ಭಾರತ್ ಹೆವಿ ಎಲೆಕ್ಟ್ರಿಕಲ್ಸ್ ಲಿಮಿಟೆಡ್
भारत हेवी इलेक्ट्रिकल्स लिमिटेड
Bharat Heavy Electricals Ltd.,
(A Government of India undertaking)
Electronics Division
PB 2606 , Mysore Road Bangalore , 560026 INDIA

CE: PR: 003- Rev 03

SPECIAL COMMERCIAL CONDITIONS OF CONTRACT

Reference is brought to BHEL's Instructions to Bidders (Document Ref: CE: PR: 001- Rev 05) and General Commercial Conditions for Contract (Document Ref: CE: PR: 002- Rev 04).

These two documents along with Special Conditions of Contract annexed to this RFQ will form an integral part of the contract as and when the RFQ culminates into a Purchase Order / Contract.

RFQ No.	: ATLNIC0030
RFQ Date	: As per E-procurement website
RFQ Due Date	: As per E-procurement website
Customer	: M/s HINDALCO INDUSTRIES LTD (HIL)
Project	: COAL FIRED HINDALCO THERMAL POWER PLANT
Item Description	: VFDs for 2125kW, 6.6 kV Motor & 400kW, 6.6 kV Motor

Kindly submit your quotation as **two part bid** (Pre-Qualification Criteria & Techno-Commercial bid-1st part & Price bid-2nd Part) in E-Procurement System portal: https://eprocurebhel.co.in within the Due- Date of __ As per E-procurement website _____ before _ As per E-procurement website _____ hours IST and note that tenders will be opened on the same day at _ As per E-procurement website _____hours IST.

Purchase Executives: Clarifications with regard to the tender shall be addressed to purchase officers whose e-mail IDs are given below:
sathishkumars@bhel.in or atulsood@bhel.in

Splitting of tendered quantity to MSE vendors for Purchase preference: Non-Splitable

Destination: For Indigenous scope of supply, items are to be directly despatched to BHEL site office/stores located at Hindalco Industries Ltd, Aditya Aluminium Project, Lapanga, Pin 768212, District Sambalpur, State Odisha. Detailed Consignee details will be issued by BHEL along with Despatch Clearance.

Terms of Delivery:

- **Indigenous scope of supply:** Ex-works, ___<indicate station of dispatch>_____ (including Packing & Forwarding charges but excluding Taxes).

Under-mentioned details shall be provided against indigenous supplies & services:

a. GSTIN of place of supply : _____

b. HSN (Harmonized System of Nomenclature) code : _____
Applicable tax and Rate : _____&_____

c. GSTIN of place of supply of service : _____

d. SAC (Service Accounting Code) : _____
Applicable tax and Rate : _____&_____

e. GeM Seller ID mandatorily required for PO placement: _____

f. MSE vendor : Yes-MSE supporting documents enclosed/No
(If MSE, supporting documents such as Udyam certificate to be enclosed)

I. Bidders to mandatorily provide confirmation/compliance for the under-mentioned terms:

SL NO.	TERMS	BHEL ACCEPTABLE TERM	BIDDER'S CONFIRMATION	REMARKS, if any
01	**Reverse Auction (RA).** Not applicable for this tender	~~BHEL shall be resorting to Reverse Auction (Guidelines as available on https://www.bhel.com/guidelines-reverse-auction-2024) 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 as initial bids of bidders in 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.~~	~~AGREE~~	Not applicable for this tender.
02	**Delivery Period**	i) Delivery period for 1st unit shall be within 259 days from the date of placement of Purchase Order. ii) Delivery period for 2nd unit shall be within 364 days from the date of placement of Purchase Order. iii) Delivery period for 3rd unit shall be within 546 days from the date of placement of Purchase Order. However, Manufacturing Clearance will be issued based on latest site delivery schedule. Delay in contractual delivery will attract Penalty /Liquidated Damages(LD) as per GCC Clause no.:04.b.	AGREE	
03	**Terms of Payment at the time of material supply**	Refer Clause "F" of Instructions to Bidder for BHEL-EDN standard Payment terms and loading factors applicable for non-compliance against payment terms: A) Indigenous Procurement: i)~~Supply Only~~ *ii)Supply with Service(s)* B) ~~Import Procurement~~ ~~C) High Sea Sales Procurement~~ Note: MSME vendors may opt to get payment through Trade Receivables electronic Discounting System (TReDS)	AGREE	
04	**Declaration of local content**	'Local content' means the amount of value added in India which shall, unless otherwise prescribed by the Nodal Ministry, be the total value of the item procured (excluding net domestic indirect taxes) minus the value of imported content in the item (including all customs duties) as a proportion of the total value, in percent. (Refer Clause 'A' Sl. No. 12 of Instructions to Bidders). The 'Class-I local supplier' shall be required to indicate percentage of local content and provide certification that the item offered meets the local content requirement for 'Class-I local supplier'.	Percentage of local content: _____% Details of the Location(s) at which the local value addition is made: _____	

II. **Bidder to note that Deviations shall not be permitted for the below mentioned terms and are deemed to be complied. In case of non-compliance/deviation, offer shall be liable for rejection:**

(1) **a) Submission of Engineering documents post PO as indicated in Cl: 04 of GCC:** After award of contract, Successful bidder shall submit complete set of documents (like drawings, bill of materials, datasheets, catalogues, quality plan, etc. as called in tender specification) for approval, within **28** days from the date of award of contract. Buyer shall issue manufacturing clearance along with approved documents within **35** days for Unit 1, **140** days for Unit 2 and **322** days for Unit 3 after receipt of documents from seller. Any delay by buyer/consignee in providing approved documents beyond specified period shall be on the part of buyer and BHEL will extend the delivery period for such period of delay.
In case of any corrections in documents to be incorporated by seller for approval of document based on end-user/consultant/buyer comments, revised documents have to be submitted by seller incorporating the comments within **7** days from the date of receipt of the same.

Seller shall be required to commence manufacturing only after receipt of approved documents from BHEL.

b) **Extension of Delivery Period:** Refer ***Cl.04 b) Extension of Delivery Period*** **of GCC**.

(2) **Validity:** The offer will be valid for a period of _90_ days from the date of Part-I bid opening and in case of Negotiation/ Counter-offer/Reverse Auction, price validity will apply afresh for a period of _60_ days from the date of according final price by bidder (or) up to original validity period, whichever is later.

(3) **Warranty:** _18_ months from the date of delivery of goods or 12 months from date of commissioning, whichever is earlier.

(4) **a) Pre-dispatch inspection at Seller premises as indicated in Cl: 06 a) of GCC**: While bidding, the sellers should take into account **10** days for arranging inspection from the date of email offering the goods for inspection. Any delay in arranging inspection beyond the specified period due to reasons not attributable to seller, shall be on the part of buyer and BHEL will extend the delivery period for such period of delay.

b) **Material despatch clearance certificate (MDCC):** Seller should take into account **10** days for issuance of despatch clearance by BHEL from the date of successful inspection report. Any delay in issue of MDCC beyond the specified period shall be on the part of buyer and BHEL will extend the delivery period for such period of delay.

(5) **Despatch Documents:** Complete set of despatch documents (original + 1 photocopy set) as per Purchase Order shall be forwarded to Purchase Executive/BHEL directly. Depending upon the project/customer demands, Despatch documents may include one (or) more documents from the following:

Invoice (01 original and 01 copy with original sign & seal / digitally signed invoice), Lorry Receipt (L/R) (or) Bill of Lading, Packing List, NIL Short-Shipment Certificate, Warranty certificate, insurance intimation letter, E-way bill (Part-A & B), original POD (Proof of Delivery) on L/R etc.

The precise list of despatch documents needed for the project will be specified in the Purchase Order.
One set of Invoice, Packing List, Lorry Receipt (or) AWB/BOL, E-way bill with part-A,B details shall be e-mailed immediately to BHEL-EDN at the time of despatch.

Note: Detailed Packing List should indicate package-wise content details and also Net & Gross weight of each package.

(6) **Freight Charges:** Freight charges shall be to vendor's account. Bidder to quote reasonable Freight charges along with applicable tax, in price bid.

(7) **Evaluation criteria to determine L1 bidder:** Items will not be split on item-wise lowest offer. Evaluation of the lowest bidder will be done as a combined package basis. The Procuring Entity reserves its right to grant preferences to eligible Bidders under various Government Policies/ directives (policies relating to Make in India, MSME etc.)

a. Preference to Micro & Small Enterprises (MSEs): Purchase preference will be given to MSEs as defined in *Public Procurement Policy* for Micro and Small Enterprises (MSEs) Order, 2012 dated 23.03.2012 issued by Ministry of MSME (and its subsequent Orders/Notifications issued by concerned Ministry) & the latest *Office Memorandum* issued by Department of Expenditure dt:18.05.2023.

If the bidder wants to avail the Purchase preference, the bidder must be the manufacturer of the offered product in case of bid for supply of goods. Traders are excluded from the purview of Public Procurement Policy for Micro and Small Enterprises. Relevant documentary evidence in this regard shall be uploaded along with the bid in respect of the offered product.

Bidder shall furnish the following declaration;

MSE declaration	Any Bidder falling under the MSE category shall furnish UDYAM Registration certificate in support of the same along with their techno-commercial offer. Note: If the bidder does not furnish the above in the tender, the offer shall be processed construing that the bidder does not fall under the MSE category.
MSE Category declaration	If the bidder belongs to any of the below MSE category, the bidder to mention Social Category and Gender in the REMARKS column and furnish UDYAM Registration certificate containing these details in support of the same along with their techno-commercial offer a. SC/ST Owned b. Women Owned Note: If the bidder does not furnish the above in the tender, the offer shall be processed construing that the bidder does not fall under the above category.

b. Preference to Make in India (MII) products: Preference shall be given to Class 1 local supplier as defined in public procurement (Preference to Make in India) order 2017 as amended from time to time (and its subsequent Orders/Notifications issued by concerned Nodal Ministry for specific Goods/Products) & the latest *Office Memorandum* issued by Department of Expenditure dt:18.05.2023 and Revision dt.19-07-2024.

{'Class-I local supplier' means a supplier or service provider, whose goods, services or works offered for procurement, has local content equal to or more than 50%, as defined under Public procurement order no. P-45021/2/2017-PP (BE-II) dt.: 16.09.2020 and Revision dt.19-07-2024.

'Class-II local supplier' means a supplier or service provider, whose goods, services or works offered for procurement, has local content more than 20% but less than 50%, as defined under Public procurement order no. P-45021/2/2017-PP (BE-II) dt.: 16.09.2020 and Revision dt.19-07-2024}.

In the event of any Nodal Ministry prescribing higher or lower margin of purchase preference and/or higher or lower percentage of local content in respect of this procurement, same shall be applicable.'}

If the bidder wants to avail the Purchase preference, the bidder must upload a certificate from the OEM regarding the percentage of the local content and the details of locations at which the local value addition is made along with their bid, failing which no purchase preference shall be granted.

Note: For this procurement, the local content to categorize a supplier as a Class I local supplier/ Class II local Supplier/ Non local supplier and purchase preference to Class I local supplier, is as defined in Public

Procurement (Preference to Make in India), Order 2017 dated 19.07.2024 issued by DPIIT. In case of subsequent orders issued by the nodal ministry, changing the definition of local content for the items of the NIT, the same shall be applicable even if issued after issue of this NIT, but before opening of Part-II bids against this NIT.

Penal provisions for false self-declaration of MII, in case of Contract more than Rs.10Crs.

For contract valuing more than Rs.10 Crores, local content (in case of self-declaration certification submitted by bidders at the time of tendering), the contractor/ supplier shall be required to give local content certification duly certified by cost/chartered accountant in practice, within 120 days from the date of release of the Purchase order by BHEL. In case the contractor/ supplier does not meet the stipulated local content requirement and the category of the supplier changes from Class-I to Class-II/Non-local or from Class-II to Non-local, a penalty upto 10% of the contract value may be imposed. However, contract once awarded shall not be terminated on this account.

Default margin of purchase preference shall be 20% to local suppliers with default minimum local content of 50%.

Operation methodology of Purchase preference clause to MSE & MII bidders is as detailed under clause:4. c. b) in the Office Memorandum issued by Department of Expenditure dt:18.05.2023 (ref. Annexure-VIII of ITB).

Note: In case of negotiations, the margin of purchase preference (20% for Class-I Non-MSE or 15% for MSE) shall be based on pre-negotiated L1 price and the eligible Class-I & MSE local bidder will have to match the negotiated L1 price.

Note: Non-Local suppliers (with local content < 20%) are not eligible to participate in this tender.

(8) **Performance security**: Performance of the contract, Performance Bank Guarantee (PBG) or Security Deposit (SD), hereafter referred as performance security has to be submitted by successful bidder for **05%** of the contract value.

CPBG has to be furnished within **05** Weeks after notification of the award and it should remain valid for a period of **60** days beyond the date of completion of all contractual obligations, including warranty obligations.

Refer Clause "H" of Instructions to Bidders. Also note that CPBG should be in the format specified in Annexure VII of ITB and no deviation to this format will be allowed.

Modes of deposit:

a) Performance security may be furnished in the following forms:

(i) Local cheques of Scheduled Banks (subject to realization)/ Pay Order/Demand Draft/ Electronic Fund Transfer in favour of BHEL.

(ii) Bank Guarantee from Scheduled Banks/Public Financial Institutions as defined in the Companies Act.

(iii) PBG should be in the format specified in Annexure VII of ITB and no deviation to this format will be allowed.

(iv) Fixed Deposit Receipt issued by Scheduled Banks/Public Financial Institutions as defined in the Companies Act (FDR should be in the name of the Contractor, a/c BHEL).

(iv) Securities available from Indian Post offices such as National Savings Certificates, Kisan Vikas Patras etc. (held in the name of Contractor furnishing the security and duly endorsed/hypothecated/ pledged, as applicable, in favour of BHEL).

(v) Insurance Surety Bond.
(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)

b) The Performance security will be forfeited and credited to BHEL's account in the event of a breach of contract by the supplier.

c) Performance security shall be refunded to the supplier without interest, after duly performing and completing the contract in all respects but not later than 60 days of completion of all such obligations including the warranty under the contract.

d) The Performance security shall not carry any interest.

e) **CPBG/PBG should be mandatorily submitted along with SFMS (Structured Financial Messaging System**).

(9) **Breach of Contract, Remedies & Termination**: In case of breach of contract (failure of supplier), wherever the value of Performance security available with BHEL against the said contract is at least 10% of the contract value, the same shall be encashed.
In case the value of the security instruments available is less than 10% of the contract value, the balance amount shall be recovered from other financial remedies (i.e. available bills of the contractor, retention amount, etc. with BHEL) or legal remedies be pursued.
Further, levy of liquidated damages, debarment, termination, de-scoping, short-closure, etc. shall be applied as per provisions of the contract.

(10) **Erection Supervision & Commissioning** - Evaluation methodology**:**

Range of procurement value	**Minimum percentage of basic material value proposed for Erection Supervision & Commissioning charges**
Up to Rs. 2.50 crs.	05%
Greater than Rs. 2.50 crs. and lesser than Rs. 10 crs.	03% (or) Rs.12.50 lakhs, whichever is higher.
Greater than Rs. 10 crs. and lesser than Rs. 20 crs.	02% (or) Rs.30 lakhs, whichever is higher.
Greater than Rs. 20 crs.	01.50% (or) Rs.40 lakhs, whichever is higher.

Depending on the material quotation value, the bidder will have to quote the corresponding Erection Supervision & Commissioning charges for the respective slab/range as per above table. In case the quoted total Erection Supervision & Commissioning value is less than above stipulated charges, BHEL shall evaluate Bidders offered Price deducting differential amount from main supply price (excluding spares, training charges) and apportioning towards Erection Supervision & Commissioning charges.

Payment terms for E&C charges: 100% payment (on per-diem basis), will be paid in 15 days from the date of submission of supplementary invoice/documents against proof of completion of E&C. Contractor's payment is subject to TDS, TCS as per applicable act of Govt.

Note: Wherever bidders doesn't agree for such apportioning, the differential charges shall be retained from main supply invoice and retention amount will be paid after successful completion of Erection & Commissioning.

(11) Based on the under-mentioned declarations of Bidder as insisted under Rule 144(Xi) of General Financial Rules,2017 amendment dt. 24.02.2023, eligibility of offer will be ascertained in the tender:

"I have read the clause regarding restrictions on procurement from a bidder of a country which shares a land border with India; I certify that our firm is not from such a country or, if from such a country, has been registered with the Competent Authority. I hereby certify that our firm fulfils all requirements in this regard and is eligible to be considered."

Note: Wherever applicable, evidence of valid registration by the Competent Authority shall be attached.

Additional declaration by Bidder in the cases of specified Transfer of Technology (ToT):

"I have read the clause regarding restrictions on procurement from a bidder having Transfer of Technology (ToT) arrangement. I certify that our firm does not have any ToT arrangement requiring registration with the Competent Authority."

OR

"I have read the clause regarding restrictions on procurement from a bidder having Transfer of Technology (ToT) arrangement. I certify that our firm has valid registration to participate in this procurement."

(12) **Integrity Pact: Applicable**

Execution of Integrity Pact is applicable for this tender (Refer clause "K" of Instructions to Bidders). The IP as enclosed with the tender is to be submitted (duly signed by authorized signatory who signs in the offer) along with techno-commercial 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.

(13) **EMD/Bid security:** Not Applicable

(14) Declaration regarding 'Conflict of Interest among Bidders/Agents' should be submitted as part of the tender as per attached format.

(15) Grievance Redressal Mechanism:

To promote transparency and ensure fair treatment of all bidders, a structured Grievance Redressal Mechanism is in place to address any concerns or issues arising during the tendering process or in subsequent business dealings with the company.

Suppliers/Contractors are requested to follow the below escalation process for grievance resolution:

1. ***First Level:*** Any grievance should initially be addressed to the designated Dealing Officer, whose contact details are provided in the Notice Inviting Tender (NIT)/Contract.

2. ***Second Level:*** If the issue remains unresolved, it may be escalated by lodging a formal grievance through the SUVIDHA Portal: **https://suvidha.bhel.in/suvidha/.**

Responses will be provided in accordance with the defined escalation matrix."

(16) **For goods / works / services on Indian Suppliers / Contractors:** Irrespective of the value of the invoice amount, the supplier/ contractor should necessarily upload the invoice details on BHEL SUVIDHA portal at https://suvidha.bhel.in/suvidha/, prior to despatch/raising invoice. All documents as per contract checklist, along with additional documents (if any), must be uploaded on the portal. It is mandatory that

tax invoices with a net amount (including taxes) exceeding Rs five lakhs uploaded on the portal are digitally signed using a Class 3 Digital Signature Certificate (DSC) issued by a licensed Certifying Authority. Submission of invoice document in hard copy is allowed for invoices with a net amount (including taxes) equal to and upto Rs five lakhs in case the requirement for digitally signed invoice is not explicitly mentioned in the contract checklist.

The Invoice will not be accepted in absence of the above

With this, we hereby confirm that all the terms & conditions as indicated in Instructions to Bidders (Document Ref: CE: PR: 001- Rev 05) & General Commercial Conditions for Contract (Document Ref: CE: PR: 002- Rev 04) are accepted without any deviation.

Vendor's Signature with Seal

On Bidder Letter Head

Date:

To,
M/s Bharat Heavy Electricals Ltd.
Electronics Division, Mysore Road,'
Bangalore – 560026

Sub: Declaration regarding 'Conflict of Interest among Bidders/Agents'

Ref: BHEL Tender / RFQ / NIT Number ……

Bidders having a conflict of interest shall not be eligible to participate in the tender process. In this regard, following declaration regarding 'conflict of interest' should be signed by the authorized signatory of the bidder and submitted as part of the tender.

Treatment of cases regarding conflict of interest:

The bidder notes that a conflict of interest would said to have occurred in the tender process and execution of the resultant contract, in case of any of the following situations:

i) If its personnel have a close personal, financial, or business relationship with any personnel of BHEL who are directly or indirectly related to the procurement or execution process of the contract, which can affect the decision of BHEL directly or indirectly;

ii) The bidder (or his allied firm) provided services for the need assessment/ procurement planning of the tender process in which it is participating;

iii) Procurement of goods directly from the manufacturers/suppliers shall be preferred. However, if the OEM/principal insists on engaging the services of an agent, such agent shall not be allowed to represent more than one manufacturer/supplier in the same tender. Moreover, either the agent could bid on behalf of the manufacturer/supplier or the manufacturer/supplier could bid directly but not both. In case bids are received from both manufacturer/supplier and the agent, bid received from the agent shall be ignored. However, this shall not debar more than one authorised distributor (with/ or without the OEM) from quoting equipment manufactured by an Original Equipment Manufacturer (OEM) in procurements under a Proprietary Article Certificate.

iv) A bidder participates in more than one bid in this tender process. Participation in any capacity by a Bidder (including the participation of a Bidder as a partner/ JV member or sub-contractor in another bid or vice-versa) in more than one bid shall result in the disqualification of all bids in which he is a party. However, this does not limit the participation of an entity as a sub-contractor in more than one bid if he is not bidding independently in his own name or as a member of a JV.

The Bidder declares that they have read and understood the above aspects, and the bidder confirms that such conflict of interest does not exist and undertakes that they will not enter into any illegal or undisclosed agreement or understanding, whether formal or informal with the other Bidder(s), in this regard. This applies in particular to prices, specifications, certifications, subsidiary contracts, submission or non-submission of bids or any other actions to restrict competitiveness or to introduce cartelization in the bidding process. **In case, the Bidder is found having indulged in above activities, the same will be considered as a violation of the tender conditions, and suitable action shall be taken by BHEL as per extant policies/guidelines.**

For M/s ……

Authorized Signatory

(with company seal & Name)

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भारत हेवी इलेक्ट्रिकल्स लिमिटेड
Bharat Heavy Electricals Ltd.,
(A Government of India undertaking)
Electronics Division
PB 2606 , Mysore Road, Bengaluru , 560 026, INDIA

CE:PR:001- Rev 05

INSTRUCTIONS TO BIDDERS

Bidder is requested to read the instructions carefully and submit their quotation taking into consideration of all the points:

A. GENERAL INSTRUCTIONS:

1. Any Purchase Order resulting from this enquiry shall be governed by the Instructions to Bidders (document reference: CE: PR: 001 – Rev 05), General Conditions of Contract (document reference: CE: PR: 002 - Rev 04) and Special Conditions of Contract, if any, of the enquiry.
2. Any deviations from or additions to the "General Conditions of Contract" or "Special Conditions of Contract" require BHEL's express written consent. The general terms of business or sale of the bidder shall not apply to this tender.
3. Regret letter (either through post or by mail or by EPS) indicating reasons for not quoting must be submitted without fail, in case of non-participation in this tender.

   Supplier shall be liable for removal as a registered vendor of BHEL when the supplier fails to quote against four consecutive tender enquiries for the same item or all enquiries in last two years for the same item, whichever is earlier.
4. Procurement directly from the manufacturers is preferred. However, if the OEM/ Principal insist on engaging the services of an agent, such agent shall not be allowed to represent more than one manufacturer/ supplier in the same tender.

   Moreover, either the agent could bid on behalf of the manufacturer/ supplier or the manufacturer/ supplier could bid directly but not both. Agent/Representative authorized by the OEM/Principal in turn cannot further sub authorize any other firm for submitting the offer or for placement of order.

   In case bids are received from the manufacturer/ supplier and his agent, bid received from the agent shall be ignored.
5. Consultant / firm (and any of its affiliates) shall not be eligible to participate in the tender/s for the related goods for the same project if they were engaged for consultancy services for the same project.
6. If an Indian representative/associate/liaison office quotes on behalf of a foreign based bidder, such representative shall furnish the following documents:
   a. Authorization letter to quote and negotiate on behalf of such foreign-based bidder.
   b. Undertaking from such foreign based bidder that such contract will be honored and executed according to agreed scope of supply and commercial terms and conditions.
   c. Undertaking shall be furnished by the Indian representative stating that the co-ordination and smooth execution of the contract and settlement of shortages/damages/replacement/repair of imported scope

till the equipment is commissioned and handed over to customer will be the sole responsibility of the Indian representative/associates/agent/liaison office.

d. Refer **Annexure I** on "Guidelines for Indian Agents".

7. In case of imported scope of supply, customs clearance & customs duty payment will be to BHEL account after the consignment is received at Indian Airport /Seaport. Bidders must provide all original documents required for completing the customs clearance along with the shipment.

   Warehousing charges due to incomplete or missing documentation will be to supplier's account. All offers for imported scope of supply by air, must be made from any of the gateway ports (within the country) indicated **(Refer Annexure II).**

8. The offers of the bidders who are on the banned list and also the offers of the bidders, who engage the services of the banned firms, shall be rejected. The list of the banned firms is available on BHEL website: http://www.bhel.com/vender_registration/vender.php

9. Business dealings with bidders will be suspended if they are found to have indulged in any malpractices/misconduct which are contrary to business ethics like bribery, corruption, fraud, pilferage, cartel formation, submission of fake/false/forged documents, certificates, information to BHEL or if they tamper with tendering procedure affecting the ordering process or fail to execute a contract, or rejection of 3 consecutive supplies or if their firms / works are under strike/lockout for a long period. Bidder may refer "Guidelines for Suspension of Business Dealings with Suppliers/ Contractors" available on https://bhel.com/guidelines-suspension-business-dealings-supplierscontractors for more details.

   The Bidder declares that they 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 competitiveness 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.

10. 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.edn.bhel.com and shall immediately bring to the notice of BHEL Management about any fraud or suspected fraud as soon as it comes to your notice.

11. Offer is to be submitted in English language only.

12. For this procurement, the local content to categorize a supplier as a Class-I local supplier/ Class-II local supplier/ Non-local supplier and purchase preference to Class-I local supplier, is as defined in Public procurement (Preference to Make in India), Order 2017 dated 16.09.2020 issued by DPIIT.

    In case of subsequent Orders issued by the Nodal Ministry, changing the definition of local content for the items of the NIT, the same shall be applicable even if issued after issue of this NIT, but before opening of price bids against this NIT. Default margin of purchase preference shall be 20% for Class-I local supplier only.

13. The Bidder shall mandatorily submit Declaration as mentioned under Rule 144(xi) of General Financial Rules, 2017 amendment dt 23.07.2020 issued by Ministry of Finance, Govt. of India. Where applicable, evidence of valid registration by the Competent Authority shall be attached.

The Competent Authority for the purpose of registration under this Order shall be the Registration Committee constituted by the Department for Promotion of Industry and Internal Trade (DPIIT). Refer Annexure-X for 'Restrictions under Rule 144(Xi) of General Financial Rules,2017 amendment dt: 23.07.2020'.

B. <u>GUIDELINES FOR PREPARATION OF OFFER:</u>

1. Quotation shall be submitted in Single Part Bid, Two Part Bid or Three Part Bid, as called for in the tender:

   - **SINGLE PART BID**: Technical and Commercial Bid with prices along with price summary & filled in BHEL Standard Commercial terms and conditions in a single sealed envelope.

   - **TWO PART BID**: Unpriced offer i.e. "Techno-commercial Bid" with filled in BHEL Standard Commercial terms and conditions in a sealed envelope **along with the copy of the "Price Bid" without the prices** should be enclosed in one cover and the cover must be super scribed **"Techno-commercial offer)** and Priced offer i.e. "Price Bid "containing price summary in a separate sealed envelope and must be super scribed **"Price Bid"**.

     Both these envelopes shall be enclosed in a single sealed envelope superscribed with enquiry number, due date of tender and any other details as called for in the tender document.

   - **THREE PART BID**: Pre-qualification Bid (Part-I), Techno Commercial Bid with filled in BHEL Standard Commercial terms and conditions (Part-II), and Price Bid (Part-III). All three envelopes shall be enclosed in a single sealed envelope superscribed with enquiry number, due date of tender and any other details as called for in the tender document.

   If any of the offers (Part I, Part II or Part III) are not submitted before the due date and time of submission (or) if any part of the offer is incomplete, the entire offer of the bidder is liable for rejection.

2. Supplier shall ensure to superscribe each envelope with RFQ number, RFQ Date, RFQ Due date and time, Item Description and Project clearly & boldly. Also mention on the envelope whether it is "Techno Commercial Bid" or "Price Bid" or "Pre-Qualification Bid".

   Please ensure complete address, department name and purchase executive name is mentioned on the envelope (before dropping in the tender box or handing over) so that the tender is available in time for bid opening.

3. BHEL standard Commercial Terms and Conditions (duly filled, signed & stamped) must accompany Technical-Commercial offer without fail and should be submitted in original only.

   The above indicated submission of Offers in "sealed envelope/hard copy" as mentioned in points B.1-B.3 is applicable for tenders that are not floated through E-Procurement System (EPS).

4. Validity: Unless otherwise specified in SCC (special commercial conditions of contract), the offer will be valid for a period of 90 days from the date of Part-I bid opening and in case of Negotiation/Counter-offer/Reverse Auction, price validity will apply afresh for a period of 60 days from the date of according final price by bidder (or) up to original validity period, whichever is later.

5. Any of the terms and conditions not acceptable to supplier, shall be explicitly mentioned in the Techno-Commercial Bid.

   If no deviations are brought out in the offer it will be treated as if all terms and conditions of this enquiry are accepted by the supplier without deviation.

6. Deviation to this specification/item description, if any, shall be brought out clearly indicating "DEVIATION TO BHEL SPECIFICATION" without fail, as a part of Techno-Commercial Bid.

   If no deviations are brought out in the offer it will be treated as if the entire specification of this enquiry is accepted without deviation.

7. Suppliers shall submit one set of original catalogue, datasheets, bill of materials, dimensional drawings, mounting details and/or any other relevant documents called in purchase specification as part of Technical Bid.

8. "Price Bid" shall be complete in all respects containing price break-up of all components along with all applicable taxes and duties, freight charges (if applicable) etc. Once submitted no modification / addition / deletion will be allowed in the "Price Bid." Bidders are advised to thoroughly check the unit price, total price to avoid any discrepancy.

9. In addition, bidder shall also quote for erection & commissioning charges/erection supervision & commissioning charges (E&C service charges), documentation charges, testing Charges (type & routine), training charges etc. if & as applicable along with corresponding tax. The price summary must indicate all the elements clearly.

10. Wherever applicable, bidders should indicate "Lumpsum" Erection and Commissioning (or) Erection Supervision and Commissioning charges, as applicable (including To & Fro Fare, Boarding, Lodging, Local Conveyance etc.) for carrying out E&C activity and further handing over to customer.

    The quotation shall clearly indicate scope of work, likely duration of commissioning, pre-commissioning checklist (if any).

11. Wherever bidders require PAC (Project Authority Certificate)/applicable certificates for import of raw materials, components required for DECC, EPCG Power Projects, Export Projects or other similar projects wherein supplies are eligible for customs duty benefits, lists and quantities of such items and their values (CIF) has to be mentioned in the offer. Prices must be quoted taking into account of such benefits.

12. Prices should be indicated in both figures & words**.** Bid should be free from correction/overwriting, using corrective fluid, etc. Any interlineation, cutting, erasure or overwriting shall be valid only if they are attested under full signature(s) of person(s) signing the bid else bid shall be liable for rejection.

    Any typographical error, totalling mistakes, currency mistake, multiplication mistake, summing mistakes etc. observed in the price bids will be evaluated as per **Annexure III** "Guidelines for dealing with Discrepancy in Words & Figures – quoted in price bid" and BHEL decision will be final.

13. Documents submitted with the offer shall be signed and stamped in each page by authorized representative of the bidder. However, this requirement is not mandatory for offers uploaded through E-Procurement System (EPS).

C. <u>GUIDELINES FOR OFFER SUBMISSION:</u>

The under-mentioned clauses 1, 2&3 will not be applicable for EPS tenders.

1. Offers / Quotations must be dropped in tender box before 13.00 Hrs. on or before due date mentioned in RFQ. The offers are to be dropped in the proper slot of the Tender Box kept in tender opening room near reception.

   Tenders are opened on 3 days in a week (Monday/Wednesday/Friday).

2. E-Mail/ Internet/EDI offers received in time shall be considered only when such offers are complete in all respects. In case of offers received through E-mail, please send the offer to the email ID specified in the SCC document of the tender.

3. Offers of Vendors who already have a valid Technical/Commercial MOU with BHEL-EDN for the items of the RFQ shall mention the relevant MOU reference no. and give only such other details not covered in the MOU.

4. In cases where tender documents are bulky, or due to some reasons tender documents are required to be submitted by hand or through posts/couriers, the offers are to be handed over either of the two purchase officers whose names are mentioned in the SCC document of tender RFQ.
5. Tenders will be opened on due date, time and venue as indicated in the RFQ in the presence of bidders at the venue indicated in the RFQ. For EPS tenders, e-mail notifications will be automatically generated and forwarded to registered e-mail ID/s of bidders during opening of tenders.
6. Bidder will be solely responsible:
   a. for submission of offers before due date and time. Offers submitted after due date and time will be treated as "Late offers" and will be rejected.

   b. for depositing offers in proper sealed condition in the tender box. If the bidder drops the tender in the wrong box (or) if the tender document is handed over to the wrong person, BHEL will not be responsible for any such delays.

   c. for offers received through email etc., suppliers are fully responsible for lack of secrecy on information and ensuring timely receipt of such offers in the tender box before due date & time (This clause will not be applicable for EPS tenders).

   The above indicated submission of Offers as mentioned in points 6.a-6.c is applicable for tenders that are not floated through online procurement portal considered by BHEL.

   d. In case of e-tender, all required documents should be uploaded before due date and time. Availability of power, internet connections, system/software requirements etc. will be the sole responsibility of the bidder.

      Wherever assistance is needed for submission of e-tenders, help-line numbers as available in the web-site of service provider of BHEL may be contacted.

      Purchase Executive/ BHEL shall not be responsible for any of the activities relating to submission of offer.

D. <u>PROCESSING OF OFFERS RECEIVED:</u>

1. Any discount/ revised offer submitted by the supplier on its own shall be accepted provided it is received on or before the due date and time of offer submission (i.e. Part-I bid).

   The discount shall be applied on pro-rata basis to all items unless specified otherwise by the bidder.
2. Changes in offers or Revised offers given after Part-I bid opening shall not be considered as a part of the original offer unless such changes/revisions are requested by BHEL.

   In case of withdrawal of any Technical/Commercial deviation(s) by the bidder before opening of price bids/conducting the Reverse Auction, revision of price/price impact bid, if any will not be accepted.
3. In case there is no change in the technical scope and/ or specifications and/ or commercial terms & conditions, the supplier will not be allowed to change their price bid after technical bids are opened (after the due date and time of tender opening).
4. In case of changes in scope and/ or technical specifications and/ or commercial terms & conditions by BHEL

and it accounts for price implications from bidders, all techno-commercially acceptable bidders shall be asked by BHEL (after freezing the scope, technical specifications and commercial terms & conditions) to submit the impact of such changes on their price bid.

Impact price will be applicable only for changes in technical specification / commercial conditions by BHEL. The impact price must be submitted on or before the cut-off date specified by BHEL and the original price bid and the price impact bid will be opened together at the time of price bid opening.

5. Un-opened bids (including price bids) will be returned to the respective bidders after release of Purchase order.

   Regarding Offers for EPS tenders that get rejected on PQC/ techno-commercial grounds, the bids for the subsequent parts will not be opened i.e., both technical bid and price bid (Parts-II & III) will not be opened in case of rejection on PQC ground and price bid (Part-II/Part-III, as applicable) will not be opened in case of rejection on techno-commercial ground.

6. After receipt of Purchase Order, supplier should submit required documents viz., specified drawings, bill of materials, datasheets, catalogues, quality plan, test procedure, type test report, O & M Manuals and/or any other relevant documents as per Specification/Purchase Order, as and when required by BHEL/Customer.

7. Any deviation to the terms and conditions not mentioned in the quotation by supplier in response to this enquiry will not be considered, if put forth subsequently or after issue of Purchase Order, unless clarification is sought for by BHEL and agreed upon in the Purchase Order.

8. Evaluation shall be on the basis of delivered cost (i.e. “Total Cost to BHEL").

   “Total Cost to BHEL” shall include total basic cost, packing & forwarding charges, taxes and/or duties (as applicable), freight charges, taxes on Services, customs clearance charges for imported items, any other cost indicated by bidder for execution of the contract and loading factors (for non-compliance to BHEL Standard Commercial Terms & Conditions).

   Benefits arising out of Nil Import Duty on DEEC, EPCG, DFIA Projects, Physical Exports or such 100% exemptions (statutory benefits), project imports, customer reimbursements of statutory duties (like Basic Customs Duty and Cess on customs duty), Input tax credits as applicable will also be taken into account for arriving at the Total cost to BHEL (wherever applicable and as indicated in SCC document of tender).

   For EPS tenders, it shall be noted that the prices (including discounts) vis-a-vis currency quoted in EPS portal only will be considered as Final for the purpose of evaluation of the lowest bidder.

   Bidder shall ensure to indicate the applicable taxes against each line item in online portal, failing to which the same will be considered as inclusive/NIL.

   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.

   Incase more than one bidder happens to occupy the L-1 status even after soliciting discounts, the L-1 bidder shall be decided by a 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.

9. The evaluation currency for this tender shall be INR. For evaluation of offers in foreign currency, the exchange rate (TT selling rate of SBI) shall be taken as under:

Single part bids: Date of tender opening

Two/three part bids: Date of Part-I bid opening

Reverse Auction: Date of Part-I bid opening

In case of Performance Bank Guarantee (PBG) also, exchange rate will be considered as mentioned above for converting foreign currency to Indian currency and vice versa.

If the relevant day happens to be a bank holiday, then the exchange rate as on the previous working day of the bank (SBI) shall be taken.

10. Ranking (L-1, L-2 etc.) shall be done only for the techno-commercially acceptable offers.

E. <u>INFORMATION ON PAYMENT TERMS:</u>

1. All payments will be through Electronic Fund transfer (EFT). Vendor has to furnish necessary details as per BHEL standard format **(Refer Annexure IV)** for receiving all payments through NEFT. (Applicable for Indian vendors only).
2. In case of High Sea Sales transaction, customs clearance of the consignment landed on Indian Sea/Air ports will be done by BHEL based on the original HSS documents provided by vendors.

   All warehousing charges due to delay in submission of complete and or correct HSS documents to BHEL will be to supplier's account only. Such recovery will be made out of any of the available bills **(Refer Annexure V)**.
3. Statutory deductions, if any, will be made and the deduction certificate shall be issued.

   A. In case vendor does not provide PAN details, the TDS deduction shall be at the maximum percentage stipulated as per the provisions of Income Tax Act.

   In addition to the above, Foreign vendors shall also submit relevant details of their bankers like Swift Code, Banker's Name &Address etc.

   B. TDS deduction as per section 51 of CGST Act,2017 shall be applicable as per Gazette Notification No. 50/2018-Central Tax, Dated: 13th September 2018. TDS deduction is also applicable on purchase of goods as per the latest notification under section 194Q, and subsequent notification(s) as and when released by Govt. authorities.
4. Procurement of Goods/ Works/ Services/ Consultancy Services [under clause relating to "Income Tax and Corporate Tax" or "TDS" of Model ITBs]

   a) Provision w.r.t. TDS on Purchase of Goods under section 194Q of Income Tax Act applicable from 01.07.2021 is as under:

      i. TDS as applicable will be deducted by BHEL under section 194Q of the Income Tax Act, 1961 on Purchases exceeds, the amount of Rupees. 50 Lakhs or limit defined therein from time to time during the financial year under the Indian Income Tax act 1961.

      ii. Since BHEL is liable to deduct Income Tax TDS under section 194Q, the provision of TCS as per section 206C(1H) of the Income Tax Act, 1961 shall not be applicable.

   b) Higher rate of TDS for non-filers of ITR as per Section 206AB of Income Tax Act, 1961, in case of any vendor who does not filed their Income Tax Return for both of the two previous years preceding to current year and aggregate amount of TDS is more than or equal to Rs. 50,000/- in each of those previous two years (or limit defined by Govt. from time to time), then TDS will be deducted at the higher of following rates:

      (i) Twice the rate mentioned in relevant TDS section.

(ii) Twice the rate or rates in force

(iii) 5%

5. Incomplete documentation will not be accepted. Delayed submission of invoice / documents may result in corresponding delay in payment. In this connection, request to also refer clause: G (Refer Page.11) about invoicing & payment formalities under GST regime.

   Applicable documents shall be submitted to the purchaser at the time of execution of supplies/services for availing GST input credits.

6. Bank charges of Seller's bank shall be to Seller's account and bank charges of Owner's bank other than Bill collection charges shall be to owner's account. Bill collection charges will be borne by Seller.

F. STANDARD PAYMENT TERMS OF BHEL-EDN:

PURCHASE ORDERS FOR:	**SUPPLY WITH SERVICE(S)**	**SUPPLY ONLY**
INDIGENOUS PROCUREMENT	i. 100% payment of the basic price of Goods with 100% GST on the goods price will be paid in 45 days of Delivery of consignment or 15 days from the date of submission of complete set of documentation, whichever is later. (or) ii. 100% payment of the basic price of Goods with 100% GST on the goods price will be paid against Letter of Credit with usance period of 120 days from Delivery of consignment against submission of complete set of documents. LC processing charges viz., opening, amendment / discrepancy (if & as applicable) will be to supplier's account. Note: In case PBG is not furnished, only 90% payment will be released against 100% claim without the consent of Vendor. This 10% basic amount withheld towards PBG will be paid either against submission of supplementary invoice & Original PBG (or) against supplementary invoice without PBG after expiry of Warranty period.	i.100% payment of the basic price of Goods with 100% GST on the goods price will be paid in 45 days of Delivery of consignment or 15 days from the date of submission of complete set of documentation, whichever is later. (or) ii.100% payment of the basic price of Goods with 100% GST on the goods price will be paid against Letter of Credit with usance period of 120 days from Delivery of consignment against submission of complete set of documents. LC processing charges viz., opening, amendment / discrepancy (if & as applicable) will be to supplier's account.

IMPORT PROCUREMENT	100% payment of the basic price of Goods will be paid against usance draft of 45 days from arrival of **consignment at destination as per contractual INCOTERMS** against submission of complete set of documents. Note: In case PBG is not furnished, only 90% payment will be released against 100% claim without the consent of Vendor. This 10% basic amount withheld towards PBG will be paid either against submission of supplementary invoice & Original PBG (or) against supplementary invoice without PBG after expiry of Warranty period.	100% payment of the basic price of Goods will be paid against usance draft of 45 days from arrival of **consignment at destination as per contractual INCOTERMS** against submission of complete set of documents.
HIGH-SEA SALES PROCUREMENT	i) 100% payment of the basic price of Goods will be paid in 45 days from **arrival of consignment at destination (in India as per contractual INCOTERMS)** or 15 days from the date of submission of complete set of dispatch documents, whichever is later. (or) ii) 100% payment of the basic price of Goods with 100% GST on the goods price will be paid against **Letter of Credit with usance period of 120 days from arrival of consignment at destination (in India as per contractual INCOTERMS)** against submission of complete set of documents. LC processing charges viz., opening, amendment / discrepancy (if & as applicable) will be to supplier's account. Note: In case PBG is not furnished, only 90% payment will be released against 100% claim without the consent of Vendor. This 10% basic amount withheld towards PBG will be paid either against submission of supplementary invoice & Original PBG (or) against supplementary invoice without PBG after expiry of Warranty period.	i) 100% payment of the basic price of Goods will be paid in 45 days from **arrival of consignment at destination (in India as per contractual INCOTERMS)** or 15 days from the date of submission of complete set of dispatch documents, whichever is later. (or) ii) 100% payment of the basic price of Goods with 100% GST on the goods price will be paid against **Letter of Credit with usance period of 120 days from arrival of consignment at destination (in India as per contractual INCOTERMS)** against submission of complete set of documents. LC processing charges viz., opening, amendment / discrepancy (if & as applicable) will be to supplier's account.

1. Erection and Commissioning:

Evaluation methodology: Unless and otherwise specified in SCC, E&C charges should not be less than 10% of the main supply value. In case the quoted total E&C value is less than 10% of the main supply value, BHEL shall evaluate Bidders Price deducting differential amount from main supply price proportionally from all items and apportioning towards E&C charges.

Payment term: 100% E&C charges along with tax as applicable, will be paid in 15 days from the date of submission of supplementary invoice/documents against proof of completion of E&C.

2. Erection Supervision and Commissioning:

Evaluation methodology: Unless and otherwise specified in SCC, E,S&C charges should not be less than 5% of the main supply value. In case the quoted total E&C value is less than 5% of the main supply value, BHEL shall evaluate Bidders Price deducting differential amount from main supply price proportionally from all items and apportioning towards E,S&C charges.
Payment term: 100% E,S&C charges along with tax as applicable, will be paid in 15 days from the date of submission of supplementary invoice/documents against proof of completion of E,S&C.

3. Comprehensive Annual Maintenance Contract:

Evaluation methodology: Unless and otherwise specified in SCC, CAMC will be applicable for a period of 04 years from the date of expiry of warranty period (or) from the date of completion of commissioning of equipment, whichever is later and the total CAMC value should not be less than 20% of the main supply value. In case the quoted total CAMC value is less than 20% of the main supply value, BHEL shall evaluate Bidders Price deducting differential amount from main supply price proportionally from all items and apportioning towards CAMC charges.

Payment terms: 100% CAMC charges along with tax as applicable, will be paid in 15 days from the date of submission of supplementary invoice/documents against proof of completion of CAMC on yearly basis.

4. Terms of Payment for Training: 100% payment will be made in 45 days from the date of completion of Training or 15 days from the date of submission of complete set of invoice along with documentary evidence, whichever is later.

LOADING FACTORS FOR DEVIATION IN PAYMENT TERMS (APPLICABLE FOR IMPORT PROCUREMENT ONLY):

1) For offers received with Sight draft payment term in place of Usance draft, loading applicable will be 1.0% of basic value.

2) For offers received with Letter of Credit payment term with Usance of 45 days, loading applicable will be 2.5% of basic value.
   Additional loading of 2% will be applicable for payment term as Letter of Credit at Sight.

5. Any payment term with credit period of less than 45 days for indigenous supply/HSS and any other variation of payment terms are liable for rejection.

6. Standard payment terms indicated in Clauses: F (a), (b), (c), (d), (e), (f), (g), (h), (i) & (j) will not attract any loading.

Note 1: Basic value of Purchase Order mentioned above will include all components of the purchase order and will exclude only taxes, duties, freight, training charges, E&C/E,S&C and AMC charges (wherever applicable). Wherever the Purchase Order is split into import portion and indigenous portion of supply, minimum % to be quoted for Services, wherever mentioned, will be of both purchase order values put together.

Note 2: In case of multiple packages/units in a power plant, payment of E&C/E,S&C charges will be processed on pro-rata basis.

Note 3: No deviation will be permitted from the duration of Guarantee/Warranty and/or Comprehensive Annual Maintenance Contract period specified in SCC.

Note 4: Indigenous bidder may opt to quote with payment through Letter of Credit with usance period of 120 days. Bank charges of seller's bank shall be to seller's account and bank charges of BHEL's bank other than bill collection charges shall be to BHEL's account. Bill collection charges will be borne by seller.

G. Terms & Conditions to be complied under GST regime:

1. All invoices to contain BHEL-EDN (buyer) GSTIN number: 29AAACB4146P1ZB. However for CGST +SGST/UGST billing outside the state of Karnataka, invoice has to be generated with BHEL's Nodal Agency GSTIN number. Address of Nodal Agency along with GSTIN number will be provided by BHEL at the time of issuing dispatch clearance.

2. The Bidder shall mention Bidder's GSTIN number in all quotations and Invoices submitted.

3. The Bidder shall also mention HSN (Harmonized System of Nomenclature) / SAC (Services Accounting Code) mandatorily in all quotations and invoices submitted.

4. Invoice submitted should be in the format as specified under GST Laws viz., all details as mentioned in Invoice Rules like GST registration number(GSTIN), invoice number with date of issue, quantity, rate, value, taxes with nomenclature – CGST, SGST, UGST, IGST mentioned separately, HSN Code / SAC Code etc. Invoice should be submitted in original for buyer plus duplicate for credit availment.

5. Payment of GST to Vendor will be made only if it is matching with data uploaded by the Vendor in GST portal.

6. For invoices paid on Reverse charge basis – "Tax payable on reverse charge basis" to be mentioned on the invoice.

7. In case GST credit is delayed/denied to BHEL due to non/delayed receipt of goods and/or tax invoice or expiry of timeline prescribed in GST law for availing such ITC, or any other reasons not attributable to BHEL, GST amount will be recoverable from vendor along with interest levied/ leviable on BHEL.

8. In case vendor delays declaring such invoice in his return and GST credit availed by BHEL is denied or reversed subsequently as per GST law, GST amount paid by BHEL towards such ITC reversal as per GST law will be recoverable from vendor/contractor along with interest levied/ leviable on BHEL.

9. Vendor should intimate BHEL immediately on the same date of invoicing without any delay.

10. In case of discrepancy in the data uploaded by supplier in the GSTN portal or in case of any shortages or rejection in the supply, then BHEL will not be able to avail the tax credit and will notify the supplier of the same. Supplier has to rectify the data discrepancy in the GSTN portal or issue credit note (details to be uploaded in GSTN portal) for the shortages or rejections in the supplies, within the calendar month notified by BHEL.

11. Bidders to note that Rules & Regulations pertaining to E-way bill system are to be strictly adhered to, as and when notified by Govt. authorities.

12. As per Notification 88/2020-Central Tax dated 10th November 2020 (applicable w.e.f. 01 January 2021), the turnover for applicability of E-invoicing provisions has been reduced from 500 crores to 100 crores. In other words, registered person [other than a SEZ unit and those referred in Rule 54(2), 54(3), 54(4) and 54(4A) of the CGST Rules], whose aggregate turnover in any preceding financial year from 2017-18 onwards exceeds 100 crores, is required to comply with the requirement of IRN and QR code in respect of supply of goods or services or both to a registered person or for exports.

H. Performance bank guarantee (PBG):

Performance bank guarantee (PBG) will be applicable as called in the tender documents. Unless otherwise specified in the SCC, the PBG against performance of the contract shall be valid for a period of 24 months from the date of delivery of goods + claim period of 03 months, for a value equal to 10 % of the basic value of the purchase order which will include all components of the purchase order and will exclude only taxes, duties, freight, training charges, E&C/E,S&C and AMC charges (wherever applicable).

1. The BG issued in Indian Rupees by Banks in India is to be executed on Non-Judicial Stamp paper/e-stamp paper of appropriate value as per Stamp Act prevailing in the State(s) where the BG is submitted or is to be acted upon or the rate prevailing in the State where the BG was executed, whichever is higher. The Stamp Paper/e-stamp paper shall be purchased in the name of Vendor/Bank issuing the guarantee.
2. No deviation for the duration and value of PBG will be permitted.
3. PBG shall be from any of the BHEL consortium of bankers **(refer Annexure VI)**.
4. PBGs from nationalized banks are also acceptable.
5. PBG should be sent directly by the bank to the dealing executive mentioned in the purchase order located at the address mentioned in the purchase order.
6. PBG should be in the format specified **(refer Annexure VII)**. No deviation to this format will be allowed. However in case BHEL changes the PBG format, bidder shall honor the same.
7. Bank Guarantee should be enforceable in Bangalore.
8. In Case of Bank Guarantees submitted by Foreign Vendors-
   a. From Nationalized/Public Sector / Private Sector/ Foreign Banks (BG issued by Branches in India) can be accepted subject to the condition that the Bank Guarantee should be enforceable in Bangalore.
   b. From Foreign Banks (wherein Foreign Vendors intend to provide BG from local branch of the Vendor Country's Bank)

   b.1 Please note that Bank Guarantee issued by any of the Consortium Banks only will be accepted by BHEL. As such, Foreign Vendor needs to make necessary arrangements for issuance of Counter-Guarantee by Foreign Bank in favor of the Indian Bank's (BHEL's Consortium Bank) branch in India. It shall be noted that all charges for issuance of Bank Guarantee/ counter- Guarantee should be borne by the Foreign Vendor.
   b.2 In case, Foreign Vendors intend to provide BG from Overseas Branch of our Consortium Bank (e.g. if a BG is to be issued by SBI Frankfurt), the same is acceptable. However, the procedure at sl.no. b.1 is required to be followed.
   b.3 The BG issued may preferably be subject to Uniform Rules for Demand Guarantees (URDG) 758 (as amended from time to time).
9. Expired PBGs will be returned only after expiry of the claim period.
10. PBG shall not be applicable for spares.

I. PURCHASE PREFERENCE FOR MSE(MICRO AND SMALL ENTERPRISES) VENDORS:

Purchase preference will be given to MSEs as defined in Public Procurement Policy for Micro and Small Enterprises (MSEs) Order, 2012 dated 23.03.2012 issued by Ministry of Micro, Small and Medium Enterprises and its subsequent Orders/Notifications issued by concerned Ministry. If the bidder wants to avail the Purchase preference, the bidder must be the manufacturer of the offered product in case of bid for supply of goods.

Traders are excluded from the purview of Public Procurement Policy for Micro and Small Enterprises. Relevant documentary evidence in this regard shall be uploaded along with the bid in respect of the offered product. Purchase preference to Micro and Small Enterprises clause in the bid, the same will get precedence over this clause.

a. If tendered quantity is Splittable: In tender, participating MSEs quoting price within price band of L1+15 percent shall also be allowed to supply a portion of requirement by bringing down their price to L1 price in a situation where L1 price from someone other than a MSE and such MSE shall be allowed to supply at least 25% of total tendered value. In case of more than one such MSE, the supply shall be shared proportionately (to tendered quantity).

- 3% of the 25% will be earmarked for women owned MSEs.
- 25% of the 25% (i.e., 6.25% of the total enquired quantity) will be earmarked for SC/ST owned MSE firms.
- In case where no SC/ST category firms have not participated in the tender, the 6.25% of earmarked quantity for SC/ST owned MSE firms will be distributed among the other eligible MSE vendors who have participated in the tender.

b. If tendered quantity is Non-Splittable: If L-1 is not an MSE and MSE Seller (s) has/have quoted price within L-1+ 15% of margin of purchase preference /price band defined in relevant policy, such Seller shall be given opportunity to match L-1 price and contract will be awarded for 100% of total value.

J. INTEGRITY COMMITMENT IN THE TENDER PROCESS, AND EXECUTION OF CONTRACTS:

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 / suppliers in a transparent and fair manner, and with equity.

2. Commitment by Bidder(s)/ Contractor(s):

   a. The Bidder(s)/ Contractor(s) commit(s) to take all measures to prevent corruption and will not directly or indirectly try to influence any decision or benefit which he is not legally entitled to.
   b. The Bidder(s)/ Contractor(s) will not enter with other Bidder(s) into any undisclosed agreement or understanding or any actions to restrict competition.
   c. The Bidder(s)/ Contractor(s) will not commit any offence under the relevant Acts. The Bidder(s)/ Contractor(s) will not use improperly, for purposes of competition or personal gain or pass on to others, any information or document provided by BHEL as part of business relationship.
   d. The Bidder(s)/ Contractor(s) will, when presenting his bid, disclose any and all payments he has made, and is committed to or intends to make to agents, brokers or any other intermediaries in connection with the award of the contract and shall adhere to the relevant guidelines issued from time to time by Government of India/ BHEL.

   If the Bidder(s) / Contractor(s), before award or during execution of the Contract commit(s) a transgression of the above or in any other manner such as to put his reliability or credibility in question, BHEL is entitled to disqualify the Bidder(s) / Contractor (s) from the tender process or terminate the contract and/ or take suitable action as deemed fit.

K. 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.
   For details of Independent External Monitors (IEMs) on the present panel appointed by BHEL with the approval of CVC to oversee implementation of IP in BHEL, kindly refer BHEL website www.bhel.com

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 (Annexure IX). 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 IEM/s shall be done through email 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 indicated in SCC document of tender.

L. Conflict of Interest among Bidders/Agents:

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

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

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

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

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

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

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

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

or

g) A Bidder or any of its affiliates participated as a consultant in the preparation of the design or technical specifications of the contract that is the subject of the Bid; ***or***

h) In case of a holding company having more than one independently manufacturing units, or more than one unit having common business ownership/management, only one unit should quote. Similar restrictions would apply to closely related sister companies. Bidders must proactively declare such sister/ common business/ management units in same/ similar line of business."

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Annexure-I

BHEL-IP

AA:SSP:IP:R04 dtd 12-11-2025

INTEGRITY PACT

Between

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

and

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

Preamble

The Principal intends to award, under laid-down organizational procedures, contract(s) for Supply of VFDs for 2125KW, 6.6KV Motor & 400KW, 6.6KV Motor for HINDALCO Thermal Power plant (Unit 1, 2, 3) (hereinafter referred to as "Contract"). The Principal values full compliance with all relevant laws of the land, rules and regulations, and the principles of economic use of resources, and of fairness and transparency in its relations with its Bidder(s)/ Contractor(s).

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

Section 1- Commitments of the Principal

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Section 4 - Compensation for Damages

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

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

Section 5 - Previous Transgression

5.1 The Bidder declares that no previous transgressions occurred in the last 3 (three) years (to be reckoned from date of bid submission) with any other company in any country conforming to the anti-corruption approach in India that could justify his exclusion from the tender process. The date of such transgression, for the purpose of disclosure by the bidders in this regard, would be the date on which cognizance of the said transgression was taken by the competent authority. The transgression(s), for which cognizance was taken even before the said period of three years, but are pending conclusion, shall also be reported by the bidders.

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

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

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

6.2 In case of a joint venture, all the partners of the joint venture should sign the Integrity Pact. In case of Sub-contracting, the Principal Contractor shall be solely responsible for the adherence to the provisions of IP by the sub-contractor(s).

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

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

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

Section 8 -Independent External Monitor(s)

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

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

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

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

8.5 The role of IEM is advisory and the advice of IEM is non- binding on the Organization. However, as IEMs are invariably persons with rich experience who have retired as senior functionaries of the government, their advice would help in proper implementation of the IP.

8.6 For ensuring the desired transparency and objectivity in dealing with the complaints arising out of the tendering process, the matter should be examined by the full panel of IEMs jointly, who would look into the records, conduct an examination, and submit their joint recommendations to the Management. In case the full panel is not available due to some unavoidable reasons, the available IEM(s) will conduct examination of the complaints. Consent of the IEM(s), who may not be available, shall be taken on record.

8.7 The IEMs shall examine all the representations/grievances/ complaints received by them from the bidders or their authorized representative related to any discrimination on account of lack of fair play in modes of procurement and bidding systems, tendering method, eligibility conditions, bid evaluation criteria, commercial terms & conditions, choice of technology/ specifications etc.

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

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

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

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

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

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

Section 9 - Pact Duration

9.1 This Integrity Pact shall be operative from the date this Integrity Pact is signed by both the parties. Any violation of the same would entail disqualification of the bidders and exclusion from future business dealings.

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

Section 10 - Other Provisions

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

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

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

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

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

10.6 In the event of any dispute between the Principal and Bidder(s)/ Contractor(s) relating to the Contract, in case, both the parties are agreeable, they may try to settle dispute through Mediation before the panel of IEMs in a time bound manner. If required, the Principal may adopt any mediation rules for this purpose. However, not more than five meetings shall be held for a particular dispute resolution. The fees/expenses on dispute resolution shall be equally shared by both the parties. In case, the dispute remains unresolved even after mediation by the panel of IEMs, either party may take further action as per the terms & conditions of the Contract.

ಅತುಲ್ ಸಿ ... ಅಭಿಯಂತರರು/ಸಿ.ಐ.ಎಂ.-ಎಂ.ಎಂ.-ಪಿ.ಆರ್.
अतुल ... अभियंता/सी.ई.-एम.एम.-पी.आर.
ATUL ... ENGINEER / CE-MM-PR
BHEL-EDN, ... BENGALURU-560026

For & On behalf of the Principal
(Office Seal)

Place Bangalore
Date 28-05-26

Witness:_____
(Name & Address) S. Sathish Kumar
BHEL-EDN, Bangalore.

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

Witness:_____
(Name & Address) _____
_____

Annexure-2

Clause on IP in the tender

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	IEM	Email
1.	Dr. Sarat Kumar Acharya, Ex-CMD, NLC	iem1@bhel.in
2.	Shri R. Mukundan, IRPS (Retd.)	iem2@bhel.in
3.	Shri Madan Lal Meena, IAS (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 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 email 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):

Name: Sathish Kumar S
Dept.: CE-MM-PR
Address: BHEL-EDN, Bangalore
Phone: 9449869753
Email: sathishkumars@bhel.in
I
Name: Atul Sood
Dept.: CE-MM-PR
Address: BHEL-EDN, Bangalore
Phone: 7795367467
Email: atulsood@bhel.in

Annexure I

Guidelines for Indian Agents

- **Definition of Indian Agent**: An Indian Agent of foreign prinicipal is an individual, a partnership, an association of persons, a private or pubile company, that carries our specific obligation(s) towards processing of BHEL tender or finalization or execution of BHEL's contract on behalf of the foreign supplier.

In case of yes, vendor to note the following and reply accordingly:

i. BHEL shall deal directly with foreign vendors, wherever required, for procurement of goods. However, if the foreign principal desires to avail of the services of an Indian agent, then the foreign principal should ensure compliance to regulatory guidelines - which require mandatory submission of an Agency Agreement.

ii. It shall be incumbent on the Indian agent and the foreign principal to adhere to the relevant guidelines of Government of India, issued from time to time.

iii. The Agency Agreement should specify the precise relationship between the foreign OEM / foreign principal and their Indian agent and their mutual interest in the business. All services to be rendered by agent/ associate, whether of general nature or in relation to the particular contract, must be clearly stated by the foreign supplier/ Indian agent. Any payment, which the agent or associate receives in India or abroad from the OEM, whether as commission or as a general retainer fee should be brought on record in the Agreement and be made explicit in order to ensure compliance to laws of the country.

iv. Any agency commission to be paid by BHEL to the Indian agent shall be in Indian currency only.

v. Tax deduction at source is applicable to the agency commission paid to the Indian agent as per the prevailing rules.

vi. In the absence of any agency agreement, BHEL shall not deal with any Indian agent (authorized representatives / associate / consultant, or by whatever name called) and shall deal directly with the foreign principal only for all correspondence and business purposes.

vii. The "Guidelines for Indian Agents of Foreign Suppliers" enclosed at annexure –'A' shall apply in all such cases.

viii. The supply and execution of the Purchase Order (including indigenous supplies/ service) shall be in the scope of the OEM/ foreign principal. The OEM/ foreign principal should submit their offer inclusive of all indigenous supplies/ services and evaluation will be based on 'total cost to BHEL'. In case OEM/ foreign principal recommends placement of order(s) towards indigenous portion of supplies/ services on Indian supplier(s)/ agent on their behalf, the credentials/ capacity/ capability of the Indian supplier(s)/ agent to make the supplies/ services shall be checked by BHEL as per the extant guidelines of Supplier Evaluation, Approval & Review Procedure (SEARP), before opening of price bids. In this regard, details may be checked as per Annexure-B (copy enclosed). It will be the responsibility of the OEM/ foreign principal to get acquainted with the evaluation requirements of Indian supplier/ agent as per SEARP available on www.bhel.com.

The responsibility for successful execution of the contract (including indigenous supplies/ services) lies with the OEM/ foreign principal. All bank guarantees to this effect shall be in the scope of the OEM/ foreign principal.

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Vendor's Signature with Seal

Annexure-A

Guidelines for Indian Agents of Foreign Suppliers

1.0 There shall be compulsory registration of agents for all Global (Open) Tender and Limited Tender. An agent who is not registered with BHEL shall apply for registration in the registration form in line with SEARP.

1.1 Registered agents will file an authenticated Photostat copy duly attested by a Notary Public/Original certificate of the Principal confirming the agency agreement and giving the status being enjoyed by the agent and the commission/ remuneration/ salary/ retainership being paid by the principal to the agent before the placement of order by BHEL.

1.2 Wherever the Indian representatives have communicated on behalf of their principals and the foreign parties have stated that they are not paying any commission to the Indian agents, and the Indian representative is working on the basis of salary or as retainer, a written declaration to this effect should be submitted by the party (i.e. Principal) before finalizing the order.

2.0 Disclosure of particulars of agents/ representatives in India, if any.

2.1 Tenderers of Foreign nationality shall furnish the following details in their offers:

2.1.1 The Bidder(s)/ Contractor(s) of foreign origin shall disclose the name and address of the agents/ representatives in India if any and the extent of authorization and authority given to commit the Principals. In case the agent/ representative be a foreign Company, it shall be confirmed whether it is existing Company and details of the same shall be furnished.

2.1.2 The amount of commission/ remuneration included in the quoted price(s) for such agents/ representatives in India.

2.1.3 Confirmation of the Tenderer that the commission/ remuneration, if any, payable to his agents/ representatives in India, may be paid by BHEL in Indian Rupees only.

2.2 Tenderers of Indian Nationality shall furnish the following details in their offers:

2.2.1 The Bidder(s)/ Contractor(s) of Indian Nationality shall furnish the name and address of the foreign principals, if any, indicating their nationality as well as their status, i.e. whether manufacturer or agents of manufacturer holding the Letter of Authority of the Principal specifically authorizing the agent to make an offer in India in response to tender either directly or through the agents/ representatives.

2.2.2 The amount of commission/ remuneration included in the price (s) quoted by the Tenderer for himself.

2.2.3 Confirmation of the foreign principals of the Tenderer that the commission/ remuneration, if any, reserved for the Tenderer in the quoted price(s), may be paid by BHEL in India in equivalent Indian Rupees on satisfactory completion of the Project or supplies of Stores and Spares in case of operation items.

2.3 In either case, in the event of contract materializing, the terms of payment will provide for payment of the commission/ remuneration, if any payable to the agents/ representatives in India in Indian Rupees on expiry of 90 days after the discharge of the obligations under the contract.

2.4 Failure to furnish correct and detailed information as called for in paragraph 2.0 above will render the concerned tender liable to rejection or in the event of a contract materializing, the same liable to termination by BHEL. Besides this there would be a penalty of banning business dealings with BHEL or damage or payment of a named sum.

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ANNEXURE - II
LIST OF INTERNATIONAL GATEWAY AIRPORTS

For air based consignment, terms of delivery will be on FCA basis from following listed airports only. Vendors are requested to verify this list for use before submission of offer.

SCHEDULE NO	COUNTRY	CURRENCY CODE	AIRPORT
D01	UK	GBP	LONDON (HEATHROW)
D02	UK	GBP	NEW CASTLE
D03	UK	GBP	OXFORD. CHETLAM
D04	UK	GBP	BRISTOL. WELLINGBOROUGH
D05	UK	GBP	BIRMINGHAM
DO6	UK	GBP	EAST MIDLANDS
D07	UK	GBP	MANCHESTER
D08	UK	GBP	LEEDS
D09	UK	GBP	GLASGOW
D10	FRANCE	EURO	PARIS (ROISSY) & LYON
D11	SWEDEN	EURO	STOCKHOLM
D12	SWEDEN	EURO	GOTHENBERG & MALMO
D13	ITALY	EURO	ROMA, MILAN
D14	ITALY	EURO	TURIN, BOLOGNA, FLORENCE
D15	NETHERLANDS	EURO	AMSTERDAM, ROTTERDAM
D16	AUSTRIA	EURO	VIENNA, LINZ, GRAZ
D17	BELGIUM	EURO	ANTWERP, BRUSSELS
D18	DENMARK	DKK	COPENHAGEN
D19	JAPAN	JPY	TOKYO, OSAKA
D20	SINGAPORE	SGD	SINGAPORE
D21	CANADA	CAD	TORONTO
D22	CANADA	CAD	MONTREAL
D23	USA	USD	NEW YORK, BOSTON
D24	USA	USD	CHICAGO
D25	USA	USD	SAN FRANCISCO, LOS ANGELES
D26	USA	USD	ALANTA, HOUSTON
D27	GERMANY	EURO	MUNICH, KOLN, DUSSELDORF, HANNOVER, HAMBURG, STUTTGART, DAMSTADT, MANIHIEM, NURUMBERG
D28	GERMANY	EURO	FRANKFURT
D29	GERMANY	EURO	BERLIN
D30	SWITZERLAND	SFR	BASLE, ZURICH, GENEVA
D31	SPAIN	EURO	BARCELONA
D32	AUSTRALIA	AUD	SYDNEY
D33	AUSTRALIA	AUD	MELBOURNE
D34	AUSTRALIA	AUD	PERTH
D35	CZECH	EURO	PRAGUE
D36	HONG KONG	HKD	HONG KONG
D37	NEW ZELAND	NZD	AUCKLAND
D38	RUSSIA	USD	MOSCOW
D39	SOUTH KOREA	USD	KIMPO INTERNATIONAL, INCHEON
D40	FINLAND	EURO	HELSINKI
D41	ROMANIA	EURO	BUCHAREST
D42	NORWAY	EURO	OSLO
D43	IRELAND	EURO	DUBLIN
D44	ISRAEL	USD	TEL AVIV
D45	UAE	USD	DUBAI
D46	OMAN	USD	MUSCAT
D47	EGYPT	USD	CAIRO
D48	TAIWAN	USD	TAIPEI
D49	UKRAINE	USD	KIEV
D50	CHINA	USD	SHANGHAI, SHENZHEN
D51	PHILIPINES	USD	MANILA
D52	MALAYSIA	USD	KUALALUMPUR, PE NANG
D53	CYPRUS	USD	LARNACA
D54	SOUTH AFRICA	USD	JOHANNESBERG, DURBAN
D55	SLOVAKIA	EURO	BARTISLOVA
D56	SAUDI ARABIA	SAR	RIYADH
D57	TURKEY	EURO	ISTANBUL
D58	THAILAND	USD	BANGKOK
D59	BRAZIL	USD	SAO PAULO, RIO DE JANEIRO

ANNEXURE – III

DISCREPANCY IN WORDS & FIGURES – QUOTED IN PRICE BID

Following guidelines will be followed in case of discrepancy in words & figures-quoted in price bid:

(a) If, in the price structure quoted for the required goods/services/works, there is discrepancy between the unit price and the total price (which is obtained by multiplying the unit price by the quantity), the unit price shall prevail and the total price corrected accordingly, unless in the opinion of the purchaser there is an obvious misplacement of the decimal point in the unit price, in which case the total price as quoted shall govern and the unit price corrected accordingly.

(b) If there is an error in a total corresponding to the addition or subtraction of subtotals, the subtotals shall prevail and the total shall be corrected; and

(c) If there is a discrepancy between words and figures, the amount in words shall prevail, unless the amount expressed in words is related to an arithmetic error, in which case the amount in figures shall prevail subject to (a) and (b) above.

(d) If there is such discrepancy in an offer, the same shall be conveyed to the bidder with target date upto which the bidder has to send his acceptance on the above lines and if the bidder does not agree to the decision of the purchaser, the bid is liable to be ignored.

ANNEXURE - IV

Electronic Funds Transfer (EFT) OR

Paylink Direct Credit Form

Please Fill up the form in **CAPITAL LETTERS** only.
TYPE OF REQUEST(Tick one): _____ CREATE _____ CHANGE

BHEL Vendor / Supplier Code:
Company Name :
Permanent Account Number(PAN):
Address

City: PINCODE STATE

Contact Person(s)
Telephone No:
Fax No:
e-mail id:

1 Bank Name:
2 Bank Address:

3 Bank Telephone No:
4 Bank Account No:
5 Account Type: Savings/Cash Credit
6 9 Digit Code Number of Bank and branch appearing on MICR cheque issued by Bank
7 Bank IFSC Code(applicable for NEFT)
8 Bank IFSC code(applicable for RTGS) (Indian Financial System Code)

A I hereby certify that the particulars given above are true, correct and complete and that I, as a representative for the above named Company, hereby authorise BHEL, EDN, Bangalore to electronically deposit payments to the designated bank account.

B If the transaction is delayed or not effected at all for reasons of incomplete or incorrect information, I would not hold BHEL / transfering Bank responsible.

C This authority remains in full force until BHEL, EDN,Bangalore receives written notification requesting a change or cancellation.

D I have read the contents of the covering letter and agree to discharge the responsibility expected of me as a participant under ECS / EFT.

Date:

Authorised Signatory:
Designation: Telephone No. with STD Code

Company Seal

Bank Certificate

We certify that_____has an Account No_____ with us and we confirm that the bank details given above are correct as per our records.

Date: (.....)
Place: Signature

Please return completed form **along with a blank cancelled cheque or photocopy** thereof to:
Bharath Heavy Electricals Ltd,
Attn:
Electronics Division, Mysore Road,
BANGALORE - 560 026
In case of any Querry, please call concerned purchase executive.

ANNEXURE - V
PRESENT PROCEDURE FOR SALE IN TRANSIT (HIGH SEA SALES)

In case of High Sea Sales, vendor should submit following documents:

1. **ORIGINAL HIGH SEA SALES AGREEMENT**
   - Sale agreement (on Rs. 200/- non-judicial stamp paper & notarised with 2 witnesses with identity) has to be signed between BHEL and the Party importing material. The date of the sale documents should be in between the date of House Air Way Bill / Bill of Lading and before landing of the goods in Indian origin.
   - Following shall be included in the High Sea Sales Agreement:
     "THE BUYER ALSO UNDERTAKE DISCHARGES, THE OBLIGATION AND FULFILLMENT OF CONDITIONS, IF ANY, ATTACHED TO THE IMPORTATION, ASSESSMENT AND CLEARANCE OF THE GOODS IN TERMS CUSTOMS TARIFF ACT 1975, THE CUSTOMS ACT 1962 & RULES & REGULATIONS MADE THERE UNDER AND OTHER RELEVANT ACTS, ORDERS, NOTIFICATIONS".

2. **ORIGINAL INVOICES: INDIGENOUS RUPEE INVOICE & FOREIGN CURRENCY INVOICE**
   - Prices should be C.I.F., designated airport/seaport basis.
   - I.E.C., C.S.T., K.S.T. Nos. to be mentioned.
   - Description of item (Nomenclature), Unit & Quantity in both the Foreign Currency & the Indigenous Invoice in Rupee shall be exactly as per Purchase Order Description of item, Quantity and Unit. The Indigenous Invoice value shall be exactly as per Purchase Order value.
   - Seller should give Foreign Currency Invoice from the original consignor. The Foreign Currency Invoice value should be at least 2% (two per cent) less than the Indigenous Rupee Invoice value in equivalent foreign currency.

4. **ORIGINAL HOUSE AIR WAY BILL/ BILL OF LADING**
   - The sale agents should duly endorse House Air Way Bill (HAWB) for air shipments or original Bill of Lading (O.B.L.) for sea shipments and Foreign Currency Invoice in favour of BHEL-EDN.

5. **ORIGINAL CARGO ARRIVAL NOTICE FROM FORWARDER.**

6. **ORIGINAL DELIVERY ORDER ISSUED IN NAME OF BHEL-EDN.**

7. **ORIGINAL PACKING LIST.**

8. **A LETTER TO THE COMMISSIONER OF CUSTOMS FOR EFFECTING ABOVE SALE.**

9. **A LETTER TO THE DEPUTY ASSESSOR (OCTROI) FOR EFFECTING ABOVE SALE IN FAVOUR OF BHEL.**

REMARKS: In case vendor needs any clarifications on the above, the same may be sought in writing.

Sl No	Name of Bank
1	State Bank of India
2	Canara Bank
3	IDBI Bank Limited
4	ICICI Bank Limited
5	HDFC Bank Limited
6	Axis Bank
7	IndusInd Bank Limited
8	Bank of Baroda
9	Exim Bank
10	Indian Bank
11	Punjab National Bank
12	Union Bank of India
13	Yes Bank Limited
14	RBL Bank Ltd.
15	Indian Overseas Bank
16	Kotak Mahindra Bank Limited
17	Federal Bank Limited
18	Hongkong and Shanghai Banking Corporation Ltd

ANNEXURE-VII

BANK GUARANTEE FOR PERFORMANCE SECURITY

Bank Guarantee No:

Date:

To

NAME

& ADDRESSES OF THE BENEFICIARY

Dear Sirs,

In consideration of Bharat Heavy Electricals Limited (hereinafter referred to as the 'Employer' which expression shall unless repugnant to the context or meaning thereof, include its successors and permitted assigns) incorporated under the Companies Act, 1956 and having its registered office at _____[1] through its Unit at……...(name of the Unit) having awarded to (Name of the Vendor / Contractor / Supplier) with its registered office at_____[2] hereinafter referred to as the ' Vendor / Contractor / Supplier ', which expression shall unless repugnant to the context or meaning thereof, include its successors and permitted assigns), a contract Ref No.……dated ……..[3] valued at Rs……[4] (Rupees ----------)/FC……(in words……..) for ……[5] (hereinafter called the 'Contract') and the Vendor / Contractor / Supplier having agreed to provide a Contract Performance Bank Guarantee, equivalent to ……% (…. Percent) of the said value of the Contract to the Employer for the faithful performance of the Contract,

we, ……., (hereinafter referred to as the Bank), having registered/Head office at ……. and inter alia a branch at …… being the Guarantor under this Guarantee, hereby, irrevocably and unconditionally undertake to forthwith and immediately pay to the Employer any sum or sums upto a maximum amount of Rs ---------- [6] (Rupees ----------) without any demur, immediately on first demand from the Employer and without any reservation, protest, and recourse and without the Employer needing to prove or demonstrate reasons for its such demand.

Any such demand made on the Bank shall be conclusive as regards the amount due and payable by the Bank under this guarantee. However, our liability under this guarantee shall be restricted to an amount not exceeding Rs. _____.

We undertake to pay to the Employer any money so demanded notwithstanding any dispute or disputes raised by the Vendor / Contractor / Supplier in any suit or proceeding pending before any Court or Tribunal, Arbitrator or any other authority, our liability under this present being absolute and unequivocal.

The payment so made by us under this Guarantee shall be a valid discharge of our liability for payment thereunder and the Vendor / Contractor / Supplier shall have no claim against us for making such payment.

We the ……bank further agree that the guarantee herein contained shall remain in full force and effect during the period that would be taken for the performance of the said Contract/satisfactory completion of the performance guarantee period as per the terms of the Contract and that it shall continue to be enforceable till

all the dues of the Employer under or by virtue of the said Contract have been fully paid and its claims satisfied or discharged.

We ……..BANK further agree with the Employer that the Employer shall have the fullest liberty without our consent and without affecting in any manner our obligations hereunder to vary any of the terms and conditions of the said Contract or to extend time of performance by the said Vendor / Contractor / Supplier from time to time or to postpone for any time or from time to time any of the powers exercisable by the Employer against the said Vendor / Contractor / Supplier and to forbear or enforce any of the terms and conditions relating to the said Contract and we shall not be relieved from our liability by reason of any such variation, or extension being granted to the said Vendor / Contractor / Supplier or for any forbearance, act or omission on the part of the Employer or any indulgence by the Employer to the said Vendor / Contractor / Supplier or by any such matter or thing whatsoever which under the law relating to sureties would but for this provision have effect of so relieving us.

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

This Guarantee shall remain in force upto and including…….. [7] and shall be extended from time to time for such period as may be desired by Employer.

This Guarantee shall not be determined or affected by liquidation or winding up, dissolution or change of constitution or insolvency of the Vendor / Contractor / Supplier but shall in all respects and for all purposes be binding and operative until payment of all money payable to the Employer in terms thereof.

Unless a demand or claim under this guarantee is made on us in writing on or before the ……..[8]we shall be discharged from all liabilities under this guarantee thereafter.

We, …… BANK lastly undertake not to revoke this guarantee during its currency except with the previous consent of the Employer in writing.

Notwithstanding anything to the contrary contained hereinabove:

a) The liability of the Bank under this Guarantee shall not exceed…… [6]
b) This Guarantee shall be valid up to ……[7]
c) Unless the Bank is served a written claim or demand on or before _____[8] all rights under this guarantee shall be forfeited and the Bank shall be relieved and discharged from all liabilities under this guarantee irrespective of whether or not the original bank guarantee is returned to the Bank.

We, _____ Bank, have power to issue this Guarantee under law and the undersigned as a duly authorized person has full powers to sign this Guarantee on behalf of the Bank.

For and on behalf of
(Name of the Bank)

Dated……
Place of Issue……..

[1] NAME AND ADDRESS OF EMPLOYER I.e Bharat Heavy Electricals Limited

[2] NAME AND ADDRESS OF THE VENDOR /CONTRACTOR / SUPPLIER.

[3] DETAILS ABOUT THE NOTICE OF AWARD/CONTRACT REFERENCE

[4] CONTRACT VALUE

[5] PROJECT/SUPPLY DETAILS
[6] BG AMOUNT IN FIGURES AND WORDS

[7] VALIDITY DATE

[8] DATE OF EXPIRY OF CLAIM PERIOD

Note:

1. Units are advised that expiry of claim period may be kept 3-6 months after validity date. It may be ensured that the same is in line with the agreement/ contract entered with the Vendor.

2. The BG should be on Non-Judicial Stamp paper/e-stamp paper of appropriate value as per Stamp Act prevailing in the State(s) where the BG is submitted or is to be acted upon or the rate prevailing in the State where the BG was executed, whichever is higher. The Stamp Paper/e-stamp paper shall be purchased in the name of Vendor/Contractor/Supplier /Bank issuing the guarantee.

3. In line with the GCC, SCC or contractual terms, Unit may carry out minor modifications in the Standard BG Formats. If required, such modifications may be carried out after taking up appropriately with the Unit/Region's Law Deptt.

4. In Case of Bank Guarantees submitted by Foreign Vendors-

   a. From Nationalized/Public Sector / Private Sector/ Foreign Banks (BG issued by Branches in India) can be accepted subject to the condition that the Bank Guarantee should be enforceable in the town/city or at nearest branch where the Unit is located i.e. Demand can be presented at the Branch located in the town/city or at nearest branch where the Unit is located.

   b. From Foreign Banks (wherein Foreign Vendors intend to provide BG from local branch of the Vendor country's Bank)

      b.1 In such cases, in the Tender Enquiry/ Contract itself, it may be clearly specified that Bank Guarantee issued by any of the Consortium Banks only will be accepted by BHEL. As such, Foreign Vendor needs to make necessary arrangements for issuance of Counter- Guarantee by Foreign Bank in favour of the Indian Bank's (BHEL's Consortium Bank) branch in India. It is advisable that all charges for issuance of Bank Guarantee/ counter- Guarantee should be borne by the Foreign Vendor. The tender stipulation should clearly specify these requirements.

      b.2 In case, Foreign Vendors intend to provide BG from Overseas Branch of our Consortium Bank (e.g. if a BG is to be issued by SBI Frankfurt), the same is acceptable. However, the procedure at sl.no. b.1 will required to be followed.

      b.3 The BG issued may preferably be subject to Uniform Rules for Demand Guarantees (URDG) 758 (as amended from time to time). The BG Format provided to them should clearly specify the same.

Annexure-VIII

F. No. DPE/3(3)/10-Fin.
Government of India
Ministry of Finance
Department of Public Enterprises
Block No. 14, CGO Complex,
Lodi Road, New Delhi-110003
Dated the 29th May, 2023

To,

Chief Executives of all CPSEs

Subject:- Concurrent application of Public Procurement Policy for Micro and Small Enterprises Order, 2012 and Public Procurement (Preference to Make in India) Order, 2017 - regarding

Sir/Madam,

The undersigned is directed to forward herewith a copy of Department of Expenditure O.M. dated 18th May, 2023 on the subject mentioned above for information and strict compliance.

Encl : As stated

29/5/2023

(Kailash Bhandari)
Deputy Director
Tel : 2436-6247

Copy to :- Shri Kanwalpreet, Director, Department of Expenditure, Room No. 264-C, North Block, New Delhi.

No.F.1/4/2021-PPD
Government of India
Ministry of Finance
Department of Expenditure
Public Procurement Division
*****

264-C, North Block, New Delhi.
18.05.2023.

OFFICE MEMORANDUM

Subject: Concurrent application of Public Procurement Policy for Micro and Small Enterprises Order, 2012 and Public Procurement (Preference to Make in India) Order, 2017.

The undersigned is directed to refer two Preferential Procurement Orders mandated for the Public Procurement in India, namely:

i. Public Procurement Policy for Micro and Small Enterprises (MSEs) Order dated 23.03.2012 (PPP-MSE Order) issued by Ministry of Micro, Small and Medium Enterprises (MoMSME) in exercise of the powers conferred in Section 11 of the MSME Development Act, 2006. (Last revised on 09.11.2018)

ii. Public Procurement (Preference to Make in India) Order, 2017 (PPP-MII order), under Rule 153(iii) of the General Financial Rules (GFRs) 2017, approved by the Cabinet. Implementation of this PPP-MII order is monitored by Department for Promotion of Industry and Internal Trade (DPIIT). (Last revised on 16.09.2020.)

2. It has been brought to the notice of this Department that concurrent application of these two orders are creating confusion to the procuring entities and different procuring entities interpret them differently. In order to bring predictability both to the procuring entities as well as bidders, following guidelines are being issued.

Guidelines

3. The Class-I local suppliers, under PPP-MII Order, participating in any government tender, may or may not be MSEs, as defined under the MSME Act. Similarly, MSEs participating in any government tender, may or may not be Class-I local suppliers. Suppliers may be categorised in following four broad categories for consideration or applicability of purchase preference:

Category	**Terminology**
Supplier is both MSE & Class-I local supplier.	"MSE Class-I local supplier"
Supplier is MSE but not Class-I local supplier.	"MSE but non-Class-I local supplier"
Supplier is not MSE but is Class-I local supplier.	"Non-MSE but Class-I local supplier"
Supplier is neither MSE nor Class-I local.	"Non-MSE non-Class-I local supplier"

4. The applicability of PPP-MSE Order and PPP-MII Order in various scenarios, involving simultaneous purchase preference to MSEs and Class-I local suppliers under PPP-MSE Order and PPP-MII Order respectively, shall be as under:

a) *Items covered under Para 3(a) of PPP- MII Order, 2017 for which Nodal Ministry has notified sufficient local capacity and competition:* For these items, only Class-I local suppliers are eligible to bid irrespective of purchase value. Hence, Class-II local suppliers or Non-local suppliers, including MSEs which are Class-II local suppliers/ Non-local suppliers, are not eligible to bid. Possible scenarios can be as under:

(i) L-1 is "MSE Class-I local supplier" - 100% of the tendered quantity is to be awarded to L-1.

(ii) L-1 is "Non-MSE but Class-I local supplier" - Purchase preference is given to MSEs as per PPP-MSE Order. Balance quantity is to be awarded to the L-1 bidder.

b) *Items reserved exclusively for procurement from MSEs as per PPP-MSE Order:* These items are reserved exclusively for purchase from MSEs. Hence, non-MSEs are not eligible to bid for these items. Possible scenarios can be as under:

(i) L-1 is "MSE Class-I local supplier" - 100% of the tendered quantity is to be awarded to L-1.

(ii) L-1 is "MSE non-Class–I local supplier" - Purchase preference is to be given to Class-I local supplier as per PPP-MII Order. Balance quantity, is to be awarded to L-1 bidder.

c) *If items are neither notified for sufficient local capacity nor reserved for MSEs, then the process will be as follows:*

c (a) Items covered under Para 3A(b) of PPP-MII Order are divisible items and both MSEs as well as Class-I local suppliers are eligible for purchase preference. Possible scenarios can be as under:

(i) L-1 is "MSE Class-I local supplier" - 100% of the tendered quantity is to be awarded to L-1.

(ii) L-1 is "Non-MSE but Class-I local supplier" - Purchase preference is to be given to MSEs, if eligible, as per PPP-MSE Order. Balance quantity is to be awarded to L-1 bidder.

(iii) L-1 is "MSE but non-Class-I local supplier" - Purchase preference is to be given to Class-I local suppliers, if eligible, as per PPP-MII Order. Balance quantity is to be awarded to L-1 bidder.

(iv) L-1 is "Non-MSE non-Class-I local supplier" - Purchase preference is to be given to MSEs as per PPP-MSE Order. Thereafter, purchase preference is to be given to Class-I local suppliers for "50% of the tendered quantity minus quantity allotted to MSEs

above" as per PPP- MII Order. For the balance quantity, contract is to be awarded to L-1 bidder. *(Kindly refer to the illustrative example in the annexure).*

c (b) Items covered under Para 3A(c) of PPP-MII Order, 2017 are non-divisible items and both MSEs as well as Class-I local suppliers are eligible for purchase preference. Possible scenarios can be as under:

(i) L-1 is "MSE Class-I local supplier" - Contract is awarded to L-1.

(ii) L-1 is not "MSE Class-I local supplier" but the "MSE Class-I local supplier" falls within 15% margin of purchase preference - Purchase preference is to be given to lowest quoting "MSE Class-I local supplier". If lowest quoting "MSE Class-I local supplier" does not accept the L-1 rates, the next higher "MSE Class-I local supplier" falling within 15% margin of purchase preference is to be given purchase preference and so on.

(iii) If conditions mentioned in sub paras (i) and (ii) above are not met i.e. L-1 is neither "MSE Class-I local supplier" nor "MSE Class-I local supplier" is eligible to take benefit of purchase preference, the contract is to be awarded/ purchase preference to be given in different possible scenarios as under:

A. L1 is "MSE but non-Class-I local supplier" or "Non-MSE but Class-I local supplier" – Contract is be awarded to L1.

B. L1 is "Non-MSE non-Class-I local supplier" - First purchase preference to be given to MSE as per PPP-MSE Order. If MSE not eligible/ does not accept - purchase preference to be given to Class- I Local supplier as per PPP-MII Order. If Class-I Local supplier also not eligible/ does not accept – contract to be awarded to L-1.

d) *Items reserved for both MSEs and Class-I local suppliers*: These items are reserved exclusively for purchase from MSEs as well as Class-I local suppliers. Hence, only "MSE Class-I local supplier" are eligible to bid for these items. Non-MSEs/Class-II local suppliers/ Non-local suppliers cannot bid for these items. Hence the question of purchase preference does not arise.

e) Non-local suppliers, including MSEs falling in the category of Non-local suppliers, shall be eligible to bid only against Global Tender Enquiry.

18/5/2023

(Kanwalpreet)
Director
Tel.:-223093811; email: - kanwal.irss@gov.in

To

1. Secretaries of all Central Government Ministries/ Departments.
2. Secretary Department of Public Enterprises with a request for issuing suitable instructions to all Central Public Sector Enterprises in this regard.

Annexure

Example explaining applicability in scenario explained in para 4 c (a)(iv)

(Scenario: Divisible items, both MSEs as well as Class-I local suppliers eligible for purchase preference and L-1 is "Non-MSE non-Class-I local supplier")

Item – Desktop computer

Qty – 50 Nos.

Details of bids received

Sr. No.	Name of bidder	Rates quoted	Price Ranking	Status of bidder
1.	A	100	L1	"Non-MSE non- Class-I local supplier"
2.	B	110	L2	"Non-MSE but Class-I local supplier"
3.	C	112	L3	"MSE but non- Class-I local supplier"
4.	D	115	L4	"Non-MSE but Class-I local supplier"
5.	E	118	L5	"MSE but non- Class-I local supplier"
6.	F	120	L6	"MSE Class-I local supplier"

1. In this case, first purchase preference is to be given to MSEs as per PPP-MSE Order for 25% of tendered quantity of 50 Nos. i.e. 12.5 Nos. (rounded off to the next whole number say 13 Nos). Accordingly, invite L3 (bidder C), whose quoted rates falls within 15% margin of purchase preference to match L1 price i.e. Rs. 100/- for quantity of 13 Nos. Bidder "E" and "F", although MSEs, will not get purchase preference since their quoted rates don't fall within 15% margin of purchase preference. Bidder C will be considered for order of 13 Nos. on confirmation of reduction of price.

2. For 50% of balance quantity of 37 number (tendered quantity of 50 – 13 awarded to bidder C; assuming bidder C has confirmed to accept L1 rates), purchase preference will be given to lowest Class-I local supplier as per PPP-MII Order. Accordingly, bidder B will be invited to match L-1 price for 50% of 37 Nos i.e. 18.5 (say 19 Nos of computers). If bidder "B" does not accept the L1 price i.e. price of Rs. 100/- per unit, next higher Class-I local supplier falling within 20% margin of purchase preference, i.e. bidder "D", may be invited to match L-1 price for 19 Nos. of computers and so on.

3. For remaining quantity i.e. 18 Nos (50-13-19), the contract will be awarded to lowest quoting bidder i.e. Bidder "A", who is L-1 in the example.

***

Annexure-X

Restrictions under Rule 144(xi) of General Financial Rules, 2017 amendment dt: 23.07.2020

I. Any bidder from a country which shares a land border with India will be eligible to bid in this tender only if the bidder is registered with the Competent Authority.

II. "Bidder" (including the term 'tenderer', 'consultant' or 'service provider' in certain contexts) means any person or firm or company, including any member of a consortium or joint venture (that is an association of several persons, or firms or companies), every artificial juridical person not falling in any of the descriptions of bidders stated hereinbefore, including any agency branch or office controlled by such person, participating in a procurement process.

III. "Bidder from a country which shares a land border with India" for the purpose of this Order means :-

a. An entity incorporated, established or registered in such a country; or

b. A subsidiary of an entity incorporated, established or registered in such a country; or

c. An entity substantially controlled through entities incorporated, established or registered in such a country; or

d. An entity whose *beneficial owner* is situated in such a country; or

e. An Indian (or other) agent of such an entity; or

f. A natural person who is a citizen of such a country; or

g. A consortium or joint venture where any member of the consortium or joint venture falls under any of the above

IV. The *beneficial owner* for the purpose of (iii) above will be as under:

1. In case of a company or Limited Liability Partnership, the beneficial owner is the natural person(s), who, whether acting alone or together, or through one or more juridical person, has a controlling ownership interest or who exercises control through other means.

Explanation--

a. "Controlling ownership interest" means ownership of or entitlement to more than twenty-five per cent of shares or capital or profits of the company;

b. "Control" shall include the right to appoint majority of the directors or to control the management or policy decisions including by virtue of their shareholding or management rights or shareholders agreements or voting agreements;

2. In case of a partnership firm, the beneficial owner is the natural person(s) who, whether acting alone or together, or through one or more juridical person, has ownership of entitlement to more than fifteen percent of capital or profits of the partnership;

3. In case of an unincorporated association or body of individuals, the beneficial owner is the natural person(s), who, whether acting alone or together, or through one or more juridical person, has ownership of or entitlement to more than fifteen percent of the property or capital or profits of such association or body of individuals;

4. Where no natural person is identified under (1) or (2) or (3) above, the beneficial owner is the relevant natural person who holds the position of senior managing official;

5. In case of a trust, the identification of beneficial owner(s) shall include identification of the author of the trust, the trustee, the beneficiaries with fifteen percent or more interest in the trust and any other natural person exercising ultimate effective control over the trust through a chain of control or ownership.

V. An Agent is a person employed to do any act for another, or to represent another in dealings with third person.

(On Company Letter Head)

FORM NO. 10F
[See sub-rule (1) of rule 21AB]
Information to be provided under sub-section (5) of section 90 or sub-section (5) of section 90A of the Income-tax Act, 1961

I……. son/daughter of Mr ……. in the capacity of……. (Designation) do provide the following information, relevant to the previous year **2021-22** in case of …….. for the purposes of sub-section (5) of section 90/section 90A:-

Sl.No.	Nature of information	Details
(i)	Status (individual; company, firm etc.) of the assesse	Company
(ii)	Permanent Account Number (PAN) of the assessee if allotted	
(iii)	Nationality (in the case of an individual) or Country or specified territory of incorporation or registration (in the case of others)	……
(iv)	Assessee's tax identification number in the country or specified territory of residence and if there is no such number, then, a unique number on the basis of which the person is identified by the Government of the country or the specified territory of which the assessee claims to be a resident	……

(v)	Period for which the residential status as mentioned in the certificate referred to in sub-section (4) of section 90 or sub-section (4) of section 90A is applicable	**2021-22**
(vi)	Address of the assessee in the country or territory outside India during the period for which the certificate, mentioned in (v) above, is applicable	…….. ……. ……

I have obtained a certificate to in sub-section (4) of section 90 of sub-section (4) of section 90A from the Government of……. (name of country or specified territory outside India)

Signature:…….
Name:…….
Address:…….
Email ID:……
Contact Number…….
Permanent Account Number:…….

Verification

I……. do hereby declare that to the best of my knowledge and belief what is stated above is correct complete and is truly stated. Verified today the……. day of……..…….

Signature of the person providing the information

Place:…….

(On Company Letter Head)

No Business Connection or Permanent Establishment Certificate

Date

To

Bharat Heavy Electricals Limited
Electroncis Division, PB NO. 2606,
Mysore Road, Bangalore
India - 560026

Sir,

Sub: No Business Connection or Permanent Establishment declaration for FY **2021-22**

This is to certify that …… (Name of the supplier) is a company incorporated in ……(country) and does not have any business connection in India as per the provision of Section 9 of the Income Tax Act 1961 or any Permanent Establishment as defined in Article 5 of the India and …….(country) DTAA.

We hereby certify that we will notify BHEL in case of any change in the status as certified above.

For ……

Authorised Signatory

(Note – Please refer definition of the Business Connection on reverse and Permanent Establishment in the relevant DTAA)

"Business connection" as defined in Section 9 of the Income Tax Act the shall include any business activity carried out through a person who, acting on behalf of the non-resident,—

(a) has and habitually exercises in India, an authority to conclude contracts on behalf of the non-resident or habitually concludes contracts or habitually plays the principal role leading to conclusion of contracts by that non-resident and the contracts are—

(i) in the name of the non-resident; or

(ii) for the transfer of the ownership of, or for the granting of the right to use, property owned by that non-resident or that non-resident has the right to use; or

(iii) for the provision of services by the non-resident; or

(b) has no such authority, but habitually maintains in India a stock of goods or merchandise from which he regularly delivers goods or merchandise on behalf of the non-resident; or

(c) habitually secures orders in India, mainly or wholly for the non-resident or for that non-resident and other non-residents controlling, controlled by, or subject to the same common control, as that non-resident:

Provided that such business connection shall not include any business activity carried out through a broker, general commission agent or any other agent having an independent status, if such broker, general commission agent or any other agent having an independent status is acting in the ordinary course of his business :

Provided further that where such broker, general commission agent or any other agent works mainly or wholly on behalf of a non-resident (hereafter in this proviso referred to as the principal non-resident) or on behalf of such non-resident and other non-residents which are controlled by the principal non-resident or have a controlling interest in the principal non-resident or are subject to the same

common control as the principal non-resident, he shall not be deemed to be a broker, general commission agent or an agent of an independent status

For the removal of doubts, it is hereby clarified with explanation-2A, that the significant economic presence of a non-resident in India shall constitute "business connection" in India and "significant economic presence" for this purpose, shall mean—

(a) transaction in respect of any goods, services or property carried out by a non-resident in India including provision of download of data or software in India, if the aggregate of payments arising from such transaction or transactions during the previous year exceeds such amount as may be prescribed; or

(b) systematic and continuous soliciting of business activities or engaging in interaction with such number of users as may be prescribed, in India through digital means:

Provided that the transactions or activities shall constitute significant economic presence in India, whether or not,—

(i) the agreement for such transactions or activities is entered in India; or

(ii) the non-resident has a residence or place of business in India; or

(iii) the non-resident renders services in India:

Thresholds for the purposes of significant economic presence.

11UD. (1) For the purposes of clause (a) of Explanation 2A to clause (i) of sub-section (1) of section 9, the amount of aggregate of payments arising from transaction or transactions in respect of any goods, services or property carried out by a non-resident with any person in India, including provision of download of data or software in India during the previous year, shall be two crore rupees;

(2)For the purposes of clause (b) of Explanation 2A to clause (i) of sub-section (1) of section 9, the number of users with whom systematic and continuous business activities are solicited or who are engaged in interaction shall be three lakhs.

To,
M/s Bharat Heavy Electricals Ltd.,
Electronics Division P.B. No. 2606
Mysore Road, Bangalore –560 026
~~Ph. No.: 080 2699 8994~~

Ref –

Subject: Declaration as a Compliance of Restrictions under Rule 144 (xi) of GFR 2017 as per DOE Order (Public Procurement No.4) dated 23.02.2023 (as amended from time to time).

I have read the clause regarding restrictions on procurement from a bidder of a country which shares a land border with India; I certify that our firm is not from such a country or, if from such a country, has been registered with the Competent Authority. I hereby certify that our firm fulfils all requirements in this regard and is eligible to be considered.

On Bidder Letter Head

Date:

To,

M/s Bharat Heavy Electricals Ltd.

Electronics Division, Mysore Road,'

Bangalore – 560026

Sub: Model Clause / Certificate as per clause 9 (a) of Revised Public Procurement (Preference to Make in India Order, 2017 of DPIIT dated 19.07.2024

Ref: BHEL Tender / RFQ / NIT Number ……

I (authorized signatory for M/s ……..) a 'Class-I Local Supplier' / 'Class-II Local Supplier' at the time of tender, bidding or solicitation hereby confirm that the item meets the Local Content requirement for 'Class-I Local Supplier' / 'Class-II Local Supplier' .

Tick appropriate option & cut the other one:

1)We are the reseller/distributor of the quoted product and the Local Content percentage is …… Break up of Local value addition to be furnished below (inclusive of Taxes):

a)

b)

c)

OEM certificate for country of origin to be submitted for above.

2) We are not the reseller/distributor of the quoted product and the Local Content percentage is ……

The address is as below, where the local content / value addition is made:

[Factory Address]

For M/s ……

Authorized Signatory

(with company seal & Name)

ಭಾರತ್ ಹೆವಿ ಎಲೆಕ್ಟ್ರಿಕಲ್ಸ್ ಲಿಮಿಟೆಡ್
भारत हेवी इलेक्ट्रिकल्स लिमिटेड
Bharat Heavy Electricals Ltd.,
(A Government of India undertaking)
Electronics Division
PB 2606 , Mysore Road Bengaluru , 560026 INDIA

CE: PR: 002- Rev 04

GENERAL COMMERCIAL CONDITIONS FOR CONTRACT

These 'General Commercial Conditions for Contract for Purchase' herein after referred to as GCC apply to all enquiries, tenders, requests for quotations, orders, contracts and agreements concerning the supply of goods and the rendering of related services (hereinafter referred to as "deliveries") to Bharat Heavy Electricals Limited and any of its units, regions or divisions (hereinafter referred to as "BHEL" or the Purchaser) or its projects/ customers.

Any deviations from or additions to these GCC require BHEL's express written consent. The general terms of business or sale of the vendor shall not apply to BHEL. Acceptance, receipt of shipments or services or effecting payment shall not mean that the general terms of business or sale of the vendor have been accepted.

Orders, agreements and amendments thereto shall be binding if made or confirmed by BHEL in writing. Only the Purchasing department of BHEL is authorized to issue the Purchase Order or any amendment thereof.

Definitions: Throughout these conditions and in the specifications, the following terms shall have the meanings assigned to them, unless the subject matter or the context requires otherwise.

a) 'The Purchaser' means Bharat Heavy Electricals Limited, Electronics division, Mysore road, Bengaluru 560 026, a Unit of Bharat Heavy Electricals Limited (A Govt. of India Undertaking) incorporated under the Companies Act having its registered office at BHEL House, Siri Fort, New Delhi-110049, India and shall be deemed to include its successors and assigns. It may also be referred to as BHEL.
b) 'The vendor' means the person, firm, company or organization on whom the Purchase Order is placed and shall be deemed to include the vendor's successors, representative heirs, executors and administrator as the case may be. It may also be referred to as Seller, Contractor or Supplier.
c) 'Contract' shall mean and include the Purchase Order incorporating various agreements, viz. tender/ RFQ, offer, letter of intent/acceptance/ award, the General Conditions of Contract and Special Conditions of Contract for Purchase, Specifications, Inspection/ Quality Plan, Schedule of Prices and Quantities, Drawings, if any enclosed or to be provided by BHEL or his authorized nominee and the samples or patterns if any to be provided under the provisions of the contract.
d) 'Parties to the Contract' shall mean the 'The Vendor' and the Purchaser as named in the main body of the Purchase Order.

Order of Precedence:

In case of any inconsistency or contradiction between any of the documents, the order of precedence shall be Purchase Order, LOI / LOA, Special Conditions of Contract and General Conditions of Contract for commercial conditions; and specific agreement on technical conditions, RFQ/offer and specification for Technical Conditions.

Interpretation:

In the contract, except where the context requires otherwise:

a) words indicating one gender include all genders;
b) words indicating the singular also include the plural and words indicating the plural also include the singular;

c) provisions including the word "agree", "agreed" or "agreement" require the agreement to be recorded in writing, and
d) "Written" or "in writing" means hand-written, type-written, printed or electronically made, and resulting in a permanent record.

Applicable Conditions:

1. Price Basis: All prices shall be firm until the purchase order is executed / completed in all respects. No price variations / escalation shall be permitted. For any delay at BHEL end towards issuing clearance for supply of spares for reasons attributable to BHEL/Customer, Contractor shall honor the PO prices for additional 01 year period from the date of expiry of contractual schedule and delivery schedule will be extended for such period of delay at BHEL end.

2. Ordering and confirmation of Order: Vendor shall send the order acceptance on their company letter head/ through e-mail within a week from the date of receipt of Purchase Order or such other period as specified/ agreed by BHEL. BHEL reserves the right to revoke the order placed if the order confirmation differs from the original order placed. The acceptance of goods/services/supplies by BHEL as well as payments made in this regard shall not imply acceptance of any deviations.
   The purchase order will be deemed to have been accepted if no communication to the contrary is received within one week (or the time limit as specified/agreed by BHEL) from the date of receipt of the purchase order.

3. Documentation: After receipt of Purchase Order, vendor should submit necessary documents (if & as applicable) like drawings specified, bill of materials, datasheets, catalogues, quality plan, test procedure, type test report , O & M Manuals and/or any other relevant documents as per Specification/Purchase Order, as and when required by BHEL/Customer.
   At any stage within the contract period, the vendor shall notify of any error, fault or other defect found in BHEL's documents /specifications or any other items for reference. If and to the extent that (taking account of cost and time) any vendor exercising due care would have discovered the error, fault or other defect when examining the documents/specifications before submitting the tender, the time for completion shall not be extended. However if errors, omissions, ambiguities, inconsistencies, inadequacies or other defects are found in the vendor's documents, they shall be corrected at his cost, notwithstanding any consent or approval.

4. Penalty:
   a. Submission of Engineering documents as per PO: After award of contract, Successful bidder shall submit complete set of documents (like drawings, bill of materials, datasheets, catalogues, quality plan, etc. as called in tender specification) for approval, within 14/21 days (as specified in SCC/Purchase Order) from the date of award of contract. Buyer shall issue manufacturing clearance along with approved documents within 60/75 days (as specified in SCC/Purchase Order) after receipt of documents from seller. Any delay by buyer/consignee in providing approved documents beyond specified period shall be on the part of buyer and BHEL will extend the delivery period for such period of delay.
      In case of any corrections in documents to be incorporated by seller for approval of document based on end-user/consultant/buyer comments, revised documents have to be submitted by seller incorporating the comments within 07/14 days (as specified in SCC) from the date of receipt of the same.
      Seller shall be required to commence manufacturing only after receipt of approved documents from BHEL.

   b. Liquidated Damages (LD): Delivery will commence from the date of placement of Purchase Order. If the seller fails to deliver any or all of the Goods within the original/re-fixed delivery period(s) specified in the contract, the Buyer will be entitled to deduct/recover the Liquidated damages for the delay @ 0.5% of the contract value of delayed quantity per week or part of the week of delayed period as pre-estimated damages not exceeding 10% of the contract value of the delayed quantity without any controversy/dispute of any sort whatsoever. GST as applicable will be recovered along with LD amount.

Extension of Delivery Period: Buyer may, on request of the Seller or otherwise, extend the delivery date subject to Force Majeure conditions and/or also on the ground/reasons of delay attributable to the Buyer / Consignee.

5. Contract variations (Increase or decrease in the scope of supply): BHEL may vary the contracted scope as per requirements at site. If vendor is of the opinion that the variation has an effect on the agreed price or delivery period, BHEL shall be informed of this immediately in writing along with technical details. Where unit rates are available in the Contract, the same shall be the basis for such additional work. Vendor shall not perform additional work before BHEL has issued written instructions/ amendment to the Purchase Order to that effect. The work which the vendor should have or could have anticipated in terms of delivering the service(s) and functionality (i.e.) as described in this agreement, or which is considered to be the result of an attributable error on the vendor's part, shall not be considered additional work.

6. a. Pre-dispatch inspection at seller premises: Before dispatch, the goods will be inspected by Buyer/ Consignee or their Authorized Representative or by Nominated External Inspection Agency (independently or jointly with Buyer or Consignee as decided by the Buyer) at the seller premises (or at designated place for inspection as declared / communicated by the seller) for their compliance to the contract specification. For in-house testing, the sellers will provide necessary facilities free of cost. Seller shall notify the Buyer through e-mail about readiness of goods for pre-dispatch inspection and Buyer shall notify the Seller about the Authorized Representative / Nominated External Inspection Agency and the date of testing. Scope of inspection is limited to 'approved quality plan or QA checklist or Purchase Specification'.
   While bidding the sellers should take into account 12 days (unless otherwise specified in SCC) for arranging inspection from the date of email offering the goods for inspection. Any delay in arranging inspection beyond the specified period due to reasons not attributable to seller, shall be on the part of buyer and BHEL will extend the delivery period for such period of delay.

   b. Material Dispatch Clearance Certificate (MDCC): Seller should take into account 10 days (unless otherwise specified in SCC) for issuance of dispatch clearance by BHEL from the date of successful inspection report. Any delay in issue of MDCC beyond the specified period shall be on the part of buyer and BHEL will extend the delivery period of such period of delay.

   BHEL reserves the right for conducting repeat test, if required. All costs related to inspections & re-inspections shall be borne by vendor. Whether the Contract provides for tests on the premises of the vendor or any of his Sub-contractor/s, vendor shall be responsible to provide such assistance, labour, materials, electricity, fuels, stores, apparatus, instruments as may be required and as may be reasonably demanded to carry out such tests efficiently. Cost of any type test or such other special tests shall be borne by BHEL only if specifically agreed to in the purchase order.

7. Transit Insurance: Transit insurance coverage between vendor's works and project site shall be to the account of BHEL, unless specifically agreed otherwise. However, vendor shall send intimation directly to insurance agency (as mentioned in dispatch instructions issued by BHEL) through fax/courier/e-mail, immediately on dispatch of goods for covering insurance. A copy of such intimation sent by vendor to insurance agency shall be given to BHEL along with dispatch documents. Dispatch documents will be treated as incomplete without such intimation copy. BHEL shall not be responsible for sending intimations to insurance agency on behalf of the vendor.

8. Mode of dispatch:
   Indigenous Scope: By road on Door Delivery Consignee Copy attached basis through your approved transporter (unless otherwise indicated in Dispatch Instructions), only on receipt of Despatch Clearance from BHEL.
   Imported Scope: By Air/Sea through BHEL approved Freight Forwarder/supplier approved Consolidator respectively as per agreed contractual terms, only on receipt of Dispatch Clearance from BHEL.

9. Changes in Statutory levies:
   If any rates of Tax are increased or decreased, a new Tax is introduced, an existing Tax is abolished, or any change in interpretation or application of any Tax occurs in the course of the execution of Contract, which was or will be assessed on the bidder in connection with performance of the Contract, an equitable

adjustment of the Contract Price shall be made to fully take into account any such change by addition to the Contract Price or deduction there from, as the case may be. However, these adjustments would be restricted to direct transactions between BHEL and the bidder /agent of foreign bidder (if applicable). These adjustments shall not be applicable on procurement of raw materials, intermediary components etc. by the bidder /agent.

10. Avaiing duty/tax exemption benefits by bidder, wherever applicable: BHEL shall issue the required Certificate/s, as per relevant policies of the Govt. of India, to facilitate the bidders to avail any such benefits under the Contract. In case of failure of the bidders to receive the benefits partly or fully from the Govt. of India and/or in case of any delay in receipt of such benefits, BHEL shall neither be liable nor responsible in any manner whatsoever.

11. Taxes against sub-vendor dispatches: All taxes/levies, as applicable in respect of all components, equipments and material to be despatched directly from the sub-vendor's works to Site irrespective of the fact whether such taxes and levies are assessable and chargeable on Vendor or the BHEL, shall be to the vendor's account and no separate claim in this regard will be entertained by BHEL.

12. High Sea Sales (HSS): Customs clearance of the consignment landed on Indian Sea/Air ports will be done by BHEL based on the original HSS documents provided by vendors.
    Any delay in submission of complete/correct HSS documents to BHEL may incur demurrage charges. All demurrage charges on account of incomplete /incorrect HSS documents submission by vendor will be to vendor's account and all such charges will be recovered from any of the available vendor bills with BHEL.

13. Packaging and dispatch:The Seller shall package the goods safely and carefully and pack them suitably in all respects considering the peculiarity of the material for normal safe transport by Sea/ Air / Rail/ Road to its destination suitably protected against loss, damage, corrosion in transit and the effect of tropical salt laden atmosphere. The packages shall be provided with fixtures/ hooks and sling marks as may be required for easy and safe handling. If any consignment needs special handling instruction, the same shall be clearly marked with standard symbols / instructions. Hazardous material should be notified as such and their packing, transportation and other protection must conform to relevant regulations.
    The packing, shipping, storage and processing of the goods must comply with the prevailing legislation and regulations concerning safety, the environment and working conditions. Any Imported/Physical Exports items packed with raw/ solid wood packing material should be treated as per ISPM – 15 (fumigation) and accompanied by Phytosanitory/ Fumigation certificate. If safety information sheets (MSDS – Material Safety Data Sheet) exist for an item or the packaging, vendor must provide this information without fail along with the consignment.
    Each package must be marked with Consignee name, Purchase order number, Package number, Gross weight and net weight, dimensions (LxBxH) and Seller's name. Packing list of goods inside each package with PO item number and quantity must also be fixed securely outside the box to indicate the contents of each box. Total number of packages in the consignment must also be indicated in the packing list.
    Separate packing & identification of items should be as follows.
    1. Main Scope - All items must be tagged with part no. & item description.
    2. Commissioning accessories/spares - All items must be tagged with part no. & item description.
    3. Mandatory spares - All items must be tagged with part no. & item description.
    Nevertheless, vendor shall adhere to dispatch & packing instructions issued by BHEL at the time of dispatch.

14. Assignment of Rights & Obligations; Subcontracting: Vendor is not permitted to subcontract the delivery or any part thereof to third party or to assign the rights and obligations resulting from this agreement in whole or in part to third parties without prior written permission from BHEL. Any permission or approval given by the BHEL shall, however, not absolve the vendor of the responsibility of his obligations under the Contract.

15. Progress report: Vendor shall render such report as to the progress of work and in such form as may be called for by the concerned purchase officer from time to time. The submission and acceptance of such reports shall not prejudice the rights of BHEL in any manner.

16. Non-disclosure and Information Obligations: Vendor shall provide with all necessary information pertaining to the goods as it could be of importance to BHEL. Vendor shall not reveal any specified confidential information that may be divulged by BHEL to Vendor's employees not involved with the tender/ contract & its execution and delivery or to third parties, unless BHEL has agreed to this in writing beforehand. Vendor shall not be entitled to use the BHEL name in advertisements and other commercial publications without prior written permission from BHEL.

17. Cancellation /Termination of contract: BHEL shall have the right to completely or partially terminate the agreement by means of written notice to that effect. Termination of the Contract, for whatever reason, shall be without prejudice to the rights of the parties accrued under the Contract up to the time of termination. BHEL shall have the right to cancel/foreclose the Order/ Contract, wholly or in part, in case it is constrained to do so on account of any decline, diminution, curtailment or stoppage of the business.

18. Risk Purchase Clause: In case of failure of supplier, BHEL at its discretion may make purchase of the materials / services not supplied / rendered in time at the RISK & COST of the supplier. Under such situation, the supplier who fails to supply the goods in time shall be wholly liable to make good to BHEL any loss due to risk purchase.
    In case of items demanding services at site like erection and commissioning, vendor should send his servicemen/representatives within 7 days from the service call. In case a vendor fails to attend to the service call, BHEL at its discretion may also make arrangements to attend such service by other parties at the **RISK & COST** of the supplier. Under such situation the supplier who fails to attend the service shall be wholly liable to make good to BHEL any loss due to risk purchase/service including additional handling charges due to the change.

19. Shortages: In the event of shortage on receipt of goods and/or on opening of packages at site, all such shortages, caused by supplier's act or omission, shall be made good at the cost of seller within a reasonable time that BHEL may allow from such intimation.
    Transit Damages: In the event of receipt of goods in damaged condition or having found them so upon opening of packages at site, supplier shall make good of all such damages within a reasonable time from such intimation by BHEL. In case BHEL raises an insurance claim, the cost of material limited to insurance settled amount less handling charges will be reimbursed to supplier.

20. Remedial work: Notwithstanding any previous test or certification, BHEL may instruct the vendor to remove and replace materials/goods or remove and re-execute works/services which are not in accordance with the purchase order. Similarly, BHEL may ask the vendor to supply materials or to execute any services which are urgently required for any safety reasons, whether arising out of or because of an accident, unforeseeable event or otherwise. In such an event, Vendor shall provide such services within a reasonable time as specified by BHEL.

21. Indemnity Clause: Vendor shall comply with all applicable safety regulations and take care for the safety of all persons involved. Vendor is fully responsible for the safety of its personnel or that of his subcontractor's men / property, during execution of the Purchase Order and related services. All statutory payments including PF, ESI or other related charges have to be borne by the vendor. Vendor is fully responsible for ensuring that all legal compliances are followed in course of such employment. Vendor shall fully indemnify and keep indemnified BHEL against all claims of whatsoever nature arising during the course and out of execution of this Order/Contract.

22. Product Information, Drawings and Documents: All specified drawings, technical documents or other technical information received by Vendor from BHEL or vice versa shall not, without the consent of the other party, be used for any other purpose than that for which they were provided. They may not, without the consent of the Disclosing party, otherwise be used or copied, reproduced, transmitted or communicated to third parties. All information and data contained in general product documentation, whether in electronic or any other form, are binding only to the extent that they are by reference expressly included in the contract. Vendor, as per agreed date/s but not later than the date of delivery, provide free of charge information and drawings which are necessary to permit and enable BHEL to erect, commission, operate and maintain the product. Such information and drawings shall be supplied in as many numbers of copies as may be agreed upon.

All intellectual properties, including designs, drawings and product information etc. exchanged during the formation and execution of the Contract shall continue to be the property of the disclosing party.

23. Intellectual Property Rights, Licenses: If any Patent, design, Trade mark or any other intellectual property rights apply to the delivery (goods/related service) or accompanying documentation shall be the exclusive property of the Vendor and BHEL shall be entitled to the legal use thereof free of charge by means of a non-exclusive, worldwide, perpetual license. All intellectual property rights that arise during the execution of the Purchase Order/ contract for delivery by vendor and/or by its employees or third parties involved by the vendor for performance of the agreement shall belong to BHEL. Vendor shall perform everything necessary to obtain or establish the above mentioned rights. The Vendor guarantees that the delivery does not infringe on any of the intellectual property rights of third parties. The Vendor shall do everything necessary to obtain or establish the alternate acceptable arrangement pending resolution of any (alleged) claims by third parties. The Vendor shall indemnify BHEL against any (alleged) claims by third parties in this regard and shall reimburse BHEL for any damages suffered as a result thereof.

24. Force Majeure: If at any time during the continuance of the contract, the performance in whole or in part by either party of any obligation under this Contract shall be prevented or delayed by the reasons of any war, hostility, acts of the public enemy, epidemics, civil commotion, sabotage, fires, floods, explosion, quarantine restrictions, strikes, lockouts or act of God provided notice of happening of such event duly evidenced with documents is given by one party to the other within 10 days from the date of occurrence thereof, neither party shall be by reasons of such event, be entitled to terminate the contract not shall either party have any claim for damages against the other in respect of such non-performance after such event has come to an end or ceased to exist and the decision of the Buyer as to whether the deliveries have been so resumed or not, shall be final and conclusive.
    If force majeure applies, dates by which performance obligations are scheduled to be met will be extended for a period of time equal to the time lost due to any delay so caused.
    Notwithstanding above provisions, in an event of Force Majeure, BHEL reserves for itself the right to cancel the order/ contract, wholly or partly, in order to meet the overall project schedule and make alternative arrangements for completion of deliveries and other schedules.

25. Warranty:
    Wherever required, and so provided in the specifications/ Purchaser Order, the Seller shall ensure that the goods supplied shall comply with the specifications laid down, for materials, workmanship and performance.
    Unless otherwise specified in SCC, warranty period shall be applicable for a period of 24 months from the date of delivery of goods or 18 months from the date of commissioning of goods, whichever is earlier.
    The warranty period as described above shall apply afresh to replaced, repaired or re-executed parts of a delivery. Unless otherwise specifically provided in the Purchase Order, Vendor's liability shall be co terminus with the expiration of the applicable warranty period.

26. Limitation of Liability: Vendor's liability towards this contract is limited to a maximum of 100% of the contract value and consequential damages are excluded. However the limits of liability will have no effect in cases of criminal negligence or wilful misconduct.
    The total liability of Vendor for all claims arising out of or relating to the performance or breach of the Contract or use of any Products or Services or any order shall not exceed the total Contract price.

27. Liability during warranty: Vendor shall arrange replacement / repair of all the defective materials / services under its obligation during the warranty period. The rejected goods shall be taken away by vendor and replaced / repaired. In the event of the vendor's failure to comply, BHEL may take appropriate action including disposal of rejections and replenishment by any other sources at the cost and risk of the vendor.
    In case, defects attributable to vendor are detected during Warranty period or where the commissioning call is issued within the warranty period, vendor shall be responsible for replacement/ repair of the goods as required by BHEL at vendor's cost even after expiry of warranty period.
    Further if the equipment or any part thereof cannot be used by reason of such defect and/or making good of such defect, the warranty period of the equipment or such part, as the case may be, shall be extended by a period equal to the period during which the equipment or such part cannot be used by BHEL because of any of the aforesaid reasons. Upon correction of the defects in the facilities or any part thereof by

repair/replacement, such repair/replacement shall have the warranty period for a period of twelve (12) months from the time such replacement/repair of the equipment or any part thereof has been completed.

28. Liability after warranty period: At the end of the warranty, the Vendor's liability ceases except for latent defects. For the purpose of this clause, latent defects shall be the defects inherently lying within the material or arising out of design deficiency which do not manifest themselves during the warranty Period, but later. The Contractor's liability for latent defects warranty for the equipment including spares shall be limited to a period of six months from the end of the warranty period of the respective equipment including spares or first time commissioning, whichever is later but not later than one (01) year from the date of expiry of warranty period.

29. Compliance with Laws: Vendor shall, in performing the contract, comply with all applicable laws. The vendor shall make all remittances, give all notices, pay all taxes, duties and fees, and obtain all permits, licences and approvals, as required by the laws in relation to the execution and completion of the contract and for remedying of any defects; and the Contractor shall indemnify and hold BHEL harmless against and from the consequences of any failure to do so.

30. Settlement of Disputes:Except as otherwise specifically provided in the Purchase Order, decision of BHEL shall be binding on the vendor with respect to all questions relating to the interpretation or meaning of the terms and conditions and instructions herein before mentioned and as to the completion of supplies/work/services, other questions, claim, right, matter or things whatsoever in any way arising out of or relating to the contract, instructions, orders or these conditions or otherwise concerning the supply or the execution or failure to execute the order, whether arising during the schedule of supply/work or after the completion or abandonment thereof. Any disputes or differences among the parties shall to the extent possible be settled amicably between the parties thereto, failing which the disputed issues shall be settled through arbitration. Vendor shall continue to perform the contract, pending settlement of dispute(s).

31. Arbitration Clause in case of Contract with vendors other than Public Sector Enterprise (PSE) or a Government Department:

    Arbitration & Conciliation:

    The parties shall attempt to settle any disputes or difference arising out of the formation, breach, termination, validity or execution of the Contract; or, the respective rights and liabilities of the parties; or, in relation to interpretation of any provision of the Contract; or, in any manner touching upon the Contract, or in connection with this contract through friendly discussions. In case no amicable settlement can be reached between the parties through such discussions, in respect of any dispute; then, either Party may, by a notice in writing to the other Party refer such dispute or difference to the sole arbitration of an arbitrator appointed by Head of the BHEL–EDN. Such Sole Arbitrator appointed, shall conduct the arbitration in English language.
    The Arbitrator shall pass a reasoned award and the award of the Arbitration shall be final and binding upon the Parties.
    Subject as aforesaid, the provisions of Arbitration and Conciliation Act 1996 (India) or statutory modifications or re-enactments thereof and the rules made thereunder and for the time being in force shall apply to the arbitration proceedings under this clause. The seat of arbitration shall be Bengaluru.
    The cost of arbitration shall be borne as decided by the Arbitrator upon him entering the reference.
    Subject to the Arbitration Clause as above, the Courts at Bengaluru alone shall have exclusive jurisdiction over any matter arising out of or in connection with this Contract.
    Notwithstanding the existence or any dispute or differences and/or reference for the arbitration, the parties shall proceed with and continue without hindrance the performance of its obligations under this Contract with due diligence and efficiency in a professional manner except where the Contract has been terminated by either Party in terms of this Contract.

    Arbitration Clause in case of Contract with a Public Sector Enterprise (PSE) or a Government Department:
    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 by either party for Arbitration to the Sole

Arbitrator in the Department of Public Enterprises to be nominated by the Secretary to the Government of India in-charge of the Department of Public Enterprises. The Arbitration and Conciliation Act, 1996 shall not be applicable to arbitration under this clause. 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. The Parties to the dispute will share equally the cost of arbitration as intimated by the Arbitrator.'

32. Applicable Laws and Jurisdiction of Courts: Prevailing Indian laws both substantive and procedural, including modifications thereto, shall govern the Contract. Subject to the conditions as aforesaid, the competent courts in Bengaluru alone shall have jurisdiction to consider over any matters touching upon this contract.

33. General Terms: That any non-exercise, forbearance or omission of any of the powers conferred on BHEL and /or any of its authorities will not in any manner constitute waiver of the conditions hereto contained in these presents.
    That the headings used in this agreement are for convenience of reference only.
    That all notices etc., to be given under the Purchase order shall be in writing, type script or printed and if sent by registered post or by courier service to the address given in this document shall be deemed to have been served on the date when in the ordinary course, they would have been delivered to the addressee.

34. Clause reserved.

35. NO CLAIM FOR INTEREST OR DAMAGE:
    1) Interest on Money due to the Seller/Supplier/Vendor: Vendor shall not be entitled to any interest or damage in case of any delay on the part of the BHEL to pay the amount due upon measurement or as per Contract or otherwise. Vendor shall also not be entitled to interest upon any guarantee / security / retention money or payments in arrears or upon any balance which may on the final settlement of his account be due to him.
    2) No Claim for Interest or Damage: No claim for interest or damage will be entertained or be payable by BHEL in interest of any amount or balance which may be lying with BHEL or may become due upon settlement/adjudication of any dispute, difference or misunderstanding between the parties by way of arbitration or court proceedings or otherwise or in respect of any delay or omission on the part of the Employer in making intermediate or final payment or in respect of any amount / damage which may be claimed through arbitration or court proceedings or in any other respect whatsoever.

Pre-Qualification Criteria

Item: VFDs for ID FAN (2125KW, 6.6 kV Motor) & CEP (400KW, 6.6 kV Motor)
Project: 1 X 150MW COAL FIRED THERMAL POWER PLANT
Customer: HINDALCO INDUSTRIES LIMITED (HIL)

1. The vendor shall be an Original Equipment Manufacturer (OEM) of VFD Equipment. Only the OEM can submit offers.

2. The vendor should have designed, engineered, manufactured, type tested or got type tested, supplied and commissioned or supervised commissioning of at least one (1) number of VFD system (of the type & model offered) for feeding squirrel cage induction motor/ synchronous motor of 1000kW, 6.6 kV or higher rating, which is in successful operation for a period of at least one (1) year as on 01.01.2026 Necessary supporting document shall be provided. The Reference List of VFD supplies made giving the ratings, application, details of the customers, year of supply and commissioning status to be provided along with the offer.

3. The vendor or their authorized service representatives shall have trained engineers for commissioning & service for the offered equipment and shall be in a position to provide prompt after sales service and spares support for our installations. This service network shall necessarily be available in India.

4. The vendor shall be in a position to undertake AMC or provide service support for the equipment supplied, after the expiry of the warranty / guarantee period either directly or through a service representative.

5. Technical clearance of vendor offer will be based on Customer acceptance of Vendor Credentials (does not apply to Customer approved vendors for this project).

Note:

a. Vendor must furnish all necessary supporting documents, as required, along with the bid to satisfy Pre-Qualification criteria as specified above.

b. The Pre-Qualification criteria are mandatory requirements and the technical bids will be evaluated only when the Pre-Qualification criteria are met.

Checklist for Pre-Qualification Criteria

Sl. No.	Vendor Confirmation to the points above	Reference of documents attached
1	Yes / No	
2	Yes / No	
3	Yes / No	
4	Yes / No	
5	Yes / No	

REVISION HISTORY SHEET

REV. NO.	DATE	NATURE OF CHANGE	REASONS	PREPARED BY	APPROVED BY
00	18.02.2026	FIRST ISSUE	------	KD	GD
01	22.04.2026	QTY. UPDATED & MINOR MODIFICATION	------	KD	GD

INDEX:

TECHNICAL SPECIFICATION OF IGBT/ IGCT/ SGCT BASED VFD FOR SQUIRREL CAGE INDUCTION MOTOR

The vendor shall be responsible for engineering and functioning of the complete VFD system comprising of Dry Type Transformer and VFD panel, meeting the intent and requirement of this specification, Customer specification and datasheet. This shall include but not be limited to inverter sizing, transformer sizing, transformer impedance selection, vector group, input and output harmonic filter design and sizing, output dv/dt filter sizing, adequacy of motor cable size selected by BHEL/Customer etc.

All necessary interlocks as required for safe and reliable operation of VFD system along with Input Breaker, Bypass Breaker, Output Breaker/Isolator shall be provided in VFD system. If any special arrangement is required in input breaker, same shall be informed by the vendor in offer.

The machine shall normally run on VFD. However, at the discretion of the operator, it shall be switched on to bypass control manually (if bypass is applicable as per annexure).

Note: Data mentioned in Annexure shall supersede the standard specification data in case of any conflict.

1. Project Details

Sl.	Parameter	Specification
a	Project Location	As per attached Annexure to specification
b	Project Title	
c	End-Customer	
d	Consultant	

2. Environment Specifications

Sl.	Parameter	Specification
a	Maximum / Minimum Ambient Temperature	As per attached Annexure to specification
b	Equipment Design Temperature	
c	Relative Humidity	
d	Altitude	
e	Location of VFD Panels	
f	Seismic Zone	
g	Environment	

3. Input & Transformer Data

Sl.	Parameter	Specification
a	System V/ freq./ ph.	As per attached Annexure to specification.
b	Voltage variation	
c	Frequency variation	
d	Combined Voltage and Frequency Variation	
e	Fault level	
f	Transformer Type	As per attached Annexure to specification.
g	Transformer insulation class/winding temp. rise	As per attached Annexure to specification.
h	Power Cables	As per attached Annexure to specification

4. Motor Data: (Refer Motor Datasheet attached with Specification)

Sl.	Parameter	Specification	
a	Type	Squirrel Cage Induction Motor	
b	Scope	Manufactured by BHEL-Bhopal	
c	Rating (kW)	As per attached Annexure to specification.	
d	Rated V and I	As per attached Annexure to specification.	
e	Fed from	As per attached Annexure to specification.	
f	Duty Class	Continuous - S1	
g	Efficiency and Power Factor	As per motor datasheet	As per motor datasheet
h	Power Cables	As per attached Annexure to specification.	

5. VFD Specifications:

Sl.	Parameter	Specification
1	Drive Application	As per attached Annexure to specification.
2	Input Voltage	From Integrated Dry Type Transformer.
3	Power/Torque vs speed	Torque α Speed^2, Power α Speed^3
4	Single Line Diagram	As per attached Annexure to specification.
5	Output Voltage of VFD	As per attached Annexure to specification.
6	Output Current of VFD	As per attached Annexure to specification.
7	Output Frequency	0 to 50Hz , Resolution: +/- 0.01% under transient conditions; +/- 0.5% under steady state conditions
8	Overload capacity	As per attached Annexure to specification.
9	Speed Regulation & Speed Accuracy	+ 0.5% +1%
10	Drive Control	Sensorless Vector Control
11	Braking Operation	Not Applicable
12	Output LC Sinusoidal Filter	Motor is designed for PWM operation. Distance between VFD and Motor are as per attached Annexure to specification. Vendor to clarify and offer output Filter, if required. Cable glands, lugs and termination kit for the cables at both the end of the filter must be supplied by vendor.
13	Distance between VFD & Motor	As per attached Annexure to specification.
14	Limiting dimensions	As per attached Annexure to specification.
15	VFD Efficiency	As per attached Annexure to specification

5.1 VFD Panel Construction

a) Degree of Protection: As per attached Annexure to specification.

b) **Drive Panel**: Free standing, floor mounting type, comprising of rigid welded structural frames with Cold Rolled Sheet Steel enclosure of minimum thickness 2 mm for structural and 1.6 mm for other members. All doors and removable covers shall have neoprene gaskets. Ventilating louvers shall have easily removable and washable dust filters with provision for cleaning them without switching off the panel.

c) Busbar Material – Electrolytic grade copper, colour coded. Sleeving/shrouding for safety purposes shall be done.

d) Cooling: Forced Air Cooled VFD should be considered. Cooling system shall include well dimensioned panel, adequate cooling air flow path. Vendor shall ensure that the panel dimensions and flow paths have been designed for continuous running at the specified ambient without overheating.

e) Earth Bus – minimum 50*6 mm or equivalent Copper. Vendor can use either Copper bus or cable for internal earthing of the panel. Adequate size of earth bus/cable shall be provided.

f) Door Interlock: The VFD shall have a door interlock for safety. This interlock system should ensure that none of the power cabinets can be opened until the main source of power is disconnected or will cause the main source of power to trip. Additionally, the same interlock system should ensure that power cannot be initialized to the drive unless the doors are closed. Suitable shrouding mechanism shall be provided so that the DC capacitors cannot be touched till their voltage is zero.

g) Painting: 2 Coats of Primer and 2 Coats of Finish Paint to be given for all surfaces of enclosure. Paint shall be Epoxy Based with Powder Coated Finish. Paint shade for VFD & Transformer are available in customer spec/ annexure. Paint Thickness: 100 Microns (minimum). Exact paint shade will be confirmed during drawing approval stage.

h) Power and control wiring shall be done with Fire retardant (FRLS) cables.

i) Double compression weather-proof type Nickel plated brass cable glands shall be supplied. Height of the terminal from cable gland plate shall be adequate to take care of the cable sizes and quantity mentioned. Minimum space for the power cable

termination shall be 600mm clear from the cable gland plate. Cable entry will be from bottom only. Gland Plates shall be blank (undrilled) – to be drilled at site. The gland plate thickness shall be min. 3.0 mm. for hot / cold-rolled sheet steel and min. 4.0 mm for non-magnetic material. The gland plate selected shall be based on the cable size and runs mentioned in Annexure.

j) All electronic modules and components shall be accessible from front of panel only. Modular assemblies for both the system control electronic equipment and power electronic equipments shall be used.

k) All low voltage compartment and cabling shall be electrically and physically separated from the high voltage compartment.

l) 20% spare terminals shall be provided in the VFD panel.

m) Noise level: Shall be less than 85dB at a distance of 1 metre from the outline of VFD Panels at a height of 1.5 metres from the floor with all normal cooling fans running in the VFD Panels.

n) Vibration: According to IEC68-2-6

o) Storage temperature: 0°C to 60°C.

p) Interference: According to IEC801 parts 2,3,4
Immunity: The panels shall be designed so as to have low Radio Frequency Interference (RFI) and Electromagnetic Interference (EMI).

q) VFD Efficiency (including transformer): As per attached Annexure. Exact value to be specified by vendor.

r) Duty cycle: Class I Duty Cycle as per IEC 146-1

5.2 VFD Requirements

a) Vendor to provide input and output choke or filter (if required for operation of Drive).

b) Local/Remote: Selector switch shall be provided on VFD panel door / HMI for operator to select mode of operation.
- Local – Operation from VFD Panel for Speed Control from door mounted interface;
- Remote – Operation from DCS.

Mode changes shall be password protected to be used exclusively by operator.

If VFD is set for speed reference from Remote, it shall be possible to program the VFD to either shutdown, go to minimum speed or continue operation at its last known speed reference point whenever a loss of speed reference is detected.

c) Local Start/Stop Push Button to be provided either on Panel door or on keypad.

d) Emergency Stop: Door Mounted Lockable Push-Button to be provided with 4 NO + 4 NC contact. All contacts to be wired to Terminal Block for external Interlocking / Annunciation.

e) Every panel shall be provided with covered illumination Lamp with limit switch and MCB. Space heater shall be provided in panel with switch fuse and variable setting thermostat. 240V AC power socket with MCB shall be provided.

f) The expected life time of the drive system shall be minimum 20 years. The system including all individual components forming part of the system shall have an availability of minimum 0.997 and a minimum MTBF of 4 years.

g) The equipment may be stored outdoors for long periods before installation. The packing should also be suitable for outdoor storage areas with heavy rains / high ambient temperatures.

h) Vendor shall certify readiness of system fit for commissioning. Vendor's scope shall also include supply of all specialized tools and tackles required.

i) Any special requirement regarding CT/ PT, protection relay or any other device, in input breaker, which is required for functioning and protection of VFD system shall be considered by the VFD vendor in their scope.

j) Earthing scheme should be provided by the vendor. Requirement of electronic earthing for control cards should be clearly mentioned in the offer.

k) Any special cable other than power and control cables required to connect VFD to other equipment shall be in vendor scope.

l) Bypass Feature requirement: As per attached Annexure to Specification

m) Drive Control: Sensorless Vector Control (Speed switch is not available in Motor).

n) VFD overload capacity : As per attached Annexure to specification.

o) Harmonics :

Harmonics Limitations (Source): Shall be as per latest IEEE 519

Voltage harmonics: Vendor to inform the values with calculations during detailed engineering stage.

Current harmonics: Vendor to inform the source side 5th, 7th & 11th harmonics values with calculations during detailed engineering stage.

Vendor to provide suitable filter to keep system harmonics within limits.

Harmonics at VFD Output / Motor Input: Shall be as per latest IEC 61800-4

Vendor to specify the maximum amount of voltage and current harmonics at the VFD Output / Motor Input terminals.

5.3 VFD Features

1. Soft Start and Auto Restart.
2. Auto Speed Search Facility (Catch on Fly) shall be available for starting into rotating loads.
3. Momentary Power-off Ride through feature to maintain drive operation during voltage dip of upto 20% or power interruption for less than 1 Sec.
4. Automatic VFD tuning during start-up.
5. Flux optimisation function shall be provided to reduce the total energy consumption and noise level in case drive is operated below nominal load.
6. Selectable reverse run prohibition.
7. Adjustable motor overload feature.
8. Settable minimum and maximum operating frequency.
9. VFD shall produce not greater than 1% torque pulsation to the shaft of driven equipment.
10. Field adjustable Torque limits and acceleration and deceleration ramps.
11. Accelerate / Decelerate Times to be specified.
12. User programmable preset speeds.

13. VFDs shall be installed in Air-conditioned area but it shall be suitable for operation in non-air-conditioned area also.

14. The operator interface shall be used for drive programming, drive monitoring and drive trouble shooting. The operator interface must also be able to start and stop the drive, reset VFD faults and manually adjust the VFD's speed reference.

15. The operator interface shall have LED indicators for drive fault, drive run, and drive in current limit. Exact LED indications shall be finalized during detailed engineering stage. In case LED indicators are not possible to be provided due to vendor's standard design of panel, details shall be included in panel HMI.

16. The operator interface shall allow monitoring of inverter operating conditions including speed, current, voltage, torque, power etc.

17. Messages shall be alphanumeric in nature. All the fault messages shall be in English.

18. Provision shall be made available for remote operation through 4-20mA reference signal from DCS.

19. The operator interface shall be able to display all real time operating variables and all drive programming parameters.

20. The operator interface shall be capable of displaying a specific user selected parameter on power-up. This power-up parameter would typically be a parameter that is important to the operator such as motor speed or motor load.

21. The following Control signals must be provided:

    i) Local/Remote
    ii) Emergency stop
    iii) Trip/Close Input breaker

    These are indicative. Vendor to suggest the interlocking scheme using these and other outputs as required for the system during detailed Engineering. These Outputs shall be provided with individual relay having 3 changeover potential free contacts wired to terminal blocks.

22. All VFD operating parameter shall be stored in non-volatile memory.

23. The drive shall have built in monitoring of following parameters as minimum on its digital operator interface and these parameters shall also be displayed at Plant DCS through Modbus link:

    i) Input & Output Frequency
    ii) Input & Output Current
    iii) Motor Speed
    iv) Input & Output Voltage
    v) DC Bus Voltage
    vi) Torque
    vii) Input & Output Power (It shall be possible to display power output of the drive in kW)
    viii) Digital Input Status
    ix) Digital Output Status
    x) Analog Input Status
    xi) Drive Thermal state
    xii) Output kWhr of Drive
    xiii) Hour run
    xiv) Transformer Temperature for alarm & trip

24. Necessary transducer shall be provided with 4-20 mA output for indicating Motor Speed & Current in the DCS.

25. The following indications shall be provided on the VFD Panel Door/ Keypad:

i) Motor Running/ VFD ON
ii) Motor Stopped/Tripped
iii) Local/Remote status
iv) AC Mains ON
v) Auxiliary Control Supply ON
vi) VFD Ready
vii) VFD Fault
viii) External Fault
ix) Emergency Stop Activated
x) Motor Overspeed
xi) Input Breaker Trip
xii) Motor zero speed
xiii) Rectifier output 'ON'
xiv) Transformer winding temperature alarm & trip.

30. The VFD shall store fault logs of minimum last 10 faults in memory.

31. Communication: VFD panel shall have facility for communication with DCS through Modbus TCP/IP.
    The interface details of VFD shall be incorporated as required for data communication with DCS system with serial interfaces with TCP/IP data links. Necessary hardware shall be included in the scope and the interface protocol (i.e. Modbus RTU or TCP/IP) shall be provided.

32. The following Audio-visual annunciations must be provided.

    i) Rectifier fuse failure / drive fault
    ii) Main AC failure
    iii) Inverter fuse failure / Drive fault
    iv) Inverter overload
    v) Inverter high temperature / Drive fault
    vi) Cooling system failure
    vii) Motor failed to start / Drive fault
    viii) Transformer fault and alarm
    ix) Communication and measurement system unhealthy

5.4 Protection

Following protections shall be built in the Drive:

a) Motor Overload / Over Torque

b) Instantaneous Over current

c) Ground Fault protection

d) Over Voltage/Under Voltage protection

e) Output Short Circuit

f) Output Phase Loss, Phase reversal, Locked rotor protection

g) Phase Sequence Protection

h) Input Phase Loss/Single Phasing Preventer

i) Over Speed/Over frequency of motor

j) Heat sink over temperature/VFD Panel Temperature High

k) Loss of Cooling Fans (Ventilation failure Indication and Alarm)

l) External faults like Transformer fault & alarm

m) Incoming and outgoing Line surge protection

n) Loss of Speed reference

o) Inverter fault

p) Differential protection of motor

q) DC Link Overvoltage

r) The system shall be designed to deliver the motor input current and torque for the complete speed torque characteristics of the driven equipment, with input supply & frequency variation as mentioned in this Specification.

s) If the motor load exceeds the limit, the drive shall automatically reduce the frequency and voltage to the motor to guard against overload. If load demands exceed the current limit for more than 1 min, the drive shall shut down to prevent over heating of the motor and damage to the drive.

t) The drive shall trip in case the speed exceeds 110% of the maximum operational speed or reduces to 95% of the minimum operational speed for more than 10 seconds.

u) Fault diagnostic shall be built into the system to supervise the operation and failure of the system. The information regarding failure of any of the system including shut down of the system shall be available for a period of minimum 4 days after a shut down even though no supply available.

v) Converter transformer: Short circuit, over current, Earth fault, and Winding temperature high protection.

6. Dry type Transformer: (mounted in panel)

Dry type Transformer

a) HV: Taps of ±5% on HV side in steps of 2.5%. In case vendor is quoting Active Front End (AFE) drive and not providing taps on transformer HV winding, then the AFE drive shall be able to adjust the voltage equivalent of ±5% taps (in case of AFE Drive).

b) LV voltage: Multi secondary type. Number of secondaries and secondary voltage to be indicated by the vendor in technical offer.

c) Class of insulation: As per attached Annexure to specification.

d) Winding material: Electrolytic grade Copper

Protection:

RTDs / FO based sensors to be provided in each limb for winding temperature measurement. Temperature scanner to be provided for winding temperature measurement of all limbs.
Alarm and trip contacts required for annunciation for fault and tripping action.

Connection:

HV Incomer:

Termination arrangement and Cable glands to be provided by the vendor. The exact number and sizes will be intimated during drawing approval stage. Cables in BHEL/Customer scope.

LV Connection:

Cables along with glands, Lugs for connection between LV secondaries and VFD to be supplied by the Vendor. This shall be used for testing of the VFD and later bunched in the panel during dispatch and the same shall be connected at site. Necessary connection and routing arrangements to be made at Vendor's works. For more details, please refer Annexure attached with this Specification.

In case of non-integrated transformer, Cable termination kits (if required) for LV connection between transformer and VFD shall also be supplied by vendor. Adequate derating factor shall be considered in sizing of power cables both transformer and VFD. Cable shall be routed through cable trays/trenches. Please refer Annexure for derating factor (if available).

7. ISOLATOR PANEL: (if applicable)

Please refer attached Annexure to Specification.

8. LCS PANEL: (if applicable)

Please refer attached Annexure to Specification.

9. Auxiliary Supply:

Please refer attached Annexure to Specification.

10. Mandatory Spares: (if applicable).

Please refer attached Annexure to Specification.

11. Testing and Quality requirements

a) Routine Tests shall be carried out on all equipments (VFD, transformer, Isolator panel) as per relevant standards / Customer document.

b) Type Test Certificates for similar equipment and rating supplied by the Vendor shall be submitted during detailed engineering. Refer relevant clause of Customer Specification. If valid type test certificates for Isolator panel (if applicable), Transformer and VFD panels are not available as per Customer Specification, vendor shall conduct the type tests as per IEC standard without any cost implication to BHEL/Customer.

c) During fabrication, the VFD drive, Transformer and Isolator panel shall be subject to inspection by BHEL/ Customer, or by an agency authorized by the BHEL/ Customer to assess the progress of work, as well as to ascertain that only quality raw material is used.

12. Inspection, Training and Commissioning support

a) Final Inspection: BHEL / Customer representative will be present at respective manufacturer's works in India for witness of FAT. This is to be incorporated in the Quality Plan. No charges shall be applicable for witnessing of final tests. Inspection call has to be raised atleast 02 weeks in advance.

b) Training: Training of Customer officials at project site/vendor works, please refer attached Annexure. Boarding, lodging, To and fro travel charges are in vendor's scope. Content of training programme is to be provided by the vendor during detailed engineering phase.

c) Commissioning: Commissioning of VFD System at site shall be in the scope of vendor. Vendor shall arrange for deputation of service representatives of other major

equipments to carry out commissioning of respective equipments at site. Boarding, Lodging, to and fro travel charges shall be in vendor scope.

d) Any replacement of failed/damaged items during commissioning shall be exclusively at vendor's cost.

e) Vendor is advised to stock necessary spares and ensure easy availability to facilitate trouble free commissioning.

13. Documentation

Sl.	Parameter	Specification
1	Attached Documents	a) Pre-Qualification Criteria (PQC) b) Customer Specifications, SLD & Motor Data.
2	Technical Information required along with Offer	a) Dimensional Drawing of VFD, Transformer & Isolator Panels along with minimum clearance to be maintained for effective cooling, Heat loss of panel, feeder requirement and Weight of the panel. b) Technical Catalogue of VFD System being offered. c) Reference list for similar rating VFDs giving the following: Model number, Application, Rating, Year of supply and status of commissioning. d) Filled up Pre-Qualification Criteria e) Confirmation / Clarification / Information / Deviation List. f) Confirmation / Clarification / Deviation List to the Specifications and other documents in (1) above g) Datasheet for Transformer and VFD . h) Datasheet for Isolator (if applicable) i) Sizing Calculation for Transformer and VFD. Note: In case the ratings of VFDs are different, separate datasheets & sizing calculation shall be provided for each rating.

3	Information / Confirmations required along with offer	a) Supply of the VFD and transformer, Isolator shall be from OEM of respective equipments only. The name of the country from which the drive is sourced and the location of the manufacturing plant should be mentioned in the offer. b) After Sales Service and Support shall be given by the vendor for a minimum period of 10 (Ten) years after supply. Address of the Sales and Service Representatives in India with complete contact details: Name/Telephone/Email are to be provided during detailed engg. c) Vendor shall give a notice of at least 1 year to the end user of the equipment and BHEL before phasing out the product / spares to enable the end user for placement of order for spares and services.
4	Technical (unpriced) & Commercial (priced) Bids – For Evaluation	Refer Scope of Supply and Services for Unpriced and Priced bid.
5	Information required for Customer / Consultant Approval after placement of Purchase Order	a) GA Drawing of VFD, Transformer, Isolator Panels along with minimum clearance to be maintained for effective cooling, and Weight. b) Schematic Diagrams & Bill of Materials c) Feeder Requirements d) Heat Loss for Air Conditioning System sizing. e) Technical Catalogue of VFD System being offered. f) Test Protocol and Quality Plan g) Type test certificates. h) Filled up Datasheet for Transformer and VFD. i) Sizing Calculation for Transformer and VFD.
6	Information Required along with Supply. Maintenance Manuals and Documentation	Soft copies of Erection, Commissioning and Maintenance Manuals along with Final Drawings and Documentation, Test and Guarantee Certificates, Complete Bill of Material for the equipment supplied.

7	Confirmations/Deviations to Specification	**Point-wise confirmation to this specification to be given along with offer**. Deviations, if any, shall be indicated separately. If there are no deviations to the specifications, vendor shall mention the same explicitly. A reply from vendor stating that "**Equipment will generally meet the specifications**" will not be accepted by BHEL. Clause-wise Confirmation / Clarifications shall be furnished in the format given below. This is mandatory. Deviations furnished in below format only will be considered by BHEL. Deviations mentioned elsewhere will not be allowed. BHEL has the right to not accept the deviations mentioned by vendor.

Point No.	Page No.	Confirmation / Clarification / Information / Deviation	Details	Remarks, if any

14. Scope of Supply & Services

As per attached Annexure to Specification

VFD SYSTEM DATA SHEET

A	VFD Data	
1	Manufacturer	
2	Model No.	
3	Manufacturing Location	
4	Rating and Application	
5	Applicable codes /standards	
6	Speed reference	4-20 mA from DCS
7	Speed range	
8	Switching Frequency	
9	No. of Pulse	
10	Total number of Diodes/ IGBTs/ IGCTs	
11	Drive output Voltage	
12	Overload capability	
13	Inrush current 250% In for	
14	Combined efficiency (Transformer & Drive) at:	
	i) 100% Load	
	ii) 75% Load	
	iii) 50% Load	
	iii) 25% Load	
15	Overall power factor at:	
	i) 100% Load	
	ii) 75% Load	
	iii) 50% Load	
	iii) 25% Load	
16	Output voltage range and Accuracy	
17	Output Frequency range and Accuracy	
18	Type of Cooling	
19	Redundancy in Cooling	
20	Type of feedback for speed control	
21	Output Filter/ Choke:	
	i) Manufacturer	
	ii) Type/ Model No.	
	iii) Rated Current and Voltage	
22	Acceleration / Deceleration time	
23	Degree of protection	

24	VFD Panel Dimensions (Dimensional details inclusive of all panels shall be furnished)		
	i) Length (mm)		
	ii) Height (mm)		
	iii) Depth (mm)		
	iv) Weight (kg)		
25	Paint Shade		
26	Heat Load (kW)		
27	Auxiliary Power Requirement:	415V, 3ph, 4Wire	UPS supply
	i) KVA		
	ii) Voltage and Phase		
B	**Transformer Data**		
1	Manufacturer		
2	Manufacturing Location		
3	Type	Dry type Transformer	
4	Integrated / Non-Integrated		
5	Duty	Continuous (Converter Duty)	
6	Rating (Transformer must be designed to carry 110% current of calculated VFD rating.)		
7	Class of insulation and Temperature Rise		
8	Insulation level:		
	P. f withstand		
	i) HV Winding		
	ii) LV Winding		
	Impulse withstand		
	i) HV Winding		
	ii) LV Winding		
9	Fault Level on HV Side		
10	HV Voltage and Phase		
11	LV Voltage/ Current		
12	No. of LV Windings		
13	Rated Frequency	50Hz	
14	Impedance		
15	Cooling Type		
16	Winding Material	Electrolytic grade Copper	
17	Location of Tap Changer	HV Winding	
18	No. of Taps and Type		

19	Vector Group	
20	Neutral CT specification:	
	51G	
	64R	
	Vk	
	Im at Vk/2	
	RCT	
21	Cable Size/Type	
	i) HV Winding	
	ii) LV Winding	
22	No Load Loss	
	i) At 100% Voltage	
	ii) At 110% Voltage	
23	Full Load Copper loss at 75°C	
24	No Load Current	
	i) At 100% Voltage	
	ii) At 110% Voltage	
25	Efficiency at 75°C and unity power factor	
	i) At 100% of Full Load	
	ii) At 75% of Full Load	
	iii) At 50% of Full Load	
	iv) At 25% of Full Load	
26	Efficiency at 75°C and 0.8 power factor	
	i) At 100% of Full Load	
	ii) At 75% of Full Load	
	iii) At 50% of Full Load	
	iv) At 25% of Full Load	
27	Load at which maximum efficiency occurs	
28	Regulation at 75°C at full load	
	i) At 0.8 pf	
	ii) At UPF	
29	Dimensions	
	i) Length (mm)	
	ii) Height (mm)	
	iii) Depth (mm)	
	iv) Weight (kg)	
30	Degree of protection for enclosure.	
31	Paint Shade	
32	Heat Load (kW)	

ANNEXURE-HINDALCO LAPANGA TO PS/445/3127

1	**Project Details**		
	Parameter	**Specification**	
a	Project Title	**1 X 150MW COAL FIRED THERMAL POWER PLANT-UNIT 1**	
		ID FAN : 2 VFDs	**CEP** : 2 VFDs
		2 X 150MW COAL FIRED THERMAL POWER PLANT- UNIT 2 & 3	
		ID FAN : 4 VFDs	**CEP** : 4 VFDs
b	End Customer	HINDALCO INDUSTRIES LIMITED (HIL)	
c	Consultant	TATA CONSULTING ENGINEERS LTD.	
d	Location	LAPANGA, SAMBALPUR, ODISHA	

2	**Environmental Specifications:**	
	Parameter	**Specification**
a	Max. Ambient temperature	50℃
	Min. Ambient temperature	6℃
c	Equipment Design temperature	50℃
d	Relative Humidity	87% max / 27% min
e	Altitude	Less than 1000m above mean sea level
f	Location of VFD Panels	Indoor, Ventilated Room with Air Conditioning
g	Seismic Zone	Zone- III,Importance factor shall be considered as per IS 1893 (Part 1): 2016 & IS 1893 (Part 4): 2015 depending on the category for all the structures of the proposed power plant.
h	Environment	All cards/hardware of VFD panel shall be suitable for operation in harsh environmental conditions with respect to high temperature, humidity & dust.

3	**Input & Transformer Data**	
a	System V / Freq / ph	6.6 kV / 50 Hz / 3-phase
b	Voltage Variation	± 10%
c	Frequency Variation	± 5%
d	Combined Voltage and Frequency Variation	10%
e	Fault Level at 6.6 kV input side	40kA for 3 Sec.
f	Transformer type	Dry type Integrated Transformer along with VFD. Cables between VFD and transformer shall be in VFD vendor's scope.
g	Transformer Insulation class / Wdg temp. rise	H/H
h	Power cables	Please refer sl. No. 8 (b) in "Other important data"

4	**VFD Specifications**			
a	Drive Application	**ID FAN** (Induced draft fan)		**CEP** (Condensate extraction pump)
b	VFD type	Fully assembled units of 6.6kV VFD Panels (IGBT/SGCT/IGCT), Air Cooled with **Integrated Dry Type Transformer**		
c	Bypass feature required	Yes (bypass breaker in BHEL scope). Please refer VFD-SLD.		
d	VFD Output Current (50 °C Design Ambient)	**ID FAN**		**CEP**
		220 A		44 A
e	Output Voltage of VFD	0 to 6.6 kV (V/f = Constant)		
f	Overload capacity	The overload capacity shall be 110% of rated current for 1 minute at rated voltage.		
g	Single line diagram	Refer Drg. No. 3-674-0-00001		
h	Cooling Fan redundancy	Not applicable.		
i	Efficiency	Overall Efficiency of VFD System (including Transformer) shall be minimum 96%. (Max. heat loss of Drive shall be 4% of motor rated power)		
j	Degree of Protection	IP: 41 or better		
k	Paint shade	VFD: IS 631 (Light Grey)		
l	Limiting Dimensions	Maximum height of False ceiling in VFD room shall be 3.5 meters. Vendor to ensure compliance to the same with respect to VFD panel height including clearance.		
m			**ID FAN**	**CEP**
	Distance between VFD & Motor (approx.)	Unit 1	200 meters	100 meters
	Distance between VFD & Motor (approx.)	Unit 2		
		Unit 3		
5	**Motor Data**			
a	Motor Rating	**ID Fan Motor**: 2125 kW, 6.6kV,220A,1000 RPM		**CEP Motor**: 400kW,6.6 kV,44A,1500 RPM
b	Fed from	Variable frequency drive (V/f control) with bypass		
c	Motor Efficiency & Power Factor	As per attached Motor Datasheet of ID Fan motor & CEP motor.		
d	Power cables	Please refer sl. No. 8 (b) “Other important data”		
6	**Isolator panel**			
	Applicable. For detail spec, refer “Annexure-Isolator”			
7	**LCS**			
	Not applicable			

8	Other Important Data		
a	Cables and accessories	HT Cable glands (weather proof), busbar termination, gland plate etc. suitable for - Transformer HV side - VFD output side Exact cable size will be intimated during drawing approval stage. All external inter connecting cables (HT Power, LT Power, LT Control and Instrumentation Cable) required in VFD System shall be supplied by BHEL/Customer. HT Termination kits are in BHEL/customer scope.	
b	Cable Sizes between :		
	i. 6.6 kV Swbd. & VFD Transformer	**ID FAN**	**CEP**
		6.6kV, 1 R X 3Cx185 sq.mm.Al XLPE	6.6kV,1 R X 3Cx185 sq.mm.Al XLPE
	ii. VFD Transformer & VFD	In VFD Vendor's scope.	In VFD Vendor's scope.
	iii. VFD & Motor	6.6kV, 1 R X 3Cx185 sq.mm.Al XLPE	6.6kV,1 R X 3Cx185 sq.mm.Al XLPE
c	Pre-Qualification Criteria	Pre-Qualification Criteria(PQC) requirement of Medium Voltage Variable Frequency Drive (6.6 kV VFD) is attached. Vendor to furnish details in line with the document.	
d	Testing requirements	As per Customer ITP / manufacturer ITP .	
e	Training	Training for Customer personnel for 6 Mandays for each unit at Customer/Manufacturer's works	
f	Auxiliary Supply	a) 230V AC UPS feeder will be provided by BHEL. KVA rating is to be given by the Vendor. Control supply for electronic modules has to be derived from the UPS. b) Auxiliary Supply – 415V, 3ϕ, 50Hz, 4 wire will be provided by BHEL. Feeder Power rating (short time & continuous) to be specified by the Vendor. c) Other supplies required by the VFD system to be generated internally within the VFD system.	
g	Packing	Wooden packing shall be provided suitable to withstand shocks and vibrations during equipment transit and to withstand handling during loading/unloading. Material handling marks should be provided on the packages.	
h	Transformer inspection (at Transformer manufacturer's works)	Not applicable.	
i	Load test at VFD Shop floor with Motor	Vendor to Confirm the availability of the facility for the VFD functional & performance testing along with 6.6 KV HT Motor of the comparable rating on their VFD test beds (for testing with VFD)	

j	Reference date for type test purpose	Date to be considered as 21.04.2025.

9	Mandatory Spares	For ID Fan	For CEP
Sl. No.	**Item Description**	**Qty (3X)**	**Qty (3X)**
1	Power Supply unit	1 no. of each type	1 no. of each type
2	Control Fuses	2 nos. of each type and rating	2 nos. of each type and rating
3	Power semiconductor - Power cell (complete Power cell to be supplied in case of cell type construction).	10% of qty. used in 1 VFD	10% of qty. used in 1 VFD
4	Cooling fan	1 no. of each type	1 no. of each type
5	Semiconductor fuses of each rating	1 no.	1 no.
6	Auxiliary relays of each type	1 no.	1 no.
7	Filter capacitor of each type and rating	10% of qty. used in 1 VFD	10% of qty. used in 1 VFD
8	Push buttons	1 Set	1 Set
9	Filter choke	1 no.	1 no.
10	Controller card of each type	1 no.	1 no.

Note: "In case of a fractional quantity arising due to percentage calculations, the quantity shall be rounded up to the next higher integer."

10	Attachments to the Specification
Sl. No.	**Description**
1	Electrical requirements (Extract from Customer Specification)
2	Quality assurance requirement & Information on Quality plan (Extract from Customer Specification)
3	Painting requirements (Extract from Customer Specification)
	Packing Instructions (Extract from Customer Specification)
4	Type Tests – Sec C4, SPEC. NO.TCE. 13807B-ME-6002-6001 (Extract from Customer Specification)
5	VFD Specification (Extract from Customer Specification)
6	Motor Datasheet ID Fan motor and CEP motor
7	SLD for VFD System

11	Consolidated Scope of Supply and Services	
Sl.	**Items**	**Qty.**
1.	Fully Assembled Units of 2125 KW, 6.6 kV VFD Panels (IGBT/SGCT/IGCT), Air Cooled with Integrated Dry type transformer for ID FAN Motor	6 Nos
2.	O/P Isolator for VFD ID FAN Motor	6 Nos
3.	Fully Assembled Units of 400 KW, 6.6 kV VFD Panels (IGBT/SGCT/IGCT), Air Cooled with Integrated Dry type transformer for CEP Motor	6 Nos
4.	O/P Isolator for VFD CEP Motor	6 Nos
5.	Cable Accessories (One set consists of total quantity for Unit 1, 2 & 3 : ID FAN- 06 nos.)	3 Set
6.	Cable Accessories (One set consists of total quantity for Unit 1, 2 & 3 : CEP- 06 nos.)	3 Set
7.	Mandatory Spares for VFD for ID Fan motor	3 Set
8.	Mandatory Spares for VFD for CEP motor	3 Set
9.	Laptop loaded with Drive Software	3 Nos.
10.	Training charges	03 Lot (Lumpsum)
11.	Erection Supervision & Commissioning: (Vendor to quote lumpsum commissioning charges for 10 mandays per VFD which shall be considered for bid evaluation) Payment shall be made for actual mandays consumed at Site with per manday charges calculated on the basis of the lumpsum charges quoted above. Lumpsum charges quoted shall include travelling, boarding and lodging expenses.	12 Lot (Lumpsum)

"Annexure-Isolator"

VFD Vendor to supply Double Throw Motorized Isolator for connection at the VFD output and shall be suitable for variable frequency operation. Double throw isolator is envisaged for operator safety when the motor is running in either VFD mode or Bypass mode and maintenance activity can be carried out in Bypass breaker or VFD respectively. The selection of Motorised Isolator Panel shall be governed by VFD manufacturer's operational requirements. Adequate provision shall be provided for closing from remote through contacts and from local by switch provided on panel door. The Isolator shall be able to provide closing/opening contacts of both the positions for remote monitoring.

a) Rated Voltage = 6.6 kV

b) Rated Current = Shall be designed to carry 110% of VFD output Current. Isolator shall be suitable for overload requirements of the VFD.

c) Rated short time current rating for terminals = 40kA for 3 Sec

d) Degree of Protection = IP41 or better

e) Termination shall be suitable for termination each of 6.6 kV 1R X 3C x 185 Sq. mm, Al, Cable at the input-1 & input-2 and output of the Isolator Panel. Provision shall be kept for O/P cable termination from Bypass breaker output as well as for cable connection to motor.

f) Aux. supply for Isolator panel 230V 1 ph UPS supply to be derived from VFD panel. Feeder rating to be confirmed by vendor.

g) Sheet Steel thickness = 2mm for doors and covers and 3mm for load bearing members and instrument panel (if any).

h) Paint shade & thickness: Light grey IS:631, Thickness: 60 Microns (min).

i) Main and earth Busbars = Electrolytic grade Tinned Copper. Busbar sizing calculations shall be provided during detail engineering stage.

j) ON/OFF indications shall be provided on panel door. All indicators shall be LED type.

k) All components shall be accessible from front side for easy maintenance.

l) Panel space heater shall be provided with Thermostat.

m) Facility for padlocking of panel doors shall be provided.

n) Provision shall be provided for charging of spring charging motor manually.

o) Cable entry shall be from bottom only.

p) Safety interlocks shall be provided in the panel so that, panel cannot be opened when current is flowing in this circuit.

q) Sub vendor: Isolator panel shall be sourced from reputed vendors like Panicker/A-bond Strands etc.

r) Following type test reports shall be submitted for Isolator panels.

i. Temperature rise test
ii. Degree of Protection of Enclosure
iii. Dielectric tests (Lightning Impulse voltage and Dry Power frequency withstand test)
iv. Short time withstand current and peak withstand current test
v. Mechanical endurance test

Note: All Routine tests for Isolator panel shall be carried out as per relevant standards. Type test certificates for similar equipment supplied by the vendor shall be submitted. In case Type test certificate for similar equipment is not available, the same shall be conducted without any cost & time implication to BHEL/Customer.

BHARAT HEAVY ELECTRICALS LIMITED, BHOPAL
MOTOR TECHNICAL DATA (REV. 00)

CUSTOMER : M/S HINDALCO INDUSTRIES LIMITED
PROJECT : 1X150 MW BTG AT ADITYA ALUMINUM AT LAPANGA, SAMBALPUR, ODISHA
WORK ORDER : 45082A40121
TD Date : 15-Dec-2025

NOTE: Data given below is subject to tolerances as per IS/IEC:60034-1 unless specified otherwise as '*' for which the data is guaranteed.

1.0	**GENERAL**		
1.1	Application	:	ID Fan
1.2	Quantity	:	02 Nos.
1.3	Make	:	BHEL, Bhopal
1.4	Frame Size	:	1LA7905-6
1.5	Applicable Standard	:	IS/IEC:60034-1
2.0	**TYPE AND RATING**		
2.1	Type of Motor	:	SCIM
2.2	Service		
2.2.1	Outdoor/Indoor	:	Outdoor
2.2.2	Hazardous Area Classification	:	NA
2.3	Duty Cycle / Designation	:	Continuous (S1)
2.4	Rated Continuous output (kW)	:	2125
2.5	Ambient Temperature (Deg. C)	:	50
2.6	Full load / Synchronous speed	:	997 / 1000 rpm
2.7	(a) Rated voltage (v) and variation	:	6600 $\pm$ 10%
	(b) No. of phases	:	3
2.8	Rated frequency (Hz) and variation	:	50 $\pm$ 5%
2.9	Combined voltage and Frequency variation	:	10% abs.
2.10	Full load current (amps)	:	220
2.11	No load current (amps)	:	60
2.12	Type of enclosure	:	TETV

2.13	Power factor (100% / 75% / 50% Load)	:	0.88 / 0.87 / 0.82		
2.14	Efficiency (100% / 75% / 50% Load)	:	96.0 / 95.6 / 94.8		
2.15	Starting current % of FLC	:	600%		
3.0	**PERFORMANCE**				
3.1	Method of starting	:	DOL		
3.2	Torque at rated voltage (% of FLT)		FLT = 2075.98 kg-m		
3.2.1	Breakaway starting torque	:	80 %		
3.2.2	Pull-up torque	:	80 %		
3.2.3	Pull-out torque	:	205 %		
3.3	Starting time at (for DOL /Soft starter)	:	**90% RV**	**100%RV**	**110% RV**
	a) Load coupled (sec)	:	53	37	29.5
	b) Load un-coupled (sec)	:	2.0	1.4	1.1
			90% RV	**100%RV**	**110% RV**
3.4	Locked rotor withstand time (hot) in sec.	:	57	46	38
	(cold)	:	67	54	45
3.5	Starting requirement				
	a) No. of equally spread starts per hour	:	3		
	b) No. of cold starts	:	2		
	c) No. of hot starts	:	1		
3.6	Thermal time constant Heating/Cooling	:	50 / 150 Minutes.		
3.7	Whether motor suitable for bus transfer	:	Yes		
3.8	Noise Level	:	As per IS:12065		
3.9	Vibration Level	:	As per IS:12075		
3.10	Minimum starting voltage	:	90% of RV		
4.0	**CONSTRUCTION**				
4.1	Degree of protection	:	IP55		
4.2	Method of cooling	:	IC511		
4.3.1	Motor suitability for rotation	:	Uni-Directional		
4.3.2	DOR facing DE	:	Clockwise (CW)		
4.4	Insulation class	:	H, Temp. Rise limited to class F		
4.5	Permissible temp. rise above an ambient	:	95 deg. C (by Resistance method)		
4.6	Tropicalized (Yes / No)	:	Yes		
4.7	Stator Winding connection	:	Star		

4.8	BEARINGS		
4.8.1	Make	:	Reputed supplier
4.8.2	Type	:	Antifriction
4.8.3	Recommended lubricant	:	Grease
4.8.4	Catalogue No. (DE / NDE)	:	NU238M + 6238MC3 / NU232M
4.8.5	Life	:	40,000 Hour.
4.8.6	For FOL system		
4.8.6.1	Oil flow (LPM) per bearing	:	NA
4.8.6.2	Max / Min. oil pressure (kg-m2)	:	NA

5.0 MISCELLANEOUS

5.1	Type of mounting	:	Horizontal (B3)
5.2	Moment of inertia (GD^2) kg-m^2		
5.2.1	Load (referred) to motor speed	:	23000
5.2.2	Motor	:	868
5.3	WEIGHTS		
5.3.1	Stator (kg)	:	11300
5.3.2	Rotor (kg)	:	3300
5.3.3	Total (kg)	:	14600
5.4	OGA Drawing Number	:	14020041931

LIST OF ACCESSORIES:

1.01	RTD for winding (type/nos./leads)	:	Pt-100, 12 Nos., 3-Wire, Simplex
1.02	RTD for bearing (type/nos./leads)	:	Pt-100, 02 Nos., 3-Wire, Duplex
1.03.01	RTD for hot air (type/nos./leads)	:	NA
1.03.02	RTD for cold air (type/nos./leads)	:	NA
1.04	Space heaters	:	Yes
1.04.01	Nos.	:	02
1.04.02	Power (watts)	:	600 watts, Total power = 1200 watts
1.04.03	Supply voltage	:	240V AC, 1Phase
1.05	Stator terminal box		
1.05.01	Type	:	PSTB
1.05.02	Fault level	:	50 kA
1.05.03	Fault level duration (sec)	:	0.25
1.06	Neutral TB	:	Non-PSTB
1.07	Current transformers	:	Yes **(Customer to furnish details)**
1.07.01	Nos.	:	3
1.07.02	Ratio	:	--
1.07.03	Accuracy class	:	PS
1.07.04	Knee point voltage (volts)	:	$\geq$ -
1.08	Dial type thermometer		
1.08.01	For bearing (nos.)	:	2
1.08.03	Contact rating	:	0.5 / 5A 220V DC / 240V AC
1.08.04	Range	:	0 To 120 Deg C
1.08.05	Supply voltage	:	240 V AC, 1-phase
1.09	Rotor terminal box	:	NA
1.10	TB for RTD, BTD and space heaters	:	YES
1.11	Sole plate	:	NA
1.12	Foundation and anchoring bolts	:	As per Outline General Arrangement Drawing
1.13	Base Frame	:	NA
1.14	Speed Switch	:	YES
1.14.01	Supply Voltage	:	240 V AC, 1-phase
1.15	Insulation of bearing	:	Yes, NDE bearing insulation (Refer OGA)
1.16	Forced oil lubrication	:	NA
1.17	Oil level indicator	:	NA

1.18	Noise reducer	:	YES (at NDE)
1.19	Water flow indicator	:	NA
1.20	Water leakage detector	:	NA
1.21	Tacho-generator	:	NA
1.22	Grounding pads		
1.22.01	Nos., Size on motor body	:	2; 25tk X 65 mm wide X 70 mm (Refer OGA)
1.22.02	Nos. on terminal box	:	2
1.23	Vibration pads	:	Yes
1.23.01	No. , size	:	01, 80 mm^3
1.23.02	Location	:	Refer OGA

LIST OF CURVES:

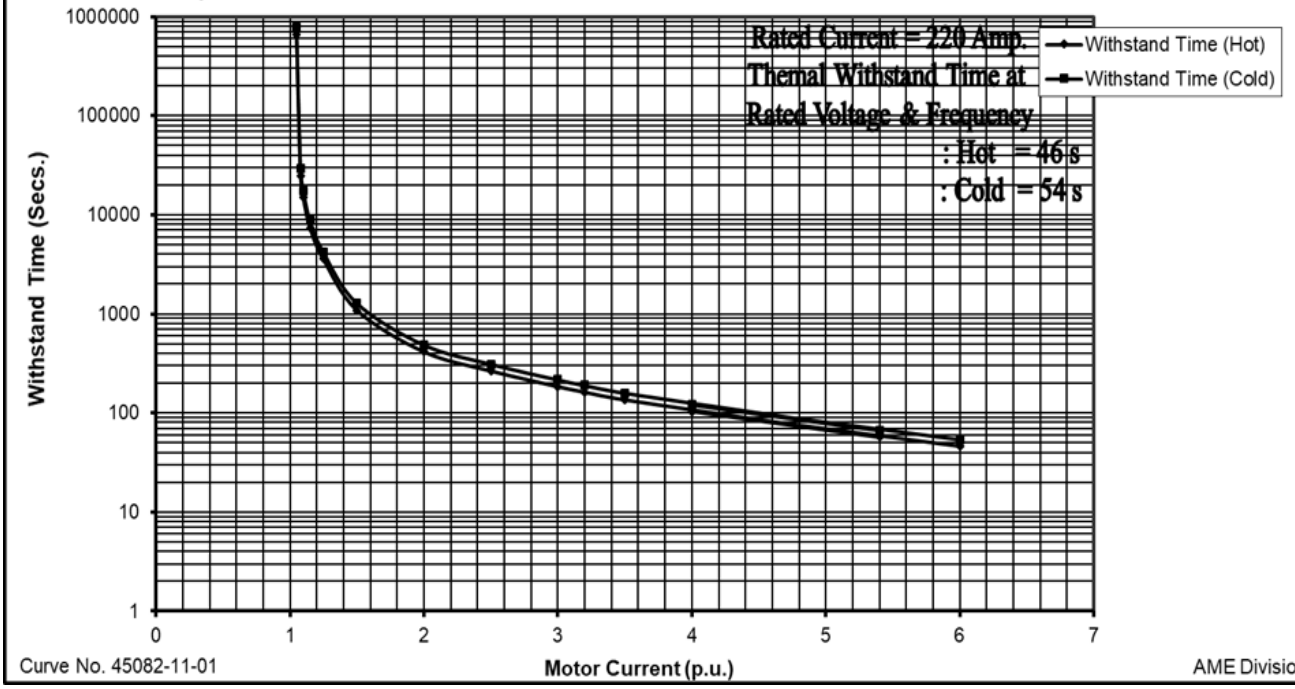
1.	Thermal withstand curves	:	45082-11-01
2.	Torque & Current Vs Speed Curves	:	45082-11-02
3.	Speed & Current Vs Time Curves	:	45082-11-03
4.	Efficiency & PF Vs load curves	:	45082-11-04
5.	Negative sequence curve	:	45082-11-05

Prepared by :

BHASKAR
AME Department
BHEL, Bhopal

Thermal Withstand Curves

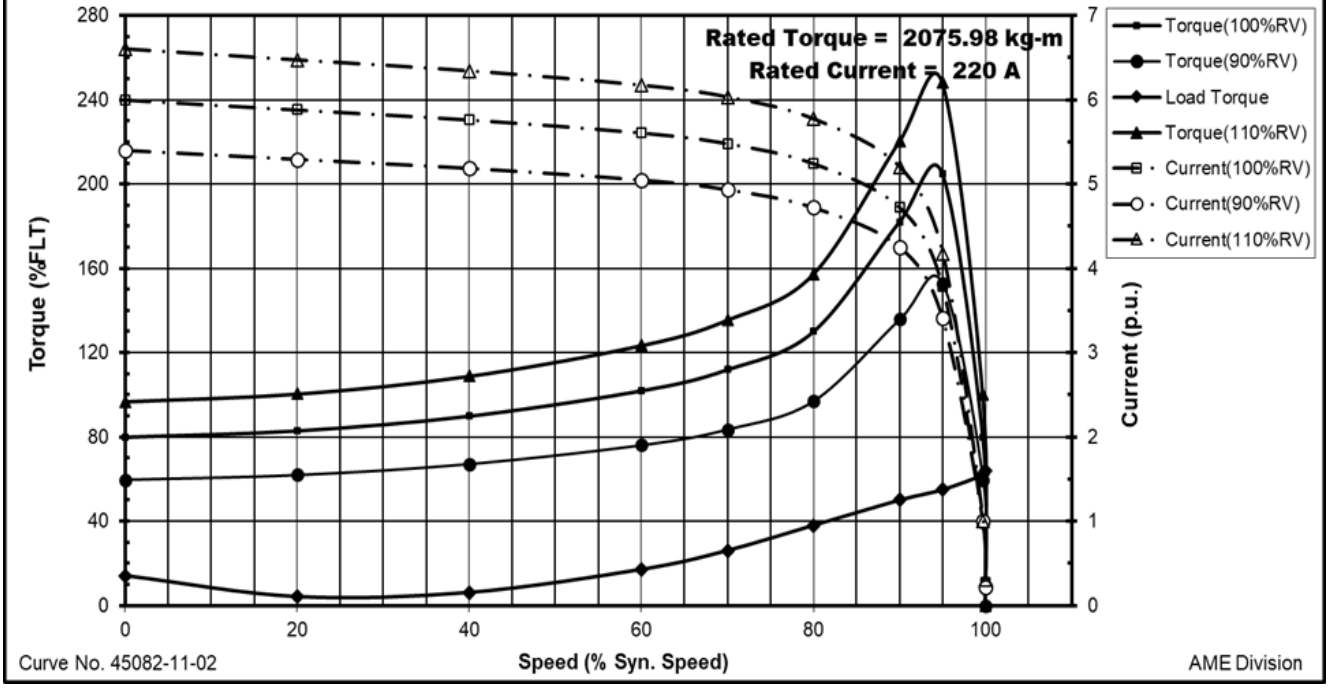
Rating : 2125 KW, 6.6 KV, 6 P , TETV , SQUIRREL CAGE INDUCTION MOTOR
W.O.No. : 45082A42111
Frame : 1LA7905-6
Customer : M/s HINDALCO INDUSTRIES LIMITED
Project : 1X150 MW BTG AT ADITYA ALUMINUM AT LAPANGA, SAMBALPUR, ODISHA



Curve No. 45082-11-01 AME Division

Torque & Current Vs Speed Curves

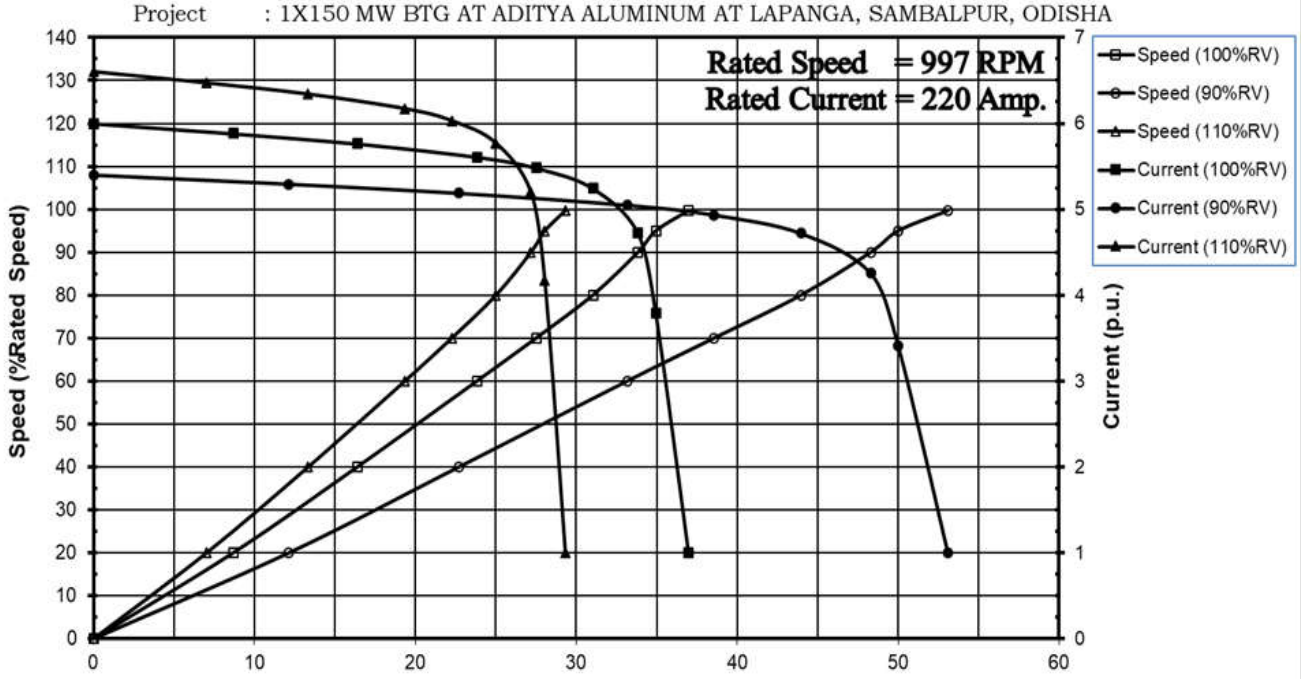
Rating : 2125 KW, 6.6 KV, 6 P , TETV , SQUIRREL CAGE INDUCTION MOTOR
W.O.No. : 45082A42111
Frame : 1LA7905-6
Customer : M/s HINDALCO INDUSTRIES LIMITED
Project : 1X150 MW BTG AT ADITYA ALUMINUM AT LAPANGA, SAMBALPUR, ODISHA



Curve No. 45082-11-02 AME Division

Speed & Current Vs Time Curves

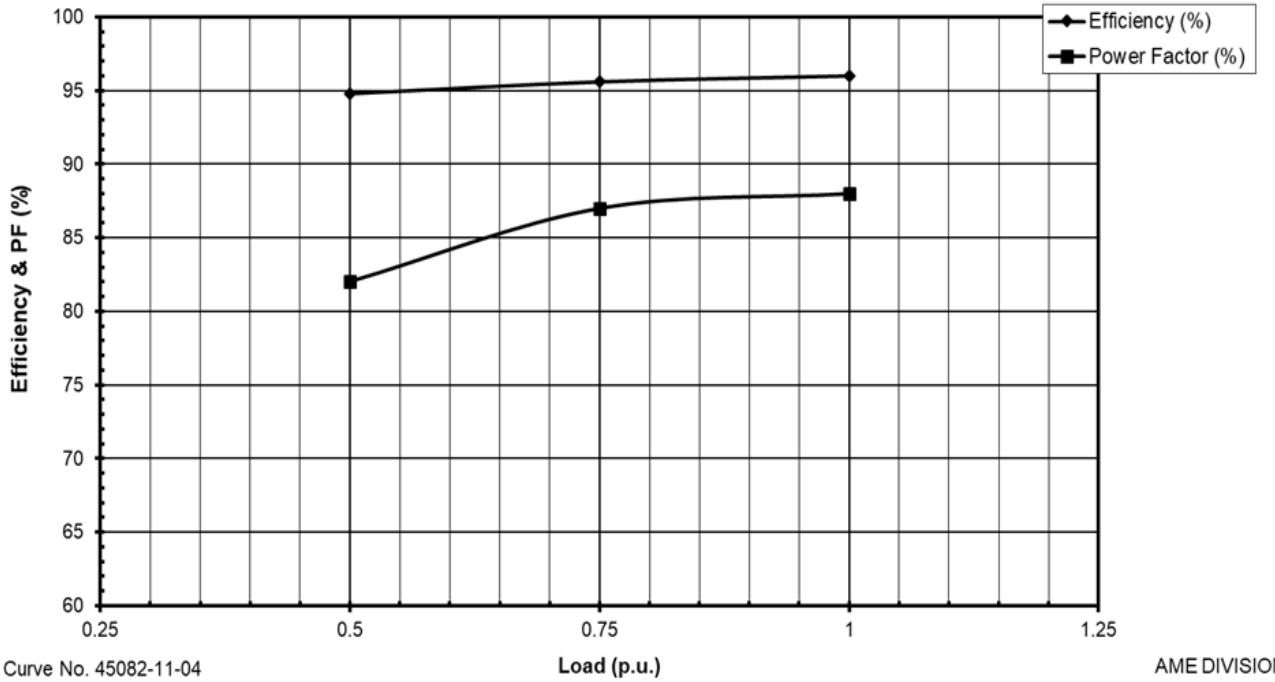
Rating : 2125 KW, 6.6 KV, 6 P , TETV , SQUIRREL CAGE INDUCTION MOTOR
W.O.No. : 45082A42111
Frame : 1LA7905-6
Customer : M/s HINDALCO INDUSTRIES LIMITED
Project : 1X150 MW BTG AT ADITYA ALUMINUM AT LAPANGA, SAMBALPUR, ODISHA



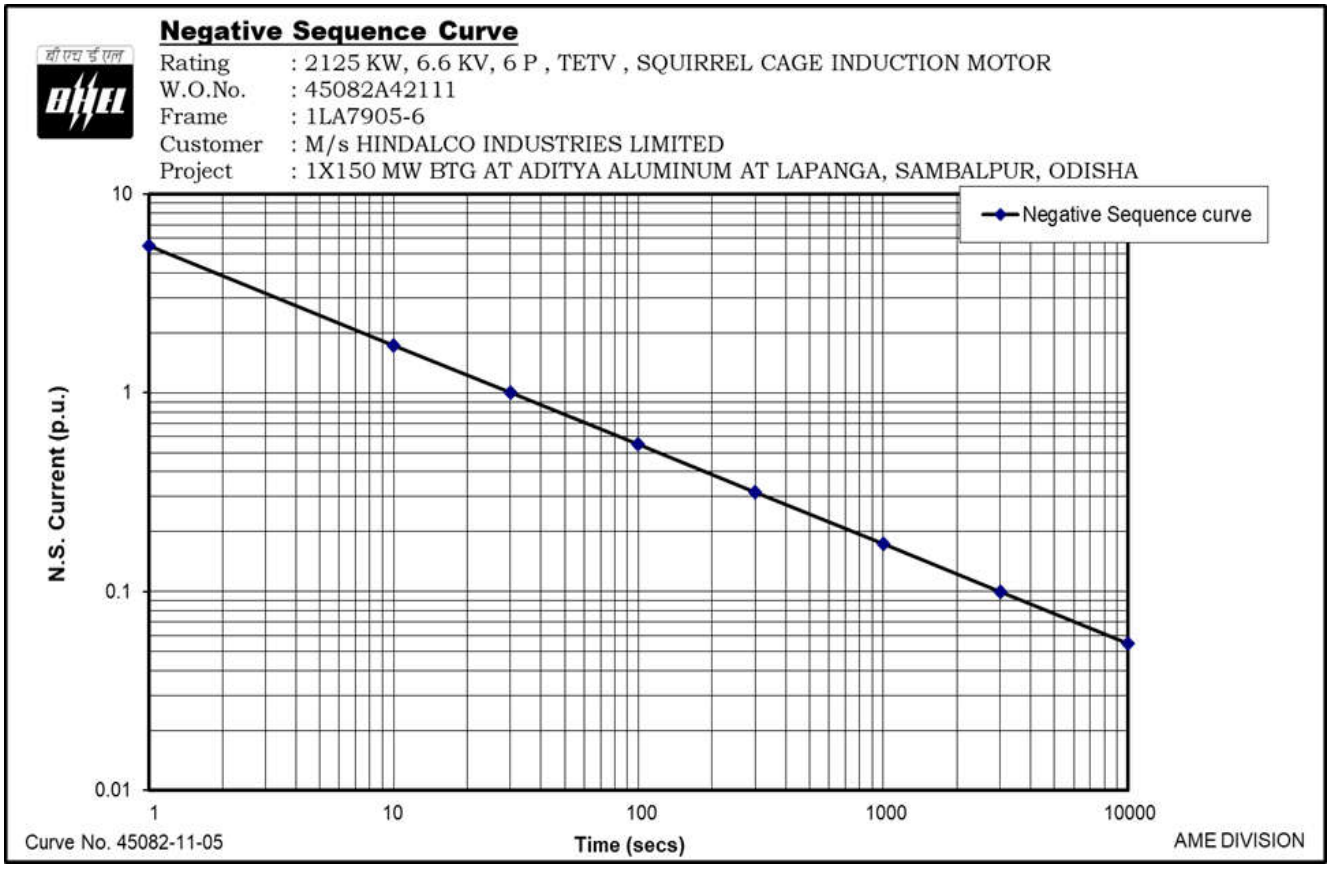
Curve No. 45082-11-03 AME DIVISION

Efficiency, PF Vs Load Curves

Rating : 2125 KW, 6.6 KV, 6 P , TETV , SQUIRREL CAGE INDUCTION MOTOR
W.O.No. : 45082A42111
Frame : 1LA7905-6
Customer : M/s HINDALCO INDUSTRIES LIMITED
Project : 1X150 MW BTG AT ADITYA ALUMINUM AT LAPANGA, SAMBALPUR, ODISHA



Curve No. 45082-11-04 AME DIVISION


Negative Sequence Curve
Rating : 2125 KW, 6.6 KV, 6 P , TETV , SQUIRREL CAGE INDUCTION MOTOR
W.O.No. : 45082A42111
Frame : 1LA7905-6
Customer : M/s HINDALCO INDUSTRIES LIMITED
Project : 1X150 MW BTG AT ADITYA ALUMINUM AT LAPANGA, SAMBALPUR, ODISHA
Negative Sequence curve
N.S. Current (p.u.)
10
1
0.1
0.01
1
10
100
1000
10000
Time (secs)
Curve No. 45082-11-05
AME DIVISION

BHARAT HEAVY ELECTRICALS LIMITED, BHOPAL
MOTOR TECHNICAL DATA (Rev. 00)

CUSTOMER	**:**	**M/S HINDALCO INDUSTRIES LTD**
PROJECT	**:**	**ADITYA ALUMINIUM 6X150MW BTG**
WORK ORDER	**:**	**49143A404-61(Old WO) / 45082A40451(New WO)**
TD Date	**:**	**02/04/2026 Rev 00**

NOTE: Data given below is subject to tolerances as per IS: 325 unless specified otherwise as '*' for which the data is guaranteed.
Motor is similar (VFD cum DOL in place of DOL) to earlier supplied BHEL Motor SL No. 49143A404-61(YR:2009)

1.0	**General**		
1.1	Application	:	CEP
1.2	Quantity	:	2 Nos
1.3	Make	:	BHEL, Bhopal
1.4	Frame Size	:	1LA7562-4
1.5	Applicable Standard	:	IEC: 60034-1
2.0	**TYPE AND RATING**		
2.1	Type of Motor	:	SCIM
2.2	Service		
2.2.1	Outdoor/Indoor	:	OUTDOOR
2.2.2	Hazardous Area Classification	:	SAFE
2.3	Duty Cycle / Designation	:	Continuous (S-1)
2.4	Rated Continuous output (kW)	:	400
2.5	Ambient Temperature (Deg. C)	:	50
2.6	Rated speed/Syn. Speed(rpm)	:	1488 / 1500
2.7	Rated voltage (v)and variation	:	6600 $\pm$ 10%
2.7(a)	No. of phases	:	3
2.8	Rated frequency (Hz) and variation	:	50 $\pm$ 5%
2.9	Combined voltage and Frequency variation	:	10% abs.
2.10	Full load current(amps)	:	44
2.11	No load current(amps)	:	13
2.11.1	Type of Enclosure	:	TETV

			F.L. / ¾ F.L. / ½ F.L.		
2.12	Power factor	:	0.85 / 0.83 / 0.76		
2.13	Efficiency (%) at rated voltage and frequency	:	94.2 / 93.8 / 92.6		
2.14	Locked rotor / starting current % of FLC	:	600 % (MAX)		
3.0	**PERFORMANCE**				
3.1	Method of starting	:	VFD cum DOL		
3.2	Torque at rated voltage (%of FLT)				
3.2.1	Breakaway starting torque	:	85 %		
3.2.2	Pull-up torque	:	75 %		
3.2.3	Pull-out torque	:	220 %		
3.3	Starting time at	:	**80%RV**	**100%RV**	**110%RV**
	a) Load coupled (sec)	:	2.4	1.4	1.1
	b) Load un-coupled (sec)	:	2.0	1.1	0.9
3.4	Locked rotor withstands time (hot) in sec.	:	37	24	20
	(Cold)	:	48	31	26
3.5	Starting requirement				
	a) No. of equally spread starts per hour	:	3		
	b) No. of cold starts	:	2		
	c) No. of hot starts	:	1		
3.6	Thermal time constant (Heating/cooling) (minutes)	:	30 / 105 minutes.		
3.7	Whether motor suitable for bus transfer	:	Yes		
3.8	Noise Level	:	85 dB at 1 mtr		
3.9	Vibration Level	:	As per IS: 12075.		
4.0	**CONSTRUCTION**				
4.1	Degree of protection	:	IP-55		
4.2	Method of cooling	:	IC-511		
4.3.1	Motor suitability for rotation	:	BI-DIRECTIONAL		
4.3.2	DOR facing DE in case of unidirectional motor	:	-		
4.4	Insulation class	:	F, Temp. Rise limited to class B		
4.5	Permissible temp. rise above an ambient By resistance method (Deg. C)	:	70		
4.6	Tropicalized (Yes/No)	:	Yes		
4.7	Winding connection	:	Star		

4.8	BEARINGS		
4.8.1	Make	:	Reputed supplier
4.8.2	Type	:	ANTIFRICTION
4.8.3	Recommended lubricant	:	GREASE (IOC-SERVOGEM-3/ EQV)
4.8.4	Catalogue No. (DE/NDE)	:	6222C3 / 7322B
4.8.5	Life	:	40000Hours.
4.8.6	For FOL system		
4.8.6.1	Oil flow (LPM) per bearing	:	NA
4.8.6.2	Max / Min. oil pressure (kg-m2)	:	NA

5.0 MISCELLANEOUS

5.1	Type of mounting	:	VERTICAL (V-10)
5.2	Moment of inertia (GD2) KG-M2		
5.2.1	Load (referred) to motor speed	:	13
5.2.2	Motor	:	60
5.3	WEIGHTS (APPROX)		
5.3.1	Stator (kg)	:	3050
5.3.2	Rotor (kg)	:	700
5.3.3	Total (kg)	:	3750
5.4	OGA Drawing no.	:	34020048928

LIST OF ACCESSORIES:

1.01	RTD for winding (type/nos./leads)	:	Pt-100, 12Nos, 3wire, Simplex
1.02	RTD for bearing (type/nos./leads)	:	Pt-100, 2 No, 3wire, Duplex
1.03.01	RTD for hot air (type/nos./leads)	:	NA
1.03.02	RTD for cold air (type/nos./leads)	:	NA
1.04	Space heaters	:	Yes
1.04.01	Nos.	:	4
1.04.02	Power (watts)	:	630 watts Each, Total power = 630 watts.
1.04.03	Supply voltage	:	240V AC, 1Phase
1.05	Stator terminal box		
1.05.01	Type	:	PSTB type
1.05.02	Fault level (MVA)	:	500
1.05.03	Fault level duration (sec)	:	0.25
1.06	Neutral TB	:	Non PSTB type
1.07	Current transformers	:	NO
1.07.01	Nos.	:	--
1.07.02	Ratio	:	--
1.07.03	Accuracy class	:	--
1.07.04	Knee point voltage (volts)	:	--
1.08	Dial type thermometer		
1.08.01	For bearing (nos.)	:	2Nos. (each at DE & NDE)
1.08.02	For air temp. (nos.) a) hot air	:	NA
	b) Cold air	:	NA
1.08.03	Contact rating	:	0.5/5A AT 220/240 V DC/ AC
1.08.04	Range	:	0 To 120 Deg C
1.08.05	Supply voltage	:	240V, 1Phase, AC
1.09	Rotor terminal box	:	NA
1.10	TB for RTD, BTD and space heaters	:	YES
1.11	Sole plate	:	NA
1.12	Foundation bolts	:	As per Outline general arrangement drg
1.13	Base Frame	:	NA
1.14	Speed Switch	:	NA
1.14.01	Supply Voltage	:	-
1.15	Insulation of bearing (NDE bearing housing)	:	NA
1.16	Forced oil lubrication	:	NA
1.17	Oil level indicator	:	NA

1.18	Noise Reducer	:	NA
1.19	Water flow indicator	:	NA
1.20	Water leakage detector	:	NA
1.21	Tacho-generator	:	NA
1.22	Grounding pads		
1.22.01	Nos., Size on motor body	:	2
1.22.02	Nos. on terminal box	:	2
1.23	Vibration pads	:	
1.23.01	Nos., size	:	2 nos / 60 x 60 x 60 (mm)
1.23.02	Location	:	one no. each at DE & NDE Endshields
1.24	Any other fitments	:	NA

LIST OF CURVES:

1.	Thermal withstand curves	:	45082-51-01
2.	Torque & Current Vs Speed Curves	:	45082-51-02
3.	Speed & Current Vs Time Curves	:	45082-51-03
4.	Efficiency, PF, Current Vs load curves	:	45082-51-04

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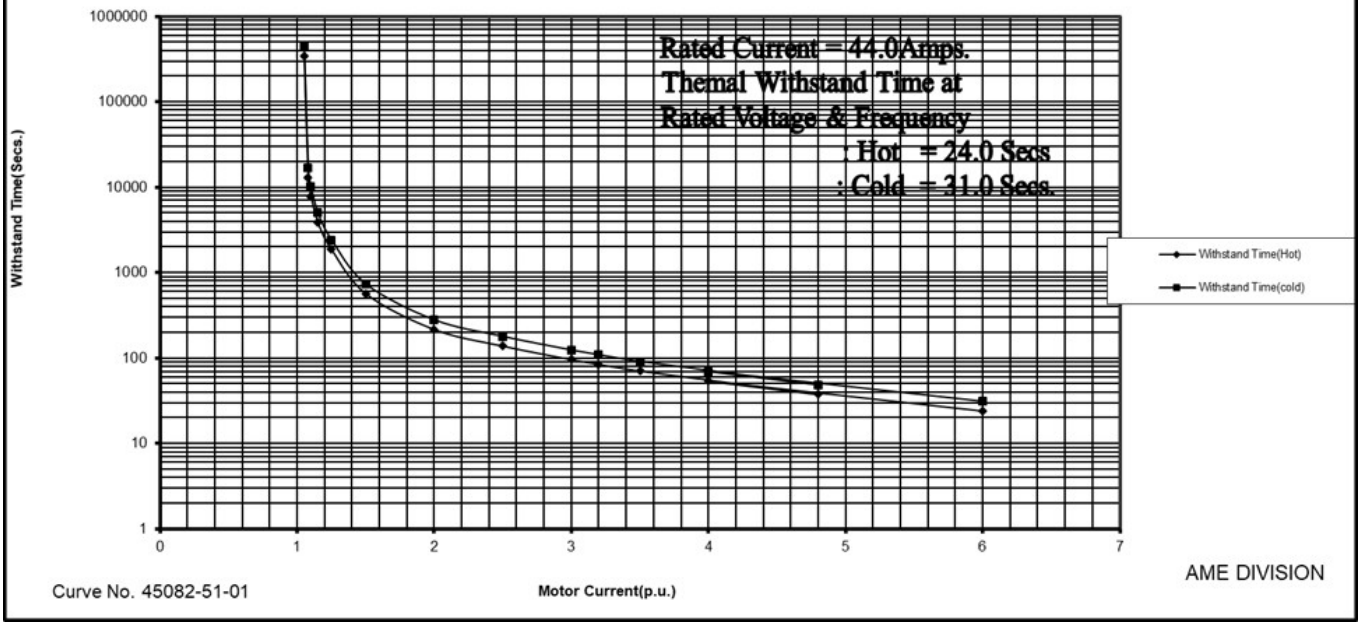
SHIVAM SHARMA
AME Divn
BHEL Bhopal

Thermal Withstand Curves

Rating : 400 KW, 6.6 KV,4P , TETV , SCIM
W.O.No. : 49143A404-61(Old WO) / 45082A404-51(New WO)
Frame : 1LA7562-4
Customer : M/S HINDALCO



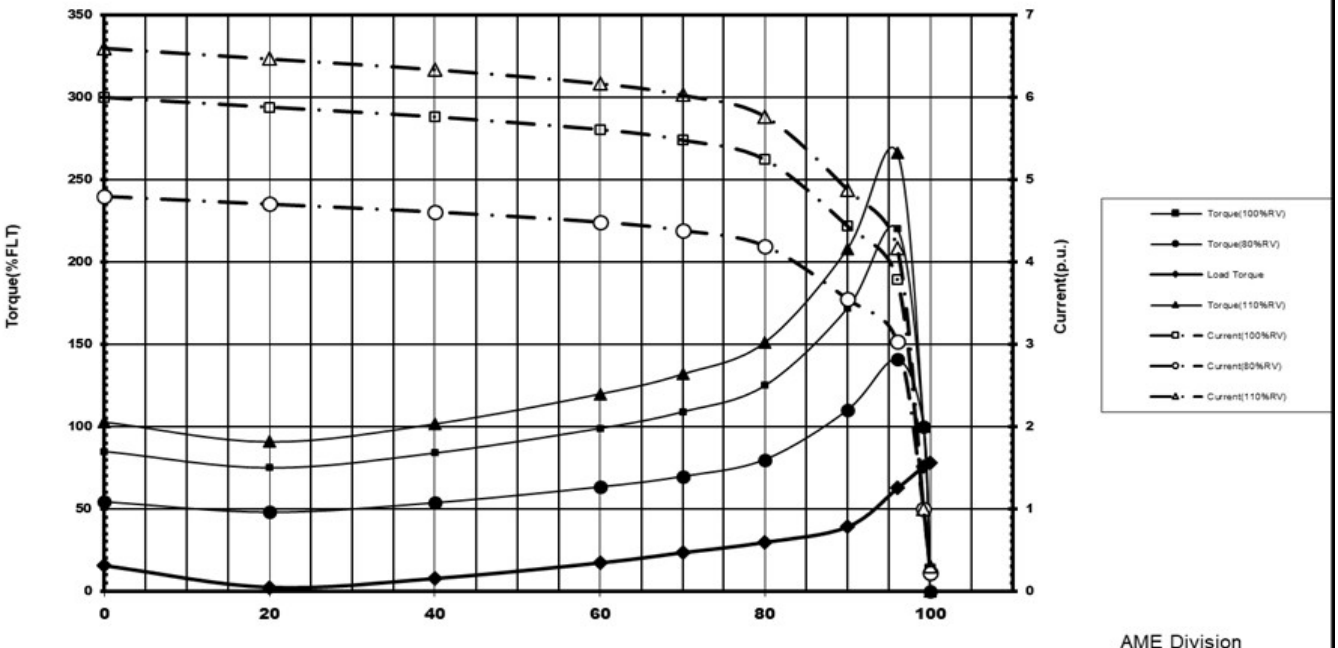
Curve No. 45082-51-01

AME DIVISION

Torque & Current Vs Speed Curves

Rating : 400 KW, 6.6 KV,4P , TETV , SCIM
W.O.No. : 49143A404-61(Old WO) / 45082A404-51(New WO)
Frame : 1LA7562-4
Customer : M/S HINDALCO

Rated Torque = 262 kg-m
Rated Current = 44 A

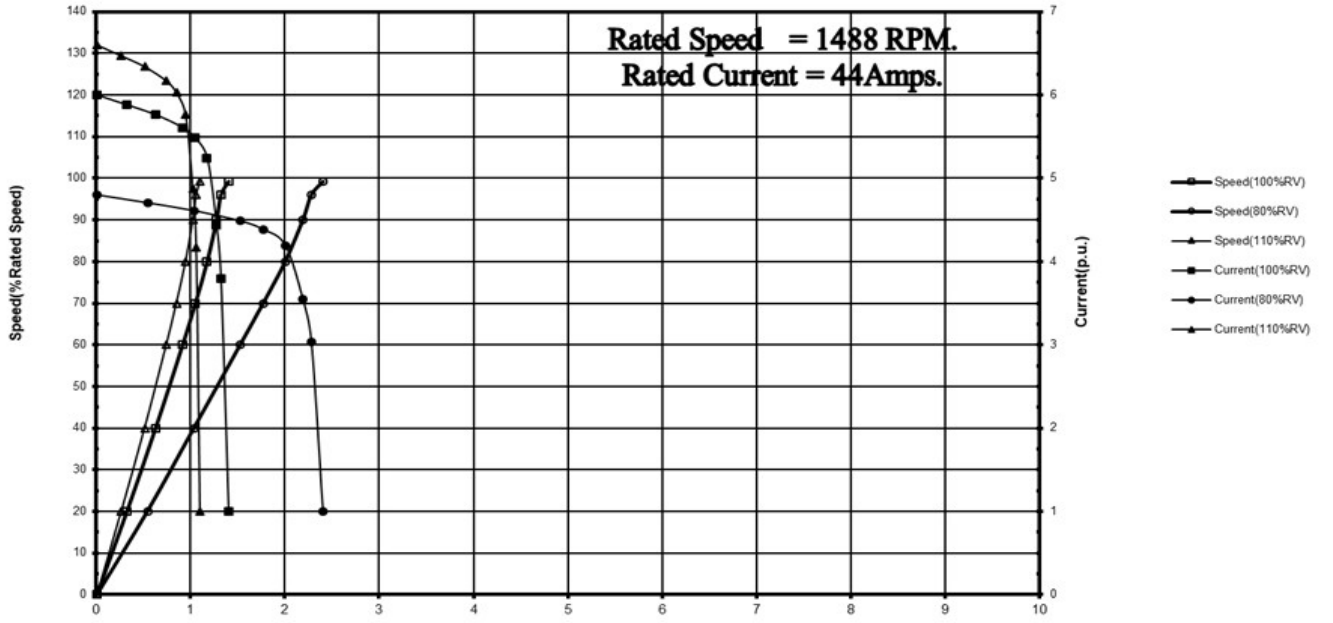


Curve No 45082-51-02

AME Division

Speed & Current Vs Time Curves

Rating : 400 KW, 6.6 KV,4P , TETV , SCIM
W.O.No. : 49143A404-61(Old WO) / 45082A404-51(New WO)
Frame : 1LA7562-4
Customer : M/S HINDALCO

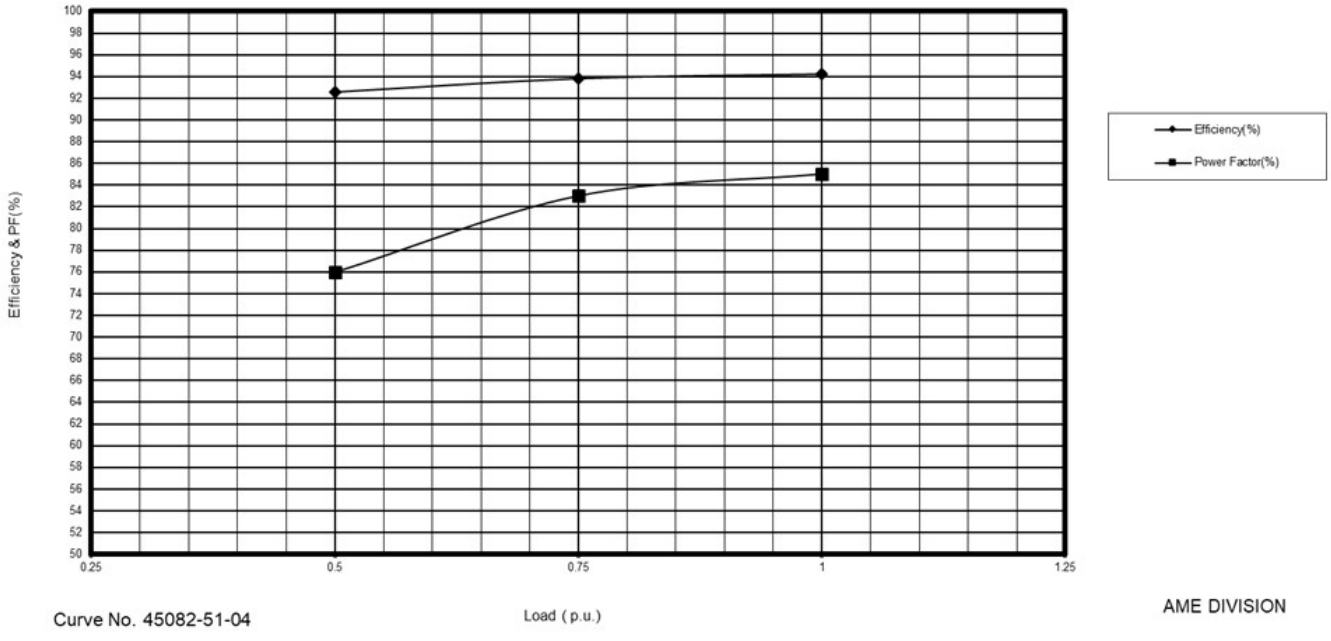


Curve No. 45082-51-03

AME DIVISION

Efficiency, PF Vs Load Curves

Rating : 400 KW, 6.6 KV,4P , TETV , SCIM
W.O.No. : 49143A404-61(Old WO) / 45082A404-51(New WO)
Frame : 1LA7562-4
Customer : M/S HINDALCO



Curve No. 45082-51-04

AME DIVISION

4.1 SCOPE

This specification is intended to provide general technical guidelines for the complete Electrical system with auxiliaries and accessories for the entire power plant as specified in Section A and C1. Transient stability study shall be done and the fault clearing time shall be considered adequate with the critical clearing time. CONTRACTOR shall share the native editable ETAP files to customer.

4.2 DESIGN CRITERIA AND REQUIREMENTS

DESIGN

4.2.1 The electrical systems shall be designed for operation where continuity of supply is the first consideration & Redundancy shall be provided so that failure of any one equipment/connection shall not result in loss of power supply and it assists maintenance without interfering with continued operation.

4.2.2 The design shall incorporate every reasonable precaution and provision for the safety of all those concerned in the operation and maintenance of the works.

4.2.3 The design of equipment shall ensure satisfactory operation under any sudden variations of load and voltage specified herein as may be met under operating conditions, including those due to starting loads, short circuit and other fault conditions including faulty synchronization. The equipment shall be designed to operate satisfactorily under all variations of load, pressure and temperature that may be met in normal usage under the variation in climatic conditions given in the Specifications.

4.2.4 Standard designs of electrical equipment may be used providing the criteria of quality, reliability, and maintainability are met. All equipment performing similar duties shall be of the same type, model and make to limit the stock of spare parts required, maintain uniformity of plant and equipment to be installed and ease of operation & maintenance.

4.2.5 Electrical design and equipment shall minimize the risk of fire and materials used shall be fire retardant.

4.2.6 Ambient temperature, corrosive conditions, dust conditions, hazardous area classification and humidity to be experienced by all electrical equipment shall be considered in the selection of equipment physical and operating parameters.

4.2.7 Load flow, Short circuit and motor starting studies using ETAP shall be performed to ensure that the equipment provided is adequately rated for the service. Motor starting study shall include voltage drop when starting the largest motor with all other required auxiliaries running.

4.2.8 The auxiliary electric system and the generating plant shall be designed such that stability of operation, current carrying capacity, and satisfactory fault levels are maintained throughout under all possible operating conditions. All detail design calculations and studies such as equipment sizing calculations, lightning protection, earthing grid calculations, protection relay setting and coordination, Switchyard calculations, detailed insulation coordination studies etc., shall be performed in addition to the fault calculations required above. All such calculations and studies shall be submitted for owner's approval. All the equipment rating shall be finalised only after owner's approval.

4.2.9 The key single line diagram TCE.13807B-EL-4100-AU-4000 describes a typical Electrical power distribution scheme for the proposed captive power plant.

4.2.10 Design ambient temperature for electrical equipment will be 50 deg C.

AUXILIARY POWER SUPPLY SYSTEM

4.2.11 The proposed auxiliary power supply system shall be supplied at the following nominal voltages depending upon their ratings and functions:

(a) 6600V, ±10%, 50 Hz ±5%, 3 phases, 3 wire, medium resistance grounded AC supply for motors rated above 160 kW & Service transformer.
(b) 415 V, ±10%, 50 Hz ±5%, 3 phases, 3 wire, solidly grounded AC supply for motors rated 160 kW and below and 3 phase, 4 wire system for other L.T. services.
(c) 230 V, ±10%, 50 Hz ±5%, 1 phase AC supply for lighting, space heating of motors and panels, single phase motors/ loads, etc.
(d) 220V, 2 wire grounded DC supply for protection, control & indication, emergency lighting etc.
(e) 240V, 1 phase AC uninterruptible power supply for instrumentation and control system equipment such as LCD monitors, Printers, Analysers etc.

4.3 SPECIFIC REQUIREMENTS

4.3.1 GENERATOR & ASSOCIATED SYSTEM

The electric generator including all associated equipment but not limited to excitation system, AVR, synchronizing and control equipment, Protection and Relay panel, Generator Auxiliary Cubical (GAC), neutral grounding devices, etc shall be adequately rated to deliver the steam turbine generated power at its output terminals under all operating conditions. During start-up, the generator shall be isolated by opening the circuit breaker at 220kV AIS. The unit auxiliaries shall be fed from the unit a transformer which shall be fed from Generator during running condition & during start up condition the unit auxiliaries shall be fed from station switchgear which shall be fed from Station transformer. The generator shall be brought up to the rated speed, voltage and frequency closely matched to the system parameters, and the generator shall be synchronized at the 220kV AIS, and then it shall be gradually loaded. Auto synchronization of generator shall be considered taking voltage output from the CVT installed at the 220KV side of GT.

I. Generator

The electric generator for the turbine-generator set shall comply with the International Electrotechnical Commission's code IEC 60034 or ANSI/IEEE C50.13 standards. The rating of the generator shall be selected to match the maximum continuous output of the steam turbine. The bidder shall submit generator capability curves for the generator to demonstrate that the generator shall be capable of providing full electrical output matching to turbine and boiler capacity for complete operating range of power factor, frequency, ambient and voltage variations without undue restrictions.

The quality of the generator and its accessories shall be controlled through a shop quality assurance program in accordance with International Standardization Organization (ISO)-9001, EN 29001 or BS 5750 Part 1 and other equivalent international quality standards.

The generator shall be designed in accordance with IEC Publications 60034-1 through 60034-3 or ANSI Standard C50.13. Testing shall be done in accordance with the IEC 60034 series of Publications or ANSI/IEEE Standard 115.

The cooling system for generator will be CACW (IC9A1W7). The coolers would be adequately sized so that with one cooler section out of operation / under maintenance, the Generator can carry the rated load continuously without exceeding the permissible temperature rise. The generator shall be vacuum impregnated (VIP). Generator coolers shall be designed for peak temperature 50DegC, and sufficient margin shall be considered.

The stator and rotor winding insulation shall be non-hydroscopic type and to Class H standards in accordance with IEC 60085. Design of generator shall limit the temperature rises to Class F materials temperature limits. Resistance type temperature detectors shall be provided where the highest temperatures are expected in the winding, core, cooling air inlet and outlet, bearings, etc. Triplex type RTDs shall be provided for each bearing. Separate generator rotor temperature monitoring system shall be provided.

Anti-condensation heaters shall be provided for the air circuits, generator windings, excitation system, and control cubicles. Heaters shall be capable of maintaining the air temperature above that of dew point to prevent condensation. These heaters shall automatically switch on when the generator is taken out of service.

The generator shall be factory tested to an overspeed of 20% above rated speed and shall be capable of repeatedly withstanding the overspeed resulting from full load rejection, without undue stresses and with an adequate margin of safety. Shaft vibration probes shall be provided in the generator bearings.

Continuous partial discharge monitoring system shall be provided. The partial discharge shall be winding embedded type and include flux probe as well. All the readings shall be made available to remote control system in real time for trending. Special Tools for assembling and dismantling of the generator coolers, handling, removal and insertion of generator rotor, including jacks, slings, lifting beams, skids, shaft extensions, shall be provided. Load shedding relay shall be considered in turbine governing system for load thrown up beyond 50% & safety coming to house load.

An online rotor/shaft grounding voltage monitoring shall be provided.

Online condition monitoring system & digitalization in Control room shall be considered, the following to be included:

a) Online PD monitoring system
b) Online flux monitoring system (flux probe)
c) Shaft voltage & current monitoring system
d) Stator end winding vibration monitoring system
e) Temp. & hotspot monitoring system for core & winding
f) Stator online leakage current monitoring system

II. Generator excitation system

The electric generator set shall be provided with an excitation system of brushless rotating diodes type and it shall include solid-state voltage controls with 2x100% automatic voltage regulator (AVR) and 2x100% manual voltage regulator (MVR). Dual Auto & Manual channel to be considered for each channel 1 & 2. The detail of Auto and Manual Chennel configuration are mentioned below,

Channel-1 Auto to Channel-2 Auto
Channel-1 Manual to Channel-2 Manual
Channel-1 Auto to Channel-2 Manual
Channel-1 Manual to Channel-2 Auto
The excitation system shall be one of high initial response type as defined in IEEE Standard 421.1. The continuous current capability of the excitation system at maximum ambient conditions shall be adequate for the operation of the generator at full load, rated power factor and at 105% terminal voltage, with the generator field at maximum temperature.

The excitation system shall be capable of supplying its ceiling voltage and the growing field current associated with the sudden application of ceiling voltage to the generator field for at least 5 seconds. The ceiling current shall be at least 2 times the rated field current. The transient thermal capabilities of the excitation system for periods of more than 5 seconds shall be higher than the short-time thermal capabilities required in Section 7.1 of IEEE Standard C50.13 for the generator field winding.

The excitation system shall meet the requirements of the interconnection system but in any case, the AVR shall be capable of maintaining the steady-state terminal voltage of the generator within ± 0.2 % of the set point over the entire operating range of the synchronous machine.

The excitation equipment shall operate reliably and shall not impose restrictions on the availability of the generators due to excitation equipment faults or malfunctions according to excitation architecture and relevant redundancy.

If a brushless rotating excitation system is offered, it will basically consist of:

- A three-phase, rotating armature alternator;
- Rotating rectifying diodes and
- Excitation controls.

The rotating armature of main exciter shall not have any open overhang portion, it shall be concealed with VIP insulation. Suitable provision of cooling of main exciter (additional cooling) is to be provided. Separate RTD to be mounted for main exciter temperature monitoring.

The cables coming out for the rotating sleep ring in the PMG rotor shall be of special design PTFE type to withstand temperature 500degC.

The excitation system and equipment shall be complete with fast response continuously acting two Automatic Voltage Regulators (AVR), and Two Manual Voltage Regulator (MVR), Power System Stabilizer (PSS) in accordance with the Electrical Grid requirements, limiters and stabilizers, droop compensation and cross circuit compounding, field suppression equipment and all control, monitoring and protection equipment to enable operation from the CCR. The regulations functions shall include, but not be limited to, voltage, field current, reactive and active load droop/compensation, under excitation limiter (UEL) and overexcitation limiter (OEL), maximum stator current (lead/lag), volts-per-Herz (V/Hz) limiter, power factor/reactive load regulation, and power system stabilizer (PSS). The protection functions shall include, but not be limited to, over current protection,

overexcitation protection, V/Hz protection, loss of excitation protection, and generator overvoltage protection.

The excitation system shall be provided with an online field ground detection system that monitors the soundness of the field insulation. The brushless exciter the system shall provide online detection automatically through a set of auxiliary slip rings on the shaft and brushes for momentary contact. A system to detect open circuits and short circuits in the assembly of rotating diodes and fuses shall also be provided. Online automatic monitoring shall be provided for detection of diode failure also.

III. Synchronising equipment

Automatic synchronizing facilities backed up with check synchronizing circuits shall be provided for the generator circuits. Synchronizing equipment shall operate satisfactorily in conjunction with the automatic excitation control and turbine speed governing equipment. Generator Breaker Synchronizing panel will be located in Central Control Room (CCR) of TG Building.
Provision of synchronization in both AUTO/MANUAL selection shall be considered. The system shall be equipped with high end Auto synchronizing relay of ABB/SEL make for auto synchronization & automatic raising/lowing of voltage/speed during synchronization.

IV. Generator Auxiliary cubical (GAC)

a. Constructional Features of the Cubicle

Generator Auxiliary cubicle shall be fabricated from 3 mm thick aluminium or 2 mm thick cold rolled sheet steel. The cubicle shall be suitable for floor mounting. Base channels along with anti-vibration pads shall be furnished. The cubicle shall be dust-tight, vermin and weatherproof construction. The cubicle shall preferably be designed without louvres. However, if a ventilated type of construction is essential, the louvers shall be covered by G.I. fine wire meshed screens to prevent entry of insects and rodents.
A separate cubicle shall be provided for each phase. Each cubicle shall be in two sections. The front section shall comprise the voltage transformer compartments, and the rear section shall comprise of busbars, lightning arresters with surge counter and capacitors, as specified.
When fabricated from sheet steel, the surfaces shall be cleaned, phosphated and applied with two coats of ready mixed, stoving type zinc chromate primer. After application of primer, two coats of finishing synthetic enamel paint shall be applied, with each coat followed by stoving.

b. Voltage Transformer Compartments

Each single-phase voltage transformer shall be mounted in a horizontal draw out type modular compartment. Additional voltage transformers, if specified, shall be arranged in tier formation compartments. The number of tiers shall be limited to three. When four VTs per phase are specified, the front section of each cubicle shall be divided into two vertical portions, with two tiers each. Segregation shall be maintained between each compartment. All LAVT cubical, VT junction box & CT junction box shall be of Aluminium / Cold rolled SS material.

Each draw out type voltage transformer compartment shall comprise the following:

- One cast epoxy resin type of voltage transformer tested for partial discharge. The partial discharge at 10 per cent over voltage on the highest system voltage shall not exceed 50 pico coulombs.
- Bolted type HRC fuse of adequate rupturing capacity on the primary side
- HRC fuses or high-speed overcurrent switch with auxiliary contacts of approved type and of suitable rating on the secondary side.
- Primary disconnecting contacts (phase and neutral) which will permit access to primary fuse only after complete opening of the contacts.
- Secondary disconnecting contacts which will open prior to primary disconnecting contacts.
- Earthing device which will ground the primary of the voltage transformer on withdrawal of the carriage. The earthing device shall be of fail-safe mechanism. The draw-out carriage shall be earthed at all times.
- Cylinder type of locks which shall have a common set of keys.
- Glass panel on the front of the compartment to visually check the primary disconnecting contact alignment, while in service.
- Suitable automatic shutters to cover all live parts in the plugged-in and drawn-out positions of the VT
- Voltage Transformers Secondary Wiring Marshalling Box
- The secondary wiring of each voltage transformer, after the secondary disconnecting contacts and HRC fuses / high speed overcurrent switches, shall be brought up to terminal blocks located in a separate marshalling box, which is common for all three phases. This marshalling box shall be provided at the middle tier of the middle single phase cubicles and shall be provided with a hinged lockable door with gaskets. Removable gland plate shall be provided in this box for Purchaser's external cable connections.
- VT secondary terminals which are to be earthed shall be brought to separate terminals in this box and thereafter connected to the common earth bus of the VT & SP cubicles.
- Ferro resonance protection to be consider for voltage transformer.

c. Current Transformers

Current transformers (CTs) mounted inside GAC enclosure shall be bar primary, cast resin, ring type and suitable for ambient temperature of at least 90°C. CTs shall be designed for generator rated voltage insulation level and mounted so as to prevent any corona / partial discharges from the bus bar. All secondary terminals of CTs shall be brought to a common marshalling box at each major location. Test reports for the CTs shall be furnished.

d. Surge Protection Equipment Compartment

This compartment shall house the following with segregation maintained. Access to the equipment shall be through bolted covers

- Lightning arresters with specified rating complete with surge counters.
- Capacitors with specified rating, if required. The capacitors shall be non-oil type.
- Support insulators for the bus connections as required.
- Bus bars of adequate rating to withstand normal and short circuit current. Suitable connectors shall be provided at all equipment like lightning arrester, capacitor, support insulator, etc.

Each voltage transformer and surge protection cubicle shall be provided with one seal-off bushing at the entrance of the tap-off bus duct. Bushings shall also be provided for bus conductors between sections / compartments of the cubicle.

A common copper earth bus of adequate size shall be provided at the rear of the VT & SP cubicles. Individual connections from each equipment earth terminal/body earth terminal, etc. shall be terminated on this earth bus. Necessary provision shall be made to facilitate further connection to Purchaser's station earth grid.

e. Neutral Connection and Earthing Equipment Enclosure

A grounding using a dry type grounding transformer with secondary connected grounding resister connected to limit the ground fault current less than 15 Amps or less shall be furnished and connected through star point formed by neutral connections enclosure and isolated-phase bus duct. Grounding resister shall be of stainless grid type with a short time rating of 10 minutes. Maximum temperature of resister shall be limited to 350°C. Terminals for mounting neutral current transformer for 100 % start earth fault protection shall also be brought out. The neutral grounding transformer shall be of ratio 15.75KV/√3 / 230V/√3.

The enclosure shall be provided with space heaters and a thermostat for maintaining normal operating temperature shall also be provided. Enclosure shall be of Aluminium

The grounding resister compartment of cubicles shall be suitable for indoor service and provided with an enclosure of at least IP-54 to IEC 60529.

V. Isolated Phase Bus Ducts (IPBD), Segregated phase bus duct (SPBD), Non-segregated phase bus duct (NSPDB) & Connections

The connection between the Generator, Generator Auxiliary Cubical (GAC), Generator step-up transformer and tap–off connections to Unit Auxiliary Transformer shall be done by means of isolated phase busduct.

The busduct sections are as follows:

- Main busduct between Generator phase side terminals to Generator Auxiliary Cubical (GAC)
- Main busduct Generator circuit breaker to Generator transformer LV terminals
- Delta formation at GT LV terminals
- Tap-off connections to UAT

Following equipment shall be provided along with IPBD:

- Current transformer on the primary side of UAT.
- Generator current transformer on phase side to be mounted on IPBD

Positive Air pressurization equipment shall be provided for the Bus duct to prevent dust ingress the same shall be tapped from station air compressor.

Hot Air Blowing System with a mobile trolley shall be provided, to remove moisture and to prevent moisture condensation inside the duct at commissioning time or in long shutdown periods.

The busbar connections between LV side of Unit Auxiliary Transformer (UAT) and HT Unit switchgear, Station transformer to HT Station switchgear and tie feeder between Unit switchgear and Station switchgear shall be by the segregated phase bus duct of self-cooled, continuous enclosure minimum flux type of design.

The installation shall be required to carry the maximum bus duct rated current, continuously under all operating conditions. The equipment shall conform to, and tests shall be conducted in accordance with, the latest applicable IEC, ANSI, or IEEE standards. The temperature rise, at rated current, above ambient temperature of air surrounding the bus enclosures and cubicles, shall be in accordance with ANSI C37.23, Table 1. Momentary current values which the buses are mechanically braced to withstand shall be not less than recommended per ANSI C37.23 Section 5.4.3.

The neutral connections shall be designed for full phase to earth voltage.

The segregated phase bus duct shall consist of rigid conductors of electrical grade aluminium, mounted on wet process high strength porcelain insulators. Each phase bus shall be enclosed in a separate weather and dust-tight, pressurized, electrical grade aluminium enclosure separates from the adjacent phases. The installation shall be capable of operating satisfactorily at continuous maximum current when any pressurizing unit is not operating. The SPBD insulator creepage distance shall not be less than 25 mm/kV. Bus duct installation shall be maintained at slight positive air pressure of instrument air quality to keep out external dust and moisture ingress.

All bus duct conductors, enclosures, flexible connectors and hardware connections (including tee's) and supporting insulators shall be designed to withstand and limit heating effects of short circuit currents for three phase to ground, line to line and line to ground currents for 3 seconds as per ANSI standards. All conductors, enclosures and supporting structures, insulators, connections, gaskets shall have sufficient mechanical strength to withstand, without incurring any damage, the mechanical effect of any peak momentary currents resulting from a three-phase to ground, line-to-line or line-to-ground short circuit.

Outdoor sections of bus duct shall be designed to withstand forces for prevailing maximum wind, rain and heating effects of solar radiations.

The bus duct shall be designed, including flanges, to permit removal of transformer and generator bushings with a minimum of bus disassembly. Further, the bus duct shall be routed such that the generator end casings, rotating exciter (if required), and any other auxiliaries can be removed without disassembly of the bus duct.

All apparatus shall be phase isolated throughout apart from connection points to apparatus, where full phase segregation may be provided as required.

Outdoor bus duct support structure and hardware shall of hot-dipped galvanized steel or equivalent processes. All bus duct supports shall be designed to prevent damage of any portion of the installation due to short circuit forces, wind, rain, or seismic criteria. Sunshade shall be provided to reflect the sun radiation and decrease the temperature of the bus ducts.

Bus insulators shall be placed so as to allow easy removal, cleaning and assembly of insulators from outside without dismantling bus duct. Conductors shall be supported on insulators so as to allow alignment and expansion of conductors due to temperature changes.

Bus duct support structures shall be continuously earthed in an approved manner by earthing conductor to the grounding grid. Bus duct enclosure shall be earthed at one point or multiple points based on bus duct vendor's design and standard practice.

The bidder shall submit type test reports of similar IPBD/SPBD of the same or higher ratings, otherwise type testing of the IPBD/SPBDs shall be done. Extrapolated type test reports will not be acceptable to Owner.

Non-segregated phase bus duct shall be considered to connect LV side of service transformer to LV switchboard panel. Bus duct shall be suitable for IP 55 for outdoor portion & IP 52 for indoor portion.

a. Flexible Connections, Joints and Disconnecting Links

Flexible connections shall be provided at all terminations and where necessary to accommodate thermal expansion or other differential movement of conductors and enclosures, CT removal and to ensure that no undue force or vibration is transmitted to external equipment and structure of the main buildings.

For all joints approved means like tinning or silver plating shall be provided for mating surfaces to prevent electrolytic corrosion and good electrical contact.

Disconnecting links shall be provided in the tee-off connections to the transformer to allow continued operation of the generator in the event that any transformer is required to be out of service or removed for maintenance. Enclosure end caps shall be provided to close open enclosure ends and retain pressurization when any transformer has been removed. The links shall be arranged so that the main protection can be retained during an outage of the particular transformer.

b. Bus Duct Enclosures

The outer surface of bus duct enclosure shall be painted in light grey (RAL 7032) shade and inside shall be painted in black color. A seal-off bushing shall be provided in each enclosure where bus duct comes out of turbine building to ensure that in the event of any fire out-door smoke or flames do not enter turbine building. Total installation shall be maintained at slightly positive pressure of at least 10-15 mm of water column by using dry instrument air to prevent ingress of any moisture in the enclosures. Air tightness of installation shall be guaranteed by demonstrating maximum instrument air consumption of not exceeding 5% of total enclosure volume per hour.

The bus enclosures shall be fabricated and designed to afford easy access to conductor joints and insulators for assembly, inspection, and maintenance. Removable sections, covers and inspection doors in the enclosures shall be furnished with gaskets. The gasket material shall ensure long life without replacement or adjustment and shall be reusable.

The enclosure at the transformer ends shall allow for any thermal movement of the bus duct and misalignment up to 25 mm in any direction.

The enclosure shall utilize a forced air-cooling system encompassing redundant fans, filters, air dryers, etc. Redundant pressure switches shall be provided to monitor the

enclosure pressure and shall activate an alarm at the DCS in the event of low air pressure in the enclosure.

Filter drains shall be provided at terminations and at all low points in the horizontal portions of the bus structure, to ensure the elimination of any condensation that might collect in the enclosures.

The connection between the bus duct enclosures and flanges at the generator auxiliary cubical and transformer tank shall be provided with insulated gaskets.

The connection between the bus duct enclosures and flanges at the generator auxiliary cubical shall ensure continuity of minimum flux type of design. Shorting plates between enclosures shall be provided at all terminating points to ensure continuous type design for entire bus duct installation.

4.3.2 TRANSFORMERS

I. Service Transformers

The power required for the LT auxiliaries of the STG is supplied from the 6.6kV switchgear, which is connected to the new station transformer. The voltage is stepped down to 415V using MV/LV service transformers to feed the auxiliaries. Power is tapped from the 6.6kV switchgear and stepped down to 415V for feeding the LV auxiliary loads. Required number of service transformers of appropriate rating would be provided for meeting the auxiliary requirements.
Indoor application transformers shall be of dry type cast resin with mechanical protection enclosure rated to IP-41 and temperature rise limited to Class-H. Dry type transformers shall be equipped with winding RTDs & temperature monitoring relays for tripping of the transformer on high temperature.
High-voltage terminal box suitable for bus duct or cable connection shall be provided based on choice for external connections. Transformers directly coupled to switchgear busbars shall have terminal chamber integral to transformer with clamp type connectors. Low-voltage bus connection to switchgear shall be rated for full rating of transformer at lowest voltage as minimum. Temperature monitoring and controls system shall be furnished. OCTC of +/-5% with five steps shall be provided. High temperature alarm shall be provided in the central control DCS.

4.3.3 CONTROL & INSTRUMENT TRANSFORMER

I. Current Transformers

All current transformers shall comply with the requirements of IEC 60044 relevant parts. The current transformers, unless otherwise approved, shall have one (1) Amp secondary windings rating except for primary rating of 1000 A and above when it shall be rated for 5A. The secondary windings of each set of current transformers shall be earthed at one point only made through a link in an accessible position.

Each current transformer shall be of approved ratio, accuracy class, and output as determined by the bidder to match the rating of the circuit to which it is connected. The secondary windings shall be wired to shorting type terminal blocks and the connections

suitably braced to prevent contact with the main circuit. All current transformers shall be provided with rating plates.

Current transformers used for performance tests and revenue metering shall be of accuracy class 0.2.

II. Voltage Transformers

All voltage transformers shall comply with the requirements of IEC 60044 relevant parts. Primary windings shall be connected to the HV/LV circuit through renewable fuses of approved type, generally to IEC 60282 or IEC 60269, and shall be readily accessible. The primary winding shall be connected to the switchgear through renewable fuses and shall be readily accessible.

Secondary fuses shall be provided on each voltage transformer and secondary windings shall be earthed at one point only through a link in an accessible position. All voltage transformer fuses shall be provided with labels indicating their function and phase color.

Voltage transformers shall be of the air or epoxy resin insulated type and metal cases shall be earthed. Voltage transformers used for performance tests metering shall be of accuracy class 0.2 or better.

4.3.4 SWITCHGEAR & MCC

I. General Requirements

The switchgear shall be designed, manufactured, and tested in accordance with the latest IEC, ANSI, and NEMA standards as applicable. Each MV switchgear, LV switchgear and MCC shall have dual incomers so that failure of one incomer shall not cause of loss power to the connected loads or any reduction of output. The switchgear shall be complete with LOTOTO provision and access control via LAN Network.

The design of the equipment shall be such as to prevent accidental contact with live metal and to avoid the spread of fire or damage from short circuits or other cause. Cubicle type equipment shall include barriers to segregate the equipment for each circuit and main and subsidiary bus bar compartments.

All enclosures containing electrical equipment which can cause rise in temperature shall be provided with thermostatically controlled anti-condensation heaters operating at 240V or less.

All switchgear shall be located indoors in non-hazardous, air conditioned, environment controlled and dry areas and shall be metal clad cubical type incorporating circuit breakers, contactors, and high breaking capacity fuse gear with air insulating bus bars chambers, current transformer chambers, voltage transformers and cable boxes. Outdoor equipment shall be subject to Owner approval and shall be weathertight.
If a switchgear enclosure/panel is contained indoor but without air conditioning for any specific reason, the enclosure/panel rating shall be to IP 54 or better. If for any reason a switchgear needs to be installed outdoor, the enclosure/panel shall be to minimum IP65 weather proof and of stainless steel material.

All switchgears shall be covered by an arc flash study and appropriate labelling shall be done for each panel indicating the arc flash level.

The switchgear shall be normally controlled from the DCS and local control, for emergency shutdown and maintenance, shall be provided. The DCS shall have electrical device position indications. Control selector switches to allow the point of control from local, remote or maintenance shall be provided and shall be lockable in any position.
To provide maximum reliability, all load centers are double ended, equipped with two main breakers and one tie breaker. Main and tie breakers are mechanically interlocked for safety.

All incoming circuits shall be equipped with a voltmeter and ammeter. The meters shall have selector switches to allow all phases to be monitored.

The switchgear shall be provided with circuit labels with Danger Sign as per rated voltage on the front and rear of the board and panels. All enclosures and apparatus shall be clearly labeled, on both the front and back, indicating and at a minimum the full equipment identification number for the device being controlled, English description and function. Complete labels in accordance with NFPA 70 E shall also be installed. The labels shall be corrosion resistant material, fade resistant and securely fastened.

All electrical disconnect devises shall be provided with means to lock them in the open and out position. When locked out all cabinet and enclosure doors shall have the ability to be closed.

The operation of all devices shall be from an ergonomic height.

All switchgear MCC/PCC shall be of smart type having all digitalization features.

II. MV Switchgear

6.6kV Medium voltage (MV) switchgear shall comprise of circuit breakers / fused backed contactors of vacuum type mounted in fully draw out type, indoor, metal clad construction. It shall have service, test and isolated distinct positions for the withdrawable switchgear with cubicle doors closed. All incomers, bus-couplers and feeders shall be circuit breakers and provision to operating from DCS. Racking mechanism shall have interlocks to prevent breaker being left in any intermediate position and visible position indicators from outside shall be provided. Remote/DCS control for both RACK-IN and RACK-OUT operation. Automatic shutters interlocked with breaker movement shall be provided so as to prevent access to cubicle busbars with breaker not in service position or removed from cubicle. Truck type circuit breakers shall be designed to avoid excessive impact loads being imposed on the floor finish in front of the cubical when the trucks are withdrawn. Switchgear shall be dead front type and electric arc safe design.

Circuit breaker operating mechanisms shall be trip free type so designed that in the event of failure to the latch in the closed position or if a trip impulse is given during the closing stroke, it shall not be possible for the circuit breaker to open except with normal speed and travel.

Electrical closing mechanisms shall be motor wound spring or solenoid type. Where stored energy operating mechanisms are employed a lockout device shall be incorporated which shall prevent operation whenever the energy stored is below that required for satisfactory operation.
A mechanical device positively driven in both directions shall be provided on all mechanisms to show whether the circuit breaker is open or closed and shall be operative when the circuit breaker is in service, open, isolated or grounded positions. The device shall be visible when the cubical doors are closed.

A mechanical trip button suitably shrouded and recessed to prevent inadvertent operation and with facilities for padlocking shall be provided on the outer door of all each electrical isolation device.

The switchgear manufacturer shall furnish one set of accessories for test, inspections, maintenance and operation.

Each unit of the switchgear shall be furnished with space heaters to prevent condensation of moisture within the switchgear.

Cable and bus bar earthing facilities shall be provided. The design of any earthing devices shall be such that the device cannot be connected unless the breaker is open and in the isolated position.

Each of the switchgear line-ups shall include at least one (1) complete breaker/contactor feeder equivalent to the highest rating feeder from that board with all accessories, at the time of handover. Switchgear shall be placed so as to allow future expansion on at least one side for each bus section. Each of the switchgear line-ups shall also include 10% spaces for future expansions.
The MV switch gear shall be equipped with min. following safety standards:

a) **Compartmentation of Chambers**: The Contractor shall ensure that the chambers are suitably compartmentalized to enhance safety and prevent the spread of faults.

b) **Automatic Racking In/Out**: The Contractor shall ensure that each circuit breaker is capable of being automatically racked in and out without any human intervention, and this function shall be operable locally.

c) **Arc Detection and Tripping**: The Contractor shall provide arc detection facilities in the switchgear/breaker, along with an arc flash tripping provision to ensure safe operation under fault conditions.

d) **Emergency Shut-off Devices**: The Contractor shall equip the switchgear with emergency shut-off devices for the release of gases during flashover. The released gases shall be safely dispersed in a suitable location within the room.

III. LV Switchgear

LV auxiliary power supply system shall comprise a number of main switchboards which will in turn supply motor control centres and distribution boards associated with the respective station and unit auxiliary loads.

The switchgear shall be of the free-standing cubicle pattern suitable for three phase 3-wire or 4-wire operation, with high resistive, grounding. Single phase-ground fault shall be limited to 5A to allow continuous operation of the switchgear. An alarm shall be generated in CCR DCS for the operator's attention. Alternatively, switchgear shall be designed for a solidly grounded LV system with Type-2 coordination based on IEC 60947.

The construction of the switchgear shall be such that the internal separation by barriers complies with form 3A separation in accordance with the requirements of IEC 61439-1. The circuit breakers and or MCCB shall be air break, triple pole, horizontally withdrawable with independent manual spring closing and electrical trip release suitable for 220V DC operation.

Each circuit shall be self-contained within its own cubicle with an individual access door. Circuits shall be separated from each other by earthed metal. Cubicle doors shall be provided with lift-off type hinges and shall have facilities for being locked in the closed position. It shall be possible to operate each switch without the need to open the cubicle access door.

Cubicles may be arranged vertically in tiers, the number being limited by ergonomics/access and the need to ensure the circuits are thermally independent.
The switchgear shall be designed so that it is possible to safely work within each cubicle with the equipment withdrawn and the incoming contacts energized.
Cubicles shall be suitable for safely terminating all necessary cabling while adjacent circuits are energized. LV Switchgear shall be fuse less type, suitable rating of MPCB/ MCB to be consider in place of Fuse.
Control will be on the same basis as for the MV switchgear.
All LV switchgears provided with power contactors shall have voltage dip recovery scheme so that the module can be started automatically when the voltage is recovered after following a dip without any start command & without any tripping.

IV. Switchgear Components

a. <u>Contactors</u>

Contactors of the electrically held type shall each be equipped with its own control circuit transformer. The control transformers will be in accordance with this Aggregate Technical Specifications. Latch contactors shall be provided as determined by the duty of the particular circuit.

Contactors shall each have an uninterruptible current rating and a category AC3 breaking current rating, at least 50% in excess of the normal full load current and motor stalled current where applicable and in accordance with relevant standards. Vacuum contactor shall be provided for frequent operation feeders like heater, drain pump etc.

A visual mechanical indications device shall be provided on each contactor. It shall be positively driven in both directions to show whether the contactor is open or closed and shall be operated in both service and isolated positions on draw out equipment.
Each piece of contactor equipment in a switchboard shall be screened from adjacent units and any current carrying parts which may remain alive when access is gained to

the contactor and moving parts of the isolating device for maintenance so that it shall not be possible to touch live metal parts without the use of tools.

Contactors for motor control shall be suitable for direct-on-line motor starting and shall be capable of withstanding without damage the motor stalled current until the associated protective device operates.

Contactors shall be arranged as type “2” co-ordination for switchgear and type 1 for MCC and shall conform to IEC 60947-4.

b. Isolating Devices

In order that they may be made dead for examination, or other purposes, all circuit breakers and contactors shall be connected to the busbars through isolating devices of approved design. The isolating devices shall be arranged for operation while the busbars are alive and while no current is passing.

Isolators shall be capable of carrying the rated load current to the circuit and the short time current specified.

On-load isolators shall be capable of making a current equivalent to the specified prospective fault current as limited by the cut-off characteristics of the largest fuse with which it may be associated.

Means shall be provided to prevent movement of the circuit breaker from the isolated to service position when the shutters are padlocked closed.

Plug connections, including those for auxiliary wiring shall be of the self-aligning type. All motor control feeders shall be provided with suitable MCCB without any switch fuse unit as a isolating device.

c. Bus bars and Connections

Bus bars and electrical connections between the several pieces of apparatus forming the equipment shall be of electrolytic copper and they shall comply with the relevant standard. Bus bars shall be protected against atmospheric corrosion by means of tinning or heat shrink sleeves.

Cubical type switchgear shall have busbar barriers provided between the units to prevent spreading of ionized gasses in the event of a fault. The arrangement of the barriers and bus bar insulation shall avoid the introduction of small air gaps between the conductor and the insulation.

Torque and tightness parameters and recommended inspection frequencies shall be included in the O&M Manual.

Bus bar placement shall be consistent throughout the Facility so that the line side position in a switchboard in one area of the Facility is the same in all others.

Metal shutters shall be provided to cover each of the 3-phase group stationary isolating contacts. Each set shall be capable of being individually operated and individually

locked closed. The shutters shall open automatically by a positive drive initiated by the movement of the circuit breaker, voltage transformer carriage or other equipment as required. The closing shall also be automatic.

The bus bar shutters shall be painted and labeled. Line side shutters shall be clearly be marked “Danger – Live Cables” and painted a different color then the bus bar. The bus bar shutters shall be labeled “Bus bars.”

d. Auxiliary Switches

With each circuit breaker, contactor, isolating device and earthing device there shall be supplied all necessary auxiliary switches and mechanisms for indication, protection, control, interlocking, supervisory and other functions to meet the requirements of this Aggregate Technical Specifications. A breaker position switch shall be furnished with each breaker to bypass all “b” auxiliary contacts in remote interlocking circuits when the breaker is in the test position or in the disconnected position.

All auxiliary switches shall be wired up to a terminal board on the fixed portion of the switchgear whether they are in use or not in the first instance.

All auxiliary switches and mechanisms shall be mounted in approved accessible positions clear of the operating mechanisms and are to be protected in an approved manner.

Composite fuse and switch equipment may comprise either a fuse-switch unit with integral fuses, or switch-fuse units in which the air break switch and the connections from it up to the associated fuse shall be so designed as to minimize the possibility of a fault. The equipment shall comply with the requirements of IEC 60947-3 and ensure that the fuse is isolated when it has to be changed.

Switch-fuse units shall be arranged with the switch on the bus bar side of the fuse.

Power fuses shall be of the high breaking capacity cartridge type complying with the requirements of IEC 60269.

Use of fuses shall be limited to very fast acting applications.
Miniature Circuit Breakers

The DC distribution boards associated with the batteries and LV AC distribution boards shall preferably be equipped with miniature circuit breakers on outgoing circuits. They shall be single, double or triple pole as appropriate to the circuit and shall have sealed operating and overload mechanisms.

Ground Fault Circuit Interrupter (GFI) breakers shall be provided as required by Codes and Standards, local requirements and safety requirements.

e. Circuit Breaker Handling Equipment

Suitable handling equipment shall be provided where necessary for easy handling of circuit breakers.

All LT ACB shall be provided with arc flash tripping features which can be made ON/OFF as required.

f. Interlocks

Safety interlocks to ensure correct system operation, to avoid unsafe switching conditions and to ensure safe isolation for maintenance shall be provided by mechanical or electrical means.

Mechanical interlocks shall be of the preventative type and shall be arranged as close as practicable to the point at which manual force is applied to prevent miss-operation. Mechanical interlocks shall be installed on all contactors and breakers to ensure the electrical equipment is tripped and remains tripped while the equipment is being racked. Electrical interlocks shall be function to prevent the closing operation of the switches.

Key interlock devices of the Kirk or Castel type shall be provided to prevent the paralleling of certain supplies. An identification system shall be provided and subject to Owner's approval.

V. Motor Control Centers

MCC enclosure shall be designed, manufactured, tested as per NEMA 3S. All equipment for panels shall be located at an ergonomic height of an average operator.

4.3.5 ESSENTIAL SERVICES AC & DC SYSTEM

4.3.5.1 Battery Systems

Ungrounded DC system consisting of battery system(s) of appropriate voltage levels per unit shall be provided. The batteries shall be sized to handle the duty cycles determined in the final design. Nickel Cadmium electrolyte Battery shall be sized as per IEEE 1189. Batteries must be able to supply full projected load for no less than 2 hours after loss of charging system.

220V DC system shall have both poles fully insulated and suitable for unearthed operation. Batteries shall be sized to include an aging factor of 25%, a 20% design margin, and temperature correction factor based on expected battery room temperature limits. Batteries shall be selected so that they will not require replacement earlier than 20 years. All momentary loads shall be assumed to be of one-minute duration. DC system sizing calculation and battery selection basis shall be provided for Owner's review. Batteries shall be placed in Air Condition room.

Dual redundant Float Cum Boost Chargers (FCBC), each sized to provide 100 % DC system load for the each generating unit, along with charging load of the battery shall be provided. Battery shall be 2x100% 2200v Nickel Cadmium battery. Power supplies to each charger shall not be from a common bus (subject to a single point of failure). Each charger shall have capacity to fully charge a battery in 8 hours maximum. Chargers shall maintain the voltage of DC system within permissible limits while float or boost charging.

Each battery charger shall be provided with local alarms and instrumentation and provision for remote indication of common alarm with fault indication to DCS. Each battery charger shall be equipped with AC input and DC output circuit breakers. Means to detect earth fault in DC system shall be provided.

Charger DC output breakers thermal overloads shall be disabled, and only short circuit protection shall be incorporated.

The battery charger shall be of modular design type & capable of catering reduced DC load without any tripping of charger in the event of failure of modules.

Station battery set with station DCDB shall be considered separately from unit power & control DCDB. Unit power & control DCDB are two separate DCDB each having one incomer from unit battery charger & other from station DCDB.

Protective devices in DC distribution panels shall be equipped with double pole circuit breakers for each incoming, interconnecting and outgoing circuit. Breakers and switches shall have an interrupting capacity greater than the maximum available short circuit current and the bidder shall verify that the interrupting devices are DC rated for the maximum available fault current. All cables and the DC distribution system shall be designed to withstand the maximum available short circuit current. In addition, battery main leads and main distribution panel buses shall be rated so that the temperature rise due to the battery one-minute design current does not exceed the emergency overload temperature.

A full set of battery test accessories shall be provided, mounted in a box.

4.3.5.2 Uninterrupted Power Supply

All AC equipment, instrumentation, communication, and protection systems which cannot tolerate a disconnection of power supply and is required to operate continuously such as a distributed control system (DCS) and other local control systems shall be powered with supplies from an uninterruptible power supply system (UPS) system.

The UPS equipment shall be single phase having rectifier, static switch, powered from station battery system, a manual bypass switch, a Constant Voltage and Constant Frequency (CVCF) for bypass mode. All equipment shall be cubicle mounted and complete with local alarms and instrumentation as well as provision for remote indication of common alarm with fault indication to DCS.

All uninterruptible loads shall be supplied at the same nominal voltage which shall be 230V. The equipment shall be designed to supply switch mode type loads with in-rush values being 200% of the equipment rating.

The UPS equipment shall be provided with isolation facilities to permit full replacement without disrupting any part of the systems to which it is normally connected.

The UPS equipment shall be powered from batteries of the DC system, which is sized to provide for a standby period of 2 hours when supplying 125% of the maximum continuous load of its associated distribution board without the need for enhanced ventilation.

The static switch shall be capable of carrying the continuous, short time (overload) and short circuit specified for the UPS system and shall be used for automatic transfer between the synchronized static inverter and the alternate ac supply. When the normal power supply is lost, the static switch shall transfer to the alternate supply within 0.25 cycles.

The equipment shall be capable for operation with and input voltage variation of ±10% and frequency variation of ±5% and shall comply with the following:

Sl. No.	Parameter	Requirement
i.	Output Voltage Static tolerance Dynamic Tolerance	As required by Facility installation +1% +4% for 100% load change
ii.	Output regulation	Output voltage Regulation ± 1 % Output frequency regulation ± 0.2 %
iii.	Harmonic distortion	3% maximum
iv.	Overload capacity	150% for 1 minute 125% for 10 minutes
v.	Short circuit current	2 x rated current for 10 seconds
vi.	Ambient temp range	0 to 40°C
vii.	Cooling	Natural
viii.	Noise level	60 dB(A) max

For maintenance purposes a manual by-pass switch shall be provided to allow the DCS to be powered from an alternate source. This shall consist of a second AC supply which will allow maintenance procedures to be carried out safely and without interruption to system operation.

4.3.6 PROTECTIVE EQUIPMENT

4.3.6.1 General

Protective gear shall be provided to disconnect faulty circuits with speed and certainty and without interference with healthy circuits. They shall also be such as to prevent incorrect operation of circuit breakers or contactors as a result of transient phenomena not arising from a faulty condition of the section of line or plant associated with each set of relays, but which may occur during fault periods due to disturbances on the system.

Permanent facilities shall be provided for the convenient testing of protective equipment in place without the need to remove wires.

At a minimum digital protection equipment shall be provided for the following equipment:

a) Generators;
b) Auxiliary Transformers;
c) Medium Voltage (MV) Switchgear;
d) Low Voltage (LV) Switchgear; and
e) MV Motors.
f) LV Motors

The protection relays for the generator shall be mounted in relay protection cabinets to be located in the TG Building Control room. The protection relays for the MV switchgear, LV switchgear and MV motors shall be located on the respective switchgear.

The bidder shall prepare relay coordination calculations to ensure that a short circuit or an earth fault shall be cleared without cascading to upstream circuit breakers.

The protection relays shall be microprocessor based multi-function type of latest, proven technology available and shall be provided with multiple functions that can be selectively used or disabled.

4.3.6.2 Relays

All relays and protection shall comply with the requirements of the appropriate parts of the IEC 60255.

Electronic, solid-state protection relays, preferably of the programmable microprocessor type incorporating fault and transient measurement memories, matrices for programming tripping sequences and auxiliary relays shall be provided.

All relay cases shall prevent the ingress of dust and shall meet the requirement of IEC 60529, classification IP 54.

All protection relays, including those for motor circuits, shall be of the hand reset type, or alternatively operate through a hand reset tripping relay. The action of resetting shall not cause the associated equipment to start automatically.

Each protection relay or protection system shall be provided with an adequate number of output contacts of suitable rating to carry out the tripping functions, alarm indication, indication and remote monitoring as required. All protection relays shall be provided with soft link to DCS through IEC 61850 communication protocol of all measured electrical parameters without limitation on configured span and measured value.

Wherever possible the design of the relay schemes shall be on the “fail-safe” principle. Care shall be taken to ensure that loss of DC supply or an open circuit does not cause incorrect opening or closing of a circuit breaker. Circuit breaker or isolator repeat relays shall be of the latching type and a discrepancy alarm shall be provided to check correct operation of the relays following circuit breaker or isolator operation.

Protection Relays shall be of Latest Numerical Type for Generator, Power Transformer, HV Motors, Auxiliary Transformers, HV/LV Incomers and HV/LV Feeders. All the Relays shall be connected to station level protection SCADA for data acquisition trouble shooting, monitoring & checking. All the relays shall be IEC 61850 compatible having watch dog facility and contact.

4.3.6.3 Protection system

The type of protection schemes required shall include but not be limited to the following sections. Protective relays and systems shall be provided to detect and discriminate all credible faults on each item of the Facility and equipment and their power supply source. In the event of unacceptable electrical system disturbances occurring, the protection shall operate, positively and consistently, maintaining adequate discrimination, to minimize damage to the Facility and equipment and disturbance to the system as a whole. It shall be designed to preclude, all possibilities of inadvertent operation. All relays to TIME SYNC through common GPS and critical events to be captured through DR(disturbance recorder).

a. *Generator Protection Systems*

The generator protection system shall be provided with state of art digital multifunctional relay of proven make and model for the application. Selected relay shall have extensive self-monitoring capabilities and communication facility through serial

links with operator terminals (PCs) and control systems. All Micro-processor based multifunction digital relays shall be provided with on-line self-diagnostic alarm capability. Generator protection circuit shall be totally redundant with auto synchronizing facility. Two multi-functional programmable digital relays shall be provided for each generator protection. Each fed from a separate set of current transformers to provide redundant protection from sensing devices to tripping mechanism. The Generator relay panel shall accommodate to 2nos generator protection relays in main -1 & main-2 configuration, at least one of the generator protection relay shall be of latest SEL make. Separate protection for rotor & stator earth fault to be considered (Sub frequency AC injection). The multi-function relays shall include, as a minimum, the following protective functions:

- Generator Differential;(87G)
- Stator Earth Fault;(64G, 59N, 100% stator)
- Negative Sequence;(46)
- Loss of Excitation;(40)
- Reverse Power; Inadvertent Generator Energizing (32R)
- Under current or Low forward power (37)
- System Distance Backup;(21)
- Inverse Time Phase Overcurrent; (51)
- Over excitation; (24)
- Stator overload (49)
- Undervoltage; (27)
- Generator over voltage (59)
- Over/Under Frequency; (81)
- PT fuse failure alarm
- Generator rotor Earth fault alarm and protection ; (64R)
- Generator Synchronism Check; (25)
    - Lockout Relays (to trip the switchyard circuit breakers and mechanical equipment (such as turbine inlet valves); (86G)
- Exciter Field Earth. (64F)
- Pole slipping. 78/21G
- Overexcitation relay. 59/81(v/Hz)
- Dead machine relay. (27/50G)
    - Stator phase and ground instantaneous and time over-current (50P, 50G, 51P, and 51G)
- Neutral over-voltage (59N)
- Inadvertent energization

  Generator protection shall consider the following:

    - Differential protection shall not operate for magnetizing in-rush currents or for through flows to external faults with worst-case symmetrical current conditions.
    - Separate lockout relays shall be used for primary, back-up and breaker failure relay systems.
    - Interlocks associated with generator circuit breaker failure scheme shall be used as applicable.

- The various tripping methods, such as “simultaneous trip,” “sequential trip,” etc., shall be given proper considerations and will be appropriately applied.
- The generator and its prime mover shall be protected from over- and under-frequency operation in accordance with ANSI C37.106.
- Digital, multifunction type indicating meters shall be provided.

b. *Transformer Protection Systems*

Service Transformer Numerical Protection Relay to be provided at 6.6kV MV Switchboard.

c. *Switchgear and Motor Protection Systems*

The microprocessor based multi-function relays shall include, as a minimum, the following protective functions. The relays shall be mounted on the related compartments of the respective switchgear.

Numerical fast bus transfer system (BTS) shall be provided for bus transfer between-

- Station Bus to Unit Bus & Viz versa
- Station Bus to station Bus
- In unit PCC, between two incomer & bus coupler.

a) Medium-Voltage Switchgear
- Bus Undervoltage / Over voltage;
- Bus Fault Comparison;
- Incoming Feeders Phase instantaneous Overcurrent
- Phase time over current
- Earth Fault
- Outgoing Feeders Phase instantaneous Overcurrent and Earth Fault.

b) Low-Voltage Switchgear
- Bus Undervoltage; and
- Incoming Feeders Phase Overcurrent and Earth Fault.

d. *Medium-Voltage Motors*

The microprocessor based multi-function relays shall include, as a minimum, the following protective functions. The relays shall be mounted on the related motor feeder compartments of the respective switchgear.

- Short circuit (50)
- Ground Fault Protection (50G)
- Stator RTD (49)
- Bearing RTD (38)
- Unbalance phase loading (46)
- Phase reversal (47)
- Phase current unbalance;(51)
- High-impedance differential protection; (87M) for > =600 kW
- High-impedance differential protection; (87M) for > =2000 kW
- Speed switch and locked rotor (Coal mills) (14+51R)
- High vibration. (Alarm)
- High Vibration trip (> 180 kW motors).

e. *Digital Fault-Monitoring and Disturbance Recorder*

A digital fault-monitoring and disturbance recorder system (FMS) shall be provided, which shall cover the entire power station electrical system items, including the following:

- Incomers and couplers of all MV, LV and Generator switchgears.
  - All medium-voltage switchgear feeders and MV, LV motor feeders.
  - All LV & MV feeders shall have digital energy meter with EMS system (Energy management system)

4.3.7 MOTORS

4.3.7.1 General requirements

Motors shall comply with the requirements of IEC 60034 or NEMA-MG-1 (For NEMA rated motors). All motors shall be IE3 Energy Efficient and construction.

All AC motors shall be designed for continuous operation. DC motors shall be designed for continuous operation at any voltage between ±10% of nominal voltage without exceeding permitted temperatures and without injurious sparking at the commutator.

The medium voltage (MV) motors shall include those motors rated above 160 kW. The low voltage (LV) motors shall include those rated 160 kW and less. Motors up to 0.2 kW may be of single-phase type. However, all motorized actuators for valves shall be of three phase type.

All medium voltage motors shall have space heaters. The space heaters shall be rated for 230 volts. They shall be located and insulated so they do not damage motor components or finish. They shall be sized as required to maintain the motor internal temperature above the dew point when the motor is idle. All outdoor-mounted low voltage motors shall be provided with space heaters. A separate space heater terminal box and isolating facilities shall be provided for each motor.

Motors shall be provided with suitable terminal boxes and terminal bushings which may be over sized to accommodate cable sizes calculated per Site ambient conditions. Terminal boxes shall be designed so as not to direct any explosive gases towards the person standing near the motor in case of fault.

Degree of protection provided by the enclosure shall be IP-54 per IEC 60529 (NEMA 3S for NEMA rated motors) for indoor motors and IPW-55 for motors located outdoors. (NEMA 55 for NEMA rated motors).

Motor windings shall be insulated with materials having at least thermal classification H. The temperature rises shall not exceed the permissible limits for Class F materials.

An earthing terminal of appropriate design and adequate current carrying capacity shall be provided adjacent to the motor box.

4.3.7.2 Medium voltage motors

All motors above 160 kW shall be medium voltage, 6.6 kV, with Class H insulation and a temperature rise limited to Class F. All motors shall have an IP-55 rating with an industrial enclosure. The motor terminal box shall be of the PSTB type. The BFP motor shall be of the CACW type, while the CWP motor shall be of the CACA type. All other motors shall preferably be of TEFC or TETV type.

Medium voltage motors shall conform to IEC 60034 or NEMA MG-1 based on the Country's requirements. Motor shall be sized such that they have at least 5% margin over design duty point at service factor 1.0 (Continuous duty). Nameplate horsepower/KW multiplied by the 1.15 motor nameplate service factor shall be at least 20% greater than the driven equipment operating range maximum brake horsepower. The motors shall be designed for DOL full voltage starting. Motors shall be suitable for 2 consecutive hot starts and 3 equally spaced starts in one hour at specified ambient.

Motor shall be suitable to start and accelerate with driven equipment connected at any voltage from 90% rated voltage to 110% rated voltage. Motors shall not stall when voltage momentarily dips to 70% of rated level. During supply changeovers motors running at full speed initially shall be able to re-accelerate when voltage is restored after changeover. Such motors may be subjected to phase voltage which is out of phase to internal induced voltage phasor when voltage is applied in such conditions.

All medium voltage motor shall be furnished with bearing and winding temperature 3 wire RTDs wired to the DCS/ Motor protection relay for monitoring, protection and alarm functions. Two out of three in case of winding and two out of two in case of bearing, voting schemes shall be implemented. Each bearing shall have two temperature detectors set for alarm and trip levels. Each winding shall have three temperature detectors. A separate RTD terminal box shall be provided on the motor.

Motors shall be designed for full voltage starting and frequent starting and shall be suitable for continuous duty in the specified ambient. Intermittent duty motors are not permitted. Motors that will be fed from an inverter shall meet the inverter duty motor requirements of NEMA.

The 6.6kV motors shall have mica tape turn and mica tape ground wall insulation and corona (partial discharge) tapes (grading tapes) shall extend a minimum of 4 inches into the end turn area from the stator core. Paint shall not be used for grading.

All medium voltage motors shall have surge withstand capability in accordance with NEMA C50.41, Section 18.3. Surge capacitors shall be considered for long length motors as per standard.

The solid shaft shall be fabricated of a corrosion-resistant material or furnished with corrosion-resistant treatment.

Care shall be taken for shaft voltage & current while design of the motor & accordingly the bearing & bearing housing to be designed.

Rotor Temperatures: Maximum temperatures after second consecutive start shall not exceed 300°C rise (adiabatic).

The motors shall be designed so their copper or copper alloy rotor bars and end rings shall not exceed a total temperature (adiabatic) of 300°C maximum after two starts.

The motors shall be provided with mountings for vibration sensing equipment in the horizontal and vertical directions at each bearing to facilitate mounting of vibration sensors. Location of flat areas to facilitate mounting of vibration sensors for pumps shall be in accordance with ANSI/HI.

Bearing housing vibration velocity shall not exceed the unfiltered values per ISO 10816 when measured in three mutually perpendicular directions on the bearing housing, and on the motor shaft extension in the vertical and horizontal direction.

All MV motors shall be provided with shaft and bearing housing vibration monitoring system with links to DCS for real time recording and tripping. Redundant probes shall be provided for each bearing housing and the shaft. All HT motor shall be provided with triplex type winding & bearing RTD.

Space heaters rated at 800 watts or less shall be wired for operation on 230 volts, single phase. Space heater leads shall be stranded copper cable with 600-volt insulation and shall include terminal connectors. Space heaters shall be sized as required to maintain the motor internal temperature above the dew point when the motor is idle. The internal temperature shall not cause winding temperatures to exceed rated limiting values nor cause thermal protective device "over temperature" indication when the motor is not energized.

Motors and any other electrical components located outdoor shall be provided IP 65 class or better weather protection. The electrical equipment which is located indoor such as switchgear, electrical and control panels shall be provided IP 41 class or better weather protection.

4.3.7.3 LV Motors

All motors rated 160kW and below will be Low Voltage motors of 415V with Class F insulation with temperature rise limited to Class B.

LV motors shall conform to IEC 60034 standards or NEMA MG-1. LV motors shall be TEFC, air-cooled type. Degree of protection provided by the enclosure shall be IP-54 per IEC 60529 (NEMA 3S for NEMA rated motors) for indoor motors and IPW-55 for motors located outdoors. (NEMA 55 for NEMA rated motors).

All motors shall be able to start and accelerate with minimum voltage at motor terminals of 80% of rated voltage. Motors shall be rated for continuous duty and sized to provide at least 10 % margin over driven equipment design duty point. Insulation shall be class-F limited to class B temperature rise. Motors rated 30 kW and above shall be preferably premium efficiency motors.

Motors rated above 18kW shall be provided with space heaters and rated above 30kW shall be protected with Electronic Over Current Relay (EOCR).

4.3.7.4 Motor Operated Valves & Damper Actuators

A safety factor of 300% shall be used for sizing of operators for valves and dampers and all drive system components. Operators shall be capable of transmitting design torque (including safety factor) within the torque range specified by the actuator manufacturer. The strength of the operator mounting, based on the required operator torque, shall not exceed 30% of the yield strength in any mode of stress. Integral type actuator shall be considered for valves/dampers.

Motor operated actuators shall be complete in all respects including the motor and the necessary controls for automatically stopping the motor when the valve gate has reached the ‘full open’ or ‘full shut’ position. A clutch mechanism shall be included to prevent damage in the event of jamming. The motor and control gear shall be placed

in such a position relative to the valve that there is no possibility of leakage of steam or water from the valve joints or glands blowing on to the motor or control equipment. All valve actuators shall be provided with hand operation facility shall be provided and be so arranged that the hand operated mechanism which shall automatically disengaged during motor operation and vice versa. Motor operated valves shall be provided with hand wheels having plain polished rims. Valves actuators shall be provided with at least one adjustable torque switch and drum type 4 sets each of NO and NC adjustable contacts of limit switches. Motor actuators shall be provided with a resistance type potentiometer for position indication and anti-condensation space heater. All internal wiring shall be brought out to a single terminal strip. All motor operated valve actuators shall be rated for 3 phase AC supply. Motors actuators shall be rated for short time duty of S2-15 minutes and provided with degree of protection of IP-65 or better based on IEC standards of equivalent. Valves and actuators shall be suitable rated to ambient, process and hazard conditions apart from above basic specifications.

All operators shall be of Limitorque or AUMA or ROTOK make and preferably with integral motor starters. Valves and actuator series shall be selected based on criteria of proven applications. All MOV actuators shall be of intelligent type with programmable limit/torque settings. All MOVs shall be of same make to minimize spare inventory.

4.3.8 VARIABLE FREQUENCY DRIVE

4.3.8.1 Design criteria

a. The inverter units shall be microprocessor based and shall be suitable for the site ambient conditions. Necessary de-rating factors shall be considered for temperature correction.

b. The converter section shall consist of 18-pulse rectification configuration scheme with required line current harmonic filter.

c. Harmonic filter shall either be active or passive and designed to limit the harmonics generated by the equipment shall be well with in the limit so that the system harmonic levels shall meet the requirements specified in IEEE 519. Bidder to note that equipment harmonic levels shall be much less than the THD levels indicated in IEEE.

d. The inverter section shall be IGBT based type with suitable designed for feeding continuous full load, overload and starting of motor conditions. The inverter shall be provided with current limiting circuitry which will limit the output current to a value which will not damage the inverter or blow its fuses and sufficient capability to prevent damage to itself until short circuit conditions on the output are cleared.

e. The inverter shall have LVRT functionality. The cables connecting inverter to motor shall be of 3core cables/single core cable with trefoil configuration, having armor earthing at single end. The VFD for HT 6.6KV motor shall be of direct MV VFD. The Heat load of the VFD to be furnished & suitable capacity cooling arrangement to be considered.

f. The inverter shall be designed to withstand momentary dips of about 30% in supply voltage for 3 cycles without damage to semi-conductor components or blowing of fuses. Power loss ride through feature for 2 Secs shall be provided.

g. Motor and VFD shall withstand the voltage and torque stresses developed due to the vector difference between the motor residual voltage and the incoming supply voltage equal to 150% of the rated voltage during fast changeover of buses. The VFD shall have auto-speed search (fly catcher) for starting into rotating load. The VFD must be able to catch the motor spinning and bring to the desired operating speed in the proper direction without stopping the motor or tripping the drive.

h. The VFD shall be able to deliver motor Class II duty overload as per IEC 60146 -1 standard i.e. ~~150%~~ of motor rated current for 60 secs, at 50 deg. C temperature. If the motor load exceeds the limit, the drive shall automatically reduce the frequency and voltage to the motor to guard against overload. Necessary de-ration, if required, to be taken into accounts to meet overload requirements. Necessary calculations to arrive at the current rating of the VFD shall be furnished.

110%

i. VFD shall be provided with automatic sequence control which include start-up of cooling system, interlock checking, automatic start and run-up of drive, planned / emergency shutdown etc.

j. Input Power Factor (not only the fundamental Power factor) shall be greater than 0.93 at 100% load and rated speed and overall efficiency of the system shall be greater than 95%.

k. The VFDs shall be provided with Metal Oxide Varistors (MOVs) if required for transient voltage suppression on all three phases of the incoming power line. The VFD shall protect itself from damage due to any grounding or shorting of its output power circuit.

l. VFD shall be designed considering the location of the motor and its cable surge impendence to take care of the impact of the reflected voltage on the motor end. If required suitable line reactors or reflected wave limiters shall be provided at the motor terminal.

m. VFD shall be provided with suitable breaker and DOL starter to bypass the VFD in case of VDF failure / mal-operation. Necessary motor protection relay with suitable interlock arrangement with the VFD circuit shall be considered. Bypass shall be made such that, VFD can be taken out for maintenance without disturbing the bypass mode.

n. Fault diagnostic feature shall be built into the system to supervise the operation and failure of the VFD system and with the necessary storage of events.

o. VFD controller shall have facility to receive external trip and close signal and also provided with programmable auxiliary contacts for the remote operation and control.

p. The interface of VFD shall be considered as required for data communication with PLC/DCS system for online/ real time monitoring. Required hardware such as cables, converters shall be provided to meets the communication requirement.

4.3.9 CABLING SYSTEM

4.3.9.1 MV Power Cables

6.6kV system cables shall be 6.6 kV (UE) grade suitable for use in medium resistance earthed system, stranded & compacted copper conductor, extruded semi conducting screen over conductor, XLPE insulated, semi-conducting followed by copper tape screened, extruded black PVC Type ST – 2 inner sheathed, aluminium/GS wire armoured, overall FRLS extruded black PVC outer sheathed, conforming to IEC for constructional details and tests.

4.3.9.2 LV Power Cables

LV Power Cables shall be 1100 V grade, single / multi core, stranded copper conductor, XLPE insulated, with PVC inner sheath, armoured and outer sheath made of FRLS PVC compound, generally conforming to IEC. The cables used for DC system shall be of single core type.

4.3.9.3 Control Cables

Control cables shall be annealed high conductivity 1100 V grade, multi core, minimum 1.5 sq. mm cross section, stranded copper conductor having minimum 7 strands, PVC insulated, black PVC inner sheathed / galvanised steel wire armoured, overall black FRLS PVC outer sheathed generally conforming to IEC. In situations where accuracy of measurement or voltage drop in control circuit warrants, 2.5sqmm and 4 sq.mm. cables required shall be used

4.3.9.4 Instrumentation cable

Instrumentation cables shall be 1100 Voltage grade, 0.5 sq. mm, stranded high conductivity annealed, tinned copper, twisted pair (with min. 12 twists for meter) extruded XLPE insulated with overall and / or individual screening, extruded PVC inner sheathed, galvanized steel wire armoured, extruded outer sheathed with FRLS PVC compound. Instrumentation cables carrying digital signals shall have overall screening along with drain wire and analogue signal carrying cables shall have each pair screening and overall screening along with each pair drain wire and overall drain wire. Cores to be identified by colour and numbering on primary insulation.

4.3.9.5 Fire Survival Cables

Power and control, single/multi core, stranded copper conductor fire survival cables complying with IEC-60331 shall be provided for areas as per power plant standards.

4.3.9.6 Cable Properties

a. The sheath shall be resistant to water, UV radiation, fungus, termite, and rodent attack.

b. The outer sheath of FRLS PVC compound shall meet the following performance requirements:

- The critical oxygen index value shall be minimum 29 when tested at 27+ 20C as per ASTM-D-2863 and the temperature index shall be minimum 2500C at oxygen index value of 21 when tested as per ASTM-D-2863.
- The maximum acid gas generation as determined by titration method shall be less than 20% by weight when tested as per IEC-60754-1. Halogen acid content in outer sheath in FS cables shall not be more than 2%.
- Fire survival shall pass flammability tests as per IEC-331.

- The smoke generation under fire shall have maximum smoke density rating of 60% when tested as per ASTM-D-2843. Smoke density in FS cables shall not exceed 20%.
- The cable outer sheath shall pass the ultraviolet tests as per DIN 53387.
- The cables shall pass the tests for Water absorption tests as per IEC.

c. The finished cable shall pass the flammability test as per IEC 332-1 and IEEE-383. In addition, it shall also pass flammability test as per Class F3 of Swedish Standard SS-424-1475.

d. In addition, cables for devices mounted on or near hot surfaces of Steam Generators, Main steam etc shall have heat resistance type outer sheath.

e. All HV, MV & LV cable shall have embossing at uniform interval for size, core, and type.

4.3.9.7 Cable Terminations

a. Cables shall be laid in overhead only and underground cable trench/ pit shall be avoided as far as possible. Also, joint markers shall be provided at each joint.

b. All 1100V termination for XLPE/PVC power cables and control cables shall be by Double compression weatherproof type cable glands. Heavy duty, tinned, long barrel copper lugs shall be used for termination.

c. Cable terminations and cable joints for use on electrical system operating at voltages 6.6kV or higher in indoor and outdoor application shall be of heat shrinkable and Pre-Moulded “PUSH ON” type system.

4.3.9.8 Cable Carrier System

a. The cable carrier system shall be designed considering the following :

- Facility for easy laying of cables.
- Access to maintenance.
- Neat and aesthetic appearance.
- Safety of equipment & personnel.
- Ground water seepage.
- Drainage system for oil and water.

b. Cables shall be laid in galvanized / steel prefabricated ladder (for power and control) / perforated (instrumentation) type trays and in conduits. Also joint markers shall be provided at each joint. The cable trays shall be laid vertical in boiler and Material Handling area.

c. Cable trays and supporting structures in chemically corrosive area like battery room shall be avoided to the extent possible. But if the same has to be envisaged, the support structures shall be of mild steel painted trays finished with chlorinated rubber based paint/epoxy paint.

d. Following methods of cable laying shall be followed in the power plant.

a) Outdoor Areas

- Transformer yard ---- Shall be underground cable trenches with provision of ducts at wall location above the ground & to avoid water ingress to TG side cable duct. No underground duct bank for laying of cable shall be considered.

- Boiler area ---- Main routes: Overhead cable racks with trays in vertical formation and with conduits to branch off connections. Cable routes from TG to Boiler platforms shall be in overhead cable trays at suitable elevations.
- Boiler Platforms --- Cable trays mounted in vertical formation.
- Outlying areas/ Road crossing --- Overhead racks. To the extent possible pipe racks shall be used for supporting the cable trays.

b) Indoor Areas

- TG Building --- Cable trays, conduits/floor chases for branch-off connections.
- Battery Rooms --- Cable Trays
- Utilities & offsite buildings --- Overhead trays for Switchgear/MCC

e. Cable trenches shall be avoided where possibility of oil and water collection exists.

f. No direct underground burial cables shall be laid except lighting tower, street lighting. For some exceptional case like isolated individual equipment it shall be allowed after approval by the owner.

4.3.9.9 Cable Trays, Covers and Installation

a. All outdoor cable trays are to be provided with covers. All vertical cable tray race ways are to be provided with covers. Cable trays shall be of ladder / perforated type complete with all necessary coupler plates, elbows, tees, bends, reducers, earthing and other accessories. Cable trays of ladder and perforated types and the associated accessories such as coupler plates, tees, elbows, etc., shall be fabricated from 14 gauge (2mm thick) mild steel sheets. Cable tray covers shall be provided for all. The cable tray accessories like trays, elbows, bends, etc., shall be fabricated and galvanized before bringing to site. Cable tray covers shall be fabricated from 16-gauge (1.7 mm thick) MS sheets. All the sheet steel shall be hot dip galvanized.

b. Inside widths of trays shall the cable trays shall be supplied in standard lengths of 2500 mm and clear be as follows:

- Perforated type trays: 150, 300, 450 and 600 mm.
- Ladder type trays: 300, 450 and 600 mm.

c. 1100 V rated cables of sizes 120 sq.mm and above shall be laid in single layer. Single core cables used for 3-phase AC power circuits shall be laid in Trefoil form with suitable PVC aluminium clamps to hold the cables.

d. Slotted angles shall not be used for cabling. In all locations smaller size cable trays of 50 mm / 100 mm wide shall be used for one or two cables.

e. Plate inserts for cable tray mounting structure shall be embedded during civil construction in floor slabs at 1000 mm spacing. Wherever embedded plates or steel structural beams/members are not available for welding the cable tray mounting structure, the M.S. plate shall be provided and is to be fixed to floor slab by four anchor fasteners of minimum 16 mm dia. with holding power of at least 5000 kg.

f. Spacing between cable tray mounting structures shall be 1000 mm for horizontal straight run of cable trays unless otherwise noted.

g. Loading on a horizontal support arm shall not exceed 120kg / meter run of cable/ tray (for say maximum width of tray 600W).

h. Width of the horizontal arms of the mounting structures shall be same as the tray widths required in the cable layout drawings plus length required for welding to the vertical supports (maximum tray width will be 750 mm) except where shown otherwise in the layout drawings.

i. The length of the vertical supporting members for horizontal cable tray runs shall be to suit the number of cable tray tiers indicated in the cable tray layout drawings.

j. Spacing between horizontal support arms of vertical cable tray runs shall be 600 mm unless otherwise noted.

k. Cable trays shall be welded to tray mounting supports.

l. Minimum clearance between topmost tray tier and structural member/ceiling shall be 300 mm.

m. Minimum vertical clearance below the bottom of the lowest cable tray tier and any structural member shall be 200 mm and 300 mm in case of steam or process pipelines.

n. The vertical clearance between two cable tray tiers shall be as per IEEE-384.

o. However, considering a flange height of 100mm and max. OD of cable (laid in trefoil formation), 275mm is opted in project when density of cable trays is high otherwise standard clearance adopted is 300mm.

p. A clear walk space of minimum 800 mm x 950 mm to be provided for cable trays in cable/pipe racks.

4.3.9.10 Conduits & Pipes

a. Steel conduits shall be used for sizes upto 63.5mm. The conduits shall be manufactured by electric resistance welding process and shall be hot dip galvanised.

b. Galvanised steel pipes shall be used for sizes from 80mm onwards. The pipes shall be manufactured by electric resistance welding and hot dip galvanised.

c. Flexible steel conduits shall be manufactured with electro galvanising process.

d. Conduits shall be seamed by welding and shall be hot dip galvanised both inside and outside. Conduits and fittings shall be as per relevant standards.

e. Pipes shall be of heavy duty type as per relevant standards and shall be hot dip galvanised both inside and outside.

f. Flexible conduits shall be made with bright, cold rolled, annealed and galvanised mild steel strips. Flexible conduits and adaptors shall be as per relevant standards.

g. Suitable pipe sleeves, adequate in nos. And of adequate size shall be provided in building walls/slabs for passage of cables into a building from cable trays/racks/cable trenches located outside the building. Detail of sleeves and exact locations of such entry points shall be available on relevant project drawings.

4.3.9.11 Fire-Proof Sealing of Cable Penetration

Cables / cable tray openings in walls and floors or through pipe sleeves from one area to another or one elevation to another, between the units and within the same unit, shall be sealed by a fire-proof sealing system. The fireproof sealing system (FPSS) shall effectively prevent the spread of fire from the flaming to the non-flaming side, in the event of a fire. The FPSS shall conform to the following requirements:

- FPSS shall have a fire rating of two hours. 100% fire coating shall be coating at ZONE-0 & ZONE-1 area.
- The FPSS shall be subjected to fire endurance test, hose stream test, temperature measurement of non-flaming side as per ASTM-E119. 'Standard method of fire tests of building construction and materials'.
- The FPSS shall also conform to the in-combustibility test carried out in accordance with relevant standard.
- Under fire condition, the FPSS material shall not emit excessive smoke or any corrosive or toxic fumes.
- FPSS shall have minimum life of 25 years.

4.3.9.12 Fire Break

a. Fire break shall be provided by applying a suitable fire-resistant coating on cables for the required length to meet the fire rating of 30 minutes.

b. Fire breaks shall undergo the following tests as per ANSI-IEEE-383

- Ampacity test
- Flame test

c. Fire break shall be provided at an interval of 30 metres in the straight portion of each of the cable tray above ground, at intervals of 30 metres in cable trenches and at 5M for all vertical trays. All cable inter section and tee offs shall be provided with firebreaks.

d. When pipe sleeves are provided for cables from outdoor areas to indoor areas, the pipe opening at the outdoor side shall be sealed by fire proof sealing material, which is also continuously waterproof. The indoor side of the pipe opening shall also be sealed by continuous fire proof sealing materials. The duct banks in outdoor areas also need to be sealed by water poof seals. It is necessary to explore possibility of applying waterproof coating on fireproof sealing.

4.3.10 LIGHTING SYSTEM

4.3.10.1 Description

The illumination of the boiler area shall be provided as described here. Lighting system shall be designed as per IEC 60598 & the applicable standards. All Lights shall be of LED type only. The lighting system of various areas shall comprise of one or more of the following systems:

- Normal 230V AC Lighting System
- Normal-cum-Emergency 230V AC Lighting System
- Emergency 220V DC Lighting System

4.3.10.2 Normal 230V AC Lighting System

The lighting circuits in the normal 230V AC lighting system shall be fed through 415V, 3 phase, 4 wire lighting transformers connected to the 415V distribution system. Lighting transformers in each area in the power station shall be fed from a convenient 415V Switchgear/MCC located nearby. All the lighting fixtures connected to this system shall be available as long as supply is available from normal source.

4.3.10.3 Normal-cum-Emergency 230V AC Lighting system

Certain lighting fixtures considered as "essential" shall be connected to a 415V AC source designated as the 415V Normal / Emergency Bus. The lighting fixtures connected to this system shall be available whenever normal supply is available in the plant and are also backed by Emergency Diesel Generator power supply in the event of failure of normal supply. This supply shall be made available for TG building, switchgear rooms, battery rooms, control room. Aviation warning lighting for Boiler and chimney shall also be fed through this system.

4.3.10.4 Emergency 220V DC Lighting System

To enable safe movement of operating personnel and access to important control points during a station emergency involving total AC supply failure, DC lighting fixtures will be provided. LED type DC lighting is envisaged at strategic locations in TG building, switchgear rooms, control room, Boiler landings, DG room, near entrances, staircase landings, etc. These fixtures shall be connected to lighting panels fed from 220V plant DC system. These lighting fixtures will normally be 'OFF' and shall be automatically switched 'ON' when normal AC power supply fails. On restoration of normal AC supply, the supply to DC fixtures will be Automatically cut-off.

4.3.10.5 Illumination Levels

Suitable illumination shall be provided to facilitate normal operation and maintenance activities and also to ensure safety of working personnel will be provided. Following average illumination level shall be considered at working level in different areas:

Area	Average illumination level (lux)
Control room, desks & vertical panels	500
Offices, laboratories & first aid rooms	500
Workshop	500
Rest room	300
Computer & Electronic equipment room	300
Switchgear & relay room	300
Engine – Generator rooms	100
Toilet, Building corridors & stairways	100
All indoor areas not specifically listed	200
Transformer yard	150
Battery room	200
Gas receiving area	100
Fuel storage area	50
Outdoor plant area not specifically listed	20
Roadways & car parks	20

Gates (where vehicle documents checked)	100
Site perimeter fence	20
TG bay & high bay	200

The average illumination mention in above table shall be as per IS standard and best industrial practice.

Adequate numbers of MLDB, ELDB & Lighting transformers shall be considered & Adequate lighting panel to be provided for each individual location. The lighting transformer shall be having OFF load tap changer arrangement for controlling the illumination voltage.

4.3.11 EARTHING AND LIGHTNING PROTECTION

4.3.11.1 General Requirement for Earthing

- Earthing system will be according to IS 3043 and local rules & Regulations.
- Protective earthing and service earthing will be connected together to create common earthing system with common earthing electrode.
- Earthing rods & conductors will be designed based on soil resistivity and maximum ground fault current. The earth conductor will be adequately sized to withstand the maximum fault current for 1 sec without any deformation and with tolerable temperature rise.
- Steel reinforcing bars of concrete structure of the building (Columns, beams, foundation, and footing) will be connected all together by welding to achieve electrical continuity. If steel reinforcing bars do not have enough size for maximum ground fault current they will be augmented by additional earth conductor.
- Separate earthing electrode will be considered for steel reinforcing bars of concrete foundation and footing that is in direct contact with the earth. If earthing resistance is too high such earthing electrode will be augmented by additional electrodes.
- Earthing resistance of common earthing system will be less than 1 (one) Ohm.
- G.I. strip will be installed in concrete of grade slab to connect all columns to create one common earthing electrode. Reinforcement bars of each column will be connected to the grid of G.I. strip by welding.

4.3.11.2 Protective & Service Earthing

- For equipment earthing G.I strip will be installed as main earthing bus bar. Size of G.I strip for main earthing bus bar will be adequately sized.
- Connections between the main earthing bus bar and various equipment will be carried out by PVC insulated copper or aluminum conductor or G.I strip.
- The following will be earthed by connection to the main earthing bus bar: -
    - System neutral. (Neutral point of the distribution transformers).
    - Potential transformer secondary.
    - Metallic non-current carrying parts of all electrical apparatus, such as lightning arrestors, transformers, switchgears, motors, lighting fixtures, power panels, cable trays, terminal boxes, etc.
    - Steel structures

- Storage tanks
- Cable shields and cable armour.

- To provide electrostatic protection of pneumatic transfer pipelines their flanges will be bonded, and they will be earthed at every 25 meters.
- All electrical equipment will have two separate and distinct connections to the earth.
- Earthing bus bar for other free-standing panel will be connected to the main earthing bus bar with two separate and distinctive connections.
- Each motor frame will be connected to the main earthing bus bar. Protective conductor of the motor power supply cable will be connected to the earth point inside motor terminal box and to the MCC earth bus bar.
- Additional core will be considered for local control station earthing. It will be connected to the earth post of each local control station and to the MCC earth bus bar.
- Cable armour will be earthed on both side of the cable, but cable shield will be earthed only on one side (panel side – source side) of the cable.

4.3.11.3 Earthing Electrode Type

Transformer & Generator Neutral Earthing	Copper plate type
Body Earthing	GI pipe electrode
DCS Earthing	Copper rod / As per DCS vendor's recommendation
Main earth loop material	GI strip
Substation earth loop	GI / copper

4.3.11.4 Lightning Protection System

- Lightning Protection will be according to IS 2309 & IEC 62305.
- Lightning protection system for BTG package buildings at plant will be provided depending upon the lightning flash density, area of exposure / collection etc.
- Lightning protection system consists of suitable sized horizontal conductors that are laid over the rooftop of every building and are connected to individual lightning protection earth pits through a test link. All the lightning protection earth pits are interconnected by a suitable sized flat and finally the system is connected to the Plants Main Earthing system at minimum of two places.
- Lightning conductor will be GI strip.
- Lightning Protection system to be consider for chimney structure.

4.3.12 TESTS

All Routine tests for all the major electrical equipment of the BTG package shall be carried out as per relevant standards. Type test certificates for similar equipment supplied by the Bidder shall be submitted. In case Type test certificate for similar equipment is not available, the same shall be conducted in presence of Owner.

11.0 QUALITY ASSURANCE REQUIREMENTS

11.1 INTRODUCTION

11.1.1 The minimum Quality Assurance / Quality Control (QA/QC) requirements and the services the CONTRACTOR is expected to provide to assure 'Quality Assurance' are described in this section. `Quality Assurance' is defined as the entire program adopted by the CONTRACTOR during engineering, manufacture, procurement and construction to assure conformity with the contract specifications and relevant codes and standards indicated in the specifications. Quality Assurance/Quality Control procedures followed by the BIDDER shall address the QA/QC requirements during the following phases of the project:

a) Engineering

b) Procurement

c) Manufacture

d) Construction including commissioning testing and commissioning.

11.1.2 BIDDER shall submit documents to demonstrate that the BIDDER and his sub-vendors possess, QA/QC procedures meeting the requirements set forth in this section. The minimum inspection requirements for all major equipment are as indicated in the attached documents [Refer Section E]. However, it is the CONTRACTOR'S responsibility to prepare a list of all relevant major additional requirements if any to ensure the required quality, prepare quality plans with such additional requirements taking into account the minimum inspection requirement of this specification and obtain these quality plans reviewed / approved by the OWNER / CONSULTANT.

11.1.3 The BIDDER shall submit an organization chart defining the permanent positions responsible for QA/QC accompanied by a brief description of each position's function and responsibility. A second organization chart along with a descriptive write up shall also be provided outlining the proposed QA/QC program for this particular project. This chart and write up shall identify the personnel responsible for the Engineering Quality Assurance procedure for the complete duration of the project.

11.2 ENGINEERING

11.2.1 Prior to Finalization of Contract

Prior to finalization of the Contract, the CONTRACTOR shall prepare and submit a project Quality Assurance Procedure that covers the engineering phase of the Works. The procedure shall be designed for this project and shall address the specifics of how the CONTRACTOR will control, monitor and verify the requirements contained in this section. The CONTRACTOR shall utilise all of his QA/QC resources, manuals and procedures when preparing the plan. OWNER / CONSULTANT will review the plan prior to utilization and upon issue the plan will become the basis by which OWNER / CONSULTANT will evaluate the CONTRACTOR'S engineering QA/QC activities as they relate to this project.

11.2.2 OWNER / CONSULTANT Participation

The OWNER / CONSULTANT reserves the right to audit and verify procedures set forth in the Engineering Quality Plan. This audit right in no way relieves the CONTRACTOR from performing the control verification procedures outlined in the plan.

11.3 ENGINEERING QUALITY ASSURANCE AND QUALITY CONTROL REQUIREMENTS

Following are the minimum Quality Assurance and Quality Control requirements for the project. The CONTRACTOR'S Engineering Quality Plan shall set forth in detail the procedures to satisfy these QA/QC requirements:

11.3.1 Design Control

The CONTRACTOR will define, document and advise the appropriate handling of the following design controls:

a) Establish internal as well as external discipline relationships

b) Qualifications of personnel assigned for each task

c) Establish audit procedures to ensure that the design conforms to the requirements

d) Define and outline the number of multidiscipline design reviews

e) Establish procedures for handling design changes

f) Establish guidelines to handle all issues in pre -award, award and pre-fabrication with MANUFACTURER and SUB-CONTRACTOR.

11.3.2 Document Control

The CONTRACTOR shall include in his QA/QC – procedures the document control methodology defining:

a) Authorised use of documents

b) Receipt, logging and distribution of documents

c) Methodology for updating and implementation of additions and revisions

d) Methodology for document transmittal to OWNER / CONSULTANT representative. Some of the requirements for document transmittal maybe covered in other parts of this specification.

11.3.3 Audits

All documents shall be audited by the CONTRACTOR for conformance with the QA/QC procedures.

The OWNER / CONSULTANT reserve the right to review design details, either directly or through their CONSULTANTS. The OWNER / CONSULTANT may audit detailed design including steam turbine generator, steam generator and auxiliaries related design, structural designs/piping design and other areas.

11.3.4 Engineering SUB-CONTRACTOR

The subcontracting of detailed engineering to third parties does not relieve the CONTRACTOR of his responsibility for Engineering Quality Assurance.

11.4 PROCUREMENT

11.4.1 Source quality control

It is the OWNER / CONSULTANT'S intent that the CONTRACTOR deal only with SUB-CONTRACTORS and MANUFACTURERS (Vendors) who have established and demonstrated effective quality assurance and quality control procedures. OWNER / CONSULTANT does require, however, that the CONTRACTOR perform such normal inspection of equipment manufactured in his own manufacturing unit or at the works of his SUB-CONTRACTORS/ Vendors, as is necessary to obtain equipment and materials conforming to the project specifications and their supporting documents (applicable codes and industry consensus standards) and good engineering, fabrication practices as described

herein. Source Quality Control is also a valuable input for confirmation of delivery performance.

The minimum inspection requirements in respect of major mechanical items have been included in this section. Minimum inspection requirements in respect of electrical and instrumentation/control equipment are covered in their respective specifications.

11.4.2 After Award of Subcontract

Once SUB-CONTRACTORS and MANUFACTURERS are established, OWNER / CONSULTANT and the CONTRACTOR shall review item by item all major engineered equipment and systems and to reach an agreement on the need for pre-fabrication/pre-inspection and any additional quality plans needed to ensure the required quality.

11.4.3 OWNER / CONSULTANT Participation

a) The OWNER / CONSULTANT reserve the right to audit the performance of the SUB-CONTRACTORS/MANUFACTURERS and the CONTRACTORS inspection effort. This is normally accomplished by visiting the SUB-CONTRACTORS/MANUFACTURERS with the CONTRACTOR'S Inspector at pre-selected points during manufacture. CONTRACTOR will identify notification points so that the OWNER'S / CONSULTANT'S representative(s) can be present at particularly important stages of fabrication should the OWNER / CONSULTANT wish to attend.

b) The notification points are not hold points unless specifically identified as such. Should OWNER / CONSULTANT elect not to or fail to attend; the Work shall proceed without interruption. However, wherever customer hold points as H are indicated and mutually agreed upon, the CONTRACTOR shall not proceed further unless the hold is cleared / waived.

c) The OWNER / CONSULTANT reserves the right, however, to make announced spot-checks to facilitate evaluation of the SUB-CONTRACTOR and/or the CONTRACTOR'S inspection effort. OWNER / CONSULTANT may wish to hold technical meeting with the SUB-CONTRACTOR during the design and fabrication of the machinery. Should OWNER / CONSULTANT desire to hold technical meetings, the CONTRACTOR will be advised at a reasonable notice.

d) During audit visits to fabricator shops, OWNER / CONSULTANT may elect to spot-check base materials and welds to verify proper metallurgy using whatever methods OWNER / CONSULTANT may wish to utilise, but only in the presence of CONTRACTOR'S Inspector unless otherwise agreed. Some of these requirements have been identified in the minimum inspection requirements listed in this section.

11.4.4 Communication

Direct, timely communication between the CONTRACTOR'S Inspectors and OWNER'S / CONSULTANT'S auditing Inspectors is mandatory, especially in notification points and in the event of problems, OWNER / CONSULTANT shall be advised in a timely manner of all situations where changes or compromises in specifications are considered or where non-conformances are being encountered. Suggested format for inspection request is enclosed with this section. The CONTRACTOR shall give advance notice of fifteen (15) days for all overseas travel and seven (7) days for travel inside India.

11.5 QA/QC REQUIREMENTS

11.5.1 Inspection plan

Inspection plans with detailed instructions for the Inspector's guidance shall be provided for each item. The CONTRACTOR shall prepare a list of all relevant major equipment / systems, prepare quality plans for these equipment / systems, covering all the minimum inspection requirements stipulated in this specification and any additional technical requirements. The CONTRACTOR'S Procurement Inspection function will begin with the Letter of Award (LOA) of the purchase order and conclude when the Inspector (including inspection by client's

inspector wherever applicable) has duly released the equipment in the SUB-CONTRACTOR'S shop.

11.5.2 Inspection office

a) The CONTRACTOR shall identify the key inspection office located at its engineering and construction office. All inspection assignments, inspection instructions, after placement of the purchase order shall be covered from this designated office.

b) One individual in the CONTRACTOR'S key inspection office shall be designated to fill the function outlined in 12.5.3 and must report to the CONTRACTOR'S Manager for Inspection. Additional staff may be added as necessary, provided they are under the supervision of the individual designated. This individual will hereafter be referred to as the "Quality Control Project Inspector (QCPI)'.

c) For technical problems arising during manufacturing, after purchase orders are placed, the QCPI is responsible for clearing such technical problems with CONTRACTOR'S Engineering Department and/or OWNER / CONSULTANT. All purchase orders shall have a clause requiring the Sub-CONTRACTOR to submit all questions of a technical nature concurrently to the QCPI and OWNER / CONSULTANT representative in writing via fax or letter for resolution. The QCPI will be responsible for obtaining replies from CONTRACTOR'S Engineering Department, documenting the response to the SUB-CONTRACTOR and making distribution. The assigned QCPI shall be on distribution list for all other correspondence. When technical requests arise from rejection made by the CONTRACTOR'S source Inspector, the source Inspector's rejection report must be attached to the Sub-CONTRACTOR'S request for engineering evaluation.

11.5.3 Inspection Co-ordination and Responsibility

12.5.3.1 The QCPI shall have the overall coordination responsibility for inspection activities. The QCPI's responsibilities shall include, but not be limited to the following:

a) Issue assignments for source inspection

b) Issue specific inspection instructions when required to the assigned source inspector

c) Indicate the required type of report forms

d) Coordinate and respond to questions of a technical nature

e) Monitor inspection reports to determine if inspections are being performed as per written instructions

f) Forward all related order correspondence to the assigned source Inspector

g) Receive inspection reports from the source Inspector and make distribution as required

h) Ensure that comprehensive files are maintained for each job

11.5.4 Inspectors' qualifications

The CONTRACTOR shall submit with their QA/QC Manual resumes of CONTRACTOR'S inspectors detailing their experience, education and qualifications for OWNER / CONSULTANTs review / approval. The Inspectors shall have sufficient prior experience and qualifications for the equipment assigned.

11.5.5 Inspector's responsibilities

After receiving the assignment from the QCPI, the source Inspector shall review the order, conduct a pre-inspection meeting (when instructed), perform the inspections outlined, maintain field file in an organised manner and report the results to the key office and OWNER / CONSULTANT. The following is a more detailed, but not inclusive, list of what OWNER / CONSULTANT typically expects from the CONTRACTOR'S QCPI:

11.5.5.1 Pre-fabrication meeting - The CONTRACTOR'S Inspector shall conduct a pre-fabrication meeting with the SUB-CONTRACTOR prior to start of fabrication. The discussion shall include, but not be limited to a review of the following items:

a) Purchase order requirements with emphasis on any special requirements (technical and quality)

b) Specification and Code requirements

c) Inspection Agency for ASME Code Requirements/IBR requirements

d) SUB-CONTRACTOR'S Quality Control Programs

e) Fabrication Schedule

f) Critical Component or Sub-CONTRACTOR Fabrication

g) Major SUB-CONTRACTORS

h) Welding Procedure Specification (WPS), Procedure Qualification Record (PQR) and Welder Performance Records (WPR).

i) Special Welding Procedure Requirements

j) Qualification of Non-Destructive Testing Personnel

k) Non-Destructive Examination Requirements

l) Heat Treatment Requirements

m) Testing - Hydrostatic and Pneumatic

n) MANUFACTURER'S Data Reports

o) Preservation, Packing and Shipping

p) Extent of OWNER/CONSULTANT/CONTRACTOR Inspection

q) Witness Points and Hold Points and Notice requirements.

11.5.5.2 Initial inspection visit:

The Inspector shall perform as a minimum, the following inspection activities prior to start of fabrication:

a) Review fabrication schedule to ensure required Quality Control examinations and other intermediate tests have been included

b) Establish approval of major SUB-CONTRACTORS

c) Verify that Welding Procedures and Procedure Qualifications have been approved

d) Verify that all welders assigned to the job are qualified

e) Review Mill Test Reports to verify materials meet specifications

f) Review SUB-CONTRACTOR'S Examination and Inspection Plan

g) Review SUB-CONTRACTOR'S procedure for identifying and transferring material markings

h) Make a visual examination of major materials, verify SUB-CONTRACTOR'S examination of all materials, and verify proper storage facilities (environment and security).

11.5.5.3 Progressive inspection visits:

The following minimum activities, where applicable, shall be executed and reported upon by the Inspector:

a) Monitor on a random basis the transfer of material marking throughout the fabrication

b) Initial and random inspection of edge preparation, root gap and fit up for all vessel and fabricated machinery components

c) Initial and random witnessing of production welding to verify approved procedures, qualified welders and proper techniques are being used

d) Ensure that preheat requirements are followed

e) Ensure that welding materials are being properly controlled

f) Inspect major weld seams, nozzle and attachment welds, overlay welding and any weld repairs

g) Perform random check of back gouging of pressure retaining welds

h) Inspect critical/major materials from sub SUB-CONTRACTORS

i) Check nozzles / main ways for size, rating and extension

j) Check dimensions and workmanship of internal tubing, coils and components

k) Examine gaskets and bolting against specifications

l) Check location and attachment welds for support clips, lugs, brackets and saddles

m) Make final visual inspection for quality of work and for damage

n) Make complete dimensional inspection

o) Verify post weld heat treatment meets specifications

p) Witness all hydrostatic and pneumatic testing.

q) Witness routine and special testing as may be outlined in project specifications or data sheets for Electrical and Instrumentation

r) Assure electrical and instrument function and operational checks have been performed as per project specifications.

11.5.5.4 Non-destructive Examination (NDE) - The Inspector shall perform as a minimum the following NDE activities during progressive inspections:

a) Radiographic test (RT)

i) Review SUB-CONTRACTOR'S radiography procedures for approval.

ii) Review all radiographs progressively through out fabrication.

iii) Evaluate for acceptable film quality and weld quality.

b) Ultrasonic test (UT)

i) Review SUB-CONTRACTOR'S procedures and Inspector qualifications

ii) Witness at least 25% Ultrasonic examinations

iii) Review certified results.

c) Magnetic particle inspection (MPI)

i) Review SUB-CONTRACTOR'S procedures and Inspector qualifications

ii) Witness the initial MPE examinations and 10% minimum of all MPE examinations, as well as all examinations after repair.

d) Liquid penetrant (LPI)

i) Same as for MPI

e) Hardness testing - production welds

i) Review procedure and witness initial tests

ii) Verify 10% of hardness values during progressive inspections

iii) Review all hardness readings for acceptance as per specifications and require certified results.

11.5.5.5 Shipping

a) Verify that all shipping requirements related to cleaning, dry out, surface preparations are met.

b) Verify that pressure equipment is appropriately code stamped and all "MANUFACTURER'S Certified Data Reports" are complete and properly signed

c) Verify required documentation for acceptance and record is complete.

11.6 INSPECTION REPORTS

11.6.1 Inspection reports for interim inspection visits shall be consecutively numbered and identify non-conformance and exceptions found/ corrected at that time. Final checklists should indicate all items inspected during interim inspections.

11.6.2 Inspection rejection reports shall be by telefax to the key office and OWNER/CONSULTANT when the SUB-CONTRACTOR'S proposed resolution deviates from order specifications, or would require repairing.

11.6.3 Final inspection reports shall be by check-off for all major equipment and bulk piping components. The check-off indicates the inspections were performed and would be covered on an interim inspection report.

11.6.4 Inspection release certificate shall be issued by the assigned Inspector only after all the requirements of the purchase order is met and the rectifications mentioned in the inspection report/s are satisfactorily completed. The inspection release certificate issued by the inspector is an authorisation to the sub-CONTRACTOR to present final billing to the CONTRACTOR. A copy of the release note shall be attached to the packing list to serve as notification to the job site about the inspection approval.

11.7 CONSTRUCTION

11.7.1 OWNER / CONSULTANT'S Participation

OWNER/CONSULTANT will have a Quality Assurance/Quality Control organisation to audit the CONTRACTOR'S QC effort. The assigned OWNER / CONSULTANT'S personnel will provide assurance to OWNER / CONSULTANT'S management that the Work meets specifications, however, the basic inspection and quality control responsibility is vested with CONTRACTOR. The PURCHASER/CONSULTANT will have access to the CONTRACTOR'S/Sub-CONTRACTOR'S/site premises/site office/site stores to check the quality of materials at any point of time during construction/commissioning stage.

OWNER / CONSULTANT'S auditing may include spot checks of materials including their testing in the field to ensure that inadvertent substitutions have not been made in the fabrication shops or mixing point or in field ordered materials. OWNER / CONSULTANT'S auditing shall also include testing of concrete, cement mortar, etc.

11.7.2 Communication

Direct, informal communication between the CONTRACTOR'S field Inspectors and OWNER / CONSULTANT'S auditing Inspectors is mandatory. Further OWNER / CONSULTANT shall be advised when major problems related to design or fabrication is uncovered.

CONTRACTOR'S in-progress inspection report follow up/punch out sheets, records of radiograph inspections, etc. shall be available to OWNER / CONSULTANT'S auditing Inspectors during the course of the Work.

At the end of the Work, CONTRACTOR'S standard inspection reports, check off sheets, radiographs, master copy of loop diagrams, electrical test data sheets, etc. shall be handed over to OWNER / CONSULTANT in an organised, agreed upon format. CONTRACTOR shall verify that all of the required documentation of the equipment has been received and placed in the equipment files. The CONTRACTOR is responsible for obtaining any outstanding documentation from the suppliers.

11.7.3 Construction QA/QC Requirements

11.7.3.1 It is the OWNER / CONSULTANT'S intent that the CONTRACTOR (and any Sub-CONTRACTORs employed) provide sufficient qualified Inspectors to assure that facilities are installed in accordance with the plans and OWNER / CONSULTANT'S specifications and intents and that the level of quality called for therein is obtained. Prior to finalisation of Contract award, the CONTRACTOR shall submit a detailed Field Quality Assurance Program for OWNER / CONSULTANT'S review. The program must be tailored to show compatibility with engineering design, compliance with applicable codes, specifications, standards, drawings, support documents, governmental regulations and this document.

11.7.3.2 For the construction period, the CONTRACTOR shall provide a full time, dedicated Quality Assurance Organisation. As a minimum the CONTRACTOR'S Construction Quality Assurance Program shall include the following:

a) Quality control program

Details of the program to be implemented, its use, control and identification of hold and inspection points shall be submitted to OWNER / CONSULTANT Representative for approval.

b) Organisation, authority and responsibility

Delineate the CONTRACTOR'S Quality Control organisation, responsibility and authority for performance of QC functions by discipline.

c) Inspector qualifications

The CONTRACTOR'S Construction Assurance organisation will consist of people with qualifications similar to the requirements outlined in the Procurement clause 12.5.4. The field QA organisation will be a full time organisation, with no other construction related duties. As with engineering and procurement, OWNER / CONSULTANT will review Construction QA staffing plans.

d) Document control

This system shall ensure that the latest issues of drawings, specifications, standards, and supporting documents are being used for fabrication and installation and that field changes are incorporated into final "As Built" drawings.

e) Receiving control

Procedure for receipt of purchased items delivered at the job site initial identification, qualification and review of supporting documents shall be described. In addition the procedure shall ensure that spare parts supplied by CONTRACTOR are properly labeled by the Sub-CONTRACTOR with description and purchase order number.

f) Receiving inspection

This shall establish the method of notification and inspection to be performed on received items to verify the condition and conformance to the appropriate acceptance standards reference or contained in the purchased documents.

g) CONTRACTOR/SUB-CONTRACTOR non-conformance

This shall provide for documentation and disposition of non-conformances resulting from CONTRACTOR/Sub-CONTRACTOR errors and shipping damage to material, fabrications and equipment received at the job site. It also provides for interface with

the design engineer when the non-conformance does not comply with the engineering design.

h) Storage and Maintenance of Materials and Equipment

This system shall describe the controls and inspection performed to show that the handling, storage and preservation of materials and equipment are performed to prevent damage or harmful deterioration to the materials and equipment received at the job site.

11.7.4 Inspection, Examination and Testing of On-Site Fabrication and Installation

11.7.4.1 This section shall establish the responsibility for performance and recording of examinations, tests and inspections as required by the engineering design.

11.7.4.2 Inspection of work in progress to determine conformance with drawings, specification, any field definition agreed to shall be included. Some of the inspections are listed below:

a) Performing random dimensional check and visual material verification of field fabricated pressure equipment and of any piping, vessel, electrical and instrument installation.

b) Internal checking of all vessels for:

i. Cleanliness

ii. Proper internals. This involves opening the vessel manways and removal of internals.

c) Witness testing and installation of items such as:

i. Welder testing and qualifications and maintenance of records thereof

ii. Weld examination and maintenance of records thereof in accordance with applicable codes and specifications

iii. Monitor selected field post weld heat treating

iv. Hydro tests, hydro-pneumatic tests, pneumatic tests, lead and service tests

v. Electrical inspection and testing which includes witnessing of Hipot testing, megger testing, AC power factor testing etc.

vi. Instrument model/name plate data verification

vii. Instrument installation check out

viii. Instrument loop checks

ix. Mechanical and electrical equipment bearing flushing and filling

x. Mechanical equipment cold alignment checks and rotation verification

xi. Witness verification that piping loads on machinery equipment meet specifications

xii. Pump installation check out

xiii. Coating and lining tests

xiv. Surface preparation, paint application and thickness verification.

xv. Ensure that the refractory material used for the lining, the process of lining, curing and final testing of the lining meets the boiler MANUFACTURER'S recommended specification requirements.

d) Final checking of installed facilities, completing check out forms, and signing on behalf of the CONTRACTOR documents attesting completion of the Work, as called for in the Contract documents.

e) Monitoring or inspecting the work of Sub-CONTRACTORs This requires pre-award and pre-field start meetings for major subcontracts with CONTRACTOR'S/SUB-CONTRACTOR/ OWNER/ CONSULTANT participation to establish quality (QA/QC) requirements and how they will be met. Typical areas/ disciplines may include, but not be limited to the following:

i. Foundations
ii. Field fabricated vessel
iii. Tanks
iv. Piping
v. Electrical
vi. Instrumentation
vii. Insulation
viii. Painting

f) Execute CONTRACTOR'S standard quality tracking program

g) Perform final check of installed facilities with OWNER / CONSULTANT'S representatives to verify completeness and accuracy in accordance with P and ID's / Engineering Flow Diagrams and other scope documents as may be required.

h) See that proper protective procedures are employed and maintained for early installed equipment and equipment stored in offsite staging areas.

11.7.5 Non-Conformances of On-Site Fabrication and Installation

This section shall control on-site fabrication and installation items, which do not conform to the engineering design or for which the engineering design is incorrect.

11.7.6 Calibration of Test Equipment

Calibration of tools, gauges, instruments and other measuring and testing devices shall be included.

11.7.7 QA Personnel Qualification and Certification

The qualification required of QA/QC personnel shall be outlined.

11.7.8 Quality Assurance/Quality Control Records

The system which shall ensure that all quality assurance records are maintained for ready reference and shall also provide for the accumulation, evaluation, retention and distribution of QA/QC records.

11.7.9 Interface with Statutory Authorities

Participation of statutory authorities, which require testing, witnessing and inspection, shall be provided.

11.7.10 Audits

Requirements for audits to verify implementation of the QA/QC program on a regular basis shall be included.

11.7.11 Mechanical completion acceptance

CONTRACTOR shall perform final inspection of the Work in accordance with the Contract documents. Periodic reporting of QA/QC activities (once a month or earlier) as required shall be submitted.

11.7.12 Quality Assurance for Electrical, Instrumentation and Control System

BIDDER shall furnish a detailed Quality Assurance/Quality Control Plan (QA/QC) for each Electrical, Instrument/ system covered under this specification for PURCHASER/

CONSULTANT'S review and approval. The QAP shall be subject to PURCHASER's approval.

11.8 INSPECTION REQUEST FORM

From:

To:

Attn: Mr.

Dear Sirs,

Items detailed below are ready for inspection. Please arrange inspection and confirm the date of inspection:

1. OWNER / CONSULTANT **:**
2. Project **:**
3. OWNER'S order reference **:**
4. CONSULTANT'S reference **:**
5. Sub-order reference **:**
6. Sub-CONTRACTOR'S name and
   Full address **:**
7. Place of Inspection
   (Full address) **:**
8. Contact person, telephone
   no. and fax no. **:**
9. Description of item and Quantity **:**
10. Nature of inspection required **:**
11. Proposed date(s) :
12. Weekly holiday **:**

We confirm that the items have been fully inspected/tested by us at all stages, of inspection as per quality plan, and all material test certificates, QC records., test Reports, calibration records of measuring/testing instruments with traceability to National Level* are available with us.

Thanking you and awaiting your confirmation,

Yours faithfully,

cc: Sub-CONTRACTOR

NOTE: 1. Following clear notice periods (date of receipt to date of inspection) are required:

a) Local Inspection (within India) - 7 days

b) Overseas Inspection (Outside India) - 21 days

* The master instruments used for calibration of instruments/gauges used for measurement/testing by the firm or by any calibrating agency should have valid calibration certificate with reference to the master instrument at National Physical Laboratory, New Delhi (India) or any other similar International Laboratory/Organization

This specification shall be followed by the vendor in addition to the requirements specified in specification no. TCE.M4-904 titled "shop inspection and test procedure".

1.0 QUALITY ASSURANCE/QUALITY CONTROL PROGRAMME

1.1 Only critical inspection stages have been indicated in the enclosed "Minimum Inspection Requirements" documents. This is however, not intended to form a comprehensive programme as it is the vendor's responsibility to draw up and implement such programme duly approved by the purchaser. The detailed Quality Plans for manufacturing and field activities should be drawn up by the bidders, separately in the format attached and shall be submitted to purchaser at the time of submitting his offer.

2.0 All the sub-vendors proposed by the vendor for procurement of major bought out item including castings, forgings, semi-finished and finished components/equipment shall be subject to Purchaser's review/clearance for systems and packages.

3.0 A consolidated list of all major equipment including bought outs like pumps, valves, fans etc. shall be submitted by the vendor along with the offer for purchaser's review/comments.

4.0 The purchaser reserves the right to carry out quality audit and quality surveillance of the systems and procedures of the vendor's or their sub-vendor's quality management and control activities. The vendor shall provide all necessary assistance to enable the purchaser to carry out such audit & surveillance.

5.0 The vendor shall undertake an inspection and testing programme during manufacture in his works and that of his sub-contractor to ensure the mechanical accuracy of components, compliance with drawings, conformance to functional and performance requirements, identification and acceptability of all materials, parts and equipment. He shall carry out all tests/inspections required to establish that the items/equipment conform to requirements of contract specification and the relevant codes/standards specified therein, in addition to carrying out tests as per the approved Quality Plan.

6.0 Vendor shall use calibrated instruments for testing, with traceability to national /international levels. If not the Purchaser/Consultant will not witness the tests till the same is organised.

Only latest edition of the codes/standards and specifications shall be used for materials and testing. The latest edition is reckoned with the date of contract awarded

7.0 Copies of all the test certificates/calibration reports/internal inspection reports shall be furnished by the vendor during the relevant inspection stages to the purchaser/ consultant.

8.0 The bidder shall furnish his fully documented, operational manual on the quality assurance programme (QAP) indicating the following minimum details:

a) Organisation chart for the following quality inspection activities:
   i) Purchasing of raw materials and bought out items
   ii) Engineering and design
   iii) Manufacturing

b) Applicable quality standards and procedures for material, design and manufacture including non-destructive testing.

c) QAP for design engineering and documentation control system

d) The inspection and tests programme indicating details of inspections/tests to be carried out during various manufacturing stages indicating acceptance norms, extent of inspection by the vendor as given in the enclosed format. Purchaser will review and approve the programme indicating his 'HOLD' points. These stages will be witnessed by the purchaser's engineer/authorised representative.

e) Procurement of control system for equipment or services purchased outside including approval of sub-suppliers/sub-contractors and surveillance on sub-suppliers/sub-contractors.

f) Material control to ensure that only the approved materials are used in the manufacture.

g) Details of final stages of inspection and tests at shops.

h) Corrective actions on items or systems containing significant conditions adverse to quality.

i) Control and inspection of material handling, storage, packing and shipping.

j) Quality records/test certificates/calibration reports of testing & measuring instruments with traceability to National Standards, to provide objective evidence that all quality assurance requirements have been met.

k) Quality assurance based on feedback received from the previous operating installations.

QUALITY PLAN

MAIN VENDOR		MAIN ITEM		Q.P. NO.	
SUB - VENDOR		SUB - ITEM		Q.P.DATE	
CLIENT	PROJECT	P.O.NO. & DT.		TCE REF.	

SR. NO.	COMPONENT /	CHARACTERISTICS CHECKED	TYPE / METHOD OF CHECK	EXTENT	REF. DOCUMENT / ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY S	AGENCY M	AGENCY T	AGENCY C	H	REMARKS / HOLD POINTS (H)
1	2	3	4	5	6	7	8				H	9

A. STATUTORY REQUIREMENTS SHALL BE COMPLIED WITH BY THE VENDOR.
B. MATERIAL TESTS OF SAMPLES DRAWN BY TCE SHALL BE WITNESSED BY TCE.
C. FOR STAGES WITNESSED / DOCUMENTS REVIEWED BY TCE, COPIES OF RELEVANT DOCUMENTS SHALL BE FURNISHED TO TCE.
D. TCE'S IDENTIFICATION STAMP ON MATERIALS SHALL BE PRESERVED / GOT TRANSFERRED BY TCE AT APPROPRIATE STAGES.
E. THE EXTENT INDICATED IN COLUMN 5 IS IN VENDOR'S SCOPE. TCE / CLIENT MAY INSPECT AS PER THIS COLUMN OR RANDOM SAMPLES.
F. COLUMN 6 SHALL BE AS PER TCE / CLIENT APPROVED DRAWINGS / DATA SHEETS / SPECIFICATIONS WHEREVER APPLICABLE.
G. INSTRUMENTS FOR LEAK TESTS & PERFORMANCE TESTS SHALL HAVE VALID CALIBRATION CERT. WITH TRACEABILITY TO NATIONAL LEVEL.
H. LEGENDS : S - SUB - VENDOR, M - MAIN VENDOR, T- TCE, C - TCE'S CLIENT, 1 - WITNESS, 2 - DOCUMENTS REVIEW, H - HOLD POINT.

S	SIGN.	
	NAME	
M	SIGN.	
	NAME	
T	SIGN.	
	NAME	
C	SIGN.	
	NAME	

TCE FORM NO. 104 R1

SHEET OF

15.0 **PAINTING**

15.1 GENERAL

15.1.1 This section defines the technical requirements for surface preparation selection and application of paints on equipment, vessels, machinery, piping, ducts etc. However, manufacturers shall follow their standard procedures for painting their equipment. The Bidder shall submit a detailed painting procedure for approval of OWNER / OWNER'S representative after the award of contract.

15.1.2 The following surface and material shall require painting:

a) All un-insulated carbon steel and alloy steel equipment like columns, vessels, drums, storage tanks, heat exchangers etc.

b) All un-insulated carbon steel and low alloy piping, fitting and valves (including painting of identification marks)

c) All pipe structural steel supports, walkways, platforms, hand rails, ladders etc.

15.1.3 The following surfaces and material shall not require painting:

a) Non-ferrous materials

b) Austenitic stainless steel

c) Plastic and / or plastic coated materials

d) Insulated surface of equipment and pipes except colour coating wherever required

e) Painted equipment like blowers, pumps, valves, etc., with finishing coats in good condition and with matching colour-code

15.2 CODES AND STANDARDS

15.2.1 Painting of equipment shall be carried out as per the specifications indicated below and shall conform to the relevant IS specification for the material and workmanship.

15.2.2 The following Indian Standards may be referred to carrying out the painting job.

IS : 5	:	Colours for ready mixed paints and enamels
IS : 1303	:	Glossary of terms relating to paints
IS : 2379	:	Colour code for identification of pipelines.
IS : 1477	:	Code of practice for painting of ferrous metals in buildings (Parts I & II)
IS: 2524	:	Code of practice for painting of non-ferrous metals in buildings (Parts I & II)
IS : 2395	:	Code of practice for finishing of concrete, masonry and plaster surfaces (Parts I and II)
IS : 2338	:	Code of practice for finishing of wood and wood based materials (Parts I & II)

IS : 158	:	Ready mixed paint, brushing, bituminous, black, lead free, acid, alkali, water and heat resisting
IS : 2074	:	Ready mixed paint, air drying, red oxide zinc chrome, and priming.
IS : 104	:	Ready mixed paint, brushing, zinc chrome, priming
IS : 2932	:	Enamel, synthetic, exterior (a) undercoating (b) Finishing.
SIS : 55900	:	Swedish standard for blasting
IS: 14506	:	Epoxy Red oxide Zinc Phosphate Wieldable Primer, Two Component Specification
IS: 14209	:	Epoxy Enamel, Two Component, Glossy Specification
IS: 14589	:	Zinc priming paint, Epoxy based, Two-pack-specification

15.3 SURFACE PREPARATION

The surface shall be prepared in a manner suitable for coatings. Chemical de-rusters or rust converters shall not be applied. Acid cleaning is subject to approval of PURCHASER / PURCHASER'S representative.

15.2.1 Blasting

The surface of the part / component shall be blasted before the coating material is applied.

Unless otherwise specified in the documents, the surface shall satisfy the following requirements after blasting:

Primer paint shall be zinc silicate of approved brand. Dry film thickness of each primer coat shall be 15 – 25 μm

15.2.2 Manual Rust Removal

Manual rust removal shall be allowed for welded zones and for touching up installed components.

15.2.3 Cleaning

Removal of impurity

a) Impurity	Removal
b) Dust, loose deposits	Vacuum-cleaning, brushing
c) Adhesive deposits	Power brushing
d) Oils, greasy impurities	Wet blasting, use of detergent additives by agreement
e) Salt deposits	Rinsing
f) Markings (e.g., felt tip pen)	Organic solvents to manufacturer's specifications e.g., Trichloro- trifluoro -ethane and solvents containing acetone (renew solvent and rag frequently).

15.4 Mechanical

15.4.1 General

15.4.1.1 Application Conditions

The primer shall be applied to properly prepared surfaces only. The specifications of the coating material manufacturers shall be observed. The minimum temperature shall be $+5^0$C and the relative humidity shall not exceed 80%. The temperature of the work piece shall be at least 3 ^{0}C above dew point.

15.4.1.2 Application Procedure

The primer shall be applied by means of brush or by spray. The topcoats shall be applied by means of brush, roller or by spray.

At points where coating application is interrupted, the individual layers shall be adequately stepped to ensure proper layer sequence when coating operations are resumed.

15.4.1.3 Touching Up

Before each layer is applied, previous coating shall be touched up where necessary by way of rust removal and cleaning, according coating MANUFACTURER'S specifications. The final top coat shall be reapplied completely, if required.

15.4.1.4 Uncoated Surfaces

Moving parts of machines (e.g., stems, shafts, sliding and locating bearings), nameplates, instruments and sealing surface shall not be coated. Welds shall be left free of coating up to a distance of 30 mm on each side of the weld edge until erection and weld examinations, if any, have been completed.

15.4.1.5 Bond Strength

The pull-off stress determined using the pull-off test method for adhesion shall be not less than 1.5 N/mm^2, according to ISO 4624.

15.4.1.6 Surface Conditions of Coating Surfaces

The coating surface shall have a uniform film thickness, shade and gloss and shall be free from inclusions, sags and wrinkles.

15.4.1.7 Coating Systems

15.4.1.7.1 General Requirements for Coating Systems

Coating materials according to SSPC, BS 5493 or DIN 55 928 shall be used. Intermediate coats are to be pigmented with micaceous iron oxide. The materials shall be matched with each other so that they are compatible. Coatings deviating from this specification shall be subject to approval. Standards of surface preparation and painting shall give a time to first maintenance of 10 years.

The colour and gloss of topcoats shall be in accordance with sub-clause suggested colour codes for painting (Sub-clause 15.10).

15.4.1.7.2 Standard Coating System (External Coatings)

a) Steel Structures

i) All steel structures shall receive two primer coats and two finish coats of painting. First coat of primer shall be given in shop after fabrication before dispatch to erection site after surface preparation as described below. The second coat of primer shall be applied after erection and final alignment of the erected structures. Two finish coats shall also be applied after erection.

ii) Steel surface which is to painted shall be cleaned of dust and grease and the heavier layers of rust shall be removed by chipping prior to actual surface

preparation. The surface shall be abrasive blasted to Sa-2½ finish as per SIS05-5900. Primer paint shall be zinc silicate of approved brand. Dry film thickness of each primer coat shall be 40 microns.

iii) Finish paint shall be 2 coats of High built epoxy finish of approved brand. Dry film thickness of each finish coat shall be 90 microns. The undercoat and finish coat shall be of different tint to distinguish the same from finish paint. The total dry film thickness shall be 300 microns. All paints shall be of approved brand and shade as per the OWNER'S requirement.

iv) Joints to be site welded shall have no paint applied within 100 mm of welding zone. Similarly where Friction grip fasteners are to be used no painting shall be provided. On completion of the joint the surfaces shall receive the paint as specified.

v) Surfaces inaccessible after assembly shall receive two coats of primer prior to assembly. Surfaces inaccessible after erection including top surfaces of floor beams supporting gratings or chequered plate shall receive one additional coat of finish paint over and above number of coats specified before erection. Portion of steel member embedded / to be encased in concrete shall not be painted.

b) Galvanised iron and steel requiring paint finish at site

i) Surface Treatment

Mechanical cleaning from contaminants by means of washing or steam jetting and sweep blasting with fine sand or etching (T-Wash).

ii) Touch-up mechanical damages:

De rusting St 3 and application of high build epoxy primer DFT 80 μm.

iii) Finish coating:

Analogous to standard painting scheme

15.4.1.7.3 Painting of indoor components such as valves, pumps, motors, electrical parts, tanks etc.

a) At works

Surface preparation:

Blasting according to SIS 055900: grade SA 2 ½. Depending on production flow, a weldable, inorganic ethyl zinc silicate shop primer dry film thickness 15 – 25 μm, may be used.

Prime coat:

Two (2) layers of zinc phosphate epoxy, total dry film thickness 75 μm.

b) At site

Thorough cleaning to remove oil, grease, dirt and any other contaminants. De-rusting of all mechanical damages according to SIS 055900 Grade ST3. Touch up with dry film thickness 50 μm.

Finish coat:

Application of two finishing coats of Chlorinated rubber paint in approved shades at 30-40 microns DFT each coat in approved shades.

Remarks:

Equipment coated with a standard application system can be accepted if the quality of this application system is corresponding with the quality of the above mentioned system.

15.4.1.7.4 Painting of Outdoors equipment (external surfaces) such as piping, valves, pumps, motors, electrical parts, tanks etc.

Weather exposure, weather resistance, temperature up to 120^0C

Surface Preparation:

Blasting according to SIS 055900: grade Sa 2 ½. Depending on production flow, a weldable, inorganic ethyl zinc silicate shop primer dry film thickness 15-25 μm, may be used.

Prime Coat:

Two (2) layers of zinc phosphate epoxy, total dry film thickness 75 μm.

Intermediate Coat:

One (1) layer 2 pack high build epoxy polyamide Mio, dry film thickness 100 μm.

Finish Coat:

Application of two finishing coats of Chlorinated rubber paint in approved shades at 50 microns DFT each coat in approved shades.

15.4.1.7.5 Special Coating System (External Coatings)

Parts exposed to temperatures above 120^0C, up to 200^0C, not insulated

a) At works

Surface Preparation:

Blasting according standard SIS 55900 Grade Sa $2^1/2$ and ISO 8501-1: 1988. Depending on production flow, a weldable, inorganic ethyl zinc silicate shop primer, dry film thickness 15-25 μm, may be used

Prime coat

Inorganic ethyl zinc silicate, dry film thickness 75 μm.

b) At site

Pre-treatment:

De-rusting of all mechanical damages, according to ISO 8501-1: 1989, grade St 3 Touch-up with 1 pack inorganic ethyl zinc silicate, dry film thickness 50 μm.

Removal of all decontaminants from prime coat.

Intermediate Coat:

1 pack silicon acrylic, dry film thickness 35 μm.

Final coat

1 pack silicon acrylic, dry film thickness as 35 μm.

Total system dry film thickness 145 μm.

Final coat according to colour code.

Parts exposed to temperatures above 200^0C, up to 400^0C, not insulated

a) At works

Surface Preparation:

Blasting according to ISO 8501-1: 1988 grade Sa 21/2. Depending on production flow, a weldable, inorganic ethyl zinc silicate shop primer, dry film 15-25 μm, shall be used

Prime coat:

Inorganic ethyl zinc silicate, dry film of thickness 75 μm.

b) At site

Pre-treatment:

De-rusting of all mechanical damages, according to standard Sa 21/2 to ISO 8501-1: 1988. Touch-up with coating system according to MANUFACTURER'S recommendations.

Insulated Parts, continuously exposed to condensing water or parts exposed to temperatures

For parts that are provided with insulation on site.

a) Insulated parts, exposed to condensing water

At works

Surface Preparations:

Blasting according to standard Sa $2^1/2$ to ISO 8501-1: 1988. Depending on production flow, a weldable, inorganic ethyl zinc silicate shop primer, dry film thickness 15-25 μm shall be used.

Prime coat:

Inorganic ethyl zinc silicate, dry film thickness 75μm.

b) Insulated parts exposed to temperatures

Parts, exposed to temperatures up to $<400^0$C at works

Surface Preparation:

Blasting according to standard Sa $2^1/2$ to ISO 8501-1: 1988. Depending on production flow, a weldable, inorganic ethyl zinc silicate shop primer, dry film thickness 15-25 μm shall be used.

Parts, exposed to temperatures above 400^0C at works (Steam pipes, pressure tubes and parts for the HRSG, such as heating surfaces, heaters and super heaters reheaters, etc.)

Surface preparation:

Blasting according standard Sa 21/2 to ISO 8501-1: 1988.

Temporary primer:

Varnish.

c) Intermittent exposure due to condensing water / chemicals (Indoors)

At works

Surface Preparation:

Blasting according to standard Sa 21/2 to ISO 8501-1: 1988. Depending on production flow, a weldable, inorganic ethyl zinc silicate shop primer, dry film thickness 15-25 μm may be used.

Prime Coat:

Two layers of zinc phosphate epoxy primer total dry film thickness greater than or equal to 75 μm.

At site

Pre-treatment:

De-rusting of all mechanical damages, according standard Sa 3 to ISO 8501-1: 1988, touch-up with 2 pack high build epoxy with volume solid content of more than 85%, 75 μm.

Intermediate Coat:

2 pack high build epoxy, dry film thickness 80 μm.

Finish coat:

2 pack epoxy according to colour appearance, dry film thickness of 50 μm.

Total system dry film thickness 205 μm.

When exposed to weathering, weather resistance finish coat shall be applied.

d) Water exposure

Surfaces permanently or predominantly in contact with water.

At site / works

Pre-treatment:

Removal of all welding pearls.

Blasting according standard Sa 3 to ISO 8501-1: 1988.

Coat:

4 coats 2 pack coal-tar-epoxy, dry film thickness 125 μm each. Total system dry film thickness 500 μm.Touch-up after erection as required.

15.4.1.7.6 Buried / underground piping system (except for sea water piping)

Where pipelines are buried, underground protection shall be provided for the piping system as indicated in any one of the methods given below:

Coal tar primer, coal tar enamel, inner wrap of fibre glass, final outer wrap of enamel impregnated fibre glass. Total thickness of coating shall not be less than 4.0 mm.

With anti-corrosive tape of minimum 4 mm thick conforming to IS-10221 and AWWA C 203-93

Pipe surfaces shall be cleaned by shot or sand blasting before application

Tests to be carried out after application

Bond / Adhesion test

Holiday test

15.4.1.7.7 Internal coatings

Tanks (Internal Surfaces) as specified in relevant sections of specification

Industrial, deionised, demineralised and potable water up to 60^0C pH range: 4.5 – 9.5.

Blasting according to ISO 8501-1: 1988, grade Sa $2^1/2$.

Prime coat:

Two layers of zinc phosphate epoxy primer total DFT greater than or equal to 75 μm.

Pre-treatment:

De-rusting of all mechanical damages, according to standard Sa 3 to ISO 8501-1:1998, touch up with 2 pack high build epoxy with volume solid content of more than 85%, 75 μm.

Intermediate coat:

2 pack high build epoxy, dry film thickness 80 μm.

Finish coats:

2 pack solvent free epoxy paint dry film thickness 150 μm per coat.

In case of service or potable water tanks, the coating material selected shall not taint the water.

QA / QC procedure, including pinhole inspection, for shall be submitted for approval by Owner / Owner's Representative.

15.4.1.7.8 Rubber Lining of Pipes, Valves and Tanks as specified in relevant sections.

At works

Pre-treatment:

Blasting according standard $2^1/2$ to ISO 8501-1: 1988.

Rubber lining:

Hard rubber 5mm for DM water applications, thickness greater than or equal to 3 mm for others. In case of failure of rubber lining for both pipes and vessels, the rubber lining shall be replaced by COROCOAT

15.5 **Painting for Electrical Items**

15.5.1 All the steel work shall be thoroughly cleaned of rust, scale, oil, grease, dirt and scarf by pickling, emulsion cleaning, etc. The sheet steel shall be phosphated / oven dried and then painted with two coats of zinc rich primer paint. After application of the primer, two coats of finishing synthetic enamel paint shall be applied. The colour of the finishing coats inside shall be glossy white and exterior of the treated sheet steel shall be shade 631 of IS-5 / RAL 7032 for all switchboard/MCC/ Distribution boards, control panels, etc.

15.5.2 All electrical equipment shall be given tropical and fungicidal treatment and outdoor equipment shall be provided with rain hood to prevent entry of rain water into the equipment.

15.6 Painting for I & C equipment: Epoxy coating required for all I&C equipment.

15.7 Suggested Colour Codes for Painting

Sl. No.	Item / Service	Colour	IS–5	Colour (Band)	IS-5
1.	Structures, platforms, galleries, ladders and handrails.	Dark Admiralty Grey	632	-	-
2.	Boiler casing, ducting	Nut Brown	413	-	-
3.	Crane				
4.	Crane structure	Golden Yellow	356	Black	-
5.	Trolley and hook	Crimson	540	-	-
6.	Pump motors, compressors	Light Grey	631	-	-
7.	Tanks (without insulation and cladding)				

8.	Outdoor	Aluminium	-	-	-
9.	Indoor	Light Grey	631	-	-
10.	Vessels and all other proprietary equipment (without insulation and cladding)	Light Grey	631	-	-
11.	Switchgear	Light Grey	631	-	-
12.	Control and relay panels	Light Grey	631/ 7078 of IS1650	-	
13.	Turbines	Light Grey	631	-	-
14.	Generators and exciter	Light Grey	631	-	-
15.	Transformers	Aluminium	-	-	-
16.	Machinery guards	Signal red	537	-	-
17.	Piping (Without insulation and cladding)				
	a) Water System				
	i) Boiler feed	Sea Green	217	-	-
	ii) Condensate	Sea Green	217	Light Brown	410
	iii) DM Water	Sea Green	217	Light Orange	557
	iv) Soft Water	Sea Green	217	French Blue	166
	v) Bearing cooling water	Sea Green	217	French Blue	166
	vi) Potable and filtered water	Sea Green	217	French Blue	166
	vii) Service and clarified wate	Sea Green	217	French Blue	166
	viii) Cooling water	Sea Green	217	French Blue	166
	ix) Raw water	Sea Green	217	White	-
	b) Air system				
	i) Station air	Sky Blue	101	-	-
	ii) Control air	Sky Blue	101	White	-
	c) Oil system				
	i) Light oil (HSD)	Light Brown	410	French blue	166
	ii) Lubricating oil	Light Brown	410	Light grey	631

	iii) Transformer oil	Light Brown	410	Light Orange	557
	d) Gas system				
	i) Fuel gas (Re-gassified LNG)	Canary Yellow			
	ii) Carbon dioxide	Canary Yellow	309	Light grey	631
	iii) Hydrogen	Canary Yellow	309	Signal red	537
	e) Fire Services	Fire red	536	-	-
	f) Effluent pipes	Black	-	-	-
	g) Vacuum pipes	Sky Blue	101	Black	-
	h) Drainage	Black	-	-	-

NOTES

1. This colour code basically refers to IS: 2379 for piping with necessary modifications.
2. Where band colour is specified, same shall be provided at 10 metre intervals on long uninterrupted lines and also adjacent to valves and junctions

1.0 PACKING

1.1 All equipment and material shall be protected for ocean shipment, inland transport, and storage at the site, according to applicable National / International Standards and to the instructions given in this specification.

1.2 The PURCHASER/CONSULTANT may require inspecting and approving the packing before the items are despatched. However, the VENDOR/ CONTRACTOR shall be entirely responsible for ensuring that the packing is suitable for the mode of shipment and such inspection will not exonerate the VENDOR/CONTRACTOR from any loss or damage due to faulty packing.

1.3 The VENDOR/CONTRACTOR shall be responsible for any damage to the equipment and materials during transit due to improper and inadequate packing.

1.4 Any material found short upon opening the intact packing cases shall be supplied by the VENDOR/CONTRACTOR at no extra cost to the PURCHASER.

1.5 Only packages constructed out of sound material and of dimensions proportional to the size and weight of contents shall be used.

1.6 All packing cover and packing material shall become the property of the PURCHASER.

1.7 In the case of large and bulky equipment, the VENDOR/CONTRACTOR shall be responsible for ascertaining transport limitations and supply the equipment in the minimum number of components or sub-assemblies, within the framework of transport limitations.

1.8 For ocean transport, containers shall be used as far as possible. Dimensions of packages and kind of packaging must be chosen to fully utilise the size of containers.

1.9 All equipment shall be protected for the entire period of despatch, storage and erection, against corrosion, incidental damage due to vermin, sunlight, rain, high temperature, humid atmosphere, rough handling in transit and storage in open including possible delays in transit. Material and equipment shipped across the sea shall be packed to withstand without damage, the effects of saline atmosphere. All machined and plated parts shall be protected with anti-rust grease. Precautions shall be taken to protect shafts and journals where they rest on wooden or other supports likely to contain moisture. At such points, wrappings impregnated with anti-rust composition or vapour phase inhibitors shall be used. These shall have sufficient strength to resist chafing and indentation due to the movement, which is likely to occur in transit. The protective wrappings and impregnation shall last for a minimum period of three months or transport time whichever is more.

1.10 All openings in the equipment shall be tightly covered, plugged or capped to prevent foreign material from entering into the equipment.

1.11 The contents of the packages shall be sealed in thick polythene sheets. The inside walls of the packages shall be lined with waterproof material to protect the equipment from damage due to dust and moisture. Packing for sea transport shall be seaworthy in view of saline environment.

1.12 Adequate provision of skids or pallets shall be made to keep the packages above the ground drain water. Crates and other large containers should have drain holes in the bottom to prevent collection of water within the packing. This is especially important where the cargo itself is subjected to condensation (cargo sweat).

1.13 Silica gel or approved equivalent moisture absorbing material in small cotton bags shall be placed and tied at various points on the equipment, wherever necessary.

1.14 All cases shall be provided with suitable cut-outs, closed by bolted wooden planks to facilitate inspection by custom authorities. Waterproof transparent papers shall be provided at the cut-out locations to prevent water ingress into the casing through the cut-out.

1.15 The contents of the package shall be punched on non-corrosive metal plate and nailed to the package on a prominently visible place. If the number of items in the package is too many, a typed list in transparent waterproof bag shall be kept inside a galvanised sheet steel pocket nailed on to the outside of package at prominently visible location.

Copies of the packing list, in triplicate, shall be forwarded to the PURCHASER prior to despatch. All items of material shall be clearly marked for easy identification against the packing list.

1.16 Fragile materials shall be securely braced within the package or otherwise amply fastened and packed to prevent shifting or rattling. Soft non-hygroscopic packaging materials shall be placed between the hard packing materials and the fragile equipment. Articles, which do not completely fill the selected package/ container, must be cushioned, braced, fastened or blocked to prevent damage to the article itself or destruction of the package. Inner bracing or blocking must be such that the content's weight is distributed over interior surfaces rather than concentrated at one or two points.

1.17 Components containing glass shall be carefully covered with shock absorbing protective material such as expanded polystyrene ('Thermo Cole').

1.18 All flanges, etc., which are prone to scratching shall be provided with either metal or wooden or plastic blanks bolted in place. Metal blanks should have a minimum thickness of 3 mm and wooden blanks should be made from two layers of wood, each of 10 mm thickness, nailed together with the grain of each layer located at right angles to one another.

1.19 Loose material, e.g. bolts, nuts, etc. shall be packed and sealed in polythene bags with proper tagging and packed in cases.

1.20 All spare parts shall be packed and treated for long storage conditions at site.

2.0 MARKING

2.1 All packages shall be clearly, legibly and durably marked with uniform block letters (preferably with waterproof paint) on at least three sides with:

(a) Purchaser's Name and destination address

(b) Purchase Order/Contract Number and Date

(c) Vendor's/Contractor's or Sub-Vendor's/Sub-Contractor's Name

(d) Consignment Serial Number

(e) Overall Dimensions

(f) Net and gross weights

(g) Sign showing 'side up'

(h) Sign showing 'fragile' marks in case of delicate equipment

(i) Sign showing slinging and sling position

(j) Any handling and unpacking instructions, if considered necessary

(k) Identification markings relating to the appropriate shipping documents

(l) In case of spare parts, each spare part shall be clearly marked and labelled on the outside of its packing with its description and catalogue/ part number and item number of main equipment to which it relates.

2.2 ERECTION MARKS

In case of spare parts, each spare part shall be clearly marked and labelled on the outside of its packing with its description and catalogue/ part number and item number of main equipment to which it relates.

Colour banding to an approved code shall be employed to identify members of similar shape or type but of different strengths or grades.

3.0 TRANSPORT

3.1 No equipment or material shall be despatched without prior consent (acceptance certificate) of the PURCHASER/CONSULTANT or his representative. On receipt of the acceptance certificate, the equipment shall be packed up and made ready for despatch either on Free On Board (FOB), (Free Alongside Ship (FAS), Free On Road (FOR), Free On Truck, (FOT), Free Alongside Road (FAR), or free alongside Truck (FAT) basis as per the PURCHASE ORDER/CONTRACT. If it is on FOB basis, the VENDOR/ CONTRACTOR is responsible for loading the equipment on the board of ship. On FAS basis, another agency takes over from the VENDOR/CONTRACTOR for loading. The same applies to FOR, FOT and FAR, FAT.

3.2 Depending upon the equipment and the mode of transport the VENDOR/ CONTRACTOR may propose to deliver the equipment in container or as Break Bulk i.e. in components or sub-assembly form.

3.3 In the event of VENDOR/CONTRACTOR proposing to deliver the equipment in Break Bulk form, he shall furnish full particulars of the quantity and approximate size of each item. All sub-assemblies shall be match-marked to facilitate assembly at site.

3.4 In case of ocean shipment, the VENDOR/CONTRACTOR shall send an advance 'Advice of Shipment' to the PURCHASER and site separately, so as to reach at least seven (7) days in advance for foreign supply and three (3) days in advance for domestic supply. This advice shall state the Cost including Freight and Insurance (CIF) value of the consignment, the details of the transport and the probable date of its departure and arrival. Copies of packing list shall also be sent along with the advance intimation.

3.5 The VENDOR/CONTRACTOR shall ship the equipment on behalf of the PURCHASER by the first available vessel belonging to a recognised shipping line. He shall ensure that the freight rates charged are not higher than the conference rates applicable to the shipping route at the time of shipment and all rebates and refunds available for such consignments are duly taken into account. The VENDOR/CONTRACTOR shall be responsible for the correct appraisal of freight rates (structural or machinery as the case may be), weights and volumes. In no case, the PURCHASER will pay any warehouse or wharf charges.

3.6 Immediately after the shipment has been effected, the shipping documents, comprising Bill of Lading, Freight Invoice, FOB/FAS/FOR/FOT/FAT/FAR Invoice, Packing List, Certificate of Origin, Letter to Insurers and Certificates of Inspection shall be issued by the VENDOR/CONTRACTOR in accordance with the instructions of the PURCHASER/CONSULTANT. These documents shall reach the PURCHASER before the arrival of ship. Responsibility for delays, loss or damages of shipping documents shall rest with the VENDOR/ CONTRACTOR.

3.7 In case of inland despatch by rail or truck, similar equivalent procedures as applicable to rail or truck transportation shall be adopted.

3.8 All Equipment manufactured by the VENDOR/CONTRACTOR shall be under his charge. The PURCHASER shall arrange for insurance coverage during shipment and till delivered at site, if necessary.-as per PURCHASE ORDER/CONTRACT

4.0 TRANSPORT OF ELECTRICAL EQUIPMENT AND INSTRUMENTATION ITEMS

4.1 Transformers rated 2000 kVA and less shall be shipped filled with oil. Transformers rated above 2000 kVA shall be shipped without oil but with the tank filled with nitrogen or equivalent inert gas. A gas cylinder with suitable reducer connection and pressure gauge shall be supplied. These accessories shall become the property of the PURCHASER. The required quantity of oil shall be supplied separately in non-returnable drums.

4.2 Switchgear cubicles and instrument control panels shall be packed and shipped in separate and convenient sections. All withdrawable equipment like circuit breakers and circuit breaker arc-chutes shall be packed and shipped separately. All relays and panel-mounted instruments shall be packed and shipped separately with their operating mechanisms temporarily arrested from movement during transport.

4.3 Batteries shall be shipped to site in dry, uncharged condition. Appropriate quantity of acid of the correct specific gravity shall be shipped separately in non-returnable porcelain jars packed in steel wire baskets.

4.4 Cables shall be shipped on non-returnable drums, adequately braced, and with cable ends adequately sealed to prevent ingress of moisture.

- Storage tanks
- Cable shields and cable armour.

- To provide electrostatic protection of pneumatic transfer pipelines their flanges will be bonded, and they will be earthed at every 25 meters.
- All electrical equipment will have two separate and distinct connections to the earth.
- Earthing bus bar for other free-standing panel will be connected to the main earthing bus bar with two separate and distinctive connections.
- Each motor frame will be connected to the main earthing bus bar. Protective conductor of the motor power supply cable will be connected to the earth point inside motor terminal box and to the MCC earth bus bar.
- Additional core will be considered for local control station earthing. It will be connected to the earth post of each local control station and to the MCC earth bus bar.
- Cable armour will be earthed on both side of the cable, but cable shield will be earthed only on one side (panel side – source side) of the cable.

4.3.11.3 Earthing Electrode Type

Transformer & Generator Neutral Earthing	Copper plate type
Body Earthing	GI pipe electrode
DCS Earthing	Copper rod / As per DCS vendor's recommendation
Main earth loop material	GI strip
Substation earth loop	GI / copper

4.3.11.4 Lightning Protection System

- Lightning Protection will be according to IS 2309 & IEC 62305.
- Lightning protection system for BTG package buildings at plant will be provided depending upon the lightning flash density, area of exposure / collection etc.
- Lightning protection system consists of suitable sized horizontal conductors that are laid over the rooftop of every building and are connected to individual lightning protection earth pits through a test link. All the lightning protection earth pits are interconnected by a suitable sized flat and finally the system is connected to the Plants Main Earthing system at minimum of two places.
- Lightning conductor will be GI strip.
- Lightning Protection system to be consider for chimney structure.

4.3.12 TESTS

All Routine tests for all the major electrical equipment of the BTG package shall be carried out as per relevant standards. Type test certificates for similar equipment supplied by the Bidder shall be submitted. In case Type test certificate for similar equipment is not available, the same shall be conducted in presence of Owner.

in such a position relative to the valve that there is no possibility of leakage of steam or water from the valve joints or glands blowing on to the motor or control equipment. All valve actuators shall be provided with hand operation facility shall be provided and be so arranged that the hand operated mechanism which shall automatically disengaged during motor operation and vice versa. Motor operated valves shall be provided with hand wheels having plain polished rims. Valves actuators shall be provided with at least one adjustable torque switch and drum type 4 sets each of NO and NC adjustable contacts of limit switches. Motor actuators shall be provided with a resistance type potentiometer for position indication and anti-condensation space heater. All internal wiring shall be brought out to a single terminal strip. All motor operated valve actuators shall be rated for 3 phase AC supply. Motors actuators shall be rated for short time duty of S2-15 minutes and provided with degree of protection of IP-65 or better based on IEC standards of equivalent. Valves and actuators shall be suitable rated to ambient, process and hazard conditions apart from above basic specifications.

All operators shall be of Limitorque or AUMA or ROTOK make and preferably with integral motor starters. Valves and actuator series shall be selected based on criteria of proven applications. All MOV actuators shall be of intelligent type with programmable limit/torque settings. All MOVs shall be of same make to minimize spare inventory.

4.3.8 VARIABLE FREQUENCY DRIVE

4.3.8.1 Design criteria

a. The inverter units shall be microprocessor based and shall be suitable for the site ambient conditions. Necessary de-rating factors shall be considered for temperature correction.

b. The converter section shall consist of 18-pulse rectification configuration scheme with required line current harmonic filter.

c. Harmonic filter shall either be active or passive and designed to limit the harmonics generated by the equipment shall be well with in the limit so that the system harmonic levels shall meet the requirements specified in IEEE 519. Bidder to note that equipment harmonic levels shall be much less than the THD levels indicated in IEEE.

d. The inverter section shall be IGBT based type with suitable designed for feeding continuous full load, overload and starting of motor conditions. The inverter shall be provided with current limiting circuitry which will limit the output current to a value which will not damage the inverter or blow its fuses and sufficient capability to prevent damage to itself until short circuit conditions on the output are cleared.

e. The inverter shall have LVRT functionality. The cables connecting inverter to motor shall be of 3core cables/single core cable with trefoil configuration, having armor earthing at single end. The VFD for HT 6.6KV motor shall be of direct MV VFD. The Heat load of the VFD to be furnished & suitable capacity cooling arrangement to be considered.

f. The inverter shall be designed to withstand momentary dips of about 30% in supply voltage for 3 cycles without damage to semi-conductor components or blowing of fuses. Power loss ride through feature for 2 Secs shall be provided.

g. Motor and VFD shall withstand the voltage and torque stresses developed due to the vector difference between the motor residual voltage and the incoming supply voltage equal to 150% of the rated voltage during fast changeover of buses. The VFD shall have auto-speed search (fly catcher) for starting into rotating load. The VFD must be able to catch the motor spinning and bring to the desired operating speed in the proper direction without stopping the motor or tripping the drive.

h. The VFD shall be able to deliver motor Class II duty overload as per IEC 60146 -1 standard i.e. 150% of motor rated current for 60 secs, at 50 deg. C temperature. If the motor load exceeds the limit, the drive shall automatically reduce the frequency and voltage to the motor to guard against overload. Necessary de-ration, if required, to be taken into accounts to meet overload requirements. Necessary calculations to arrive at the current rating of the VFD shall be furnished.

i. VFD shall be provided with automatic sequence control which include start-up of cooling system, interlock checking, automatic start and run-up of drive, planned / emergency shutdown etc.

j. Input Power Factor (not only the fundamental Power factor) shall be greater than 0.93 at 100% load and rated speed and overall efficiency of the system shall be greater than 95%.

k. The VFDs shall be provided with Metal Oxide Varistors (MOVs) if required for transient voltage suppression on all three phases of the incoming power line. The VFD shall protect itself from damage due to any grounding or shorting of its output power circuit.

l. VFD shall be designed considering the location of the motor and its cable surge impendence to take care of the impact of the reflected voltage on the motor end. If required suitable line reactors or reflected wave limiters shall be provided at the motor terminal.

m. VFD shall be provided with suitable breaker and DOL starter to bypass the VFD in case of VDF failure / mal-operation. Necessary motor protection relay with suitable interlock arrangement with the VFD circuit shall be considered. Bypass shall be made such that, VFD can be taken out for maintenance without disturbing the bypass mode.

n. Fault diagnostic feature shall be built into the system to supervise the operation and failure of the VFD system and with the necessary storage of events.

o. VFD controller shall have facility to receive external trip and close signal and also provided with programmable auxiliary contacts for the remote operation and control.

p. The interface of VFD shall be considered as required for data communication with PLC/DCS system for online/ real time monitoring. Required hardware such as cables, converters shall be provided to meets the communication requirement.

4.3.9 CABLING SYSTEM

4.3.9.1 MV Power Cables

FIRST ANGLE PROJECTION

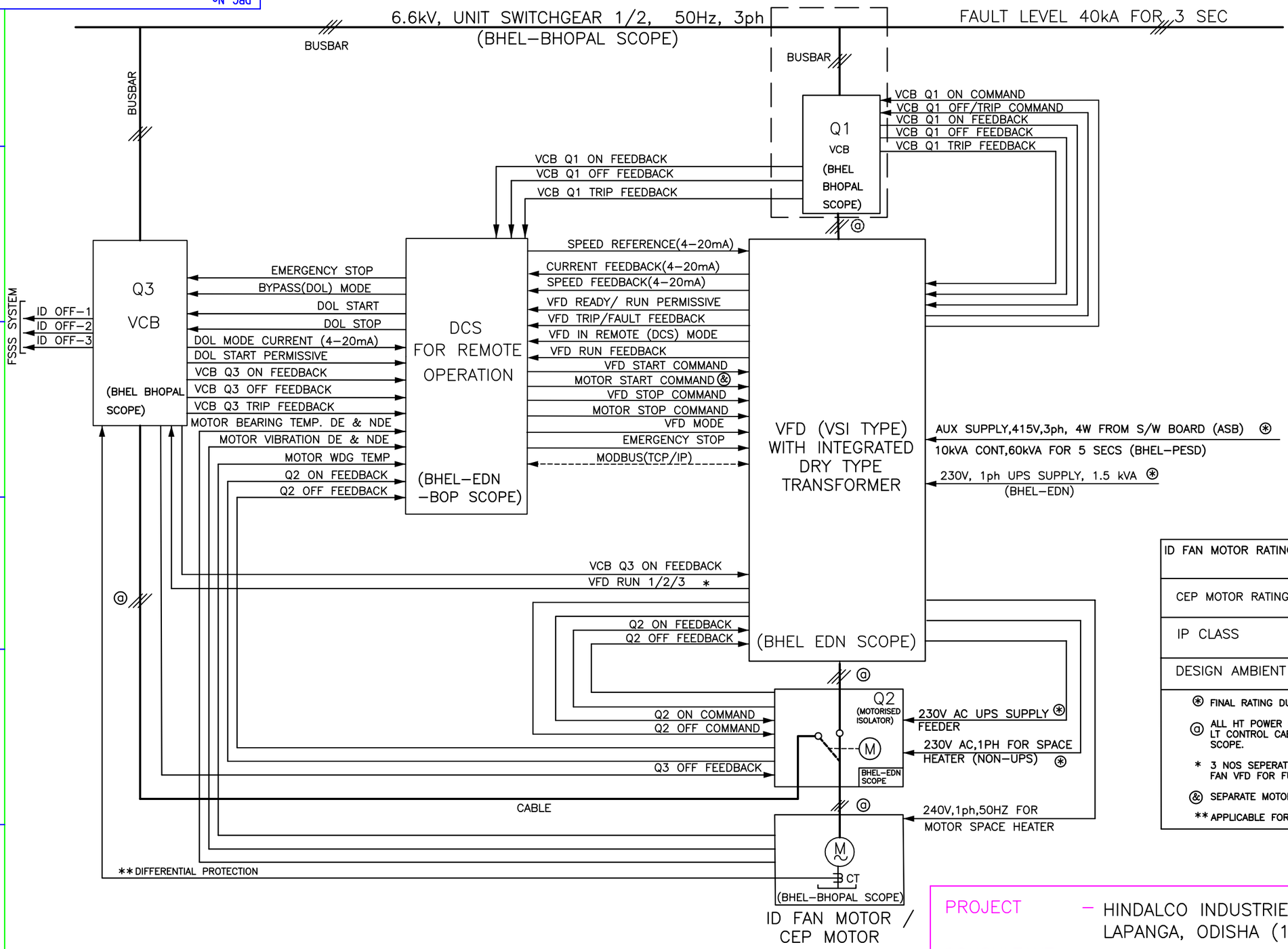
(ALL DIMENSIONS ARE IN mm)

DRG. No. 3-674-00-00001

REF. DRG. No.

SIGN. & DATE

INVENTORY No.



ID FAN MOTOR RATING	SQUIRREL CAGE INDUCTION MOTOR 6.6KV, 50 HZ, 2125KW
CEP MOTOR RATING	SQUIRREL CAGE INDUCTION MOTOR 6.6KV, 50 HZ, 400KW
IP CLASS	VFD PANEL : IP41 OR BETTER ISOLATOR PANEL: IP41 OR BETTER
DESIGN AMBIENT	50 DegC

(*) FINAL RATING DURING DRAWING APPROVAL STAGE

(@) ALL HT POWER CABLE, HT CABLE TERMINATION KIT, LT POWER CABLE, LT CONTROL CABLE AND INSTRUMENTATION CABLE IN BHEL-PESD SCOPE.

* 3 NOS SEPERATE VFD RUN FEEDBACKS ARE REQUIRED ONLY FROM ID FAN VFD FOR FURTHER COMMUNICATION TO FSSS SYSTEM

(&) SEPARATE MOTOR START COMMAND IS REQUIRED ONLY FOR CEP MOTOR

** APPLICABLE FOR ID FAN MOTOR ONLY

REV.	DATE			REV.	DATE		
02	01.01.26	ALTERED	SB	01	10.12.25	ALTERED	SB
		CHECKED	KD/GD			CHECKED	KD/GD
		APPROVED	LSL			APPROVED	LSL

	NAME	SIGN	DATE
DRAWN	SB		12.11.25
CHECKED	KD/GD		12.11.25
APPROVED	LSL		12.11.25

DISTRIBUTION OF PRINTS | DEPT. | CODE

PROJECT – HINDALCO INDUSTRIES LIMITED ADITYA ALUMINIUM AT LAPANGA, ODISHA (1 X 150 MW BTG)

CONSULTANT – TATA CONSULTING ENGINEERING LIMITED

BHARAT HEAVY ELECTRICALS LIMITED.
ELECTRONICS DIVISION, BANGALORE

CARD CODE

TITLE: SLD FOR VFD SYSTEM – ID FAN & CEP

No. OF SHEETS	01
SHEET No.	01
REV	02

M.O. No. | AS PER OPEN TOLERANCE TO ED 0230499 | DRG. No. 3-674-00-00001

FORM No. A3-03

A3 SIZE