, cabling, support for complete Testing, dismantling & reloading on carrier are to be provided by Bidder

Annexure: GIS_HITACHI_SCOPE

ARCHITECTURE OF PDM SYSTEM



DETAIL 1

OCU
FOR MAINS DETAILS SEE SHEETS 20 & 21.
FOR FIBRE DETAILS SEE DRAWING SEE SHEET 25.
FOR UHF DETAILS SEE DRAWING SHEETS 22 TO 24.

PROJECT	ARUN-3 HYDRO ELECTRIC POWER PROJECT (NEPAL) (4x225 MW)
CUSTOMER:	SJVN ARUN-3 POWER DEVELOPMENT COMPANY (P) LTD.
CONSULTANT:	SJVN LTD.
CONTRACTOR:	BHARAT HEAVY ELECTRICALS LTD.
SUB CONTRACTOR:	HITACHI ENERGY INDIA LTD. (formerly known as ABB Power Products and Systems India Limited)
MANUFACTURER:	QUALITROL (Manufacturer and supplier of Online PD Monitoring System)

TITLE
ONLINE PD MONITORING SYSTEM
BASE DESIGN

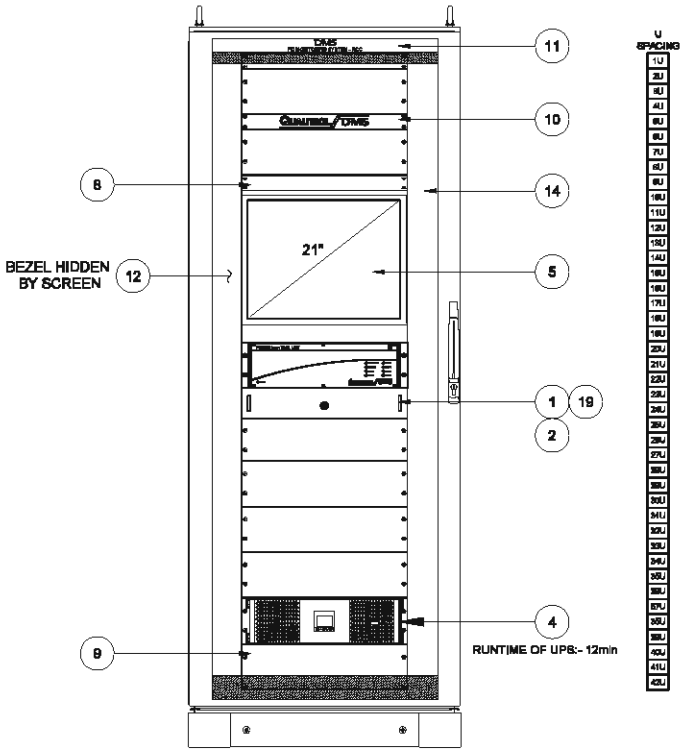
DRG. NO.	TB-405-317-10-50	REV.	01
SHT. No 04	NO. OF SHT. 32		

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CHD.	R.Nagarjuna	10.01.2021	
APPD.	R.Nagarjuna	10.01.2021	

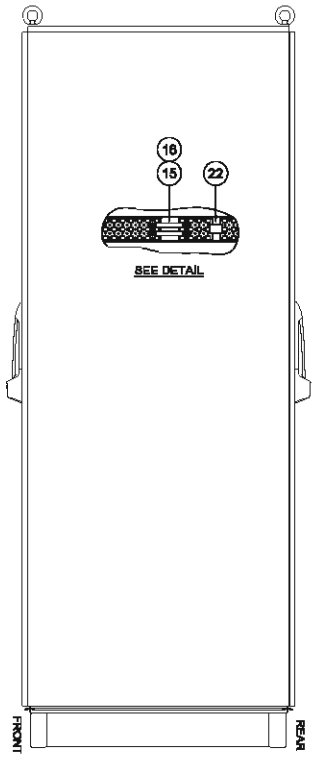
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SUBJECT(S) DOCUMENT(S)	GE04106
TITLE	ONLINE PD MONITORING SYSTEM BASE DESIGN
SIZE	A3
SCALE	NTS
DOC	DWG
LANGUAGE	EN

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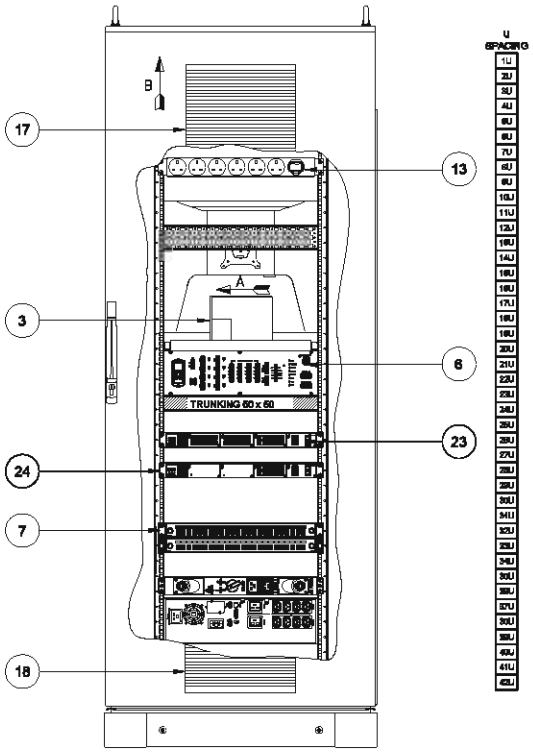
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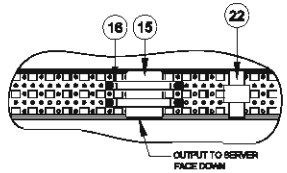
RCC FRONT



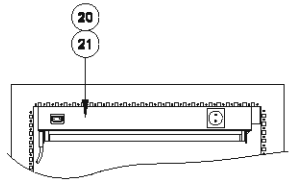
RCC SIDE



RCC REAR



VIEW ON ARROW 'A'



ITEM	PART NUMBER	DESCRIPTION	QTY
1	CEK00224-01	KEYBOARD	1
2	CEK00225-01	MOUSE	1
3	CEK00498	MXC-6401D/M8G Debadged, Win 10, 1TB SSD	1
4	CEK00407	UPS EATON 9PX 3000VA, WITH BYPASS SWITCH(RUNTIME:- 12min)	1
5	CEK00419	21" LCD MONITOR	1
6	AE02645	POWER CONTROL UNIT (PCU) ASSEMBLY	1
7	CMA00409	FIBRE TERMINATION BOX, 48 WAY LC DUPLEX, BLACK	2
8	CMD00297-02	1U BLANKING PLATE, RAL 7035	2
9	CMD00298-02	3U BLANKING PLATE, RAL 7035	7
10	CMD01473-02	1U QUALITROL NAMEPLATE	1
11	CMP00050-01	RCC LABEL	1
12	CMD01559	BEZEL, 19" RACK, 19" MONITOR	1

ITEM	PART NUMBER	DESCRIPTION	QTY
13	CEH00707	SOCKET (6) STRIP - UK	1
14	CMD00456-02	19" CABINET RACK SKIRT	2
15	CEK00402	EXTERNAL BACK UP	1
16	CMD01838	BRACKET, EXTERNAL BACKUP	2
17	CEI00007	FAN	1
18	CMA00261	FILTER	1
19	CMA00425	2U SHELF	1
20	CEK00235	COURTESY LIGHT 18W, 100-240V, 50/60Hz(W:582mm)	1
21	CEK00108	DOOR OPERATED SWITCH	1
22	CEK00065	SURGE VOLTAGE PROTECTOR, N-TYPE	1
23	AE04260	ETHERNET SWITCH	1
24	AE04256	ETHERNET SWITCH	1

PROJECT: ARUN-3 HYDRO ELECTRIC POWER PROJECT (NEPAL) (4x225 MW)

CUSTOMER: SJVN ARUN-3 POWER DEVELOPMENT COMPANY (P) LTD.

CONSULTANT: SJVN LTD.

CONTRACTOR: BHARAT HEAVY ELECTRICALS LTD.

SUB CONTRACTOR: HITACHI ENERGY INDIA LTD. (formerly known as ABB Power Products and Systems India Limited)

MANUFACTURER: QUALITROL (Manufacturer and supplier of Online PD Monitoring System)

TITLE: ONLINE PD MONITORING SYSTEM
BASE DESIGN

CUSTOMER DOCUMENT NO.	80441318		
SUPPLIER DOCUMENT NO.	GE04103		
TITLE	ONLINE PD MONITORING SYSTEM BASE DESIGN		
SIZE	A3	SCALE	NTS
TYPE	DWG	LANGUAGE	EN

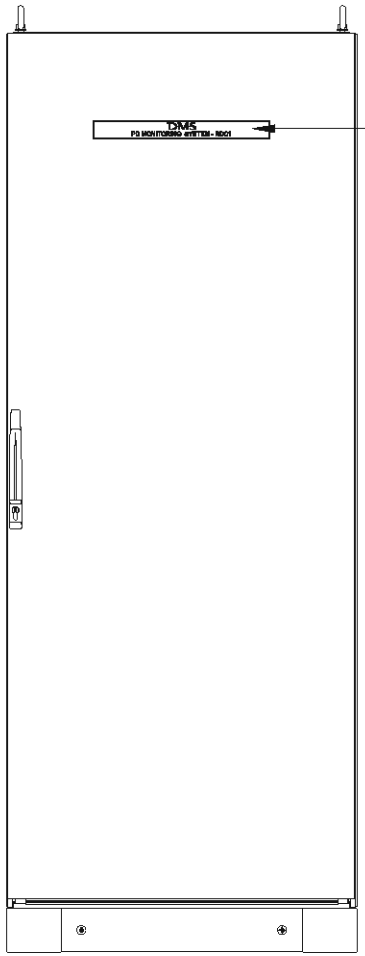
DRG.NO. TB-405-317-10-50 | REV. 01

	NAME	DATE	SIGN.
DRN.	C.Cullen	10.01.2022	
CHD.	S.Nagarjuna	10.01.2022	
APPD.	S.Nagarjuna	10.01.2022	

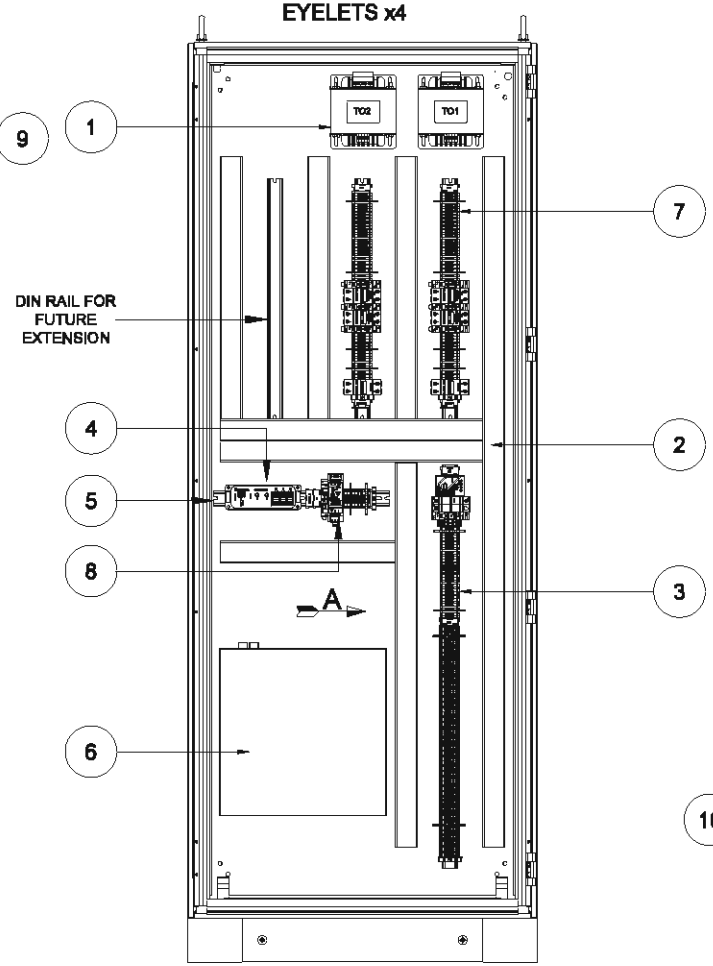
SHT. No. 11 | NO. OF SHT. 28

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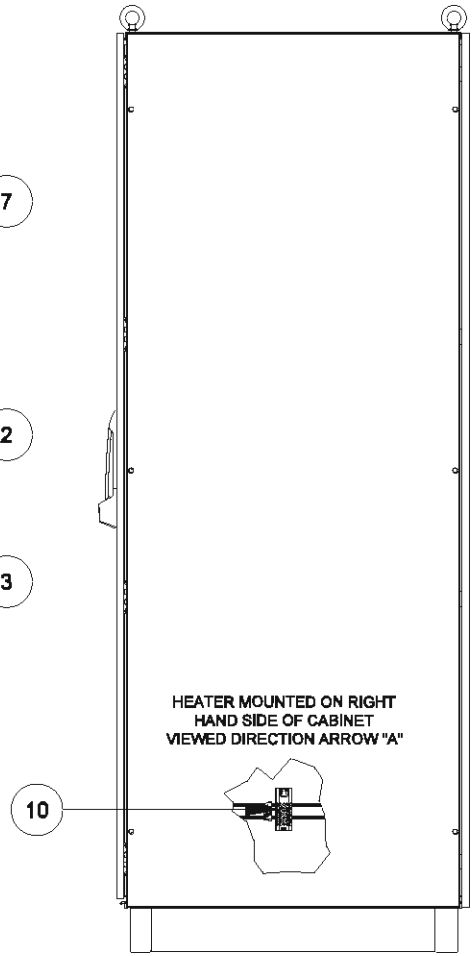
RADIAL DISTRIBUTION CABINET 1- LAYOUT DETAILS



FRONT



FRONT (DOOR OPEN)



SIDE

ITEM	PART NUMBER	DESCRIPTION	QTY
1	CEC00023	ISOLATING TRANSFORMER	2
2	CEQ00019	TRUNKING GREY, OPEN SLOT, 50 WIDE x 50 HIGH	A/R
3	AE03496	RDC DIN RAIL 1 ASSEMBLY (MAINS)	1
4	AE02359	SYNC. DRIVER ASSEMBLY	1
5	CMQ00005	DIN. RAIL - TS 35 x 15 X 200 LG.	1
6	CMD00173	FIBRE DISTRIBUTION BOX	1
7	AE03281	RDC DIN RAIL 2-3 ASSEMBLY (SPUR SUPPLY)	2
8	AE04852	RDC DIN RAIL 5(SYNC DRIVER SUPPLY)	1
9	CM000058-01	RDC1 NAMEPLATE	1
10	CEJ00032	HEATER, CONVECTION, 20W, 100-240VAC	1
11			

PROJECT: ARUN-3 HYDRO ELECTRIC POWER PROJECT (NEPAL) (4x225 MW)

CUSTOMER: SJVN ARUN-3 POWER DEVELOPMENT COMPANY (P) LTD.

CONSULTANT: SJVN LTD.

CONTRACTOR: BHARAT HEAVY ELECTRICALS LTD.

SUB CONTRACTOR: HITACHI ENERGY INDIA LTD.

MANUFACTURER: QUALITROL

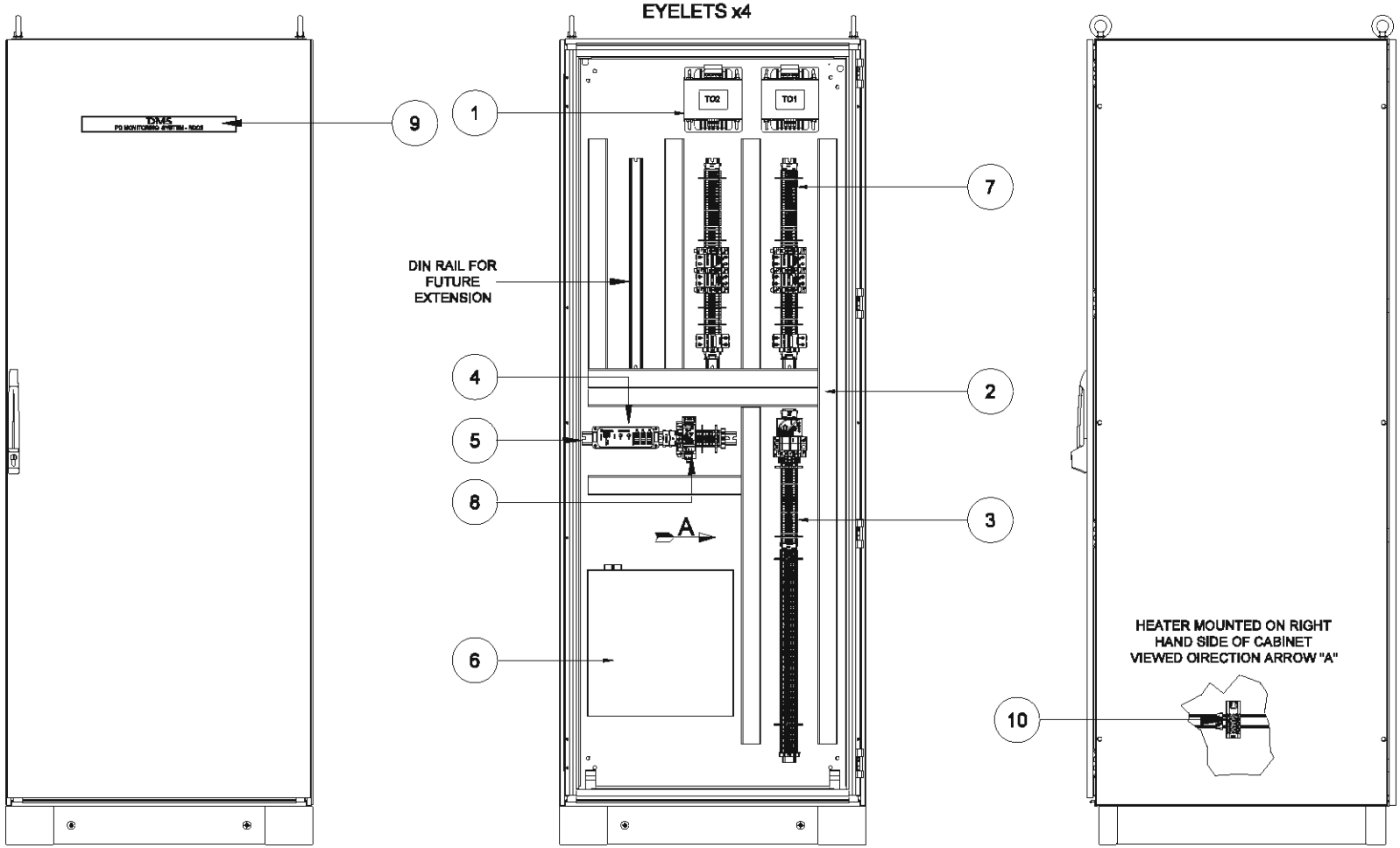
TITLE: ONLINE PD MONITORING SYSTEM
BASE DESIGN

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BHEL DOCUMENT NO	GE04104
TITLE	ONLINE PD MONITORING SYSTEM BASE DESIGN
SIZE	A3
SCALE	NTS
UNIT	DWG
LANGUAGE	EN
DRG.NO.	TB-405-317-10-50
REV.	01
SHT. No.	14
NO. OF SHT.	28

	NAME	DATE	SIGN.
DSN.	C.Cullen	10.01.2022	
CKD.	S.Nagarjuna	10.01.2022	
APPD.	S.Nagarjuna	10.01.2022	

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RADIAL DISTRIBUTION CABINET 2- LAYOUT DETAILS



FRONT | FRONT (DOOR OPEN) | SIDE

ITEM	PART NUMBER	DESCRIPTION	QTY
1	CEC00023	ISOLATING TRANSFORMER	2
2	CEQ00019	TRUNKING GREY, OPEN SLOT, 50 WIDE x 50 HIGH	A/R
3	AE03496	RDC DIN RAIL 1 ASSEMBLY (MAINS)	1
4	AE02359	SYNC. DRIVER ASSEMBLY	1
5	CMQ00005	DIN. RAIL - TS 35 x 15 X 200 LG.	1
6	CMD00173	FIBRE DISTRIBUTION BOX	1
7	AE03281	RDC DIN RAIL 2-3 ASSEMBLY (SPUR SUPPLY)	2
8	AE04852	RDC DIN RAIL 5(SYNC DRIVER SUPPLY)	1
9	CM000058-02	RDC2 NAMEPLATE	1
10	CEJ00032	HEATER, CONVECTION, 20W, 100-240VAC	1
11			

PROJECT: ARUN-3 HYDRO ELECTRIC POWER PROJECT (NEPAL) (4x225 MW)

CUSTOMER: SJVN ARUN-3 POWER DEVELOPMENT COMPANY (P) LTD.

CONSULTANT: SJVN LTD.

CONTRACTOR: BHARAT HEAVY ELECTRICALS LTD.

SUB CONTRACTOR: HITACHI ENERGY INDIA LTD.

MANUFACTURER: QUALITROL

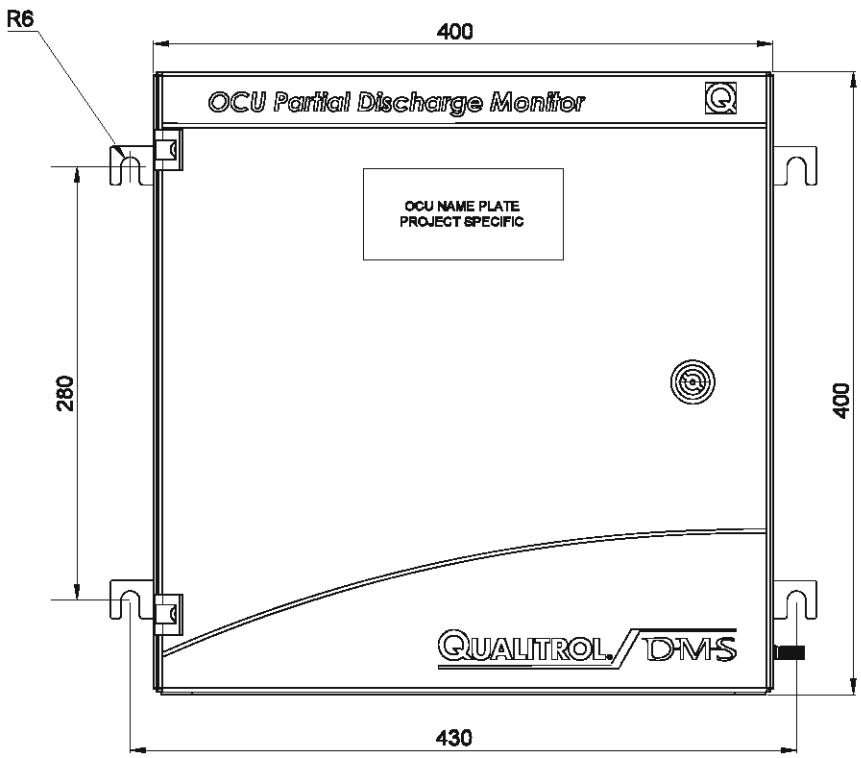
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BASE DESIGN

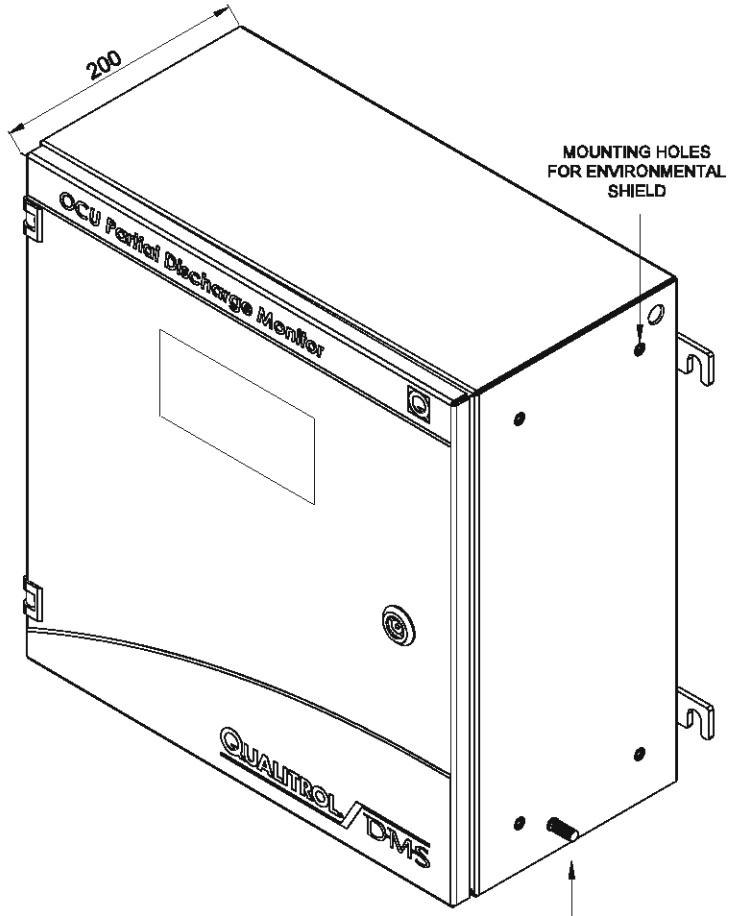
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REV.	01
SHT. No.	17
NO. OF SHT.	28

	NAME	DATE	SIGN.
DRN.	C.Cullen	10.01.2022	
CHD.	S.Nagarjuna	10.01.2022	
APPD.	S.Nagarjuna	10.01.2022	

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OPTICAL CONVERTER UNIT :- MOUNTING DETAILS





NOTES:-
1. MATERIAL 1.5mm STAINLESS STEEL.
2. COLOUR:- INTERNAL/EXTERNAL- PALE GREY RAL 7035.
3. IP RATING:- IP66.
4. WEIGHT:- 17kg APPROX.
5. FIXING CENTRES OF OCU SHOWN ON SHEET 26. M10 FIXINGS RECOMMENDED.
6. MINIMUM CLEARANCES AS SHOWN IN SHEET 27 & 28.
7. OCU MUST BE MOUNTED ON A WALL OR SUITABLE METAL FRAME (SUPPLIED BY CUSTOMER) TO BE EASILY ACCESSIBLE FOR SERVICE.
8. OCU MUST NOT BE DIRECTLY INSTALLED ON TRANSFORMER WALLS, GIS OR ON METALWORK SUPPORTING GIS CIRCUIT BREAKERS.
9. SEE SHEET 29 FOR OCU BOM.

PROJECT	ARUN-3 HYDRO ELECTRIC POWER PROJECT (NEPAL) (4x225 MW)
CUSTOMER	SJVN ARUN-3 POWER DEVELOPMENT COMPANY (P) LTD.
CONSULTANT	SJVN LTD.
CONTRACTOR	BHARAT HEAVY ELECTRICALS LTD.
SUB CONTRACTOR	HITACHI ENERGY INDIA LTD.
MANUFACTURER	QUALITROL
TITLE	ONLINE PD MONITORING SYSTEM BASE DESIGN
DRG.NO.	TB-405-527-10-50
REV.	01

	NAME	DATE	SIGN.
DRN.	G.Cullen	10.01.2022	
CHD.	S.Waggerjee	10.01.2022	
APPD.	S.Waggerjee	10.01.2022	

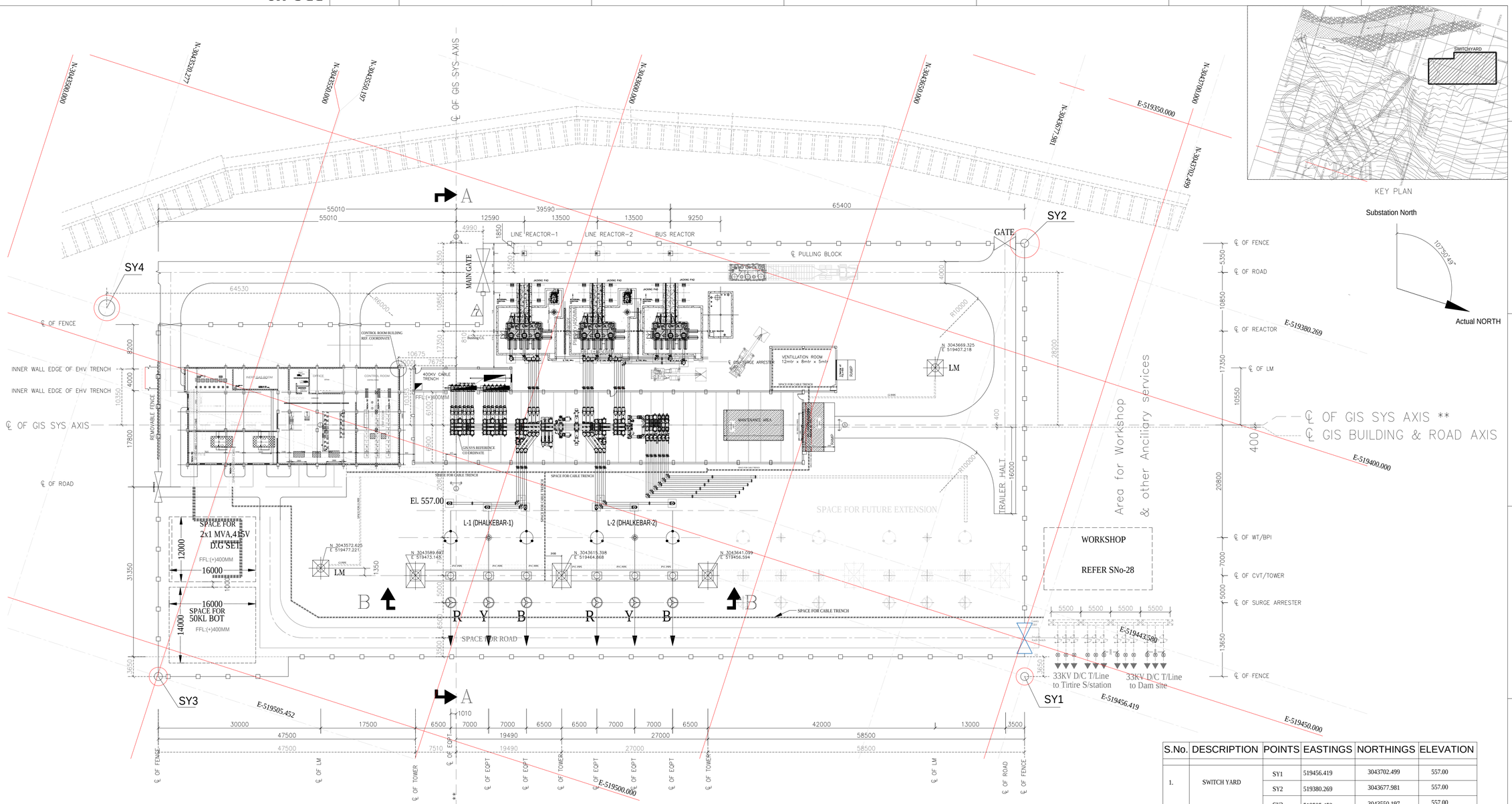
CONTRACT NUMBER	B041318
CUSTOMER DOCUMENT NO	AE07248
TITLE	ONLINE PD MONITORING SYSTEM BASE DESIGN
SIZE	A3
SCALE	NTS
TYPE	DWG
LANGUAGE	EN

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

DRG. NO. TB-3-405-316-001

KEY PLAN



S.No.	DESCRIPTION	POINTS	EASTINGS	NORTHINGS	ELEVATION
1.	SWITCH YARD	SY1	519456.419	3043702.499	557.00
		SY2	519380.269	3043677.981	557.00
		SY3	519505.452	3043550.197	557.00
		SY4	519443.580	3043520.277	557.00

** GIS SYS AXIS HAS BEEN TAKEN AS REFERENCE CO-ORDINATE FOR POSITION OF OTHER SYSTEMS
PLEASE NOTE GIS, GAS INSULATED BUS DUCT (GIB), SF6 TO AIR BUSHING, SF6 TO OIL BUSHING ARE HAVING BUS DUCT CONNECTION (RIGID CONNECTIONS) SO RELATIVE DIMENSIONS ARE IMPOTENT TO BE FOLLOWED. IMPORTANT GIS DRAWINGS FOR LAYOUT PURPOSE ARE FOLLOWS
TB-405-317-10-11 Drawing GIS SUPPORT STRUCTURE LAYOUT
TB-405-317-10-02 Drawing 400KV GIS LAYOUT (PLAN, SECTION & ISOMETRIC VIEW)
TB-405-317-10-10 Drawing CIVIL GUIDE FOR GIS (CIVIL WORK REQUIREMENTS FOR GIS ERECTION)
INNER WALL EDGE OF EHV TRENCH IS ALIGNED IN CONTROL ROOM BUILDING AND GIS HALL

REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED
09*	04/11/22	CHD/APPD	07	16/12/21	CHD/APPD	06	22/06/21	CHD/APPD	05	28/05/21	CHD/APPD
ZONE	MOUNTAIN SIDE ROAD & FENCE SHIFTED TOWARDS SURGE ARRESTOR NO CHANGE IN EQUIPMENT / TOWER POSITION		ZONE	CURRENT REVISION INCORPORATES CHANGES AS PER REVISED GIS DRAWING AND CUSTOMER'S COMMENT DATED 14 JUNE AND 5TH JULY 2021 FROM M/S SJVN		ZONE	CURRENT REVISION INCORPORATES CHANGES AS PER EMAIL DATED 14 JUNE 2021 FROM M/S SJVN		ZONE	CURRENT REVISION INCORPORATES SOAK PIT AS PER SOAK PIT DOCUMENT REV-04 (TB-405-316-018)

REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED
08	26/09/22	CHD/APPD	04	20/10/20	CHD/APPD	03	10/03/20	CHD/APPD	02	07/06/19	CHD/APPD
ZONE	DIMENSIONS HIGHLIGHTED		ZONE	1. DETAILS OF THE REACTOR AND REACTOR CUM NGR AREA INCLUDED. 2. DISTANCE BETWEEN THE REACTORS OPTIMISED. 3. REPRESENTATION OF THE REACTOR UNLOADING INCLUDED. 4. RAILS REMOVED FROM THE MAIN ROAD.		ZONE	1. Building for Ventillation Room is now limited for catering to the requirement of GIS.		ZONE	1.Building for Inert Gas System included. 2.Common Ventilation Room for Power House and GIS Building included. 3.Cable Trench shown for the CAT to Switchyard. 4. The Layout of the Tranformer Cavern shall be part of shown in 'Cross Section and Plan of Transformer Cavern - 1 200 00 20558. 5. Comments marked on Rev-01 incorporated.

REV.	DATE	ALTERED
01	30/03/19	CHD/APPD
ZONE	Revised Switchyard Layout - Sketch - Drg No. SJVN/ED/Arun-III/EM-2017-04	

ADDITIONAL INFORMATION :
WO NO. :

STATUS OF DRAWING :

DISTRIBUTION OF PRINTS :

PROJECT: ARUN-3 HYDRO ELECTRIC PROJECT (NEPAL)
(4 x 225 MW)

CUSTOMER: SJVN ARUN-3 POWER DEVELOPMENT COMPANY PVT. LTD. (SAPDC LTD.)

CONSULTANT: SJVN LTD.
(A JOINT VENTURE OF GOVT OF INDIA AND GOVT OF HP)

BHARAT HEAVY ELECTRICALS LTD.
TRANSMISSION BUSINESS GROUP
NOIDA

	NAME	SIGN.	DATE
DRN.	PK		30/10/2018
CHD.	Vyom/VK		30/10/2018
APPD.	SKS		30/10/2018

DEPT. CODE: TBG
SCALE: NTS
CARD CODE:

TITLE: ELECTRICAL LAYOUT PLAN AND SECTION OF 4x225MW OF ARUN-3 HEP

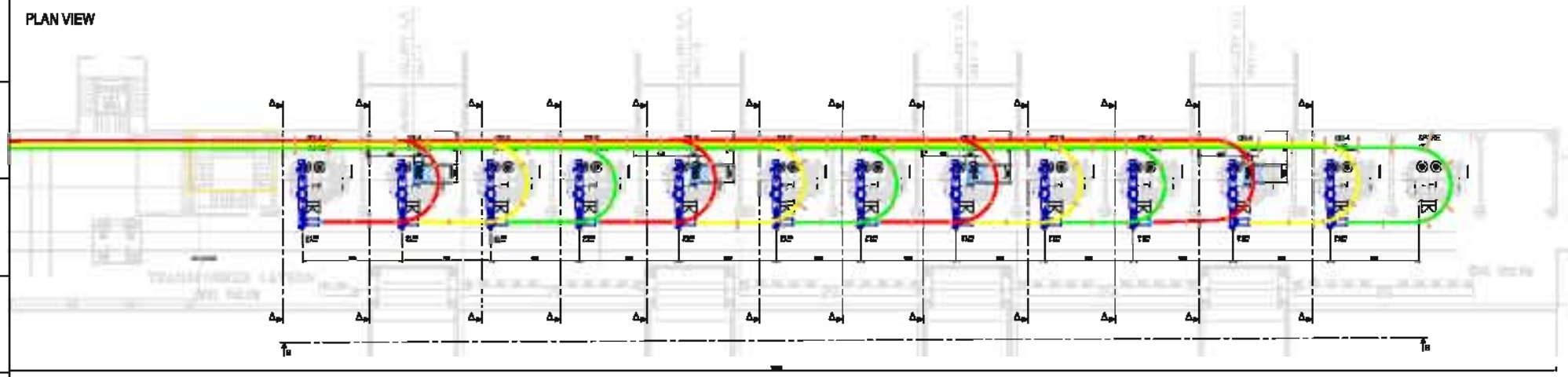
DRG.NO. TB-3-405-316-001 REV. 08

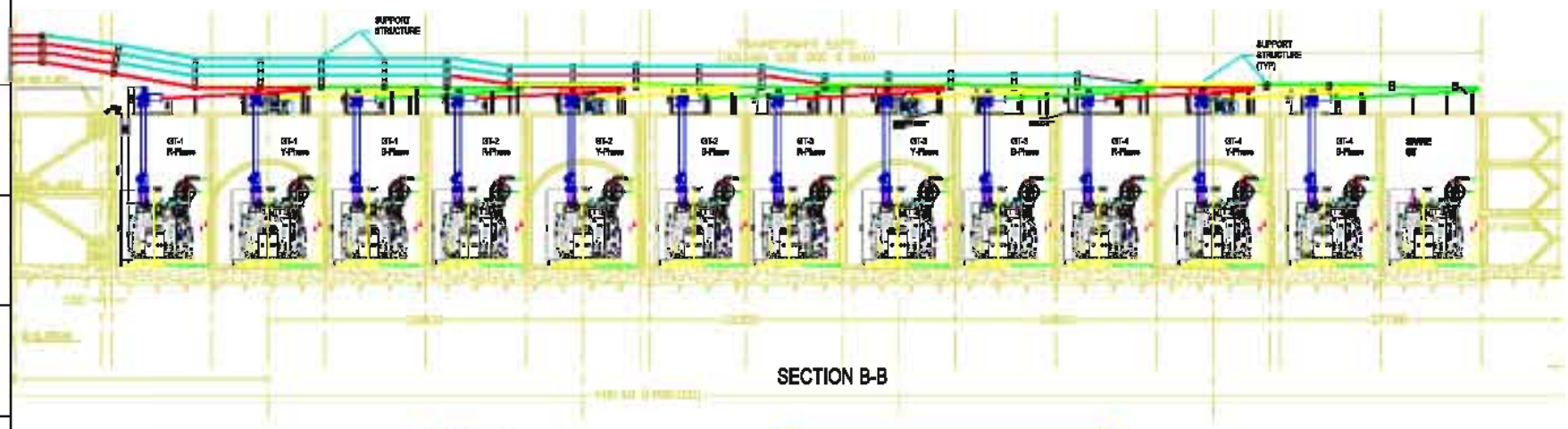
SHT. No 01 NO. OF SHT. 04

SIZE-A2

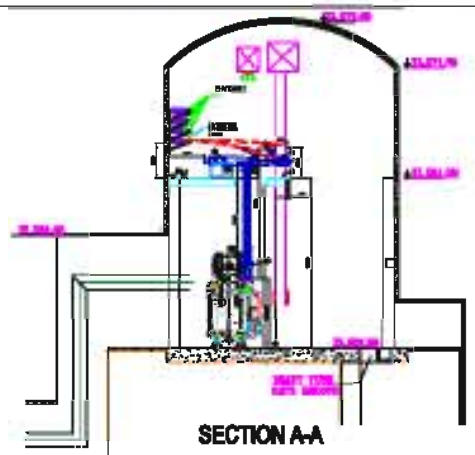
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PLAN VIEW





SECTION B-B



SECTION A-A



TYPICAL ISOMETRIC VIEW

Interfacing GIS Module (near Generator Transformer in GT Cavern Area) Portion of vertical bus duct approximate 7 meter is also part of interfacing GIS Module and no separate payment shall be made.

INSTALLATION OF GENERATOR TRANSFORMER AND 400KV CABLE ON EITHER SIDE OF "INTERFACING GIS MODULE" IS NOT IN BIDDER'S SCOPE

BASE DESIGN

NOTES

1. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE STATED.
2. [illegible]
3. [illegible]

LEGEND

4 – [illegible]	
5 – [illegible]	
10 – [illegible]	
11 – [illegible]	
12 – [illegible]	

REFERENCE DOCUMENTS

Drawing No.	Approval No.	Customer No.
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

No.	Revision	Date	Description
A0	[illegible]	[illegible]	[illegible]
A1	[illegible]	[illegible]	[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

ELECTRICAL LAYOUT PLAN AND SECTION – GT HALL

[illegible]

[illegible]

[illegible]

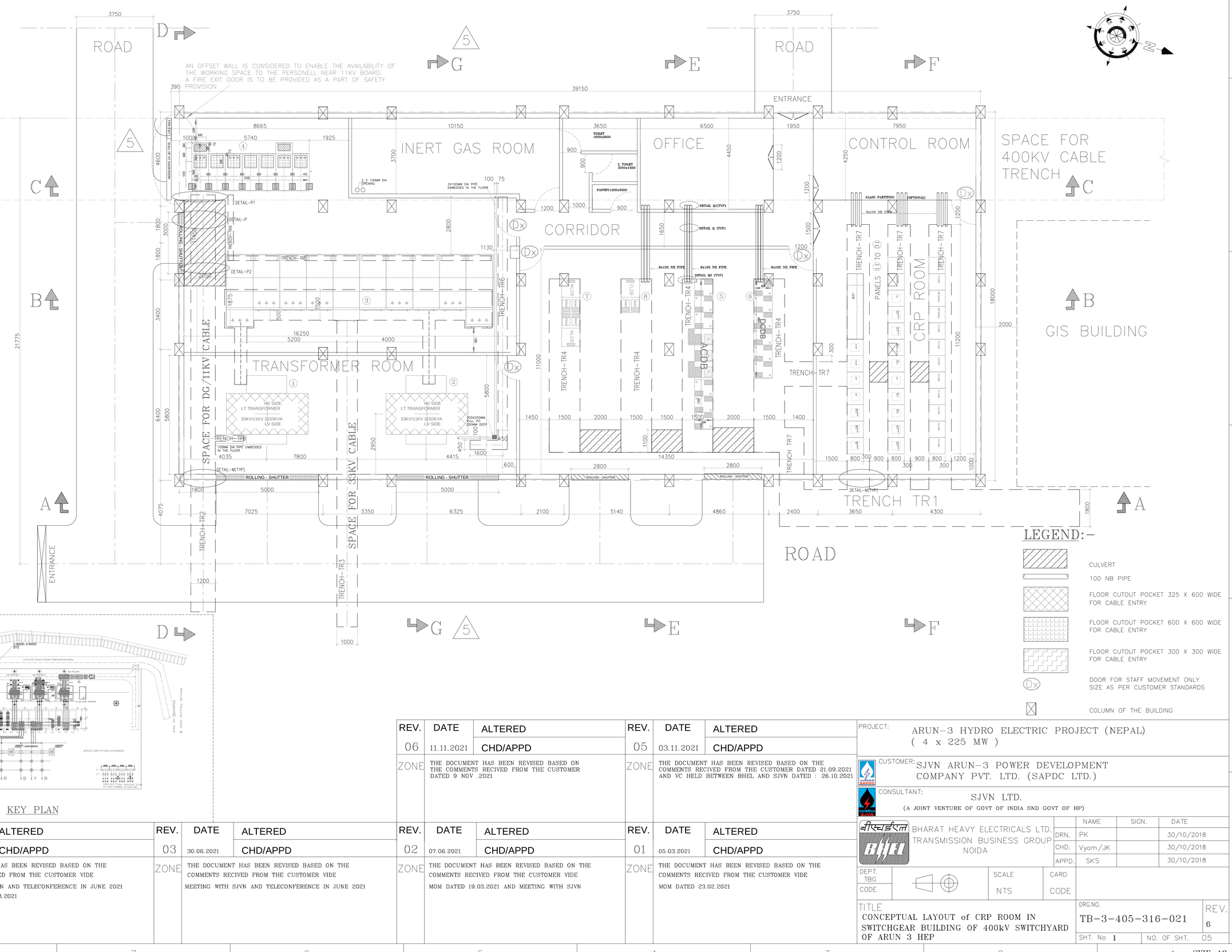
[illegible]

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

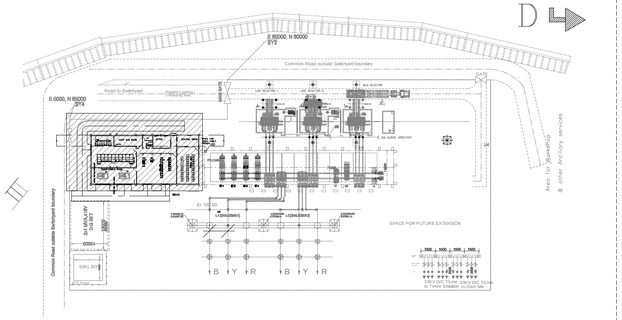
DRG. NO. TB-3-405-021

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LEGEND:-

- CULVERT
- 100 NB PIPE
- FLOOR CUTOUT POCKET 325 X 600 WIDE FOR CABLE ENTRY
- FLOOR CUTOUT POCKET 600 X 600 WIDE FOR CABLE ENTRY
- FLOOR CUTOUT POCKET 300 X 300 WIDE FOR CABLE ENTRY
- (Dx) DOOR FOR STAFF MOVEMENT ONLY SIZE AS PER CUSTOMER STANDARDS
- COLUMN OF THE BUILDING



KEY PLAN

REV.	DATE	ALTERED
06	11.11.2021	CHD/APPD
ZONE	THE DOCUMENT HAS BEEN REVISED BASED ON THE COMMENTS RECIVED FROM THE CUSTOMER DATED 9 NOV .2021	

REV.	DATE	ALTERED
05	03.11.2021	CHD/APPD
ZONE	THE DOCUMENT HAS BEEN REVISED BASED ON THE COMMENTS RECIVED FROM THE CUSTOMER DATED 21.09.2021 AND VC HELD BETWEEN BHEL AND SJVN DATED : 26.10.2021	

REV.	DATE	ALTERED
04	08.09.2021	CHD/APPD
ZONE	THE DOCUMENT HAS BEEN REVISED BASED ON THE COMMENTS RECIVED FROM THE CUSTOMER VIDE MEETING WITH SJVN AND TELECONFERENCE IN JUNE 2021 AND AUGUST 20.08.2021	

REV.	DATE	ALTERED
03	30.06.2021	CHD/APPD
ZONE	THE DOCUMENT HAS BEEN REVISED BASED ON THE COMMENTS RECIVED FROM THE CUSTOMER VIDE MEETING WITH SJVN AND TELECONFERENCE IN JUNE 2021	

REV.	DATE	ALTERED
02	07.06.2021	CHD/APPD
ZONE	THE DOCUMENT HAS BEEN REVISED BASED ON THE COMMENTS RECIVED FROM THE CUSTOMER VIDE MOM DATED 19.03.2021 AND MEETING WITH SJVN	

REV.	DATE	ALTERED
01	05.03.2021	CHD/APPD
ZONE	THE DOCUMENT HAS BEEN REVISED BASED ON THE COMMENTS RECIVED FROM THE CUSTOMER VIDE MOM DATED 23.02.2021	

PROJECT: ARUN-3 HYDRO ELECTRIC PROJECT (NEPAL) (4 x 225 MW)

CUSTOMER: SJVN ARUN-3 POWER DEVELOPMENT COMPANY PVT. LTD. (SAPDC LTD.)

CONSULTANT: SJVN LTD. (A JOINT VENTURE OF GOVT OF INDIA SND GOVT OF HP)

BHARAT HEAVY ELECTRICALS LTD. TRANSMISSION BUSINESS GROUP NOIDA

	NAME	SIGN.	DATE
DRN.	PK		30/10/2018
CHD.	Vyom/JK		30/10/2018
APPD.	SKS		30/10/2018

DEPT. TBG		SCALE	CARD
CODE		NTS	CODE

TITLE: CONCEPTUAL LAYOUT of CRP ROOM IN SWITCHGEAR BUILDING OF 400kV SWITCHYARD OF ARUN 3 HEP

DRG.NO. TB-3-405-316-021 REV. 6

SHT. No 1 NO. OF SHT. 05

SIZE-A2

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

DRG. NO. 3 469 00 01991

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IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO THE INTEREST OF THE COMPANY.

REF.DRG.NO.

SIGN.DATE

INVENTORY NO.

SJVN Arun-3 Power Development Company Pvt. Ltd.

Recommended by Consultant	To be issued to Contractor
	Category: APPROVAL
	Status: Approved Dated: 19.07.2020
☒Yes ☐No	Reviewed / Recommended / Approved

SUITABLE FOR M12 BOLT

LABLE FOR GROUNDING (S.S)

EARTHING PAD

EARTHING STRIP 12 X 75

2 X M4 BOLT

2 X M12 BOLT

LOCKING BAR

DETAIL - A
EARTHING ARRGT
(DETAIL OF IT. 4)
SUITABLE FOR 12 X 75 FLAT

TANK COVER

TANK RIM

DETAIL-'B'

℄ OF S.R.

℄ OF S.R.

1425

2462

JACKING POINT

DETAIL-'C'

6

BRAZED JOINT

40 40

2 x Ø14

197 147 100

45

20 100 20

75 20

DETAIL-E
NEUTRAL GROUNDING ARRGT.

02

3200

℄ OF CONSERVATOR

'W' 'V' 'U'

86c 15 86a 133 86c

14b 211 10a 12a

206 12b

6 6x 150 148

180 163 180 180

153 153

164

10 10 10

SEE DETAIL-B

85

8

157 SEE DETAIL-E 02

2 2a 2b 2c

C.G. 02

3b 125 17

79 19 4 SEE DETAIL-A

14 85 450

1490

19 SEE DETAIL-C

4 1200

5645±10 3350 3092

1050±2 6550±50 4595±8

23 871.5 871.5 109

PLINTH LEVEL

SEE FOUNDATION PLAN
DRG NO. 34690001996

2462 JACKING POINT 2462 JACKING POINT

ADDITIONAL INFORMATION	WO:-68013-X-517-01 68013-X-517-02
STATUS OF DRAWING	"U"
DISTRIBUTION OF PRINTS	TRE-1, TRM-3

PROJECT	ARUN-3 HYDRO ELECTRIC PROJECT, NEPAL (4X225MW)
CUSTOMER	SJVN ARUN-3 POWER DEVELOPMENT COMPANY PVT.LTD.(SAPDC LTD)
CONSULTANT	SJVN LTD. (A JOINT VENTURE OF GOVT OF INDIA AND GOVT OF HP)
TYPE OF PRODUCT	80 MVAR, 420KV, 3-PHASE, SHUNT REACTOR (LINE & BUS)

REV	DATE	ALT.	MKP	
02	14.07.2020	CKD.	KD/JS	
		APPD.	KD/JS	

ZONE: SHEET 1 CLEARANCE TABLE ADDED. SHEET 3 NO CHANGE. SHEET 2 & 4 NEUTRAL BUSHING INCLINED. SHEET 4 FOTS TABLE ADDED, ITEM 119a REPLACED BY 119b. CUSTOMER COMMENTS INCORPORATED.

REV	DATE	ALT.	MKP	
01	02.06.2020	CKD.	KD/JS	
		APPD.	KD/JS	

ZONE: CUSTOMER COMMENTS INCORPORATED.

भारत हेवी इलेक्टिकल्स लिमिटेड भोपाल
BHARAT HEAVY ELECTRICALS LTD. BHOPAL

DEPT	CODE	SCALE	WEIGHT(kg)
TRE	405	COMP.SCALE-1:1	-----

TITLE: OUTLINE GENERAL ARRANGEMENT ELEVATION VIEW

	NAME	SIGN	DATE
DRN.	MKP		13.07.19
CHD.	KD/JS		13.07.19
APPD.	KD/JS		13.07.19

DRG. NO 3 469 00 01991 REV. 02

SHEET 02 OF 04

Manish

FIRST ANGLE PROJECTION

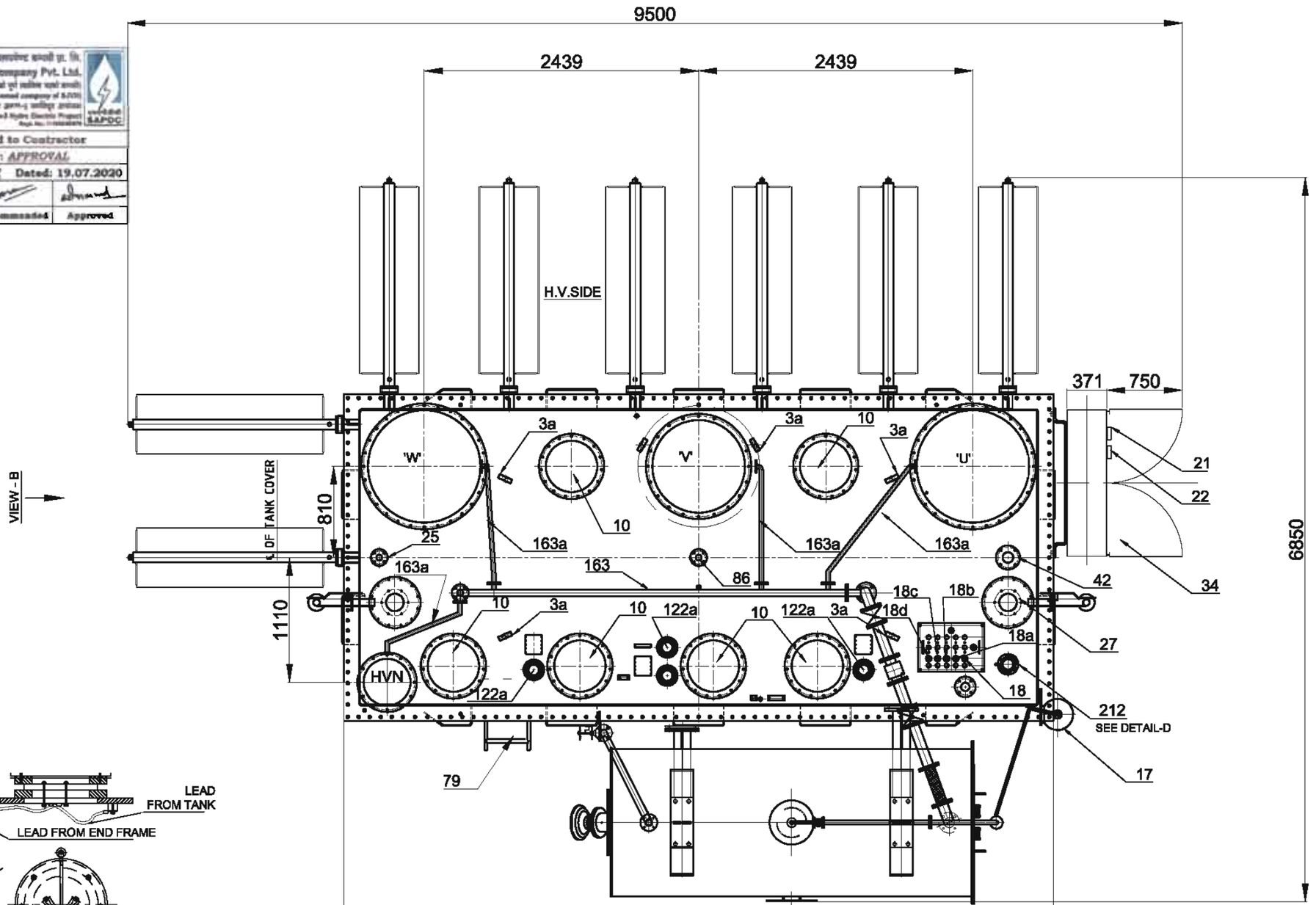
(ALL DIMENSIONS ARE IN mm)

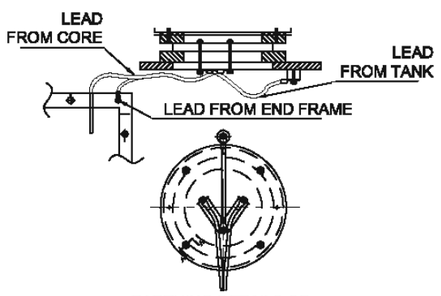
DRG. NO. 3 469 00 01991

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IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO THE INTEREST OF THE COMPANY.

SJVN Arun-3 Power Development Company Pvt. Ltd.

Recommended by Consultant	To be issued to Contractor Category: APPROVAL Status: Approved Dated: 19.07.2020		
☑Yes ☐No	Reviewed	Recommended	Approved





EARTHING DETAILS OF CORE, END FRAME & TANK

DETAIL-'D'

ADDITIONAL INFORMATION	WO:-68013-X-517-01 68013-X-517-02
STATUS OF DRAWING	"U"
DISTRIBUTION OF PRINTS	TRE-1, TRM-3

PROJECT	ARUN-3 HYDRO ELECTRIC PROJECT, NEPAL (4X225MW)
CUSTOMER	SJVN ARUN-3 POWER DEVELOPMENT COMPANY PVT.LTD.(SAPDC LTD)
CONSULTANT	SJVN LTD. (A JOINT VENTURE OF GOVT OF INDIA AND GOVT OF HP)
TYPE OF PRODUCT	80 MVAR, 420KV, 3-PHASE, SHUNT REACTOR (LINE & BUS)

भारत हेवी इलेक्टिकल्स लिमिटेड भोपाल
BHARAT HEAVY ELECTRICALS LTD. BHOPAL

DEPT	CODE	SCALE	WEIGHT(kg)
TRE	406	COMP.SCALE-1:1	-----

	NAME	SIGN	DATE
DRN.	MKP		13.07.19
CHD.	KD/JS		13.07.19
APPD.	KD/JS		13.07.19

TITLE: OUTLINE GENERAL ARRANGEMENT
PLAN VIEW

DRG. NO 3 469 00 01991 REV. 02

SHEET 03 OF 04

REV	DATE	ALT.	MKP	
02	14.07.2020	CKD.	KD/JS	
		APPD.	KD/JS	

ZONE: SHEET 1 CLEARANCE TABLE ADDED. SHEET 3 NO CHANGE. SHEET 2 & 4 NEUTRAL BUSHING INCLINED. SHEET 4 FOTS TABLE ADDED, ITEM 119a REPLACED BY 119b. CUSTOMER COMMENTS INCORPORATED.

REV	DATE	ALT.	MKP	
01	02.06.2020	CKD.	KD/JS	
		APPD.	KD/JS	

ZONE: CUSTOMER COMMENTS INCORPORATED.

REV	DATE	ALT.		
		CKD.		
		APPD.		

ZONE

Manish

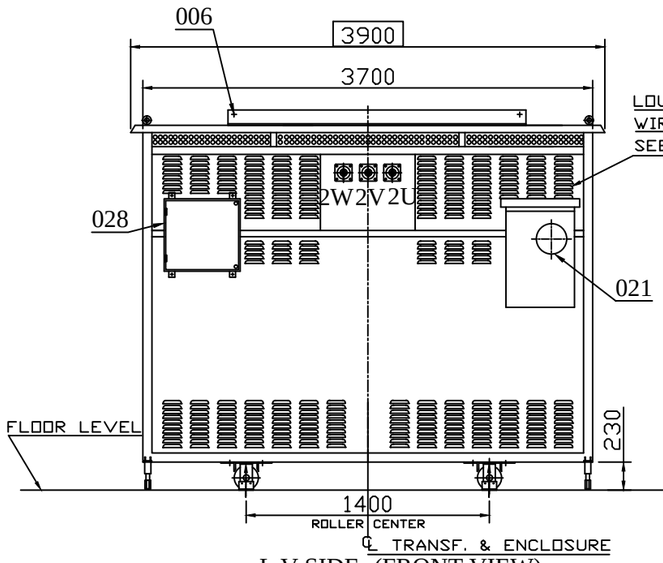
INVENTORY NO. | SIGN.DATE | REF.DRG.NO.

301 302 303 304 305 306 307 308

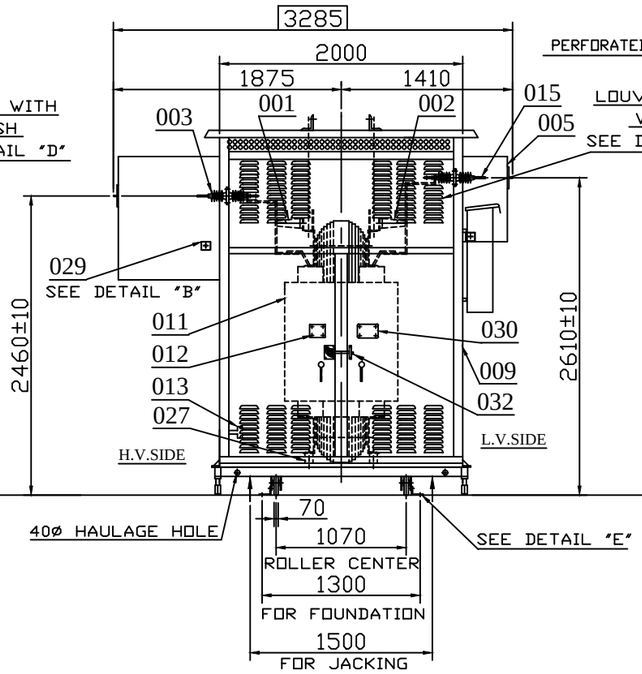
First Angle Projection

All dimensions in 'mm'

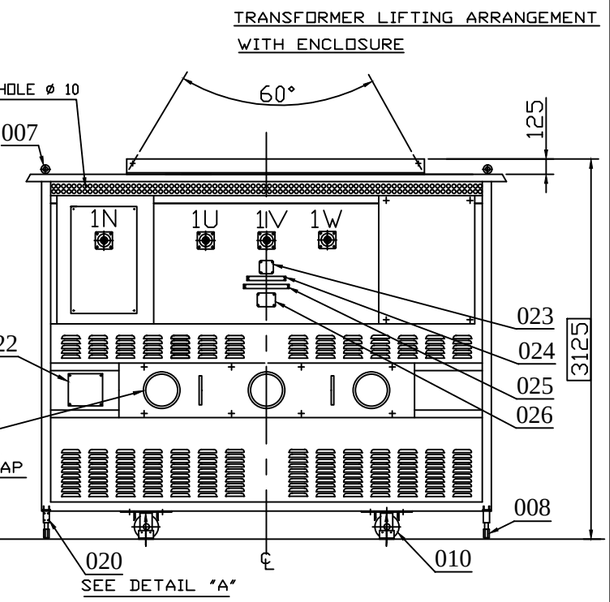
DRG.No. 34730052489



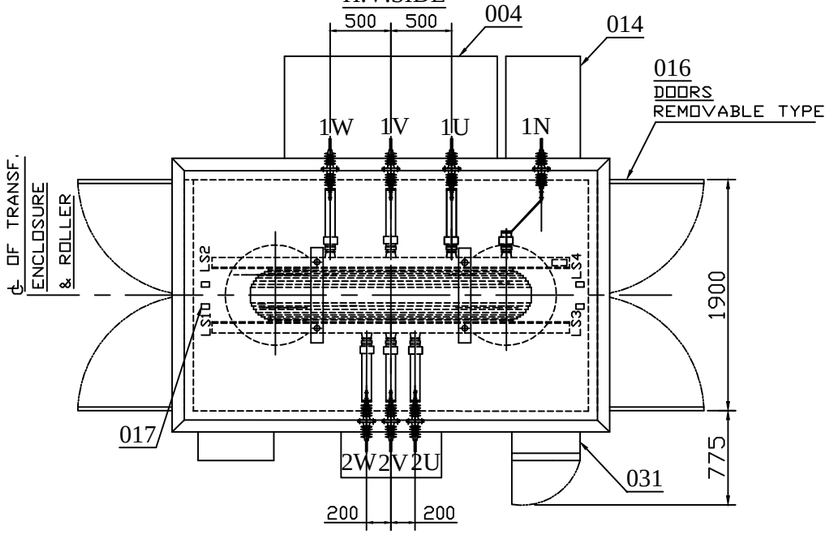
L.V.SIDE (FRONT VIEW)



(SIDE VIEW)



H.V.SIDE (REAR VIEW)



L.V.SIDE

(PLAN VIEW)

NOTES :-

1. FOR NOTES & OTHER DETAILS REFER DRG. 34730052491
2. FOR LIST OF REF. DRGS., FITTINGS & SPECIFICATIONS REFER DRG. 34730052490

PROJECT	(4X225MW) ARUN-3 HYDRO ELECTRIC PROJECT (NEPAL)
CUSTOMER	SJVN ARUN-3 POWER DEVELOPMENT COMPANY Pvt. LTD.
CONSULTANT	SJVN LTD.

ADDITIONAL INFORMATION
72167X10700

STATUS OF DRAWING

DISTRIBUTION OF PRINTS

TRE	PPC	BAY 1&2	BAY 3, 4&5	BAY 6&7	BAY 8	BAY 9	LMM	Other
								0

TYPE OF PRODUCT OR 3150 KVA, 33/11 KV CAST RESIN DRY TYPE TRANSFORMER (SST)

NAME OF CUSTOMER/PROJECT (4X225MW) ARUN-3 HYDRO ELECTRIC PROJECT (NEPAL)

BHARAT HEAVY ELECTRICALS LTD. JHANSI

	NAME	SIGN	DATE
DRN	SSV		31/08/2018
CHD	SHN1		21/09/2018
APPD	SSY1		

NO. OF VAR

REF. DRG. NO.															
SIGN AND DATE		REV	DATE	ALTERED CHECKED APPROVED	REV	DATE	ALTERED CHECKED APPROVED	REV	DATE	ALTERED SSV CHECKED SHN1 APPROVED SSY1	DEPT-TRE CODE-406	UN. TOL, DIM. C/M/F		SCALE	WEIGHT [KG]	REF. TO ASSY. NO.	ITEM NO	NO. OF ITEM
INVENTORY NO.		ZONE			ZONE			00										

TITLE: OUT LINE GENERAL ARRANGEMENT

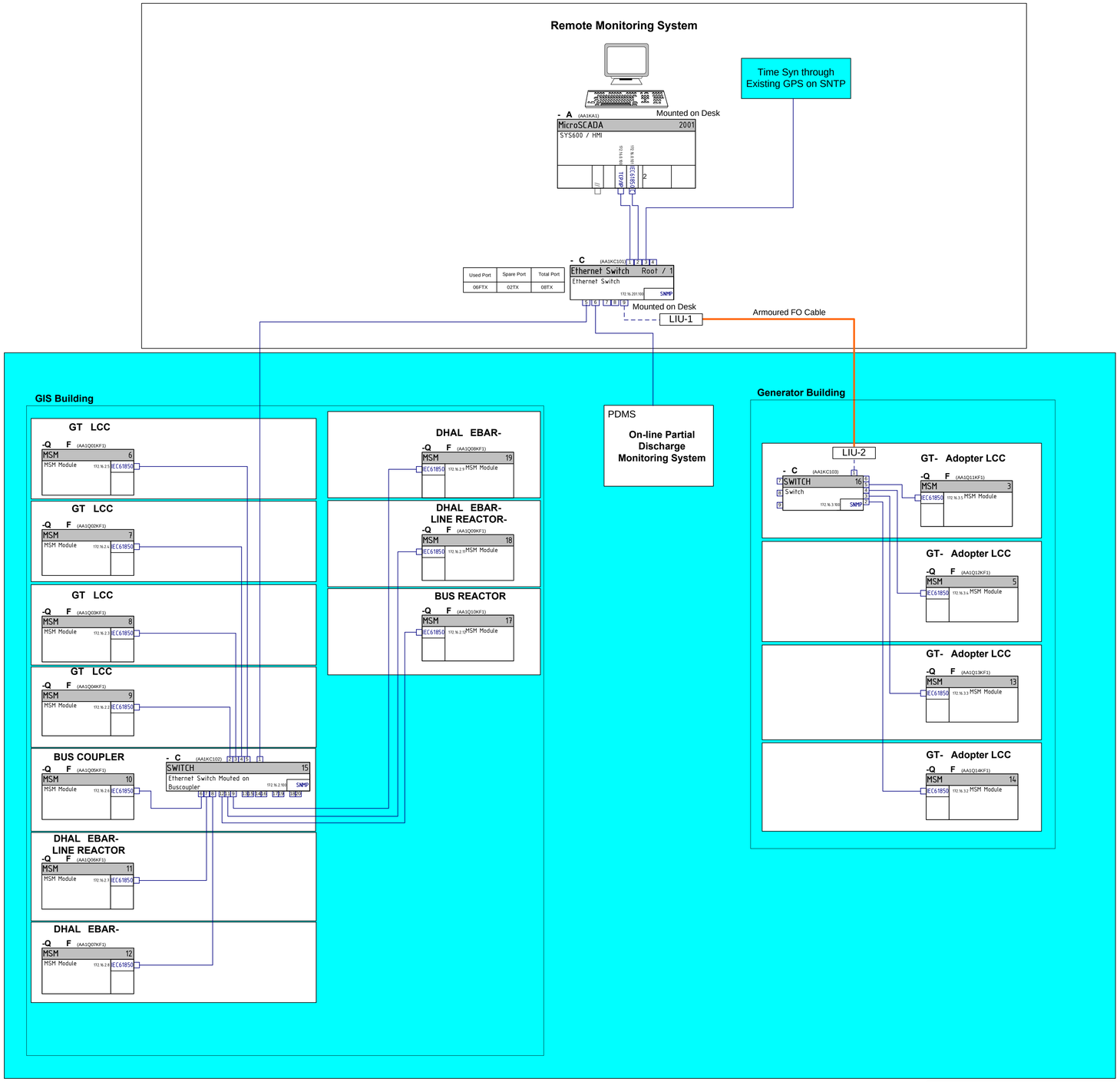
DRAWING NO. 34730052489 REV. 00

SHT NO 1 NO OF SHT 1

SIGNATURE NOT REQUIRED AS IT IS SYSTEM GENERATED DRAWING SIZE A3

MW ARUN- HYDRO ELECTRIC PRO ECT SAPDC LTD., NEPAL A/C OF BHARAT HEAVY ELECTRICALS LTD., NOIDA.

COMMUNICATION CONNECTIVITY DIAGRAM - REMOTE MONITORING SYSTEM



LEGEND

CAT5 LAN CABLE	
Multi Mode FO Duplex Patch Cable	
Armored FO Cable (6 Core, Multimode)	
LIU-1,LIU-2	Light Interface Unit, 12 port with ST connectors. (DIN rail mounting)

Note:-

1. All the ports of Ethernet switches to which cable are not connected shall be considered as spare ports.

Rev		Rev	

Based on: SALE ORDER NO:3100133979	Title: COMMUNICATION CONNECTIVITY DIAGRAM 4X225 MW ARUN-3 HYDRO ELECTRIC PROJECT SAPDC LTD., NEPAL.	
Prepared: SMB		
Approved: PSK		
Project: 4X225 MW ARUN-3 HYDRO ELECTRIC PROJECT BHEL ARUN-3 Nepal Remote Monitoring System SAPDC LTD., NEPAL.	Doc. des.: Remote Monitoring System	Ref. des.:
	Resp. dept.: PG-GASE	Rev. ind.: 03 / Lang.: English:
APPSIL	Doc. No.: 1MNS500745-SAA	Sheet: 1
		Page 1

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C:\Users\vinshkum6\OneDrive - PG\2022\Projects_2022\BHEL Arun LCC\Documents\ARchitecture\BHEL_ARUN3\BHEL\AA1\SCD - AA1.vsd / 22-11-17

Sl. No.	Description	Make	Article No.	Qty.
01.	Ethernet switch, DIN Rail Mount Type, 08 x copper port (TX- 10/100 Mbps Copper port of type RJ45 + 2 Nos SFP FX Multimode LC port). Operating temperature range: 0 to +60 deg C.	Siemens/HIRSCH MANN/AFS	1MYN900010-GFB	1 Nos.
02.	DR/EWS Remote Monitoring Workstation With Following Features: - Based on Intel I5, 6th Gen. Processor. 1 x 8GB DDR 4 Memory. 2 x 1TB HDD with Hot-Swap and Raid-1 Compliant. 1 x DVD-RW Drive. 2 x 10/100/1000 mbps LAN Ethernet Ports onboard. 1 x Dual Port 10/100/1000 mbps LAN Port Card. 4 x USB, 2 x Serial and 1 x VGA Port 1 x USB Keyboard and Optical Mouse. 1 x 400 Watt Single Power Supply. Windows 10 enterprise LTSB 64-Bit O.S.	Advantech	1MNS500745-SPAB	1 Nos.
03.	Monitor (24") TFT Local	HP/DELL	YN1M302361-TD	1 Nos.
04.	Remote Monitoring software (MicroSCADA) License. (In line with the SAS Architecture)	Hitachi Energy	1MNS500745-SLA	1 Nos.
05.	Shielded CAT front communication cable 10 meter	Hitachi Energy Approved	1MYN172009-S02	2 Nos.
06.	Shielded CAT communication cable 30 meter	Hitachi Energy Approved	1MYN172009-S06	1 Nos.
07.	Armored FO cable (6 Core Multimode)	Hitachi Energy Approved	1MYN900010-FOC	750 Mtr.
08	Armored CAT cable	Hitachi Energy Approved	1MNS500745-CAB	250 Mtr.
09	Light Interface Unit (DIN rail mounting) 12 Port with ST connectors	IVEONET/ Hitachi Energy Approved	1MYN900010-LDA	2 Nos.
10	Duplex Multi mode FO Patch Cable with ST-LC Connectors	Hitachi Energy Approved	1MYN172005-A005	3 Nos.

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

REF: …… **Dated**…….

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

SUB.:Tender for "Receipt of equipment/ material at site, unloading, reconciliation, inspection, verification, storage, up-keeping during storage, erection, testing, commissioning and handing over of 400 KV GIS & 400 KV AIS and associated systems/equipment at Arun-3 Hydro Electric Project and reconciliation and handing over surplus materials to BHEL for 4X225 MW SJVN Arun-3 Power Development Company (P) Ltd. in Nepal."

TENDER NO.: - TBSM/ARUN-3/NEPAL/ETC/TENDER/23-24 **Date: 10.04.2023**

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,
AGM/TBSM
BHARAT HEAVY ELECTRICALS LIMITED,
TRANSMISSION BUSINESS GROUP,
PLOT NO.-25, SECTOR-16A,
NOIDA – 201301 (U.P.)

Dear Sir,

Sub: Declaration for relation in BHEL

Ref: 1) NIT/Tender Specification
No……., Date:-

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.

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.

A. Documents required for Registration of a Branch Office in Nepal

1. Application form

2. Permission from Department of Commerce to carry on its business or transaction in Nepal/ Copy of the Contract Document for Services to be rendered to the Customer in Nepal;

3. Charter Documents (to be Notorized)

- ✓ Copies of the charter
- ✓ certificate of incorporation
- ✓ memorandum of association,
- ✓ articles of association of the company,
- ✓ and Nepalese translation thereof;

4. Address and other information

- ✓ Full name, address of the registered office and principal place of business of the company
- ✓ date of incorporation of the company
- ✓ description of the paid up capital; and
- ✓ major objectives of such company

5. Details of the Directors

- ✓ Names, addresses of directors, managers, company secretaries or main officers of the company; and
- ✓ description of their citizenship;

6. Name of the Representative

- ✓ Name and address of the person residing or staying in the Nepal, who is authorized by the company to receive, on its behalf, any summons, notice etc. issued in the name of the company;
- ✓ Copy of the Passport
- ✓ 8 passport size photographs

7. Address of the Representative Office

Full address of the principal place where the company carries on its transaction or business in Nepal and of the office of the company situated in that place;

8. Description of Business

Where the company is to carry on any transaction or business in the State of Nepal, details of the proposed investment and transaction;

9. Date of Commencement of Transactions

Where the company is to commence its transaction in Nepal, the proposed date thereof;

10. Director Declaration

A declaration made by a director of the company or his/her representative, on behalf of the company, that the matters contained in the returns submitted by the company are true and correct.

Original Board Resolution (to be notorized) authorizing the opening of the Branch Office in Nepal and appointment of the Representative.

11. Power of attorney (to be notorised) as referred to in Section 157 as follows:-

A foreign company to be registered pursuant to Section 154 of this Act shall submit office copy of a power of attorney executed in the specified format in accordance with the legal requirements of the country where the company has been incorporated or its registered office is situated, hereby appointing a person residing in Nepal as its authorized representative for the purposes of the service of any summons or notice or authorizing such person to receive any other lawful notices on a lawsuit or legal action instituted on behalf or legal against the company .

B. List of Documents Required for Income Tax Registration in Nepal

1. Application form (standard format available in the IRD website)
2. Certified copy of the Branch office registration in Nepal
   a) Certificate of incorporation;
   b) Memorandum of association;
   c) Articles of association of the company;
3. Original Board Resolution (to be notorized) authorizing the opening of the Branch Office in Nepal, appointment of the Representative
4. Power of Attorney (notorised) to be issued to the Representative for the operations.
5. Letter from the Client to IRO for recommending registration
6. Authorized person signing the application form – 3 passport size photographs
7. Copy of Passport or Other Identification of the authorized person signing the application form
8. Address of the office in Nepal and main place of business. Hand drawn sketch of the business location of the applicant.
9. Rent Agreement with tax withholding for at least three months**.**
10. Tax office may demand an advance deposit upto NRs 50,000.

Note: The authorized representative is required to self present at the IRO at the time of registration.

C. Documents required for opening bank account in NPR

For Nepal related Registered documents:

i. Certificate of incorporation with Office of company registrar.
ii. PAN registration
iii. MOA/AOA
iv. IDs & Photo of Board of Directors/members/signatories/POA-Holders, Nepal. (If person is foreigner, copy of IDs should be NOTARISED by legal authority of jurisdiction)
v. Board resolutions to open bank account OR POA to any representative to do so.
vi. Account opening request in Co. Letter head.
vii. If any of the signatories signs & put **THUMB PRINT** in Signature Specimen Card outside Nepal, the specimen card also must be NOTARISED.
viii. KYC details of all signatories.

For Foreign Registered Entity:

i. Written declaration in Co. Letter head by Authorized representative of Company mentioning "There is no any individual person who is a Beneficial Owners (Holding 10% or more shares of the company)
ii. If any individual person is a Beneficial owner, ID, Photo & KYC details of that person is required.
iii. IDs, Photo & KYC details of any TWO controlling directors of Company.
iv. Overall Ownership Structure of company
v. Certificate of incorporation
vi. TAX registration
vii. TAX clearance certificate- Latest
viii. Articles of Association
ix. Financial statements- Latest

Note: - Copies of all documents originated from outside Nepal must be NOTARISED by legal authority of jurisdiction.

For INR, the banks do not open bank accounts in INR, a special approval may be required from NRB.