

INDEX SHEET

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REQUEST FOR QUOTATION

	BHARAT HEAVY ELECTRICALS LIMITED Electronics Division PB No. 2606, Mysore Road Bangalore - 560026 INDIA	RFQ NUMBER: KTI0000069 RFQ DATE : 25.OCT.2017	Due Date 17.NOV.2017 Time: 13:00 HRS
MMI:PU:RF:003			

	(for all correspondence) Purchase Executive : ISAAC. K.T. Phone : 26998901 Fax : 0091802670534 E-mail: isaac@bheledn.co.in
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Please submit your lowest quotation subject to our terms and conditions attached for the material mentioned below. The quotation must be enclosed in a sealed envelope / Fax superscribed with RFQ no.and due date, should reach us on or before the due date by **13.00** hours IST and will be opened on the same day

SI No.	Description	Qty	Unit	Delivery qty	Delivery Date
1	EC-001 ERECTIONING AND COMMISSIONING	1	AU	1	
2	FREIGHT-CHARGE FREIGHT CHARGES	1	AU	1	
3	PR0900007851 600KW VFD SYSTEM FOR NSPCL-ROURKELA IGBT/IGCT/SGCT BASED VFD (WITH INTEGRATED TRANSFORMER) FOR 600KW/6.6KV SQUIRREL CAGE INDUCTION MOTOR DRW PS4452571 00 Test Certificate	2	NO	2	
4	PR0900007860 3800KW VFD SYSTEM FOR NSPCL-ROURKELA IGBT/IGCT/SGCT BASED VFD (WITH INTEGRATED TRANSFORMER) FOR 3800KW, 6.6KV SQUIRREL CAGE INDUCTION MOTOR DRW PS4452571 00 Test Certificate	2	NO	2	
5	PR0900007860A LAPTOP FOR VFD NSPCL ROURKELA IGBT/IGCT/SGCT B AS PER PS 445 2571 REV00 DRW PS4452571 00	4	NO	2	2

Total Number of Items - 5

Please note that the tender will be opened in the presence of the bidders or his authorised representatives (maximum two per organisation) who choose to be present with authorisation letters. Refer annexure for the terms and conditions.
Preference will be given to vendors who accepts our standard payment terms.

Please specify Terms of delivery, Excise duty, sales tax, Ex-BHEL, Ex-works surcharge, Insurance,P&F, Freight and other taxes very clearly .
For evaluation,exchange rate(TT selling rate of SBI) as on scheduled date of tender opening (Part-I bid incase of two part bid) shall be considered.
The offers of the bidders who are on the banned list as also the offer of the bidders, who engage the services of the banned firms, shall be rejected.The list of banned firms is available on BHEL web site www.bhel.com

- i). This is only RFQ not an order.
- ii). In all correspondence quote RFQ No. & due date.
- iii). In Quotation BHEL material code / RFQ SI. No. should be mentioned clearly.
- iv). Quotation should remain valid for a minimum peiod of 120 days from date of TBO.
- v). In case of non-receipt of Quotation or regret letter for 3 consecutive RFQs you are liable to be removed from our vendors list.
- vi). All Prices should be written in words and numbers.

For and On behalf of BHEL.



ಭಾರತ ಹವಿ 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 00

SPECIAL COMMERCIAL CONDITIONS OF CONTRACT

Reference is brought to BHEL's Instructions to Bidders (Document Ref: CE: PR: 001- Rev 00) and General Commercial Conditions for Contract (Document Ref: CE: PR: 002- Rev 00). These documents along with required annexures are available in our website: _____ . 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: KTI0000069

RFQ Date: 25.10.2017

Due Date: 17.11.2017

Project: NSPCL ROURKELA

Item Description: VFD SYSTEM & spares

Purchase Executives: In cases where tender documents are bulky, or due to some reasons tender documents are required to be submitted by hand, the offers are to be handed over to either of the following Purchase Officers:

K.T.ISAAC / Sr. Manager/CE-MM-PR or Ponnuguru Packiam G/AGM/CE-MM-PR

E-mail IDs: In case offers are sent through E-mail, please send the offers to both of the following email IDs: nagarajpk@bheledn.co.in & ponnuguru@bheledn.co.in

E-tendering: **Applicable** / Not Applicable

Type of Bid: Three part Bid system (Pls refer ITB for details)

Reverse Auction: **Not Applicable / Will be intimated** during commercial clarifications to technically acceptable vendors. In case BHEL does not resort to Reverse Auction, the price bids and price impacts (if any) shall be opened as per BHEL's standard practice.

Splitting of tendered quantity to MSE vendors: The tendered quantity **will/will not** be split to MSE vendors subject to submission of relevant documents by vendors. **Refer clause H of Instructions to Bidders for conditions applicable and for information on documents to be submitted.**

Destination: Items are to be directly despatched to BHEL's Site Office or Stores/Customer's Stores located at/near **ROURKELA in ODISHA State**. Road Permit, if applicable, will be issued by BHEL along with Despatch Clearance.

For Import portion **port of discharge will be Chennai sea port, port of delivery shall be ICD, Bangalore**

Project Benefits: Reimbursements is not applicable for this project.

• **Indigenous scope of supply:**

- Project is Mega Power Project or Ultra Mega Power Project: Eligible for "NIL" Excise Duty. Necessary documents for availing Excise Duty exemption by suppliers will be furnished by BHEL.
- Physical Export project: Eligible for complete exemption of Excise Duty & Sales Tax. Necessary documents for availing such benefits will be furnished by BHEL to suppliers.
- Nuclear Power Project under a special category: Eligible for claiming Terminal Excise Duty benefit from DGFT as per present EXIM policy. Confirm submission of following in original:
 - Disclaimer Certificate (Annexure -XI)
 - Copy of Excise Invoice attested by Suptd of Central Excise authorities with signature and seal, in blue ink, to enable BHEL to claim terminal Excise duty benefit from DGFT.

• **Imported scope of supply:**

- Project is Mega Power Project or Ultra Mega Power Project: Eligible for "NIL" Customs Duty.
- Physical Export project: Eligible for complete exemption of Customs Duty.

Terms of Delivery:

Indicate station of despatch: _____

Indicate place of manufacturing (wherever applicable): _____

- **Indigenous scope of supply:** Ex-works (including Packing & Forwarding charges but excluding Taxes & Duties): _____

- **Imported scope of supply:** C.I.F/Bangalore. (for air consignments) /C.I.F/ ICD Bangalore. (for sea consignments)

(Including Packing, Forwarding, Handling, Ancillary charges like processing of Sight Draft/ Letter of Credit, negotiation of bank Documents, Export declaration, Country of Origin etc.): _____

S NO.	TERMS	BHEL ACCEPTABLE TERM	BIDDER'S CONFIRMATION	DEVIATION IF ANY
01	Validity	The offer will be valid for a period of 120 days from the date of technical bid opening.	AGREE	
02	Excise Duty & Cess	<p>If applicable, indicate current rate of Excise Duty and maximum rate of Excise Duty (against proof of Excise Invoice).</p> <p>However, for calculation purpose and arriving at "Total Cost to BHEL" maximum rate of Excise Duty will be considered. In case Excise Duty remains firm throughout the contract, the same shall be specifically indicated. Otherwise, maximum Excise Duty will be considered for arriving at lowest bidder.</p> <p>However, reimbursement of Excise Duty shall be at actuals against proof of Excise Invoice only. (Within contractual delivery).</p> <p>Physical export contract eligible for complete exemption of Excise duty against submission of necessary documents by BHEL like ARE 1/CT 1 form.</p>	<p>APPLICABLE / NOT APPLICABLE</p> <p>Present rate of Excise Duty with CESS%</p> <p>Maximum rate of Excise Duty with CESS%</p>	REFER LAST PAGE.
03	Central Sales Tax (CST) (Please confirm the physical movement of goods i.e. interstate or within state)	<p>If applicable, indicate current rate of sales tax against form "C".</p> <p>For issue of original form "C", vendor has to furnish "E1/E2" form. To enable vendor give E1/E2 form, photocopy of C form will be issued by BHEL.</p> <p>Please confirm submission of "E1/E2 Sale form".</p> <p>For physical export project, Sales Tax is exempted against necessary documents furnished by BHEL.</p>	<p>APPLICABLE / NOT APPLICABLE</p> <p>Present Sales Tax rate against form "C"%</p> <p>CONFIRMED</p>	REFER LAST PAGE.
04	Value Added Tax (VAT) (Please confirm the physical movement of goods i.e. interstate or within state)	<p>If applicable, indicate current rate of VAT.</p> <p>When VAT is applicable, BHEL ROD's/ Nodal Agency's Name, TIN No. and address to be indicated in invoice. (Note that two original invoice and one tax invoice should be submitted to BHEL).</p>	<p>APPLICABLE / NOT APPLICABLE</p> <p>VAT rate at present%</p> <p>NOTED</p>	REFER LAST PAGE.
05	Octroi	If applicable, indicate current rate of octroi.	<p>AGREE</p> <p>Present Octroi rate%</p>	
06	Freight Charges (for indigenous scope of supply) (Please confirm % of service tax extra / inclusive.)	<p>Freight charges shall be to vendor's account.</p> <p>Quote lumpsum reasonable Freight charges separately in priced offer, plus service tax if any.</p> <p>Vendor's offer will be evaluated on "Total cost basis" including freight charges.</p> <p>Vendor shall book the consignment through their approved Road carriers on "Freight pre-paid" and door delivery consignee copy attached basis. Freight charges to be claimed from BHEL along with POD (Proof of Delivery) on original L/R.</p>	<p>AGREED</p> <p>and quoted as lumpsum amount in price bid.</p> <p>GST _____% (extra /inclusive in freight charges)</p>	
07	Service Tax on E&C and Training Charges	<p>If applicable, indicate current rate of Service Tax _____%</p> <p>Service Tax Regn. No. _____</p> <p>Confirmation that Service Tax register is maintained.</p>	<p>APPLICABLE / NOT APPLICABLE</p> <p>CONFIRMED</p>	REFER LAST PAGE.

08	Parting of license for imported raw materials	<p>In case of Mega project, Ultra Mega project and Physical Export project where Custom Duty and Excise Duty are NIL and vendor is importing any raw materials / components for the enquired item, same are eligible for Zero Customs duty. As per EXIM policy, BHEL will part the import licence with the vendors to obtain import licence by themselves and custom clear the raw materials/ components by availing zero customs duty. Hence, please furnish list of raw materials / components to be imported by you with Quantity and CIF value (for which BHEL has to share import licence). The benefit due to the above shall be passed on to BHEL and confirmed in the quotation.</p> <p>If there are no imported raw materials/components, same shall be confirmed in the offer.</p>	<p>AGREE</p> <p>—CIF value</p> <p>Yes, benefit passed on to BHEL in the priced quotation.</p> <p>We confirm that there are no imported components.</p>	
09	Delivery Period	Within 04 months from the date of issue of approved documents or manufacturing clearance by BHEL, whichever is later.	<p>AGREE</p> <p>..... weeks</p>	
10	Guarantee/ Warranty	24 months from the date of delivery of goods or 18 months from the date of commissioning of goods, whichever is earlier.	AGREE	
11	Inspection agency	<p>Materials will be inspected by :</p> <ul style="list-style-type: none"> • BHEL • Customer/Consultant/BHEL nominated Third Party Inspection Agency (TPIA) 	AGREE	
12	Terms of Payment at the time of material supply	<p>Refer Clause "F" of Instructions to Bidder for BHEL standard Payment terms and loading factors applicable for non-compliance against payment terms:</p> <p>Indigenous Scope:</p> <p>a) Supply with E&C</p> <p>b) Supply with Supervision of E&C</p> <p>c) Supply only</p> <p>Imported Scope:</p> <p>d) Supply with E&C</p> <p>e) Supply with Supervision of E&C</p> <p>f) Supply only</p> <p>Note: Kindly indicate if High Sea Sales will be operated. If yes, confirm submission of relevant documents as per Annexure V.</p>	<p>AGREE</p> <p>YES / NO</p> <p>CONFIRMED</p>	
13	Performance Bank Guarantee (PBG)	<p>PBG will be applicable for a period of 24 months + claim period of 6 months for a value equal to 10% of the basic value of the purchase order.</p> <p>Refer Clause "G" of Instructions to Bidders.</p>	AGREE	
14	Terms of Payment not related to material supply	<p>For Training:</p> <p>100% will be paid in 45 days from the date of completion of Training or 15 days from the date of submission of complete set of documentation, whichever is later. Separate invoice shall be submitted for Training charges along with documentary evidence.</p> <p>For Engineering & Documentation Charges:</p> <p>100% will be paid in 45 days from the date of approval of final documents or 15 days from the date of submission of invoice, whichever is later. Separate invoice to be submitted for Engineering & documentation charges.</p>	AGREE	

15	Mode of despatch	<p>Indigenous Scope: By Road on Door Delivery Consignee Copy attached basis through your approved transporter (unless otherwise indicated in Despatch Instructions), only on receipt of Despatch Clearance from BHEL.</p> <p>Imported Scope: By Air/Sea through BHEL approved Consolidator/Supplier Freight Forwarder, only on receipt of Despatch Clearance from BHEL.</p>	AGREE	
16	Despatch Documents	<p>Complete set of despatch documents (original + 1 photocopy set) as per Purchase Order shall be forwarded to BHEL directly.</p> <p>Depending upon the project/customer demands, despatch documents may include one or more documents from the following: Commercial Invoice, Excise Invoice (if ED is applicable), Lorry Receipt (L/R), Packing List, Air Way Bill (AWB), Country of origin certificate, Warranty Certificate, Insurance Intimation letter, NIL Short Shipment Certificate, Original Performance Bank Guarantee (directly from issuing bank to BHEL), POD (Proof of Delivery) on original L/R, Disclaimer Certificate (as per BHEL format attached as Annexure XI) along with ER-1 form & attested excise invoice (as per project demands like Nuclear Power plant) etc.</p> <p>The precise list of despatch documents needed for a particular project will be specified in the Purchase Order.</p> <p>One set of Invoice, Packing List and L/R or AWB shall be e-mailed/faxed immediately to BHEL-EDN after despatch.</p>	AGREE	
17	O & M Manuals	<p>As built Drawings, O & M Manuals and other approved documents shall be furnished in required no. of sets as per Specification/Purchase Order.</p> <p>Note: Supply of above documents (O&M) in required no. of sets along with material shall be indicated in packing list. If not mentioned BHEL may insist for submission in required sets once again.</p>	AGREE	
18	Quantity Tolerance	<p>If applicable, indicate Quantity tolerance for each of the line item.</p> <p>For Impulse/seamless/ GI pipes one random length applicable for each variety of pipes.</p>	CONFIRMED	Quantity Tolerance % Per Variety
19	Evaluation criteria for tendered item	<p>Itemwise evaluation of tendered item.</p> <p>Splitting of tendered quantity to MSE vendors (if any) is applicable.</p> <p>OR</p> <p>Items will not be split on item wise lowest offer. Items to be evaluated and procured as a package.</p>	AGREE	
20	Integrity Commitment	<p>Integrity commitment will be applicable in the tender process and execution of contracts as mentioned in clause "1" of Instructions to Bidders.</p>	AGREE	

Vendor's scope against Erection and Commissioning as follows :

- 1) Deputation of Service Engineer for Supervision of Erection activities at site & combined testing at site.
- 2) Commissioning and hand over of the complete system to customer is vendor's responsibility. Hence, request to submit the "LUMPSUM" amount only which include Travelling, Boarding and Lodging expenses with No. of persons.

Note:

Applicable GST only will be considered for evaluation and ranking. Pls. attach the tax structure (IGST or CGST, SGST, UGST) as applicable for the tender item & HSN code for each material and services along with filled SCC.

Vendor to mandatorily provide GSTN in the offer.

With this, it is inferred that vendor has understood and accepts all terms & conditions as indicated in Instructions to Bidders (Document Ref: CE: PR: 001- Rev 00) & General Commercial Conditions for Contract (Document Ref: CE: PR: 002- Rev 00).

The above filled-in and signed-sealed document (in original) shall be furnished as part of Part-I Bid without fail. If no deviations are brought, it will be treated as if all terms and conditions of this enquiry are accepted by vendor without any deviation.

A.*.Delivery shall be as mentioned below.

For Imported portion: Within 04(four) months from the date of issue of approved documents or manufacturing clearance by BHEL, whichever is later.

The date for which Inspection call is issued by vendor along with test certificates / test reports / Certificate of Conformance / Calibration reports, as proof of completion of manufacturing will be treated as date of deemed delivery. Supplier is supposed to arrange AWB within one weeks of dispatch clearance.

For Indigenous Portion: Within 04(four) months from the date of issue of approved documents or manufacturing clearance by BHEL, whichever is later

The date for which Inspection call is issued by vendor along with test certificates / test reports / Certificate of Conformance / calibration reports, as proof of completion of manufacturing will be treated as date of deemed delivery for penalty calculation. Supplier is supposed to arrange LR within one weeks of dispatch clearance.

B. Evaluation criteria for tendered item:

This project is having Customer approved vendors. If the quoted vendor, is not approved by ultimate Customer, such bidder will be referred to customer with credentials for their approval. Efforts will be made with Customer to get the approval. In case the customer does not approve a bidder for a project, then such bidder's offer will not be considered for opening of price bid.

Offers of customer approved vendor only will be evaluated and will be processed further. Priced offers of vendors, not approved by customer will not be opened

VENDOR'S SIGNATURE WITH SEALNOTE:

1. Registration of Suppliers and Flow.

Unregistered Supplier: Supplier visits EPS at <https://bheleps.buyjunction.in>

- a. Supplier visits EPS at <https://bheleps.buyjunction.in>
- b. Clicks "REGISTER" for registration
- c. Fills up the Registration Page form
- d. MJ will ensure Authentication of Registration ¹
- e. Supplier logs in with the ID and password
- f. Supplier Maps the signing Certificate
- g. MJ will ensure the authentication the signing certificate ¹.
- h. Supplier Logs in to the system again and views the RFQ
- i. Supplier Attaches himself to the RFQ by clicking the Interested button
- j. Supplier fills the bid template and makes necessary attachments
- k. Supplier submits his bid by clicking CONFIRM.

NB:-

¹ -- BHEL Administrator or user will have no role for approving Registration and Open Tenders and DSC for Any supplier who has registered himself from the front END which is in case of OT.

- **For registered Supplier:**
 - Supplier visits EPS home page
 - Supplier signs in with his/her user id and password
 - Selects the RFQ Code and views it.
 - Attaches himself to the RFQ by clicking the Interested button
 - Supplier fills the bid template and makes necessary attachments
 - Supplier submits his bid by clicking CONFIRM.

2. Open Tender Process For all units with data transfer Mechanism – Template based Bid submission mechanism

• BID SUBMISSION

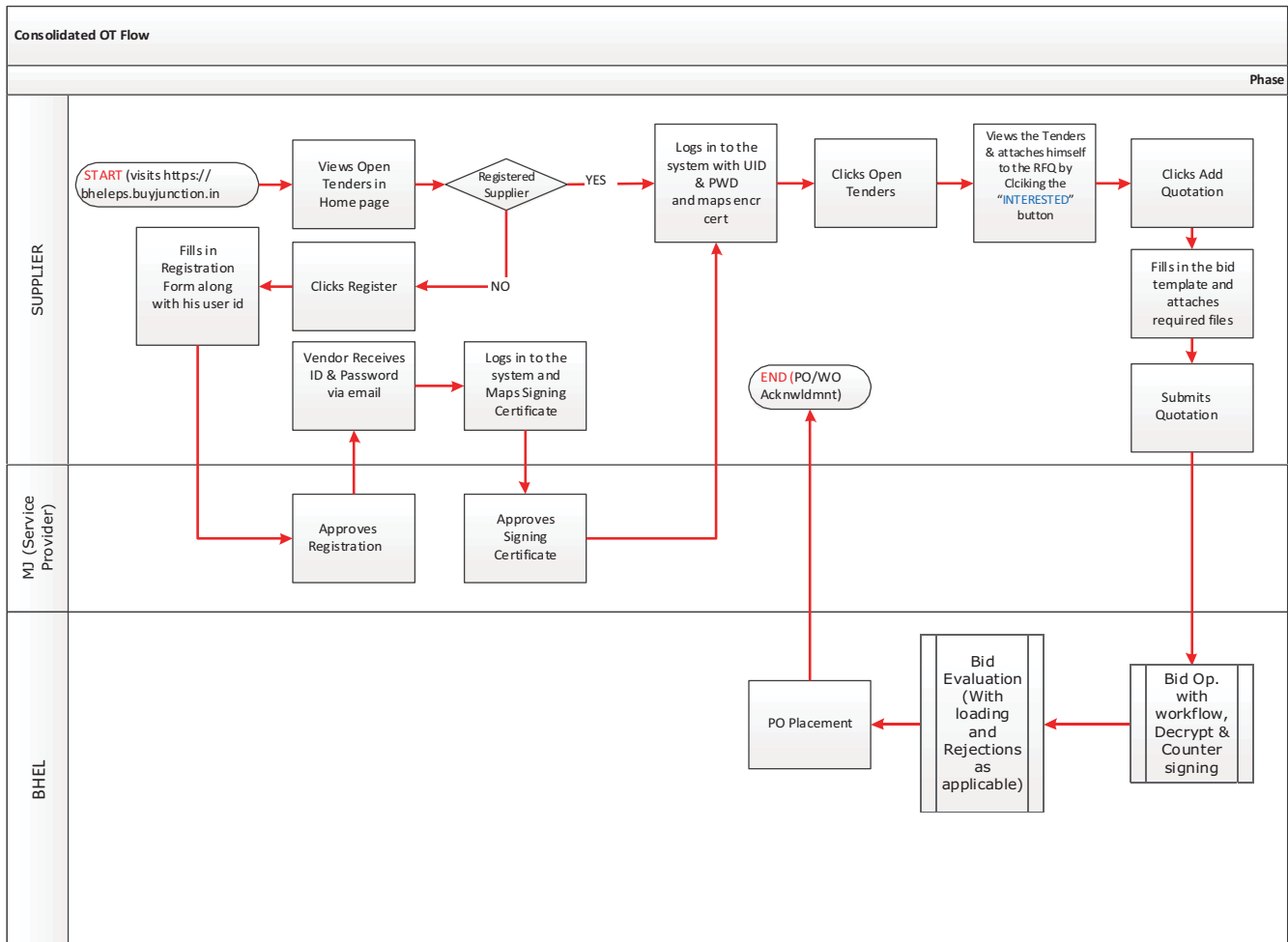
Supplier Login - Select RFQ & view it - Show INTEREST to participate - Respond to RFQ - Add Quotation – Upload proof of TENDER FEE & EMD with the valid document proof (as attachment) – Uploads Pre-qualification docs, Fills Techno-commercial & Price template – Submits Quotation.

NB:

² - ADD Intimation is mechanism by which RFQ owner adds Supplier/Contractor i.e known sources' email ids for intimation that an OT has been Issued. This is for information sake only. This does not mean that unintimated supplier cannot participate in OTs. Intimations can be issued by RFQ owner only, both during Tender publication in draft mode and after tender publication till the tender is still live and is viewable by RFQ owner and Approvers only in View Intimation list link in RFQ. This is not to be printed in any report, including chronological report

EPS will only trigger intimation email to all the email ids in the Intimation list.

3. Consolidated Flow Diagram of OT process





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भारत हेवी इलेक्ट्रिकल्स लिमिटेड

Bharat Heavy Electricals Ltd.,
(A Government of India undertaking)
Electronics Division

PB 2606 , Mysore Road Bangalore , 560026 INDIA

CE: PR: 002- Rev 00

GENERAL COMMERCIAL CONDITIONS FOR CONTRACT

These 'General Commercial Conditions for Contract for Purchase' hereinafter 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, Bangalore 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.

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 unless otherwise such variations / escalations are provided for and agreed by BHEL in writing in the purchase order.
2. **Validity:** The offer will be valid for a period of 120 days from the date of technical bid opening date. Validity beyond 120 days, if required, will be specified in the SCC (special conditions of contract).
3. **Ordering and confirmation of Order:** Vendor shall send the order acceptance on their company letter head within two weeks from the date 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 two weeks (or the time limit as specified / agreed by BHEL) from the date of the purchase order.
4. **Documentation:** After receipt of Purchase Order, vendor should submit required documents like 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.
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.
5. **Penalty:**
For delay in documentation: In the event of delay in submission of complete set of documents ((like drawings, bill of materials, datasheets, catalogues, quality plan etc. as called in tender specifications including soft copies wherever applicable) in required sets beyond three weeks (or as agreed/indicated in the Purchase Order) from the date of Purchase Order, penalty at 0.5% (half percent) per week or part thereof, limited to a maximum of 5% (five percent) of the basic material value of the Purchase Order will be applicable.
For delay in delivery: In the event of delay in agreed contractual delivery as per Purchase Order, penalty @ 0.5 % (half percent) per week or part thereof but limited to a max of 10% (ten percent) value of undelivered portion (basic material cost) will be applicable. Delivery will commence from the date of document approval by customer / BHEL or date of issue of manufacturing clearance, whichever is later. The date for which Inspection call is issued by vendor along with test certificates / test reports / Certificate of Conformance / calibration reports, as proof of completion of manufacturing will be treated as date of deemed delivery for penalty calculation. In the absence of furnishing such document indicated above as proof of completion of manufacturing along with inspection call, actual date of inspection will be considered as date of deemed delivery and BHEL will not be responsible for delay in actual date of inspection.

Penalty for delayed documentation/delayed delivery, if applicable, shall be deducted at the time of first payment. If penalty is applicable for duration of less than a week, penalty @ 0.5% (half percent) of the basic material value will be deducted.
6. **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 applied to 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.

7. Reverse Auction: BHEL reserves the right to follow REVERSE AUCTION PROCEDURE (ONLINE BIDDING ON NETWORK) before finalising the Purchase order on technically competent bidders, as per the guidelines given in Annexure III. In case BHEL does not resort to Reverse Auction, the price bids and price impacts (if any) already submitted and available with BHEL shall be opened as per BHEL's standard practice.
8. Inspection: Prior written notice of at least 10 days shall be given along with internal test certificates / COC and applicable test certificates. Materials will be inspected by BHEL-EDN-QS/CQS or BHEL nominated Third Party Inspection Agency (TPIA) or BHEL authorized Inspection Agency or Customer / Consultant or jointly by BHEL & Customer / consultant. All tests have to be conducted as applicable in line with approved Quality plan or QA Checklist or Purchase specification and original reports shall be furnished to BHEL-EDN, Bangalore for verification / acceptance for issue of dispatch clearance.
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.
9. 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.
10. 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.
11. 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 Phytosanitary / 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 (L x B x H) 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.
Separate packing & identification of items should be as follows.
 1. Main Scope - All items must be tagged with part no. & item description.
 2. Commissioning spares - All items must be tagged with part no. & item description.
 3. Mandatory spares - All items must be tagged with part no. & item description.

12. 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.
13. 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.
14. 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 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.
15. 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.
16. 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.
17. Shortages: In the event of shortage on receipt of goods and/or on opening of packages at site, all such shortages shall be made good within a reasonable time that BHEL may allow from such intimation and free of cost. In case BHEL raises an insurance claim, the cost of material limited to insurance settled amount less handling charges will have to be reimbursed by the Supplier.
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.
18. 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.
19. 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.

20. Product Information, Drawings and Documents: 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.

21. 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.

22. Force Majeure: Notwithstanding anything contained in the purchase order or any other document relevant thereto, neither party shall be liable for any failure or delay in performance to the extent said failures or delays are caused by the "Act of God" and occurring without its fault or negligence, provided that, force majeure will apply only if the failure to perform could not be avoided by the exercise of due care and vendor doing everything reasonably possible to resume its performance.

A party affected by an event of force majeure which may include fire, tempest, floods, earthquake, riot, war, damage by aircraft etc., shall give the other party written notice, with full details as soon as possible and in any event not later than seven (7) calendar days of the occurrence of the cause relied upon. 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.

23. Guarantee / Warranty: Wherever required, and so provided in the specifications / Purchaser Order, the Seller shall guarantee that the stores supplied shall comply with the specifications laid down, for materials, workmanship and performance. Unless otherwise specified, guarantee / warranty period shall be 30 months after the date of delivery of goods or 24 months from the date of commissioning of goods whichever is earlier. The guarantee / 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 guarantee / warranty period.

24. 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.

25. Liability during guarantee / warranty: Vendor shall arrange replacement / repair of all the defective materials / services under its obligation under the guarantee / 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 first time commissioning or use, vendor shall be responsible for replacement / repair of the goods as required by BHEL at vendor's cost. In all such cases expiry of guarantee / warranty will not be applicable.
26. Liability after guarantee / warranty period: At the end of the guarantee / warranty, the Vendor's liability ceases except for latent defects (latent defects are defects / performance issues notices after the guarantee / warranty has expired). The Contractor's liability for latent defects warranty for the plant and equipment including spares shall be limited to a period of six months from the end of the guarantee / warranty period of the respective plant and equipment including spares or first time commissioning whichever is later but not later than 3 (three) years from the date of shipment.
27. 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.
28. 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).
29. Arbitration Clause: In case amicable settlement is not reached in the event of any dispute or difference arising out of the execution of the Contract or the respective rights and liabilities of the parties or in relation to interpretation of any provision in any manner touching upon the Contract, such dispute or difference shall (except as to any matters, the decision of which is specifically provided for therein) be referred by either party to the sole arbitration of an Arbitrator appointed by the Executive Director/ General Manager of the purchasing unit/ region/ division of BHEL. Vendor shall have no objection even if the Arbitrator so appointed is an employee of BHEL or has ever dealt/ had to deal with any matter relating to this Contract.
Subject as aforesaid the provisions of the Arbitration and Conciliation Act, 1996 of India or any statutory modification or re-enactment thereof and the rules made there under and for the time being in force shall apply to the arbitration proceedings under this clause. It is a term of contract that the party initiating arbitration shall specify the dispute or disputes to be referred to arbitration under this clause together with the amount or amounts claimed in respect of each such dispute. The venue for the arbitration shall be Bangalore, India. The award of the arbitrator shall be a speaking award and shall be final, conclusive and binding on all parties to this contract.
The cost of arbitration shall be borne equally by the parties. Notwithstanding the existence of any dispute or difference or any reference for the arbitration, the vendor shall proceed with and continue without hindrance the performance of the work under the contract with due diligence and expedition in a professional manner.
30. 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 BANGALORE alone shall have jurisdiction to consider over any matters touching upon this contract.

31. 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.



ಭಾರತ್ ಹವಿ 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: 001- Rev 00

INSTRUCTIONS TO BIDDERS (Common for all RFQs)

Bidder is requested to read the instructions carefully and submit their quotation covering 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 00), General Conditions of Contract (document reference: CE: PR: 002 - Rev 00) 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. Bidders (also includes the term suppliers / contractors wherever used in this document) are instructed to quote their most competitive price and best delivery, etc. in the offer. Prices should be indicated in both figures & words. **(Please also refer clause 11 under section B)**
4. Regret letter (either through post or by mail) indicating reasons for not quoting must be submitted without fail, in case of non-participation in this tender. If a bidder fails to respond against 3 consecutive tenders for the same item, he will be liable for removal as a registered vendor of BHEL.
5. Procurement directly from the manufacturers shall be 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. In case bids are received from the manufacturer / supplier and his agent, bid received from the agent shall be ignored.
6. 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.
7. If an Indian representative / associate / liaison office quotes on behalf of a foreign based bidder, such representative shall furnish compulsorily 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 system is commissioned and handed over to customer will be the sole responsibility of the Indian representative / associates / agent / liaison office.
 - d. Refer **Annexure X** on “Guidelines for Indian Agents”.
8. 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 recovered from the supplier's bill. All offers for imported scope of supply must be made from any of the gateway ports (within the country) indicated. **(Refer Annexure I)**

9. 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: **www.bhel.com**
10. 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.

B. GUIDELINES FOR PREPARATION OF OFFER:

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 super scribed 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 super scribed 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 super scribe 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. Xerox copy will not be accepted.
4. 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.
5. 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.
6. 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.
7. "Price Bid" shall be complete in all respects containing price break-up of all components along with all

applicable taxes and duties, packing & forwarding charges (if applicable), 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.

8. In addition, bidder shall also quote for erection & commissioning charges (E&C charges), documentation charges, service charges, testing Charges (type & routine), training charges, service tax, etc. wherever applicable. The price summary must indicate all the elements clearly.
9. Vendors should indicate "lump sum" charges (including To & Fro Fare, Boarding, Lodging, Local Conveyance etc.) for Supervision of Erection, Commissioning and handing over to customer. The quotation shall clearly indicate scope of work, likely duration of commissioning, pre-commissioning checklist and service tax (if any).
10. Wherever bidders require PAC (Project Authority Certificate) for import of raw materials, components required for Mega 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.
11. All quotations shall be free from corrections /overwriting. Corrections if any should be authenticated with signature and seal. Any typographical error, totaling mistakes, currency mistake, multiplication mistake, summing mistakes etc. observed in the price bids will be evaluated as per **Annexure II** "Guidelines for dealing with Discrepancy in Words & Figures – quoted in price bid". BHEL decision will be final.

C. GUIDELINES FOR OFFER SUBMISSION:

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 our reception area with caption "CE, SC&PV, DEFENCE." Tenders are opened on 3 days in a week (Monday/Wednesday/Friday). Tender must be deposited in the slot corresponding to the day (Monday - Box no.4/Wednesday - Box no. 6 /Friday - Box no.8) while depositing the offer. **(This clause will not be applicable for e-tenders)**
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 of the tender. (Refer to SCC document of tender)
3. 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 officers whose names are mentioned in the RFQ. (Refer to SCC document of tender)
4. 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. In case of e-procurement, bidders can see tender results till seven days after due date and time.
5. Vendor 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 submission of offers in the correct compartment of the tender box based on the day of due date (Monday/Wednesday/Friday). Please check before dropping your offer in the correct tender box.
 - c. For depositing offers in proper sealed condition in the tender box. If the bidder drops the tender in the wrong tender box or if the tender document is handed over to the wrong person BHEL will not be responsible for any such delays.
 - d. 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.
 - e. In case of e-tender, all required documents should be uploaded before due date and time. Availability of power, internet connections, etc. will be the sole responsibility of the vendor. Wherever assistance is

needed for submission of e-tenders, help line numbers and executives of service provider of BHEL may be contacted.

Service provider: M-junction

Website address: <https://bheleps.buyjunction.in/>

Helpline no.: 033-66106426/6217/6013/6046/6176 (9:30 am to 5:30 pm)

9163348283/9163348284/9163348285/9163348286/8584008116 (5:30 pm to 8:30 pm)

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

D. PROCESSING OFFERS RECEIVED:

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.
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 any of their bids 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 vendors, 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. BHEL EDN reserves the right to adopt Reverse Auction or standard Price Bid Opening procedure for price evaluation, at its discretion. This will be decided after completion of technical evaluation of tender. **(Refer Annexure III for Guidelines for Reverse Auction).**
6. Un-opened bids (including price bids) will be returned to the respective bidders after release of PO and receipt of order acknowledgement from the successful bidder.
7. After receipt of Purchase Order, supplier should submit required documents like 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.
8. 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 EDN and agreed upon in the Purchase Order.
9. 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 duties, freight charges, insurance, service tax for services, any other cost indicated by vendor 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 Mega Projects, Physical Imports or such 100% exemptions (statutory benefits), customer reimbursements of statutory duties (like Excise Duty, CST, VAT) will also be taken into account at the time of tender evaluation. (wherever applicable and as indicated in SCC document of tender)

10. 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.

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

E. INFORMATION ON PAYMENT TERMS:

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 suppliers 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. 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. (Applicable for Indian vendors only).
Foreign vendors shall submit relevant details of their bankers like Swift Code, Banker's Name & Address etc.
4. Vendors must submit bills & invoices along with required supporting documents in time. Incomplete documentation / delayed submission of invoice / documents will result in corresponding delay in payment.

F. STANDARD PAYMENT TERMS OF BHEL-EDN

Purchase Orders for indigenous procurement

(a) SUPPLY WITH E&C:

- 1) 85% of basic value (excluding E&C charges) + 100% of taxes, duties and freight charges will be paid in 45 days from the date of dispatch or 15 days from the date of submission of complete set of documentation whichever is later.
- 2) 15% of basic value (retention money), (excluding E&C charges) will be paid in 15 days from the date of submission of documents against supplementary invoice with proof of completion of E&C along with E & C charges (if any)

(b) SUPPLY WITH SUPERVISION OF E&C:

- 1) 90% basic value (excluding E&C charges) + 100% of taxes, duties and freight charges will be paid in 45 days from the date of dispatch or 15 days from the date of submission of complete set of documentation whichever is later.
- 2) 10% of basic value (retention money), (excluding E&C charges) will be paid in 15 days from the date of completion of erection and commissioning against supplementary invoice with proof of completion of E&C along with supervision charges (if any)

(c) SUPPLY ONLY:

- 1) 100% of PO value with taxes, duties and freight will be paid in 45 days from the date of dispatch or 15 days from the date of submission of complete set of documentation whichever is later.

Purchase orders for import procurement:**(d) SUPPLY WITH E&C:**

- 1) 85% of the basic value (excluding E&C charges) will be paid in 45 days, against usance draft of 45 days, from the date of AWB/BOL on submission of complete set of documents.
- 2) 15% of basic value (retention money), (excluding E&C charges) will be paid in 15 days from the date of completion of E&C along with E & C charges against supplementary invoice with proof of completion of E&C (if any).

(e) SUPPLY WITH SUPERVISION OF E&C:

- 1) 90% of the value of the order will be paid on the 45th day, against usance draft of 45 days, from the date of AWB/BOL on submission of complete set of documents.
- 2) 10% of basic value (retention money) will be paid in 15 days from the date of completion of erection and commissioning against supplementary invoice with proof of completion of E&C along with supervision charges (if any).

(f) SUPPLY ONLY:

- 1) 100% of PO value will be paid against usance draft of 45 days from the date of dispatch or 15 days from the date of submission of complete set of documents whichever is later.

LOADING FACTORS FOR PAYMENT TERMS:

- 1) For offers received with requests for negotiation of documents through bank loading will be 15% of basic value (all bank charges to be borne by the seller).
(This loading factor is applicable only for purchase orders for indigenous supply).
- 2) In all cases where credit period is 30 days but not in line with the above mentioned standard payment terms offered loading applicable will be 5% of basic value.
(This loading factor is applicable only for purchase orders for indigenous supply).
- 3) For offers received with Letter of Credit payment term in place of sight draft payment term, loading applicable will be 5% of basic value. Additional loading of 5% will be applicable for payment terms as Letter of Credit with usance of less than 45 days.
(This loading factor is applicable only for purchase orders for imported supply).
- 4) For offers received with Sight Draft payment terms with usance of less than 45 days, loading of 5% will be applicable.
(This loading factor is applicable only for purchase orders for imported supply).
- 5) All payment terms with credit period of less than 30 days for indigenous supply and any other variation of payment terms are liable for rejection.
- 6) Standard payment terms indicated in para F (a), (b), (c), (d), (e) and (f) 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 and E&C charges (wherever applicable).

Wherever the Purchase Order is split into import portion and indigenous portion of supply the retention money will be 15% or 10% (as applicable) of both purchase order values put together.

Note 2: *If the E&C could not be completed till the end of the Warranty period due to reasons not attributable to the supplier, BHEL may consider releasing the retention money to the supplier against Bank Guarantee for equivalent value valid for an initial period of one year.*

G. Bank guarantee (BG) / Performance bank guarantee (PBG):

1. Bank guarantee (BG) / Performance bank guarantee (PBG) will be applicable as called in the tender documents. Such PBG shall be valid for a period of 36 months + claim period of 6 months for a value equal to 10 % of the basic value of the purchase order. No deviation for the duration of PBG / BG will be permitted.
 - a. PBG shall be from any of the BHEL consortium of bankers (**refer Annexure VI**).
 - b. PBGs from nationalized banks are also acceptable.
 - c. 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. PBG should be in the format indicated. (**Refer annexures VII & VIII respectively**). No deviation to these formats will be allowed.
 - d. Confirmation from any of the BHEL consortium of banks or any of the Indian Public Sector Banks is essential for the acceptance of PBGs issued by foreign banks (located outside India).
 - e. Expired BGs / PBGs will be returned only after expiry of the claim period or on completion of the contractual obligation.
 - f. **Non acceptance for submission of PBG will attract loading as indicated below**
 - i. Loading will be equal to the percentage of value for which BG / PBG is not provided. (Ex: if PBG / BG is given for 3 % of the basic value against 10% specified, loading applicable will be 7% (10 – 3 = 7 %). This value will be added to the quoted price while evaluating the lowest offer.

H. PROVISIONS APPLICABLE FOR MSE VENDORS (MICRO AND SMALL ENTERPRISES)

Vendors who qualify as MSE vendors are requested to submit applicable certificates (as specified by the Ministry of Micro, Small and Medium Enterprises) at the time of vendor registration. Vendors have to submit any of the following documents along with the tender documents in the Part I / Technical bid cover to avail the applicable benefits.

- a. Valid NSIC certificate or
- b. Entrepreneur's Memorandum part II (EM II) certificate (deemed valid for 2 years).
- c. EM II certificate with CA certificate (**in the prescribed format given in Annexure IX**) applicable for the year certifying that the investment in plant and machinery of the vendor is within permissible limits as per the MSME Act 2006 for relevant status where the deemed validity is over.
- d. Documents submitted for establishing the credentials of MSE vendors must be valid as on the date of part I / technical bid opening for the vendors to be eligible for the benefits applicable for MSE vendors. Documents submitted after the Part I / Technical bid opening date will not be considered for this tender.

PURCHASE PREFERENCE FOR MSE VENDORS:

- e. MSE vendors quoting within a price band of L1 + 15% shall be allowed to supply up to 20% of the requirement against this tender provided
 1. The MSE vendor matches the L1 price
 2. L1 price is from a non MSE vendor
 3. L1 price will be offered to the nearest vendor nearest to L1 in terms of price ranking (L2 - nearest to L1). In case of non-acceptance by the MSE vendor (L2) next ranking MSE vendor will be offered who is within the L1 + 15% band (if L3 is also within 15% band).
 4. 20% of the 20% (i.e. 4% of the total enquired quantity) will be earmarked for SC/ST owned MSE firms provided conditions as mentioned in (1) and (2) are fulfilled.

5. In case no vendor under SC / ST category firms are meeting the conditions mentioned in (1) and (2) or have not participated in the tender, in such cases the 4% quantity will be distributed among the other eligible MSE vendors who have participated in the tender.
6. Serial no. 1 to 5 will not be applicable wherever it is not possible to split the tendered quantity / items on account of customer contract requirement, or the items tendered are systems. Such information that tendered quantity will not be split will be indicated in the SCC.

I. 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.

PURCHASE EXECUTIVE

ANNEXURE - I
LIST OF INTERNATIONAL GATEWAY AIRPORTS

For airbased consignment, terms of delivery will be on FCA basis from following listed airports only. This list is valid from 01.03.2013 to 28.02.2015. Vendors are requested to verify this list for use after 28.02.2015.

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
D06	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 – II
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-III
GUIDELINES FOR REVERSE AUCTION PROCEDURE

Against this enquiry for the subject item/ system with detailed scope of supply as per enquiry specifications, BHEL may resort to "REVERSE AUCTION PROCEDURE" i.e., ON LINE BIDDING (THROUGH A SERVICE PROVIDER). The philosophy followed for reverse auction shall be English Reverse (No ties).

1. For the proposed reverse auction, technically and commercially acceptable bidders only shall be eligible to participate.
2. Those bidders who have given their acceptance for Reverse Auction (quoted against this tender enquiry) will have to necessarily submit "online sealed bid" in the Reverse Auction. Non-submission of "online sealed bid" by the bidder for any of the eligible items for which techno-commercially qualified, will be considered as tampering of the tender process and will invite action by BHEL as per extant guidelines in vogue.
3. BHEL will engage the services of a service provider who will provide all necessary training and assistance before commencement of on line bidding on internet.
4. In case of reverse auction, BHEL will inform the bidders the details of Service Provider to enable them to contact & get trained.
5. Business rules like event date, time, bid decrement, extension etc. also will be communicated through service provider for compliance.
6. Bidders have to fax the Compliance form before start of Reverse auction. Without this, the bidder will not be eligible to participate in the event.
7. In line with the NIT terms, BHEL will provide the calculation sheet (e.g., EXCEL sheet) which will help to arrive at "Total Cost to BHEL" like Packing & forwarding charges, Taxes and Duties, Freight charges, Insurance, Service Tax for Services and loading factors (for non-compliance to BHEL standard Commercial terms & conditions) for each of the bidder to enable them to fill-in the price and keep it ready for keying in during the Auction.
8. Reverse auction will be conducted on scheduled date & time.
9. At the end of Reverse Auction event, the lowest bidder value will be known on auction portal.
10. The lowest bidder has to fax/e-mail the duly signed and filled-in prescribed format for price breakup including that of line items, if required, as provided on case-to-case basis to Service provider within two working days of Auction without fail.
11. In case BHEL decides not to go for Reverse Auction procedure for this tender enquiry, the Price bids and price impacts, if any, already submitted and available with BHEL shall be opened as per BHEL's standard practice.
12. Bidders shall be required to read the "Terms and Conditions" section of the auctions site of Service provider, using the Login IDs and passwords given to them by the service provider before reverse auction event. Bidders should acquaint themselves of the "Business Rules of Reverse Auction", which will be communicated before the Reverse Auction.
13. If the Bidder or any of his representatives are found to be involved in Price manipulation/ cartel formation of any kind, directly or indirectly by communicating with other bidders, action as per extant BHEL guidelines, shall be initiated by BHEL and the results of the RA scrapped/ aborted.
14. The Bidder shall not divulge either his Bids or any other exclusive details of BHEL to any other party.
15. In case BHEL decides to go for reverse auction, the H1 bidder (whose quote is highest in online sealed bid) may not be allowed to participate in further RA process.

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 / transferring 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 Query, 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.
- The date of the stamp paper should be prior to the Air Way Bill / Bill of Lading date.
- 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.

Annexure-VI
BHEL MEMBER BANKS (LIST OF CONSORTIUM BANKS)

BANK GUARANTEE (BG) SHALL BE ISSUED FROM THE FOLLOWING BANKS ONLY:

	Nationalised Banks		Nationalised Banks
1	Allahabad Bank	19	Vijaya Bank
2	Andhra Bank		Public Sector Banks
3	Bank of Baroda	20	IDBI
4	Canara Bank		Foreign Banks
5	Corporation Bank	21	CITI Bank N.A
6	Central Bank	22	Deutsche Bank AG
7	Indian Bank	23	The Hongkong and Shanghai Banking Corporation Ltd. (HSBC)
8	Indian Overseas Bank	24	Standard Chartered Bank
9	Oriental Bank of Commerce	25	The Royal Bank of Scotland N.V.
10	Punjab National Bank	26	J P Morgan
11	Punjab & Sindh Bank		Private Banks
12	State Bank of India	27	Axis Bank
13	State Bank of Hyderabad	28	The Federal Bank Limited
14	Syndicate Bank	29	HDFC Bank
15	State Bank of Travancore	30	Kotak Mahindra Bank Ltd
16	UCO Bank	31	ICICI Bank
17	Union Bank of India	32	IndusInd Bank
18	United Bank of India	33	Yes Bank

Note:

- All BGs must be issued from BHEL consortium banks listed above.
- BHEL may accept BG from other Nationalised Banks also which are not listed above.
- BG will not be accepted from Scheduled Banks and Co-operative Banks.
- In case BG is issued from a bank located outside Indian territory and is issued in foreign currency, the BG must be routed through and confirmed by any one of the above mentioned consortium banks or any of the Indian Public Sector Banks.
- This list is subject to changes. Hence vendors are requested to check this list every time before issuing BGs.

ANNEXURE-VII
PROFORMA OF PERFORMANCE BANK GUARANTEE
(For Bank Guarantees issued in Indian Rupees by Banks in India)

Note:

- To be executed in Rs. 100/- Non-Judicial stamp paper.
- To be submitted by issuing bank to Purchase Dept. directly. Please give BHEL address to banker.
- Do not enclose with Bank document.
- Modifications and additions/deletions to this BG format are not permitted.

PERFORMANCE GUARANTEE (PROFORMA OF BANK GUARANTEE)

Ref no: (BG No.) _____

THIS DEED OF GUARANTEE made and executed on the _____ day of _____ (month & year), by the _____ (Bank), registered under the Companies Act 1956/Nationalised Bank constituted under the Banking Companies (acquisition and transfer of undertakings) Act constituted under the **State Bank of India Act / Subsidiary Banks Act**, having its registered / head office at _____ represented herein by its Branch Manager / authorised representatives Sri. _____ & Sri. _____ (Hereinafter called 'guarantor' which term shall mean and include its successors and assigns)

IN FAVOUR OF BHARAT HEAVY ELECTRICALS LIMITED

_____ (Buyer's Name), a company registered under the companies Act, 1956 having its registered office at BHEL House at Siri Fort, New Delhi-110 049 and its Electronics Division at Mysore Road, Bangalore - 26 (hereinafter referred to as the 'Company' Which term shall include its successors and assigns):

Whereas the company has placed an order on _____ (State the name of the company / firm and its address) (hereinafter referred to as the 'Supplier' which term shall mean and include its liquidators, successors and assign) for the supply of system under order / Contract No _____ Dtd _____.

AND WHEREAS the supplier has agreed to supply the materials and carryout the works as detailed and in accordance with the terms set out in the said order / contract.

AND WHEREAS the company is not required to pay to the supplier a sum of Rupees _____ being the 10% of the value of the goods supplied / Works performed / Services rendered under the said order / contract between the supplier and the company, till the company is satisfied with the mechanical Warranties and the performance standards stipulated in the said order / contract between the company and the supplier has been duly fulfilled, except, against a Bank Guarantee for the said sum of Rs. _____ in favour of the company by reputed Bank, in which case the company has agreed to make payment to the supplier of the said sum of Rupees _____ being (10%) of the value of the goods supplied / Works performed / Services rendered under the agreement between the supplier and the company and the Guarantor has at the request of the supplier, agreed to furnish this Guarantee subject to the terms and conditions stated below :

NOW THIS DEED WITNESSES THAT IN pursuance of the above said agreement, the guarantor hereby agrees and covenants with company is as follows:

- 1) That during the period this contract of Guarantee remains effectual, the guarantor shall be liable in respect of the amount due and owing to the company in respect of the payments to the extent of Rs _____ (in words) _____ against any loss or damage caused to or suffered by the company by reasons of any breach of the terms of the said order / contract / Agreement by the supplier
- 2) The Guarantor hereby undertakes to pay the amounts and payable under this guarantee without any demur, merely on demand from the company intimating that the amount claimed is due by way of loss or damage caused to or suffered or would be caused or suffered by any terms contained in the said order/contract. Any such demand made on the guarantor shall be conclusive as regards the amount due and payable by the Guarantor irrespective of the fact whether the contractor/supplier admits or denies.
- 3) The Guarantor further agrees that the agreement herein contained shall remain in force and effect till all supplies to be made /works to be performed / services to be rendered under the said order /contract /agreement are completed to the entire satisfaction of the company or till company certifies that the terms and conditions of the said order / contract agreement have been fully and

properly carried out by the said supplier and accordingly discharges the Guarantee. Unless a demand or claim under this guarantee is made on the guarantor in writing on or before the expiry of claim period indicated in clause 6 below, the guarantor shall be discharged from all the liability under this guarantee thereafter.

- 4) The guarantor further agrees with the company that the company shall have the fullest liberty without the consent of the guarantor and without effecting in any manner the obligations of the guarantor hereunder to vary any of the terms of the said order / contract / agreement or extend the time of performance by the said supplier from time to time or refrain from exercising the power exercisable by the company against the said supplier or to forebear or omit to enforce any of the terms and conditions relating to the said order / contract / agreement, and the guarantor shall not be relieved of its liability in whole or in part, by reason of any act, commission or forbearance on the part of the company or by reason of any such variation, or extension being granted to the said supplier or by reason of any such matter or thing whatsoever which under the law relating to sureties would but for this provision have effect of so relieving the guarantor.
- 5) The guarantor undertakes not to revoke this guarantee during its currency except with the previous consent of the company in writing.
- 6) Notwithstanding anything herein above obtained, the liability of the guarantor under these presents is restricted to Rs._____. The guarantee shall be in force till its expiry on _____ unless a demand is made on the guarantor within SIX months from the date of expiry, all the liability of the guarantor under this guarantee shall stand fully discharged. The decision of the claimant in regard to breach of contract is final and binding on the Bank.

IN WITNESS whereof, the guarantor, acting through it authorised representative has executed this deed of Guarantee on the day, month and year first above written.

(Seal of the Bank to be affixed)
For & On behalf of _____ Bank
Signature of authorized person with
seal & designation

WITNESS:

- 1.
- 2.

ANNEXURE-VIII
PROFORMA OF PERFORMANCE BANK GUARANTEE
(For Bank Guarantees issued in Foreign Currency by Banks located outside India)

BANK NAME AND ADDRESS

Electronics Division
Bharat Heavy Electrical Limited (B.H.E.L.),
Mysore Road, P.B. No. 2606,
Bangalore- 560 026

Dear Sir,

Sub : CONTRACT PERFORMANCE GUARANTEE Ref no. Dtd.....

WHEREAS you have entered into a contract reference No & PO NO. _____
Date _____ with M/s _____ having its registered office at
_____ for the supply of _____ as detailed in your purchase
order No. _____ which is hereinafter referred to as "the said contract" and WHEREAS M/s
_____ has undertaken to produce a Bank Guarantee for 10% (Ten Percent)
of the contract price amounting to _____
(_____) to secure its obligations to Electronics Division, BHEL
having its registered office at New Delhi for the performance of the contract including the warranty of the
equipment supplied, We _____ Bank,
_____ hereby expressly, irrevocably and unreservedly undertake and
guarantee as principal obligors on behalf of M/s _____ that in the event Bharat
Heavy Electricals Ltd. (B.H.E.L.) declares to us in writing that M/s _____
has not fulfilled any obligations according to the contractual obligation of the said contract, to pay you on
demand and without demur to Bharat Heavy Electricals Ltd., Electronics Division, Mysore Road, P.B.No.
2606, Bangalore - 560 026., India an amount of _____
(in words _____) subject to
as may be determined below :

1. Notwithstanding any right M/s. _____ may have directly against or any
disputes raised by M/s. _____
_____, Your written demand shall be conclusive
evidence to us that repayment is due under the terms of the said contract and shall be binding on
us.

2. We shall not be discharged or released from this undertaking and Guarantee by any arrangements, variations made between you and M/s. _____ with or without our consent and knowledge or by any alteration in the obligations of M/s. _____ by any forbearance whether as to payment, time, performance or otherwise.
3. This guarantee shall remain valid until the end of six months after the close of the warranty period or until the same is reported by BHEL to us whichever is earlier.
4. We agree and undertake not to revoke this guarantee during its validity unless discharged in writing by you subject to the provision of clause (7) below :
5. This guarantee shall be a continuing guarantee subject to the foregoing and shall not be discharged by any change in the constitution of the Bank or M/s. _____ .
6. This guarantee shall be governed by and constructed in accordance with the Laws of India.
7. At any time _____ Bank may render this guarantee null and void by paying to Bharat Heavy Electricals Ltd. the full amount being _____ (in words _____)
_____)

**For and On behalf of Bank
By its Authorised Signatory**

Annexure - IX
Certificate by Chartered Accountant on Letter Head

This is to certify that M/s
.....(Hereinafter referred to as 'Company')
having its registered office at is registered under MSMED Act 2006,
(Entrepreneur Memorandum No (Part-II dtd
Category: (Micro/Small). (Copy enclosed).

Further verified from the Books of Accounts that the investment of the company as
on date..... **as per MSMED Act 2006 is as follows:**

1. For Manufacturing Enterprises: Investment in plant and machinery (i.e., original
cost excluding land and building and the items specified by the Ministry of Small
Industries vide its notification No.S.O.1722 (E) dated October 5, 2006:

2. For Service Enterprises: Investment in equipment (original cost excluding land and
building and furniture, fittings and other items not directly related to the service
rendered or as may be notified under the MSMED Act, 2006:

Rs.Lacs.

The above investment of Rs. Lacs in within permissible limit of
Rs..... Lacs for.....Micro / Small (Strike off which is not
applicable) Category under MSMED Act 2006.

Date:

(Signature)

Name -

Membership Number -

Seal of Chartered Accountant

Guidelines for Indian Agents
ANNEXURE - X

- Definition of Indian Agent: An Indian Agent of foreign principal is an individual, a partnership, an association of persons, a private or public company, that carries out 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.

--X--

Vendor's Signature with Seal

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.

Disclaimer Certificate For Deemed Export Benefits

I, (Name & Designation)on behalf of M/s. (Name and address of the supplier) hereby certify that we have supplied the following goods to M/s..... (Name and address of the recipient):

S.No.	Inv. No. & date	Description of goods	Unit	Qty.	Value

1. We are the manufacturer exporters/suppliers and are registered/not registered with Central Excise and have not availed and will not avail CENVAT facility in respect of the input/components used in aforesaid supplies. We have also not availed and will not avail rebate on the inputs/components used in aforesaid supplies.

OR

We are the suppliers and our supporting manufacturer(s) is/are registered/not registered with Central Excise and have not availed and will not avail CENVAT facility in respect of the inputs/components used in aforesaid supplies.

2. We also certify that we have not been issued any Advance Authorization/Duty Free Import Authorization in respect of the aforesaid supplied goods and have not availed any benefit thereon.

3. We further state that we have not drawn nor will draw any benefit for deemed export and we have no objection if M/s..... (Name and address of the recipient) draws the deemed export benefits on the supplies mentioned above. (Required to be given in case benefits are claimed by recipient of goods).

OR

We have not given disclaimer certificate to M/s..... (Name and address of the recipient) and will not give disclaimer certificate, in future, in respect of these supplies for claiming deemed export benefits (Required to be given in case benefits are claimed by DTA suppliers).

Pre-Qualification Criteria

Item: VFDs for ID Fans (3800kW, 6.6kV motor) and CEPs (600kW, 6.6kV motor)

Project : ROURKELA, PP-II EXPANSION PROJECT (1x250MW)

Customer : NSPCL (NTPC SAIL POWER CO. LTD.)

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 offered) for feeding squirrel cage induction motor/synchronous motor of 1250 kW or above rating, which is in successful operation for a period of atleast one (1) year as on 02-04-2015. The Reference List of VFD supplies made giving the ratings, year of supply, application and details of the customers etc. to be provided along with the offer.
3. Letter from user (end customer) for atleast one year successful operation of the VFD system shall be furnished in support of pt.2 above. This letter shall also contain contact details of the customer.
4. 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.
5. 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.
6. The vendor shall offer VFD for both ID Fans and CEPs.

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.

L. S. Subrahmaniam 13/09/17

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	
6	Yes / No	



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PURCHASE SPECIFICATION

GROUP: VFD ENGINEERING

P.S NO. : PS/445/2571

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CONTENTS SHEET

PART-A: BHEL DOCUMENTS

- (A1) VFD PANEL AND TRANSFORMER SPECIFICATION
- (A2) SINGLE LINE DIAGRAM OF VFD SYSTEM
- (A3) MOTOR DATASHEET
- (A4) VFD SYSTEM DATASHEET

PART-B: NSPCL DOCUMENTS

- (B1) TECHNICAL SPECIFICATION FOR VFD FOR MEDIUM VOLTAGE APPLICATION
- (B2) PROVENNESS CRITERIA REQUIREMENT OF MEDIUM VOLTAGE VFD
- (B3) QA DOCUMENTS

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REVISION HISTORY SHEET

REV. NO.	DATE	NATURE OF CHANGE	REASONS	PREPARED BY	APPROVED BY
00	05-09-2017	FIRST ISSUE	-----		

REVISION 00

APPROVED BY *L. Subbalakshmi*
L SUBBALAKSHMI

PREPARED BY *Swarna*
SWARNALATHA.N

ISSUED BY
VFD ENGG

DATE
05-09-2017



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

a. FOR ID FAN 3800KW,745 RPM, 401A

b. FOR CEP (Condensate Extraction Pump) 600KW, 1489 RPM, 64A

1. Project Details

Sl. No.	Parameter	Specification
1	PROJECT	ROURKELA PP-II EXPANSION PROJECT (1x250MW)
2	CUSTOMER	NSPCL
3	CONSULTANT	MECON LIMITED

2. Environment Specifications

Sl. No.	Parameter	Specification
1	Maximum Ambient Temperature	48°C
2	Minimum Ambient Temperature	6°C
3	Equipment Design Temperature (IS-9676)	50°C
4	Relative Humidity	95%
5	Altitude	Less than 1000m above mean sea level
6	Location of VFD Panels	Indoor, Ventilated Room with Air Conditioning.
7	Seismic Zone	As per IS-1893-Zone-II

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REVISION 00

APPROVED BY *L. Subbalakshmi*
L SUBBALAKSHMI

PREPARED BY
Swarna
SWARNALATHA.N

ISSUED BY
VFD ENGG

DATE
05-09-2017



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3. Input and Transformer Data

Sl. No.	Parameter	Specification
1	System Voltage / Frequency / Phase	6.6kV / 50Hz / 3
2	Voltage Variation	±10%
3	Frequency Variation	+3% -5%
4	Combined Voltage and Frequency Variation	±10%
5	Fault Level	40kA/1 sec
6	Transformer Type	Dry type integrated Transformer (In Vendor scope)
7	Rating	Transformer must be designed to carry 110% current of calculated VFD rating. Transformer sizing calculation shall be provided along with offer.
8	Power Cables	Cable glands to be provided by the vendor for Transformer HV side cable termination suitable for a. For ID Fan 2Rx3Cx240 sqmm b. For CEP 3Cx150 sqmm Al, XLPE cable. The exact no and size will be intimated during drawing approval stage. Cables in Customer /BHEL scope.

4. Motor Data

Sl. No.	Parameter	Specification		
1	Type	Squirrel Cage Induction Motor		
2	Scope	Manufactured by BHEL-Bhopal		
3	Rated Output	<u>For ID Fan</u>	<u>For CEP</u>	
		3800KW, 745RPM	600KW, 1489RPM	
4	Rated Voltage and Current	6.6kV, 401A	6.6kV, 64A	
5	No load current	120A	18A	
6	Fed from	Variable Frequency Drive (V/f Control) with Bypass		
7	Duty Class	Continuous - S1		
8	Efficiency and Power Factor:	% of Load	Efficiency	Power Factor
		50	Refer Motor Data Sheets attached	
		75		
		100		

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9	Power Cables	Cable glands to be provided by the vendor for VFD Output side cable termination suitable for a. For ID Fan 2Rx3Cx240 sqmm b. For CEP 3Cx150 sqmm Al, XLPE cable. The exact no and size will be intimated during drawing approval stage. Cables in Customer /BHEL scope.
---	--------------	--

5. Scope:

Sl. No.	Scope of Supply	Description
1	a) Fully Assembled Units of 6.6kV VFD Panels (IGBT/SGCT/IGCT), Air Cooled with integrated Dry type transformer- 2 Nos. for ID Fans and 2 nos. for CEPs b) All interconnecting cables between the VFD and integrated Transformer c) Any special cable other than power and control cables from VFD to other equipment. d) Cable glands and lugs e) 4 Laptops (1 No. for each VFD).	The vendor shall be responsible for engineering and functioning of the complete VFD system, meeting the intent and requirement of this specification & Customer specification. 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, motor cable selection etc. All necessary interlocks as required for safe and reliable operation of VFD system along with Input breaker, Output breaker and Bypass breaker shall be provided in VFD system. If any special arrangement is required in input and output breaker, same shall be informed by the vendor in offer. The machine shall normally run on VFD. In case of drive mal-operation, the motor could be taken on bypass control manually, while the drive could be attended independently.

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6. VFD Specifications

Sl.No.	Parameter	Specification
1	Drive	a. VFD for ID fan b. VFD for CEP
2	Input Voltage	From Integrated dry type Transformer
3	Power/Torque vs Speed	Torque \propto Speed ² , Power \propto Speed ³
4	Single Line Diagram	See Attachment 3-661-00-00961 for ID fan 3-661-00-00962 for CEP
5	Output Voltage of VFD	0 to 6.6kV (V/f = Constant)
6	Output Current of VFD	401A at 50°C (Design Ambient) for ID fan 64A at 50°C (Design Ambient) for CEP
7	Output Frequency	0 to 50Hz, Resolution: +/- 0.01% under transient conditions; +/- 0.5% under steady state conditions
8	Overload capacity	110% for 1 minute once every 10 minutes
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 is ~250 meters. Vendor to clarify and offer output Filter, if required.
13	VFD Panel Construction	a) Protection Class: IP32 b) Panel: Free standing, floor mounting type, comprising of rigid welded structural frames with Cold Rolled Sheet Steel enclosure of minimum thickness 2 mm for load bearing 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. c) 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. Vendor to provide low noise redundant cooling fan for the VFD panels (minimum n+1, where 'n' is the number of fans required for operation at specified rating) with a changeover arrangement. Changeover scheme shall be submitted along with the offer. Supply of loose redundant fan is not acceptable. Suitable thermal switch for exit air temperature monitoring shall also be incorporated.

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Sl. No.	Parameter	Specification
13	VFD Panel Construction	<p>d) Busbar Material – Electrolytic grade Copper, colour coded. Sleeving/shrouding for safety purposes shall be done.</p> <p>e) Earth Bus – minimum 50*6 mm Copper.</p> <p>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.</p> <p>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 - shade RAL9002 front and rear panels, end panel sides RAL5012. Paint Thickness: 60 Microns (minimum). Exact paint shade will be confirmed during drawing approval stage.</p> <p>h) Power and Control Wiring shall be done with Fire retardant (FRLS) cables.</p> <p>i) Double compression 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. Gland Plates shall be minimum 4 mm thick Aluminium (steel not allowed). Gland plate shall be of sufficient strength to handle all the cables.</p> <p>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.</p> <p>k) All low voltage compartment and cabling shall be electrically and physically separated from the high voltage compartment.</p> <p>l) Lugs for all control cables shall be terminated in terminal block itself. This would avoid usage of different types of lugs at site during commissioning.</p>



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Sl. No.	Parameter	Specification
14	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 the fans running in the VFD Panels.
15	Storage Temperature	-40°C to +60 °C
16	Vibration	According to IEC68-2-6
17	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).
18	VFD Efficiency	Shall be > 96%. Exact value to be specified by the Vendor.
19	Duty Cycle	Class I Duty Cycle as per IEC 146-1
20	VFD Requirements	<p>a) Input Choke: Input chokes to be provided, if necessary.</p> <p>b) Local/Remote: Selector switch shall be provided for operator to select type of operation: Local – Operation from VFD Panel for Speed Control from door mounted interface; Remote – Operation from DCS. 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.</p> <p>c) Local Start/Stop Push Button to be provided either on Panel door or on keypad.</p> <p>d) Door Mounted Lockable Push-Button with cover to be provided with 2NO + 2 NC contact for Emergency Stop. One normally open and close contact to be wired to Terminal Block for external Interlocking / Annunciation</p> <p>e) Every Panel shall be provided with CFL illumination Lamp with limit switch and MCB. Space heater shall be provided in panel with switch fuse and variable setting thermostat. 240V power socket with MCB shall be provided.</p> <p>f) 230V, 1phase, 50Hz (exact rating during drawing approval stage) Power Supply to the motor space heater shall be derived from VFD. Necessary interlocking arrangement for this supply shall also be made available in the VFD panels.</p> <p>g) Two numbers of 415V, 3Ph, 4W, 50Hz feeders shall be provided by customer for each VFD. Vendor has to build necessary redundancy with auto changeover arrangement either in the VFD panel itself or in a separate panel.</p>



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Sl. No.	Parameter	Specification
20	VFD Requirements	<p>h) PLC: PLC shall be provided for Interlocking and Protection (if required)</p> <p>i) 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.</p> <p>j) <u>Any special requirement regarding CT/ PT, protection relay or any other device, in input and output breaker, which is required for functioning of VFD system shall be considered by the VFD vendor in their scope.</u></p>
21	VFD Features	<p>a) Soft Start and Auto Restart</p> <p>b) Auto Speed Search Facility (Catch on Fly) shall be available for starting into rotating loads.</p> <p>c) Power loss ride through (Kinetic Buffering) and for voltage dips over 20% or Power interruption for less than 2 secs.</p> <p>d) Automatic VFD tuning during start-up.</p> <p>e) Flux optimisation function shall be provided to reduce the total energy consumption and noise level in case drive is operated below nominal load.</p> <p>f) Selectable reverse run prohibition</p> <p>g) Adjustable motor overload feature</p> <p>h) Settable minimum and maximum operating frequency</p> <p>i) VFD shall produce not greater than 1% torque pulsation to the shaft of driven equipment.</p> <p>j) Field adjustable Torque limits and acceleration and deceleration ramps</p> <p>k) Accelerate / Decelerate Times to be specified.</p> <p>l) Four (4) user programmable preset speeds.</p> <p>m) 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.</p> <p>n) Vendor shall certify readiness of system fit for commissioning. Vendor's scope shall also include supply of all specialized tools and tackles required.</p> <p>o) VFDs shall be installed in Air-conditioned area but it shall be suitable for operation in non-air-conditioned area also.</p> <p>p) Earthing scheme should be provided by the vendor.</p> <p>q) Any special cable other than power and control cables required to connect VFD to other equipment shall be in vendor scope.</p> <p>r) All electronic PCBs/Modules must have conformal coating to take care of site conditions.</p>



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Sl. No.	Parameter	Specification
22	Controls and monitoring	<p>a) VFD shall be with an interactive and user-friendly door mounted digital operator interface with LCD display and sealed membrane type keypad.</p> <p>b) 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.</p> <p>c) The operator interface shall have LED indicators for drive fault, drive run, and drive in current limit.</p> <p>d) The operator interface shall allow monitoring of inverter operating conditions including speed, current, voltage, torque, power etc.</p> <p>e) Messages shall be alphanumeric in nature. All the fault messages shall be in English.</p> <p>f) Provision shall be made available for remote operation.</p> <p>g) The operator interface shall be able to display all real time operating variables and all drive programming parameters.</p> <p>h) 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.</p> <p>i) The following Control signals must be provided:</p> <ol style="list-style-type: none"> 1) Local/Remote 2) Emergency stop 3) Trip/Close Input breaker <p>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.</p> <p>j) All VFD operating parameter shall be stored in nonvolatile memory.</p> <p>k) The drive shall have built in monitoring of following parameters as minimum on its digital operator interface and these parameter shall also be displayed at Plant DCS through Modbus link:</p> <ol style="list-style-type: none"> i) Output Frequency



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Sl. No.	Parameter	Specification
22	Controls and Monitoring	<p>ii) Output Current iii) Motor Speed iv) Output Voltage v) DC Bus Voltage vi) Output Power (It shall be possible to display power output of the drive in kW) vii) Digital Input Status viii) Digital Output Status ix) Analog Input Status x) Drive Thermal state xi) Motor energy meter xii) Hour run xiii) Transformer Temperature for alarm & trip</p> <p>l) Necessary transducer shall be provided with 4-20 mA output for indicating Motor Speed and Motor Current in the DCS. Transducers shall be capable of driving 500 ohms load.</p> <p>m) The following indications shall be provided on the VFD Panel Door/ Keypad:</p> <p>i) Motor Running/ VFD ON ii) Motor Stopped/Tripped iii) AC Mains ON iv) Auxiliary Control Supply ON v) VFD Ready vi) VFD Fault vii) External Fault viii) Emergency Stop Activated ix) Motor Overspeed x) Input Breaker Trip xi) Motor zero speed xii) Rectifier output 'ON' xiii) Transformer winding temperature alarm & trip.</p>



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22	Controls and Monitoring	<p>n) The VFD shall store fault logs of minimum last 10 faults in memory.</p> <p>o) The interface details of VFD shall be incorporated as required for data communication with DCS system with serial interfaces with RS485 data links. Necessary hardware shall be included in the scope and the interface protocol (i.e. Modbus only) shall be provided.</p> <p>The following Audio-visual annunciations must be provided.</p> <ol style="list-style-type: none"> 1) Rectifier fuse failure / drive fault 2) Main AC failure 3) Inverter fuse failure / Drive fault 4) Inverter overload 5) Inverter high temperature / Drive fault 6) Cooling system failure 7) Motor failed to start / Drive fault 8) Transformer fault and alarm 9) Communication and measurement system unhealthy
23	Protection	<p>Following protections shall be built in within the inverter and any other protection as required:</p> <ol style="list-style-type: none"> a) Motor Overload / Over Torque b) Instantaneous Over current (This device shall monitor the peak output current continuously and shall provide instantaneous shutdown without component failure whenever its trip point is surpassed. The trip point must be greater than or equal to 110% of the VFD's rated full load output current) c) Ground Fault Protection – 5-10A within 300ms maximum. d) Over Voltage/Under Voltage - VFD shall be able to withstand >20% dip in supply voltage for 2 secs without damage to semiconductors or fuses. e) Output Short Circuit f) Output Phase Loss/Fuse Failure g) Phase Sequence Protection h) Input Phase Loss/Single Phasing Preventer i) Over Speed/Over frequency of motor



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PURCHASE SPECIFICATION
GROUP: VFD ENGINEERING

P.S NO. : PS/445/2571

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Sl. No.	Parameter	Specification
23	Protection	<p>j) Heat sink over temperature/VFD Panel Temperature High Stall prevention (During acceleration, deceleration and constant speed operation)</p> <p>k) Loss of Cooling Fans</p> <p>l) External faults like Transformer Fault and Alarm</p> <p>m) Incoming Line surge protection</p> <p>n) Under/Over voltage protection</p> <p>o) Inverter fault</p> <p>p) System earth fault protection</p> <p>q) 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 variation of +/-10% and frequency variation of +3% & -5%</p> <p>r) 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.</p> <p>s) 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.</p> <p>t) 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.</p>



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PURCHASE SPECIFICATION

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Sl.No	Parameter	Specification
24	Dry type Transformer	<p>Dry type Transformer</p> <ul style="list-style-type: none">a) HV voltage: 6.6kV with Taps of $\pm 5\%$ in steps of 2.5%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: F or higher <p>Protection: RTDs (2 nos) 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. Construction: The dry type transformer shall be mounted in a panel which will be mounted along with the VFD panel Connection: HV Incomer: Termination arrangement to be provided for a) 2Rx3Cx240sqmm for ID FAN b) 3Cx150sqmm for CEP Al, XLPE cable. 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: Cable 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.</p>



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Sl. No.	Parameter	Specification
25	Type of Control:	Completely programmable by the user as: a) Flux vector control with speed feedback b) Flux vector control without speed feedback c) Scalar V/F. VFD shall be capable of maintaining motor speed within $\pm 0.5\%$ without the use of a motor mounted encoder or tachometer. The drive shall have programmable V/F patterns along with user definable custom V/F patterns.
26	Harmonic 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 5 th , 7 th & 11 th harmonics values with calculations during detailed engineering stage. Vendor to supply harmonic filters, if required, to filter the harmonics generated by VFD at input/ supply side.
27	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. It should not be more than 5%. If it is more than 5%, vendor has to provide output filter.
28	Switching frequency	To be specified by the vendor
29	Auxiliary Supply	a) 230V UPS feeder will be provided by BHEL. kVA Rating is to be given by the Vendor. Power supply for electronic modules has to be derived from the UPS. b) Auxiliary Supply – 415V, 3 ϕ , 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.



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Sl. No.	Parameter	Specification
30	Testing and Quality Plan	<p>a) Routine Tests shall be carried out on all Panels and transformer as per relevant standards and NSPCL specifications.</p> <p>b) Type Test Certificates for similar equipment and rating supplied by the Vendor shall be submitted during detailed engineering.</p> <p>If valid type test certificates for transformer and VFD panels are not available as per NSPCL Specification, vendor shall conduct the type tests without any cost implication to BHEL.</p> <p>c) During fabrication, the drive and Transformer 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.</p>
31	Inspection, Training and Commissioning Support	<p>a) Final Inspection: BHEL / Customer representative will be present at manufacturer’s works for witnessing of final testing. This is to be incorporated in the Quality Plan. No charges shall be applicable for witnessing of final tests.</p> <p>b) Training: Training for 4 (Four) persons from BHEL / Customer for a period of 1 week at manufacturer’s works free of cost.</p> <p>c) Commissioning: Commissioning of all 4 VFD Systems at site shall be in the scope of Vendor. Final Acceptance shall be based on successful completion of the same.</p> <p>d) Any replacement of failed/damaged items during commissioning shall be exclusively at Vendor’s cost.</p> <p>e) Vendor is advised to stock necessary spares and ensure easy availability to facilitate trouble free commissioning.</p>
32	Laptop & Software for Computer Interface	<p>Laptops shall be installed with Latest Compatible Licensed Operating System. The software must be loaded in the laptops & supplied along with interconnecting cables and accessories required for interface with the drive.</p> <p>The software should be an easy to use commissioning tool for drives and shall be provided along with the system. The interface details of VFD shall be incorporated as required for data communication with DCS system with serial interfaces with RS485 data links. Necessary hardware shall be included in the scope and the interface protocol (Modbus only) shall be provided.</p>



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Sl. No.	Parameter	Specification
33	Maintenance	The procedure for maintenance of VFD panels and the schedule thereof shall be mentioned in the offer.
34	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, supplier 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 of all Clauses in the Purchase Specifications 1 to 33 of Specification shall be furnished in the format below.

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

7. Consolidated Scope of Supply and Services

Sl. No.	Items	Quantity (Nos.)
1.	a) For ID Fan: Fully Assembled Units of 6.6kV VFD Panels (IGBT/SGCT/IGCT), Air Cooled with integrated Dry type transformer	2 Nos.
	b) For CEP: Fully Assembled Units of 6.6kV VFD Panels (IGBT/SGCT/IGCT), Air Cooled with integrated Dry type transformer.	2 Nos.
	c) Cable Glands and lugs	01 Set
2.	Laptops	4 Nos. (1 no. for each VFD)
3.	Supervision of Erection & Commissioning (all 4 VFD systems)	01 lot (lumpsum)



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8. Documentation

Sl. No.	Parameter	Specification
1	Attached Documents	a) NSPCL specification for VFD System and QA documents b) Motor Datasheet : 1) For ID Fan : BP-DG-427-203-0002 Rev 02 2) For CEP : BP-DG-427-204-0002 Rev 02 c) Single Line Diagram : 3-661-00-00961 for ID fan & 3-661-00-00962 for CEP. d) Provenness Criteria requirement of Medium Voltage Variable Frequency Drive (11/6.6 kV VFD) e) Datasheet for VFD system
2	Technical Information required along with Offer	a) Dimensional Drawing of Panels along with minimum clearance to be maintained for effective cooling, and Weight 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 commissioning. Provenness clause of Medium Voltage Variable Frequency Drive (11/6.6 kV VFD) attached with this specification shall be used as qualifying criteria. d) Confirmation / Clarification / Information / Deviation List as per Point 34 above. e) Confirmation / Clarification / Deviation List to NSPCL Specifications and other documents in SI No. (1) above. f) Sizing Calculation for Transformer. g) Filled up Datasheet for VFD system
3	Information / Confirmations required along with offer	a) Supply of the VFD shall be by OEM 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 15 (fifteen) years after commissioning. Address of the Sales and Service Representatives in India with complete contact details: Name/Telephone/Email are to be provided.

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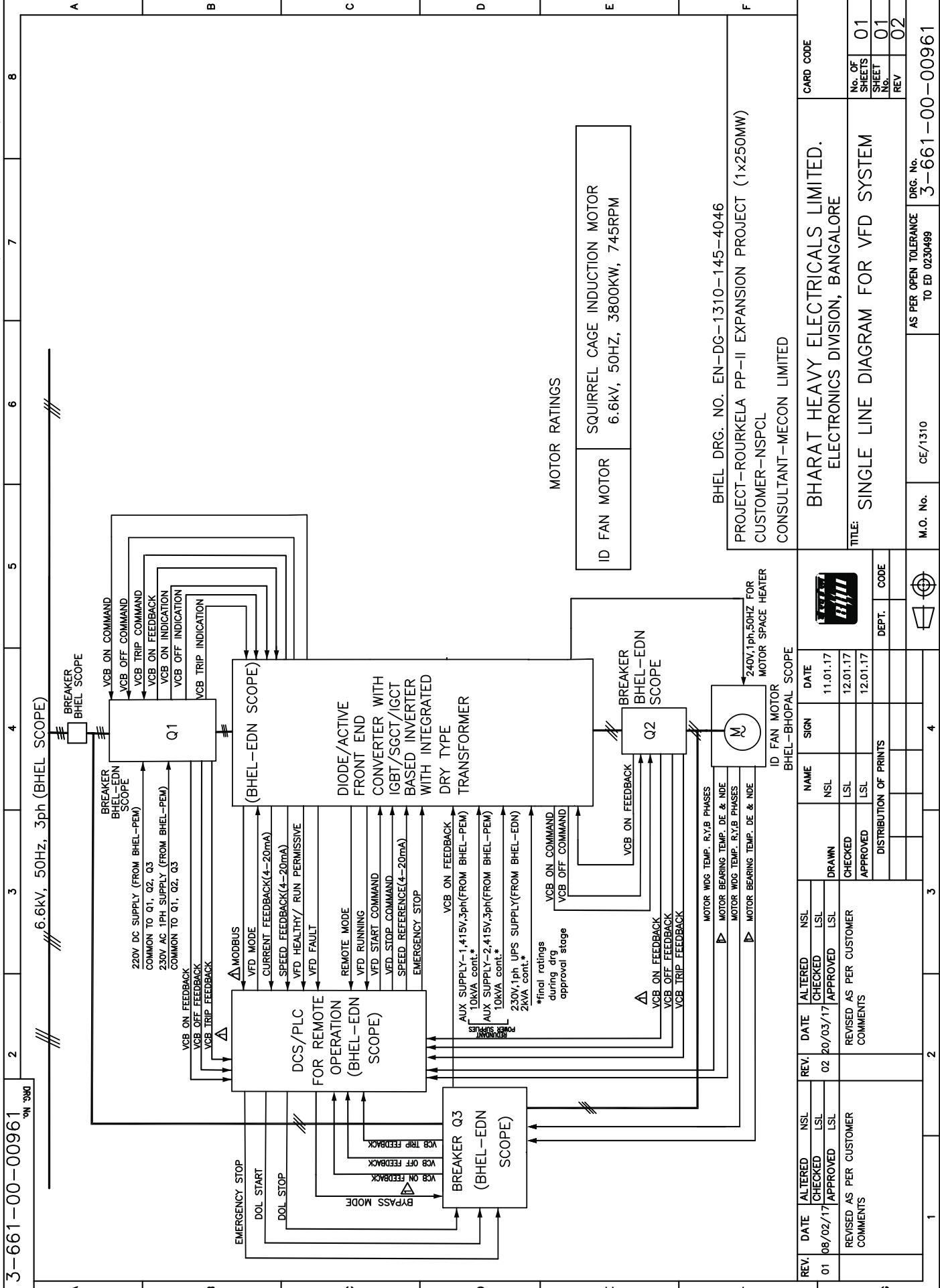
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Sl. No.	Parameter	Specification
3	Information / Confirmations required along with offer	c) Vendor shall give a notice of at least 1 year to the end user of the equipment and BHEL before phasing out the product / spares to enable the end user for placement of order for spares and services.
4	Technical (unpriced) and Commercial (priced) Bids – For Evaluation	Refer sheet no. 15 of 17. Unpriced and Priced bids for Sl. Nos. 7(1), 7(2) & 7(3).
5	Information required for Customer / Consultant Approval (within 3 weeks from the date of Purchase Order)	a) Dimensional Drawing of Panels along with minimum clearance to be maintained for effective cooling, and Weight b) Schematic Diagram c) Bill of Materials for equipment to be supplied d) Feeder Requirements – UPS and 415V supply e) Losses at Rated Load (including Fans) f) Heat Loss for Air Conditioning System sizing g) Technical Catalogue of VFD System being offered h) Test Protocol and Quality Plan i) Type test certificates of similar or higher rating equipment j) Filled up Data sheet for VFD system
6	Information Required along with Supply. Maintenance Manuals and Documentation	a) Erection, Commissioning and Maintenance Manuals along with Final Drawings and Documentation – 2 Copies b) 1 no. CD ROM consisting of the above. c) Test and Guarantee Certificates. d) Complete Bill of Material (item wise) for the equipment supplied.

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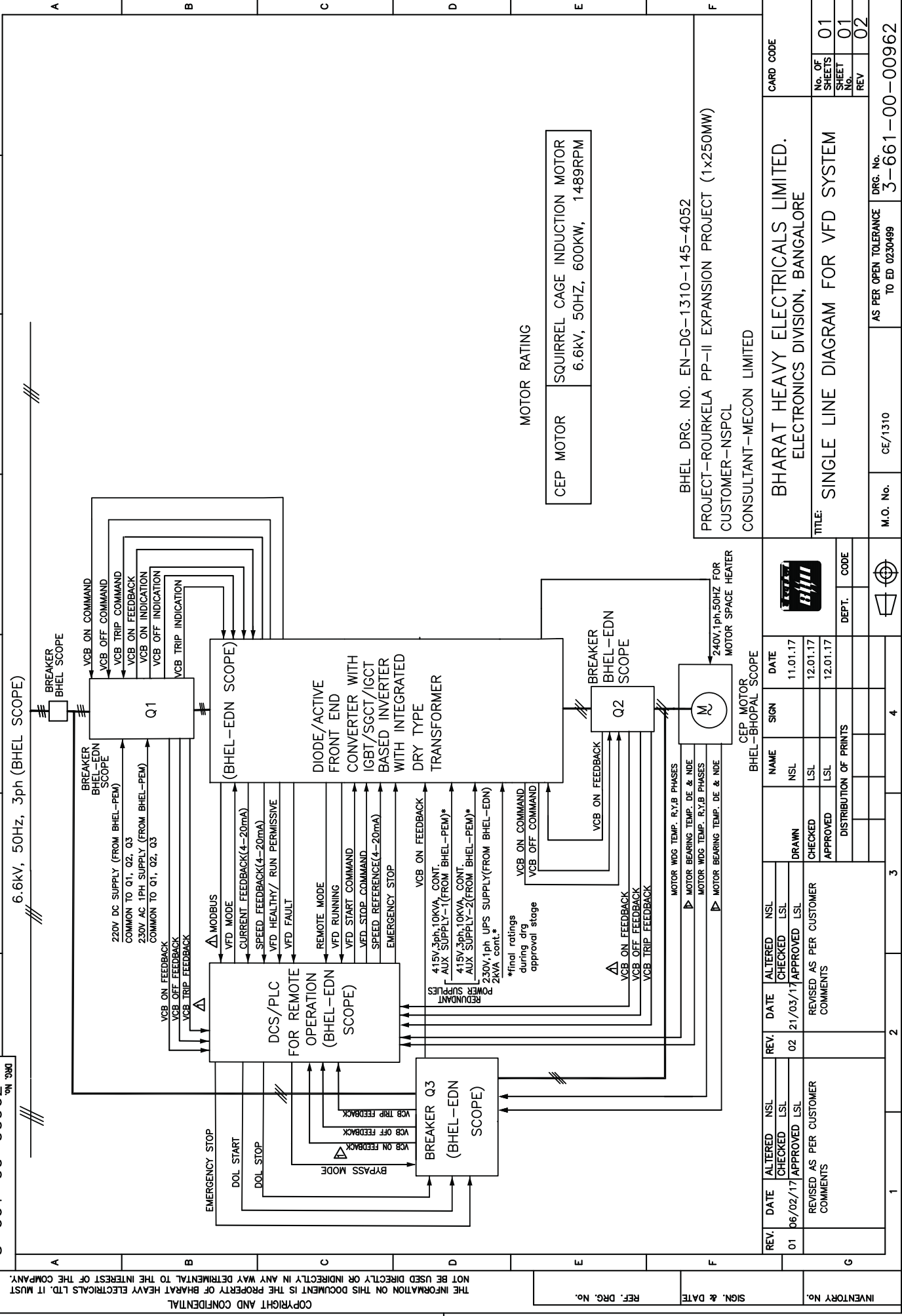


MOTOR RATINGS

ID FAN MOTOR	SQUIRREL CAGE INDUCTION MOTOR
	6.6kV, 50HZ, 3800KW, 745RPM

BHEL DRG. NO. EN-DG-1310-145-4046
 PROJECT-ROURKELA PP-II EXPANSION PROJECT (1x250MW)
 CUSTOMER-NSPCL
 CONSULTANT-MECON LIMITED

REV.	DATE	ALTERED	NSL	DATE	ALTERED	NSL	NAME	SIGN	DATE
	01	08/02/17	CHECKED	LSL	02	20/03/17	CHECKED	LSL	11.01.17
REVISED AS PER CUSTOMER COMMENTS			APPROVED	LSL	APPROVED	LSL	LSL	12.01.17	12.01.17
DISTRIBUTION OF PRINTS									
DEPT. CODE									
M.O. No. CE/1310									
AS PER OPEN TOLERANCE TO ED 0230499									
DRG. No. 3-661-00-00961									
CARD CODE									
BHEL DRG. NO. EN-DG-1310-145-4046									
PROJECT-ROURKELA PP-II EXPANSION PROJECT (1x250MW)									
CUSTOMER-NSPCL									
CONSULTANT-MECON LIMITED									
BHARAT HEAVY ELECTRICALS LIMITED.									
ELECTRONICS DIVISION, BANGALORE									
TITLE: SINGLE LINE DIAGRAM FOR VFD SYSTEM									
No. OF SHEETS 01									
SHEET No. 01									
REV 02									



MOTOR RATING
 CEP MOTOR SQUIRREL CAGE INDUCTION MOTOR
 6.6kV, 50HZ, 600KW, 1489RPM

BHEL DRG. NO. EN-DG-1310-145-4052
 PROJECT-ROURKELA PP-II EXPANSION PROJECT (1x250MW)
 CUSTOMER-NSPCL
 CONSULTANT-MECON LIMITED

BHEL-EDN SCOPE		BHEL-BHOPAL SCOPE	
REV.	DATE	ALTERED	NSL
01	06/02/17	CHECKED	LSL
		APPROVED	LSL
REVISED AS PER CUSTOMER COMMENTS		REVISED AS PER CUSTOMER COMMENTS	
DISTRIBUTION OF PRINTS		DISTRIBUTION OF PRINTS	
DEPT.	CODE	DEPT.	CODE
M.O. No. CE/1310		AS PER OPEN TOLERANCE TO ED 0230499	
DRG. No. 3-661-00-00962		A3 SIZE	



INVENTORY No.	
SIGN. & DATE	
REF. DRG. No.	

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Bharat Heavy Electricals Limited, Bhopal

Customer: M/S NSPCL Rourkela
Project: Rourkela PP-II EXPANSION (1x250MW)
Ref.: 48024A421-11 Rev. 02
Drg. No.: BP-DG-427-203-0002

Date: 2-Dec-16

Technical Data For Induction Motor

Note: Data furnished below is subject to IS tolerance unless otherwise specified.



1.0 GENERAL

1.1	Application	: ID FAN
1.2	Quantity	: 2 Nos.
1.3	Make	: BHEL, Bhopal
1.4	Frame Size	: 2RN7805-8
1.5	Applicable Standards	: IS: 325, IEC: 60034-1

2.0 TYPE AND RATING

2.1	Type of Motor	: Sq. Cage Induction Motor
2.2	Service	: 1.0 (Service Factor)
2.3	Duty Cycle / Designation	: Continuous / S1
2.4 (a)	Maximum power demand from driven equipment	: 3405 kW
(b)	Rated Continuous Output of Motor	: 3800 kW
2.5	Rated Speed	: 745 rpm
2.6	Rated voltage & % variation	: 6.6KV \pm 10%
2.7	Rated Frequency & % variation	: 50Hz, \pm 5%
2.8	Combined frequency and voltage variation	: 10 % (Absolute)
2.9	Rated torque	: 4964Kg-m
2.10	Pull out torque / Pull up torque / Starting torque	: 205% / 90% / 90% FLT
2.11	Full load current	: 401.0 Amp
2.12	No load current	: 120.0 Amps


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Date: 2-Dec-16

2.13	Efficiency & Power Factor at rated voltage and rated frequency	Efficiency	Power Factor
	a) Full Load	: 96.5	0.86
	b) ¾ load	: 96.2	0.84
	c) ½ load	: 95.2	0.78
2.14	Minimum starting voltage	: 80% RV	
3.0	PERFORMANCE		
3.1	Method of Starting	: VFD with DOL bypass	
3.2	Locked Rotor Current at rated Voltage	: 600 % FLC (Inclusive of tolerance)	
	LRC at 80% RV	: 480% FLC	
3.3	Locked Rotor Torque at rated voltage (% of full load Torque)	: 90% FLT	
3.4	Starting time at 110% /100% /80% RV		
	a) with load	: 29.0 / 40.0 / 85.0 Sec.	
	b) without load	: 1.0 / 1.50 / 2.50 Sec.	
3.5	Safe stall time hot / cold at		
	a) 100% rated voltage	: 65.0 / 80.0 sec.	
	b) 80% rated voltage	: 105.0 / 125.0 sec.	
	c) 110% rated voltage	: 55.0 / 67.0 sec.	
3.6	Frequency of starts	: 2 starts in succession / 3 equally spaced starts per hr.	
3.7	Noise level at 1 M distance	: 85 dB(A)	
3.8	Vibration level		
	a) Velocity	: 2.3 mm/sec(rms) (as per IEC 60034-14)	
	b) Displacement	: 37 microns (rms) (as per IEC 60034-14)	
3.9	Direction of rotation	: CW from DE	
4.0	Capable of withstanding the stresses imposed if started at 110% of rated voltage.	: OK	



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- 4.1 Motor shall start with rated load and accelerate to full speed with 80% rated voltage at motor terminals. : OK
- 4.2 Motor shall not stall at 70% of nominal voltage for one (1.0) minute : OK
- 4.3 Capable of operating satisfactorily at full load for five (5.0) minutes without injurious heating with 75% rated voltage at terminals. : OK

3.0 CONSTRUCTION

- 4.1 Degree of Protection of Enclosure : IP55
- 4.2 Type of Enclosure : CACW
- 4.3 Method of Cooling : IC81W
- 4.4 Insulation Class / Type : F (temp. rise ltd. to 'B') / Epoxy Mica (VPI)
- 4.5 Temperature rise under normal conditions over 50°C ambient temperature and cold water of 38°C \triangle_1 .
- (i) By resistance method : 82°C over max. cold water temp.
- (ii) By RTD method : 92°C \triangle_2
- (iii) By thermometer method : NA
- 4.6 Tropicalised (Yes / No) : Yes (With special treatment of insulation)
- 4.7 Winding
- a) Connection : Star
- b) Resistance : 0.0494 Ω /phase at 20°C
- 4.8 Bearings
- a) Make : BHEL Approved Vendor
- b) Type : Sleeve Bearing
- c) Recommended lubricant : ISO VG 68 / refer OGA for details \triangle_1 .
- d) Guaranteed life in Hrs. : 100000hrs. \triangle_1 .
- 4.9 Insulation of bearing : Yes (BOTH Bearings)



Customer: M/S NSPCL Rourkela
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Date: 2-Dec-16

- 4.10 Motor Terminal Box
- a) Type : PSTB
 - b) Capable of being turned 360° : Yes (in steps of 180°)
 - c) Fault withstand :
 - i) Current kA : 44
 - ii) Time sec. : 0.25
 - d) Cable lugs & glands furnished : Yes
 - e) Neutral Terminal box : Non-PSTB
- 4.11 Number of terminals brought out : 6 Nos(3 on Main and 3 on Neutral Side)
- 4.12 Detail of cooling water requirement : 510 LPM at 38°C water inlet temperature.
- 4.0 ACCESSORIES**
- 5.1 Space Heaters
- a) No. x Watts : 2 x 600 W each (Total = 1200 W)
 - b) Volts, phase, frequency : 240V, 1 Ph., 50 Hz
- 5.2 Winding temperature detector
- a) Type : PT100, Simplex, 3 Wire
 - b) Nos. furnished : 12
- 5.3 RTDs for hot/cold air : 01 + 01 no. PT-100, Duplex, 3Wire
- 5.4 Bearing temperature detector
- a) Type : PT100, Duplex, 4 Wire
 - b) Nos. furnished : 4nos. PT-100, Duplex, 4Wire (2 on DE + 2 on NDE)
- 5.5 Dial type thermometer
- a) For bearing(nos.) : 2nos.(each at DE & NDE)
 - b) For air temp.(nos.) (i) hot air : 01
 - (ii) cold air : 01
 - c) contact rating : 5A at 240V AC / 0.5A at 220V DC


Bharat Heavy Electricals Limited, Bhopal

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Date: 2-Dec-16

- 5.6 Accessory Terminal Box
- a) Nos. provided : 1 No. each for RTDs/BTDs, Space Heater & CT secondary
- b) Cable glands furnished Yes / No : Yes
- 5.7 Vibration pads on endshield / bearing housing : Yes, 2Nos (80x80x80) mm (Suitable for mounting vibration sensors)
- 5.8 Current Transformer : NA for VFD motors
- 5.9 Water flow indicator : Yes, with 2 contacts, 5A at 240V AC / 0.5A at 220V DC
- 5.10 Water leakage detector : Yes, with 2 contacts, 5A at 240VAC, 0.5A 220 V DC
- 5.11 Speed Switch : YES,with 2 contacts, 5A at 240V AC
- 5.12 Earth Brush : YES
- 5.0 GROUNDING**
- 6.1 No. of grounding pads provided
- a) On motor body : 2 Nos.
- b) On terminal box : 2 No.
- 7.0 MISCELLANEOUS**
- 7.1 Type of mounting : Horizontal (B3)
- 7.2 Overall dimension (L x B x H) in mm : Refer OGA No.14020041402
- 7.3 (a) Moment of Inertia (GD²) of motor : 3412Kgm²
 (b) Moment of Inertia (GD²) of Load : 90000Kgm²
- 7.4 Weight
- a) Stator Kg : 9750kg
- b) Rotor Kg : 6250kg
- c) Total Kg : 18500kg

**Bharat Heavy Electricals Limited, Bhopal****Customer: M/S NSPCL Rourkela****Project: Rourkela PP-II EXPANSION (1x250MW)****Ref.: 48024A421-11 Rev. 02****Date: 2-Dec-16****Drg. No.: BP-DG-427-203-0002**

7.5 Paint Shade : RAL 5012

8.0 Characteristic Curves

- a) Thermal Withstand Curves : AM46024-11-01
- b) Torque & Current vs Speed Curves : AM46024-11-02
- c) Current & Speed vs Time Curves : AM46024-11-03
- d) Load vs Efficiency, PF & Current : AM46024-11-04
- e) RTD Characteristic Curve : AM46024-11-05
- f) Neg. Sequence Current Curve : AM46024-11-06

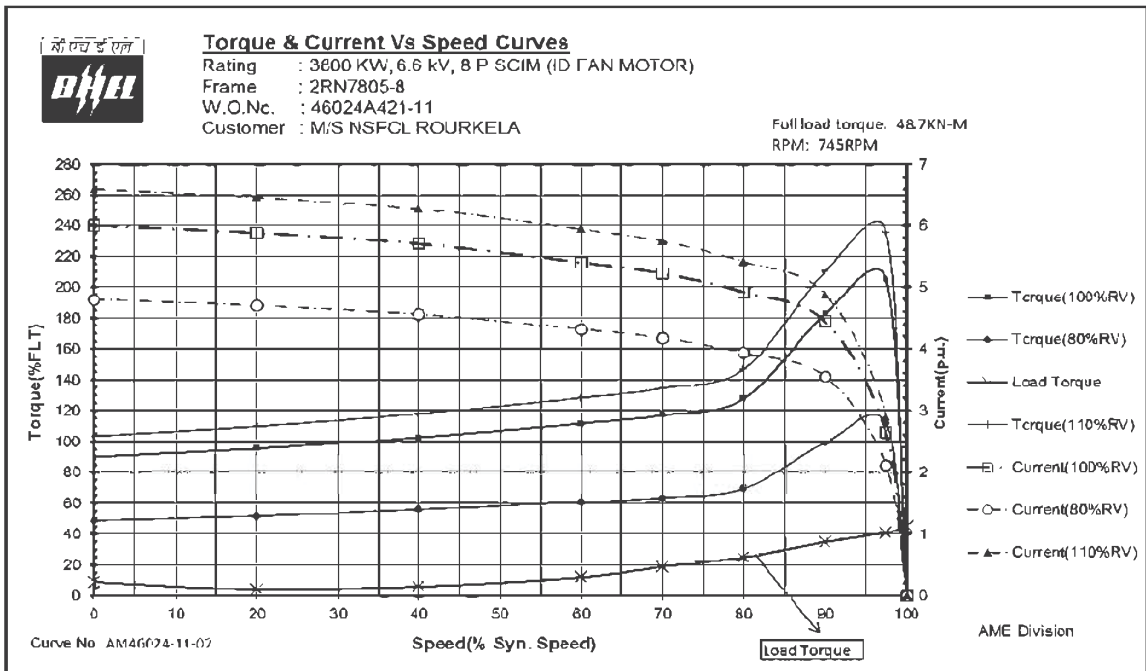
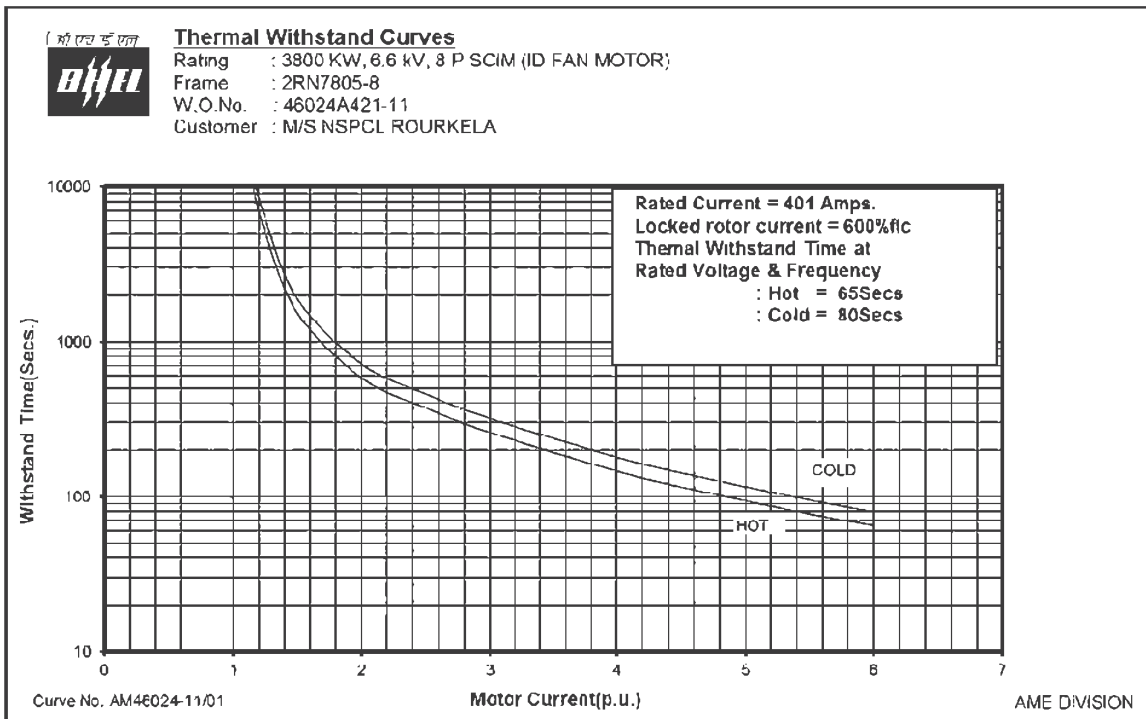
Additional Information:

- a) Suitable to Withstand 150% RV during fast bus transfer: Yes
- b) Vibration monitor for ID Fan shall be provided by BHEL, EDN.



Customer: M/S NSPCL Rourkela
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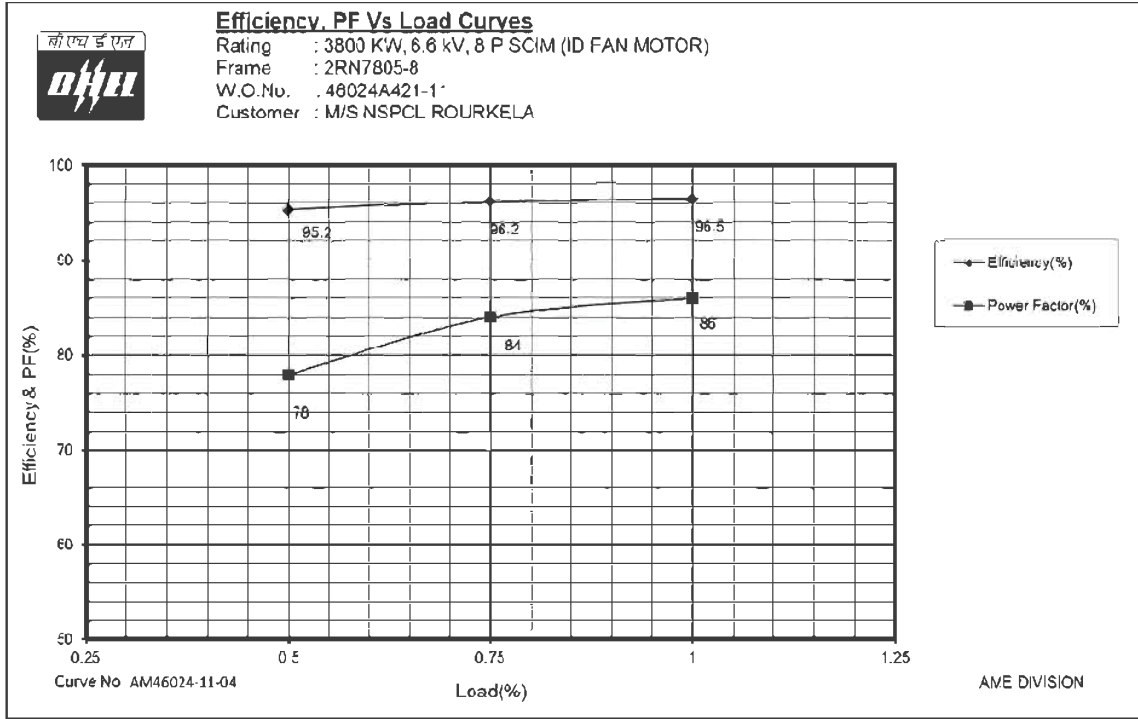
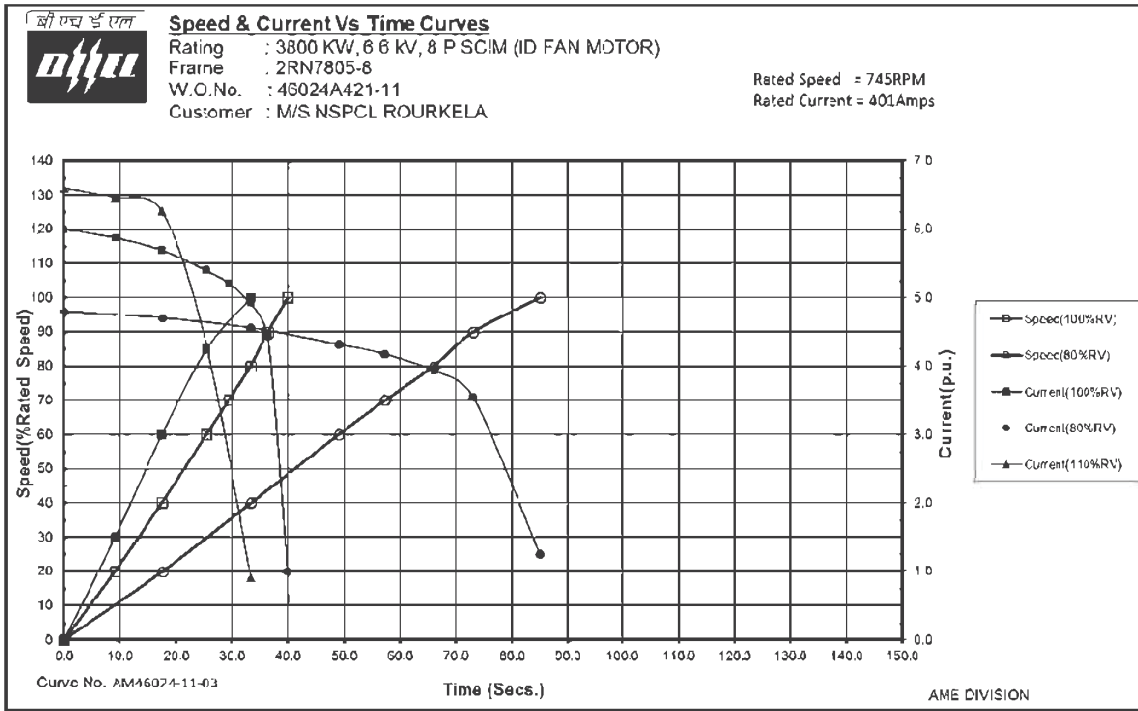
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Drg. No.: BP-DG-427-203-0002

Date: 2-Dec-16

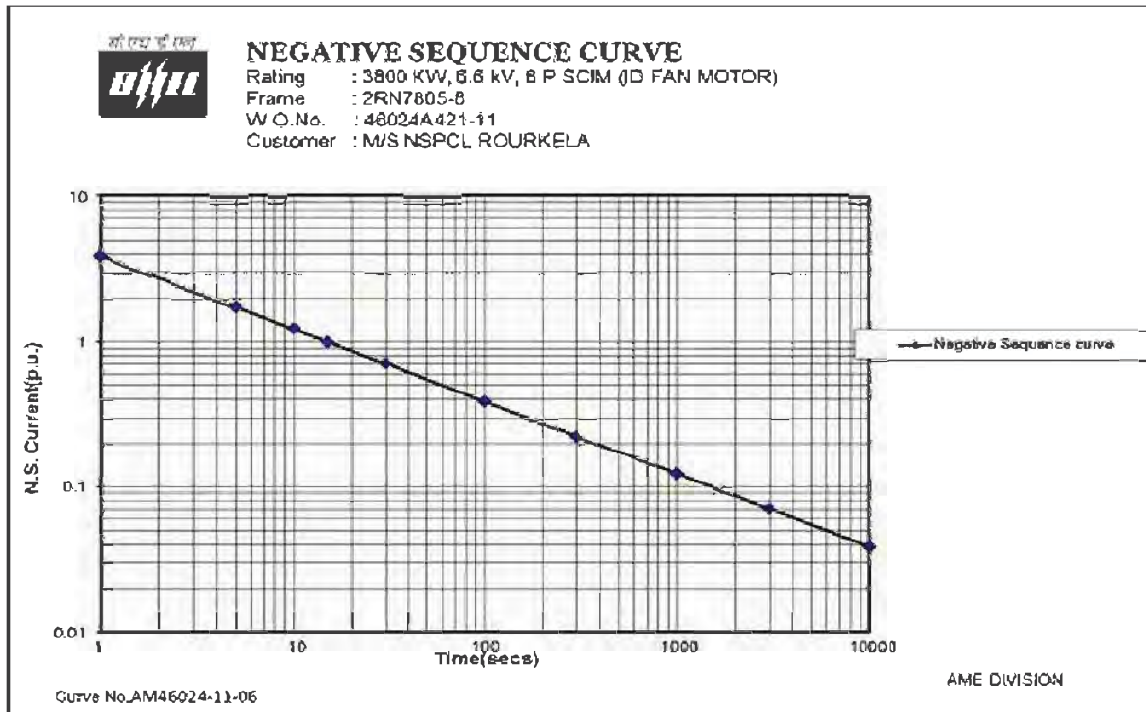
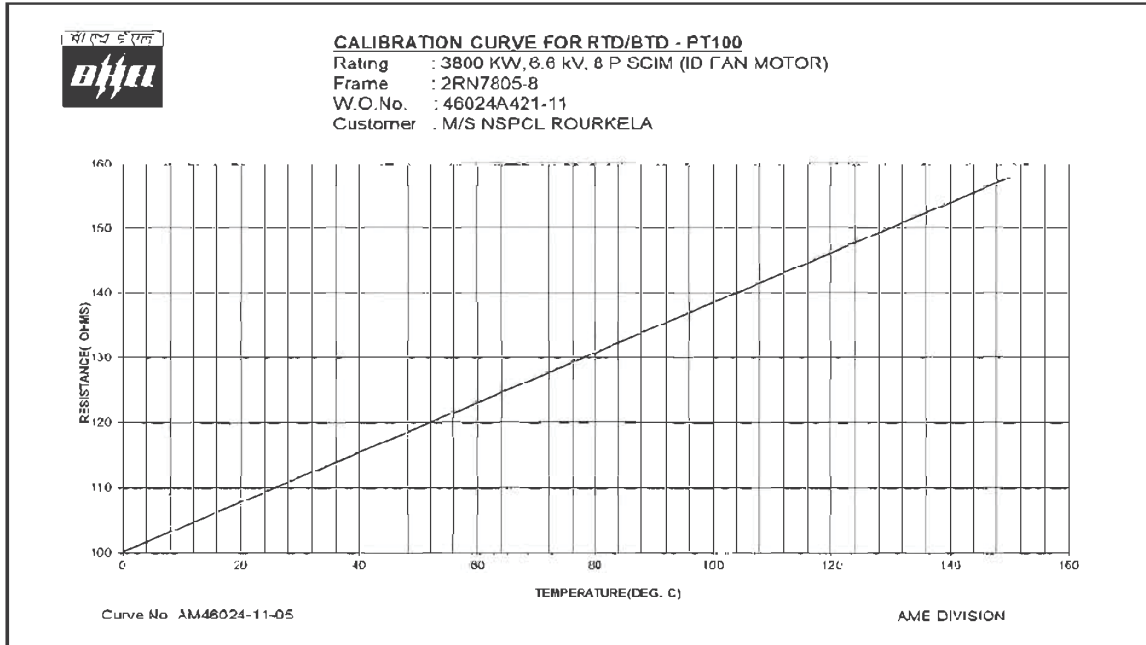




Bharat Heavy Electricals Limited, Bhopal

Customer: M/S NSPCL Rourkela
Project: Rourkela PP-II EXPANSION (1x250MW)
Ref.: 46024A421-11 Rev. 02
Drg. No.: BP-DG-427-203-0002

Date: 2-Dec-16



Ambika Singh
AME
BHEL Bhopal



BHARAT HEAVY ELECTRICALS LIMITED, BHOPAL

**A.C. MACHINES ENGINEERING DIVISION
MOTOR TECHNICAL DATA (REV-02)**

CATEGORY-I, APPROVED, 10.03.2017

Sheet 2 of 9

CUSTOMER	M/s NSPCL thro PSCM		
PROJECT	NSPCL ROURKELA PP-II EXPANSION (1x250 MW)	WO NO.	46024A404-61
TD Date	07/03/2017		

Note 1: Data given below is subject to tolerance as per IS: 325 unless specified otherwise as '*' for which the data is guaranteed.

1. GENERAL

- (i) **Manufacturer**
- (ii) **Equipment driven by motor**
- (iii) **Motor type**
- (iv) **Country of origin**
- (v) **Quantity**

1.

- (i) **BHEL, BHOPAL**
- (ii) **CBP**
- (iii) **SCIM**
- (iv) **INDIA**
- (v) **02 Nos.**

2. DESIGN AND PERFORMANCE DATA

- (i) **Frame Size**
- (ii) **Type of duty**
- (iii) **Type of enclosure, Method of Cooling, Degree of Protection**
- (iv) **Applicable standard to which motor generally conforms**
- (v) **Type of mounting**
- (vi) **Direction of rotation viewed**
- (vii) **Standard continuous rating at 40deg.C ambient temp.(KW)**
- (viii) **Derated rating for specified normal condition i.e., ambient temperature of 50 Deg.C (KW)**
- (ix) **Rated voltage (Volts)/ Rated Frequency (Hz)**
- (x) **Permissible variation of**
 - (a) **Voltage (%)**
 - (b) **Frequency (%)**
 - (c) **Combined Voltage and Frequency**
- (xi) **Minimum permissible starting voltage (%)**
- (xii) **Rated speed at rated voltage and frequency (r.p.m.)**
- (xiii) **At rated voltage and frequency**
 - (a) **Full load current (Amp)**
 - (b) **No load current (Amp)**

2.

- (i) **1LA4404-4**
- (ii) **CONTINUOUS / S1**
- (iii) **TEFC/IC411/IP55
AS PER CL. 10 OF IEC: 34-5**
- (iv) **IS: 325 -1996**
- (v) **VERTICAL (V10)**
- (vi) **BI-DIRECTIONAL**
- (vii) **642**
- (viii) **600**
- (ix) **6600 / 50**
- (x)
 - (a) **± 10**
 - (b) **+ 5**
 - (c) **10 % (Abs.)**
- (xi) **80**
- (xii) **1489**
- (xiii)
 - (a) **64**
 - (b) **18**

**BHARAT HEAVY ELECTRICALS LIMITED, BHOPAL****A.C. MACHINES ENGINEERING DIVISION
MOTOR TECHNICAL DATA (Rev 02)**

CATEGORY-I, APPROVED, 10.03.2017

WO: 46024A404-61

Sheet 3 of 9

(xiv) Power Factor at	(xiv)
(a) 100% load	(a) 0.86
(b) 75% load	(b) 0.84
(c) 50% load	(c) 0.77
(d) No load	(d) 0.049
(e) Starting	(e) 0.19
(xv) Efficiency (%) at rated voltage and frequency at	(xv)
(a) 100% load	(a) 95.2
(b) 75% load	(b) 94.8
(c) 50% load	(c) 94.0
(xvi) Starting current (%) at	(xvi)
(a) Rated Voltage	(a) 600 %
(b) Minimum / maximum starting Voltage	(b) 480 AT 80 % RV / 660 % at 110% voltage.
(xvii) Starting time at 100%/80%/110% of rated V	(xvii)
(a) Without driven equipment coupled	(a) 1.5 / 2.5 / 1.2 Sec.
(b) With driven equipment coupled	(b) 5 / 7.8 / 4.1 Sec.
(xviii) Safe stall time with 100%/80%/110% rated V	(xviii)
(a) From hot condition	(a) 20 / 31 / 16.5Sec
(b) From cold condition	(b) 26 / 40 / 21.5Sec
(xix) Torque at (in % / kg-m)	(xix)
(a) Starting (at minimum permissible voltage)	(a) 58 / 227
(b) Pull up at 100% Voltage	(b) 80 / 314
(c) Pull out at 100% Voltage	(c) 230 / 902
(d) Rated load (kg-m) at 100 % Voltage	(d) 392
(e) Minimum Accelerating Torque (Kg-m) at 80 % RV	(e) 196
(xx) Stator winding resistance per phase (ohms) ref. to 20 deg.C.	(xx) 0.403
(xxi) Flywheel Moment of motor (Kg-m ²) (GD2)	(xxi) 58 kg-m ²
(xxii) No. of Permissible Starts from Hot/Cold Condition	(xxii) 2/3
(xxiii) Locked Rotor KVA Input (at Rated Voltage)	(xxiii) 4748
(xxiv) Locked Rotor kVA / Rated kW	(xxiv) 7.9 (Without any further tolerance)
(xxv) Vibration at No Load (Brg.Housing)	(xxv)
(a) Velocity (mm/s)	(a) 2.8 (As per IS12075)
(b) Displacement (Microns)	(b) 50 (p-p) (As per IS12075)
(xxvi) Noise Level at No Load	(xxvi) 85 dBA at 1.0 metre.

**BHARAT HEAVY ELECTRICALS LIMITED, BHOPAL****A.C. MACHINES ENGINEERING DIVISION
MOTOR TECHNICAL DATA (Rev 02)**

CATEGORY-I, APPROVED, 10.03.2017

WO: 46024A404-61

Sheet 4 of 9

3. CONSTRUCTIONAL FEATURES

- | | |
|---|---|
| (i) Stator winding Insulation | 3. |
| (a) Class & type | (i) |
| (b) Tropicalised (Yes/No) | (a) F/EPOXY MICA RESIN POOR (VPI), Temp rise limited to class B |
| (c) Temperature rise over specified ambient of 50 deg C (deg C) | (b) YES |
| (d) Method of temp. Measurement | (c) 70 |
| (e) Stator winding connection | (d) BY RESISTANCE |
| (f) No. of terminals brought out | (e) STAR |
| (ii) Type of terminal box for | (f) 6 |
| (a) Stator leads | (ii) |
| (b) Space heater | (a) PHASE SEPARATED T.B. |
| (c) Temperature detectors | (b) CAST / FABRICATED |
| (d) Instrument switches etc. | (c) CAST / FABRICATED |
| (iii) For main terminal box | (d) NIL |
| (a) Location (from DE) | (iii) |
| (b) Entry of cables | (a) RHS |
| (c) Recommended cable size
(Runs/cores/x-section mm ² / material) | (b) BOTTOM ENTRY, As per OGA |
| (d) Fault level (MVA)/ Duration (Sec) | (c) TO BE FURNISHED. |
| (iv) For Bearing | (d) 500 / 0.25 |
| (a) Type | (iv) |
| (b) Manufacturer | (a) ANTIFRICTION |
| (c) Recommended lubricant | (b) NTPC APPVD. SUPPLIER |
| (d) Guaranteed Life in Hrs. | (c) IOC SERVOGEM-3/EQV. GREASE |
| (e) Lubrication Type | (d) 40000 Hrs. |
| (f) Whether Dial Type Thermometer Provided | (e) SELF |
| (v) Type of cooler (CACA/CACW) | (f) YES |
| (vi) Cooling water requirement for CACW motors | (v) NA |
| (a) Quantity required | (vi) |
| (b) Maximum permissible inlet water temperature (deg C) | (a) NA |
| (c) Pressure of water at inlet to coolers | (b) NA |
| (d) Outlet temperature of water at full load (anticipated value) | (c) NA |
| | (d) NA |
| (vii) Weight of | (vii) |
| (a) Motor Stator (Kg) | (a) 3000 |
| (b) Motor rotor (Kg) | (b) 1400 |
| (c) Cooler (Kg) | (c) NA |
| (d) Total weight (Kg) | (d) 4400 |
| (ix) Max. Perm. Temp. of Rotor | (ix) 350 Deg. C |
| (x) Total Temp. of Rotor during I Start | (x) 140 Deg.C |
| (xi) Total Temp. of Rotor during II Start | (xi) 165 Deg.C |
| (xii) Surge Withstand Voltage (Stator winding) | (xii) As per IEC: 34-15 |
| (a) 0.2/ 3 Microsecond Surge (kVp) | (a) 20.0 |
| (b) 1.2/ 50 Microsecond Surge (kVp) | (b) 31.0 |

**BHARAT HEAVY ELECTRICALS LIMITED, BHOPAL****A.C. MACHINES ENGINEERING DIVISION
MOTOR TECHNICAL DATA (Rev 02)**

CATEGORY-I, APPROVED, 10.03.2017

WO: 46024A404-61

Sheet 5 of 9

4.00 LIST OF ACCESSORIES

4.01 RTDs for winding (Type/Nos/Leads /location/make/Res. at 0 Deg.C)	: PT100 SIMPLEX / 12 / 3 Between Coil Sides in slots/ Reputed NTPC Appvd./ 100 Ohms
4.02 RTDs for bearing (Type/Nos./Leads /location/make/Res. at 0 Deg.C)	: PT100 DUPLEX/ 2(1 no each on DE and NDE side) / 4 wire/ In Bearing Housing/Reputed NTPC Appvd./ 100 Ohms.
4.03.01 RTDs for Hot Air (Type/No/Leads)	: NA
4.03.02 RTDs for Cold Air (Type/No/Leads)	: NA
4.04 Space Heaters	: YES
4.04.01 Nos.	: 2
4.04.02 Power (Watts)	: 315 W
4.04.03 Supply Voltage	: 1 PH 240VAC
4.04.04 Location	: In Air pockets
4.05 Stator Terminal Box	
4.05.01 Type	: PHASE SEPARATED T.B.
4.05.02 Fault Level (MVA)	: 500
4.05.03 Fault Level duration (sec)	: 0.25
4.06 Neutral TB	: PSTB TYPE.
4.07 Current Transformers	: NA
4.07.01 Nos.	: -
4.07.02 Ratio	: -
4.07.03 Accuracy Class	: -
4.07.04 V _k (V)/R _{ct}	: -
4.07.05 Exciting Current	: -
4.08 Dial Type Thermometer (Type/make Accuracy/ Connection Type & size)	: Mercury in Steel/ NTPC Appvd/ + - 1% Full Scale / BSP 3/4"
4.08.01 For Bearings (Nos.)	: 2
4.08.02 For Air Temp (Nos.) a. Hot Air	: NA
b. Cold Air	: NA
4.08.03 Contact Rating	: 5 A AT 240 V AC/ 0.5 A AT 220 V DC.
4.08.04 Range	: 0 -120 Deg. C.
4.08.05 Supply Voltage	: 240 V, 50 Hz, 1 Phase
4.09 Rotor Terminal Box	: NA
4.10 TBs for RTDs, BTDs & Space Heater	: YES
4.11 Sole Plate	: NO
4.12 Anchoring items	: YES (As per OGA)
4.13 Base Frame	: NO
4.14 Speed Switch	: NO
4.14.01 Supply Voltage	: NA
4.15 Insulation of Bearing	: Yes (NDE)
4.16 Forced Oil lubrication	: NA

**BHARAT HEAVY ELECTRICALS LIMITED, BHOPAL****A.C. MACHINES ENGINEERING DIVISION
MOTOR TECHNICAL DATA (Rev 02)**

CATEGORY-I, APPROVED, 10.03.2017

WO: 46024A404-61

Sheet 6 of 9

4.17	Oil level Indicator	: NA
4.18	Noise Reducer	: Yes.
4.19	Water flow Indicator	: NA
4.19.01	No/Contact Rating	: NA
4.20	Water leakage detector	: NA
4.21	Tachogenerator	: NA
4.22	Grounding Pads	
4.22.01	No & Size on motor body	: 2
4.22.02	Nos on Terminal Box	: 2
4.23	Vibration Pads	: YES
4.23.01	Nos & Size	: 02, 16 mm X 30 mm X 30 mm
4.23.02	Location	: As per OGA.
4.24	Paint Shade	: RAL 5012
4.25	Any other fitments	: NO
4.26	External Thrust on Motor	: NO
5.00	Additional points	
5.01	Over speed capability	: 120 % speed for 2 min.
5.02	Over load capability	: 160 % for 15 Sec
5.03	Paint shade	: RAL5012
5.04	Main TB rotatable by 180oC	: Ok. Noted.
5.05	Motor shall withstand stress during bus Transfer	: Ok. Noted.
5.06	Running time at 75% rated voltage should be for 5 min on full load.	: Ok. Noted.
5.07	Vibration monitors shall be provided for all HT motors	: Shall be arranged by other BHEL unit. Provision for mounting the same has been provided in the motor.
5.08	Reference CEP data sheet No	: HY-DC-FP13399
6.00	LIST OF CURVES	
6.01	Thermal Withstand Characteristics	: 46024-61 /01
6.02	Torque Vs Speed Curves	: 46024-61 /02
6.03	Current Vs Speed Curves	: 46024-61 /02
6.04	Current Vs Time curves	: 46024-61 /03
6.05	Speed Vs Time curves	: 46024-61 /03
6.06	Efficiency & PF Vs Load Curves	: 46024-61 /04
6.07	Negative sequence curve	: 46024-61 /05
6.08	Calibration curve for RTD/BTD	: 46024-61 /06



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A.C. MACHINES ENGINEERING DIVISION
MOTOR TECHNICAL DATA (Rev 02)

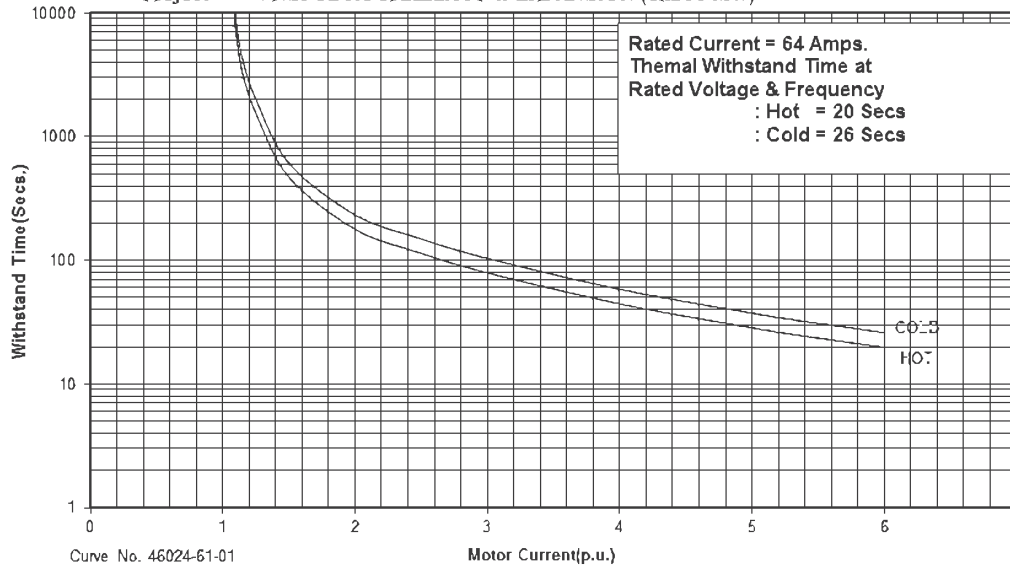
WO: 46024A404-61

Sheet 7 of 9

Thermal Withstand Curves



Rating : 600KW, 6.6 kV, 4 P, TEFC, SQ.Cage Induction Motor.
Frame : 1LA4404-4
W.O.No. : 46024A401-61
Customer : M/s NSPCL thro PSCM
Project : NSPCL ROURKELA PP-II EXPANSION (1x250 MW)

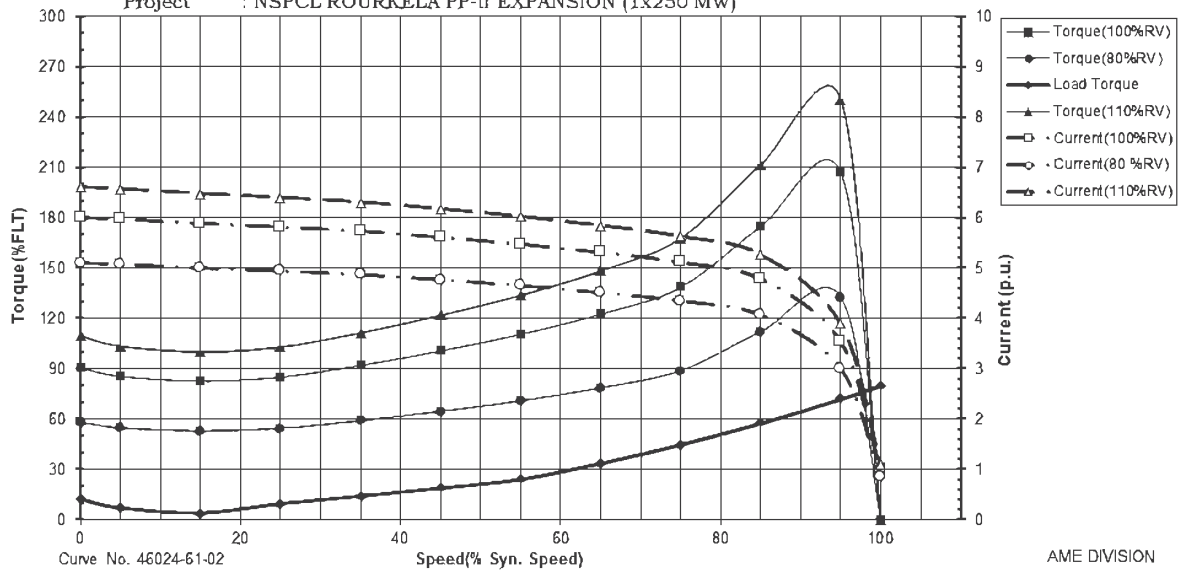


Torque & Current Vs Speed Curves



Rating : 600KW, 6.6 kV, 4 P, TEFC, SQ.Cage Induction Motor.
Frame : 1LA4404-4
W.O.No. : 46024A401-61
Customer : M/s NSPCL thro PSCM
Project : NSPCL ROURKELA PP-II EXPANSION (1x250 MW)

Rated Torque = 392 kg-m
Rated Current = 64 Amps.





BHARAT HEAVY ELECTRICALS LIMITED, BHOPAL
A.C. MACHINES ENGINEERING DIVISION
MOTOR TECHNICAL DATA (Rev 02)

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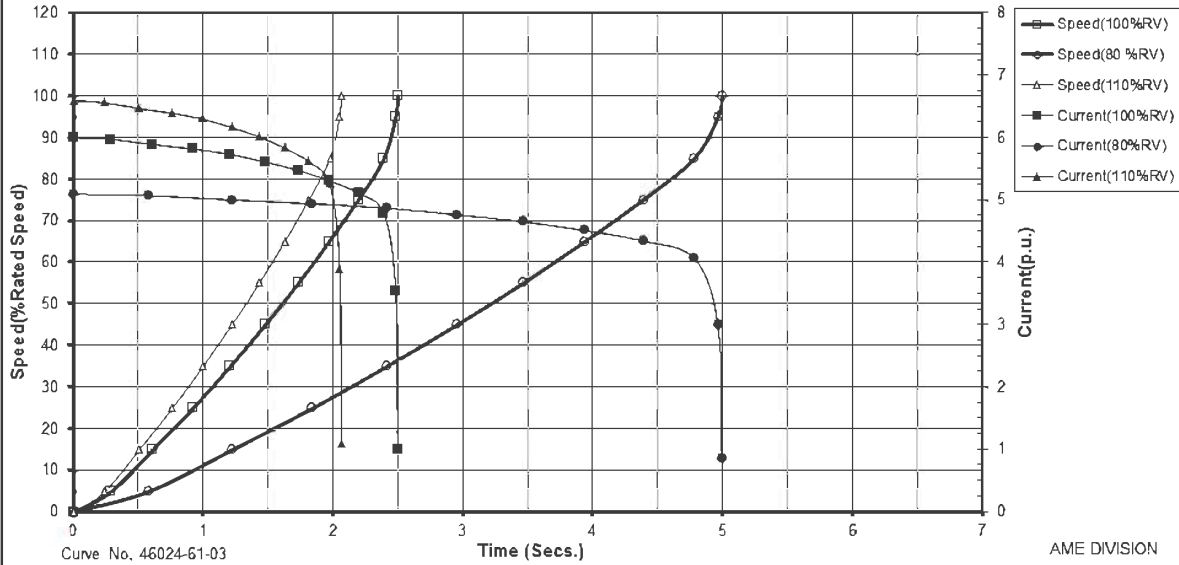


Speed & Current Vs Time Curves

Rating : 600KW, 6.6 kV, 4 P, TEFC, SQ.Cage Induction Motor.
Frame : 1LA4404-4
W.O.No. : 46024A401-61
Customer : M/s NSPCL thro PSCM
Project : NSPCL ROURKELA PP-II EXPANSION (1x250 MW)

Rated Speed = 1489 RPM.

Rated Current = 64 Amps.

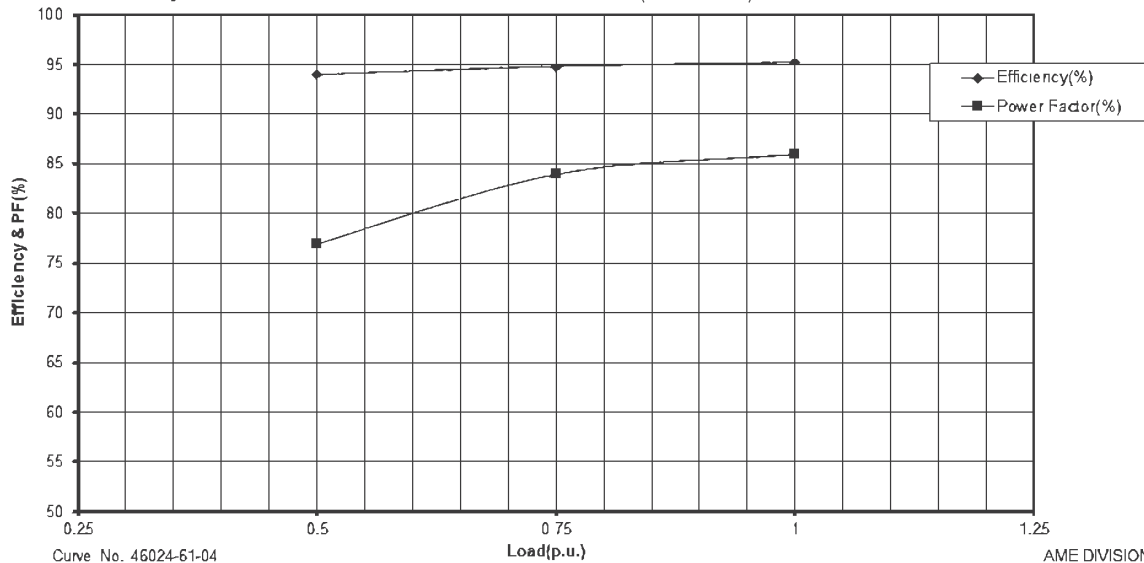


AME DIVISION



Efficiency & PF Vs Load Curves

Rating : 600KW, 6.6 kV, 4 P, TEFC, SQ.Cage Induction Motor.
Frame : 1LA4404-4
W.O.No. : 46024A401-61
Customer : M/s NSPCL thro PSCM
Project : NSPCL ROURKELA PP-II EXPANSION (1x250 MW)



AME DIVISION



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A.C. MACHINES ENGINEERING DIVISION
MOTOR TECHNICAL DATA (Rev 02)

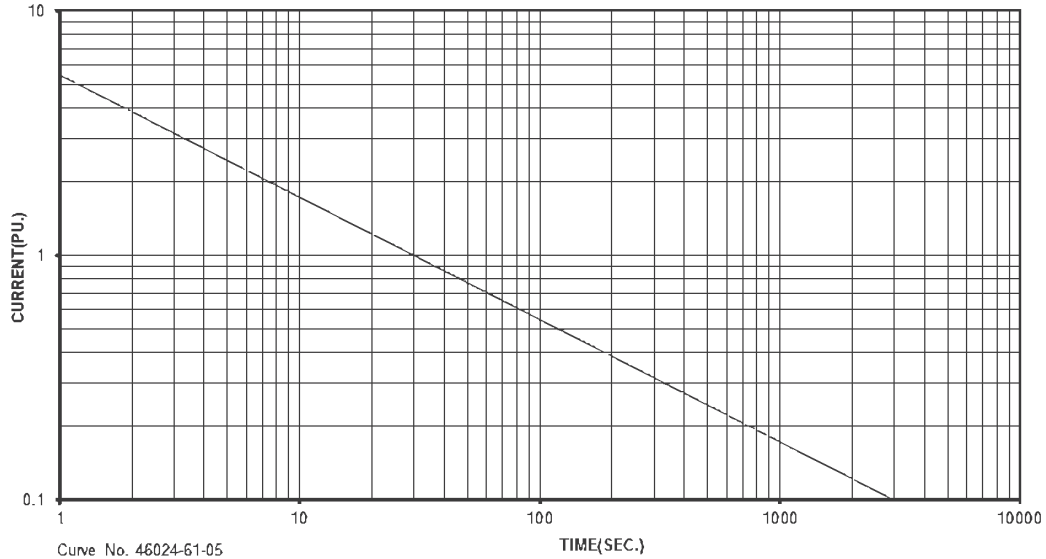
WO: 46024A404-61

Sheet 9 of 9

NEGATIVE SEQUENCE CURVE



Rating : 600KW, 6.6 kV, 4 P, TEFC, SQ.Cage Induction Motor.
Frame : 1LA4404-4
W.O.No. : 46024A401-61
Customer : M/s NSPCL thro PSCM
Project : NSPCL ROURKELA PP-II EXPANSION (1x250 MW)

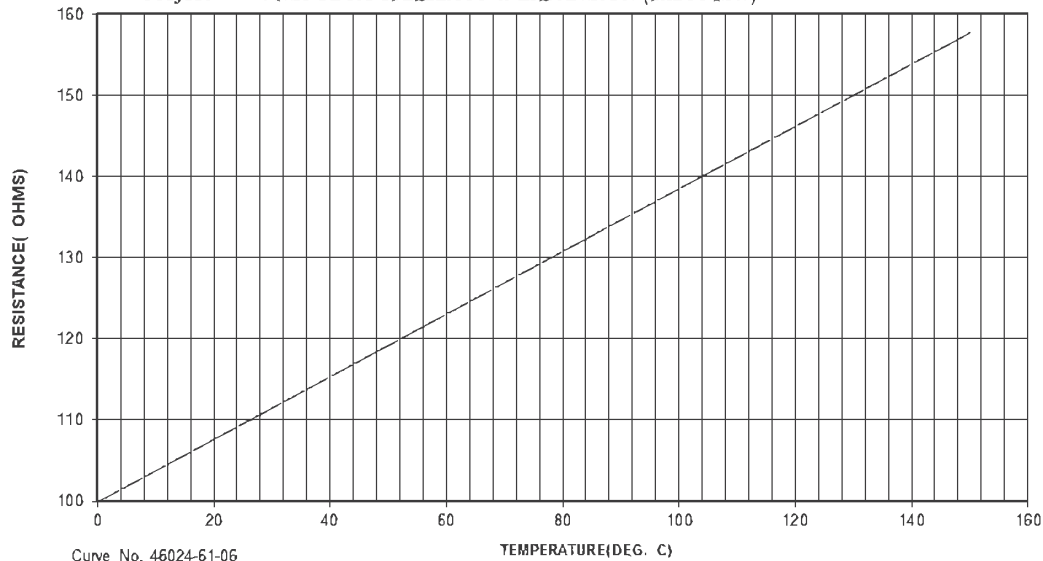


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CALIBRATION CURVE FOR RTD/BTD - PT100



Rating : 600KW, 6.6 kV, 4 P, TEFC, SQ.Cage Induction Motor.
Frame : 1LA4404-4
W.O.No. : 46024A401-61
Customer : M/s NSPCL thro PSCM
Project : NSPCL ROURKELA PP-II EXPANSION (1x250 MW)



AME DIVISION



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PURCHASE SPECIFICATION
GROUP: VFD ENGINEERING

VFD DATASHEET NSPCL

REV. NO: 00

PAGE 01 OF 08

VFD SYSTEM DATA SHEET (ID FAN)

A Environment Specifications	
1	Maximum Ambient Temperature 48°C
2	Minimum Ambient Temperature 6°C
3	Equipment Design Temperature (IS-9676) 50°C
4	Relative Humidity 95%
5	Altitude Less than 1000m above mean sea level
6	Location of VFD Panels Indoor, Ventilated Room with Air Conditioning.
7	Seismic Zone As per IS-1893-Zone-II
B General	
1	Application ID Fan
2	Rated output Power (KW) 3800
3	Rated output Voltage (KV) 6.6
C Motor Data	
1	Type Squirrel Cage Induction Motor
2	Scope Manufactured by BHEL-Bhopal
3	Rated Power (KW) 3800
4	Rated Voltage and Current 6.6KV & 401A
5	No Load Current 120A
6	Rated RPM 745
7	Duty Class Continuous - S1
D Input Power Supply Data	
1	System Voltage / Frequency / Phase 6.6kV / 50Hz / 3
2	Voltage Variation ±10%
3	Frequency Variation +3% -5%
4	Combined Voltage and Frequency Variation ±10%
5	Fault Level 40kA/1 sec
E System Requirements	
1	Drive application ID Fan
2	Speed range required As per application requirement
3	Speed Adjustment Auto (from DCS) and Manual (From Drive)
4	Reference Signal 4-20 mA from DCS
5	Bypass Operation Yes (Manual)
6	Synchronous Bypass No
7	Input, Output and Bypass Breaker Yes (in BHEL Scope)
8	Acceleration time
9	Deceleration time

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PURCHASE SPECIFICATION
GROUP: VFD ENGINEERING

VFD DATASHEET NSPCL

REV. NO: 00

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10	Fault diagnostic Required	Required
11	Cable distance between Input Breaker and VFD	40 meters (approx.)
12	Cable distance between VFD and Motor	250 meters (approx.)
13	Separate PE Conductor between VFD & Motor	(Vendor to Confirm)
14	Interface with DCS (Modbus)	Required
F	<u>VFD Data</u>	
1	Manufacturer	
2	Model No.	
3	Manufacturing Location	
4	Rating	
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	6.6kV
12	Overload capability at 110% over current	Secs.
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	(Minimum N+1 Required)
20	Type of feedback for speed control	



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PURCHASE SPECIFICATION
GROUP: VFD ENGINEERING

VFD DATASHEET NSPCL

REV. NO: 00

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21	Output Filter/ Choke:	
	i) Manufacturer	
	ii) Type/ Model No.	
	iii) Rated Current and Voltage	
22	VFD Panel Dimensions	
	i) Length (mm)	
	ii) Height (mm)	
	iii) Depth (mm)	
	iv) Weight (kg)	
	(Dimensional details of all panels shall be furnished)	
23	Degree of protection	
24	Paint Shade	As per BHEL Specification
25	Heat Load (kW)	
26	Auxiliary Power Requirement:	
	i) KVA	
	ii) Voltage and Phase	
G	<u>Transformer Data</u>	
1	Manufacturer	
2	Manufacturing Location	
3	Type	Dry type integrated Transformer
4	Duty	Continuous (Converter Duty)
5	Rating (Transformer must be designed to carry 110% current of calculated VFD rating.)	
6	Class of insulation	F
7	Insulation level:	
	P. f withstand	
	i) HV Winding	
	ii) LV Winding	
	Impulse withstand	
	i) HV Winding	
	ii) LV Winding	
8	Fault Level on HV Side	40kA for 1 Sec
9	HV Voltage and Phase	6.6kV and 3Ph.
10	LV Voltage/ Current	
11	No. of LV Windings	
12	Rated Frequency	50Hz
13	Impedance	
14	Cooling Type	
15	Winding Material	Electrolytic grade Copper



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PURCHASE SPECIFICATION
GROUP: VFD ENGINEERING

VFD DATASHEET NSPCL

REV. NO: 00

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16	Location of Tap Changer	HV Winding
17	No. of Taps and Type	
18	Vector Group	
19	Neutral CT specification:	
	51G	
	64R	
	Vk	
	Im at Vk/2	
	RCT	
20	Cable Size/Type	
	i) HV Winding	
	ii) LV Winding	
21	No Load Loss	
	i) At 100% Voltage	
	ii) At 110% Voltage	
22	Full Load Copper loss at 75°C	
23	No Load Current	
	i) At 100% Voltage	
	ii) At 110% Voltage	
24	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	
25	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	
26	Load at which maximum efficiency occurs	
27	Regulation at 75°C at full load	
	i) At 0.8 pf	
	ii) At 1 pf	
28	Dimensions	
	i) Length (mm)	
	ii) Height (mm)	
	iii) Depth (mm)	
	iv) Weight (kg)	
29	Degree of protection for enclosure.	
30	Paint Shade	
31	Heat Load (kW)	



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PURCHASE SPECIFICATION
GROUP: VFD ENGINEERING

VFD DATASHEET NSPCL

REV. NO: 00

PAGE 05 OF 08

VFD SYSTEM DATA SHEET (CEP)

A Environment Specifications	
1	Maximum Ambient Temperature 48°C
2	Minimum Ambient Temperature 6°C
3	Equipment Design Temperature (IS-9676) 50°C
4	Relative Humidity 95%
5	Altitude Less than 1000m above mean sea level
6	Location of VFD Panels Indoor, Ventilated Room with Air Conditioning.
7	Seismic Zone As per IS-1893-Zone-II
B General	
1	Application CEP
2	Rated output Power (KW) 600
3	Rated output Voltage (KV) 6.6
C Motor Data	
1	Type Squirrel Cage Induction Motor
2	Scope Manufactured by BHEL-Bhopal
3	Rated Power (KW) 600
4	Rated Voltage and Current 6.6KV & 64A
5	No Load Current 18A
6	Rated RPM 1489
7	Duty Class Continuous - S1
D Input Power Supply Data	
1	System Voltage / Frequency / Phase 6.6kV / 50Hz / 3
2	Voltage Variation ±10%
3	Frequency Variation +3% -5%
4	Combined Voltage and Frequency Variation ±10%
5	Fault Level 40kA/1 sec
E System Requirements	
1	Drive application CEP
2	Speed range required As per application requirement
3	Speed Adjustment Auto (from DCS) and Manual (From Drive)
4	Reference Signal 4-20 mA from DCS
5	Bypass Operation Yes (Manual)
6	Synchronous Bypass No
7	Input, Output and Bypass Breaker Yes (in BHEL Scope)
8	Acceleration time
9	Deceleration time

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PURCHASE SPECIFICATION
GROUP: VFD ENGINEERING

VFD DATASHEET NSPCL

REV. NO: 00

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10	Fault diagnostic Required	Required
11	Cable distance between Input Breaker and VFD	80 meters (approx.)
12	Cable distance between VFD and Motor	250 meters (approx.)
13	Separate PE Conductor between VFD & Motor	(Vendor to Confirm)
14	Interface with DCS (Modbus)	Required
F	<u>VFD Data</u>	
1	Manufacturer	
2	Model No.	
3	Manufacturing Location	
4	Rating	
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	6.6kV
12	Overload capability at 110% over current	Secs.
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	(Minimum N+1 Required)
20	Type of feedback for speed control	



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GROUP: VFD ENGINEERING

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21	Output Filter/ Choke:	
	i) Manufacturer	
	ii) Type/ Model No.	
	iii) Rated Current and Voltage	
22	VFD Panel Dimensions	
	i) Length (mm)	
	ii) Height (mm)	
	iii) Depth (mm)	
	iv) Weight (kg)	
	(Dimensional details of all panels shall be furnished)	
23	Degree of protection	
24	Paint Shade	As per BHEL Specification
25	Heat Load (kW)	
26	Auxiliary Power Requirement:	
	i) KVA	
	ii) Voltage and Phase	
G	<u>Transformer Data</u>	
1	Manufacturer	
2	Manufacturing Location	
3	Type	Dry type integrated Transformer
4	Duty	Continuous (Converter Duty)
5	Rating (Transformer must be designed to carry 110% current of calculated VFD rating.)	
6	Class of insulation	F
7	Insulation level:	
	P. f withstand	
	i) HV Winding	
	ii) LV Winding	
	Impulse withstand	
	i) HV Winding	
	ii) LV Winding	
8	Fault Level on HV Side	40kA for 1 Sec
9	HV Voltage and Phase	6.6kV and 3Ph.
10	LV Voltage/ Current	
11	No. of LV Windings	
12	Rated Frequency	50Hz
13	Impedance	
14	Cooling Type	
15	Winding Material	Electrolytic grade Copper



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PURCHASE SPECIFICATION
GROUP: VFD ENGINEERING



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16	Location of Tap Changer	HV Winding
17	No. of Taps and Type	
18	Vector Group	
19	Neutral CT specification:	
	51G	
	64R	
	Vk	
	Im at Vk/2	
	RCT	
20	Cable Size/Type	
	i) HV Winding	
	ii) LV Winding	
21	No Load Loss	
	i) At 100% Voltage	
	ii) At 110% Voltage	
22	Full Load Copper loss at 75°C	
23	No Load Current	
	i) At 100% Voltage	
	ii) At 110% Voltage	
24	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	
25	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	
26	Load at which maximum efficiency occurs	
27	Regulation at 75°C at full load	
	i) At 0.8 pf	
	ii) At 1 pf	
28	Dimensions	
	i) Length (mm)	
	ii) Height (mm)	
	iii) Depth (mm)	
	iv) Weight (kg)	
29	Degree of protection for enclosure.	
30	Paint Shade	
31	Heat Load (kW)	

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CHAPTER 17.0

VFD FOR MEDIUM VOLTAGE APPLICATION



1.00.00 GENERAL

The Design, manufacture, erection, testing and performance of items and services provided under this specification shall comply with the latest edition including all applicable official amendments and revisions as on date of award of the following standards. In case of conflict between this specification and code (IS Code, standards, etc.) referred herein, the former shall prevail. All work shall be carried out as per the following codes and standards.

1.01.00 CODES AND STANDARDS

HT breaker	IEC:60056
DC reactor	IEC 60289
Transformers	IS:2026, IEC: 60076
Bushing's	IS: 2099, IEC 60137
Insulating oil	IS:335, IEC: 60296
Adjustable Speed Electrical Power Drive Systems	IEC 61800
Semiconductor converters–General requirements	IEC 60146
IEEE Recommended practices and requirements for harmonic control in electrical power systems	IEEE 519
Recommended Practice for Efficiency Determination of AC Adjustable Speed Drives.	IEEE 995
Degrees of protection provided by enclosures (IP Code)	IEC 60529
Electrostatic immunity test	IEC1000-4-2
Fast transient immunity test	IEC1000-4-4
Surge immunity test	IEC1000-4-5
High-voltage switchgear and control gear; Pt.102 disconnectors and earthing switches	: Alternating current IEC 62271-102
High-voltage switchgear and control gear; Pt.200: AC metal-enclosed switchgear and control gear for rated voltages above 1 kV and up to and including 52 KV	IS/IEC: 62271-200
AC electricity meters.	IS: 722
Metal oxide surge arrester without gap for AC system	IEC: 60099-4
Terminal blocks for copper conductors	IEC: 60947-7-1

Equipment complying with other internationally accepted standards will also be considered if they ensure performance and constructional features equivalent or superior to standards listed above. In such a case, the Bidder shall clearly indicate the standard(s) adopted, furnish a copy in English of the



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latest revision amendments and revision in force as on date of opening of bid and shall clearly bring out the salient features for comparison.

- 1.02.00 For the purpose of design of equipment/systems, an ambient temperature of 50 deg. Centigrade and relative humidity of 95% shall be considered. Field mounted equipment shall operate in a highly polluted environment. VFD system power/control panels shall be located in air conditioned room. However, the VFD system shall be suitable for reliable operation even during periods of shut down of air conditioning equipment.
- 1.03.00 All equipments shall be suitable for rated frequency of 50 Hz with a variation of +3% & -5%, rated voltage of 6.6 kV with a variation of $\pm 10\%$ and combined variation of $\pm 10\%$ for voltage and frequency.
- 1.04.00 All the equipment, material and systems shall, in general, conform to the latest edition of relevant National and international Codes & Standards, especially the Indian Statutory Regulations.
- 1.05.00 Paint shade as follows shall be preferred; however, manufacturer's standard colour may also be acceptable.
- a) VFD transformer : RAL 5012 (Blue), legend in black letter
 - c) VFD Panels : Front and rear panels in Grey (RAL9002).
End panel sides in blue (RAL 5012)
 - d) VFD reactor : RAL 5012 (Blue), legend in black letter



1.06.00 TECHNICAL REQUIREMENTS

Type of drive	3-Phase Diode / Thyristor / IGBT / IGCT / SGCT/ IEGT.
Input Supply Voltage	6.6 KV +/- 10 %, 3-phase
Input Supply Frequency	50 Hz +3% /- 5%
Input Supply Feeder	6.6 KV, 1250 A, VCB
Auxiliary power supply	1-phase 230 V ac / 220 V DC
Application	Induce Draft Fan (ID Fan) & Condensate Extraction Pump (CEP) Motors, other drives in CHP area / AHP area ?Compressed air station
Type of Motor to be driven	3 phase induction motor
Rated Power	Same as motor rating selected based on the design duty point of the driven equipment.
Rated Frequency	50 Hz
Type of Cooling of VFD	Naturally air cooled/forced air cooled/Liquid cooled
Converter Type	Full wave controlled or diode rectifier / active front end type
Inverter Type	3-Phase Diode/Thyristor/IGBT/IGCT/SGCT/IEGT
Power factor	The total power factor at the VFD input shall be > 0.95 at 100 % load and rated speed.

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Minimum Efficiency at Motor full load	96% including losses in the transformer/ Harmonic filters (as applicable) etc comprising the VFD System.
Protection Class	IP-32
Harmonic Limitation	In Accordance with IEEE-519 & IEC – 61800-4
Relative Humidity specified for the site	Less than 95% (at 40 deg. Celsius)
Noise Level	Below 85 dB at 1 mtr. distance.
Forced Cooling	Wherever forced air/water cooling is provided, necessary redundancy (n+1) shall be provided in fan/pumps, where 'n' is the number of fans/pumps required for operation at specified rating. Whenever any pump or fan trips, the redundant fan/pump shall start automatically by the pre-set logics.

- 1.07.00 All the circuit components shall be suitably protected against over voltages, surges, lightning etc.
- 1.08.00 The panels shall be designed to provide easy access to hardware, to facilitate replacement of cards in case of any failure. The power circuit shall be air/liquid cooled type.
- 1.09.00 The VFDs shall be of same design so as to take advantage of interchange ability of components.
- 1.10.00 Hardware input and output modules shall be provided to interface with external operator and supervisory control and monitoring equipment.
- 1.11.00 For each programmed warning and fault protection function, the VFD shall display a message in complete English words or Standard English abbreviations. At least 30 time tagged fault messages shall be stored in the drive's fault history.
- 1.12.00 Compatibility and safety**
- Bidder shall provide fully compatible electrical system, equipments, accessories and services suitable for the existing setup without causing any detrimental effect on the existing motor- fan/pump system.
- 1.12.01 The bidder must ensure that the drive motor should not get over-heated while in VFD mode of operation. The motor vibration should also remain complying to IEC 60034-14 under all operating conditions.
- 1.12.02 Input isolation transformer, Common mode filter, dv/dt limiter and sinusoidal filters, as required, shall be provided by the bidder.
- 1.12.03 Suitable bearing insulation of motors on NDE side for inhibiting bearing currents & shaft grounding on DE side of motor for removing static charges shall be provided.
- 1.12.04 Shielded symmetrical multi-core cable between VFD to motor to achieve low ground impedance for high frequency shall be provided.

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1.12.05 Gearing backlash compensation function as per Annexure-B, Cl. No. B.4 of IEC 61800-4: 2002 shall be provided to avoid torsion vibration shocks due to gear play, if required.

1.12.06 The earthing of the VFD System equipments should have equipotential bonding taking into account common mode stresses & EMC issues.

2.00.00 OPERATIONAL REQUIREMENTS

2.01.00 The Variable frequency drive (VFD) system shall be of a modern proven design for similar applications in power plants. The system shall be either Current Source Inverter (CSI) or Voltage Source Inverter (VSI) type.

2.02.00 The power capacity of the converter shall meet the speed-load curve of the application provided elsewhere in the specification, even under worst mains supply voltage and frequency conditions indicated above at 1.07.00. The system shall be capable of 110% over current for 1 minute once every 10 minute.



2.03.00 The system shall be suitable for linear continuous speed control for a range as per the requirement of driven equipment. The system shall meet the requirements of IEEE 519 for the harmonics generated at the input of VFD system and transferred to power supply bus as well as output to motor. All required protections like Overload, Earth fault, Overvoltage, Over-speed, Negative sequence, etc as required and applicable for the system shall be provided.

2.04.00 The variable Frequency Drives shall be suitable for operation in ambient temperature up to 50 Deg C. The VFD cubicles shall be placed in air conditioned environment, however, the input transformer (if provided) shall be indoor dry type or outdoor oil filled type as per manufacturer's recommendation.

2.05.00 In case the offered VFD has series of Low Voltage IGBT cell type combination, necessary supervision and protection for each cell shall be provided.

2.06.00 The 3-Phase Diode/Thyristor/IGCT/SGCT/Single-stage or multistage IGBT/IEGT based VFD system shall have minimum number of components to ensure very high reliability. The input side converter shall have 3-Phase Diode/ Thyristor/ SGCT/ IGCT/ IGBT/IEGT bridge configuration modular type and inverter shall be of 3-Phase Diode/ Thyristor/ IGCT/SGCT/IGBT/IEGT type, using Pulse Width Modulation or better technique for generating near sine wave output to motor operating under varying load condition from no-load to full load.

2.07.00 In case any snag develops in the VFD, disrupting power supply to the motor, suitable manually operated by-pass arrangement shall be provided to isolate the VFD system and restore power supply to the motor by directly feeding through bypass panel. The bidder shall provide necessary safety interlocks for VFD to bypass mode and vice versa change-overs.

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2.08.00 Fibre optic cable connection shall be provided preferably to ensure high network reliability for signal interchange.

3.00.00 VFD CUBICLE

Proper ventilation using air filters and fans/pumps shall be provided in the panels to ensure that maximum temperature inside the cubicle is within permissible limits for reliable and continuous operation of the system. Cooling fans/pumps shall have n+1 redundancy with provision for auto start of stand-by fan/pump in case of outage of any working fan/pump.

Enclosure shall be fabricated from CRCA sheet steel of frame thickness at least 2.0 mm, enclosure thickness at least 1.6mm & Gland plates thickness at least 4.0 mm (Al).

The noise level inside the room shall be within the specified limits as per standard.

Cable entry/exit to the VFD System are envisaged from top of the panel in the VFD room. Cable trench and/or floor cutting are not desirable, external cabling is envisaged by over ground trestles on cable trays & support system. In case of bottom entry of cables, Bidder may arrange suitable arrangement (raised platform etc) as per site conditions without sacrificing quality of job.

4.00.00 Control & Monitoring System:

4.01.00 Speed Regulation +/- 0.5 %



Output base frequency - 50 Hz

Switching frequency- More than 0.5 kHz for 3-Phase Diode /Thyristor /IGBT /IGCT /SGCT /IEGT.

Dynamic performance: Suitable for stated application.

4.02.00 Protection Features: as per IEC 61800-4: 2002 Table-8 along with the following :

- Motor Earth fault
- Short Circuit
- Negative sequence
- Overload, AC/DC transients, voltage surge, etc. of power & control device
- Stall protection shall be programmable to provide a warning or stop the drive after the motor has operated above a programmed torque level for a set time limit.
- Motor overload protection shall be programmable to provide a warning or stop the drive, applying at least three time dependent thresholds.
- Underload protection shall be programmable to provide a warning or stop the drive after the motor has operated below a selected under load curve for a set time limit.
- Reference feedback signal from furnace lost.

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- 4.03.00 Local/Remote : Local Mode – Graphic operated Key board.
Remote Mode : Operated from plant Distributed Control System via
a 4-20 mA external signal and start/stop signal
network communication



4.04.00 **Man machine interface**

Shall have one flat TFT monitor with keyboard (password protected) for system alarm and monitoring located in VFD room. Manufacturer’s standard HMI touch screen (password protected) can be acceptable as an alternate option to TFT touch screen. Provision shall be kept for exchange of information between VFD control system and plant DCS.

- 4.05.00 Parameter Monitoring : - Input and output voltage of Drive
- Input and output current of Drive
- Motor speed
- Input and output power frequency of Drive
- Torque
- Input and Output power of Drive system (covering
transformer if applicable)
- Output kWhr of Drive
- DC Bus Voltage
- Transformer (if applicable) temperature for alarm
& trip.
- Ambient temperature
- Run/stop and local/remote status displayed
- Sub system/component fault/failure
- Power Cell (if applicable) temperature.

4.06.00 **Additional Features:**

- a) Power Loss ride through for at least 5 cycles, auto restart & flying restart.
- b) Manual By pass of VFD System for direct feeding of motor in case of VFD failure.
- c) Adjustable motor overload feature.
- d) Adjustable torque limit and acceleration/deceleration ramp.
- e) Multi-function & user programmable I/O’s.
- f) Settable Minimum & Maximum Operating frequency.
- g) The power supply units shall be compact, slim, modular and of self supervision type.
- h) The VFD to provide an automatic current limit feature to control motor currents during start-up and provide a “soft start” torque profile for the motor-load combination. Current and torque limit adjustments shall be provided to limit the maximum VFD output current and the maximum torque produced by the motor.
- i) An Emergency-stop (E-Stop) push button with cover shall be provided on the VFD door.

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5.00.00 **OTHER CIRCUIT COMPONENTS/ELEMENTS**

5.01.00 **OFFLOAD ISOLATORS**

These devices shall be suitable for manual offline connection/disconnection of VFD input and output side as well as VFD bypass line.

5.01.01 Rating of various switchgear components shall be as per the system requirement.

5.01.02 All the components shall have protection against over load, all AC/DC transients and voltage surges etc. Electronic control module shall be electrically isolated from these switching devices.

5.01.03 **Switchgear Panel**

(1.) The switchgear boards shall have a single front, metal enclosed construction complying with clause No. 3.102 of IEC 62271-200, comprising of a row of free standing floor mounted panels. Each Isolator shall have a separate panel. Panels shall be free standing type with cable entry from top.

(2.) Enclosure shall be constructed with CRCA sheet steel sections. The doors and covers shall be constructed from cold rolled steel sheets of 2.0 mm or higher thickness. Gland plates shall be 2.5 mm thick made out of hot rolled or cold rolled steel sheets and for non magnetic material it shall be 3.0 mm.

(3.) The switchgear shall be cooled by natural air flow and forced cooling shall not be accepted.



(4.) Total height of the switchgear panels shall not exceed 2600 mm. The height of switches, pushbuttons and other hand operated devices shall not exceed 1800 mm and shall not be less than 700 mm.

5.01.04 Bypass Isolator/circuit breaker shall be capable of being used for frequent direct-on-line starting of the squirrel cage induction motor.

5.01.05 All working part of the mechanism shall be of corrosion resisting material. Bearings which require greasing shall be equipped with pressure type grease fittings. Bearing pins, bolts, nuts and other parts shall be adequately secured and locked to prevent loosening or change in adjustment due to repeated operation of the mechanism.

5.01.06 The operating mechanism shall be such that failure of any auxiliary spring shall not prevent tripping and shall not lead to closing or tripping of Isolator. Failure of any auxiliary spring shall also not cause damage to the Isolator or endanger the operator.

5.01.07 Mechanical indicators in addition to electrical indicating lamps shall be provided to indicate OPEN / CLOSED conditions of the Isolator. These shall be visible without opening the door.

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5.01.08 Busbars and Insulators

- a) All busbar and jumper shall be adequately supported on insulators to withstand electrical and mechanical stresses due to system short circuit currents.

Busbar cross-section shall be uniform throughout the length of switchgear. Busbars and other high voltage connection shall be sufficiently corona free at maximum working voltage.

Contact surfaces at all joints shall be silver plated or properly cleaned and non-oxide grease applied to ensure an efficient and trouble free connection. All bolted joints shall have necessary plain and spring washers. All connection hardware shall have high corrosion resistance. Bimetallic connectors or other technically proven method shall be used for aluminium to copper connections.



- b) Busbar insulators shall be of arc and track resistant, high strength, non-hygroscopic, non-combustible type and shall be suitable to withstand stresses due to over-voltages, and short circuit current. Busbar shall be supported on the insulators such that the conductor expansion and contraction are allowed without straining the insulators. In case of organic insulator partial discharge shall be limited to 100 pico-coulomb at rated voltage $\times 1.1 / \sqrt{3}$. Use of insulators and barriers of in-flammable material such as Hylam shall not be accepted.

5.01.09 All busbars shall be colour coded.

The temperature of the busbar and all other equipment, when carrying the rated current continuously shall be limited as per the stipulations of relevant Indian Standards, duly considering the specified ambient temperature (50 deg.C).The temperature rise of the horizontal and vertical busbars when carrying the rated current shall in no case exceed 55 deg. C for silver plated joints and 40 deg. C for all other type of joints. The temperature rise at the switchgear terminals intended for external cable termination shall not exceed 40 deg. C. Further the switchgear parts handled by the operator shall not exceed a rise of 5 deg. C .The temperature rise of the accessible parts / external enclosure expected to be touched in normal operation shall not exceed 20 deg.C.

5.01.10 Earthing and Earthing Devices

- a) A copper / galvanized steel earthing bus shall be provided at the bottom and shall extend throughout the length of each switch board. It shall be bolted/ welded to the framework of each panel and each Isolator earthing contact bar.
- b) The earth bus shall have sufficient cross section to carry the momentary short-circuit and short time fault currents to earth without exceeding the allowable temperature rise.

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- c) Suitable arrangement shall be provided at each end of the earth bus for bolting to earthing conductors. All joint splices to the earth bus shall be made through at least two bolts and taps by proper lug and bolt connection.
- d) All non-current carrying metal work of the switchboard shall be effectively bonded to the earth bus. Electrical continuity of the whole switchgear enclosure frame work shall be maintained even after painting.
- e) All hinged doors shall be earthed through flexible earthing braid.

5.01.11 Necessary safety Interlocks between Isolators and Isolator to Existing Circuit Breaker shall be provided.



5.01.12 Finishing paint shade for complete panels excluding end covers shall be RAL9002 & RAL5012 for extreme end covers of all boards, unless required otherwise by the Owner. The paint thickness shall not be less than 50 microns.

5.01.13 Each switchgear panel shall be equipped with thermostatically controlled space heater(s), suitably located in Isolator and cable compartments to prevent condensation within the enclosure. The space heater shall be connected through switches and fuses provided separately for each panel.

5.01.14 A 240V single phase 50 Hz AC plug point shall be provided in the interior of each cubicle with ON-OFF switch for connection of hand lamp.

5.01.15 Terminal Blocks

1. Terminal blocks shall be 650V grade, 10Amps rated, made up of unbreakable polyamide 6.6 grade. The terminals shall be screw type or screw-less (spring loaded) / cage clamp type with lugs. Marking on terminal strips shall correspond to the terminal numbering in wiring diagrams. All metal parts shall be of non-ferrous material. In case of screw type terminals the screw shall be captive, preferably with screw locking design.
2. Terminal blocks for CT and VT secondary leads shall be of stud type, made up of unbreakable polyamide 6.6 grade. They shall be provided with links to facilitate testing, isolation star / delta formation and earthing. Terminal blocks for CT secondary shall have the short circuiting facility. The terminals for remote ammeter connection etc. shall also be disconnecting type only. All metal parts shall be of non-ferrous material. Screws shall be captive.
3. At least 10% spare terminals for external connections shall be provided on each panel and these spare terminals shall be uniformly distributed on all terminal blocks. Space for adding another 10% spare terminals shall also be available in each panel.

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4. There shall be minimum clearances of 250 mm between the terminal blocks and the cable gland plate and 150 mm between two rows of terminal blocks.
5. All panel wiring for external connections shall terminate on separate terminal blocks which shall be suitable for connecting two (2) stranded copper conductors of 2.5 sq. mm on each side, or alternatively, the terminal blocks shall have the possibility of double shorting space to facilitate looping.

5.01.16 Switchgear Wiring

1. All internal wiring shall be carried out with 650 V grade, single core, 1.5 sq. mm. stranded copper wires having minimum of seven strands per conductor and colour coded, PVC insulation. CT circuits shall be wired with 2.5 sq. mm. wires which otherwise are similar to the above. Extra flexible wires shall be used for wiring between fixed and moving parts such as hinged doors.
2. All wiring shall be properly supported neatly arranged, readily accessible and securely connected to equipment, terminals and terminal blocks. Wiring troughs or gutters be used for this purpose.
3. Internal wire terminals shall be made with solderless crimping type tinned copper lugs which shall firmly grip the conductor. Insulation sleeves shall be provided over the exposed parts of lugs.

5.01.17 Cable termination compartment shall have provision for termination of power cables of sizes as indicated during detailed engineering with removable undrilled gland plates. For all single core cables gland plates shall be of nonmagnetic material. Cable entry and exit shall be from top. Any change will be intimated later.



5.01.18 Each switch board shall have a name plate for its identification. All enclosure mounted equipment shall be provided with individual engraved name plates for clear equipment identification.

3.02.00 DC Reactor (As applicable)

- 1) Type : Dry type, air cored, self cooled, indoor type. Suitable for withstanding earth fault continuously .
- 2) Insulation : Thermal Class 155 °C (F) , temperature rise is limited to thermal class 130 °C (B).
- 3) Noise level shall not exceed value specified in NEMA TR-1.

5.03.00 Capacitor (As applicable)

Shall be of self healing film or electrolytic type having high life-time. The capacitor shall be an integral part of VFD system. DC link Capacitors shall have discharge resistors or other provisions as per manufacturer's standard practice which shall be capable of reducing the residual charges to zero just after the capacitor is disconnected from the supply source. The capacitor shall be suitable for high ripple currents.

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5.04.00 TRANSFORMER (AS AND IF APPLICABLE)

5.04.01 Shall be suitable for converter application and rated to meet VFD requirements at steady state and short time overloads as specified for VFD.

The common mode voltage should be taken into account in specifying the insulation level of the transformer. Additional voltage stresses due to fast voltage rise time and voltage reflections (including power cable) should be considered too in this regard.

Degree of protection : Dry type transformer - IP-23
Cable box, Marshalling box - IP-55

5.04.02 TEMPERATURE RISE :

Out-door Transformers - Winding 55°C above ambient 50°C
Oil 50°C above ambient 50°C.

Dry type Transformers - Winding (by resistance method) : 90°C or lower as permissible for class of insulation offered, above ambient of 50°C

Silicon Oil type indoor Transformers - Winding 55°C above ambient 50°C
Oil 50°C above ambient 50°C.

5.04.03 Noise Level : Not to exceed values specified in NEMA TR-1.

5.04.04 **OUTDOOR TRANSFORMERS**

Core shall be High grade non-ageing cold rolled grain oriented silicon steel laminations.

Winding conductor shall be Electrolytic grade copper.

Conservator tank of adequate capacity for expansion of oil from min. ambient to 100 deg.C. shall be provided.

Porcelain Bushings shall be used.

Radiators shall be Tank mounted with shut off valves.



Insulating oil : No external inhibitors are permitted.

Marshalling box shall be provided with thermostatically controlled space heaters.

The insulation of core to tank and core to core clamp shall be able to withstand a voltage of 2 KV rms for one (1) minute.

Oil Cooled Transformer shall be provided with following fittings:

- a) Buchholz relay shall be provided with double float type with alarm and trip contacts, alongwith suitable gas collecting device.

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- b) At least two numbers of spring operated pressure relief devices with extension pipe to bring oil to plinth level along with electrically insulated contact for alarm and tripping shall be provided for transformer rating 2MVA and above.
- c) Diaphragm type explosion vent shall be provided for all transformers below 2 MVA rating.
- d) Winding temperature indicator (WTI) and Oil temperature indicator (OTI), Dial type (150mm) with alarm and trip contacts and max. reading pointer along with resetting device shall be provided.
- e) Magnetic oil level gauge with alarm contact shall be provided.
- f) Oil level gauge Prismatic/toughened glass type.
- g) Oil temperature indicator (OTI)

5.04.05 **DRY TYPE TRANSFORMERS**

Enclosure

Enclosure shall be of a tested quality sheet steel of minimum thickness 2 mm & shall also accommodate cable terminations. The housing door shall be interlocked such that it should be possible to open the door only when transformer is off. The enclosure shall be provided with lifting lugs and other hardware for floor mounting.

Core Shall be High grade non-ageing cold rolled grain oriented silicon steel laminations.

Winding conductor Shall be electrolytic grade copper. Windings shall be of class F insulation.

Winding temperature Indicator (WTI) Shall be Platinum resistance type temperature detector in each limb.



Thermistors Shall be embedded in each limb with alarm and trip contacts for remote annunciation.

5.05.00 **CURRENT TRANSFORMER/ VOLTAGE TRANSFORMERS/ METERS**

Instrument transformer

CTs and VTs shall be provided for protection and metering and shall be cast-resin encapsulated type. Insulation class 'E' or better. VTs shall have suitable HRC current limiting fuses to both primary and secondary sides, under voltage relays, timers, etc. for motor tripping and remote annunciation on supply failure. Accuracy class of CTs and VTs shall be as follows

	CTs	VTs	Core balance CTS
Protection	5P 20	3P	PS
Metering	0.2	0.2	
Differential/REF	PS		

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CTs/VTs shall have accuracy class of 0.2 wherever energy meters of 0.2 class are connected to these CTs as required for the system offered and suitable for variable frequency operation.

Accuracy class for metering shall be 0.2

Class of Insulation : Class E or better

6.00.00 TYPE TESTS

6.01.01 The bidder shall carry out the type tests as listed in this specification on the equipment to be supplied under this contract. The type tests charges shall be paid only for the test(s) actually conducted successfully under this contract and upon certification by the owner's engineer.

6.01.02 The type tests shall be carried out at manufacturer's works in presence of the owner's representative or in an independent laboratory approved by the owner, for which minimum 15 days notice shall be given by the bidder. The bidder shall obtain the owner's approval for the type test procedure before conducting the type test. The type test procedure shall clearly specify the test set-up, instruments to be used, procedure, acceptance norms, recording of different parameters, interval of recording, precautions to be taken etc. for the type test(s) to be carried out.

6.01.03 In case the bidder has conducted such specified type test(s) within last ten years as on the date of bid opening, he may submit during detailed engineering the type test reports to the owner for waiver of conductance of such test(s). These reports should be for the tests conducted on the equipment with same design and rating to those proposed to be supplied under this contract and test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. The owner reserves the right to waive conducting of any or all the specified type test(s) under this contract. In case type tests are waived, the type test charges shall not be payable to the bidder.

6.01.04 Further the Bidder shall only submit the reports of the type tests as listed in "LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED" and carried out within last ten years from the date of bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. However if the bidder is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the bidder shall conduct all such tests under this contract at no additional cost to the owner either at third party lab or in presence of client/owners representative and submit the reports for approval.



6.01.05 LIST OF TESTS TO BE CONDUCTED

The following type tests shall be conducted under this contract

a) Reactor (If applicable)

- i). Lightning impulse test

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- ii). Heat run test
- iii). Short time current test
- iv). Noise level test

b) Transformer (If applicable)

Following type tests shall be conducted on one transformer and all type tests other than at Sr. (i) to (iii) shall be conducted after short circuit test:

- I. Tank Pressure test
- II. Tank vacuum Test
- III. Short circuit test as per IEC 60076-5
- IV. Noise level
- V. Measurement of harmonics of no load current
- VI. PRD operation test
- VII. Degree of protection test on marshalling box
- VIII. Zero sequence Impedance (not applicable for Delta- delta transformer)
- IX. Temperature rise test
- X. Chopped Wave Lightning impulse test on HV & LV winding as per Cl. 14 of IEC 60076-3
- XI. DGA test on oil before and after temperature rise test



c) Complete VFD System

- I. Insulation Test
- II. Light Load & functional test
- III. Temperature Rise Test
- IV. Checking of auxiliary devices
- V. Checking of properties of the control equipment
- VI. Checking of Protective Devices
- VII. Overall efficiency determination of VFD system including transformer / Harmonic filters etc (as applicable) at full load in rated condition. Power Loss determination shall be carried out either by loss calculation method or direct measurement method as per IEC 60146. The auxiliary power requirement due to forced water/air cooling, excitation and control shall be included while determining the efficiency of VFD system. However, power required for HVAC & illumination shall be excluded from measurement.

6.02.00 VFD Panels

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

6.02.02 However if the bidder is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in the case of type test

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report(s) are not found to be meeting the specification requirements, the bidder shall conduct all such tests under this contract at no additional cost to the owner either at third party lab or in presence of client/owners representative and submit the reports for approval.

6.02.03 LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED

The following type test reports shall be submitted for VFD Panels

- 1) Temperature rise test .
- 2) Input and output Surge withstand capability test
 - i. The Oscillatory SWC tests
 - ii. The Fast transient SWC tests as per ANSI / IEEE C37.90.1-2002 / IEC 60255-22-04-2008.
- 3) Noise level test
- 4) DOP test for VFD Panels.

6.03.00 All acceptance and routine tests as envisaged in QA section shall be carried out. Charges for these shall be deemed to be included in the equipment price.

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- c) Rated short circuit peak making and latching current carrying capability.
- d) Rated symmetrical RMS short circuit current interrupting capability.

5.18 Provenness of Medium Voltage Variable Frequency Drive (11/6.6 kV VFD)

The bidder/its sub-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 offered) for feeding squirrel cage induction motor / synchronous motor of 1250 kW or above rating, which is in successful operation for a period of at least one (1) year as on date of bid opening.

Alternatively

- a) The bidder/its sub-vendor should have supplied and commissioned / supervised commissioning of at least one (1) number of VFD system suitable for feeding squirrel cage induction motor / synchronous motor of 1250 kW or above rating in India, which is in successful operation for a period of at least one (1) year as on the date of bid opening.

And

- b) The bidder/its sub-vendor shall source VFD system from a party who fully meets the requirements mentioned under clause 5.18 above. This source shall not be allowed to be changed afterwards.

6.0 Provenness of C&I Equipments / Systems.

6.1 The Distributed Digital Control, Monitoring and Information System (DDCMIS) supplier(s) of BOP C&I, SG C&I and TG C&I should have engineered, supplied, and commissioned their respective sub-systems in at least one (1) unit of a power station having unit rating 200 MW or above. It is not essential that all the three sub-systems are implemented in a single unit i.e. BOP C&I, SG C&I and TG C&I DDCMIS supplier(s) may supply even if their respective sub-systems have been implemented in three different units/ power stations.

The BOP C&I DDCMIS supplier who fully meet the above requirement for BOP C&I but does not meet the requirement of SG C&I and/or TG C&I DDCMIS, may also supply SG C&I and/or TG C&I DDCMIS provided he collaborates/associates with DDCMIS/ DCS manufacturer(s) who fully meets the above requirement for SG C&I and/or TG C&I DDCMIS respectively. In such case, the Bidder shall be required to furnish a deed of joint undertaking (DJU) jointly executed by the Bidder, its sub-vendor (if applicable and the Collaborator(s) / Associate (s) for the successful performance of distributed digital control, monitoring information system (DDCMIS), as per the format enclosed with the bidding documents in which the collaborator(s) / associate(s) and the bidder, its sub-vendor (if

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VFD MODULES



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VFD MODULE SQE_28

ATTRIBUTES / CHARACTERISTICS ITEMS/COMPONENTS, SUB SYSTEM ASSEMBLY	Visual & Dimensional checks	Make / Type / Rating etc.	Final Inspection as ISS / IEC	Remarks
HT Breaker (IEC 56)	Y	Y	Y	
DC Reactor	Y	Y		For details refer table for DC Reactor
Transformer	Y	Y		For details refer table for Transformer
Motor	Y	Y		For details refer separate table for Motor
VFD Panel	Y	Y		For details refer table for VFD

Note : 1) This is an indicative list of tests/checks. The manufacture is to furnish a detailed Quality Plan indicating the practices & Procedure followed alongwith relevant supporting documents during QP finalisation.
2) Make of all major Bought Out Items will be subject to NSPCL approval.



DC REACTOR								
ATTRIBUTES / CHARACTERISTICS	Visual	Dimensional	Mech. & Chem. Property	Electrical Characteristics	Pretreatment by Seven Tank	Painting by Stove Enameling	Final Inspection as per IS-2026	Welding/NDT
ITEMS/COMPONENTS, SUB SYSTEM ASSEMBLY								
Winding Material (Aluminium)	Y	Y	Y	Y				
Insulation Material	Y	Y		Y				
Sheet Steel	Y	Y	Y					
Winding	Y	Y		Y				
Fabrication of Enclosures	Y	Y			Y	Y		Y
Assembly	Y	Y						
Routine Tests	Y	Y					Y	
<p>Note : 1) This is an indicative list of tests/checks. The manufacturer to furnish a detailed Quality Plan indicating their practice & procedure along with relevant supporting documents during QP finalisation for all items.</p> <p>2) All major Bought Out Items will be subject to NSPCL approval.</p>								



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Attributes / Characteristics Items/Components Sub Systems	Visual & Dimensional Checks	Mechanical properties	Electrical strength	Thermal properties	Chemical Composition	Compatibility with oil	NDT / DPT / MPI / UT	Ageing Test.	Voltage Ratio, Vector Group & Polarity, Magnetic Balance Test	Make / Type / Rating / Model / TC / General Physical Inspection.	WPS & PQR	Routine Test as per relevant test	Routine Test
Tank, H.V. & L.V. Cable Box / Flange throat	Y	Y					Y						
Conservator / Radiator / Cooler / Pipes	Y	Y					Y						
Copper Conductor (IS:191)	Y	Y	Y		Y								
Insulating Material	Y	Y	Y	Y	Y	Y							
CRGO Lamination & Built Core	Y	Y	Y		Y	Y							
Bushing / Insulator (IS:2544 / 5621)	Y	Y								Y		Y	
Gasket	Y				Y	Y		Y				Y	
Transformer Oil (IS:335 / IEC296)												Y	
Off-Circuit Tap Changer	Y									Y			
Core Coil Assembly & Pre-tanking	Y								Y				
Marshalling Box	Y	Y					Y					Y	
WTI, OTI, MOG, PRD, Breather, Terminal Connector, Bucholz Relay, Globe & Gate Valve,	Y									Y			
Welding (ASME Sect-IX)	Y										Y		
Complete Transformer (IS:2026/ IEC-60076)	Y												Y

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Attributes / Characteristics Items/Components Sub Systems	Visual & Dimensional check	Mechanical properties	Electrical strength	Thermal Properties	Chemical Properties	NDT / DP / MPI	Voltage Ratio, Vector Group & Polarity	Make / Type / Rating / Model / TC / General Physical Inspection	WPS & PQR	Routine Test as per relevant standard	Measurement of capacitance & tan delta between winding	Routine Test
	Enclosure door, H.V. & L.V. Cable Box / Flange Throat	Y	Y						Y			
Copper Conductor	Y	Y	Y		Y							
Insulating Material	Y			Y	Y							
CRGO Lamination & Built Core	Y											
Bushing /Insulator (IS:2544 / 5621)	Y							Y		Y		
Gasket	Y							Y		Y		
Off-Circuit Tap Changer	Y							Y				
Core Coil Assembly	Y						Y					
Marshalling Box	Y									Y		
WTI, Thermister, Terminal Connector	Y							Y				
Welding									Y			
Complete Transformer (IS:11171 / IEC 60076)	Y										Y	Y

Notes: 1) This is an indicative List of test/checks. The manufacturer is to furnish a detailed Quality Plan indicating his practice and procedure along with relevant supporting documents during QP finalization for all item.
 2) All major Bought out Items will be subject to NSPCL approval.



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Attributes Characteristics	Item Components Sub System Assembly	Electrical Properties	Mechanical Properties	Chemical Properties	Dimensions / Finish	Type/ Rating/Functional check	HV/IR	Routine test as per relevant std.	Constructional Features	IS:6005 ,Seven tank process	Paint finish/ shade/thickness	Mountings / BOM/ Make, Completeness	Interlock Functional & Operation Testing / Simulation check	Degree of Protection Test	Final testing as per Relevant IS/IEC
	Sheet Steel (IS-513)		Y	Y	Y										
	Aluminum / Copper Bus-bar (IS-5082/IS-613/IS-1987)	Y	Y	Y	Y										
	Support Insulator (BS-2782/IEC-660/IS-10912)	Y	Y	Y	Y										
	Control / Selector Switch (IS-6875)					Y	Y	Y							
	Contactors/ MCB (IS-13947)					Y	Y	Y							
	O/L Protection relays (IS-3231)					Y		Y							
	C.T /V.T/ Indicating Meter (IS-2705/3156/1248)					Y	Y	Y							
	Fuse/ Fuse carrier (IS-13703)					Y	Y	Y							
	Terminals/lugs/pvc wires (IS-13947//IS-694)	Y			Y	Y	Y	Y							
	Timers (IS-3231)					Y	Y	Y							
	Push Button/ Lamp/ (IS-6875)					Y	Y	Y							
	Control Transformer (IS-12021)					Y	Y	Y							
	Mimic, Annunciator					Y		Y							
	GASKET (IS-11149)		Y	Y	Y	Y		Y							
	Fabrication								Y						
	Pretreatment & Painting									Y	Y				
	VFD panel										Y	Y	Y	Y	Y
<p>NOTE:</p> <ol style="list-style-type: none"> This is an indicative list of Test/ Checks. The manufacturer to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents. All major Bought Out Items will be subject to NSPCL approval. 															

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DRY TRANSFORMER



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QUALITY ASSURANCE

DRY TYPE TRANSFORMER

Attributes / Characteristics Items/Components Sub Systems	Visual & Dimensional check	Mechanical properties	Electrical strength	Thermal Properties	Chemical Properties	NDT / DP / MPI	Voltage Ratio, Vector Group & Polarity	Make / Type / Rating / Model / TC / General	Physical Inspection	WPS & PQR	Routine Test as per relevant standard	Measurement of capacitance & tan delta between winding	Routine Test
Enclosure door, H.V. & L.V. Cable Box / Flange Throat	Y	Y						Y					
Copper Conductor	Y	Y	Y		Y								
Insulating Material	Y			Y	Y								
CRGO Lamination & Built Core	Y												
Bushing /Insulator (IS:2544 / 5621)	Y							Y		Y			
Gasket	Y							Y		Y			
Off-Circuit Tap Changer	Y							Y					
Core Coil Assembly	Y						Y						
Marshalling Box	Y									Y			
WTI, Thermister, Terminal Connector	Y							Y					
Welding									Y				
Complete Transformer (IS:11171 / IEC 60076)	Y										Y		Y
Notes: 1) This is an indicative List of test/checks. The manufacturer is to furnish a detailed Quality Plan indicating his practice and procedure along with relevant supporting documents during QP finalization for all item. 2) All major Bought out Items will be subject to NSPCL approval.													

