Tender Ref No. HMB/PUR/08/2018/003/OPEN-5686, Dtd 17.05.19

TENDER DOCUMENTS

SUPPLY OF CONTROL FOR 1 NO (40+40)T/32T x 30.5M EOT CRANES FOR RSP, ROURKELA

MATERIAL MANAGMENT DIVISION
HEAVY MACHINE BUILDING PLANT
HEAVY ENGINEERING CORPORATION LIMITED
P.O.-DHURWA, RANCHI

MATERIAL MANAGMENT DIVISION, GROUND FLOOR ADMINISTRATIVE BUILDING, HMBP
HEAVY ENGINEERING CORPORATION LIMITED, DHURWA, RANCHI - 834004
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INFORMATION

Tender is invited for supply Control (Electrics) for 1 no EOT cranes.

The scope of work of the tenderer shall consist **turnkey** execution of the job of design, engineering, manufacture, assembly, shop testing, painting at manufacturer's shop as well as at site after erection, supply FOR HMBP stores at Ranchi, transportation from purchaser's store at RSP Rourkela site to crane erection site, reconservation at site, erection, testing & commissioning and PAC, PG & FAC of Electrics for EOT crane at Rourkela Steel Plant Rourkela, Orissa as per technical parameters indicated in the technical specification & the GA drg

The scope of supply covers all electrical equipment commencing from main current collectors on the crane and all other electrical items beyond the main current collectors of the crane i.e. DSL main current collectors, power disconnecting switch (ACB) on bridge platform after main current collectors, protective and control switchgear, VFD & AFE panel, motors, control and all power and control cables including supports, socket outlets, lighting distribution panel and lighting fixtures with lamps, festoon cable system for crane trolley, master controllers, indicating lamps, push buttons, earthing materials etc.

1 (one) no. of laptop with licensed version of all software is included in the scope of supply. Licensed version of all the required software's, hardware / accessories i.e. cables, connectors etc. for parameterization of drives are included with the crane electrics.

All sundry erection materials including mounting channels , angles and required fasteners & cable trays required for installation and connecting up of electrical equipment with cable laying and fixing accessories shall be included in the scope of supply by tenderer. Suitable type of Lugs, Ferules, Cable tie, cleat and other required accessories for installation of electrics including cable laying etc. included in the supply of tenderer.

A broad list of items is furnished at clause no. 02.02.16 of DAP No 166/18M (Section I Pg 1-76)

However, any other item though not specifically mentioned but required for proper operation of the system shall deemed to be included in the scope of the tenderer.

The scope of supply shall also include supply of all commissioning spares with minimum quantities as indicated in clause no 03.01 of this T.S.

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Qualifying Criteria:

i) The Tenderer shall satisfy the Purchaser that he possesses necessary technical know-how and facilities to execute the order. Necessary particulars to establish the same shall be furnished along with the tender.

ii) The drive manufacturer must have supplied drives for at least two cranes which are of capacity 40T or more in steel / metallurgical process plants in PSU / Govt. / Public Limited Company. The performance of drives shall be satisfactory for a period of not less than two years during last five years. Documentary evidence of performance shall be attached.

iii) Reference list of similar job executed elsewhere during last five years (client's address, purchase order no., date of placement of order, schedule delivery period vs actual delivery period, annual audited report for last 5 years with literature/ catalogues of previous supply.

iv) A write-up on testing facilities available in the manufacturer's works shall be furnished by the Tenderer.

Cost of tender paper :

Rs. 1500/- payable by DD in favour of Heavy Engineering Corporation Ltd Payable at Hatia, Ranchi.

Last date of submission of tender:	---	01.06.2019 up to 1 PM
Tender Opening date:	---	01.06.2019 at 3 PM

Tender papers can be downloaded from CPP Portal and HEC website and can collected the tender from MM division, Ground floor, ADM building, HMBP, HEC Ltd during all working days from 8 AM to 5 PM up to 31.05.2019. If tender papers will be downloaded from website tenderer has to submit the tender cost as mentioned above along with their Techno commercial offer (Part I)

The tender documents are divided in two sections.

Section [I] - COMMERCIAL TERMS AND CONDITIONS
Section [II] - TECHNICAL SPECIFICATION - Enclosed as DAP no 166/18M

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Section I

COMMERCIAL TERMS AND CONDITIONS

INSTRUCTIONS TO TENDERER (ITT)

1.1 Submission of Tender

The complete tender is to be submitted in a separate sealed envelope super scribing the tender no., before the scheduled date of submission of tender in the tender box at MM division, Ground floor, ADM building, HMBP, HEC Ltd, Ranchi 4.

If the tender is bulky & voluminous the tenders are to be submitted to the office of MM Division, HMBP, HEC Ltd. Ranchi-04

The offer is to be submitted in two parts. Part I & Part II

Part I This tender will comprise

a) Techno Commercial offer confirming all technical specification, commercial terms and conditions and price format as per "Annexure A" with price column blanked. The price format should contain item wise list of items for which the price has been quoted.
b) EMD as specified in the tender.

The Demand draft for earnest money should be drawn in favour of Heavy Engineering Corporation Ltd, Ranchi. The DD should be preferably of State Bank of India, payable at Hatia. The EMD can also be submitted in the form of Bank guarantee in HEC's format as enclosed at Annexure E.

Part-II This part will comprise price format duly filled as per Annexure A

1. All the columns of the price format must be filled up by tenderer.
2. Price should be FOR/HMBP mentioned in the price bid
3. The transit insurance will be in supplier scope.

Offer without EMD/Documents for exemption if any will not be considered.

Both the bids i.e. Part-I, Part II shall be in separate sealed covers clearly super scribing on the top of each envelope the relevant part number, tender reference number with date and date of opening.

Both the bids i.e. Part-I, Part II shall be enclosed in one envelope. This envelop shall also be super scribed on the top with relevant tender no. and date of opening of enquiry.

1.2 Price.

The rate quoted by the tenderer must be firm and the offers may remain valid for acceptance for 90 days from the due date of opening of the tender. Quotation erased or over written are likely to be rejected unless all corrections are authenticated with the tenderer's signature.

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1.2.1 FOR SUPPLIES :

Prices quoted must be firm till completion of work defined under the scope of supplier. The prices must be quoted as indicated in Annexure-A enclosed herewith.

1.2.2 ERECTION, TESTING & COMMISSIONING :

i) Prices should be quoted for completion of the total work i.e Erection, Testing and Commissioning inclusive of all expenses towards various statutory and regulatory body and insurance coverage.
ii) GST for supervision of erection and commissioning if applicable shall be re-imbursed against documentary evidence by PURCHASER. The price also includes all charges towards to and fro travel, boarding, local transportation, medical etc.
iii) Price shall remain firm and binding and shall not be subject to any variation whatsoever on any account except for statutory variation on taxes and duties.
iv) Purchaser will not entertain any additional visit charges under following circumstances :
   a) In case of delay in erection/commissioning due to delay by supplier's engineer.
   b) Due to lack of proper documents / knowledge to be possessed by supplier's engineer.
   c) In case of additional visit necessitated due to fault / repair in the supplier's supplied equipment, because of design / manufacturing / workmanship fault.
   d) In case of delays / loss of time beyond purchaser's control.
   e) In case of short supplies by the supplier.

1.3 TAXES & DUTIES

1.3.1 FOR SUPPLY :

a) GST on finished items shall be paid at the rates prevailing at the time of delivery period or purchase order delivery period, whichever is earlier and will be limited to taxes and duties actually paid by the Supplier subject to a max. value declared in his Bid.

b) Any revised imposition of taxes/duties on the finished items within the purchase order delivery period will be reimbursed by PURCHASER against documentary evidence. Similarly, if any of existing taxes are reduced or abolished, PURCHASER shall be entitled to get the resultant benefit in full.

c) Original copy of the GST Invoice shall be furnished by Supplier for claiming GST on the finished items. In addition to the above, the Supplier shall furnish a certificate to the effect that no refund of GST has been obtained or claimed. In case any refund is obtained in future by the Supplier, the same shall be immediately passed on to PURCHASER in full.

d) Duplicate copy of the GST Invoice (i.e., Transporter's Copy) shall be sent along with Transporter and it should be ensured that the transporter's copy of GST invoice is handed over to Site/Stores of EMPLOYER/PURCHASER, along with the consignment. Documentary evidence shall be furnished by the Supplier regarding receipt of Transporter Copy of GST invoice at site stores of EMPLOYER/PURCHASER.

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e) GST Invoice should be Drawn in favour of Purchaser as per the details indicated in the despatch instructions enabling purchaser to avail CREDIT. PURCHASER shall not reimburse GST in case GST Invoice is not drawn as stated in the despatch instruction. In case PURCHASER can not avail the GST benefit due to improper documents from Supplier (Suppliers), then purchaser shall not pay GST to supplier.

f) GST Invoice should contain all the particulars as per Latest GST Notification issued by Govt of India / other concerned authorities.

g) Custom duty shall be paid at the rate prevailing at the time of delivery on documentary evidence. No statutory variation is allowed.

1.3.2 Way Bills/ Road Permit :

No consignment shall be dispatched by the Supplier without a valid way bill / Road Permit.

1.3.3 FOR ERECTION & COMMISSIONING

All applicable taxes and other charges legally levied on the supplier in connection with this work order are included in the purchase order price and shall be borne and paid by the supplier. The GST shall be re-imbursed against documentary evidence as applicable.

The supplier shall certify, if required by PURCHASER that due taxes have been paid by him on this order and produce evidence of tax paid which is legally due and payable on this order PURCHASER shall bear no liability in respect of any taxes, duties, levies etc. whatsoever.

Any Indian Income Tax which PURCHASER may be required to deduct by law or statute shall be deducted at source and the same shall be paid to Income Tax / Tax Authorities on account of Supplier. Supplier shall indicate their Permanent Account No. with the relevant Income Tax Authority for this purpose to PURCHASER.

PURCHASER's liability in respect of taxes and duties shall be limited to statutory variations, if any, from date of your final offer submission of documentary evidence.

The Supplier shall produce documentary evidence as may be called for by PURCHASER in respect of taxes etc. paid by the Supplier.

1.4 Acceptance of Tender

Tender may be accepted for full quantity. Any incomplete tender in any respect is liable to be rejected.

The company is having right to reject any tender without assigning any reason for which no question can be asked anywhere.

There is no obligation on our part to accept delayed / late tender received after the due date of opening of tender and these are liable to be summarily rejected.

1.5 Earnest money

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The earnest money will be **Rs. 750000.00** to be deposited by demand draft/ Bank Guarantee in favor of Heavy Engineering Corporation Limited, Ranchi-834004 payable at State bank of India, Hatia Branch or Bank Guarantee in HEC's format as enclosed at Annexure E. The validity of the earnest money shall be 6 months. In case of delay in finalization of the order the validity of EMD has to be got extended. EMD of unsuccessful bidders will be returned immediately after finalization of contract. EMD for successful bidder will be converted to security deposit.

Exemption from deposition of EMD for MSME/SSI/ DGS&D/NSIC registered units shall be guided as per prevailing government guidelines. Valid DGS&D/NSIC registered (for tendered items) firm to produce documentary evidence issued by government authorities for allowing exemption towards submission of EMD for availing such benefits.

1.6 Security Deposit

Successful tenderer will have to deposit security deposit equal to 5% of the basic value of the contract within 21 days from the date of award of contract, failing this, the contract will be cancelled and the stores will be procured at the Risk and expenses of the contractor. This will be in addition to other remedies available to the purchaser for the successful completion of the contract as provided in general terms & conditions of the contract of HEC. Security deposit will be valid for a period of 60 days beyond the date of completion of all contractual obligations of the supplier.

1.7 Refund of Security Deposit

The security deposit will be refunded after 60 days of successful completion of the Work Order.

1.8 Liquidated Damages (LD)

Shall be applicable @ 0.5% per week subject to maximum 10% of the contract price for delay in delivery against the schedule given to the successful tenderer.

1.9 Performance Bank Guarantee

The successful tenderer will have to submit performance bank guarantee amounting 10% of the contract period price valid till guarantee period in the form of Bank Guaranatee in HEC's format as enclosed at Annexure F.

1.10 Delivery

Within 45 days from the date of Purchase Order.

1.11 Inspection

Inspection will be done by QCA/HMBP/ RSP or its authorized representative as per approved QAP & Drawings. The success full tenderer shall submit QAP to HEC for approval.

1.12 Submission of Bills

For getting payments supplier has to submit his bill as indicated in payment terms to Sr DGM/ Pur /EL/HMBP.

1.13 Paying Authority

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DGM/I/c/ (Fin) / HMBP / HEC

1.14 Payments Terms

Subject to any deduction, which PURCHASER may be authorized to make under the Purchase order, the Purchase order Price shall be payable as follows:

FOR SUPPLY

A) 5% of the basic amount will be released on completion of the Design & Engineering of the crane. The same can be released on submission of the proforma invoice in triplicate along with the certificate of completion of D&E from RPD/ HMBP.

B) 80% of the price including packing & forwarding charges together with 100% GST for the items despatched as per approved billing schedule shall be payable against submission of following complete and correct documents in eight (8) Sets at HEC, Ranchi after receipt of items at PURCHASER.

a) Copies of Receipted Lorry Consignment Note.
b) GST Invoice.
c) Copies of Packing List & Delivery Challan including originals.
d) Copies of Inspection Certificate
e) Dispatch clearance issued by PURCHASER.
f) Original copy i.e. Buyer's copy of GST Invoice
g) Documentary evidence regarding handing over of Transporter copy of GST Invoice to the Site /Stores of PURCHASER.
h) Material Test Certificate.
i) Certificate from the supplier that the contents in each case are not less than those entered in the invoice and packing list and the quality of goods are guaranteed as new and as per the relevant technical specification.
k) Copy of intimation to Insurance Company for Transit Insurance.

The above payments shall be released on receipt of complete and correct documents as listed above at HEC, Ranchi within 60 days, provided you ensure that dispatches are made and Invoices are raised strictly as per the order.

Number & distribution of above noted despatch documents including original LR are indicated in our Despatch Instructions.

In order to avoid detention/ seizure of goods at check post during transit, the Supplier shall send the following documents along with the equipment:

I) GST No of PURCHASER
2) Delivery Challan.
3) Packing List
4) Consignment note/Lorry Receipt (LR)
5) Way Bill
6) Duplicate for Transporter copy of GST Invoice.

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In the event or any detention/seizure of goods, the Supplier shall depute his personnel, to take up the matter with appropriate authorities to get the goods released. Without prejudice to any other rights as provided in the purchase order, the supplier shall keep PURCHASER harmless and be responsible for any loss/damage/delay etc.

C) Payment on Completion

(i) 10% of the Purchase order price shall be paid to Supplier on completion of the work defined under the scope of work and issuance of Commissioning Certificate and submission of Performance Bank Guarantee for the guarantee as per NIT and the following documents in six (6) sets to PURCHASER, Ranchi directly. i.e. Invoice along with Commissioning Certificate issued by PURCHASER.

(ii) Balance 5% of the Purchase order price shall be made to the Supplier within 60 days on issuance of Final Acceptance Certificate (FAC), acceptance of the Works by the PURCHASER, Training of Engineers of RSP and submission of the following documents in eight sets to PURCHASER, Ranchi directly.

a) Invoice.
b) Completion Certificate issued by PURCHASER's site engineer.
c) No claim Certificate by the SUPPLIER.
d) Statement of reconciliation of all the payments and recoveries made in the progress bills
e) Test Certificates for items and materials where applicable.
f) Copies of other statutory documents as required by PURCHASER.
g) Final Acceptance Certificate (FAC) issued by PURCHASER.
h) Certificate regarding successful training to RSP Engineers to be issued by PURCHASER
h) PURCHASER's certificate regarding submission of all drawings & documents as per P.O.

FOR ERECTION AND COMMISSIONING

100% payment + 100% GST for erection & commissioning shall be made upon receipt of the following documents:-

a) GST Invoice along with the actual period of deployment of Engineer/Expert duly signed by SUPPLIER and certified by PURCHASER's site engineer.

b) Commissioning certificate duly signed by PURCHASER

No advance will be provided to the successful tenderer. The prices will remain firm till completion of contract . For offered payment term other than as specified in NIT , maximum interest @1% per month i.e. 12% per annum will be loaded on offered rate of the firm for calculating landed cost to decide L1 status.

1.15 Guarantee

The stores supplied shall be guaranteed for a period of 12 months from the date of commissioning against

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defective materials or bad workmanship

1.16 Acceptance of tender

The corporation does not pledge itself to accept the lowest or any tender and reserves to itself the right of accepting the whole or any part of tender or portion of the quantity offered and the firm will have to supply the same at the rate quoted.

1.17 Termination of Order

1.17.1 The order can be terminated if the supplier fails to deliver the goods in time.
1.17.2 Any other reason due to which company thinks it fit to terminate the order.
1.17.3 In the event of the termination of the contract in part/ full the company can get the work completed from any other agency/ departmentally at the risk and cost of the supplier.

1.18 Risk Purchase Clause- If the material is not supplied within the stipulated period then material can be procured at the risk & cost of the firm without giving any notice to the firm
Otherwise:

a) The purchaser to recover from the contractor a sum of 0.5% per week (completed week) of the price of the stores (up to maximum 10%) as liquidated damages, which the contactor has failed to deliver as aforesaid or
b) The purchaser may procured the undelivered stores/similar items from elsewhere, without notice to the contactor at the risk of contractor without canceling the contract is respect of the consignment not yet due for delivery or
c) to cancel the contract or a portion thereof.

1.19 MODE OF DESPATCH

By road to the consignee at Incharge, Stores, HMBP, HEC Ltd, Ranchi. For the consignments to be despatched by Road, the supplier shall ensure that the following are observed by them:

i) All dispatches must be effected only on receipt of written despatch clearance from PURCHASER.
ii) You shall despatch all the materials consigned to SDGM/I/c/Stores/HMBP, HEC Ltd, Ranchi
iii) Identify and obtain the correct type of trucks/trailers, keeping in view the nature of consignments to be dispatched.
iv) Care shall be taken to avoid damages during transit to ensure that all packages are firmly secured.
v) All consignments dispatched by truck/trailor shall be consigned on door delivery basis (Full or part lorry load)..

1.20 PACKING, FORWARDING AND SHIPMENT

a) The Supplier, wherever applicable, shall after proper painting, pack and crate all equipment in such a manner as to protect them from deterioration and damage during rail and road transportation to the site and storage at the site till the time of erection. The Supplier shall be held responsible for all damages due to improper packing. The supplier shall be liable to deliver the material at the destination as per specification. Any damage during transit shall be sole responsibility of the supplier. In case of damage, the material shall be liable to be rejected and

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supplier shall replace the same and lift the rejected material within time at their risk and cost.

b) The Supplier shall notify the Purchaser of the date of each shipment from his works, and the expected date of arrival at the site for the information.

c) The Supplier shall also give all shipping information concerning the weight, size and content of each packing including any other information the Purchaser may require.

d) The Supplier shall prepare detailed packing list of all packages and containers, bundles and loose material forming each and every consignment dispatched to site. The Supplier shall further be responsible for making all necessary arrangements for loading, unloading and other handling right from his works upto the safe delivery at site store,

1.21 FORCE MAJEURE

A) Force majeure is herein defined as any cause which is beyond the control of the Supplier or Purchaser as the case may be which they could not foresee or with a reasonable amount of diligence could not have foreseen and which substantially affect the performance of the purchase order, such as:

(a) natural phenomena, including but not limited to floods, draughts, earthquakes and epidemics:

(b) acts of any government, including but not limited to war, declared or undeclared, priorities, quarantines, embargoes, Provided either party shall within fifteen (15) days from the occurrence of such a cause notify the other in writing of such causes.

B) The bidding document will clearly state that

(a) The Supplier will advise, in the event of his having resort to this clause by a registered letter duly certified by the local chamber of commerce or statutory authorities, the beginning and end of the clause of delay, within fifteen days of the occurrence and cessation of such force majeure condition. In the event of delay lasting over two months, it arising out of force majeure, the purchase order may be terminated at the discretion of the company.

(b) For delays arising out of Force Majeure, the Supplier will not claim extension in completion date for a period exceeding the period of delay attributed to causes of Force Majeure and neither PURCHASER nor the Supplier shall be liable to pay extra costs (like increase in rates, remobilization advance, idle charges for labour, machinery etc.) provided it is mutually established that the Force Majeure conditions did actually exist.

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

C) The Supplier or the Purchaser shall not be liable for delays in performing his obligations resulting from any force majeure cause as referred to and/or defined above. The date of completion will, subject to hereinafter provided, be extended by a reasonable time even though such cause may occur after Supplier's performance of his obligations has been delayed for other causes.

1.22 LONG TERM AVAILABILITY OF SPARES

1.22.1 The Supplier shall guarantee the long term availability of spares to the Employer for the full life of the equipments covered under the purchase order. The Supplier shall guarantee that before going out of production of spare parts of the equipment covered under the purchase order, he shall give

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the Employer at least twelve (12) months advance notice so that the later may order his bulk requirement of spares, if he so desires. The same provision will also be applicable to sub-Supplier. Further, in case of discontinuance of manufacture of any spares by the Supplier or his sub-Suppliers, the Supplier will provide the Employer two years in advance, with full manufacturing drawings, material specifications and technical information required by the Employer for the purpose of manufacture of such items.

1.22.2 Further, in case of discontinuance of supply of spares by the Supplier or his sub-Suppliers, the Supplier will provide the Employer with full information for replacement of such spares with other equivalent makes, if so required by the Owner.

1.22.3 The Supplier shall provide the Employer with a "directory" of his sub-Suppliers giving the addresses and other particulars of his sub-Suppliers. The Employer, if he so desires, shall have the right to procure the spares directly from sub-Suppliers.

1.22.4 Notwithstanding anything stated elsewhere in the bid documents, the prices of all spares which may be procured to cover long term requirements beyond the 2 years' maintenance and operational requirements, will be generally in accordance with the mutually agreed prices.

1.22.5 In case of emergency requirements of spares, the Supplier would make every effort to expedite the manufacture and delivery of such spares on the basis of mutually agreed time schedule.

1.23 MARKING OF EQUIPMENT :

The materials must be marked/stenciled of Equipment No. The word ---------- should be engraved on supplied materials.

1.24 NOTIFICATION OF DESPATCH :

Each and every despatch should be notified immediately after despatch giving the relevant particulars like Truck No., Challan No. with date, C/Note No., Name of the transporter with their full address, date of despatch etc. to the person who signatures the order through fax / e-mail :

1.25 PROGRESS REPORT:

Progress of delivery/inspection must be given to the officer who has signed the purchase order, on the 15th and 30th of each month during currency of delivery period. Where delivery period is crossed by the supplier, he has to take approval of buyer in writing before despatch.

1.26 SUBLETTING AND ASSIGNMENT :

The supplier shall not, have without the previous consent in writing of the purchasers, sublet, transfer or assign the purchase order or any part thereof or interest therein or benefit or advantage thereof in any manner whatsoever. Provided nevertheless that any such consent shall not relieve the supplier from any obligation, duty or responsibility under the purchase order.

1.27 CHANGE IN A FIRM :

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Where the suppler is a partnership firm, a new partner shall not be introduced in the firm except with the previous consent in writing of the purchaser (which may be granted only as an exception) of a written undertaking by the new partner to perform the purchase order and accept all liabilities incurred by the firm under the purchase order prior to the date of such undertaking.

On the death or retirement of any partner of the supplier's firm before complete performance of the purchase order, the purchaser may at this option cancel the purchase order. In such case the supplier shall have no claim whatsoever to compensation against the purchaser.

If the purchase order is not determined as provided above notwithstanding the retirement of a partner from the firm he shall continue to be liable under Section 32 of the Partnership Act has been sent by him to the purchaser by registered post acknowledgement due.

1.28 CONSEQUENCE OF BREACH :

Should the supplier or a partner in the supplier firm commit breach of the commercial terms and conditions, it shall be lawful for the purchaser to cancel the purchase order and purchase or authorize the purchase of the stores at the risk and cost of the supplier firm and that even the provisions of Clause (1.17) shall, as far as applicable, apply.

The decision of Heavy Engineering Corporation Limited as to any matter or thing concerning or arising out of this clause or any question whether the supplier or any partner of the supplier firm has committed a breach of any of the conditions in this clause contained shall be final and binding on the supplier.

1.29 CONSIGNEE :

SDGM/ Incharge Stores HMBP/ HEC Ltd / Ranchi JHARKHAND

1.30 FIRST FILL OF CONSUMABLES, OILS AND LUBRICANTS :

Shall be provided by you at no extra cost as per Technical Specification.

1.31 TRAINING OF PERSONNEL :

You shall provide free of cost training of personnel of RSP or nominated by PURCHASER as per NIT (Details given in DAP 166/18M).

1.32 Q.A. PLAN

Approved QAP and inspection procedure by HEC/ RSP shall apply.

1.33 WEIGHT OF EQUIPMENT

Weight of each equipment must be intimated to the purchaser before effecting delivery.

1.34 COMMISSIONING SPARES:

List of commissioning spares to be furnished separately in technical bid.

MATERIAL MANAGMENT DIVISION, GROUND FLOOR ADMINISTRATIVE BUILDING, HMBP
HEAVY ENGINEERING CORPORATION LIMITED, DHURWA, RANCHI - 834004
PHONE: 0651 2401278,FAX: 0651 2401166, EMAIL: pksingh@hecltd.com/kishorkradas@hecltd.com

1.35 FORMAT AND NAME PLATE

All the drawings should be prepared in the format and nameplates with drawing No. out of allotted drawing Nos. to be given to you at the time of placement of order.

1.36 DRAWING, DOCUMENTS & MANUALS

Will be furnished as per Technical Specification clause no 7 of DAP 166/18M. Sucessful bidder to depute their person immediately to HEC for approval of drawings across the table.

1.37 TWO YEAR OPERATIONAL SPARES AND TOOL & TACKLES

Rates, terms & conditions of your quotation will be valid for 12 months from the date of issue of Purchase order.

1.38 UNIT RATES

Unit rates of various supply item which may be required during execution of this package will remain firm till execution of the order.

1.39 BOUGHT-OUT ITEMS:

Un-priced purchase order of your bought-out items will be submitted to us within a week after issue of your order.

1.40 PAINTING

Painting will be done as per Technical Speciation.

1.41 REJECTION

If the stores supplied are not to specifications/samples or in accordance with order and are rejected, the same will be removed by you at your own risk and cost within 21 days of the date of intimation of rejection by Inspection Deptt/Stores Deptt/Purchase Deptt. If no instruction are received from you with regard to mode of despatch back to you, we shall be free and reserve the right to return the rejected materials at your risk and cost and to recover entire freight and other

incidentals incurred by PURCHASER. Such rejected stores will be kept in our go down/site for 21 days from the date of intimation to you and thereafter they remain at your risk and cost. The purchaser shall also be entitled to recover ground rent/demurrage charges on the rejected stores after expiry of free time mentioned above.

1.42 SPECIAL INSTRUCTION (DESPATCH MARK/ INDENTIFICATION MARK)

The following markings are to be done on each package

a)	From	
b)	For	
c)	Case No.	The case no. shall be written in the form of a fraction the numerator of which shall be serial number of the case and the denominator representing the total number of cases.
d)	Order No.	
e)	Net Weight	
f)	Gross Weight	

1.43 LEGALITY AND DISPUTE SETTLEMENT :

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a) This order/purchase order shall be governed by and interpreted according to the relevant laws of India with jurisdiction of courts at Ranchi.

b) Any dispute that may arise between the parties out of or in-connection with this order/purchase order or for the breach thereof, shall be settled amicably and in good faith by negotiations between the designated executives of the parties, at the first instance.

c) In the event, the parties fail to resolve the disputes or differences arising out of or in connection with the order/purchase order or execution thereof through amicable settlement, the same shall be referred to settlement through "adjudication" of the same by the Sole Arbitrator appointed by PURCHASER. Such arbitration shall proceed as per the provisions of Arbitration and Conciliation Act, 1996 and /or amended from time to time.

d) The arbitration shall be governed by and in accordance with the Arbitration and Conciliation Act, 1996 for adjudication of the disputes and differences including claims and counter-claims of the parties. The award rendered shall be final and binding upon both the parties.

e) The cost of the arbitration proceedings shall be borne by the parties on pro-rata to this purchase order value.

f) The venue of arbitration shall be normally at Ranchi only, unless and until agreed otherwise by the parties.

g) The Jharkhand High Court shall have the exclusive jurisdiction in respect of the order/purchase order.

1.44 OTHER TERMS AND CONDITIONS

Other terms and conditions which are not mentioned above shall be as per General Terms and Conditions of Contract of the Corporation which can be downloaded from our website (www.hecltd.com).

Enclosures:

1. Format for Price Schedule (Annexure-"A")
2. Forms of Tender(Annexure-'B')
3. Check List for Acceptance/Confirmation of Commercial Terms & Conditions (Annexure-'C')
4. Pro forma for BG for EMD (Annexure 'D')
5. Pro forma for BG for Performance Guarantee (Annexure 'E')

Note:

(i) Price should be quoted in words and numeral without any cutting and overwriting. In case of discrepancy the price appearing in words will be binding on both the parties.

(ii) Item wise price of Mandatory and Recommended Spares also to be quoted separately.

(K.K. Das)
Dy.Mgr/Purchase
Heavy Machine Building Plant
Heavy Engineering Corp. Ltd
Ranchi-834004,PH- 0651-2401278

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Tender Ref No. HMB/PUR/08/2018/003/OPEN-5686, Dtd 17.05.19

Annexure- 'A'
Format of Price for supply items

To,

Sr. DGM/ Purchase /MM Division
HMBP / Heavy Engineering Corporation Ltd.,
Ranchi – 834 004 (Jharkhand)

Dear Sir,

I am pleased to submit my best offer without any deviation or rebate which is as follows:-

i) ITEM CODE: 5533313498

Sl No.	Description	Qty per crane	HSN Code	Unit Price (In Rs.) FOR HMBP	TotalPrice (In Rs.) FOR HMBP
1	Gravity type current collector, rated 1000A, 1.1KV, 18 nos per crane.	1 set			
2	Isolator panel Dimensional Limitation: Height = 1800mm, Depth = 800, Width = ---	1 set			
3	Protective panel Dimensional Limitation: Height = 1800mm, Depth = 800, Width = ---	1 set			
4	Active front end converter	2 sets			
5	Inverter for Main Hoist	2 sets			
6	Standby inverter for Main Hoist	1 set			
7	Inverter for Auxiliary Hoist	1 set			
8	Inverter for Main Cross Travel	1 set			
9	Inverter for Long Travel	2 sets			
10	Electric Panel cabin, Size (Inside dimension): 14000 x 1850 x 2800 mm.	1			
11	Air conditioning system for Electric Panel cabin.	1 Lot			
12	Lighting system and temperature display for Electric Panel Cabin.	1 set			
13	Anti-collision device laser beam type	2 sets			
14	UPS with battery back up	1			
15	Laptop computer with latest hardware configuration complete with licensed version of operating software, drive parameterization softwares, all special cables and connectors etc.	1 set			
16	Arm chair control unit	1			
17	Drive motors	1 lot			
18	Hollow shaft Pulse encoder with torque arm	6			

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19	Radio remote Control System	1 set			
20	Emergency corner switch	4			
21	Cables for fixed wiring	1 lot			
22	L.T flexible festoon cable for MCT	1 lot			
23	Lighting transformer 415/240V, 1Ph, 50Hz, 7.5KVA.	1			
24	Lighting distribution panel	1			
25	Lighting fittings & cabin fan	1 set			
26	Terminal box on bridge and main trolley (TBBM/TBTM)	2			
27	Junction box with 10 nos. of CATM4 terminal	8			
28	Junction box with 6 nos. of CATM4 terminal	16			
29	Fire extinguisher, CO_2 type, 3.5 kg	5 nos			
30	Mechanical gong bell (temple type)	1 no.			
31	LT movement buzzer	1 no.			
32	Electric bell to be operated from crane gantry	1 no.			
33	Cable Reeling Drum for Tong	1 no.			
33	Commissioning spares	1 set			
34	Erection accessories including channels fasteners lugs, glands, rubber mats, slotted angles, cable ties, cable trays earthing material etc.	1 lot			
35	Installation of electrical items, cable laying, termination & commissioning.	1 lot			
36	Tools & Tackles	1 set			
37	Switchgears for standby main hoist drive.	1 set			

GST to be mentioned:-

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Tender Ref No. HMB/PUR/08/2018/003/OPEN-5686, Dtd 17.05.19

Annexure- ' B '

FORMS OF TENDER

Sub : TENDER for the Work

To,

Sr. DGM/ Purchase /MM Division
HMBP / Heavy Engineering Corporation Ltd.,
Ranchi – 834 004 (Jharkhand)

Reference enquiry no:

Dear Sir,

We offer to execute the Works described above in accordance with the Conditions of Contract accompanying the Tender Document issued to us.

This tender and your written acceptance of it shall constitute a binding contract between us. We understand that you are not bound to accept the lowest or any tender you received.

We hereby confirm that this tender complies with the tender validity and tender security required by the tender documents.

Yours faithfully

Authorised Signature :

Name and Title of the Signatory :

Name of Tenderer :

Address :

Date :

MATERIAL MANAGMENT DIVISION, GROUND FLOOR ADMINISTRATIVE BUILDING, HMBP
HEAVY ENGINEERING CORPORATION LIMITED, DHURWA, RANCHI - 834004
PHONE: 0651 2401278,FAX: 0651 2401166, EMAIL: pksingh@hecltd.com/kishorkradas@hecltd.com

(To be filled by the tenderer)

ANNEXURE – C

CHECK LIST FOR ACCEPTANCE / CONFIRMATION OF COMMERCIAL TERMS & CONDITIONS

Please confirm your acceptance of following Clauses of Commercial Terms & Conditions :-

Sl No.	PARTICULARS	ACCEPTANCE / CONFIRMATION OF TENDERER (YES / NO)	REMARKS
1	SCOPE OF SUPPLY / WORK & SERVICES		
2	PRICE		
3	TAXES & DUTIES		
4	FIRM PRICE		
5	INSPECTION		
6	DELIVERY		
7	TERMS OF PAYMENT		
8	GUARANTEE		
9	A) EARNEST MONEY DEPOSIT		
	B) SECURITY DEPOSIT		
	C) SUBMISSION OF PERFORMANCE BANK GUARANTEE		
10	LIQUIDATED DAMAGES FOR DELAY IN COMPLETION		
11	TRANSIT INSURANCE		
12	MODE OF DESPATCH		
13	PACKING, FORWARDING AND SHIPMENT		
14	DEMURRAGE, WHARFAGE, ETC.		
15	FORCE MAJEURE		
16	MARKING OF EQUIPMENT		
17	NOTIFICATION OF DESPATCH		

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18	PAYING AUTHORITY		
19	PROGRESS REPORT		
20	SUBLETTING AND ASSIGNMENT		
21	CHANGE IN A FIRM		
22	CONSEQUENCE OF BREACH		
23	CONSIGNEE		
24	FIRST FILL OF CONSUMABLES, OILS AND LUBRICANTS		
25	TRAINING OF PERSONNEL		
26	Q.A. PLAN		
27	WEIGHT OF EQUIPMENT		
28	COMMISSIONING SPARES		
29	FORMAT AND NAME PLATE		
30	DRAWING, DOCUMENTS & MANUALS		
31	TOOL & TACKLES		
32	UNIT RATES		
33	BOUGHT-OUT ITEMS		
34	PAINTING		
35	REJECTION		
36	SPECIAL INSTRUCTION (DESPATCH MARK/ INDENTIFICATION MARK)		
37	LEGALITY AND DISPUTE SETTLEMENT		
38	RISK PURCHSE CLAUSE		
39	OTHER TERMS AND CONDITIONS		

Note: Detailed description of the above clauses is given in NIT in section- I (Commercial Terms and Condition). If There is any deviation against the NIT it should be mentioned separately.

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Annexure 'D'

FORMAT OF BANK GURANTEE FOR EARNEST MONEY DEPOSIT

(TO BE STAMPED IN ACCORDANCE WITH STAMP ACT & TO BE ISSUED BY ANY NATIONALISED /SCHEDULED BANK AUTHORISED BY RBI TO ISSUE A BANK GUARANTEE)

NO. Dated:

TO
HEAVY ENGINEERING CORPORATION LTD.
RANCHI-834004, JHARKHAND
INDIA

Dear Sirs,

In consideration of your agreeing to accept the Earnest money deposit of Rs.----------(Rs----------) furnishable to you by M/s----------(Hereinafter Referred to As Contractor) In terms of the Enquiry No. ---------- ----------
Dtd. ---------- for Supply of ---------- (Hereinafter Referred to as the Contract) in the form of a Bank Guarantee in the Manner hereinafter contained we ----------, having registered office at ----------do hereby covenant and agree with you as follows.

1. We hereby undertake to indemnify you up to a sum of Rs. ---------- (Rs. ---------- only) against any loss or damage caused to or suffered by you or that may be caused to or suffered by you by reason of any breach or breaches on the part of the contractor of any of the terms and conditions contained in the said contract and in the event the Contractor shall make any default or defaults in carrying out any of the works under the said contract or otherwise in the observance and performance of any of the terms and conditions relating thereto in accordance with the true intent and meaning thereof, we shall forthwith on demand and without any protest or demur pay to you such sum or sums not exceeding in total the said sum of Rs.---------- (Rs. ----------only) as may be claimed by you as your losses and/or damages, costs, charges or expenses by reason of such default or defaults on the part of the contractor.

2. Not withstanding anything to the contrary contained in this guarantee your decision as to whether the contractor has made any such default or defaults and the amount or amounts to which you are entitled by reasons thereof will be binding on us and we shall not be entitled to ask you to establish your claim or claims or damages or losses suffered by you but will pay the amount demanded by you under this guarantee forthwith without any protest or demur.

3. This guarantee shall continue and hold good until it is released by you on the application by the contractor after expiry of the related warranty period of the said contract and after the contractor have discharged all their obligations under the said contract and produced a certificate of due completion of the work under the said contract and submitted a "NO Demand Certificate" provided always that this guarantee shall in no event remain in force after the date of---------- without prejudice to your claim or claims arisen and demanded from or otherwise notified to us in writing before the expiry of six

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months from the said date which will be enforceable against us notwithstanding that the same is or are enforced after the said date.

4. We----------, further undertake to extend the validity of this beyond the period prescribed in clause 3 or as extended from time to time for such further period as may be required in writing before the Expiry of this and upon such extension(s), all terms and conditions of this shall remain in full force till the expiry of this extended period(s).

5. You will have the fullest liberty without affecting this guarantee from time to time to vary any of the terms and conditions of the said contract or extend the time of performance of the contractor or to postpone for any time or from time to time any of your rights or powers against the contractor and either to enforce or forbear to enforce any of the terms and conditions of the said contract and we shall not be released from our liability under this guarantee by the exercise of your liberty with reference to matters aforesaid or by reason of any time being given to the contractor or any other forbearance, act or omission on your part or any indulgence by you to the contractor or by any other variation or modification of the said contract or any other act, matter or things whatsoever, which, under the law relating to sureties, would but for the provisions hereof, have the effect of so releasing us from our liability hereunder provided always that nothing herein contained will enlarge our liability hereunder beyond the limit of Rs. ----------(Rs.----------) as aforesaid or extend the period of the guarantee beyond the said Date of ----------unless expressly agreed to by us in writing in terms of clause 4 hereof.

6. This guarantee shall not in any way be affected by your taking or varying or giving up any securities from the contractor or any other person, firm or company on its behalf or by the winding up, dissolution, insolvency or death as the case may be of the contractor.

7. In order to give full effect to the guarantee herein contained, you shall be entitled to act as if we are your principal debtors in respect of all your claims against the contractor hereby guaranteed by us as aforesaid and we hereby expressly waive all our rights of suretyship and other rights, if any, which are in any ways inconsistent with any of the provisions of this guarantee.

8. Subject to the maximum limit of our liability as aforesaid this guarantee will cover all your claim or claims against the contractor from time to time arising out of or in relation to the said contract and in respect of which your claim in writing is lodged on us before expiry of six months from the date of expiry of this guarantee.

9. Any notice by way of demand or otherwise hereunder shall be in writing and may be sent by registered post or Telefax to us at our Local Address as aforesaid.

10. This guarantee and the powers & provisions herein contained are in addition to and not by way of limitation or substitution for any other guarantee or guarantees heretofore given to you by us whether jointly with others or alone and now existing uncancelled and that this guarantee is not intended to and shall not revoke or limit such guarantee or guarantees.

11. This guarantee shall not be affected by any change in the constitution of the contractor or us nor shall it be affected by any change in your constitution or by any Amalgamation or absorption thereof or therewith but will ensure for the benefit or and be available to and enforceable by the absorbing or amalgamated company or concern.

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12. This guarantee is irrevocable during the period of its currency and shall not be revoked without your previous consent in writing.

13. We further agree and undertake to pay you the amount demanded by you in writing irrespective of any dispute or controversy between you and the contractor or any reference to arbitration of the said dispute/controversy pending or a civil suit filed by the contractor in respect of the dispute or controversy.

14. Not withstanding anything contained herein above our liability under this guarantee is restricted to Rs.---------- (Rs. ----------only) and this guarantee shall remain in force until ----------unless a written claim is lodged on us for payment under this guarantee within six months from the date of expiry of this guarantee . i.e. On or before----------all your rights under this guarantee shall be forfeited and we shall be deemed to have released and discharged from all liabilities there under, irrespective of whether or not the original guarantee is returned to us.

15. We have power to issue this guarantee in your favour under the memorandum and articles of association of the bank and the undersigned has full power to execute this guarantee under the power of Attorney Granted to us by the Bank.

FOR AND ON BEHALF OF

MATERIAL MANAGMENT DIVISION, GROUND FLOOR ADMINISTRATIVE BUILDING, HMBP
HEAVY ENGINEERING CORPORATION LIMITED, DHURWA, RANCHI - 834004
PHONE: 0651 2401278,FAX: 0651 2401166, EMAIL: pksingh@hecltd.com/kishorkradas@hecltd.com

Tender Ref No. HMB/PUR/08/2018/003/OPEN-5686, Dtd 17.05.19

ANNEXURE-'E'

FORMAT OF PERFORMANCE BANK GURANTEE

(TO BE STAMPED IN ACCORDANCE WITH STAMP ACT & TO BE ISSUED BY ANY NATIONALISED /SCHEDULED BANK AUTHORISED BY RBI TO ISSUE A BANK GUARANTEE)

Name of Equipment: ---------- Gurantee NO----------
Purchase Order No.:---------- dated: ---------- Date:----------
Validity ----------
Claim period----------

To:
M/s Heavy Engineering Corporation Ltd.
Heavy Machine Building Plant
Ranchi-834004 Jharkhand

In consideration of your having placed an order bearing Purchase Order No.----------dated:---------- with----------(hereinafter referred to as Supplier) for the supply of----------(hereinafter referred to as the----------

We ---------- do hereby agree with you irrevocably that, should the machinery and equipment fail to give the guarantee performance and achieve the efficiency as stipulated in the Purchase Order within the period of guarantee or should the material and/or workmanship of the machinery and equipment supplied or any part thereof be found defective and/or fully, as per the purchase order, we undertake to pay without any demur merely on demand a sum of Rs. ----------being 10% of the value of Rs. ----------for the supply of ----------

Your decision whether the supplier have made any such defaults and the amount to which you are entitled by reasons thereof shall be conclusive and bind on us, subject to maximum of Rs. ---------- as aforesaid.

We----------further guarantee that the machinery and equipment manufactured and supplied by the supplier shall be new, of good quality materials and of the first class workmanship as specified in the Purchase order and should the machinery and equipment supplied or any part thereof be found defective and that should the defect as pointed out in inspection note be not made good and/or in case of failure within guarantee period same shall be replaced on free of cost or repaired on free of cost to the entire satisfaction of Heavy Engineering Corporation Ltd..
We ----------agree that the guarantee herein contained shall remain in full force and effect till the machinery and equipment give the desired performance and it shall continue to be enforceable till your dues have been fully paid and claims satisfied or discharged subject to a period not later than---------. In the event of any extension granted for commissioning/dispatch suitable extension shall be given on your request.

We----------, further agree that any neglect, omission or forbearance or indulgence in enforcing any claim as per the terms and conditions of your purchase order or performance guarantee or

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any of them or any extension of the time granted for the performance or payment of penalty under the guarantee or any dispute between the supplier and yourselves as regard performance of machinery and equipment supplied or issued related to your Purchase order, shall not effect in any way our liability under this guarantee until the full payment, but in any case, shall not extend beyond----------.

This guarantee is in addition and not substitution for guarantee given to you by the seller or by their bankers on their behalf.

We---------- lastly undertake not to revoke this bank guarantee during its currency except with the previous consent of the corporation in writing.

Notwithstanding anything to contrary stated above, our liability under this guarantee will be restricted to Rs.---------- and shall remain in force up to ----------, unless a demand or claim under this guarantee is made from the date i.e. on or before----------all your rights under the said guarantee shall be forfeited and we shall be released and discharged from all liabilities thereunder.

Dated at ---------- day of ----------

Seal of the Bank

Section [II] - TECHNICAL SPECIFICATION - Enclosed as DAP no 166/18M (1 to 72 Pages)

MATERIAL MANAGMENT DIVISION, GROUND FLOOR ADMINISTRATIVE BUILDING, HMBP
HEAVY ENGINEERING CORPORATION LIMITED, DHURWA, RANCHI - 834004
PHONE: 0651 2401278,FAX: 0651 2401166, EMAIL: pksingh@hecltd.com/kishorkradas@hecltd.com

Work Order No.	Crane Capacity	Qty.
8011.002.150	(40 + 40)T / 32T X 30.5 M	1

01.00 INTENT OF SPECIFICATION

01.01 This tender specification calls for turnkey execution of the crane wise job covering the design, engineering, manufacture, handling, storage and re-conservation at site, supply FOR HMBP stores at Ranchi, transportation from purchaser's store at RSP Rourkela site to crane erection site, erection, testing, commissioning and PAC, PG & FAC of electrics with standard accessories and attachment as covered in this specification and demonstration of performance guarantee parameters of the equipment / system in a coordinated and integrated manner as per the relevant clauses of the specification.

The following are the list of EOT cranes with SLD drg. No. and GA Drg. No.-

Sl. No.	Capacity of Crane	GA Drg. No.	SLD Drg. No.
1.	(40 + 40)T / 32T x 30.5M Duty Class = M8	3339.00.000	3339.91.001

01.02 Electrics for the EOT cranes shall be designed, manufactured, assembled tested, erected and commissioned in accordance with the latest edition of IS: 807 and 4137 as applicable taking due notes of the various requirements laid down in different parts / sections of this specification, relevant IPSS and RSN as applicable. In addition to the latest standards and codes of practices published by ISI for various components and accessories are to be followed. Wherever imported components are utilised, these shall be manufactured in accordance with the relevant standards published in the country where they are manufactured and after allowing for specific aspects under Indian conditions, such as tropicalisation etc.

Reference to relevant RSN should be considered for interchangeability and low inventory of spares.

This specification describes the requirement of electrics for the controls of cranes and the design & engineering shall be complete in all respect and any equipment or facility not covered in this specification but considered essential for proper installation, operation and maintenance of electrics for EOT cranes shall be deemed to be included in the scope of supply and work of the tenderer.

02.00 SCOPE OF WORK & SUPPLY

02.01 The scope of work of the tenderer shall consist **turnkey execution** of the job of design, engineering, manufacture, assembly, shop testing, painting at manufacturer's shop as well as at site after erection, supply FOR HMBP stores at Ranchi, transportation from purchaser's store at RSP Rourkela site to crane erection site, reconservation at site, erection, testing & commissioning and PAC, PG & FAC of Electrics for EOT crane at Rourkela Steel Plant Rourkela, Orissa as per technical parameters indicated in the technical specification & the GA drg.

02.02 The scope of supply covers all electrical equipment commencing from main current collectors on the crane and all other electrical items beyond the main current collectors of the crane i.e. DSL main current collectors, power disconnecting switch (ACB) on bridge platform after main current collectors, protective and control switch

gear, VFD & AFE panel, motors, control and all power and control cables including supports, socket outlets, lighting distribution panel and lighting fixtures with lamps, festoon cable system for crane trolley, master controllers, indicating lamps, push buttons, earthing materials etc.

1 (one) no. of laptop with licensed version of all software is included in the scope of supply. Licensed version of all the required software's, hardware / accessories i.e. cables, connectors etc. for parameterization of drives are included with the crane electrics.

All sundry erection materials including mounting channels , angles and required fastners & cable trays required for installation and connecting up of electrical equipment with cable laying and fixing accessories shall be included in the scope of supply by tenderer. Suitable type of Lugs, Ferules, Cable tie, cleat and other required accessories for installation of electrics including cable laying etc. included in the supply of tenderer.

A broad list of items is furnished at clause no. 02.02.16.

However, any other item though not specifically mentioned but required for proper operation of the system shall deemed to be included in the scope of the tenderer.

The scope of supply shall also include supply of all commissioning spares with minimum quantities as indicated in clause no 03.01 of this T.S.

Supply of electrics for cranes shall consist of the following [Refer Electrical Single Line Diagram (HEC Drg. No. – 3339.91.001) attached]:

02.02.01 Supply of all electrical components and standard accessories required for proper functioning of the crane.

02.02.02 Supply of VFDs for 415V system for all mechanisms for the cranes (as specified in TS).

02.02.03 Supply of 100% redundant AFE convertors with common DC bus configuration along with associated DC Isolators of proper rating.

02.02.04 Supply of suitably sized Jn. Box on Crane girder & main trolley for termination of festoon Cables (as required).

02.02.05 Supply of erection, wiring and earthing material.

02.02.06 The scope of supply shall cover all items including the danger boards, rubber mat, consumables necessary for erection, testing and commissioning of the Electrics for cranes.

02.02.07 Supply of Tools & Tackles as per clause 02.02.21.

02.02.08 Supply of commissioning spares as per clause no. 03.01.

02.02.09 The scope of supply shall cover supply of required quantity of paints for retouching at site, if required.

02.02.10 Supply of drawings and documents as per Clause 07.02 & 07.03.

02.02.11 Training for engineers of RSP at OEM's premises for VFD's (1 man month), RRC system (20 man days) shall be provided.

02.02.12 Supply of accessories as indicated in the TS.

02.02.13 Supply & commissioning of Anti collision devices for crane.

02.02.14 Supply & commissioning of Radio remote control system.

02.02.15 Construction power supply board including supply of cables, tapping power from purchaser's distribution board, maintaining the board & the cables will be in the scope of supply of tenderer.

02.02.16 Scope of supply and service shall cover, but not be limited to, the following items.

i) ITEM CODE: 5533313498

Sl No.	Description	Qty per crane	Remarks
1	Gravity type current collector, rated 1000A, 1.1KV, 18 nos per crane.	1 set	
2	Isolator panel **Dimensional Limitation**: Height = 1800mm, Depth = 800, Width = ---	1 set	
3	Protective panel **Dimensional Limitation**: Height = 1800mm, Depth = 800, Width = ---	1 set	
4	Active front end converter	2 sets	Please refer AFE & VFD list as per clause 02.02.19. All these items from Sl. No. 4 to 9 are located in Electric Panel Cabin(sl. No. 10)
5	Inverter for Main Hoist	2 sets	
6	Standby inverter for Main Hoist	1 set	
7	Inverter for Auxiliary Hoist	1 set	
8	Inverter for Main Cross Travel	1 set	
9	Inverter for Long Travel	2 sets	
10	Electric Panel cabin, Size (Inside dimension): 14000 x 1850 x 2800 mm.	1	Please refer clause 05.02.21
11	Air conditioning system for Electric Panel cabin.	1 Lot	Please refer clause 05.02.21
12	Lighting system and temperature display for Electric Panel Cabin.	1 set	
13	Anti-collision device laser beam type	2 sets	
14	UPS with battery back up	1	
15	Laptop computer with latest hardware configuration complete with licensed version of operating software, drive parameterization softwares, all special cables and connectors etc.	1 set	
16	Arm chair control unit	1	
17	Drive motors	1 lot	Please refer motor list as per clause 02.02.18
18	Hollow shaft Pulse encoder with torque arm	6	
19	Radio remote Control System	1 set	
20	Emergency corner switch	4	
21	Cables for fixed wiring	1 lot	
22	L.T flexible festoon cable for MCT	1 lot	
23	Lighting transformer 415/240V, 1Ph, 50Hz, 7.5KVA.	1	
24	Lighting distribution panel	1	
25	Lighting fittings & cabin fan	1 set	
26	Terminal box on bridge and main trolley (TBBM/TBTM)	2	
27	Junction box with 10 nos. of CATM4 terminal	8	
28	Junction box with 6 nos. of CATM4 terminal	16	
29	Fire extinguisher, CO_2 type, 3.5 kg	5 nos	

30	Mechanical gong bell (temple type)	1 no.	
31	LT movement buzzer	1 no.	
32	Electric bell to be operated from crane gantry	1 no.	
33	Cable Reeling Drum for Tong	1 no.	Refer clause 05.02.22
33	Commissioning spares	1 set	Refer clause 03.01
34	Erection accessories including channels fasteners lugs, glands, rubber mats, slotted angles, cable ties, cable trays earthing material etc.	1 lot	
35	Installation of electrical items, cable laying, termination & commissioning.	1 lot	
36	Tools & Tackles	1 set	Refer clause 02.02.21
37	Switchgears for standby main hoist drive.	1 set	
38	Erection of all electrical equipments	-	
39	Testing & Commissioning of the complete electrical system.	-	Refer responsibility matrix at clause 02.02.17
40	Assistance for proper functioning of electrical system during PAC, PG & FAC of crane.	-	
41	Training for engineers of RSP at OEM's premises for VFD's (1 man month), RRC system (20 man days) shall be provided.	-	-

02.02.17 The following items are free issue items by the purchaser

a) DC Electromagnetic brakes with brake rectifier panels
b) Limit switches
c) Air conditioning equipments for Operator's cabin
d) Lifting magnet
e) Tong & Slew

Responsibility matrix defining the scope of work for the above free issue items is detailed below.

Responsibility matrix for free issue items:					
Sl No	**Equipment**	**Equipment supply**	**Cable Supply**	**Installation**	**Commissioning**
1.	**DC EM Brake**				
	a. Brake	HEC	Tenderer	HEC	Tenderer
	b. Brake Rectifier Panel	HEC	Tenderer	Tenderer	Tenderer
2.	**Limit Switch**	HEC	Tenderer	Tenderer	Tenderer
3.	**Air Conditioning Equipment for Operators cabin**				
	a. A/c Unit	HEC	Tenderer	HEC	HEC
	b. Control Panel	HEC	Tenderer	Tenderer	Assistance By Tenderer
4.	**Lifting Magnet**				
	a. Magnet	HEC	Tenderer	HEC	HEC
	b. Magnet panel	HEC	Tenderer	HEC	Assistance By Tenderer
	c. Cable Reeling Drum	HEC	----	HEC	Assistance By Tenderer
	d. Battery bank and charger	HEC	----	HEC	Assistance By Tenderer
	e. All interconnecting cables including flexible cables in CRD with	----	Tenderer	Tenderer	Assistance By Tenderer

	termination.				

Responsibility matrix for free issue items:					
Sl No	**Equipment**	**Equipment supply**	**Cable Supply**	**Installation**	**Commissioning**
4.	**Tong and Slew**				
	a. Tong & Slew	HEC	HEC	HEC	HEC
	b. Display Unit & controller	HEC	Tenderer (for power and control cables except special / communication cable)	Tenderer	Assistance by Tenderer

02.02.18 **MOTOR LIST**

The mechanical KW, selected frame KW and other details of the motors are as indicated in the table given below. However, the frame KW and the current values need to be checked by the tenderer and confirmed. It may pl. be noted that selection of frame KW and confirmation of these values on the basis of the mechanical KW furnished by us shall be the responsibility of the tenderer and they will have to guarantee the performance of the offered system.

Sl. No.	**1**	**2**	**3**	**5**
Mech.	**MH**	**AH**	**CT**	**LT**
Frame size	355L	315L	315S	280M
RPM (Syn.)	750	750	1000	1000
Duty	S4, 60%	S4, 60%	S4, 60%	S4, 60%
St / hour	300	300	300	300
Mech. KW	118	59	32	26
Frame KW at 40ºC, S1 Duty	200KW	90KW	75KW	55KW
Frame KW at rated ambient and duty	171.13KW	77.01KW	46.11KW	33.81KW
Motor current at rated ambient and duty	329A	147A	96A	71A
Shaft extension	Double tapered	Single tapered	Single tapered	Single tapered
Shaft (dia -16mm) extension for hollow shaft pulse encoder mounting	At NDE	At NDE	At NDE	At NDE
Location of terminal box	On top	On top	On top	On top
Qty of motor per crane	2	1	1	4

02.02.19 **AFE & VFD DRIVE LIST**

Minimum current ratings of AFE & VFDs are given below

Sl. No.	Mechanism	VFD		AFE		Remarks
		Minimum current ratings (heavy duty) at 50°C,	Qty / crane (Sets)	Minimum current ratings (heavy duty) at 50°C, Amps	Qty / crane (Sets)	
1.	MH	494 A	2 + 1 = 3 sets	1414 A	1 + 1 = 2 sets	
2.	AH	221 A	1 set			
3.	CT	144 A	1 set			
5.	LT	213 A	2 sets			

However, selection of the ratings of the VFD's & AFE's on the basis of the **motor rated current at specified ambient and duty** and the technical requirements will be the responsibility of the tenderer. No extra cost will be admissible on account of any increase in size due to the actual motor currents being higher. All VFDs shall be derated at 50°C.

NOTE: - 1. **Motor current values are tentative and shall be checked and confirmed by the bidder.**

2. **Selection of VFD's & AFE's as per the motor rated current at specified ambient and duty & the TS shall be the responsibility of the tenderer. No extra cost will be admissible for any increase in these values.**

3. **Rating of VFD shall be minimum 150% of the motor rated current at specified ambient and duty and all VFDs shall be derated at 50°C.**

4. **Current rating of the AFE at 50°C is sum of current rating of selected inverters at 50°C for two largest mechanism (Main Hoist and Long Travel). For example If the MH current Drive ratings selected (from product catalogue) as 500A and LT current Drive ratings selected as 225A, then minimum rating of AFE shall be 2 x (500 + 225) = 1450 A.**

5. **All the VFD / AFE shall be heavy duty type i.e. suitable for 150% of rated current for 1 minute followed by 100% load in a Duty cycle of 5 minutes.**

02.02.21 **LIST OF TOOLS & TACKLES**

Sl. No.	Description	Qty
1	Digital Multimeter (Fluke make)	1 No.
2	Digital Clamp Meter	1 No.
3	Screw Driver for use in Electrical Panels incl. VFD drives	2 Sets
4	Ramp plate or any other tackle for handling drive modules	3 Nos
5	Wire stripper and cutting pliers	2 Sets
6	Megger 1000V and 500V	1 each
7	Industrial Vacuum Cleaner	1 No.
8	Box Spanner Set	1 No.
9	Torque wrench	1 Set
10	Hydraulic coupling/ bearing puller	1 set

11	Hydraulic lug press and crimping tool	1 set

03.00 Spares

03.01 **Commissioning Spares**

The Contractor shall provide with each crane minimum commissioning spares as listed below required for proper erection and commissioning of the equipment until final acceptance following demonstration of performance guarantee.

However, any additional spares required for successful commissioning of equipment shall be supplied by contactor free of cost.

List of commissioning spares

Sl. No.	Description	Qty
1	Indication lamp with holder	1 no. Of each type
2	Power Contactor	1 no. Of each type
3	Power contactor Contacts	1 set of each type
4	Power contactor coil	1 no of each type
5	Auxiliary contactor	1 no. Of each type
6	Auxiliary contactor coil	1 no. Of each type
7	Push button , control switches and master controller	1 no. Of each type
8	Power fuses	5% of each rating (Minimum 3 numbers)
9	Control fuses	10% of each rating (Minimum 3 numbers)
10	Charging Resistance (if installed)	2 nos of each type
11	Brake coil	1 no. Of each type
12	Drive and cards exterior to drive installed on Crane	1 no. Of each rating/type

04.00 INSTRUCTIONS TO TENDERER

04.01 This specification shall be read in conjunction with other commercial part of the tender.

04.02 This specification covers design, manufacture, fabrication, assembly, shop testing, painting, supply, handling (loading & unloading) of materials & transportation from purchaser's store at RSP Rourkela site to crane erection site, erection, testing and commissioning and PAC, PG & FAC of electrics for Double / four Girders EOT cranes complete with all accessories & attachments as covered in this specification and demonstration of performance guarantee parameters of the equipment / system in a coordinated and integrated manner as per the relevant clauses of the specification.

04.03 Tenders shall be accompanied with the information as required in cl 07.01. Tenders may be rejected if all informations required are not furnished while tendering. The tenderer shall clearly specify any request for deviation from technical specifications in the format enclosed at Annexure 1. Deviation indicated elsewhere other than the enclosed format will not be considered.

04.04 The Tenderer shall submit a time bar chart along with the tender indicating starting and completion dates showing breakup of time required for various activities along with schedule of erection, testing and commissioning of the Electrics for the cranes.

04.05 Drawings as per cl. No. 07.02 shall be submitted in 6 sets for each crane to the Purchaser / his Consultant in stages for approval / reference within one month of issue of Letter of Intent and prior to commencement of manufacturing. The Purchaser / Consultant shall send his comments within 15 days of receipt of the drawings. However, approval of drawings by the Purchaser will not relieve the supplier of his responsibilities for correctness, adequacy of the design and completeness of his work as per the contract.

All the drgs. and documents will be in English Language. Drawings shall be complete in all respect with dimensions, item lists, weights, sub-supplier's name etc. Any minor change during drawing approval stage shall be the responsibility of the tenderer and same shall have to be incorporated without any price implication.

04.06 The supplier shall furnish 6 sets of prints of all drawings per crane as per Cl. No. 07.03.

04.07 If the drawings and other particulars are returned, because they are incomplete or incorrect, the Supplier shall not be given any extension of time on this account.

04.08 The supplier shall furnish adequate nos. of prints of all erection drawings showing the mark numbers with weights of the various items to be assembled at site.

04.09 The following documents shall be supplied prior to commissioning of the crane.

i) Soft copy with hard copy (6 set) of all drawing and data which have been approved by the purchaser/ consultant.

ii) Soft copy along with hard copy (6 set) of erection, testing, commissioning and operating manuals, electrical circuit diagrams, catalogues of all electrical equipments, technical specification, catalogues and technical manuals of all bought out items etc and information on special features.

04.10 The no load test of crane bridge and trolley shall be carried out separately at site in presence of purchaser's representative over load and rated load test of the cranes and hoists shall be carried out at site.

04.11 Construction power shall be provided free of cost at one point within the shop (within 300m) tenderer shall lay necessary cables up to erection site for their requirement.

04.12 The supplier shall submit test certificates for all electrical equipments & cables.

04.13 The following test shall be carried out at manufacturer's premises during inspection.

- High voltage test of panels.
- Integrated panel testing
- Routine test for all motors shall be carried out at motor manufacturer's premises.

04.14 All the electrical equipment shall be of reputed make and proven quality with regard to their performance. The make shall be as per approved list of RSP. However, makes of items not included in the preferred make list shall be

subjected to approval by RSP. **Makes of major components like VFD & motors being considered by the tenderer shall be furnished with the offer.**

04.15 The equipments shall be offered for inspection and testing during different stages of its manufacture, starting from raw materials till completion by the purchaser / his authorized representative at the Supplier's or his sub-supplier's works as per the inspection procedure mutually agreed. Inspection shall be regarded as a check up and shall be in no way binding on the purchaser.

04.16 Documents for all electrical equipment supplied with the crane shall be put up for inspection along with the equipment.

After inspection (**as per Annexure 4**), an endorsement would be made in the inspection certificate about the availability of the documents.

04.17 Ability and Experience of the Tenderer

i) The Tenderer shall satisfy the Purchaser that he possesses necessary technical know-how and facilities to execute the order. Necessary particulars to establish the same shall be furnished along with the tender.

ii) The drive manufacturer must have supplied drives for at least two cranes which are of capacity 40T or more in steel / metallurgical process plants in PSU / Govt. / Public Limited Company. The performance of drives shall be satisfactory for a period of not less than two years during last five years. Documentary evidence of performance shall be attached.

iii) Reference list of similar job executed elsewhere during last five years (client's address, purchase order no., date of placement of order, schedule delivery period vs actual delivery period, annual audited report for last 5 years with literature/ catalogues of previous supply.

iv) A write-up on testing facilities available in the manufacturer's works shall be furnished by the Tenderer.

04.18 Necessary clearance from statutory authorities (if any) shall be obtained before the cranes are put under operation immediately after the cranes are commissioned. The crane after erection shall be tested as follows:

i) Insulation tests and other tests mentioned shall be carried out as per the latest IS: 3177 & IS: 4137 (as applicable).

ii) <u>Speed Tests</u>

a) All motion of the crane shall be tested with rated load at the time of commissioning of the crane at site and the rated speeds shall be attained within the tolerance limit defined under.

The tolerance limit for speeds at full notch with rated load, voltage and frequency:

i) Hoisting / Lowering : +10%, -5%
ii) Traversing : +10%, -5%
iii) Travelling : +10%, -5%

b) All motions of the crane shall be tested with 25% over load in which case the specified speeds need not be attained but the crane shall show itself capable of dealing with the over load without difficulty.

05.00 TECHNICAL SPECIFICATION FOR ELECTRICS OF THE CRANES

05.01 Electrics for the EOT cranes shall be designed, manufactured, assembled tested, erected and commissioned in accordance with the latest edition of IS: 807 and 4137 as applicable taking due notes of the various requirements laid down in different parts / sections of this specification, relevant IPSS and RSN as applicable. In addition to the latest standards and codes of practices published by ISI for various components and accessories are to be followed. Wherever imported components are utilised, these shall be manufactured in accordance with the relevant standards published in the country where they are manufactured and after allowing for specific aspects under Indian conditions, such as tropicalisation etc.

Reference to relevant RSN should be considered for interchangeability and low inventory of spares.

05.02.01 Standards:

The equipment shall be selected, assembled and tested in accordance with relevant international/Indian standard mentioned above.

The equipment shall also conform to the latest Indian Electricity Rules as regards safety, earthing and other essential provisions specified therein for installation of electrical plant.

All equipment shall comply with the statutory requirements of the Government of India and Government of Orissa.

05.02.02 Climatic conditions:

Motor ratings shall be derated for ambient temperature of 55°C. For specific areas and shops, the ambient temperature conditions indicated below shall be taken into consideration and equipment shall be suitably derated accordingly.

Sl. No.	Area	Data
A.	Cranes in SMS	55°C
B.	Electrical rooms	
1.	Electrical panel rooms	35°C

For specific areas and shops, the ambient temperature conditions indicated above shall be taken into consideration and equipment suitably derated where necessary.

The equipment offered shall be suitable for smooth, efficient and trouble free service in the tropical humid climate prevailing at Rourkela and under the ambient temperature conditions indicated above. Wherever required the equipment shall be adequately protected against damage from radiant heat and hot air.

The equipment shall be designed to give efficient and reliable performance and shall be such that the risks of accidental short- circuits due to animals, birds or vermins are obviated.

05.02.03 Power supply and standard voltage levels:

The power at the down shop leads will be available at 415V+10% to -15%, 3–phase, 4–wire, 50 Hz$\pm$6% with 4th wire being the earthed conductor. The

equipment shall be selected accordingly. However, drive system for high capacity production crane shall be selected for voltage operating range of 70% to 110% of declared supply. Also this shall operate satisfactorily in case of a voltage dip upto 30% for duration of 500 ms. Voltage drop within the crane shall be limited to 2%. Voltage dip during starting of largest LT motor shall be limited to 20% at the motor terminals.

The following standard voltages shall be adopted for the cranes:

i) 415 V, 3–phase, 50 Hz, AC – For motors and electro-hydraulic thrustors

ii) 240 V, 1–phase, 50 Hz, AC – For control circuit of cabin operated crane, fan and lighting and indicating lamps

iii) 110 V, 1–phase, 50 Hz, AC – For control circuit of pendant operated crane and indicating lamps

iv) 24 V, 1–phase, 50 Hz, AC – For hand lamp, socket outlet

v) 220 V, DC – For lifting magnets, brakes wherever specified

vi) Hand tools - 240V, 15A, 2 pin plus earth with plug inter-locked switch.

vii) Monitoring and signaling - 24/ 48 V DC in electronic installations, mimic panels.

Three phase symmetrical short circuit rating at 415 V: 50 KA for 1 second

Voltage dip on the starting of large LT motor shall be limited to 20 % of the nominal voltage at the motor terminals.

Total voltage drop on the crane shall be limited to 2% in crane.

The different voltage mentioned above, other than 415 V, 3–phase, 50 Hz shall be obtained through individual transformer and transformer–rectifier units connected to the 415 V, AC supply. Each transformer shall be provided with ±5 per cent tappings for primary voltage variation.

05.02.04 Power distribution on crane:

One adequately rated load break manual isolator (ACB) with locking facility shall be provided immediately after current collectors on incoming line on the crane. The isolator shall be capable of carrying current of two largest mechanisms.

Power from the isolator shall be taken to the air circuit breaker. Tripping device for the ACB to be provided in operator's cabin.

The breaker shall be provided with under voltage, over load and short circuit releases. The breaker shall also be with earth fault protection. The breaker can be closed only when:

- All master controller handles are in neutral position.
- None of the stator or directional contactors are in closed positions

- Emergency corner switches not operated.
- Door/Gate switch are not actuated and gravity limit switch for hoist motion not operated.

Refer Electrical SLD (**HEC Drg. No. – 3339.91.001**)

Power for lighting shall be tapped from the outgoing side of isolator near current collectors. Power for magnet circuit shall be tapped from the outgoing side of isolator near current collectors.

05.02.05 Power supply for CT. motion:

For trolley conductors, flexible cable arrangement with EPR/CSP insulated cable shall be provided. The flexible trailing cable shall be of multi–strand copper conductors with permanent terminations on the bridge and the trolley. The cable shall have at least 1.5 times the girder length and shall be supported by means of properly designed movable clamps which shall be fitted with rollers mounted on bearings and shall run freely on a guide rail allowing relative movement of bridge and trolley without undue stress or wear on the suspended cables. The cables supported on moving trolleys shall be so mounted on the crane bridge that the trolleys are easily accessible for maintenance and convenient for replacement from the bridge platform. The design of cable carrier trolleys should be similar to existing cranes in the bay. The cables shall be protected from heat and flames. Two (2) numbers spare clamps shall be provided on cable trolley for future requirement. The design of clamp shall be as per requirement of Purchaser.

The cable car / moveable cable clamp and posts are not included in the tenderer's scope and shall be supplied and installed by the purchaser. Laying of cables on the same shall be included in the scope of the tenderer.

05.02.06 Main Current Collector

The main current collectors shall be of cast iron gravity type to suit the DSL system to be adopted. The current collector should be similar to those in the existing cranes of the bay. Minimum two collector shoes with adequate current carrying capacity shall be provided for all the three phases and single shoe for the earthed conductor. In the pad six numbers of threaded holes 3 in each side shall be provided for flexible shunt connection. Connections will be done in two and 4 holes are to be kept as spare. There shall be minimum chance of jamming at the hinge point due to accumulation of dust or corrosion. The width of the shoe shall be sufficient to cover the permissible lateral movement of the crane. The shoe shall be so arranged in such a way that while moving the crane at sectionaliser between two sources, paralleling does not take place by creating a small dead zone.

Current collector should be of gravity type not spring loaded as mentioned in T.S. R.S.N 93.11.02.04 may be referred except for the design of the pig tail. Current collectors will be similar to those in existing cranes in R'S bay.

Collector shunts

Current carrying copper braided shunts on all the collectors shall be designed so that there is no danger of contact with adjacent collectors. The shunts shall be easily replaceable.

Mounting

All the collectors shall be mounted on rigid steel staffs and suitably insulated there from. Collectors shall be designed and mounted so that these are readily accessible for maintenance work. Minimum clearance between live parts of adjacent shoes per conductor shall be 100 mm.

05.02.07 Meters:

Ammeter and voltmeter with selector switches shall be provided on the incoming line in protective panel.

05.02.08 Controls

Master controller

Master controller (**5-0-5 notch**) with joystick type lever shall be provided. The joystick shall be of cam operated micro-switch type, with double contact sets per cam, spring return to neutral and dead man features. There shall be tactile feed back of each notch position to the operator. There shall be separate contact sets in each motion. Failure of one contact should still enable operation. For motions like grab closing/holding, master controllers with universal joint (duplex type) shall be offered to facilitate operation.

Each controller shall be provided with 'OFF' position interlock contacts. The operating handle shall be capable of being latched firm in 'OFF' position. The lever shall not remain in between two consecutive notch positions and shall locate exactly and remain positively at each notch unless moved to the other position. The air gap between the fixed and moving contacts of the master controllers shall be maintained to avoid undue sparking between them when the controller is on the other notches. During operation of the mechanisms, the relevant contacts of the operating notches shall be secured with proper pressure to withstand the vibrating service of the crane.

Each controller shall be provided with five notches in each direction and shall bear a permanent marking of the motion controlled and of direction of movement along with the number of the notch indicated over a pointer.

2 nos. of master controller (**1-0-1 notch**) shall be provided – one for magnet and one for tong with slew drive arrangement. The cam sequence of these master controllers shall be given to the successful tenderer.

Duplex type master controller shall be provided for LT and CT motion.

Duplex type master controller shall be provided for Tong with slew.

Control panels

Individual control panels shall be provided for each motion of the crane. The panels shall be fabricated type cubicle made of 1.6 mm thick sheet steel for indoor cranes and 2.5 mm thick sheet metal for outdoor cranes. The panels shall be made complete dust and vermin proof by having rubber gaskets at all joints and openings including the panel doors. The Panels shall be designed as per IS: 13947 (Part–1). Enclosure protection of panels (except VFD Panels) shall be IP: 54 (with double door)

for indoor application & IP: 55 (with double door) with canopy for outdoor application. All power and auxiliary contactors, state of art electronic overload relays with digital display unit, time delay relays etc. shall be housed in the respective cubicles. It is essential that for each mechanism, all the accessories are accommodated in separate cubicles. HRC fuses in the main power circuit are not preferred. For cranes working in hot zones, heat shields of below panels shall be provided. This should be detachable type to facilitate painting of crane girders wherever necessary. All control panels shall be front wired. The components installed on the panels shall have easy accessibility for maintenance and unit replacements when necessary. In case a contactor or any other component is to be removed for replacement, it shall be possible from the front itself, without requiring an approach from the rear.

All panels shall have a lockable type front hinged door and the housing shall be suitably designed to have an easy access for maintenance. The panels shall be front accessible type only.

For control panels comprising of more than one cubicle for each mechanism the doors of each cubicle shall be provided with suitable interlocking switch such that power to the panel is cut–off if any shall be provided for testing the circuit with doors open.

Arrangement of inverter drive, contactors, terminal blocks etc. inside the panels shall be in an approved manner with due consideration to the vibration encountered in the operation of the crane. The terminals shall be so located that chances of flash overs between live terminals are minimized due to falling and accumulation of conducting dust on the terminal blocks. Bottom–most row of devices shall be easily approachable and the same shall be mounted at minimum height of 300 mm from the base of the panel. Screw less control terminal block shall be provided. Power terminals shall be bolted type.

For the power circuits, minimum 25 A and 63 A contactors shall be used for light/medium duty cranes and heavy/ extra–heavy duty cranes respectively. Auxiliary control contactors less than 10 A shall not be used.

Power and control contactors should not be mixed inside the panel.

All contactors shall be provided with two spare NO and two spare NC auxiliary contacts whether auxiliary contacts are used in the circuit or not.

There shall be provision of at least four spare terminals in the terminal block provided. Power and control cables shall be segregated. All the equipment and power/control terminals shall have proper identification labels in accordance with the circuit diagram and the power/control cables shall have white interlocked type ferrules having black engraved numbers for easy identification at the time of replacement and maintenance.

For fabrication of control panel, the electrical clearance in air between all live parts of different polarity and voltage and between live parts and earth shall be minimum 75 mm. However, electrical clearances for standard switchgear e.g. isolators, contactors, overload relays etc.

minimum 25 mm or as per IS/IPSS whichever is more shall be maintained. Spacers can also be provided between the phases.

All plates, springs, washers, bolts etc. used in the panels should be galvanized to take care of corrosion.

Control panels shall be well braced to the crane structure leaving at least 250 mm clearance at the bottom and shall be provided with adequate lifting lugs and anti–vibration pads.

Electric insulating carpet shall be provided in front of all panels and inside operator cabin.

Only one make of devices shall be used for all panels such as isolators, ACBs, MCCBs with positive isolation, MCB, contactors, overload relays, auxiliary relays, actuating devices etc. Where one make devices cannot be used because of reasons beyond the control of panel supplier, necessary test certificate shall be furnished to ensure type "2" co–ordination as per IS: 13947 (Part–4).

Inside each panel, there shall be item designation tags for each item. These shall be placed at a convenient place near irremovable portion of the panel as well as on the body of the item. Equipment designation tags on the fixed portion shall be on Acrylic plate and names shall be embossed. On the item body, the designation tags shall be on printed stickers.

In case of fixed cabin cranes, the electrical panels shall be located within the box girder if possible or on the walkway preferably on drive side. If the control panels are located inside the box girder, open type panels may be provided subject to safety requirements and clearances as per Indian Electricity Rules. The panel room shall be provided with adequate lighting and ventilation arrangement.

The electronic equipment like PLCs, inverter drive shall be housed in well ventilated preferably in air conditioned rooms.

The controls shall be designed in such a way that the crane shall be operated without air conditioning even the panels provided with AC, they should operate in case of AC failure and crane is in operation.

There will be separate panels for each motion in addition to the protective panels and resistance panels.

All panels shall be of free-standing floor-mounting construction, suitable to withstand vibrations encountered on crane. Required support shall be given to eliminate vibration. Hinged doors shall be provided for closed type panels. Panels shall be front wired. Front wired live points of bottom most equipment shall be mounted at least 350 mm above the bottom cover of the panel. Panel shall be fabricated from 2.0 mm thick steel sheet.

Power and control terminals shall be segregated. 10% spare terminals shall be provided in each panel. Cross ferruling shall be done during. Control wiring shall be done with 2.5 mm^2 single core flexible multi strand cable having insulation voltage of minimum 660 volt.

Equipment in the panel shall be so mounted that their removal or replacement from the front is easy. Heavy component shall not be fixed at

height. Suitable Door mounted DPM shall be provided for each mechanism for simultaneous display of 3 phase current of the motors. The DPM and associated equipment shall be designed to withstand the ambient conditions and vibrations.

The panels shall be mounted along the girder facing the hand railing. Sufficient clearances shall be provided between the panels. A minimum clearance shall be provided in front of the panels for walkway and approach as per I.E. Rules. The panels shall be supported in the back from the girder to avoid vibrations.

Control characteristics of different mechanisms

05.02.09 Control features:

All the motions shall be provided with VFD control using Squirrel Cage Induction Motor. All controls shall be operated through master controller.

For long travel drives, the electrical control shall be grouped for the individual pair of motors separately in case of four motor drive and each pair of motors shall be able to drive the crane at reduced acceleration and speed.

As an anti-skewing measure, out of a pair of motors for LT., if one drive motor trips, the other drive motor shall also be switched off.

Brakes shall not be used for speed control.

Closed loop regulation suitable for the system with various feedback such as speed, current etc. shall be provided.

Speed feedback shall be provided for each motor through pulse tacho mounted on the non driving end of the motor shaft. All the pulse tacho output shall be directly hardwired to the respective VFD terminals directly.

The regulation shall include ramp generators, potentiometers for various setting, various regulators, signal conditioners, logic command module sequence, module, trigger module, zero and over speed monitor, torque less protection module etc. as per the requirements. The control and regulation equipment shall be able to maintain their rated performance and control quality even under conditions of variation of +10% and - 15% in voltage and ±6% in frequency. A zero current sensing device shall be incorporated. The reversing of motor direction shall be done at zero current. Braking down to zero speed shall be electrical with mechanical brake setting only at zero speed. Protective features like anti-drop etc. shall be incorporated to prevent load sinking. The circuitry shall also provide for the protection against failure of motor torque such that the mechanical brake sets in such cases. All other features of conventional crane controls shall also be built into the scheme. The following shall also be provided on the A.C. side.

- Surge suppressor
- Over current protection
- Overload protection
- Under voltage protection
- Single phase protection
- Phase sequence protection
- Ammeter and voltmeter with selector switches
- Isolating switches

Control and auxiliary supply shall be provided with separate transformer and under voltage protection.

Hoists

The controls shall be designed in such a way that the crane shall be operated without air conditioning, they should operate in case of A/C failure also.

For hoist motions, controlled lowering shall be achieved by means of electrical braking system without the application of mechanical brake. For hoist motion, relatively flat speed control shall be provided. Hoist control shall be so designed that the hoist brake resets positively whenever motor power fails due to any reason.

The controls shall have basic inherent protective features as follows:

a) Sequence of operation, interlocking, alarm and annunciation shall be carried out through micro PLC or micro controller with the provision of hand held programming unit.

b) The hoist control system shall be fully protected against mal–operation due to erratic movement of the master controller from one extreme position to the other extreme position.

The specific speed requirements at different notches of master controllers both during hoisting and lowering are indicated in the Technical Specification. The tenderer shall offer the correct type of controls accordingly to suit the service requirements.

Variable voltage and variable frequency converter for vector controlled hoists

VFD control shall be provided for all the mechanism of all the cranes. Control shall be achieved through master controllers for each direction. Rated and creep speeds are to be provided in each direction i.e., hoisting and lowering. Creep speed shall be 10% or lower as per operational requirements of rated speed.

VFDs and AFEs shall be rated for 50 deg. Ambient.

Hard wiring shall be used from Master controller in Operators's Cabin to respective VFD panels.

VFD shall be fully controlled and suitable for four quadrant operation (Operating on a common DC bus having **100% redundant** Active Front End converters(active front end type)) & with regenerative braking feature.

All Squirrel cage motor with VFD application shall be designed specifically for this type of application with emphasis on insulation class. Motor insulation shall be Class-H with temperature rise limited to class-F with VFD application.

Fault annunciation panel shall be provided in the operators' cabin.

The cables for the VFD and associated equipment shall be laid and clamped separately on the crane.

Heavy duty Rating of the VFD shall be minimum 150% of the motor name plate current at specified ambient and duty.

For main hoist application, one cold stand by pre-wired inverter with changeover isolator/contactor shall be provided. In case contactor is used, switching at zero current to be ensured. **One Standby VFD** drive **(AFE type)** with regenerative features shall be provided for hoist motion of the crane so that if one VFD fails, another VFD could be selected manually by means of selector switch. Indication lamp shall be provided for the same at operator's desk to enable the operator to understand the failure of one drive.

The common DC bus shall have 02 incomers. All the incomers shall be double pole DC switch disconnector. The double pole DC switch disconnector shall be suitable for minimum 1000V DC.

Isolators between common DC bus and individual inverters shall be provided.

The current rating of AFE shall be selected on the basis of current rating of invertors of two largest mechanisms of crane.

Rating of the incoming circuit breaker shall be 150% of the rated current of the AFE.

To take care of the under voltage in the incoming power supply system of the crane for more than the set time in under voltage relay due to the motor regeneration and motoring mode, a UPS of proper rating shall be provided for the power supply of the AFE control section to avoid control voltage power outage resulting in dropping of all the contactors/breakers.

Closed–loop speed control of AC motor shall be provided with speed reference signal given by the master switch and feed–back signal by the pulse tacho–generator coupled to the main & auxiliary hoist drives.

For cranes the hoist motion shall be provided with VVVF drive with vector controlled squirrel cage motor**.** Considering accuracy of movement and safety in line with the requirements stipulated in the Technical Specification**,** control shall be provided with closed loop vector**.**

i) The voltage source DC link frequency converters shall be provided where the speed of AC motor is required to be adjusted step or sleeplessly from approximately zero to maximum speed**.**

ii) The unit shall be of pulse with modulation (PWM) type with the open loop frequency control to keep the ratio of voltage to frequency (v/f) constant throughout the speed range to maintain constant motor torque or vector control for closed loop with or without encoder (incremental encoder) feedback**.** Provision of sensor less vector shall be kept in the drive software, in case encoder fails.

iii) The unit shall comprise incoming ACB/MCCB with positive isolation contactor, line choke, suitable filter unit and IGBT based inverter.

iv) The PWM inverter shall have fully digital microprocessor based regulation and control system as well as field level instrument and signals as applicable**.** The microprocessor shall carry out all the functions required from the unit including triggering, protection, self-diagnostics and operation interface. Display of faults, alarms as well as diagnostic messages will be available in plain text on the operator panel**.**

v) The unit shall be housed in enclosed, self-supporting floor mounted dust and vermin proof cubicle and suitable for temperature, vibration etc prevailing in the crane. Suitable built-in air-conditioner shall be provided for drive panels.

vi) The controls shall have the following basic features:

a) Speed range control: stepless speed variation and 1: 100 speed variation.

b) Static steady state speed accuracy shall be with ±0.5%.

c) Status and fault indication shall be through LED.

d) Dynamic braking with chopper control shall be provided. External chopper is preferred to built-in type to minimize down time during maintenance.

e) Suitable master controller shall be provided.

The cranes will be provided with E rooms. The E room will be double walled type and with thermal insulation. It will be dust and vermin proof. E-room temp will be maintained at 35 deg centigrade (max). All VFD Panels and electrical panels (except Magnet, Brake and PP. Panel) will be housed in E-room with 100% redundant E-Room ACs (1Working +1 Standby). Temperature sensors will be provided in the e rooms & indication of temp will be provided in the operator's cabin.

For the control of double drum grab/tong hoist, duplex master controller in one housing with single operating lever shall be used. Proper interlocks shall be incorporated in the circuit so that holding and closing motors work in correct sequence.

Hoist control circuit shall also be provided with anti-drop feature i.e., whenever the master controller is brought back to zero position from higher notches in both directions, the motor shall automatically be connected to hoisting direction for some time (time adjustable through timers or through drive software) to avoid the downward drift of the load. Brakes shall be clamped in zero position of the master controller.

05.02.10 Variable Voltage Variable Frequency (VVVF) Drive:

1)	Construction features	- Floor mounted, free standing mounted on fabricated stool (300 mm minimum) for cable termination with vibration pads.
		- Dust and vermin proof
		- Sheet steel clad
		- Minimum 2.5 mm thick for panels.
		- Minimum 2.0 mm thick for doors and side covers
		- Suitable to withstand vibrations to be encountered in steel plant crane application.
		- Cubicles with illumination lamps, door switches, space heaters and adequate sockets for power supply to CRO, laptops & soldering.
		- All control blocks plug–in-type with necessary test sockets.
		- Units shall be self contained and serviceable.

2)	Enclosure and ventilation	- Enclosure conforming to IP-42 or better with weather proof enclosures.
		- Units shall be provided with cooling fans and louvers at the bottom sides.
		- All louvers shall have fine mesh behind them. Ventilation through individual ventilation ducts, from bottom not acceptable.
3)	Basic design particulars	- Digital control technology with vector control (with / without PG). - IGBT based with sine coded PWM control. - Active front end type for 4 quadrant operation - Industrial and continuous duty.
4)	Overload capacity	- 150% of the rated current for 1 minute following 100% load in a duty cycle of 5 minute. - 200 % for 3 sec.
5)	Efficiency	- More than 96% at full speed and full load
6)	Input power supply	- 415 V AC + 10% to – 15%. - 50 Hz + / - 6 %. - 3 phase, 4 wire neutral earthed system.
7)	Regulated power supply for reference setting	- Voltage variation of (+/-) 0.1 % with an input variation of +10% - 15%. - Steady state regulation of (+/-) 0.25% guaranteed against 100 to 200% load disturbance and + 6%, -6% input supply frequency variation.
8)	Input reference voltage	- 10 V DC to O V to + 10 V DC / 0 - 10 V DC / 4 mA to 20 mA.
9)	Output frequency	0.5 - 400 Hz.
10)	Output frequency resolution	0.01 Hz.
11)	Starting torque	- 150 % / 1 Hz. (without PG)
		- 150 % / 0 RPM (with PG)
12)	Torque accuracy	- + / - 5 %
13)	Speed control accuracy	- + / - 0.02 %
14)	Ramp rate	- Linear acceleration and deceleration adjustable independently from 0 to 999.9 seconds.
15)	Vibrations	- Suitable to withstand vibrations more than 0.5g.
16)	Main power components in incoming AC side	- ACB/MCCB with 50 KA rating
		- Line reactor for harmonic and noise suppression
		- AC line surge suppression network.
		- Input contactor.
		- EMC compatibility
17)	Main power components in incoming DC side	Isolator and DC fuse between common DC bus and VFD.
18)	Converter –Inverter Equipment	- Diode Bridge / IGBT bridge for AC/DC.
		- DC link circuit with reactor / capacitor
		- IGBT bridge for Inverter for DC / AC.
		- Harmonic transformer.

		- Separate redundant AFE
19)	Load side components	- Filter network
		- Thermal Over-load relay for each motor.
		- Output contactor in output side.
		- Output reactor / terminator.
20)	Diode Bridge	Minimum ratings of Diode cells. PIV rating : 2.5 times the peak value of line voltage dv/dt rating: 200V/microsecond for voltage control and 1000V / microsecond for inverter control di/dt rating : 100A / microsecond.
21)	Protective features	- AC line surge suppression network and overvoltage protection.
		- Under voltage in supply network
		- Phase sequence protection and monitoring
		- Under voltage in DC bus
		- Over voltage in DC bus
		- Over speed monitor
		- Over load
		- Earth fault
		- Instantaneous over current
		- Transformer fault if applicable
		- Cooling fan failure – Stall monitor for motor alarms.
22)	Annunciations	- Following faults shall be annunciated in keypad of the drive / HMI.
		- AC line surge suppression network and Overvoltage protection.
		- Under voltage in supply network
		- Phase sequence protection and monitoring
		- Under voltage in DC bus
		- Over voltage in DC bus
		- Over speed monitor
		- Over load
		- Earth fault
		- Instantaneous over current
		- Transformer fault
		- Cooling fan failure
		- Stall monitor for motor alarms.
		- Motor fault (winding / bearing temperature, vibration) as applicable
		- Loss of frequency command
		- Shall be able to store at least 16 previous faults in memory on FIFO sequence.
23)	Meters	Suitable door mounted DPM shall be provided for each mechanism for display of motor current.
24)	Selector switches	- Local / Remote.
		- Auto / Manual.
		- Main / Bypass.
25)	Pushbuttons	- Trip reset.

		- Emergency stop.
26)	Lamps	- Drive ready.
		- Drive trip.
		- R, Y, B phase power ON.
		- Control supply ON.
27)	Regulation & control Facilities	- Reference speed setter
		- Ramp generator
		- Speed feed back
		- Current feed back
		- Trigger module
		- Pulse transformers
		- Logic control module
		- Sequence module
		- PID control
		- Zero speed / over speed monitor as applicable
		- Momentary power loss restart.
		- Auto tuning.
		- Current limiter
		- Counter current / regenerative braking unit as applicable
		- Active electronic components used shall be of industrial grade hermetically sealed.
		- Output signals for fault alarm, frequency arrival, running signal.
28)	Operator panel	HMI shall be drive mounted and shall be located inside the panel.
29)	Membrane keypad	- The keypad shall be logically designed for two operating areas with required number of keys.
		- Local operator control like
		- Local start /stop
		- Jog forward / reverse
		- Programming
		- All PIN/Passwords required to use advance programming features of the drives shall be provided.
30)	LCD display	Display shall be black lighted, enabling viewing in extremes of lighting conditions. Display shall be in alphanumeric (in English only) 16 characters, 2 lines. All the last 16 faults stored in memory (in FIFO sequence) shall be displayed by scrolling.

VVVF drives and switchgear shall be supplied and commissioned by OEM of the drives.

05.02.11 Anti-collision Device

Anti-collision System shall be provided In cranes where two or more cranes are operating in the same bay (at same or different level). All Cranes wherever specified shall be provided with suitable Anti- collision system. Anti-collision device shall be electronic type. Anti collision systems shall be

Contact less infra red based distance measurement with programmable accuracy of +/- 100 mm.

There should be two steps in Anti-collision system – Slow down & stop.

After few seconds, it shall be possible to run the cranes towards each other (or only one crane can move towards the other) till buffers of the cranes meet by providing “by pass’ in the operators cabin.

The features of the Anti-collision system shall be as follows:

i) When 2 cranes in a bay come closer within the range of 6 – 8 meter gap, the LT speed will automatically slow down with Electrical braking to 10% speed for drives and with 1st notch speed for conventional control in LT motion with audio -visual alarm and further when the gap within 2 meter, it will generate a stop command and crane will stop with Electrical & Mechanical braking.

ii) If the crane is required to move beyond 2 meters for process requirement, one bypass switch should be provided along with 10% speed only and with audio alarm.

iii) Transmitter/Receiver Unit should be of high penetration features in order to take care of dust deposition on the reflector.

v) Standard value of slow down is 6 - 8 meter and stop signal is 2 meter from end buffer.

vi) Canopy to be used on the top of reflector for less dust accumulation.

05.02.12 Circuit Protection

05.02.12.1 One main metal clad triple–pole MCCB shall be provided preferably in operator’s cabin/ close to the operator’s Cabin. This ACB/MCCB load break isolator shall be in addition to the circuit–breaker provided in the protective panel.

The breaker shall be provided with shunt trip, over load and short circuit releases and with earth fault protection. The breaker can be closed only when:

i) None of the directional contactors are in closed positions.
ii) Emergency corner switches not operated.
iii) Door/Gate switch are not actuated and gravity limit switch for hoist motion not operated.
iv) Master controller handles are in neutral position.

Power for lighting and magnet circuits shall be tapped from the incoming side of isolators near current collectors.

The following shall also be provided on the power incoming AC side.

i) Surge suppressor
ii) Single phase protection
iii) Phase sequence protection
iv) Ammeter and voltmeter with selector switches

On moving cabin cranes**,** an additional main metal clad isolating switch shall be provided on the cab structure in an accessible position outside

the crane cab and connected directly to terminal box provided for trailing cable.

Each motor shall have a separate MCCB in the power circuit.

05.02.12.2 Two emergency corner switches in a totally enclosed metal cover with an operating lever outside shall be provided at four corner of the bridge to cut–off the power supply under emergency conditions by tripping the main circuit–breaker over these isolators. The degree of protection of enclosure of switches shall be IP:54 as per IS:2147.

05.02.12.3 Control and auxiliary supply shall be provided with separate transformer and under voltage protection.

05.02.12.4 Power distribution on cranes

One adequately rated load break manual isolator with locking facility shall be provided immediately after current collectors on incoming line on the crane. This Isolator shall feed the power to the Circuit breaker.

05.02.12.5 Circuit breaker panel & distribution panel

The circuit-breaker panel consisting of air circuit-breaker with shunt (magnets) instantaneous and bi-metal protection complete with associated devices shall be located near the crane operator's cabin and consist of following:
Distribution panel shall comprise of two (2) sections, one for power and the other for control and with bus bars of adequate rating. Individual outgoing feeders shall have copper links/fuses.

The panels shall be provided with all necessary devices including the following:

Triple–pole air–circuit breaker complete with over current, short–circuit and earth fault releases and shall have a minimum short–circuit capacity of 50 kA for 1 sec. However, for current rating upto 800 A, moulded case circuit–breakers with earth fault protection and magnetic over current release in combination with main line contactor can be used instead of air circuit breaker. The rating of the magnetic over current relays shall be adjustable and shall have a minimum rating equal to 2.5 times the rated full load current of two largest motors. The circuit breaker shall be manually operated, with the handle protruding out of the panel. The ACB must be designed for operation in a vibrating service and the supplier shall guarantee that the mechanism is specially designed for trouble–free operation on heavy duty cranes. One shunt release shall also be incorporated in the breaker.

ACB should have shunt trip coil, it should close, when –

- All master controller handles are in neutral position.
- None of the stator or directional contactors are in closed positions.
- Emergency corner switches not operated.
- Door/Gate switch are not actuated and gravity limit switch for hoist motion not operated. Power for lighting and magnet circuits shall be tapped from the incoming side of isolators near current collectors.

Microprocessor based digital EMPR with LCD display features shall be

considered in place of Thermal O/L / other EMPR relays, wherever used.

Two MCCB with positive isolation for primary power supply to the control transformer.

Duplicate control transformer in parallel connection shall be provided with ±5 per cent taps on the primary side. The control transformer capacity shall be so selected that voltage drop due to simultaneous closing of the magnetic contactors of multiple drives shall be maintained to the minimum. The anticipated voltage drop on the basis of which the control transformer is selected shall be indicated.

Control of crane should be separate. All the features i.e master controller "0" position, contactor drop out condition, emergency switch etc. should be incorporated in control of crane.
One multiple contact auxiliary contactor shall be provided for feeding control supply to the different motor control panels.

Double pole MCB shall be provided in each control circuit in series with the contact of the auxiliary contactor specified above for control circuit protection to the individual motor panels.

One pilot cluster LED type indicating lamp on the panel door to indicate the availability of power at the protective panel. The pilot lamps shall have grip type fuses.

One double–pole MCB feeder of adequate rating for feeding lighting transformer for crane lighting.

One heavy duty enclosed type emergency switch connected in series with the coil of the auxiliary contactor specified above. This switch shall have a positive make and break contact, operated over an operating handle.

Industrial grade online UPS of suitable rating shall be provided for power supply to PLC (wherever provided) and VFD modules.

05.02.12.6 Individual control panels

Each motor drive shall have master switch operated control panels having all necessary devices including the following:

Long travel drive

One – Triple pole load break heavy duty MCCB with positive isolation.

One – Triple pole MCCB/MPCB with positive isolation for each motor of LT drive.

One – Double pole quick break control MCB of adequate rating.

Cross travel drive

The equipment for the cross travel control shall generally be similar to those specified above for the long travel drive.

Hoist drive

The equipment shall generally be as described above with the additional requirements as specified under clause 05.02.09.

05.02.12.7 Crane lighting system

The crane lighting system shall consist of the following:

a) One 415/240 V lighting transformer which shall be designed for a minimum continuous rating of 7.5kVA. This transformer shall be separately mounted outside the operator's cabin, if adequate space is not available. The secondary of the lighting transformer shall be earthed at one end.

b) One metal clad lighting distribution board with one incoming double–pole MCCB and double pole outgoing MCBs for controlling 400W under slung sodium vapor light fillings.

c) The number of floodlights depends on the span of the crane and these will be arranged on a wide crane girder or a walkway platform. One floodlight will be arranged 3 m from one side of the girder and from other side of the girder and from then on every 5–7 m.

400W under slung lighting fittings with dispersive RLM reflector complete with lamps and provided with shock absorbing and anti–swing suspension device.

The maintenance of these fittings shall be from the Walkway only. All lights (including under bridge lights) to be used in crane should be of LED type.

d) 4 Nos. cluster LED type red warning lights shall be installed at the four corners of the crane to indicate that the crane is down undergoing repairs.

e) Four(4) nos. of 24 V two–pole and earth metal–clad plug and sockets, one in the crane cabin and the rest distributed on the crane bridge for taking power to portable hand lamps and tools. Four (4) numbers power socket outlets (3 Pin, 20A, 240V) shall be provided along with socket & switches shall be interlocked suitably. All plugs and sockets shall conform to universal standards IEC60309.2.

Necessary 415/24 V control transformer of 1.0 kVA shall be considered for this purpose.

05.02.13 Switchgears:

Each drive motor shall be provided with MCCB with suitable rating, line contactors on incoming sides.

MCB shall be provided in the control circuit of each motion. Each brake circuit shall be provided with a suitable contactor. Electronic motor protection relays shall be provided where ever necessary.

MCCB shall be designed at 415 VAC and of minimum short circuit capacity of 50KA.

Rating of contactor selected (AC3 duty minimum) for any mechanism shall be at least 50% higher than the respective motor full load current for the mechanism at specified duty cycle. The minimum thermal current rating of the contactor used shall be 32A and the life of each contactor shall not be less than 10,000 hrs. of operation.

Current rating of the circuit breaker shall be as per requirement. All the circuit breakers shall operate at ambient temperature mentioned in TS. Temperature derating (above the designed temperature of 40 deg. C) shall be considered as per IS / IEC while selecting the circuit breaker.

05.02.14 Motors

General

The motors shall be totally enclosed fan cooled type, squirrel cage induction motors with antifriction bearings. The motors shall be designed for heavy duty reversible crane service and shall be in standard IEC frame sizes with integral foot mounting and taper shaft with extension on both sides, if required. The degree of protection of motors used shall be minimum IP:55. For outdoor cranes, only weather–proof motors shall be used. Suitable canopies for the same shall be provided. All the motors of all the motions should be of VFD Grade with thermister connections.

Duty Cycle

All the motors offered shall be suitable for heavy duty reversible crane service having duty cycle rating not less than 60% ED, unless otherwise specified in the Technical Specification.

Motor rating

The motor rating for all classes of cranes shall be computed as per applicable standards such that they meet the duty cycle requirements specified. Standardisation of motor are to be maintained as far as possible. Motors are to be designed for ambient temp of 55 degree centigrade. The ambient temperature deration shall be considered while selecting hoist and travel motors. Selection of motors shall be done as per latest edition of IS: 4137. Minimum numbers of start per hour to be considered for the selection of motor for light duty/medium duty and heavy duty/extra heavy duty cranes shall be 150 and 300 respectively unless otherwise stipulated in the applicable IS standard and relevant Technical Specification. Enclosure protection of motors shall be IP: 55 for indoor application and IP: 55 (with canopy) for outdoor application. Unless otherwise specified, the following acceleration shall be considered for selecting the motors for cross and long travel motions:

Duty Class of Crane		*Acceleration* LT cm/sec^2	CT cm/sec^2
Light duty	..	15	10
Medium duty	..	20	10
Heavy duty	..	25	15
Extra heavy duty	..	30	20

All motor bearings shall have greasing facility outside the motor through appropriate greasing nipple. Terminal boxes shall be located on the top with gland facility for using copper cables.

Following conditions shall be taken into consideration while selecting motor kW rating for long travel and cross travel motions of outdoor duty crane:

a) Laden crane shall be able to accelerate against wind pressure of 8 kg/m^2 and continue to work against an operating wind pressure of 25 kg/m^2.

b) Unladen and laden crane shall be capable of being braked without skidding when wind pressure of 25 kg/m^2 is aiding the motion.

c) Acceleration of crane should not exceed to cause skidding of the crane when wind pressure of 25 kg/m^2 is aiding the motion.

Calculation on the selection of motor ratings for crane shall be submitted along with wheel skidding calculation.

Torque

The pullout torque of the motors at rated voltage and frequency shall be within 225% to 275% range of the rated torque.

Class of insulation

Class of insulation shall be 'H' with temperature rise limited to that of 'F'. Motors must be suitable for inverter duty application.

Proper derating shall be provided, where specified, for motors operating in higher ambient temperature and also for inverter controls application.

Speed selection

Synchronous speed of motors shall be limited to a maximum of 1000 rpm. The selection of motor speeds shall be generally as follows:

Hoist	- 750 rpm
Long travel	- 750/1000 rpm
Cross travel	- 750/1000 rpm
Slew	- 750/1000 rpm

All motors shall be selected for a safe running speed of at least two times the synchronous speed.

Other features

All motors shall be provided with top terminal box and shall be suitable for 360 degree rotation in horizontal plane. The terminal boxes shall be properly insulated and of adequate size for terminating copper conductor cables. The terminals shall be easily accessible when the motor is installed on the crane trolley.

Brakes shall preferably be mounted on the input pinion shaft of the drive gear box.

Greasing outlet facility with provision of collection of grease shall be provided for motors above 250 frame size.

Motors shall be provided with suitably embedded thermisters / resistance temperature detector for protection of windings for main hoist and auxiliary hoist motion of ladle cranes only.

Motors shall be suitable for inverter duty and shall be selected as per recommendation of drive supplier.

Maximum permissible operating speed shall be 250% of synchronous speed or 2000 rpm whichever is less. Over load capacity 150% of full load current for 2 minutes without damage or permanent deformation from zero to base speed.

Motors will be provided with insulated bearings on NDE side for 280M & above frame size to reduce shaft current.

Motor shall be suitable for peak transient voltage 1600V and rise time 0.1 microsecond.

The encoder couplings shall have capacity to tolerate Axial, Radial and Transverse displacements.

05.02.15 Equipment in operator's cabin

a) **Cabin Operated Cranes**

The operator's cabin shall contain the following:

- Master controllers for all the motions, magnet **and tong**
- Emergency stop push button.
- Foot switch for alarm or bell.
- Switches for all lighting equipment on crane.
- Switches for air conditioner, exhaust fan and for cabin fan.
- A fire extinguisher.
- Insulating mat and operator's chair.
- Cabin light switch.
- Selector switch for ACU / Radio remote control.
- By pass switch for anti collision.
- Main emergency mushroom head push button.
- Selector switch for emergency operation of individual mechanism.
- Temperature display of electrical panel cabin.
- Mechanical gong bell with manila wire rope

There will be one electric bell in the operator cabin for the information of operator when someone wants to board on the crane. 2 nos. of push switches to be provided in each gantry side of the crane to operate the bell near the crane boarding position / safety switches.

The operator seat shall be provided with limited vertical, backward and forward adjustments which can be locked in any position but not swivel relative to controls.

Annunciation panel with indication lamps for power 'ON', control 'ON', emergency corner switch operated, ammeter and voltmeter with selector switches.

Operator desk shall be revolving type comprising of left/right console, master controllers, indication lamps, illuminated type push-button (PB), selector switches etc.

i LED type indication lamp for Control ON, OFF, Drive Healthy, trip (separate for each drive), bridge corner switch operated, limit switch operated, tong/magnet operation, hoist overspeed (as applicable) etc. Red color blinking indication lamp shall be provided for limit switch bypass indication.

ii Start, stop & emergency stop (red-mush room headed) push buttons, limit switch by pass pushbutton, push buttons for tong operation (if applicable), selector switches (wherever applicable), foot switch for hooter etc. All push buttons shall be illuminated type.

All the operator cabins shall be fitted with proper fans and ventilation system. Suitable provision shall be provided in the operator cabin for clear visibility of the signals given by the floor staff from all corners.

b) **Radio Remote Control**

Radio remote control shall be provided for all the cranes in addition to operator cabin.

In this mode of control system, all the motions e.g Hoist, Cross Travel, Long Travel and Magnet & Tong shall be controlled through joy sticks. Spare joy sticks shall also be provided.

Local / Remote selection shall be provided only on the crane cabin control desk for enabling operation of the crane either from the Cabin or Radio remote control.

In the case of signal failure, all motion shall come to a safe stop.

The radio remote control shall be provided with the facilility to operate similar to master control station in cabin. It is preferable to provide radio remote control in license free frequency bend. Frequency allotment for RRC shall be obtained by supplier from government authorities, if required.

The crane will be with radio remote control (preferred make: **Lotus Wireless /SNT Controls**) with independent 2-0-2 joysticks (4 numbers for 4 motions), 2 numbers 1-0-1 joysticks for tong and slew) and on-off push buttons for magnet and Protective Panels and Emergency stop push button. RRC will consist of 2 rechargeable batteries with 2 charging units.

Transmitter

Transmitter shall have following features:-

- Constructed with sophisticated microprocessor technology and surface mounted electronics.
- Transmission type: - FM FSK
- Transmission speed: - 9.6 Kbps.
- Built in self test for all functions.
- Transmitter shall consist of switching breaker, dial switch and push buttons.
- Switching breaker shall be non locking to zero position or maintained function.
- Indications:
  Operation status
  Battery status
  Indicators that display information from crane.
- PIN -code (Personal Identification Number)
- Internal antenna.
- Rechargeable battery.
- Battery 7.2 V NiCd
- Operating time: - About 8 hours.
- Different operating frequencies (minimum 16 nos.)
- Two hand upstart.
- Stop push button.
- Operating conditions: - Areas having large temperature variations, dusty, more vibrations, oil and humidity.
- Operating temperature range: - Min. 10 deg.C to Max. 55 deg.C
- Protection class: IP - 54.
- Casing material: Polycarbonate / ABS plastic.

Receiver

Receiver shall have following features:-

- Upto 20 functions exclusive safety relays (for transmitting preset reference values to VFD in the crane).
- 2 safety relays (for control of main contactor)
- Power supply suitable for 240 V AC, 6 A.
- Minimum 16 different operating frequencies.
- Two redundant microprocessors for monitoring each others.
- Cyclically redundancy checks for high security of transmitted radio messages.
- Frequency scanning in the receiver.

- Memories last 10 users.
- Interlocking of the relays.
- Momentary or latched relay functions.
- Two hand up start (to avoid unintentional start).
- Protection class: IP - 65.
- Casing material: Aluminium profile for fast mounting on DIN rail
- Operating temperature range: Min. 10 Deg.C to Max. 55 Deg.C

05.02.16 Enclosure Class

a) For indoor operations

-	Motors	:	IP: 55
-	All other electric equipment	:	IP: 54
-	VFD & AFE panels	:	IP: 42 or better enclosure

05.02.17 Cabling

All wiring for power, control, lighting etc. shall be carried out with 1.1 kV grade conforming to relevant IS/International standards. Power cables shall be minimum 4 sq mm copper and control cables shall be minimum 2.5 sq mm copper. Cable cores shall be of stranded construction. For instrumentation/PLC cables lower size Cu conductors (1 or 1.5 Sum.) are permitted only at Purchaser's discretion and prior approval.

i) Power cables within the crane shall be 1.1kV grade, XLPE insulated, PVC sheathed armored Cu conductor conforming to IS: 7098 (Part-I).

ii) Control cables shall be 1.1kV grade, PVC insulated, PVC sheathed armored Cu conductor conforming to IS: 1554(Part-I).

iii) Flexible cable shall be 1.1kV grade, EPR insulated, PCP/CSP sheathed Cu conductor conforming to IS: 9968.

Cables for cranes working in abnormally high ambient temperature such as in steel melting shop, and billets/bloom yards etc. shall be provided with special insulation so that cable conductor temperature up to 85 to 90°C is permitted. This will result in overall economy as regards cable requirement as well space apart from better life expectancy for the cables themselves. Cables exposed to direct heat radiation shall be HR type and shall be provided with heat resistant shields.

Cable selection and routing on the crane shall form part of the crane design. Cable troughs shall not be routed behind the panels as far as possible. Terminal connectors used shall be got approved by the Purchaser. Cable selection shall take into consideration the ambient temperature specified, grouping factor, duty factor of the drive and the voltage drop on the crane which shall not exceed 3% with the largest drive motor starting and the second largest running. Conduits and conduit fittings if used on cranes for running cables shall be of standard design and shall be supplied with complete accessories. Each motor shall be wired through separate conduits. Only 50% of the conduit inside space shall be occupied by the cables.

All cables remaining live in open position of the isolator shall be installed separately. Cables carrying AC and DC power of different voltages shall be laid in different conduits. Power and control cables shall be laid separately and terminated in separate terminal boxes.

Use of un-armored cables other that flexible cables on the crane can be permitted only at Purchaser's discretion and prior approval. In case use of un-armored cables is agreed, the cables shall be laid in sheet metal trucking on the bridge and through conduits on the trolley.

Cabling shall be strictly conform to relevant IPSS.

For motors 75 kW and above a separate junction box shall be provided near motor. From bus bar of junction boxes the motors are to be connected through flexible copper cables.

All control cable laid to the panel should have at least 20% extra core for future requirement.

05.02.18 Earthing

The crane structure, motor frames and metal frames of all electrical equipment including metal conduits, cable trays etc. shall be effectively connected to the earth by independent earthing strips to conform to the requirements of the Indian Electricity Rules. Equipment fed by flexible cables shall be earthed by means of spare core provided with the flexible cable. Ultimately the earthing of the crane shall be effected through the 4th collector of the downshop leads provided in the bay. Additionally one (1) no. collector shall also be provided for earthing through crane rails.

05.02.19 Fire Extinguishers

A carbon dioxide dry chemical or equivalent hand fire
Extinguishers as per safety rules shall be placed in the operator's cabin and in the area where contactor panels are installed. Carbon tetrachloride extinguishers shall not be used.
The fire extinguisher should be properly fashioned by ring guard to avoid falling hazard.

05.02.20 Colour code for electrical equipment

Sl. No.	Description of equipment	Colour	Paint shade No. as per IS : 5-1991	Paint shade No. as per Equivalent RAL Code
I	MOTOR			
1.	LT AC Motors (415V or below)	Brilliant Green	221	6010
II	Mounted Electrics			
1.	Equipment installed on or along with motor (Viz Tacho-generators, brake etc.)	Same as that or motor		
2.	Equipment installed on mechanism but separate from motor (Viz. Limit switches, pull cords, speed switches, load cells, photo elec. relays etc.)	Light Gray	631	7042

Sl. No.	Description of equipment	Colour	Paint shade No. as per IS : 5-1991	Equivalent RAL Code
III	415V switch gear (Substation equipment)	Brilliant Green	221	6010
IV.	Control Gear			
1.	All control panels (MCCs, PDBs, thyristor panels etc.)	Light Admiralty Gear	697	7001
2.	Light distribution board	Brilliant Green	221	6010
3.	Local control box	Light Gray	631	7042
4.	PLC, UPS, Control desk Mimic panel	Light Gray	631	7042
5.	Pulpit equipment	Light Gray	631	7042
V.	Miscellaneous Equipment			
1.	Junction boxes		631	7042
2.	Conduit pull boxes		631	7042
3.	Light fittings		631	7042
4.	110 V and 24 V transformer, sockets, lamp sets etc.	Canary yellow	309	1016
5.	Earthing strip	Black		
6.	Battery charger	Brilliant Green	221	6010
8.	DC DB	Oriental Blue	174	5018
9.	Battery charger cum DC DB	Brilliant Green	221	6010

05.02.21 Air conditioning system with Electric Panel Cabin:-

05.02.21.01 <u>Scope of supply and work for AC system and Electric Panel Cabin:-</u>

Following capacity of Air-Conditioner units (Evaporators, Condensers, Ducts etc with all electrical appliances) are required for the 40+40T Tong EOT crane of RSP Rourkela having Capacity 40+40T/32Tx30.5m Span Tong EOT Crane with Magnet Facility.

<u>List of AC units for different Cranes</u>

SL No	W/O NO.	Crane Description	Heat Load of Elec. Panels (KW)	Minimum offered AC unit Capacity (KW)	Total no. of AC unit each having 100% Capacity (1 working +1 Standby)	Inside Panel Room Size L x W x H
1	8011.002.150	(40+40)T/32T Tong Crane with Magnet Facility	To be decided by Electrical Vendor	16	02	14 x 1.85 x 2.8m

The electrical panel cabin has one row of electrical panel and passage between the panel row & wall.

Notes:

- **a)** The AC units are required to maintain the temperature of the Electrical Panel Cabin (E-Room) for the uniform cooling of the control panels inside it.
- **b)** Inside temperature of the E-Room is to be maintained at 35^0C (max) from an ambient temperature.
- **c)** One AC unit will be working and one is standby, each having 100% capacity.
- **d)** All the dimensions are in mm unless indicated otherwise.
- **e)** Each AC unit will have one compressor and minimum 03 no. of evaporator. However no. of evaporator will be decided keeping in view the AC capacity & also the requirement of uniform cooling in the E- Room.
- **f)** Temperature sensor shall be provided for E-Room & indication of the same (digital display unit) shall be provided in Operator's cabin.
- **g)** All switchgears, breakers & VFD modules shall be front accessible type.
- **h)** Refrigerant used for Air Conditioning shall be R124.
- **i) Preferred Make of AC:**
  - **i) Lintern, USA**
  - **ii) Frigor-Tec, GmbH**

05.02.21.02 Technical conditions for the above mentioned EPC

a) Size of E-Room: (Inside): 14000 x 1850 x 2800 mm.
b) E-ROOM is made of steel sheets (2mm inside + 2mm outside) and structural items.
c) All six sides are double walled packed with glass wool (t~55mm, in between them) for thermal insulation. E-Room will be dust & vermin proof.
d) Space inside E-Room is air tight.
e) One Door of E-Room should be open inside for day to day maintenance of panels. And this door shall have fixed type double panel glass visor (approx. size 700x450).
f) Another door shall be provided on otherside wall of E-Room for placement of Electrical panels. Suitable door locking arrangement shall also be provided.
g) Doors should be robust and rigid and properly hinged for smooth opening & closing.
h) The roof of AC should be strong enough to take the load of two condenser unit of weight 500 Kg each.
i) The evaporators shall be mounted on the ceiling inside the E-Room, where all the Panels are to be located. Total no of evaporator may be 6 having max of weight 80 kg each.
j) Proper Lifting Lugs shall be provided for handling of E-Room.
k) E-Room shall be rigid enough to lift & install on Crane Platform after placement of all Panels inside it.
l) E-Room shall be robust & rigid and can withstand the crane vibration during starting and braking of the crane. The E-Room shall be braced and stiffened properly. Suitable provision shall be provided with E-Room for fixing the E-Room on Crane Platform & bracing with Crane Girder.
m) Twisting of E-Room is not allowed in any plane.
n) Painting: First Coat with Red Oxide and final coating is Lemon Yellow.
o) Floor plates shall be of 4 mm thick.
p) Ladder to be provided on one side of E-Room for approach of maintenance of condenser unit at top of E-Room.
q) Hand railing of min. 1000 mm height to be provided on three side of the roof of E-Room for safety purpose.
r) E-Room shall be properly illuminated and shall be provided with folding type table & chair and suitable pockets for keeping drawings.

A. The AC capacity indicated is minimum and the Actual higher capacity (if required) of air conditioners shall be selected by the supplier considering the heat load of panels and size of the Electrical Panel Cabin (E-Room).

B. Erection, testing and commissioning of air conditioning units at customer's premises at Rourkela Steel Plant, Rourkela is also in the scope of work.

Supply of air conditioner should be complete in all respect such as:-

i) Compressor unit motor having direct on line starter with air cooled condenser made of copper tubes and aluminum fins complete with propeller fan, fan motor starter and drive.
ii) Drive accessories like motor, pulley, V-belt etc.
iii) Oil separator for compressor.
iv) Liquid receiver.
v) Three air conditioning cabinet complete with direct expansion coil, fan, drip tray, filter etc. housed in an insulated sturdy cabinet fan shall be complete with motor, starter and suitable drive-
vi) Heat exchanger and evaporators.
vii) Thermostatic expansion etc.
viii) One set of suitable controls and fitting for automatic operation and any other completing accessory not specifically mentioned in the drawings/enquiry specification but essential for proper operation shall also be included in the scope of the supply of the tenderer.

C. Commissioning spares required for commissioning of the system are to be supplied along with the equipment. A list of such spares is to be furnished by the tenderer.

D. List of item wise price and quantity for recommended two years operational spares are to be furnished by the tenderer. However, two years operational spares are not included in the scope of supply along with the equipment and may be considered as per the requirements of the customer.

05.02.21.03 Operating Conditions:-

(I) Environmental Conditions:-

(1) Ambient temperature : 55^0C
(2) Atmosphere : Dust laden atmosphere of SMS II
(3) Climate : Tropical humid climate.

(II) Power Supply:-

(1) Voltage : 415V+10%, -15%
(2) Frequency : 50 Hz+6%, -6%

(III) TECHNICAL CONDITIONS AND REQUIREMENTS:-

a) The AC units are required for proper cooling of AFE, VFD Panels and it's auxiliaries for EOT cranes at RSP Rourkela. The AC unit shall be split type and the condensers may be mounted on the platform near the E-Room and the evaporators shall be mounted on the ceiling wall inside the E-Room, where all the Panels are to be located. The E-Room shall be installed on the platform of the respective crane. However, the layout of the Panels inside the E-Room shall be finalized after finalization of panel details by the control vendors.
b) Inside temperature of the E-Room is to be maintained at 35^0C (max) from an ambient temperature as mentioned above for cranes and relative humidity 100%. Maintaining the temperature and humidity at the desired level will be the responsibility of the tenderer.

c) The air conditioning units are to be mounted on EOT cranes; hence they should be suitable for jerks & vibrations (which generally occur during crane operation). Anti Vibration pads shall be the part of the supply with the respective equipments (such as condenser, evaporator etc wherever required).
d) Evaporators shall be mounted on anti vibration pads on the ceiling inside the E-Room.
e) Installations of the AC units (condenser, evaporator, ducts etc) are to be done on the crane at site. All erection activities related to installation, testing and commissioning of the AC units will be in the scope of the tenderer.
f) The air conditioning system shall be suitable for power supply 415V, +10%, -15%, 3Φ, 50Hz +6%,-6% 4wire supply. Any other voltage required for the system shall be obtained by providing suitable transformer or transformer rectifier unit with suitable protection.
g) The system shall be complete in all respect any item required for completion and proper functioning of the AC system shall be included in the scope of supply of the tenderer whether specifically mentioned or not in the enquiry specification.
h) Air condition system should be split type and have separate condenser and evaporator. The condenser may be mounted on the platform near to E-Room and evaporator shall be mounted equi-spaced on the ceiling walls inside the E-Room for uniform cooling, and they should be connected through ducts.
i) Required hole/cutout is to be made in the E-Room for ducts.
j) The ducting and mounting accessories & the opening on the roof of E-Room is included in the scope of supplier.

05.02.21.04 INFORMATION REQUIRED FROM THE TENDERER WITH THE OFFER

i Point wise confirmation of the enquiry specification.
ii Capacity of the AC unit along with Technical leaflet.
iii The capacity of the selected AC unit shall be more than the total heat load.
iv Details of the coolant used.
v Calculations justifying the adequacy of the selection of AC units for the respective cranes based on the technical information as given above.
vi No & capacity of the condenser and capacity of the evaporator should be clearly indicated in the offer and their matching scheme should be indicated.
vii Installation scheme for the AC units.
viii Power requirement for the AC units.
ix Electrical schematic drawing indicating the KW of motors (condenser, compressor, evaporator etc) and BOM.
x Dimensioned drawing of the AC units (condenser, evaporator etc).

05.02.21.05 List of drawings / documents to be furnished by the successful tenderer for AC System

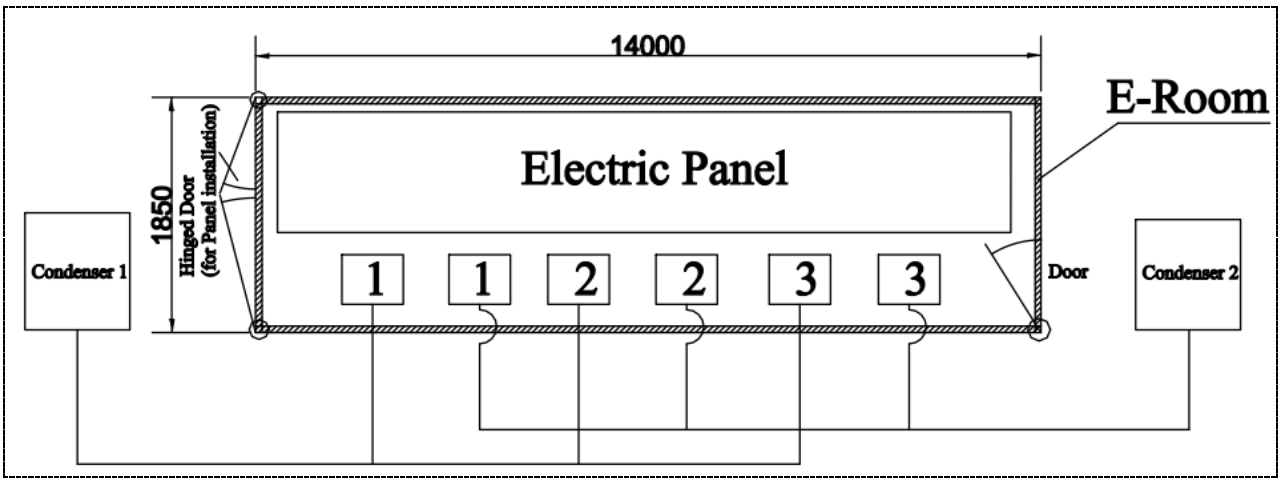
i Installation scheme for the AC units.
ii Electrical schematic drawing indicating the KW of motors (condenser, compressor, evaporator etc) and BOM.
iii Dimensioned drawing of the AC units (condenser, evaporator, control panel etc).
iv Calculations justifying the adequacy of the selection of AC units for the respective cranes based on the technical information as given above.

ELECTRICAL PANEL ROOM AC LAYOUT

Inside the E-Room electrical panels are placed in a single row along the length and there is a passage between the row of panels and the wall. Walkway of min 800mm shall be consider inside the E-Room in front of the electrics as maintenance space along the length as shown

below. Insulating mat shall be provided on the walkway inside the E-Room. The evaporators units shall be mounted on ceiling along the passage. Maximum permissible height of evaporators is 400mm. If required for proper installation of Evaporator, height of E-Room may be increased by 500 mm.

Considering the above noting, the tenderer should offer the suitable models of evaporators with their respective dimensional drawings as per the requirements. A suitable schematic arrangement is to be submitted in line with the proposed scheme.



05.02.22 Cable Reeling Drum for Tong

Suitable gear driven cable reeling drum (CRD) with required number of slip ring for cable payout of 12M shall be supplied having specification as under:

a) CRD shall be made of cast steel or fabricated from mild steel mounted on trolley frame. The flanges & surface of the drum shall be properly machined to protect the cable from any damage.
b) Positive drive to reeling drum from rope drum through suitably covered gearing is to be provided.
c) CRD shall be placed parallel to hoist drum. The maximum distance between hoist drum centre & CRD centre shall be 1250 mm.
d) CRD shall be suitable to accommodate full length of flexible cable in one layer (total cable length for CRD is 18M approximately). A multi-core flexible cable of of length 18M shall be provided.
e) It is possible to disconnect the cable reeling drum from the rope drum through a clutch when not in use.
f) Power supply to the cable reeling drum shall be through brush and slip-ring arrangement. The slip ring shall be spaced 80 mm apart and the entire slip-ring brush assembly shall be enclosed by an easily removable cover which shall be oil proof. Number of power slip rings rated 30A shall be 14 and number of control slip rings shall be 18.
g) Height of lift of the tong: 12M
h) Detail of Hoist Rope Drum:
    i. Drum Diameter: 800mm
    ii. Rope Diameter: 20mm
    iii. Detail of Axle on which gear train of CRD will fix.
    Diameter: 55 mm, Length: 70 mm

06.00 PERFORMANCE & GUARANTEE (shall be read along with Annexure 2):

After **erection and commissioning** (**refer Annexure 3**) of equipment, performance tests (PG Test) shall be carried out to prove the performance of the system and equipment.

i) For checking the performance of the hoist motion the speed at each notch of the master controller with different loads both during hoisting and lowering shall be found out and the load/speed characteristics shall tally with the speed/torque submitted.

ii) For the performance of long travel and cross travel motions, the crane shall be tested with rated load and the running time for a particular distance shall be as per the acceleration values specified under.

Duty Class of crane	Acceleration	
	LT (cm/sec²)	CT (cm/sec²)
Heavy duty	25	15
Extra heavy duty	30	20

All the equipment, tools and tackles required for successful completion of the performance tests shall be supplied by the tenderer.

The tenderer will exibit PAT test, commissioning test, Performance gurantee tests and FAT test as per parameters defined in this technical specification & relevant standards.

All the instruments for the performance tests, as required, shall be supplied by the tenderer and shall be retained by him till the satisfactory conclusion of all tests at site. All costs associated with the supply, calibration, installation and return of test equipment shall be included in the scope of supply. All test instruments shall be as per standards approved by the Employer.

06.01 The cranes after erection shall be undergo PAT test for visual inspection, no load trial runs and various components shall be inspected for smooth running, vibrations and abnormal temperature rise etc.

06.02 After rectification of major PAT defects, the cranes shall be tested as per IS-4137-1985, Reaffirmed- 2006 - Code of Practice for Heavy duty Electric Overhead Travelling Cranes including Special Service Machines for use in Steel Works which shall be deemed as both commissioning test and PG test. Test load (ingots / slabs etc) shall be identified by the client within the plant boundary. The tenderer shall arrange to bring the test load to site and transport it back to its original location or any other location identified by the client within plant boundary.

06.03 Cranes shall deemed to be successfully commissioned after all the tests as per IS-4137-1985, Reaffirmed- 2006 - Code of Practice for Heavy duty Electric Overhead Travelling Cranes including Special Service Machines for use in Steel Works are carried out satisfactorily.

06.04 The tenderer shall supervise and carry out the operation under their instruction and guidance during performance guarantee tests and shall take

full responsibility of the operation. The purchaser will make available necessary operating and maintenance personnel as per the agreed manning schedule as well as the raw materials, utilities and services etc, as specified.

06.05 The tenderer shall submit the scope, general preconditions, test procedures, guaranteed values and test evaluation methods which shall be finalized during performance guarantee tests.

06.06 The performance tests for all plant equipment shall be carried out to satisfy all operating parameters as per the relevant clauses of the technical specification for the equipment under consideration.

06.07 The electrical system for the crane shall be guaranteed for a period as per commercial part of this contract.

06.08 If the successful tenderer fails to achieve the guarantee and performance parameters, he shall investigate the causes and shall rectify and/or replace, free of cost to the Employer the defects of the equipment/system within a period of 1 (one) month from the date of commencement of performance and guarantee tests and again prove the guarantees. In such cases, the cost of modifications including labour, materials, and cost of additional testing etc. shall be borne by tenderer.

If even after necessary alteration and modifications are affected, the performance guarantees are not fulfilled, the Employer reserves the right to reject the equipment. In the event of exercising this right, the tenderer shall replace the defective equipment / system with the equipment / system that meet the performance guarantee parameters. The cost of replacement inclusive of labour, materials and repeat testing to prove compliance with the performance guarantees shall be borne by the tenderer.

06.09 The following basic performance parameter tests shall be concluded:

a. All equipment shall operate at rated capacity without undue vibration and undue noise etc.

b. Measurement of noise and vibration levels (if required).

c. Measurement of power consumption of various drive motors while operating at performance guarantee levels.

d. Continuous run system performance test.

All other parameters of the equipment or system indicated in the specification / relevant IS/IPSS codes.

07.00 DOCUMENTATION

07.01 Information to be furnished by the Tenderer along with the offer:

The Tenderer shall submit following technical drawings & technical data/ information with tender for cranes without which the tender shall be considered as incomplete & may not be considered for acceptance.

a. The technical specification duly stamped and signed as a token of acceptance.
b. Deviations from tender documents in the format enclosed as per annexure.

c. List of commissioning spare & list of spares for two (2) years normal operations for each crane as per clause no 03.01 and 03.02.
d. List of special/ maintenance tools & tackles..
e. Other supporting documents as per clause no. 04.17.
f. Un-priced copy of list of equipment.
g. Motor & Component list.
h. Technical details of AFE converters, VFDs etc.
i. Single line diagrams / Block Diagram of control panels, AFEs, VFDs, LDBs etc.
j. Connected load and 30 minute maximum demand.
k. List of Makes.
l. Motor GA drg. & motor datasheet.

07.02 List of drawings / documents to be furnished by the successful tenderer.

Following drawings shall be submitted in adequate number of copies as for each crane for approval / reference within one month of issue of letter of Intent and prior to commencement of manufacture for approval by RSP/HEC. However, approval of drawings by the Employer will not relieve the supplier of his responsibilities for correctness, adequacy of the design and completeness of his work as per the contract.

All the drawings and documents will be in English language. Drawings shall be complete in all respects with dimensions, item lists, weights, sub-supplier's name etc. Any minor change during drawing approval stage shall be the responsibility of the tenderer and same shall have to be incorporated without any price implication.

i Layout of cabin showing the location and fixing of all the equipment inside it such as controllers / operator's seat, protective panel, isolating and control switches, fire extinguishers, exhausts and circulating fans, air conditioners etc. (for approval)

ii
a) Power and control circuit diagram showing the wiring for all the panels for crane including the speed torque characteristics of each motion.
b) Layout of Electrical equipment on crane, cable layout drawings and layout of earthing system for equipment installed on crane.
c) Inter-connection diagram and cable schedule.
d) Current collection arrangement for the crane and details of current collector.
e) Power supply arrangement (details) to the trolleys and attachments.
f) GA of all panels, arm chair units, radio remote control, junction boxes, and master controllers etc. with their technical details.
g) Bill of materials for each panel and terminal plan drawings for each and every panel and equipment.
h) Single Line Diagrams for various panels
i) Power and regulation schemes for AFEs & VFDs.
j) Power and control schemes with bill of materials and technical specification.
k) Motors, VFD and field devices
   - GA drawings
   - Technical data sheet
   - Characteristic curves for motors
l) Cable selection chart & cable data sheet.

m) Ordering specification for major bought outs and technical catalog for all electrical components.
n) Manual for operation and maintenance.

iii Quality Assurance Plan for inspection

NOTE: QAP, inspection and testing of equipment shall be as per General Technical Specification.

iv In addition to the above, the purchaser / consultant may ask for submission of other drawings, documents and electrical calculations of the crane for scrutiny and reference, if required.

07.03 List of drawings / documents to be submitted along with equipment by the successful tenderer.

a. GA drawings for all the panels and other devices.
b. Drawings of all equipment/component received from sub supplier.
c. Engineering and design calculations for all installations and units.
d. Test and warranty certificate for each item of equipment.
e. Test reports and inspection reports.
f. Instruction manuals for testing and commissioning.
g. Operation, maintenance and safety manuals.
h. Requirement of special tools and tackles, if any, for subsequent maintenance.
i Detail drawing list and specifications / technical catalog for all electrical components.
j. List of spare parts with specifications and manufacturer's catalogue.
k. Erection drawings including equipment & cable layout drawings, inter-connection drawing, cable schedule etc.

8.00 LIST OF PREFERRED MAKES OF ELECTRICAL PARTS

The make of the equipments shall be as per the preferred make list of RSP. Makes of item not included in the list shall be subject to approval by RSP.

1) ELECTRICAL ITEMS		
LV EQUIPMENTS		
Sl. No.	Equipment	Preferred Makes
GROUP I: LT SWITCHGEAR & ACCESSORIES UPTO 440 V		
1	LT Air circuit breakers	ALSTOM, L&T, SCHNEIDER, GEPOWER, SIEMENS, MERLIN GERIN, ABB, C&S ELECTRIC , BCH, ABB
2	LT bus duct	ALSTOM, BEST & CROMPTON GEPOWER, L&T, SIEMENS STAR DRIVE BUS DUCT, C&S, PCE ECC, BRIGHT ENGG. VIDHYUT CONTROL
3	Isolators	ALSTOM/GEPOWER, L&T, SIEMENS, YASH ELECTRO PANELS
4	11KV / 6.6 KV Isolator	ABOND STRAND, S&S, HIVLEM SIEMENS, DREISCHER-PANICKER

5	415 V Switch Board	SIEMENS, L&T, GE POWER, SCHNEIDER
6	CT for LT panels	ABB, AEL, JYOTI KAPPA, PRAGATI, SIEMENS
7	Motor protection circuit breaker (MPCB)	SCHNEIDER, MDS-LEGRAND, L&T, SPECHER-SHU, GEPOWER, SIEMENS, ABB
8	Moulded case circuit breakers (MCCB)	ABB, CGL, MDS-LEGRAND, ALSTOM, L&T, GEPOWER, SCHNEIDER, MERLIN GERIN, SIEMENS, C&S ELECTRIC, BCH (Range upto 4000A in 3pole & 4pole)
9	Fuse switch unit	ALSTOM, L&T, SIEMENS, GE POWER CONTROL,C&S ELECTRIC
10	HRC fuses	ALSTOM, HAVELLS, L&T, SIEMENS, BUSMAN, GEPOWER, INDO-ASIAN, C&S ELECTRIC
11	Miniature Circuit Breaker	SIEMENS, HAVELLS, MDS-LEGRAND, L&T(HAGAR), SCHNEIDER, STANDARD, GEPOWER, ABB, C&S ELECTRIC
12	Earth Leakage Circuit Breaker (ELCB)	HAVELLS, MDS-LEGRAND, SCHNEIDER, STANDARD, GEPOWER, HAGAR (L&T), ABB, SIEMENS
GROUP II:LT POWER CIRCUIT DEVICES		
13	A.C. Power contactors	ABB, SPRECHER, BCH, L&T, SCHNEIDER, GEPOWER, SIEMENS, C&S ELECTRIC
14	DC Power contactors	BCH, L&T, ABB, SIEMENS, SCHNEIDER, BHEL
15	Crane duty power contacts	ABB, SCHNEIDER, L&T, SIEMENS, GEPOWER, TM
16	Vacuum Contactor (LT)	SIEMENS, L&T, ABB, SCHNEIDER
17	Electromagnetic O/L relays	BCH, SIEMENS, BHEL, SCHNEIDER, KILBURN, C&S ELECTRICAL
18	Electronic Thermal Over Load Relay	FANOX, SAMWAH, MOELLER, LG, SPECHER & SCHUH, C&S ELECTRICAL
19	Thermal Over Load relay	ABB,C&S, BCH, L&T, SCHNEIDER, GEPOWER, SIEMENS, C&S ELECTRICAL
20	Oil Dash Pot Over Load Relay	KILBURN, ELECTROGEAR, C&S ELECTRICAL
21	Bimetallic relays	ABB, SPECHER & SCHUH, BCH, TELEMECHANIQUE, L&T, SCHNEIDER (CGL), GEPOWER, SIEMENS
22	Single phase preventer	L&T, MINILEC
GROUP III:CONTROL DEVICES		
25	Control switches / Selector switches	ABB, ALSTOM, BCH, VAISHNO, KAYCEE, L&T, JYOTI, SALZER, GEPOWER, SIEMENS
26	Push Buttons	SALZER, BCH, L&T, SCHNEIDER, SIEMENS, GEPOWER, VAISHNO, ABB
27	Timers /Time delay relay	ABB, BCH, ELECTRONIC AUTOMATION PVT. LTD., L&T, GEPOWER, OMRON, SIEMENS, TM
28	Semaphor indicators	ABB, AREVA/ ALSTHOM, ALSTOM
29	Control contactors	ABB, BCH, AY, SPECHER & SCHUH, L&T, SCHNEIDER, GEPOWER, TM, SIEMENS
30	Control Transformers	AEL, AEP, VOLTAMP, INTRAVIDYUT (INDCOIL), KAPPA, INDUSREE, SIEMENS, BLUEBIRD, BCH

31	Voltage/power/current/energy transducers	ABB, SIEMENS, AEL, LEM GERMANY, SIETEX, AREVA
32	Solenoid valves	AVCON CONTROL PVT.LTD. MUMBAI, REXROTH , BLUESTAR, FLOWCON
33	Pneumatic timer Automatic water level controller	BCH, SUKURUT, MINILEC, TOSHNIWAL, C&S ELECTRIC
34	Master controller	EPCC (KAKKU), TELEMECHANIQUE, SCHNIEDER, SIEMENS, STROMKRAFT
35	Limit switches	BCH, EPCC, ESSEN, GEPOWER, JAIBALAJI, JAYSHREE ENTERPRISES, SCHNEIDER, SIEMENS, ABB, AG MECHANIC
36	Pull cord switches	EPCC, JAYSHREE ENTERPRISES, STROMKRAFT, AG MECHANIC, TELEMECHANIQUE, PROTO CONTROL, PARAMETRICS
37	Belt sway switch	EPCC, TELEMECHANIQUE, JAYSHREE ENTERPRISES, STROMKRAFT, AG MECHANIC, PROTO CONTROL, PARAMETRICS
38	Gravity type limit switch	EPCC (KAKKU), STROMKRAFT, KAYCEE
39	Rotary Limit Switch	EPCC(KAKKU), TM / SCHNEIDER, RKE, AG MECHANIC
40	Zero Speed Switches	PROTOCONTROL, JAYASHREE , AG SYSTEM, PARAMETRICS
41	Belt Rupture Switch	PROTOCONTROL, JAYASHREE , AG SYSTEM, PARAMETRICS
42	Chute Block switch	PROTOCONTROL, JAYASHREE , AG SYSTEM, PARAMETRICS, EIP ENVIRO LEVEL CONTROLS
43	Non contact Limit switch	PROTOCONTROL, JAYASHREE , AG SYSTEM
44	Industrial Netw ork Sw itches ('Hirschman' Make)	THETA CONTROL
45	Pull cord indicator system	PARAMETRICS
GROUP IV:FIELD DEVICES & SENSORS		
46	Proximity & Photo Electric Sensors	EFFECTOR, ROCKWELL AUTOMATION, SCHNIEDER (TM) SIEMENS, OMRON, SICK, DELTA, ABB, BCH, LINE & LINDE
47	Bunker level indicator	L&T, MILTRONIC INDIA, ENDRESS+HOUSSER, TOSHNIWAL, E&H, VEGA
48	Pulse encoder	HUBNER, HEIDENHEIN, LINDE & LINDE, ROCKWELL AUTOMATION (ALLEN BRADLEY), LEONARD BAUR GERMANY, SICK, GERMANY
49	Linear Encoder	HENGSTLER, PEPPERL&FUCH, LEONARD BAUR GERMANY, SONY, HELWIG GERMANY, MTSUSA
GROUP V:INDICATING / MONITORING / ANNUNCIATING DEVICES		
50	Mimic panel	BLUE CIRCLE, L&T, STARDRIVE BUSDUCT
51	Indicating lamps	OSRAM, PHILIPS

52	Indicating lamp LED jumbo type	BINAY, ESSEN, FREQUENCY, VAISHNO, SIEMENS, L&T, BCH
53	Hooter/buzzer/bell	EPCC / KHERAJ
54	Solid state Annunciator	ADVANI OERLIKON, ALSTOM, APLAB, CONTROL & DYNAMICS, DIGICON, INSTRUMENTATION LIMITED, L&T, MINILEC, AREVA
55	Temp. scanner	ADVANI OERLIKON, ECIL, INSTRUMENTATION LIMITED (KOTA), MASIBUS, PYROTECH, SIEMENS
GROUP VI:CONTROL PANELS		
56	MCC (Draw out)	ABB, ALSTOM, CGL/ SCHNEIDER, L&T, SIEMENS, GEPOWER, MEGATECH CONTROL, SONITECH, C&S ELECTRIC, YASH ELECTRO PANELS, BCH
57	MCC (Non Draw out)	ABB, ALSTOM / GEPOWER, CGL, ECC, L&T, MEDITRON, SIEMENS, SWITCHING CIRCUIT, GEPOWER, GEMCO, KMG A To Z, HINDUSTAN CONTROLS, SCHNEIDER, MEGATECH CONTROL, BCH (Non-draw out Non-intelligent), UNILEC ENGINEERS, INCOTECH ENGINEERS (LT), YASH ELECTRO PANELS, SONITECH, CONTROL DEVICES, Venus Controls & Switchgear (P) Ltd.
58	Power Distribution Board (PDB)	ABB, ALSTOM BCH, CGL/ SCHNEIDER, L&T, GEMCO, MEDITRON, SIEMENS, GEPOWER, KMG A To Z, HINDUSTAN CONTROLS, VENUS, GEPC, HAVELLS, UNILEC ENGINEERS, INCOTECH ENGINEERS, YASH ELECTRO PANELS, C&S ELECTRIC, Control Devices
59	Power Control Centre (PCC)	ABB, ALSTOM, BCH, L&T, SIEMENS
60	Motor Starters	GEPOWER, C&S ELECTRIC, KMG A TO Z, Venus Controls & Switchgear (P) Ltd. [only Non-draw out (fixed) type using RSP approved components.], ABB, BCH, L&T, SCHNEIDER, SPECKER & SCHUCH
61	Crane Control Panel	SIEMENS, C&S ELECTRIC, BCH, GEPOWER, EPCC, MEDITRON, SIEMENS
62	Control Desk & Post	ECC, VENUS, ABB, ALSTOM, BHEL, GEMCO, L&T
63	Local control station (LCS)	SIEMENS, HINDUSTAN CONTROLS, ECC, VENUS, BCH, HAVELLS, POWER & PROTECTION, INCOTECH ENGINEERS (CONTROL DESK), SONITECH, C&S ELECTRIC, YASH ELECTRO PANELS, ALFA AUTOMATION (Non-Critical & not related to Process), TRIMURTY ENTERPRISES (Non-Critical & not related to Process), ALSTOM, BCH, TECHNOCRAT ENTERPRISES, ECC, L&T
64	Relay & Control Panel	INCOTECH ENGINEERS (P) LTD, SYSTEM CONTROL & AUTOMATION, VOLTECH, ECC, SERVOMAX
65	Junction Boxes	C & S ELECTRIC, SONITECH, Control Devices (Pow er and Control)
66	Polycarbonate junction Boxes	HENSEL
67	Control panels for hydraulics for Crusher	ABB, GE POWER, L&T, MEDITRON, SIEMENS, SCHEIDER, BCH

68	Control panels for fluid coupling	BCH, HAVELLS , GEMCO, L&T, TECHNOCRAT ENTP. MEDITRON, SIEMENS, GE POWER, EPCC,
69	supervisory control cubicle, local Control post for crusher & hydraulics for crusher	C) BCH, HAVELLS, GEMCO, TECHNOCRAT ENTP. MEDITRON, SIEMENS, L&T, EPCC,
70	Control Panel for wagon haulage w inch of PCM complex	Circuits & Controls
71	6.6kV HT MCC	Megaw in Switchgear
72	RTDB AND UPSDB	Industrial IT Solution
GROUP VII:LIGHTING & POWER WIRING EQUIPMENT /ACCESSORIES		
73	Lighting Distribution Board MLDB, SLDB	ALSTOM, CONTROL & SWITCHGEAR, ECC, MEDITRON TECHNOCRAT ENTERPRISES.CUTTACK, HAVELLS, SWITCHING CIRCUITS, L&T, MDS S&S, SIEMENS, HINDUSTAN CONTROLS, POWER & PROTECTION, VENUS GEPC, BCH, KMG A TO Z, C&S ELECTRIC, UNILEC ENGINEERS (for MLDB), SONITECH - (LDB) Control Devices, Rupa Electric systems and System Control & Automation
74	Lamps	BAJAJ, CROMPTON GREAVES, GE LIGHTING ,PHILIPS, OSRAM, SIGMA
75	Light fitting (fixtures)	BAJAJ, CROMPTON GREAVES, GE LIGHTING, PHILIPS
76	Lighting w ire (PVC)	CCI, DELTON, FINOLEX, FORTGLOSTER, GOVIND, INCAB, NICCO, UNIVERSAL
77	Switch socket outlet	BCH, BEST & CROMPTON, JAI BALAJI, HANSEL, MDS LEGRAND, CGL
78	Miniature Circuit Breaker (MCB)	HAVELLS, INDO KUPP, MDS LEGRAND, S&S, SCHNEIDER, STANDARD
79	5A/15A Piano switch	ANCHOR, ELLORA, MDS LEGRAND, CONA, PRECISION, HAVELLS
80	Flame proof light fitting	BAJAJ, BALIGA, STAMCORE BOMBAY, CGL, PHILIPS, GOVAN, FLEXPRO, SUDHIR, CEAG, FCG, SIGMA, FLAME PROOF EQUIPT. PVT.LTD.
81	Switch socket outlet (240/24V)	ALSTOM, ANCHOR, BCH, CGL, ESSEN
82	Switch socket outlet (415v)	ALSTOM, BCH, ANCHOR, CGL, ABB
83	Industrial Plug & socket	ALSTOM, BCH, BEST & CROMPTON, CGL
84	Interlock power sockets	ALSTOM, BCH, BEST & CROMPTON, CGL, BAJAJ, ABB
85	Exhaust Fans	CGL, CINNI, KHAITAN, POWERVENT, VENTWELL, BAJAJ
86	Ceiling fans	CGL, CINNI, KHAITAN, USHA, HAVELS
87	High Mast lighting Towers	GE INDIA, CGL, PHILIPS, BAJAJ

GROUP VIII:TRANSFORMER AND ACCESSORIES		
88	Power transformer (Up to 11 KV)	ABB, BHARAT BIJLEE, BHEL, CGL, KIRLOSKAR ELECTRIC COMPANY, ALSTOM/ AREVA, AY, INTRAVIDYUT, VOLTAMP, TELK
89	Power transformer (220 KV,132 KV,66KV,33KV)	ALSTOM/AREVA, BHARAT BIJLEE, BHEL, CGL, TELK
90	Distribution Transformer (Oil Type - 11 or 6.6 / 0.433 KV	ABB, AREVA, CGL, BHEL, BHARAT BIJLEE, Truvolt Engineering Company (6.6 Kv/415 V, indoor type, oil cooled), VOLT AMP (Also for 33 / 0.433 KV) KIRLOSKAR ELECTRIC COMPANY (Also for 33 / 0.433 KV) INTRA VIDUT (Also for 33 / 0.433 KV)
91	Dry type transformer	CGL, VOLTAMP, KIRLOSKAR ELECTRIC COMPANY, INTRAVIDYUT
92	Current Transformers	ABB, SILKANS, INSTRANS, PRAGATI, IMP, AE, KAPPA, PRAYOG, SIEMENS, L&T
93	Potential Transformer	ABB, BHEL, SILKANS, PRAGATI, IMP, KAPPA, PRAYOG, SIEMENS, INDOCOIL, PRECISION
94	Winding & oil temperature indicator	OSMADIAL, PERFECT CONTROLS, SKII
95	Magnetic oil level indicator	SUKRUT, PRAYOG
96	OLTC	BHEL, CGL, HACKBRIDGE=HEWITIC, EASUN M R
97	Bucholz relay	ALSTOM, SUKURUT, PRAYOG
98	Convertor transformer	BHEL, CGL, ALSTOM/ AREVA, INTRAVIDYUT(<500KVA), BHARATBIJLEE, KIRLOSKAR ELECTRIC COMPANY, TRAFO UNION GERMANY, SAIGON (< 500KVA)
99	LT Transformer	CGL, BHARATBIJLEE, ALSTHOM, KEC, INTRABIDYUT, VOLTAMP
GROUP IX:AUTOMATION & CONTROL		
100	PLC & Automation	ABB, GE-FANUC, ROCKWELL AUTOMATION, SIEMENS, SCHNEIDER
101	Personal computer, Laser Printer, Plotter	HP, SONY, IBM
102	Laptop/ notebook	IBM, HP, LENOVO, SONY
103	Switches	CISCO, ENTERASIS
104	VVVF AC Drive (More than 1MW	ABB, ALSTHOM, GE, SIEMENS
105	VVVF AC Drive (Less than 1MW)	ABB, ALSTHOM, ROCKWELL AUTOMATION, SIEMENS, GE, EUROTHERM, SCHNEIDER, VACON, L&T
106	A C Drive (General Purpose)	SCHNEIDER, ABB, BONFIGLIOLI, DENFOSS, CONTROL TECHNIQUE
107	Soft starter (Electronic solid state type)	SPECHER & SCHUH, ROCKWELL AUTOMATION, SCHNEIDER, INNOVATIVE TECHNOLOGY, ALSTHOM, SIEMENS, ABB
108	Thyristor convertor (DC drive) More Than 1MW	ABB, BHEL, ALSTHOM, GE, SIEMENS

109	Thyristor convertor (DC drive) Less Than 1MW	ABB, BHEL, ABIL, SIEMENS, ALSTHOM, EUROTHERM, GEPOWER
110	HRC fuse (semiconductor protection)	BUSMANN, JE MULLER, FERRAZ/ GEPOWER, GEPOWER, SIEMENS
111	CCTV	ECIL, TECHMECH, PYROTECH, BOSCH, NELCO, DATAMATICS, PHILIPS
112	Uninterrupted power supply (UPS)	DB POWER ELECTRONICS, TATA LIBERT (EMERSON ELECTRIC), GE, FUJI
113	CVT	BHURJI, DIGITAL, ELNOVA
114	Electronic weighing system	ABB, BEST SYSTEMS & SERVICES, SENSORS & SYSTEM, NOVA WEIGH, SARTORIOUS, SANMAR, SCHENK J & N, KISTLER-MORSE AUTOMATION LTD, TRANSWEIGH, KELK
115	Pin Hole Detection	DETMASTER
GROUP X:MOTORS		
116	LT AC Motors	ABB, BHARAT BIJLEE, CROMPTON, NGEF, KIRLOSKAR ELECTRIC COMPANY, ALSTHOM, SIEMENS, LAXMI HYDRAULIC (LHP)
117	LT AC Motors (Crane duty)	ALSTOM, KEC, CGL, SIEMENS
118	LT AC Geared Motor	SEW / EURODRIVE, BAUER / INTERNAL COMBUSTION, PBL, KEB, GERMANY, KIRLOSKAR ELECTRIC COMPANY, NEW ALLENBURY, NORD DRIVE SYSTEMS, BONFIGLIOLI SHANTI GEARS, POWERBUILD, IEC, AUMA, ROSSI GEARMOTORS (INDIA) , SUMITOMO DRIVES
119	HT AC Motor (200 KW & Above)	BHEL, ALSTHOM, ABB, CGL,SIEMENS, KIRLOSKAR ELECTRIC COMPANY, WEG ELECTRIC INDIA, GE
120	Flame proof LT squirrel cage AC Motor	ALSTOM, BHARAT BIJLEE, ABB, CGL, KIRLOSKAR ELECTRIC COMPANY, SIEMENS
121	Slipring Motors(Other than Crane duty)	CGL, ALSTOM, SIEMENS, KIRLOSKAR ELECTRIC COMPANY, BHARAT BIJLEE
122	LT AC VVVF Motors & Roller Table Application	SIEMENS, ABB, KIRLOSKAR ELECTRIC COMPANY, ALSTHOM, CGL, BHARAT BIJLEE
123	Stall Torque Motor	DEMAG
124	Actuator Motor	AUMA, ROTORK, LIMITORQUE
125	DC Motors(Mill duty)	BHEL, KEC, CGL,INTERGRATED ELECTRICS, TRIDENT POWERCRAFT
126	DC Motors(Industrial duty)	KEC, IEC, KIRLOSKAR ELECTRIC COMPANY, BHEL, SIEMENS, ELECTROTYAZHMASH (Self propelled bucket car)
127	Hydraulic Motor for Side Arm Charger	EATONS VICKERS, PARKERS, L&T, HAGLUNDS, BOSCH REXROTH, DANFOSS
GROUP XI:CABLES & CABLING ACCESSORIES		
128	PVC Power Cables(LT)	CCI, COLT, UNIVERSAL, FORT GLOSTER, INCAB, NICCO, RPG CABLES (ASIAN), POLYCAB (XLPE), KEI, FINOLEX, TORRENT, HAVELLS, CRYSTAL CABLE (XLPE with ISI

		Mark), SERVEL UDYOG (up to 1100 V), Teracom Limited (PVC & XLPE 1100V)
129	PVC Control cables	CCI, FORT GLOSTER. INCAB, LAPP, HELUKABLE, NICCO, RPG CABLES (ASIAN), KEI, CORDS CABLE, MEM INDUSTRIES, UNIVERSAL, R R CABLE, POLYCAB, COLT (LT), FINOLEX, TOSHNIWAL, DELTON, SERVEL UDYOG (with ISI mark), Teracom Limited
130	XLPE cables(HT)	CCI, FORT GLOSTER, INCAB, NICCO, RPG CABLES (ASIAN), KEI (UPTO 11 KV)
131	Heat resistant cables	CCI, FORT GLOSTER, INCAB, LAPP, HELUKABLE, NICCO, RPG CABLES (ASIAN), UNIVERSAL, TOSHNIWAL, DELTON
132	11KV / 6.6 KV Cable	RPG CABLES (ASIAN), CCI, UNIVERSAL, NICCO, POLYCAB, HAVELLS
133	Screened & Special cables	BELDEN, LAPP, HELUKABLE, MEM INDUSTRIES, CCI, FINOLEX, POLYCAB, NICCO, TOSHNIWAL, DELTON
134	Trailing Cable	LAPP, CCI, UNIVERSAL, ASIAN, NICCO, United cable
135	Cable lug	DOWELLS, ISMAL, MULTI, JAINSON
136	Cable gland	HELUKABLE, LAPP, HANSEL, PHOENIX, Comet Brass Product
137	Heat shrinkable cable jointing kits / Straight through joints (HT)	RAYCHEM, DENSON, M - SEAL
138	Cable termination kits (XLPE)	MECP, RAYCHEM, MSEAL, 3M
139	Terminal connector	CONNECT WELL, ESSEN-DINKY, PHOENIX, WAGO, LAPP, HANSEL
140	Instrumentation Cable	RALLISON CABLE, MEM INDUSTRIES, CORDS CABLE, UNIVERSAL, DELTON, THERMOPADS, KEI, PARAMOUNT, LAPP, CORDS CABLE, UNIFLEX, BROOKS, ELKAY, RAJNIGANDHA, SPECIAL, TCL, FRIENDS, DAKSHA, CRYSTAL, UDEY PYRO, FORT GLOSTER
141	PVC Lighting, Power & Control Cable (up to 1.1KV) with ISI Mark	MANSFIELD (PVC / XLPE POWER & CONTROL), SPECIAL CABLES (PVC POWER & CONTROL), SHYAM CABLE INDUSTRIES, GOBIND CABLE INDUSTRIES
142	Welding Cable (with ISI Mark)	MANSFIELD, GOBIND CABLE INDUSTRIES, SHYAM CABLE INDUSTRIES
143	HR SILICON Rubber Cable - Up to 1.1KV(with ISI Mark)	MANSFIELD
144	EPR / CSP cable (LT with ISI Mark) VIR cable (LT with ISI Mark)	MANSFIELD, NANGALWALA IMPEX, NANGALWALA IMPEX
145	Optical Fiber Cable	FINOLEX CABLES, TYCO, D LINK, MOLEX, STAR LITE
146	33KV Cable	UNIVERSAL, NICCO, RPG (ASIAN), CCI
147	Thermocouple & MI cable	TEMPSENS
148	33 KV Cable Termination for GIS	ABB KABELDON, BRUGGS CABLE, PFISTER IXOSIL , LS CABLES, G&W , DEMRIER CABLES
149	OPGW Cable	FURUKAWA
150	ADSS cables	Tamilnadu Telecommunications

GROUP XII:MISCELLANEOUS		
151	Welding socket	BCH, SCHNIDER, BEST&CROMPTON, GEPOWER, HAVELL, JAIBALAJI, HENSEL, MDSLEGRAND
152	DC Electromagnetic brake	BCH, ELECTROMAG, EPCC(KAKKU)
153	Electro. Hydraulic Thrusters	E M G ELTMA
154	High speed DC circuit breaker	GEPOWER, MEYRAPID, SECHERON, SIEMENS
155	Diode	HIND RECTIFIER, SEMIKRON, BHEL, RUTTANSHA, USHA RECTIFIER
156	Battery (NiCd)	YUASA, HBL, SONY, NATIONAL PANASONIC, HITACHI, TOSHIBA, SABNIFE (HBNIFE POWER SYSTEM), AMCO
157	Valve operated Lead acid Maint. Free Battery (VRLA)	HBL, AMARARAJA, EXIDE
158	Battery (Lead acid)	AMCO, CHLORIDE (EXIDE)
159	Battery (Plante)	HBL, AMARARAJA, EXIDE
160	Battery (Sub-station)	EXIDE (PLANTE)
161	Battery charger / DCDB	ELNOVA, CALDYNE, NELCO, SABNIFE (HBNIFE POWER SYSTEM), CHHABI, HBL, KIRLOSKAR, AMARARAJA, BCH (Batt. Charger)
162	Lifting magnets	ELECTROMAG, EPCC, STERLING MAGNETICS, SUPERLIFT, SGM Magnetics
163	Power pack for magnets	ELECTROMAG, BCH, EPCC, MEDITRON
164	Crane power conductor accessories & Insulators	INDIA MILL STORES, JAYASHREE INSULATORS
165	Portable welding transformers	ADVANI OERLIKON, ESSAB, L & T
166	Resistors (CRANE)	BCH , ELECTROMAG, EPCC, SIEMENS, RSI, AMP CONTROL, RESITECH, NARKHEDGE
167	L.T. capacitors	GE POWER, ABB, CGL, MEHER CAPACITORS, UNI STAR, SRIRAM, BHEL
168	Cable Reeling Drum	BENGAL TECHNOCRAT KOLKATA, ELECTRO ZAVOD, ELECTRMAG
169	Drag chain	IGUS, ELECTROMAG, FRAMAG AUSTRIA
170	Liquid Rotor starters	INDUSTRY SYNDICATE
171	Thermoplastic Enclosure	TTPL, HENSEL
172	RRT system for EOT cranes	LOTUS WIRELESS
173	FLP type Electrical Items - f or external lift.	STAMCO INDUSTRIES, BALIGA, CGL, BAJAJ ELECTRICALS, UNITED ENGG. SYNDICATE, DEEPSUM IND. & CO.
174	Oil Filter machine / Plant	VPI
175	Clamp Connector	ISP, TMP, IAC, RASTRIYO UDYOG, Industrial Spare Products
176	Outdoor type light arrester	OBLUM
177	Steel Tubular poles	CGL, PHILIPS, GE, BAJAJ

INSTRUMENTATION & AUTOMATION **GROUP I: INSTRUMENTATION EQUIPMENT**		
178	RTD, Thermocouple	NAGMAN, TOSHNIWAL, TEMCON, TEMPSENS, GENERAL INSTRUMENTS, PYRO- ELECTRIC INSTRU. ALTOPWAREE, INDUSTRIAL INSTRUMENTATION, WAREE, ALTOP, DETRIV, UNICONTROL INSTRUMENTS
179	Smart type electronic Transmitter (Pressure / Flow / Level)	IL / FUJI, ROSEMOUNT/ EMERSON, HONEYWELL, E&H, CHEMTROLS(FUJI), YIL, ABB, SIEMENS
180	Temperature transmitter	ROSEMOUNT/ EMERSON, HONEYWELL, YIL, ABB, SIEMENS, FUJI
181	Pressure switch (Pressure/ Diff. Pressure switches)	INDFOSS/ DENFOSS, SWITZER, WIKA, DRUCK IND, VASUTECH
182	Flow elements	IL, ENGG.SPECIALITIES, MICRO PRECISION, UNICONTROLS INSTRUMENTS (FLOW & TEMP.)
183	Pressure/ Diff. Pressure Gauge	WIKA, MANOMETER, A.N.INSTRUMENT, PRECISION INDUSTRIES, GENERAL INSTRUMENTS, WAAREE, FORBES MARSHALL, WALCHANDNAGAR, HIRLEKAR
184	Pressure/ Diff. Pressure Transmitters	EMERSON, CHEMTROLS, HONEYWELL, YOKOGAWA, SIEMENS, ABB
185	Temperature gauges	WIKA, MANOMETER, A.N.INSTRUMENT, PRECISION INDUSTRIES, GENERAL INSTRUMENTS, WAAREE, WALCHANDNAGAR, GE, GAUGES
186	Pressure /Temp. Gauge	WIKA
187	Capacitance /vibrating fork type level instruments	E & H, VEGA
188	Controllers	YIL, TOSHIBA, HONEYWELL, EUROTHERM, ABB
189	Digital indicators	MASIBUS, MASTER ELECTRONICS, SWITZER, PANTECH, ABB, PYROTECH, LECTROTEC, CHINO LAXSONS, MICRO SYSTEMSRANUTROL, HONEYWELL, RANUTROL
190	Bargraph Indicator	TOSHIBA, HONEYWELL, EUROTHERM, YIL, ABB, CHINO LAXSONS, MASIBUS, PYROTECH, LECTROTEC, TELETHERM, RANUTROL
191	Signal isolatorcum distributors	MASIBUS, MASTER ELECTRONICS, PANTECH, YIL, HONEYWELL, MTL, PEPPERL & FUCHS, STAHL, FORBES, CHINO LAXSONS, PHOENIX
192	Alarm Annunciator	PROCON, PYROTECH, IIC, MINILEC
193	Temp switch	SWITZER, INDFOSS/ DENFOSS, DRUCK IND, WIKA, MANOMETER, A.N.INSTRUMENT, GENERAL INSTRUMENTS, VASUTECH
194	Optical/Radiation Pyrometer	LAND, RAYTEK, TOSHNIWAL, IRCON, CHINO, NAGMAN
195	Flame detector	HONEYWELL, DURAG
196	Control valves, Pneumatic Actuator	VIRGO, DEMBLA, MASONEILAN, ENGG.SPECIALITIES, IL, FISHER- XOMOX, VALTEK, SAMSON CONTROL, FORBES MARSHALL, ABB, FOURESS, TYCO VALVES, MIL CONTROLS, KEYSTONE, VIRGO, HABONIM
197	Motor Actuators	BERNARD(IL)

198	Electro-Hydraulic Actuator	REINEKE, ASKANIA
199	Gas Analysers	FUJI , ABB, SERVOMESH, YIL, AMETECH, CHEMTROLS, MSA, EMERSON, SIEMENS, FORBES MARSHALL, BEILER & LANG, HONEYWELL
200	Rotameter / By-pass Rotameter	ROTA INSTRUMENTS, IE, PLAKA, KROHNI-MARSHALL, INSTRUMENTATION ENGINEERS, TRAC, EUREKA INSTRUMENTS, CHEMSTROLS
201	Instrument Transformer	NATIONAL ENGG. CORPORATION, AUTOMATIC ELECTRIC
202	Solenoid valve	AVCON, SCHRADER SCOVIL, ASCO, BURKERT, HERION, ROTEX, JUCOMATIC
203	Air filter regulator	SHAVO NORGREN, PLAKA, CADILLAC, ABB, MARSH – BELLOFRAM, SCHRADER SCHOVILL
204	DC Power supply unit	APLAB, ELNOVA, SIEMENS, PHOENIX, SCHNEIDER
205	DCS	HONEYWELL, YIL, SIEMENS, TOSHIBA, ABB, EMERSON
206	Zenner Barrier	MTL, PEPPER & FUCH, STAHL
207	Panel, Mimic	RADHAKRISHNA CONTROLS, ESAKI, BLUE CIRCLE
208	Surge Proctector	MTL
209	CV Analyser	RENIEKE, CHEMTROLS, UNION, YOKOGAWA, Vortex Electronics (COSA Inc, USA make)
210	Moisture Analyser	INFRARED ENGINEERING, CHINO, EARTH TEKNIK, CHEMTROLS, CONCORD INTERNATIONAL, EMERSON
211	Thickness Gauge	THERMO ELECTRON, IMS, DOTTLE, LAPLASER, AMERICAN SENSOR, ECIL
212	Roll Force	KELK
213	Chart (Less) Recorders	HONEYWELL, CHINO, EUROTHERM, YIL, ABB, SIEMENS
214	I/P Convertor	HONEYWELL, YIL, MOORE, BRANDT, ABB, SHREYAS – BARTON, FORBES MARSHALL, MARSH – BELLOFRAM, MIL CONTROLS, WATSON SMITH, FISHER- XOMOX
215	Magnetic Flow Meter	KROHNE MARSHALL, YIL, E&H, HONEYWELL, ABB, EMERSON
216	Ultra Sonic Level meter	MILTRONIC, E&H, ABB, VEGA
217	Compensating Cables	TOSHNIWAL, TEMCON, MEM, GENERAL INSTRUMENTS, PARAMOUNT, UDEY PYRO, CORD, BROOKS, DAKSHA, FRIENDS, SERVEL UDYOG
218	Dust Monitors (On Line)	CHEMTROLS
219	Orifice Plate & flange Assembly / Ventury, Flow nozzle	ENGINEERING SPECIALITIES, MICRO PRECISION, HYDRO PNEUMATICS, CHEMSTROLS, IL
220	Flow Switch	IFM, K.MARSHALL, SWITZER, LEVCON, D.K.INSTRUMENTS
221	Vertex Flow meter	EMERSON(ROSEMOUNT), K.MARSHALL, YOKOGAWA, VORTEX
222	Mass Flow Meter	EMERSON(ROSEMOUNT), K.MARSHALL, YOKOGAWA, ABB, E & H, ROCKWIN
223	Level gauge (magnetic & reflex type)	CHEMSTROLS, LEVCON, PRATOLINA INSTRU, WAREE, FORBES MARSHALL, TECHTROL, SIGMA, ASIAN IND.

		VALVES & INSTRUMT.
224	Level Switch (Conductivity type)	CHEMSTROLS (vega), E & H, SWITZER, TECHTROL, SB ELECTRO- MECHANICAL, NIVO CONTROL, LEVEL-TECH
225	Level Switch (Capacitance / RF type)	CHEMSTROLS (vega), E & H, SWITZER, TECHTROL, SB ELECTRO- MECHANICAL, NIVO CONTROL, LEVEL-TECH
226	Level Switch (tuning fork / Rod type)	CHEMSTROLS (vega), E & H, SB ELECTRO- MECHANICAL, NIVO CONTROL
227	Level Switch (Float type)	EMERSON, TRAC, CHEMSTROLS, FORBES MARSHALL, DK INSTRU, LEVCON, TECHTROL, V-AUTOMAT, WAREE
228	Level Switch / Transmitter (Displacer type)	EMERSON, CHEMSTROLS, TRAC, DK INSTRU, LEVCON
229	Level Switch / Transmitter (Ultrasonic type)	CHEMSTROLS (vega), E & H, K.MARSHALL, SIEMENS(MILTRONICS), TOSHBRO CONTROL (ENRAF), SIEMENS
230	Level Switch / Transmitter (Radar type)	CHEMSTROLS (vega), EMERSON(ROSEMOUNT), E & H, TOSHBRO CONTROL (ENRAF), K.MARSHALL
231	Level Switch / Transmitter (Nuclionic type)	CONCORD INTERNATIONAL, EMERSON(KAY RAY), ECIL
232	Level Switch (Electro- mech type)	NIVO CONTROLS, E & H, SB ELECTRO- MECHANICAL
233	Electrical Actuator	AUMA, LIMITORQUE, MARSH – BELLOFRAM, IL, ROTORK, KEYSTONE
234	Self-regulating pressure control valve	SAMSON CONTROLS, NIRMAL IND, FORBES MARSHALL, IL
235	Pneumatic Positioner	IL, FISHER- XOMOX, DRESSER IND. (MASONEILAN), SAMSON CONTROLS, FORBES MARSHALL, ABB, FOURESS, MIL
236	Electro - pneumatic Positioner	FISHER- XOMOX, SIEMENS, DRESSER IND. (MASONEILAN), SAMSON CONTROLS, IL, FORBES MARSHALL
237	Microprocessor base controller	YOKOGAWA, SIEMENS, HONEYWELL, EUROTHERM, FUJI, ABB, FORBES MARSHALL, TOSHIBA
238	Digital scanners	LECTROTEK, MICRO SYSTEM, MASTER ELECTRONICS, MB CONTROLS, MASIBUS, PROCON
239	Annunciation system	IIC, PROCON, MICRO SYSTEM, MINILEC, IL, LECTROTEK, PIRI SYSTEM, PYROTECH, MB CONTROLS, INDUSTRIAL SWITCHGEARS & CONTROLS
240	Instrument Panels / Control desk	RITTAL, PYROTECH, RADHA KRISHNA CONTROLS, IL
241	Gas Detectors	BEILER& LANG (CO - Monitor), DRAGGER, OLDHAM, INDUST. SCIENTIFIC CORPN, DETRONICS
242	ORP/ PH/ Conductivity meter / Transmitter	EMERSON (Analytical), FORBES MARSHALL (Polymetron), YOKOGAWA, ABB, ION EXCHANGE, HONEYWELL
243	Moisture sensor & Transmitter	INVENSYS (Foxboro), BARTEC, GE- PANAMETRICS

244	Vibration sensors & Monitors	BENTLEY NAVEDA, SCHENCK – AVERY, JOSTS ENGG. (Bruel & Kjaer), SPM INSTRU, MECHANALYSIS INDIA (IRD)
245	Positive Displacement Meter	TOSHBRO CONTROLS (Bopp & Reuther), FORBES MARSHALL (Moorco product), LIQUID CONTROLS, EMERSON
246	Annubar / Flow tube	EMERSON, SWITZER
247	Dip Lance type Molten metal temperature - measurement system & T/C Tips	ARDEE ENTP. (Electronite), FERROTRAN
248	Slag detection system	ELOF HANSON (EMLI), LAND
249	SPM Analyser	EMERSON, YOKOGAWA, DURAG, ABB, HONEYWELL, FORBES MARSHALL (Codel),
250	Sox - Nox Analyser	FORBES MARSHALL, EMERSON, YOKOGAWA, ABB, HONEYWELL
251	Temp. Meas. Eqpt, Temp.OXY.- AL Meas. Eqpt. & Online HYDROGEN Meas. Eqpt.	LAGAS MELTECH P.LTD, KOLKATTA
252	Portable CO Detecto	CROWCON
253	Draft Gauge, Inclined tube Manometer	BOMBAY INSTUMENTS
254	Non Contact Level Measuring Instruments	EIP ENVIRO LEVEL CONTROLS
2	**FIRE DETECTION & ALARM. (F.D.A) SYSTEM**	
1	INTELLIGENT DETECTORS (PHOTO ELECTRIC, HEAT, THERMAL, MULTI DETECTOR) UL /FM APPROVED	SIMPLEX / NOTIFIER / EDWARDS/ CYBRUS.
2	INTELLIGENT FIRE ALARM CONTROL PANELS UL /FM APPROVED	SIMPLEX / NOTIFIER / EDWARDS/ CYBRUS.
3	ADDRESSABLE MANUAL CALL POINTS INCLUDING HAND SETS - UL /FM APPROVED	SIMPLEX / NOTIFIER / EDWARDS/ CYBRUS.
4	MONITOR MODULES - UL /FM APPROVED	SIMPLEX / NOTIFIER / EDWARDS/ CYBRUS.
5	FAULT ISOLATION MODULE - UL /FM APPROVED	SIMPLEX / NOTIFIER / EDWARDS/ CYBRUS.
6	CONTROL MODULES UL /FM APPROVED	SIMPLEX / NOTIFIER / EDWARDS/ CYBRUS.
7	UV FLAME DETECTORS UL /FM APPROVED	PATOL / DETRONICS / SPECTREX
8	BEAM DETECTORS UL /FM APPROVED	EDWARDS / NOTIFIER / SIMPLEX / CYBRUS.
9	IR FLAME DETECTORS / SOLAR BLIND EMBER, FIRE UL /FM APPROVED	ODTI / PATOL / DET-TRONIX / SPECTREX

10	ANALOG LINEAR HEAT SENSING CABLE A) WITH METAL BRAID STEEL/BRONZE, COPPER B) WITH NYLON BRAID UL /FM APPROVED	KIDDE / L.G.M / PATOL.
11	DIGITAL LINEAR HEAT SENSING CABLE A) WITH NYLON BRAID B) WITH METAL BRAID STEEL, BRONZE, COPPER . C) WITH OPTICAL FIBRE UL /FM APPROVED CONTROL UNIT FOR DIGITAL LHS CABLE UL /FM APPROVED	KIDDE / L.G.M / PATOL.
12	VIDEO DISPLAY UNIT INCLUDING CPU, PC, MONITOR, PRINTER ETC.	DELL / HP / HCL / WIPRO / IBM COMPATIBLE.
13	SIREN	KHERAJ / BEMCO / TULU
14	CABLES A: FOR DETECTOR CABLING IMPORTED INDIGENOUS	BELDON / SOUTHWEST / ALPHA FINOLEX / DELTON / UNIVERSAL / NICCO / POLYCAB / FORTGLOSTER / HAVELLS
15	POWER CABLE	FINOLEX / DELTON / UNIVERSAL / NICCO / POLYCAB / FORTGLOSTER / HAVELLS
16	SIGNAL CABLE	USHA BELTON / HCL / DELTON / VINDHYA TELELINK, SERVEL UDYOG
17	M.S.CONDUIT AS PER IS-9537-PART-II- 1981	NICCO / BHARAT / ZENITH / BEC / CENTURY
18	GI CONDUITS	BEC / NICCO / ZENITH
19	ROAD CROSSING G.I PIPES	NICCO / TATA / JINDAL
20	FDA SYSTEM SUPPLIERS	
A	Conventional	TECHNICAL TRADE LINKS PVT. LTD, GUNNEBO INDIA LTD, MATHER & PLATT PUMPS (I) LTD., M/S AGNICE FIRE PROTECTION LTD, M/S TECHNICO (INDIA) PVT. LTD, HONEYWELL, STEELAGE MUMBAI, EDWARD SYSTEM INTERNATIONAL, SUNAG ENGG., SIEMENS
b	Wireless - Complete system including- Controls, Hardwire & Accessories etc.	ECIL, DIANOSTICS PVT. LTD
21	HYDRANTS	VIVEK ENGG. CORPN. BANGALORE, ZENITH FIRE SERVICES MUMBAI, AFS CONTROL SYSTEM KOLKATTA
22	FOAM MONITOR & MOBILE UNIT	HINDUSTAN ENTERPRISES CUTTACK, VIVEK ENGG. CORPN. BANGALORE, AFS CONTROL SYSTEM, KOLKATTA

23	WATER SPRAY & CO2 FLOODING SYSTEM	VIVEK ENGG. CORPN. BANGALORE
24	TENDER VEHICLES	HINDUSTAN ENTERPRISES CUTTACK, NEW AGE INDUSTRIES MUMBAI, STEELAGE, MUMBAI, VIVEK ENGG. CORPN. BANGALORE
25	Magnetic Proximity Switches and Audio visual Alaram	VIRTUAL INDUSTRIES
3	**TELECOMMUNICATION EQPT.**	
1	ELECTRONIC PRIVATE AUTOMATIC BRANCH TELEPHONE EXCHANGE (EPABX) SUPPLIERS	1. M/S INDIAN TELEPHONE INDUSTRIES LIMITED. 2. M/S AVAYA GLOBAL CONNECT LIMITED. 3. M/S SIEMENS LIMITED. 4. M/S ALCATEL. 5. M/S B.P.L TELECOM PVT. LIMITED. 6. M/S CROMPTION GREAVES LIMITED.
2	LOUD SPEAKER TALK BACK (LSTB) / LOUD SPEAKER INTERCOMMUNICATN. (LSIS)SYSTEM SUPPLIERS	1. M/S POWER SYSTEMS 2. PHI-AUDIOCOM 3. M/S MOTAWANE PRIVATE LTD
3	TELEPHONE CABLE SUPPLIERS	1. DELTON CABLES., CORD CABLE 2. TELE-LINK NICCO 3. FINOLEX 4. CORDS CABLE 5. RR CABLE
4	PRESS TO TALK	PHI AUDICOM BYTE COMMUNICATION, DELHI
5	VHF COMMUNICATION SYSTEM	MOTOROLA MAKE
4	**FIRE PROTECTION SYSTEM**	
1	Steel pipes	SAIL, ITC, JINDAL, Ajanta, Maharashtra Seamless, Prakash Tubes Gujarat Steel tubes, TATA, Zenith, Indian seamless Ratan Deep
2	Steel pipes fittings	Tube Bends, Jindal, Ajanta Shivananda, ITC, TISCO, Prakash, Sidharth & Goutam, PTS NL Hazra,M.Brother,Shyam Engg., Deekay EBY Industries, MS Fittings, Nomaan
3	Spray nozzles/Projectors -	UL Listed Product.
4	Deluge valves	UL Listed Product.
5	Outside coating & Wrapping for pipes	IWL / LLOYDS
6	Quartzoid bulb detector	UL Listed Product
7	Diesel Engine	Cummins, Greaves, KOEL, Caterpilar
8	Fire extinguishers	Zenith, Minimax, Safex, Peter Autokits, Lightex, Vivek Engg.,Zenith, AFS Control
9	Fixed fire protection system	TYCO, Technico (India), Vecaun Projects, New Fire Engineer, Gunnebo, Agnice, Mather & Platt

10	Passive Fire protection	Llyod, 3M, Vijay System, Signum AFS Control., Vivek Engg., New Age Ind., Nitin industries, Navair Intl. Ltd.
5	**BOF GCP EQUIPMENTS:-**	
1	Hood, Stack and Lance sealing device	ISGEC, ACC-BABCOCK (ABL), BHPVL, L & T
2	Hood traverse carriage, Stack inspection device, Hood bottom closure device	L&T, WMI CRANES, JESSOP, MUKAND
3	Pressure vessels - Expansion vessel, Mixing drum, Make-up water tank, Sample cooler, Blow -down & drainage expansion tanks and Emergency spray vessel	ISGEC, ABL, BHPVL, TSL, KAVERI ENGG
4	Additive feeding system	BEEKAY, SIMPLEX, MUKAND
5	Gas holder	MICCO, SMS-DEMAG, CLAYTON - WALKER
6	Fabricated gas ducts (Dia> , 1200 mm), Trestles/Duct , Supports, Flare stack structure Walkways/Accesses	BEEKAY, ROURKELA FABRICATION, BHARAT WEST - FALIA, SUBURBAN ENGG., KM UDYOG, OTTO, APV
7	Electrostatic precipitator (w et type)	VOLTAS, OTTO, ORIENT, ANDREW YULE
8	ID fan	NEU (France), JAMES HOWDEN (UK), ROTHEMUHLE (Germany), DONKIN (UK), FLAKTWOODS, REITZ, BATLIBOI, ANDREW YULE, ARF ENGG, NADI AIRTECHNICS, PHOENIX YULE, C.DOCTOR
9	Centrifugal horizontal CW pumps	INGERSOLL, SULZER INGERSOLL, SULZER
10	Fabricated equipments – Stack Cover Plate, Saturator, Hydraulic seal Recycling tank, Convergent/Divergent ducts, Changeover device, Hydraulic non-return valve, Condensate seal pots, Sump cover	NHEC, BHPVL, KCP, BINNY ENGG. WORKS, ABL, ISGEC, OTTO
6	**INFORMATION SYSTEM**	
1	Computer equipment	IBM/HP/SONY
2	Dot Matrix Printer	EPSON/TVSE
3	Network Equipment	
a	ACTIVE COMPONENTS	CISCO/Nortel/3-Com
b	Passive components	Lucent/AMP/D-Link
4	Application software including- Process control models	Technology Supplier

Annexure- 1

Format for deviations

Sl. No.	Clause No.	Deviations	Amount of variation (+/-) to retain the tender conditions	Reason for Deviation

The Tenderer hereby certifies that the above mentioned are the only deviations from the tender documents.

Signature :

Name :

Designation :

Company Seal

Annexure - 2

PERFORMANCE GUARANTEE

1.0 PERFORMANCE GUARANTEE TEST (PG)

1.1 Performance guarantee tests will be carried out at site after installation and successful commissioning of the equipment.
1.2 All guarantees will be proved at site after installation and successful commissioning of the equipment. The successful tenderer will make arrangements for all necessary instruments and accessories required for the guarantee tests at no extra cost.
1.3 The performance guarantee test will be carried out at the site in line with the requirements indicated below taking care of the following.
1.4 List of performance guarantee parameters are as follows

Sl. No.	Guaranteed parameters	Guaranteed value	Acceptable Tolerance Limit	LD within Tolerance
1.0	Speed test			
1.1	Hoisting (MH & AH)	Design Speed as per approved GA drawing	0 to -10%	0 to -5% No LD,<-5% to -10% LD @ 0.5% for each percentage (%) or fraction of basic price
1.2	Lowering(MH & AH)	Design Speed as per approved GA drawing	0 to + 10%	0 to +5% No LD, >+5% to +10% LD @0.5% for each percentage (%) or fraction of basic price.
1.3	Cross travel	Design Speed as per approval GA drawing	± 10%	<-5% to -10% LD @ 0.5% for each percentage (%) or fraction of basic price
1.4	Long Travel	Design Speed as per approved GA drawing	± 10%	<-5% to -10% LD @ 0.5% for each percentage (%) or fraction of basic price

1.4 The performance tests will be carried out for three (3) consecutive times and average results obtained shall be considered.
1.5 If results of the performance tests are not satisfactory, then those tests shall be repeated by the successful tenderer after necessary rectification and adjustment.

Annexure - 3

ERECTION AND COMMISSIONING

1.0 The successful tenderer will be required to carry out at site the complete erection of the equipment supplied by him as well as start- up, commission and conduct performance test for the same. The successful tenderer will be responsible for the satisfactory erection, testing and commissioning of the cranes. He will also be responsible for providing all necessary tools, tackles, load handling cradles, slings etc. and instruments required for erection, testing commissioning and PG test.

2.0 Preliminary Acceptance Certificate (PAC) Refer provisions indicated in GCC.

3.0 Commissioning

3.1 After issue of PAC by Employer, successful tenderer will conduct commissioning test for the crane with attachments / electric hoists

3.2 A commissioning test procedure will be agreed before the commissioning test as per IPSS: 2- 02- 008- 97. However these following tests but not limiting to the following will be conducted:

a) Deflection test
b) Overload test, if found necessary.
c) Height of lift
d) Speed test
e) Performance test
f) Horn, lights, alarm check
g) Air –condition system start- up and functionality check.
h) Functionality of attachment check

3.3 The crane with the attachment will be operated with 100% load for all motions as required and specified in the Technical Specification/ GTS and tests will be carried out as indicated above.

3.4 All the tests should be conducted within a period of three (3) days. If any major defect/ deficiency observed the tests will be repeated after necessary repair/ replacement of the defective part/ parts.

3.5 The commissioning certificate will be issued after liquidation of all defects and successful completion of all tests.
The cranes and hoists including attachments, if any, are under operation for a minimum period of sixty (60) days from the date of commissioning tests without any major problem.

Annexure - 4

INSPECTION AT MANUFACTURERS PREMISES

1.1 All items under the scope of the specification will be inspected as per Approved QAP by Purchaser.

1.2 All necessary tests will be carried out by the tenderer to demonstrate whether the materials and equipment offered conform to the relevant standards specifications. The successful tenderer will include and provide for in his offer all facilities which will enable inspection by the employer or his authorized representatives as stipulated in, IS 4137-1985, IPSS 2- 02- 008- 97 and 2- 02- 002- 01.

1.3 The equipment will be shop assembled for checking the accuracy of parts and alignment, except where assembling is to be done at site. If disassembly is required for transport, parts will be adequately marked, where necessary, with permanent match markings to facilitate re-assembly at site.

1.4 The drives mounted inside E-room will be inspected by M/s RSP at the drive vendor’s premises.

3339.91.001

ROURKELA STEEL PLANT, ROURKELA

SINGLE LINE DIAGRAM

BAY	CRANE CAPACITY	QTY. OF CRANE	LT RAIL LEVEL	BAY LENGTH	AMBIENT TEMPERATURE
R-S BAY (SMS II SHOP)	40+40T X 30.5M	1	+12.0M	55M	55°C

CATEGORY OF DRG.	APPROVAL	INFORMATION	REFERENCE	RECORD	CONSTRUCTION

SAIL-RSP

CUSTOMER: ROURKELA STEEL PLANT,ROURKELA,ORISSA

CONTRACTOR: HEAVY ENGINEERING CORPORATION LTD. RANCHI

PACKAGE DESCRIPTION: EOT CRANE FOR R-S BAY OF SMS-II

TITLE : SINGLE LINE DIAGRAM FOR 40 + 40T X 30.5 EOT CRANE

DRAWN BY	JITENDRA		SCALE :
Design	RAVI		HEC DRAWING NO. 3339.91.001 (SHEET-1 OF 12) — REV
Chkd	R. K. SINGH		
G.LEADER	T. K. SAHU		PROJECT DRAWING NO. — 1
Approved	R. N. JHA		
DATE			

INDEX	NO.	REVISION	SIGNATURE	DATE

Rev. 1

3339.91.001

SUPPLY SYSTEM DETAILS :-

POWER SUPPLY FOR MOTORS : 415V +10% to -15%, 50Hz +6% to -6%, 3Ph, 4 wire solidly earthed
CONTROL SUPPLY : 240V +10% to -15% , 50Hz +6% to -6%, 1Ph
LIGHTING SUPPLY : 240V +10% to -15% , 50Hz +6% to -6%, 1Ph
BRAKE SUPPLY : 415V +10% to-15%, 50Hz +4% to -6%(with brake rectifier)
FAULT LEVEL : 50 KA FOR 1 SEC.
AMBIENT TEMP. : 55° C

DETAILS OF DRIVE MOTORS & BRAKE :-

MECHANISM	CRANE DUTY SQ. CAGE INDUCTION MOTOR								Est.ST.CURRENT AT		VFD		AFE		D.C.BRAKE		RECTIFIER PANEL
	FRAME KW AT 40°C S1,DUTY	FRAME KW AT RATED AMBIENT & DUTY	Mech Power (LOAD KW)	RPM (SYN)	DUTY & CDF	STARTS PER HR	FRAME SIZE	QTY. of MOTOR	KW AT RATED AMB. & DUTY AMPS.	MECH KW AMPS.	CURRENT RATING AT 50°C	QTY.	CURRENT RATING AT 50°C	QTY.	DIA. IN MM	QTY.	
MH	200	171.13	118	750	S4, 60%	300	355L	2	329A	261A	494A	2 + 1 =3 SETS	1414A	1+1(stand by)	ø500	4	2
AH	90	77.01	59	750	S4, 60%	300	315L	1	147A	124A	221A	1 SET			ø400	2	1
CT	75	46.11	32	1000	S4, 60%	300	315S	1	96A	79A	144A	1 SET			ø300	1	1
LT	55	33.81	26	1000	S4, 60%	300	280M	4	71A	62A	213A	2 SETS			ø300	4	2

Note:- 1. Electrical Kw and motor frame sizes are tentative and shall be confirmed by vendors.
2. Current ratings are tentative estimated values and shall be finalized after finalization of motors.
3. Rating of the inverter shall be min 150% of the motor rated current at specified ambient and duty.
4. Current rating of the AFE selected is sum of current rating of inverters of two largest mechanisms
5. Laser beam type non contact anticollision system will be provided.

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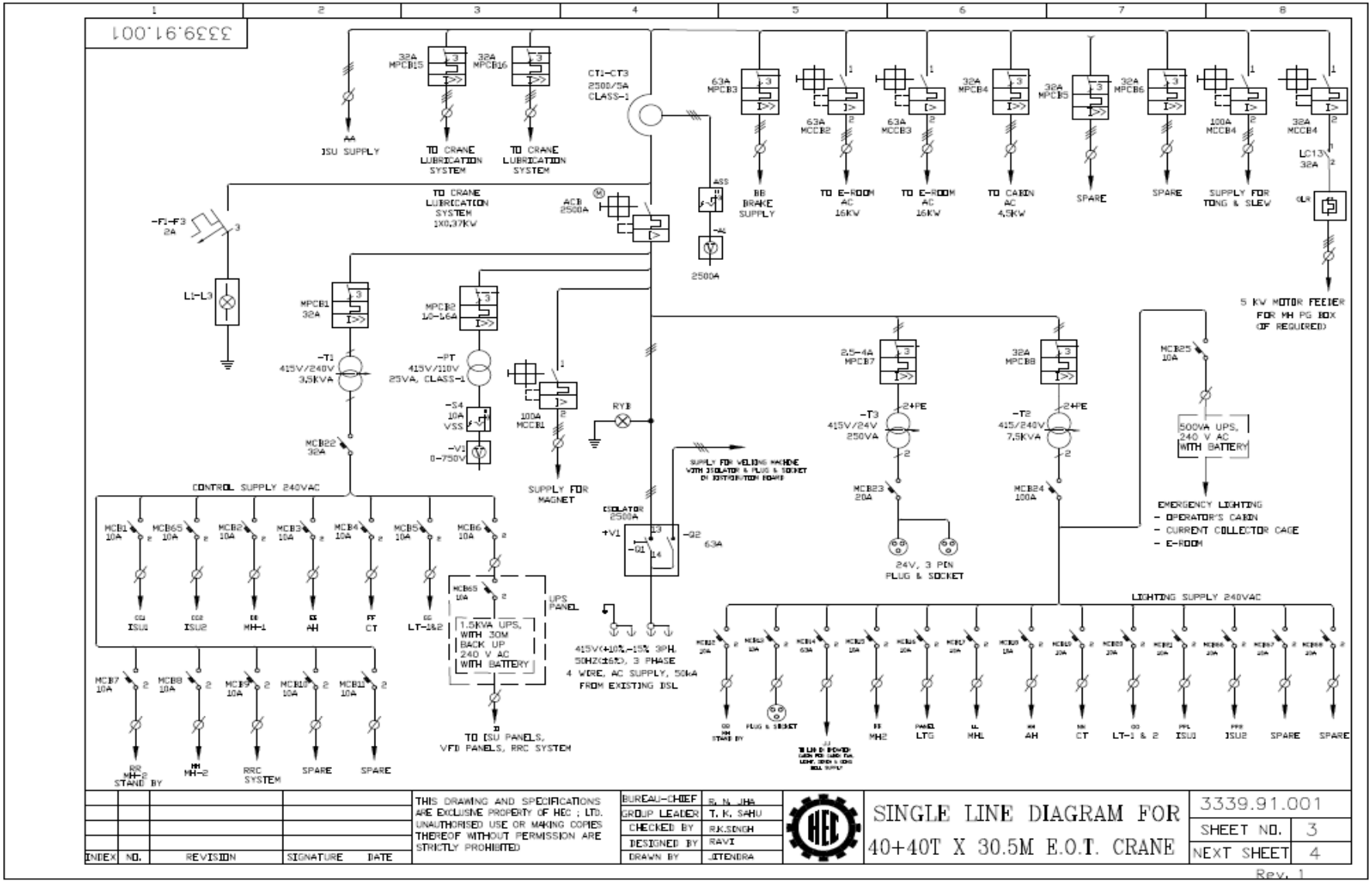
BUREAU-CHIEF	R. N. JHA
GROUP LEADER	T. K. SAHU
CHECKED BY	R. K. SINGH
DESIGNED BY	RAVI
DRAWN BY	JITENDRA

SINGLE LINE DIAGRAM FOR 40+40 T X 30.5M E.O.T. CRANE

3339.91.001	
SHEET NO.	2
NEXT SHEET	3

Rev. 1


3339.91.001
SINGLE LINE DIAGRAM FOR 40+40T X 30.5M E.O.T. CRANE
3339.91.001
SHEET NO. 3
NEXT SHEET 4
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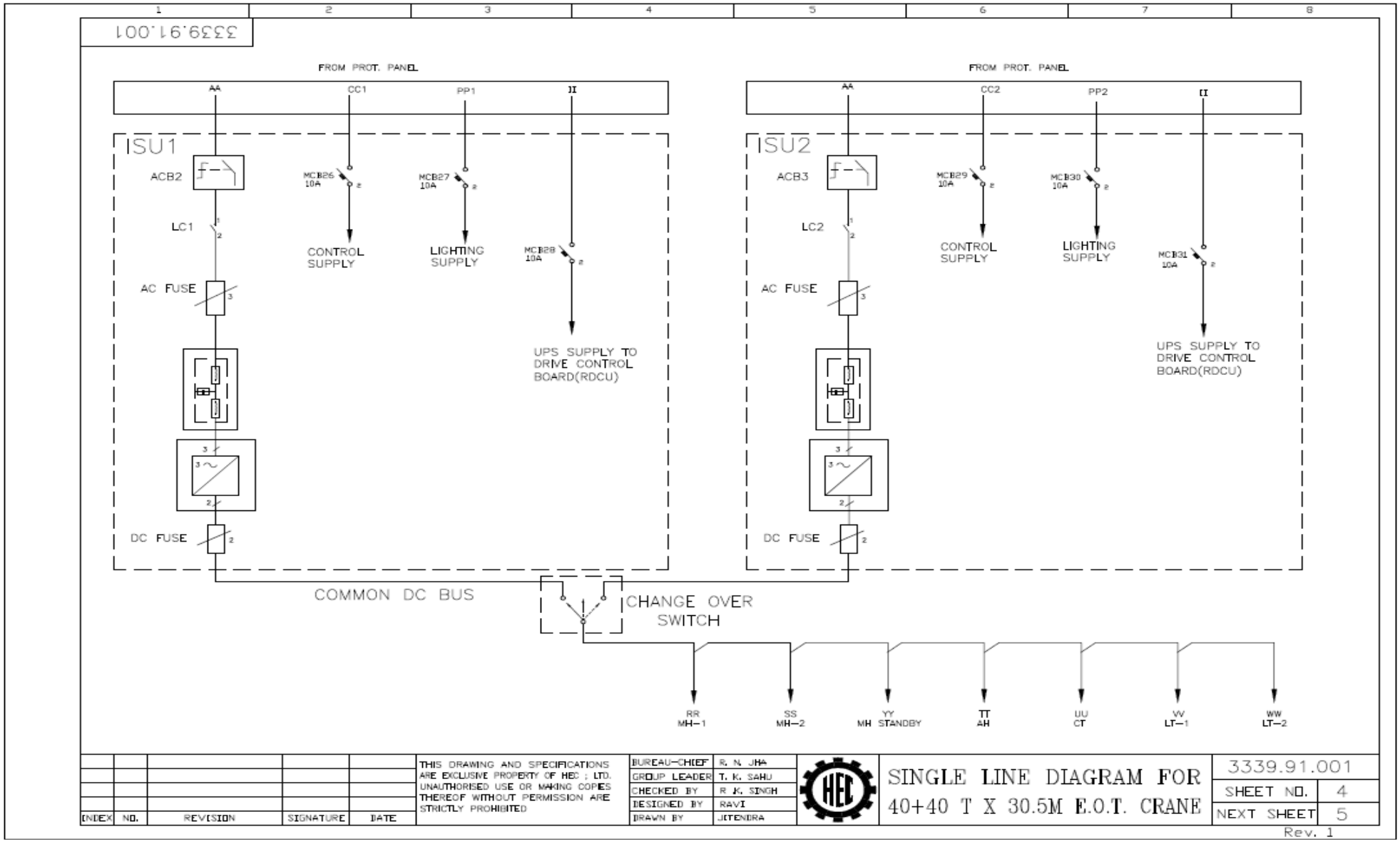
GROUP LEADER T. K. SAHU
CHECKED BY R.K.SINGH
DESIGNED BY RAVI
DRAWN BY JITENDRA
INDEX NO. REVISION SIGNATURE DATE
CT1-CT3 2500/5A CLASS-1
TO CRANE LUBRICATION SYSTEM 1X0.37KW
ACB 2500A
2500A
BB BRAKE SUPPLY
TO E-ROOM AC 16KW
TO E-ROOM AC 16KW
TO CABIN AC 4.5KW
SPARE
SPARE
SUPPLY FOR TONG & SLEW
5 KV MOTOR FEEDER FOR MH PG BOX (IF REQUIRED)
ISU SUPPLY
TO CRANE LUBRICATION SYSTEM
TO CRANE LUBRICATION SYSTEM
-T1 415V/240V 3.5KVA
-PT 415V/110V 25VA, CLASS-1
-T3 415V/24V 250VA
-T2 415V/240V 7.5KVA
CONTROL SUPPLY 240VAC
SUPPLY FOR MAGNET
SUPPLY FOR WELDING MACHINE WITH ISOLATOR & PLUG & SOCKET IN DISTRIBUTION BOARD
ISOLATOR 2500A
24V, 3 PIN PLUG & SOCKET
500VA UPS, 240 V AC WITH BATTERY
EMERGENCY LIGHTING
- OPERATOR'S CABIN
- CURRENT COLLECTOR CAGE
- E-ROOM
LIGHTING SUPPLY 240VAC
1.5KVA UPS, WITH 30M BACK UP 240 V AC WITH BATTERY
UPS PANEL
TO ISU PANELS, VFD PANELS, RRC SYSTEM
415V(+10%,-15% 3PH. 50HZ(±5%), 3 PHASE 4 WIRE, AC SUPPLY, 50kA FROM EXISTING DSL
ISU1
ISU2
MH-1
AH
CT
LT-1&2
MH-2 STAND BY
MH-2
RRC SYSTEM
SPARE
SPARE
PLUG & SOCKET
MH2
PANEL LTG
MHL
AH
CT
LT-1 & 2
ISU1
ISU2
SPARE
SPARE


3339.91.001
FROM PROT. PANEL
AA
CC1
PP1
II
ISU1
ACB2
MCB26 10A
MCB27 10A
MCB28 10A
LC1
CONTROL SUPPLY
LIGHTING SUPPLY
AC FUSE
UPS SUPPLY TO DRIVE CONTROL BOARD(RDCU)
DC FUSE
FROM PROT. PANEL
AA
CC2
PP2
II
ISU2
ACB3
MCB29 10A
MCB30 10A
MCB31 10A
LC2
CONTROL SUPPLY
LIGHTING SUPPLY
AC FUSE
UPS SUPPLY TO DRIVE CONTROL BOARD(RDCU)
DC FUSE
COMMON DC BUS
CHANGE OVER SWITCH
RR MH-1
SS MH-2
YY MH STANDBY
TT AH
UU CT
VV LT-1
WW LT-2
INDEX
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GROUP LEADER T. K. SAHU
CHECKED BY R. K. SINGH
DESIGNED BY RAVI
DRAWN BY JITENDRA
SINGLE LINE DIAGRAM FOR 40+40 T X 30.5M E.O.T. CRANE
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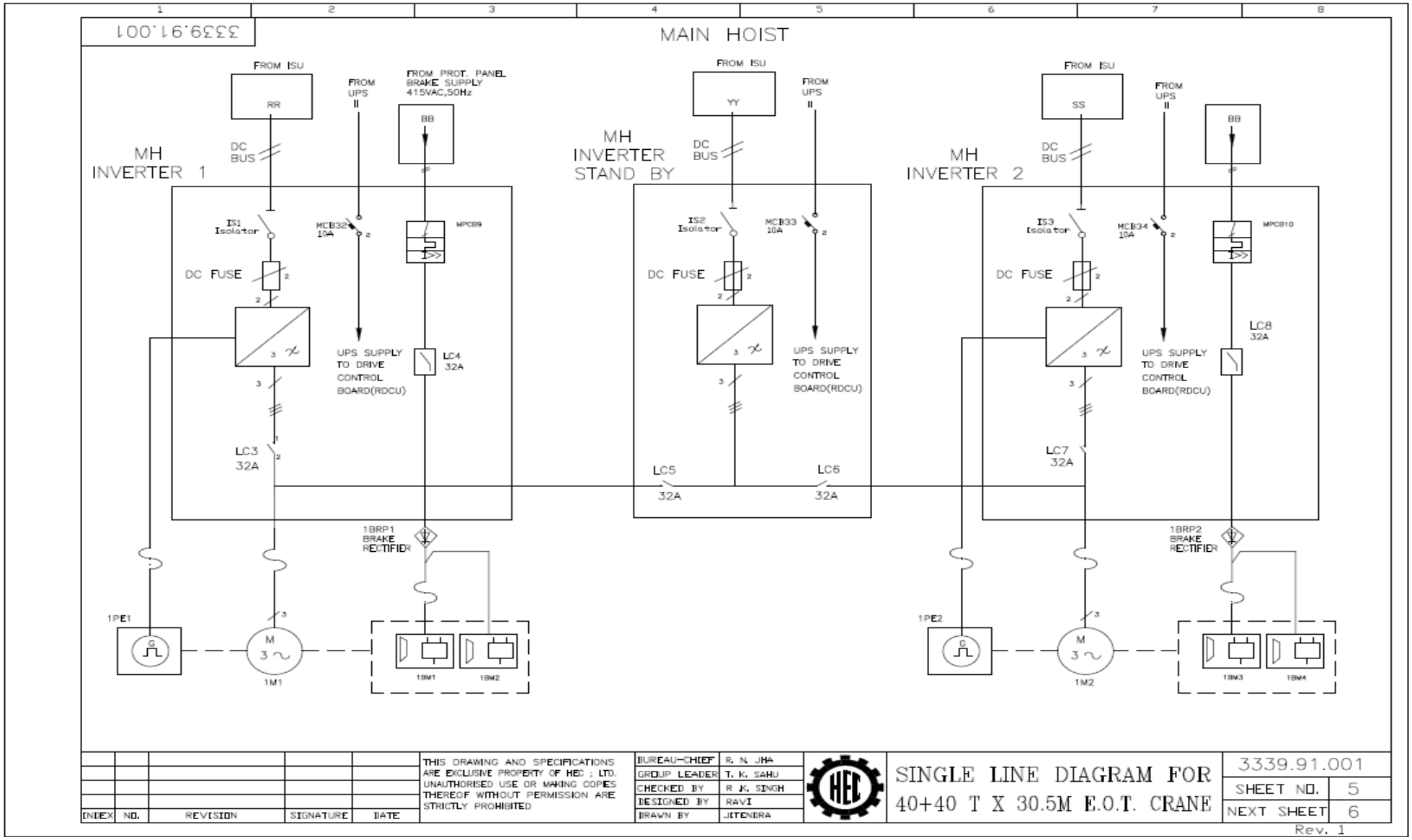
3339.91.001
MAIN HOIST
MH INVERTER 1
MH INVERTER STAND BY
MH INVERTER 2
FROM ISU
RR
YY
SS
FROM UPS II
FROM PROT. PANEL BRAKE SUPPLY 415VAC,50Hz
BB
DC BUS
IS1 Isolator
IS2 Isolator
IS3 Isolator
MCB32 10A
MCB33 10A
MCB34 10A
MPCB9
MPCB10
DC FUSE
UPS SUPPLY TO DRIVE CONTROL BOARD(RDCU)
LC4 32A
LC8 32A
LC3 32A
LC7 32A
LC5 32A
LC6 32A
1BRP1 BRAKE RECTIFIER
1BRP2 BRAKE RECTIFIER
1PE1
1PE2
1M1
1M2
1BM1
1BM2
1BM3
1BM4
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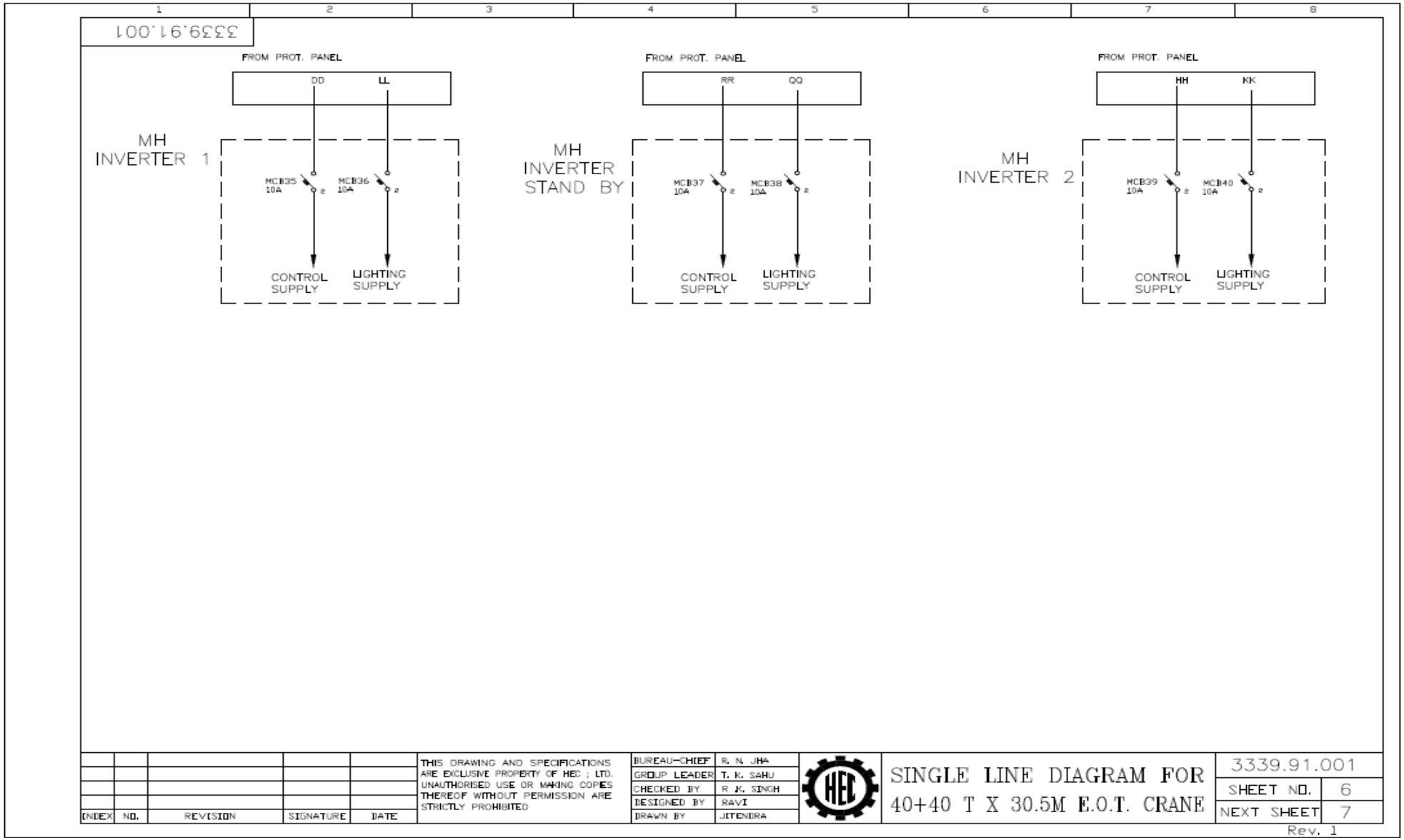
NEXT SHEET 6
Rev. 1


3339.91.001
FROM PROT. PANEL
DD
LL
MH INVERTER 1
MCB35 10A
MCB36 10A
CONTROL SUPPLY
LIGHTING SUPPLY
FROM PROT. PANEL
RR
QQ
MH INVERTER STAND BY
MCB37 10A
MCB38 10A
CONTROL SUPPLY
LIGHTING SUPPLY
FROM PROT. PANEL
HH
KK
MH INVERTER 2
MCB39 10A
MCB40 10A
CONTROL SUPPLY
LIGHTING SUPPLY
INDEX NO. REVISION SIGNATURE DATE
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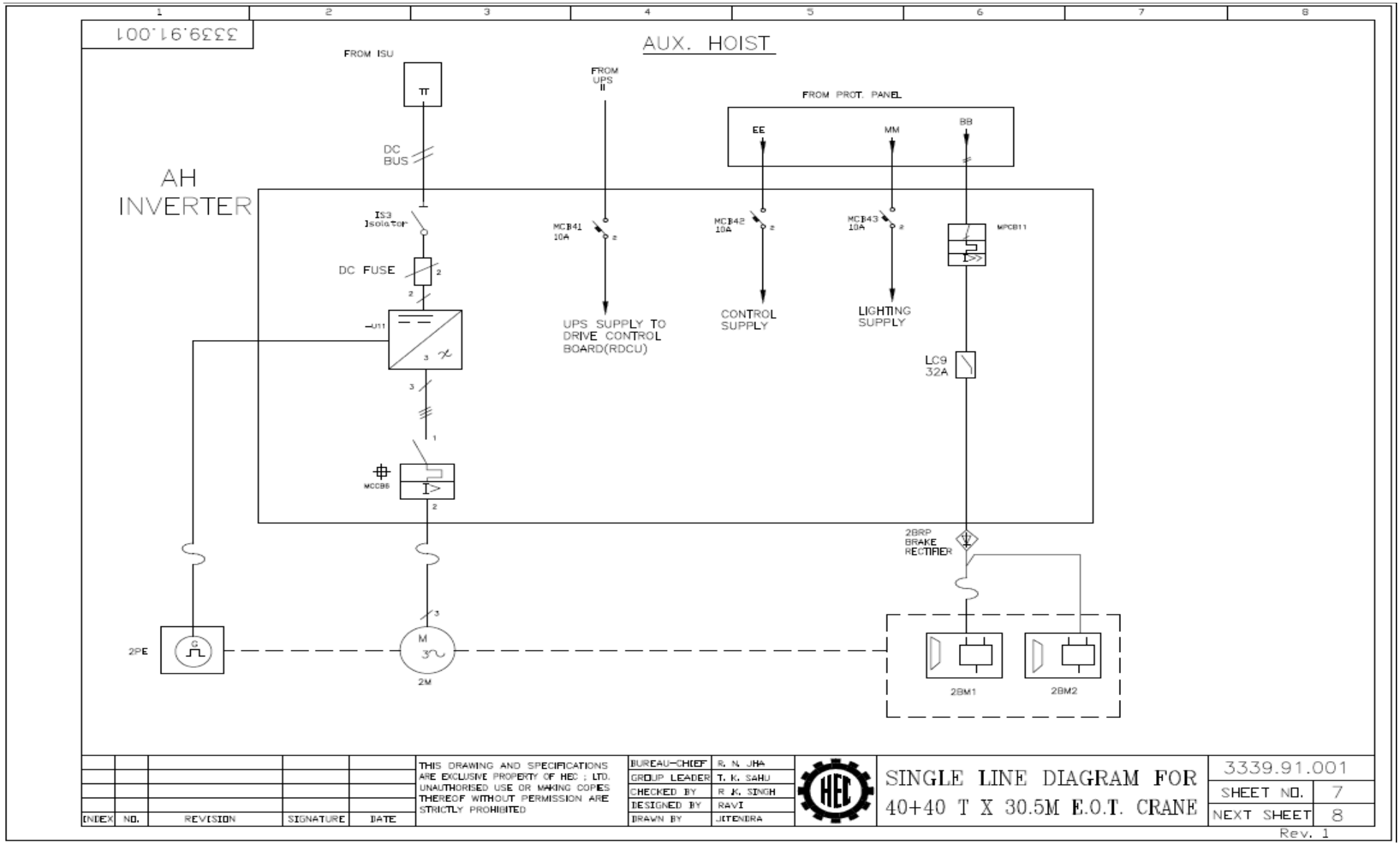
BUREAU-CHIEF R. N. JHA
GROUP LEADER T. K. SAHU
CHECKED BY R. K. SINGH
DESIGNED BY RAVI
DRAWN BY JITENDRA
SINGLE LINE DIAGRAM FOR 40+40 T X 30.5M E.O.T. CRANE
3339.91.001
SHEET NO. 6
NEXT SHEET 7
Rev. 1


3339.91.001
AUX. HOIST
FROM ISU
TF
DC BUS
AH INVERTER
IS3 Isolator
DC FUSE
-U11
MCCB6
FROM UPS II
MCB41 10A
UPS SUPPLY TO DRIVE CONTROL BOARD(RDCU)
FROM PROT. PANEL
EE
MM
BB
MCB42 10A
CONTROL SUPPLY
MCB43 10A
LIGHTING SUPPLY
MPCB11
LC9 32A
2BRP BRAKE RECTIFIER
2PE
2M
2BM1
2BM2
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3339.91.001
SHEET NO. 7
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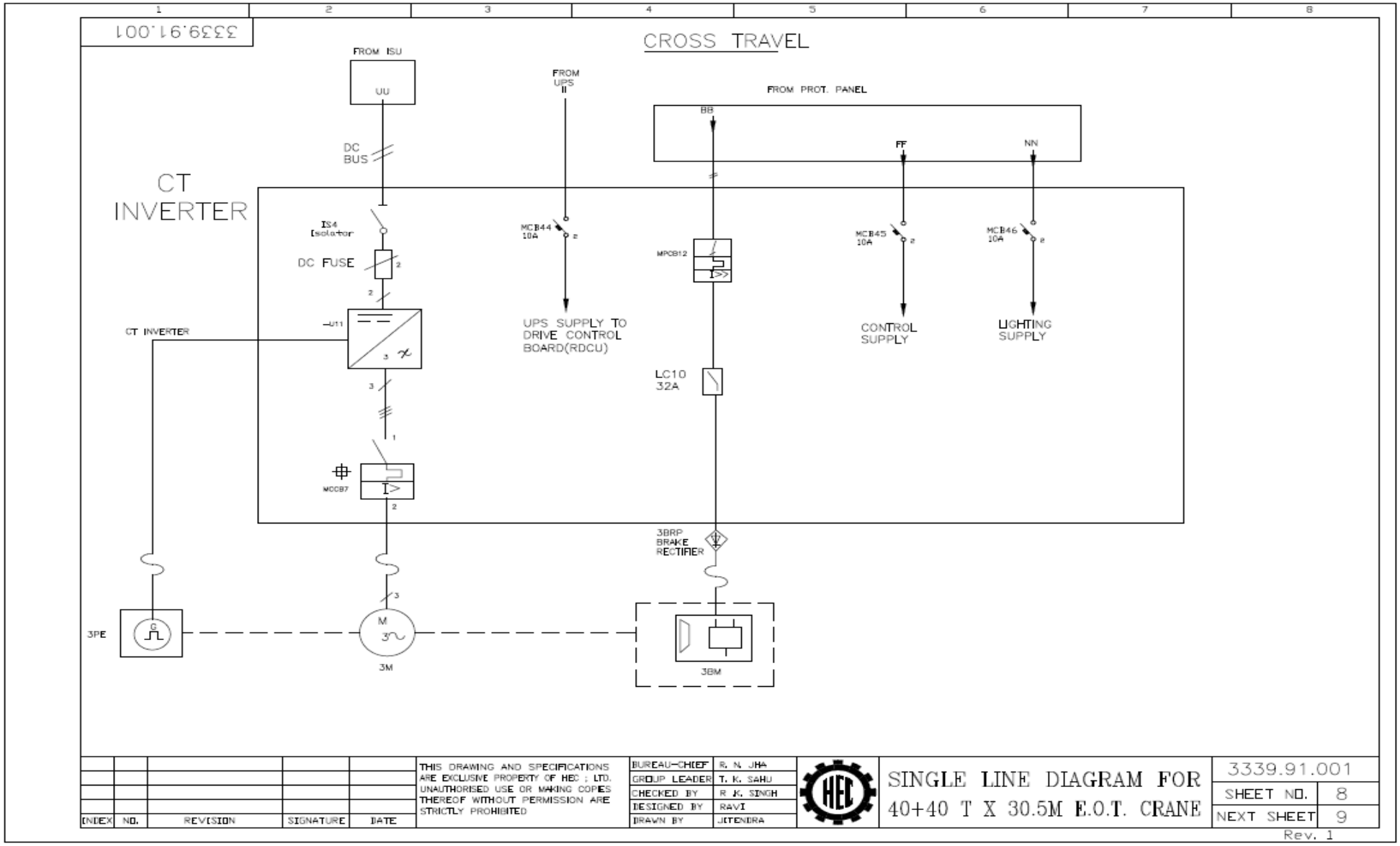
Rev. 1


3339.91.001
CROSS TRAVEL
FROM ISU
UU
FROM UPS II
FROM PROT. PANEL
BB
FF
NN
DC BUS
CT INVERTER
IS4 Isolator
DC FUSE
MCB44 10A
MPCB12
MCB45 10A
MCB46 10A
UPS SUPPLY TO DRIVE CONTROL BOARD(RDCU)
CONTROL SUPPLY
LIGHTING SUPPLY
CT INVERTER
-U11
LC10 32A
MCCB7
3BRP BRAKE RECTIFIER
3PE
3M
3BM
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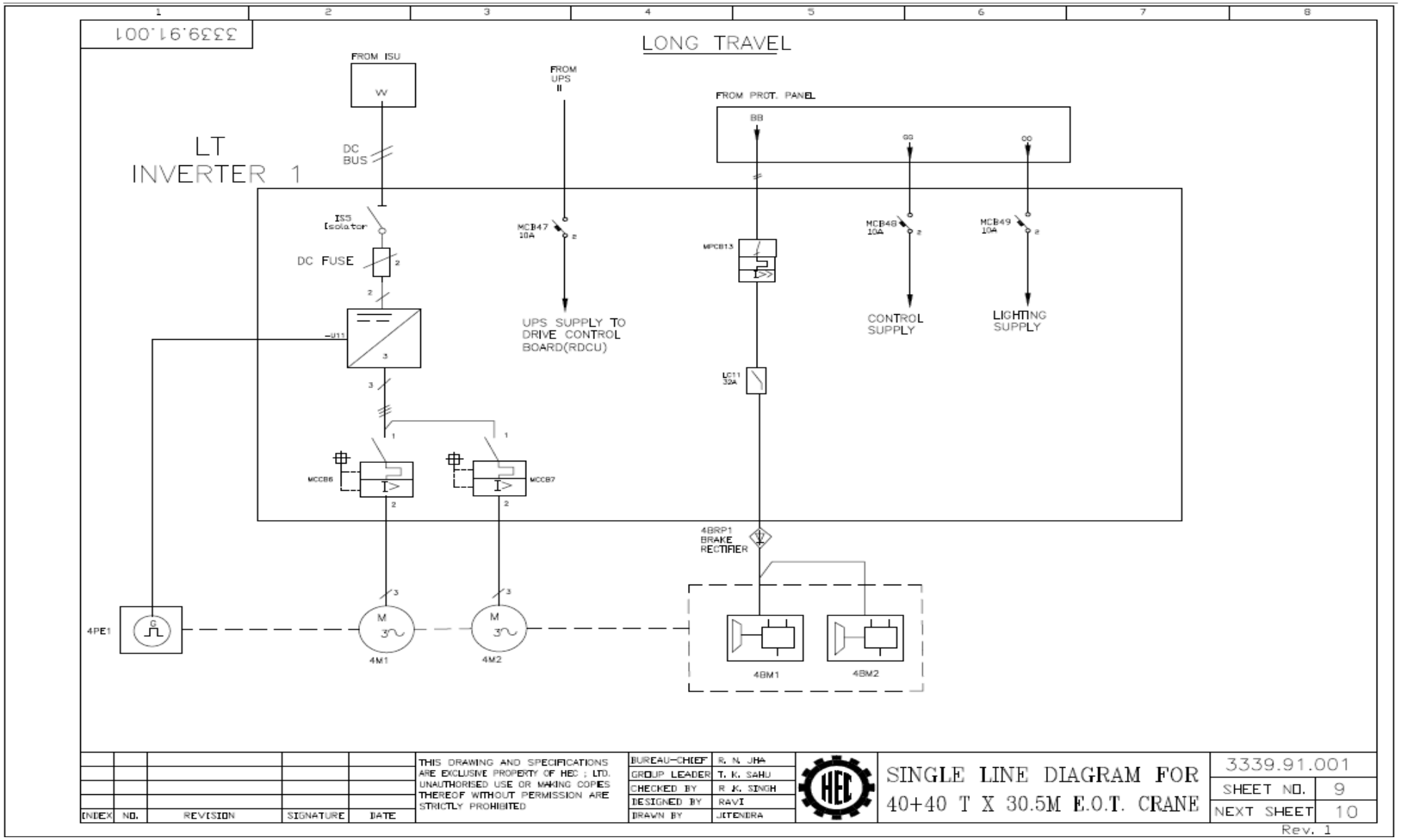
3339.91.001
SHEET NO. 8
NEXT SHEET 9
Rev. 1


3339.91.001
LONG TRAVEL
FROM ISU
FROM UPS II
FROM PROT. PANEL
LT INVERTER 1
DC BUS
ISS Isolator
DC FUSE
MCB47 10A
MCB48 10A
MCB49 10A
MPCB13
UPS SUPPLY TO DRIVE CONTROL BOARD(RDCU)
CONTROL SUPPLY
LIGHTING SUPPLY
LC11 32A
MCCB6
MCCB7
4BRP1 BRAKE RECTIFIER
4PE1
4M1
4M2
4BM1
4BM2
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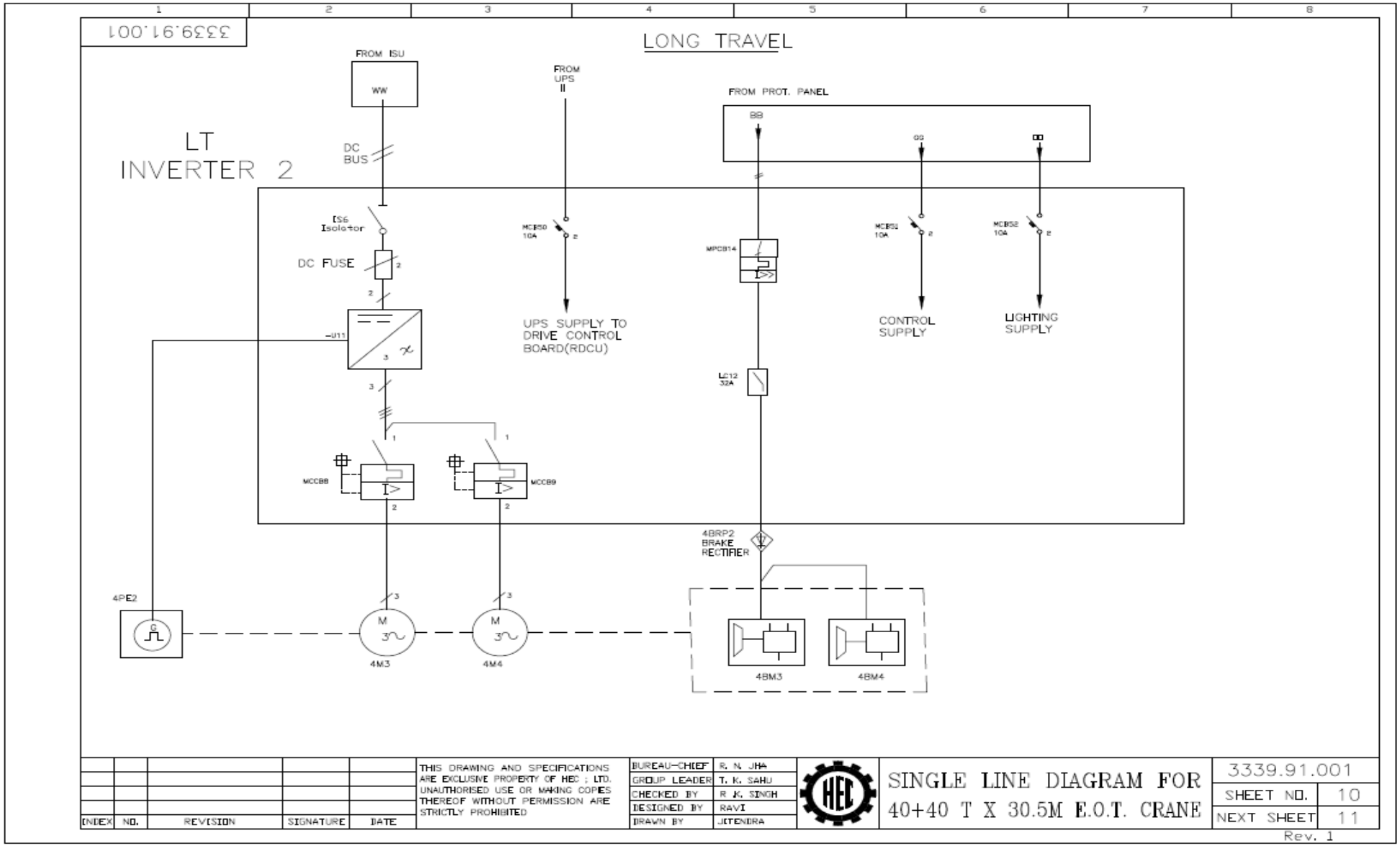
SINGLE LINE DIAGRAM FOR 40+40 T X 30.5M E.O.T. CRANE
3339.91.001
SHEET NO. 9
NEXT SHEET 10
Rev. 1


3339.91.001
LONG TRAVEL
LT INVERTER 2
FROM ISU
WW
DC BUS
FROM UPS II
FROM PROT. PANEL
BB
GG
DD
IS6 Isolator
DC FUSE
MCB50 10A
MCB51 10A
MCB52 10A
MPCB14
UPS SUPPLY TO DRIVE CONTROL BOARD(RDCU)
CONTROL SUPPLY
LIGHTING SUPPLY
LC12 32A
MCCB8
MCCB9
4BRP2 BRAKE RECTIFIER
4PE2
4M3
4M4
4BM3
4BM4
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SINGLE LINE DIAGRAM FOR 40+40 T X 30.5M E.O.T. CRANE
3339.91.001
SHEET NO. 10
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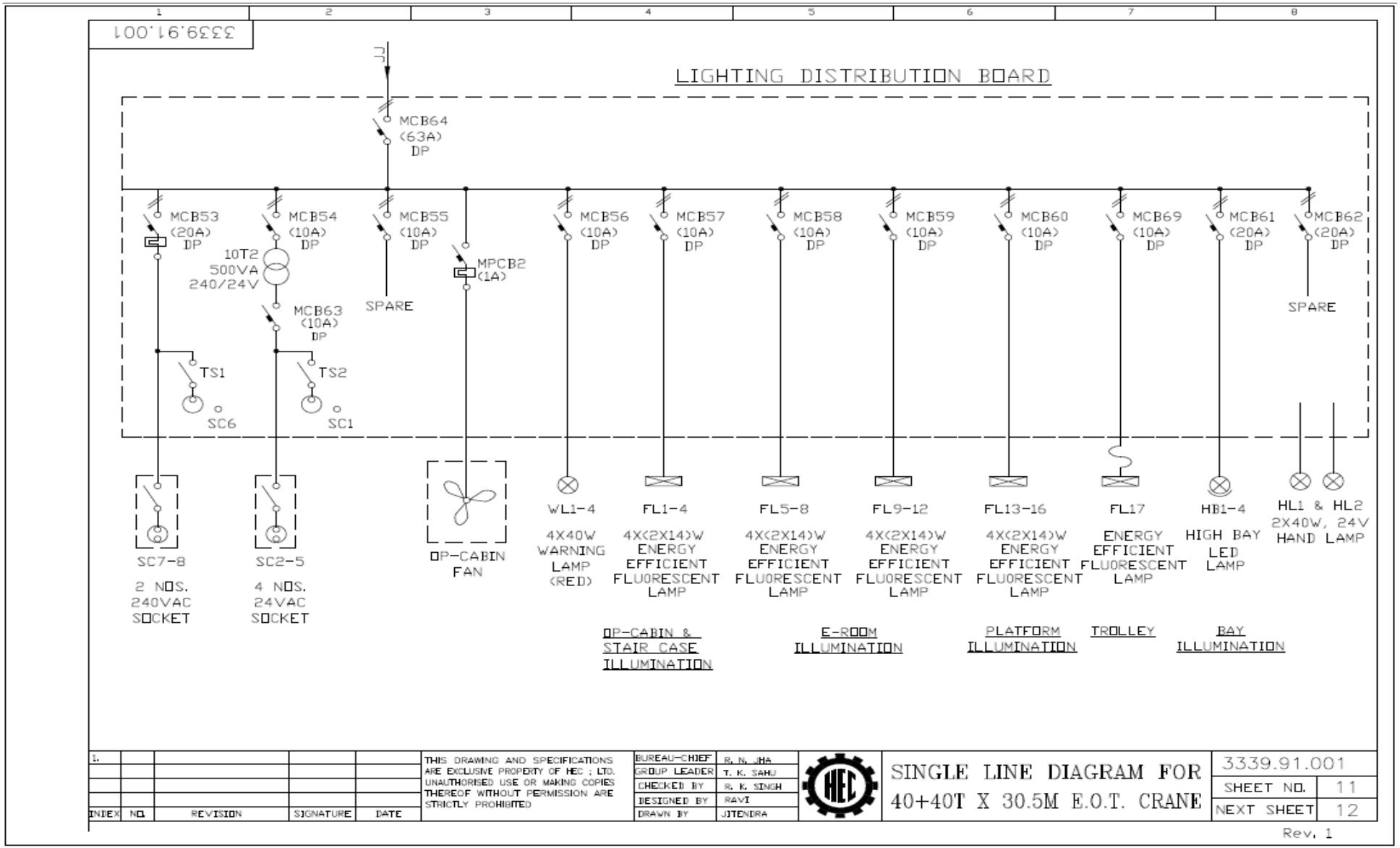
3339.91.001
LIGHTING DISTRIBUTION BOARD
JJ
MCB64 (63A) DP
MCB53 (20A) DP
MCB54 (10A) DP
MCB55 (10A) DP
MPCB2 (1A)
MCB56 (10A) DP
MCB57 (10A) DP
MCB58 (10A) DP
MCB59 (10A) DP
MCB60 (10A) DP
MCB69 (10A) DP
MCB61 (20A) DP
MCB62 (20A) DP
10T2 500VA 240/24V
MCB63 (10A) DP
SPARE
SPARE
TS1
TS2
SC6
SC1
SC7-8
2 NOS. 240VAC SOCKET
SC2-5
4 NOS. 24VAC SOCKET
DP-CABIN FAN
WL1-4
4X40W WARNING LAMP (RED)
FL1-4
4X(2X14)W ENERGY EFFICIENT FLUORESCENT LAMP
FL5-8
4X(2X14)W ENERGY EFFICIENT FLUORESCENT LAMP
FL9-12
4X(2X14)W ENERGY EFFICIENT FLUORESCENT LAMP
FL13-16
4X(2X14)W ENERGY EFFICIENT FLUORESCENT LAMP
FL17
ENERGY EFFICIENT FLUORESCENT LAMP
HB1-4
HIGH BAY LED LAMP
HL1 & HL2
2X40W, 24V HAND LAMP
DP-CABIN & STAIR CASE ILLUMINATION
E-ROOM ILLUMINATION
PLATFORM ILLUMINATION
TROLLEY
BAY ILLUMINATION
INDEX NO. REVISION SIGNATURE DATE
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LEGEND DETAILS

SL. No.	SYMBOL	DESCRIPTION
1	MH	Main Hoist
2	AH	Auxiliary Hoist
3	CT	Main Cross Travel
4	LT	Long Travel
5	IS	Isolator
6	MCCB	Moulded Case Circuit Breaker
7	MPCB	Motor Protection Circuit Breaker
8	MCB	Miniature Circuit Breaker
9	BM	Brake Magnet
10	BRP	Brake Rectifier Panel
11	PE	Pulse Encoder
12	LC	Line Contactor
13	OLR	Over Load Relay

LEGEND DETAILS

SL. No.	SYMBOL	DESCRIPTION
14	AFE	Active Front End
15	VFD	Variable Frequency Drive
16	T	Transformer
17	ACB	Air Circuit Breaker
18	PT	Potential Transformer
19	CC	Current Collector
20	FS	Fuse
21	V	Voltmeter
22	VSS	Voltmeter Selector Switch
23	A	Ammeter
24	ASS	Ammeter Selector Switch
25	CT	Current Transformer
26	SL	Signal Lamp

INDEX NO.	REVISION	SIGNATURE	DATE
1.			

BUREAU-CHIEF	R. N. JHA
GROUP LEADER	T. K. SAHU
CHECKED BY	R.K.SINGH
DESIGNED BY	RAVI
DRAWN BY	JITENDRA

SINGLE LINE DIAGRAM FOR 40+40T X 30.5M E.O.T. CRANE

3339.91.001	
SHEET NO.	12
NEXT SHEET	—

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