GeM Tender Enquiry for Single Girder EOT Crane for 1x 660 MW Bhusawal Project

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ANNEXURE –I

Additional Terms and Conditions for subject Tender Enquiry to be complied by Bidders for Consideration in this tender:

1. **Dispatch Markings: -**

   Each box shall be marked with Capital Letters in "Red" indicating the PEM supply (Main Supply OR Commissioning spare/ Mandatory Spare) for 1X 660 MW Bhusawal Thermal Power Station Project. Each package delivered under the Contract shall be marked by Supplier and such marking must be distinct and in English Language (all previous irrelevant markings being carefully obliterated). Such marking shall show the description and quantity of contents, the name and address of consignee, the Gross weight and Net weight of the package, the name of the Supplier, PEM P.O. reference number, with a distinctive number of mark sufficient for purposes of identification. Besides above necessary, packing shall bear a special marking `TOP', `BOTTOM', 'DO NOT TURN OVER", "KEEP DRY", "HANDLE WITH CARE", etc.

   IMPORTANT

   - Two copies of respective standard manufacturer's erection instruction/operation instruction manual shall be kept in each package / container for immediate reference by BHEL site and same shall be reflected in packing slip also
   - The Packing list details for the consignment must be put inside the Box/Boxes.

   Commissioning Spares: - The commissioning spares shall be properly packed separately in separate box and each spare shall be properly tagged giving details i.e. dispatch (to match the description given in the packing slip) to facilitate their proper identification. One Copy of Packing list must be put inside the Box.

   Mandatory Spares: - The Mandatory spares shall be properly packed separately in separate box painted in Red, indicating Mandatory Spares in bold letters and each spare shall be properly tagged giving details i.e. item number of the equipment in line with the CUSTOMER approved BBU for Mandatory spares & Number per item (to match the description given in the packing slip) to facilitate their proper identification by ultimate customer MAHAGENCO. One Copy of Packing list must be put inside the Box along with Manufacturing drawing no. reference, Catalogue reference etc.

   Note :- MDCC for mandatory Spares shall be issued only after receipt of detailed list of mandatory spares & photographs before final packing clearly showing mandatory spares with due tagging as per packing list (to be sent over mail/CD). Separate dispatch clearance will be issued for the mandatory spares in line with availability of customer's stores at site.

2. **Liquidated Damages: -**

   a) **Main Supply:-** Purchaser reserves the right to recover from the Seller/ Contractor, as agreed liquidated damages and not by way of penalty, a sum equivalent to half (½) percent and applicable GST thereon, of the total main supply & commissioning spares contract price excluding GST per week or part thereof, subject to a maximum of ten(10) percent of the total main supply & commissioning Spares contract price excluding GST, if the Seller/ Contractor fails to deliver any part of the ordered goods/stores within the period stipulated in the Order/ Contract.

b) **LD on mandatory spares portion:** - LD shall be applicable @ ½ percent and applicable GST thereon, of the total mandatory spares portion contract value excluding GST per week or part thereof, limiting to 10% of total contract value of mandatory spares excluding GST.

b) **LD on supervision of E&C portion:** - LD shall be applicable @ ½ percent and applicable GST thereon, of the total **supervision of E&C** portion contract value excluding GST per week or part thereof, limiting to 10% of total contract value of **supervision of E&C** excluding GST.

NOTE:

i. LR/RR date for indigenous supplies (Bill of Lading/AWB for Foreign supplies) shall be treated as the date of dispatch for levying LD. However, if receipted LR date for indigenous supply is beyond 30 days for FTL/ 45 days for PTL from the date of LR (PTL to be clearly mentioned in LR), such excess period shall be considered for LD purpose irrespective of dispatch date. Import General Manifest (IGM)/Bill of entry date (whichever is earlier), for foreign supplies, is beyond 90 days from the date of Bill of Lading/AWB, such excess period shall be considered for LD purpose irrespective of dispatch date.

ii. In case of any amendment/ revision, LD shall be linked to the amended/ revised contract value and delivery date(s).

iii. If Order/ Contract involves two or more Units/ Sets/ Lots/ Stages, then Liquidated Damages shall be levied on order/ contract value excluding GST of the delayed Unit/ Set/ Lot/ Stage, provided delivery stipulated in the Order/ Contract is Unit/ Set/ Lot/Stage wise, however total LD amount shall be limited to 10% of total order/ amended order value excluding GST of delayed Unit/ Set/ Lot/Stage. Any subsequent lot released (not envisaged in original contract) due to increase in quantity within permissible quantity variation shall be treated as separate lot for the purpose of LD.

iv. The sum specified above is not a penalty but a genuine pre-estimate of the loss/ damage which will be suffered by purchaser on account of delay on the part of the Contractor/Seller and the said amount will be deductible without proof of actual loss or damage caused by such delay.

3. Risk & Cost Purchase

BHEL reserves the right to terminate the contract or withdraw portion of work and get it done through other agency, at the risk and cost of the contractor after due notice of a period of 14 days' by BHEL in any of the following cases:

i) If the Seller/Contractor fails to deliver the goods or materials or any instalment thereof within the period(s) fixed for such delivery or the Seller's poor progress of the supply/ services vis-à-vis delivery/execution timeline as stipulated in the Contract, backlog attributable to seller including unexecuted portion of supply does not appear to be executable within balance available period;

ii) Delivers goods or materials not of the contracted quality and failing to adhere to the contract specifications;

iii) Withdrawal from or repudiation/ abandonment of the supply/ services by Seller before completion as per contract or if the Seller refuses or is unable to supply goods or materials covered by the Order/Contract either in whole or in part or otherwise fails to perform the Order/Contract;

iv) Non-supply by the Seller within scheduled completion/delivery period as per Contract or as extended from time to time, for the reasons attributable to the Seller;

v) Termination of Contract on account of any other reason (s) attributable to Seller.

vi) Assignment, transfer, subletting of Contract without BHEL's written permission resulting in termination of Contract or part thereof by BHEL.

vii) If the Seller be an individual or a sole proprietorship Firm, in the event of the death or insanity of the Seller;

viii) If the Seller/Contractor being an individual or if a firm on a partnership thereof, shall at any time, be adjudged insolvent or shall have a receiving order for administration of his estate made against him or shall take any proceeding for composition under any Insolvency Act for the time being in force or make any assignment of the Order/Contract or enter into any arrangement or composition with his creditors or suspend payment or if the firm dissolved under the Partnership Act;

ix) If the Seller/Contractor being a company is wound up voluntarily or by order of a Court or a Receiver, Liquidator or Manager on behalf of the debenture holders and creditors is appointed or circumstances shall have arisen which entitles the Court of debenture holder and creditors to appoint a receiver, liquidator or manager;

x) Non-compliance to any contractual condition or any other default attributable to Seller.

Such defaulting vendor/Seller shall not be eligible to participate in re-tendering conducted on account of risk purchase made due to fault of such vendor/Seller.

3.1 **Risk & Cost Amount against Balance Work:**

Risk & Cost amount against balance work shall be calculated as follows:

Risk & Cost Amount= [(A-B) + (A x H/100)]

Where,

A= Value of Balance scope of Work (*) as per rates of new contract

B= Value of Balance scope of Work (*) as per rates of old contract being paid to the contractor at the time of termination of contract i.e. inclusive of PVC & ORC, if any.

H = Overhead Factor to be taken as 5

In case (A-B) is less than 0 (zero), value of (A-B) shall be taken as 0 (zero).

3.2 *** Balance scope of work (in case of termination of contract):**

Difference of Contract Quantities and Executed Quantities as on the date of issue of Letter for 'Termination of Contract', shall be taken as balance scope of Work for calculating risk & cost amount.

Contract quantities are the quantities as per original contract. If, Contract has been amended, quantities as per amended Contract shall be considered as Contract Quantities.

ANNEXURE –I

Items for which total quantities to be executed have exceeded the Contract Quantities based on drawings issued to contractor from time to time till issue of Termination letter, then for these items total Quantities as per issued drawings would be deemed to be contract quantities.

Substitute/ extra items whose rates have already been approved would form part of contract quantities for this purpose.

Substitute/ extra items which have been executed but rates have not been approved, would also form part of contract quantities for this purpose and rates of such items shall be determined in line with contractual provisions.

However, increase in quantities on account of additional scope in new tender shall not be considered for this purpose.

NOTE: In case portion of work is being withdrawn at risk & cost of contractor instead of termination of contract, contract

quantities pertaining to portion of work withdrawn shall be considered as 'Balance scope of work' for calculating Risk & Cost amount.

3.3 **LD against delay in executed work in case of Termination of Contract:**

LD against delay in executed work shall be calculated in line with above LD clause, for the delay attributable to contractor. For limiting the maximum value of LD, contract value shall be taken as Executed Value of work till termination of contract.

Method for calculation of LD against delay in executed work in case of termination of contract" is given below.

i. Let the time period from scheduled date of start of work till termination of contract excluding the period of

Hold (if any) not attributable to contractor = T1

ii. Let the value of executed work till the time of termination of contract = X

iii. Let the Total Executable Value of work for which inputs/fronts were made available to contractor and were

planned for execution till termination of contract = Y

iv. Delay in executed work attributable to contractor i.e. T2 = [1-(X/Y)] x T1

v. LD shall be calculated in line with LD clause (clause 16) of the Contract for the delay attributable to

contractor taking "X" as Contract Value and "T2" as period of delay attributable to contractor.

3.4 Recoveries arising out of Risk & Cost and LD or any other recoveries due from Contractor

Without prejudice to the other means of recovery of such dues from the Seller recoveries from the Seller on whom risk & cost has been invoked shall be made from the following:

a) Dues available in the form of Bills payable to seller, SD, BGs against the same contract.

b) Dues payable to seller against other contracts in the same Region/Unit/ Division of BHEL.

c) Dues payable to seller against other contracts in the different Region/Unit/ division of BHEL.

In-case recoveries are not possible with any of the above available options, Legal action shall be initiated for recovery against contractor.

4. For recognition of dispatch, vendor to submit following documents to BHEL by e-mail/ fax immediately on dispatch: - GST compliant invoice, LR for Indian Vendors (indicating Invoice No., no. of boxes, PTL (if applicable) etc.) / Bill of Lading or AWB for foreign vendor, Packing List (Must be indicating No. of boxes, Packing size, Gross weight and net weight of each package, Contents of the package with cross reference to BoM item code no. or item serial no. and Quantity of each item separately), Insurance Intimation to underwriter through email/fax, Dispatch Clearance.

B. Following ATC available in GEM shall also be made part of NIT: -

i. Bidder's offer is liable to be rejected if they don't upload any of the certificates / documents sought in the Bid document, ATC and Corrigendum if any.

ii. Bidders are advised to check applicable GST on their own before quoting. Buyer will not take any responsibility in this regards. GST reimbursement will be as per actuals or as per applicable rates (whichever is lower), subject to the maximum of quoted GST %.

iii. Data Sheet of the product(s) offered in the bid, are to be uploaded along with the bid documents. Buyers can match and verify the Data Sheet with the product specifications offered. In case of any unexplained mismatch of technical parameters, the bid is liable for rejection.

iv. The bidder is required to upload, along with the bid, all relevant certificates such as BIS license, type test certificate, approval certificates and other certificates as prescribed in the Product Specification given in the bid document.

v. While generating invoice in GeM portal, the seller must upload scanned copy of GST invoice and the screenshot of GST portal confirming payment of GST.

ANNEXURE –I

Additional Terms and Conditions for subject Tender Enquiry to be complied by bidders for consideration in this tender:

A. Bidders to ensure that Third party/Customer issued certificates being submitted as proof of PQR qualification should have verifiable details of document/certificate issuing authority such as name & designation of Issuing Authority and its organization contact number and E-mail Id. In case the same is found not available, BHEL has the right to reject such document from evaluation.

B. "This item /package/system falls under the list of items defined in para 3 of ministry of finance guideline date 20.09.16 (procurement of items related to public safety, health, critical security operations and Equipment's etc.) & hence criteria of prior experience /turnover shall be same for all bidders including start up /MSME".

C. **Guarantee & Warrantee** shall be as per Cl. No. 10 of GTC on GeM for the bid. However, Guarantee & Warrantee time period shall be 18 months from the date of last supply in the contract for Main Supply & Mandatory Spares respectively.

D. Evaluation shall be on the basis of total all inclusive, landed price at consignee destination (Refer cl. No. 6 of GTC on GEM).

E. **Terms of Delivery** shall be as per Cl. No. 13 of GTC on GeM (i.e. Free Delivery at site basis including loading/unloading). However, unloading of items (at delivery point) shall be in the scope of buyer. Insurance shall be in seller scope. Bidder to quote prices accordingly.

F. Further, w.r.t. Transit Insurance supplier has to inform the details of dispatches (such as Policy No., Consignee Name, Consignment Packing details, Project Name, Purchase Order No., LR No. & date, Invoice No. & date, dispatch Origin & destination details etc.) to policy underwriter.

G. PQR criteria uploaded with Buyer uploaded Bid Specific document shall prevail value of Experience criteria and Past performance parameter mentioned in GeM bid.

H. "Due to COVID-19 pandemic condition prevailing in the country BHEL/PEM may go for Remote Inspection of Offered items if required. Vendors are requested to be equipped with the facilities/gadgets as indicated in the guidelines available at : https://pem.bhel.com/Documents/VendorSection/Vendor/Guidelines.pdf to take up the inspection remotely.

I. **Inspection call to be raised by bidder on BHEL CQIR portal** (details shall be shared at the of execution of order) and Inspection agency shall attend at the inspection within seven (07) days of the date on which the material is notified as being ready. In case of delay in witnessing of inspection beyond stipulated time (i.e. 7 days from the date on which the material is notified as being ready), by BHEL arising due to reasons not attributable to vendor, BHEL will extend the delivery period for such delay in carrying out inspection. If BHEL is not able to witness inspection up to 15 days then in addition to delay beyond stipulated period, extension in delivery time of 07 days for arranging fresh inspection will be given.

When the tests have been satisfactorily completed at Seller/ Contractor's works, the Inspection Agency shall issue an inspection report that effect within seven (07) days after completion of the tests, but if the tests were not witnessed by the Inspection Agency or his representative, the material acceptance report would be issued within seven (07) days after receipt of the test certificates by the Purchaser.

Purchaser will issue MDCC to the Seller/ Contractor within 7 days based on inspection report/ test certificates/Certificate of Conformance as applicable. In case of delay in issuance of MDCC beyond 7 days stipulated time (i.e. from the date of successful inspection report), by BHEL arising due to reasons not attributable to vendor, BHEL will extend the delivery period for such delay in issuing MDCC. If BHEL is not

able to issue MDCC up to 15 days then in addition to delay beyond stipulated period, 7 days' additional time shall be given to vendor to facilitate the vendor for arranging logistics arrangements.

J. All Bidders shall be required to submit applicable Freight % & GST % included in their prices during clarification stage of Tender.

K. Performance Bank Guarantee: shall be as per Cl. No. 7 of GTC of GeM. Performance Security amount shall be @5% of the value of contract value.

L. **Payment Terms:** For Supply Portion incl. Mandatory Spares and supervision of E &C : - As per clause no. 12 (i) of GTC on GeM. Supplier has to provide original+1 copy of Tax invoice, Packing List, LR/RR or AWB, CRAC, Insurance intimation, Guarantee Certificate, E-way bill (as applicable) for payment.
Offline payment mode shall be selected. Payment will be released within 60 days after submission of complete documents (45 days for vendors qualified and registered as Micro or Small as per MSMED Act).

M. **Bid reserved for Make in India products: -** Procurement under this bid is reserved for purchase from Class 1 local suppliers as defined in public procurement (Preference to Make in India), Order 2017 as amended from time to time and its subsequent Orders/Notifications issued by concerned Nodal Ministry for specific Goods/Products. The minimum local content to qualify as a class 1 local supplier is denoted in the bid document as 50%. All bidders must upload a certificate from the OEM regarding the percentage of the local content and the details of locations at which the local value addition is made along with their bid, failing which the bid is liable to be rejected.
Regarding verification of local content, the local supplier at the time of tender, bidding or solicitation shall be required to provide certification (as per enclosed annexure-IV) as per para 9 of PP-MII order revision dated 16.09.2020.

N. **This is conditional tender enquiry. Financial bid opening (Part-II) of a bidder shall be subjected to following: -**

(i) Approval of vendor by end customer i.e. M/s MAHAGENCO
(ii) Techno-Commercial evaluation/recommendation by BHEL.
(iii) Qualification of Technical PQR
(iv) Offered item should mandatorily conform to PP-MII order provisions.

O. **Consignee Details** (for PRC - Provisional Receipt Certificate & CRAC - Consignee's Receipt cum Acceptance Certificate, as applicable) shall be as per Project Site official details.

P. The Bidder has to declares that they will not enter into any illegal or undisclosed agreement or understanding, whether formal or informal with other Bidder(s). This applies in particular to prices, specifications, certifications, subsidiary contracts, submission or non-submission of bids or any other actions to restrict competitiveness or to introduce cartelization in the bidding process. In case, the bidder is found having indulged in above activities, suitable action shall be taken by BHEL as per extant policies/guidelines.

Q. **Bidders to ensure the following: -**

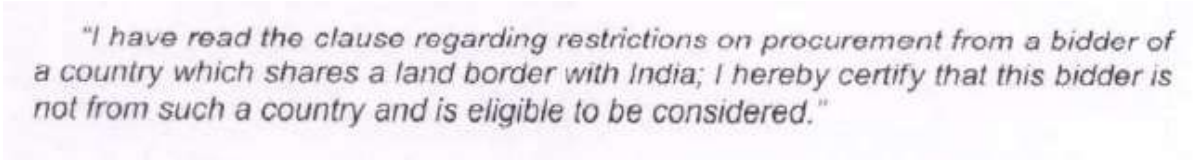
• Ensure compliance to Ministry of Power (MoP) Order No. 11/05/2018-Coord. dt. 28/07/2020, if applicable.

• Ensure compliance of Ministry of Finance (MoF) Order (Public Procurement No. 1 & 2) F. No. 6/18/2019/PPD dt. 23/07/2020.

• to submit "Model Certificate for Tenders" as per Annexure-III of Ministry of Finance (MoF) Order (Public Procurement No. 1 & 2) F. No. 6/18/2019/PPD dt. 23/07/2020. Bidder to submit the following undertaking on their letter head duly signed from the highest competent authority at your end (i.e

ANNEXURE –I

Owner, partner, CMD, Director etc.)



Note:- This bidder is to be replaced with bidders' organizational name.

R. Delivery Period: As per attached Annexure-II. Delivery Days mentioned in GeM bid shall be indicative only. Delivery shall be refixed as per terms & conditions of Annexure-II.

S. For registration in BHEL PEM- Online registration portal is operational, Non-registered Vendors who wish to apply for registration in BHEL-PEM can apply through Online Registration Portal available at www.pem.bhel.com - vendor section - Online Supplier Registration. All credentials and/or documents duly signed and stamped related to registration can be uploaded on the website and submit the application for registration. However, registration of suppliers is not mandatory in case of open tender.

T. Instructions to Packing List (annexure –III) and Certification reg. Local content (annexure –IV) to be complied by bidders.

U. All other terms & conditions shall be as per selected Additional Terms & Conditions for subject bid from GeM library and GTC version (1.21) available on GeM Portal on enquiry floating date shall be applicable.

V. Quantity Variation clause of +10 % of GeM ATC shall be utilized.

Annexure II to NIT- Delivery Schedule
SINGLE GIRDER / MISC. CRANES

Sl. No.	BHEL Drawing No	Drawing Title	Primary/ Secondary	Drg Sch for Vendors	Delivery Terms for Supply Portion and Mandatory Spares	Delivery For Supervision of E &C
1	PE-V0-415-524-A001	Manufacturing Quality Plan with sub vendor list OF SG CRANE	Primary	R-0 within 21 days from PO & subsequent revisions within 10 days of comments received from BHEL. BHEL shall furnish comments / approval on each submission within 18 days from receipt.	Within Six (06) months from date of CAT-1 approval of Primary drawing/documents, subjected to drawing/document submission/re-submission schedule as stipulated, in case of any delay in submission/re-submission of Primary drawing/documents, then same shall be reduced from the given delivery period. Delay in BHEL's comments/approval beyond 18 days shall also be considered for delay analysis. **Mandatory Spares**: Within four (04) months from the date of BHEL manufacturing clearance. Separate dispatch/ manufacturing clearance will be issued for mandatory spares	Vendor to depute its service engineer for Supervision of E&C within 15 days from BHEL's intimation (for deputing service engineer).
2	PE-V0-415-524-A002	Data sheet of Single Girder Crane with painting details	Primary			
3	PE-V0-415-524-A004	Mechanism Sizing Calculation OF SG CRANE	Primary			
4	PE-V0-415-524-A008	Schematic Circuit Diagram for a) Main Protective panel & BOM b) Main hoist panel & BOM c) Cross Traverseand Long Travel panel & BOM d) Pendent and earthing.	Primary			
5	PE-V0-415-524-A003	G.A.of Single Girder CRANE with CT DSL arrangement OF SG CRANE	Primary			
6	PE-V0-415-524-A015	Sea worthy packing(if applicable) OF SG CRANE	Secondary	R-0 within 30 days from PO & subsequent revisions within 10 days of comments received from BHEL. BHEL shall furnish comments / approval on each submission within 18 days from receipt.		
7	PE-V0-415-524-A009	Long travelMachineryAssembly with LT wheel assembly OF SG CRANE	Secondary			
8	PE-V0-415-524-A016	Erection procedure OF SG CRANE	Secondary			
9	PE-V0-415-524-A012	Cable sizing calculation and schedule OF SG CRANE	Secondary			
10	PE-V0-415-524-A010	Detailed BOM/BOQ for crane	Secondary			
11	PE-V0-415-524-A007	General arrangement for LT cable trailing/ DSL system for Single Girder crane	Secondary			
12	PE-V0-415-524-A006	Bottom Block assembly OF SG CRANE	Secondary			
13	PE-V0-415-524-A014	Mandatory spare parts list (if applicable) OF SG CRANE	Secondary			
14	PE-V0-415-524-A005	G.A. drg of Hoist with trolley wheel assembly OF SG CRANE	Secondary			
15	PE-V0-415-524-A019	O&M Manual	Secondary	within 30 days of issuance of MDCC		

Notes:-

(i) The end period specified is for completion of the deliveries. Deliveries to start progressively so as to meet the completion schedule.

(ii) The delivery conditions specified are for contractual LD purposes, however BHEL may ask for early deliveries without any compensation thereof.

(iii) Non-applicable drawings shall be decided during bid evaluation.

(iv) Wherever schedule of drawings/documents submission / re-submission is stipulated in the Technical Specifications, same shall be superseded by delivery specified in NIT.

PROJECT: 1x 660 MW BHUSAWAL TPS
PACAKGE: - SINGLE GIRDER EOT CRANE
ANNEXURE -III (TO) INSTRUCTIONS TO PACKING LIST

For faster verification of bills, successful bidder to submit detailed Bill of Material (BOM) at the time of drawings/ documents submission after placement of PO. Each item of the BOM to be uniquely identified with item code no. or item Sl. No. Supplier to ensure that all items which will find separate mention in the packing list are covered in this detailed BOM.

Supplier to also give the following undertaking in the BOM:
"The BOM provided herewith completes the scope (in content and intent) of material supply under PO No. ……. Dated …… Any additional material which may become necessary for the intended application of the supplied items/package will be supplied free of cost in most reasonable time.

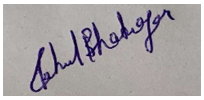
Packing List must indicate:

a) Packing size
b) Gross weight and net weight of each package
c) Contents of the package with cross reference to BOM item code no. / Sl. No.
d) Quantity of each items separately.

The packing list must cover all the BOM items.

Supplier to give following undertaking in the packing list:

The Packing list provided herewith is as per BOM approved under PO No. -----



ANNEXURE IV
1x 660 MW BHUSAWAL TPS
SINGLE GIRDER EOT/HOT MISC CRANES

Letter head of Company

Ref……. Date…….

To,
Bharat Heavy Electricals Limited
PEM, PPEI Building, Plot No 25,
Sector -16A, Noida (U.P)-201301

Subject: - Certification regarding local content

Reference: Tender Enquiry No-……

Name of Package: …….

Dear Sir,

We hereby certify that items offered by us of Single Girder EOT/HOT Misc. Cranes for 1x 660 MW Bhusawal Project ……. meets the requirement of minimum local content in line with clause no. … of NIT and the Public Procurement (Preference to Make in India), Order 2017 dated-15.06.2017, 28.05.2018 & 29.05.2019 , 04.06.20 & 16.09.20

We further confirm that details of location at which the local value addition is made will be our registered works at ……(address of the works)

Yours very truly

……. (authorized signatory of company)

…… (firm name)

authorized signatory
of company

ANNEXURE A

Maharashtra State Power Generation Company Limited			
Bhusawal Project (1x660MW)			
Proforma of Vendor Approval			
Sr. No.	Information/ Particulars required	Details furnished along with documents thereof	Remarks if any
1	Name of System /Package/Item:		
2	Name of agency on whom order for the main work is placed		
3	Approval for (Name of construction material)		
4	Name of the vendors specified in contract document for this material		
5	Name of the proposed Sub Contractor(Vendor)		
6	Reasons for asking new vendor		
7	Details of supporting documents in lieu of above reasons		
8	Specific requirement of material in terms of dia, size, quantity etc.		
9	When the material is required & for which structure		
10	Whether vendor is Partnership/ Pvt./Public Ltd. Company		
11	Particular of registration with Government		
	i) GST registration No.		
	ii) Company registration No. & Incorporation Certificate		
	iii) PF & ESIC Certificate.		
	iv) Pan No.		
12	Address of vendor's factory		
13	Contact No. of vendor's representative for additional information		
14	Production Business Area		
16	Average annual turnover for last three years as per CA's Certificate		
17	Name of Companies where the vendor is registered		
18	Details of orders completed last 3 years (Quantity & amount)		
19	Details of orders in hand (Quantity & amount)		
20	Maximum value & quantity of work executed during last 3 years		
21	Name of the reputed, well known clients to whom the vendor has supplied the material		
22	*End users Performance Certificate (Name & documents) along with the relevant PO.		
23	Any additional information		
24	Recommendation		

M/s BHEL Sub-Contractor

BOQ			Doc No:	PE-PF-415-524-A001
			Rev No:	0
			Date of issue	
NAME OF PROJECT:		**1X660MW Bhusawal TPS-Unit: 6, Maharashtra, India**		
NAME OF PACKAGE:		**SINGLE GIRDER EOT CRANE**		
TECHNICAL SPECIFICATION:		**PE-TS-415-524-A001**		

S. No.	DESCRIPTION	UNIT	QTY
1.0	Total lump sum firm price inclusive of all prevailing taxes, duties and other levies for **SUPPLY PART, SERVICES PART (Supervision of E&C) & MANDATORY SPARES** comprising of design (i.e. preparation and submission of drawing /documents including "As Built" drawings and O&M manuals), engineering, manufacture, fabrication, assembly, inspection / testing at vendor's & sub-vendor's works, painting, maintenance tools & tackles (as applicable), fill of lubricants & consumables, mandatory spares alongwith spares for erection, startup and commissioning as required, forwarding, proper packing, shipment and delivery at site as specified in NIT, supervision of erection & commissioning and/or training of customer/client O&M staff for project and package specified above complete with all accessories for the total scope defined as per BHEL NIT & tender technical specification, amendment & agreements till placement of order in line with drawings/documents/test procedures approved by BHEL/Customer for SINGLE GIRDER EOT CRANES as per details in different sections/ volumes of the specification.	Lot	1
2.0	**MAJOR BREAK-UP OF PRICES GIVEN IN 1.0 ABOVE.**		
2.1	Total lump sum firm price inclusive of all prevailing taxes, duties and other levies for **SUPPLY PART** comprising of design (i.e. preparation and submission of drawing /documents including "As Built" drawings and O&M manuals), engineering, manufacture, fabrication, assembly, inspection / testing at vendor's & sub-vendor's works, painting, maintenance tools & tackles (as applicable), fill of lubricants & consumables alongwith spares for erection, startup and commissioning as required, forwarding, proper packing, shipment and delivery at site as specified in NIT for project and package specified above complete with all accessories for the total scope defined as per BHEL NIT & tender technical specification, amendment & agreements till placement of order in line with drawings/documents/test procedures approved by BHEL/Customer for SINGLE GIRDER EOT CRANES as per details in different sections/ volumes of the specification. **(Break-up of prices as per Annexure I).**	Lot	1
2.2	Total lump sum firm price inclusive of all prevailing taxes, duties and other levies for **MANDATORY SPARES** comprising of manufacture, fabrication, assembly, inspection / testing (as applicable) at vendor's & sub-vendor's works, painting, forwarding, proper packing, shipment, delivery at site & guarantee as per tender technical specification above, amendment & agreements till placement of order. (Price break up of mandatory spares is to be furnished as per **Annexure- II**).	Lot	1
2.3	Total lumpsum firm price inclusive of all prevailing taxes, duties and other levies for Site Visit (should include travel expenses to/ fro site, insurance (if applicable), intermediary stay) for Supervision of Erection & Commissioning etc. at site for SINGLE GIRDER EOT CRANES	No. of visits	4
2.4	Total lumpsum firm price inclusive of all prevailing taxes, duties and other levies for Stay at Site including lodging, boarding, food, local conveyence etc. for Supervision of Erection & Commissioning etc. at site for SINGLE GIRDER EOT CRANES	Days	16

Note: Unit rate of Supervision Charges shall be deduced from prices quoted against S.No. 2.3 and 2.4 above for adjustment purposes.

Particulars of bidder / authorised representative

Name	Designation	Signature	Date	Company Seal

BOQ ANNEXURE-I		Doc No:	PE-PF-415-524-A001	
		Rev No:	0	
		Date of issue		
NAME OF PROJECT:	**1X660MW Bhusawal TPS-Unit: 6, Maharashtra, India**			
NAME OF PACKAGE:	**SINGLE GIRDER EOT CRANE**			
TECHNICAL SPECIFICATION:	**PE-TS-415-524-A001**			

S. No.	DESCRIPTION	UNIT	QTY	AMOUNT (Ex-Works)
	BREAK-UP OF SUPPLY PRICES GIVEN IN 2.1 OF MAIN SHEET.			
2.1	Break up of Prices inclusive of all prevailing taxes, duties and other levies for SUPPLY PART comprising of design (i.e. preparation and submission of drawing /documents including "As Built" drawings and O&M manuals), engineering, manufacture, fabrication, assembly, inspection / testing at vendor's & sub-vendor's works, painting, maintenance tools & tackles (as applicable), fill of lubricants & consumables alongwith spares for erection, startup and commissioning as required, forwarding, proper packing, shipment and delivery at site as specified in NIT for project and package specified above complete with all accessories for the total scope defined as per BHEL NIT & tender technical specification, amendment & agreements till placement of order in line with drawings/documents/test procedures approved by BHEL/Customer for SINGLE GIRDER EOT CRANES as per details in different sections/ volumes of the specification.	Lot	1	
2.1.1 (a)	For: Fuel oil (transfer) pump house, Type: Single Girder Overhead EOT Crane, Indoor duty, Hazardous Area, Cap: 2T, Span: 6.9m, Lift: 4.6m, Baylength: 22.25m.	No.	1	
2.1.1 (b)	LT Flexible Trailing Cable complete with all accessories for complete baylength.	Lot	1	
2.1.1 (c)	Rail complete with all accessories for complete baylength.	Lot	1	
2.1.1 (d)	VVVF Drive for Main Hoisting motion	Set	1	
2.1.2 (a)	For: Fuel oil (pressurizing and heating) pump house, Type: Single Girder Overhead EOT Crane, Indoor duty, Hazardous Area, Cap: 2T, Span: 12.8m , Lift: 8.5m, Baylength: 26m.	No.	1	
2.1.2 (b)	LT Flexible Trailing Cable complete with all accessories for complete baylength.	Lot	1	
2.1.2 (c)	Rail complete with all accessories for complete baylength.	Lot	1	
2.1.2 (d)	VVVF Drive for Main Hoisting motion	Set	1	
2.1.3 (a)	For: Air compressor house, Type: Single Girder Overhead EOT Crane, Indoor duty, Cap: 8T, Span: 10.8m , Lift: 6m, Baylength: 28m.	No.	1	
2.1.3 (b)	PVC shrouded bus bar type DSL complete with all accessories for complete baylength.	Lot	1	
2.1.3 (c)	Rail complete with all accessories for complete baylength.	Lot	1	
2.1.3 (d)	VVVF Drive for Main Hoisting motion	Set	1	
2.1.4 (a)	For: Clarified Water Pump House Type: Overhead, Indoor duty, Cap: 10T, Span: 6.8m , Lift : 13m, Baylength: 29m.	No.	1	
2.1.4 (b)	PVC shrouded bus bar type DSL complete with all accessories for complete baylength.	Lot	1	
2.1.4 (c)	Rail complete with all accessories for complete baylength.	Lot	1	
2.1.4 (d)	VVVF Drive for Main Hoisting motion	Set	1	
2.1.5 (a)	For: DG Building Type: Overhead, Indoor duty, Cap: 8T, Span:12.3m , Lift : 6m, Baylength: 21m.	No.	1	
2.1.5 (b)	PVC shrouded bus bar type DSL complete with all accessories for complete baylength.	Lot	1	
2.1.5 (c)	Rail complete with all accessories for complete baylength.	Lot	1	
2.1.5 (d)	VVVF Drive for Main Hoisting motion	Set	1	
2.1.6 (a)	For: Raw Water Pump House Type: Overhead, Indoor duty, Cap: 10T, Span: 5.5m , Lift: 10m, Baylength: 21.5m.	No.	1	
2.1.6 (b)	PVC shrouded bus bar type DSL complete with all accessories for complete baylength.	Lot	1	
2.1.6 (c)	Rail complete with all accessories for complete baylength.	Lot	1	
2.1.6 (d)	VVVF Drive for Main Hoisting motion	Set	1	
2.1.7 (a)	For: CW pump house- Screen and Gates handling Type: Semi-gantry, Outdoor duty, Cap: 5T, Span: 5.55m , Lift: 16m, Baylength: 40m.	No.	1	
2.1.7 (b)	Cable Reeling Drum (CRD) complete with all accessories for complete baylength.	Lot	1	
2.1.7 (c)	Rail complete with all accessories for complete baylength.	Lot	1	
2.1.7 (d)	VVVF Drive for Main Hoisting motion	Set	1	
2.1.8 (a)	For: Existing (Abandoned) Pump House Type: Overhead, Indoor duty, Cap: 5T, Span: 5.715m , Lift: 10m, Travel: 17.6m.	No.	1	
2.1.8 (b)	PVC shrouded bus bar type DSL complete with all accessories for complete baylength.	Lot	1	
2.1.8 (c)	Rail complete with all accessories for complete baylength.	Lot	1	
2.1.8 (d)	VVVF Drive for Main Hoisting motion	Set	1	
2.1.9	Maintenance tools and tackles	Set	1	
2.1.10.1	One (1) set of erection & commissioning spares for 2T crane	Set	1	
2.1.10.2	One (1) set of erection & commissioning spares for 5T crane	Set	1	
2.1.10.3	One (1) set of erection & commissioning spares for 8T crane	Set	1	
2.1.10.4	One (1) set of erection & commissioning spares for 10T crane	Set	1	

Note:
1) Bidder to note that there shall be no implication for change in lift and/or span up to 500mm.
2) Prices mentioned against clause no. 2.1.X (b) and 2.1.X (c) above will be taken for price adjustment due to change in baylength, if any, during detailed engineering.

Particulars of bidder / authorised representative

Name	Designation	Signature	Date	Company Seal

BOQ ANNEXURE-II LIST OF MANDATORY SPARES		Doc No:	PE-PF-415-524-A001
		Rev No:	0
		Date of issue	
NAME OF PROJECT:		1X660MW Bhusawal TPS-Unit: 6, Maharashtra,	
NAME OF PACKAGE:		SINGLE GIRDER EOT CRANE	
TECHNICAL SPECIFICATION:		PE-TS-415-524-A001	
Sl. No.	Description	QTY	UNIT
2.2	BREAK-UP OF SUPPLY PRICES GIVEN IN 2.2 OF MAIN SHEET.		
2.2.1	MANDATORY SPARES FOR SINLGE GIRDER CRANES (2T capacity)		
2.2.1.1	ONE SET CONSISTING OF TWO (2) BEARING FOR:		
2.2.1.1.1	CT wheel	1	One (1) set
2.2.1.1.2	LT wheel	1	One (1) set
2.2.1.2	One set consisting of Two (2) brake linings with rivets for :		
2.2.1.2.1	MH brake	1	One (1) set
2.2.1.2.2	CT brake	1	One (1) set
2.2.1.2.3	LT brake	2	Two (2) sets
2.2.1.2.4	MH creep brake	1	One (1) set
2.2.1.3	ONE SET CONSISTING OF TWO (2) BRAKE SHOES WITH LINING FOR :		
2.2.1.3.1	MH brake	1	One (1) set
2.2.1.3.2	CT brake	1	One (1) set
2.2.1.3.3	LT brake	2	Two (2) sets
2.2.1.3.4	MH creep brake	1	One (1) set
2.2.1.4	ONE SET CONSISTING OF SIX (6) CARBON BRUSHES FOR :		
2.2.1.4.1	MH motor	1	One (1) set
2.2.1.4.2	CT motor	1	One (1) set
2.2.1.4.3	LT motor	2	Two (2) sets
2.2.1.5	ONE SET CONSISTING OF THREE (3) BRUSH HOLDERS FOR :		
2.2.1.5.1	MH motor	1	One (1) set
2.2.1.5.2	CT motor	1	One (1) set
2.2.1.5.3	LT motor	2	Two (2) sets
2.2.1.6	Fixed and moving contacts for each type of contactor	1	One (1) set
2.2.1.7	No volt coil for each type of contactor	1	One (1) set
2.2.1.8	OVERLOAD RELAY FOR		
2.2.1.8.1	MH motor	1	Number(s)
2.2.1.8.2	CT motor	1	Number(s)
2.2.1.8.3	LT motor	2	Number(s)
2.2.1.9	MOTOR BEARINGS		
2.2.1.9.1	MH	2	Number(s)
2.2.1.9.2	CT	2	Number(s)
2.2.1.9.3	LT	4	Number(s)
2.2.1.10	BEARING FOR		
2.2.1.10.1	MH Main Pulley	2	Number(s)
2.2.1.10.2	MH Eq. Pulley	2	Number(s)
2.2.1.11	Mandatory Spares for VVFD in Main Hoist		
2.2.1.11.1	Thysrister	12	Number(s)
2.2.1.11.2	Ignition Transformer	12	Number(s)
2.2.1.11.3	Firing card	4	Number(s)
2.2.1.11.4	Control Transformer	2	Number(s)
2.2.1.11.5	Auxiliary contactor	2	Two (2) numbers each
2.2.2	MANDATORY SPARES FOR SINLGE GIRDER CRANES (5T capacity - Overhead		
2.2.2.1	ONE SET CONSISTING OF TWO (2) BEARING FOR:		
2.2.2.1.1	CT wheel	1	One (1) set
2.2.2.1.2	LT wheel	1	One (1) set
2.2.2.2	One set consisting of Two (2) brake linings with rivets for :		
2.2.2.2.1	MH brake	1	One (1) set
2.2.2.2.2	CT brake	1	One (1) set
2.2.2.2.3	LT brake	2	Two (2) sets
2.2.2.2.4	MH creep brake	1	One (1) set
2.2.2.3	ONE SET CONSISTING OF TWO (2) BRAKE SHOES WITH LINING FOR :		
2.2.2.3.1	MH brake	1	One (1) set
2.2.2.3.2	CT brake	1	One (1) set
2.2.2.3.3	LT brake	2	Two (2) sets
2.2.2.3.4	MH creep brake	1	One (1) set
2.2.2.4	ONE SET CONSISTING OF SIX (6) CARBON BRUSHES FOR :		
2.2.2.4.1	MH motor	1	One (1) set
2.2.2.4.2	CT motor	1	One (1) set
2.2.2.4.3	LT motor	2	Two (2) sets
2.2.2.5	ONE SET CONSISTING OF THREE (3) BRUSH HOLDERS FOR :		
2.2.2.5.1	MH motor	1	One (1) set
2.2.2.5.2	CT motor	1	One (1) set
2.2.2.5.3	LT motor	2	Two (2) sets
2.2.2.6	Fixed and moving contacts for each type of contactor	1	One (1) set
2.2.2.7	No volt coil for each type of contactor	1	One (1) set

BOQ ANNEXURE-II LIST OF MANDATORY SPARES		Doc No:	PE-PF-415-524-A001
		Rev No:	0
		Date of issue	
NAME OF PROJECT:		1X660MW Bhusawal TPS-Unit: 6, Maharashtra,	
NAME OF PACKAGE:		SINGLE GIRDER EOT CRANE	
TECHNICAL SPECIFICATION:		PE-TS-415-524-A001	
Sl. No.	Description	QTY	UNIT
2.2.2.8	**OVERLOAD RELAY FOR**		
2.2.2.8.1	MH motor	1	Number(s)
2.2.2.8.2	CT motor	1	Number(s)
2.2.2.8.3	LT motor	2	Number(s)
2.2.2.9	**MOTOR BEARINGS**		
2.2.2.9.1	MH	2	Number(s)
2.2.2.9.2	CT	2	Number(s)
2.2.2.9.3	LT	4	Number(s)
2.2.2.10	**BEARING FOR**		
2.2.2.10.1	MH Main Pulley	2	Number(s)
2.2.2.10.2	MH Eq. Pulley	2	Number(s)
2.2.2.11	**Mandatory Spares for VVFD in Main Hoist**		
2.2.2.11.1	Thysrister	12	Number(s)
2.2.2.11.2	Ignition Transformer	12	Number(s)
2.2.2.11.3	Firing card	4	Number(s)
2.2.2.11.4	Control Transformer	2	Number(s)
2.2.2.11.5	Auxiliary contactor	2	Two (2) numbers each
2.2.3	**MANDATORY SPARES FOR SINLGE GIRDER CRANES (5T capacity - Semi-gantry crane)**		
2.2.3.1	**ONE SET CONSISTING OF TWO (2) BEARING FOR:**		
2.2.3.1.1	CT wheel	1	One (1) set
2.2.3.1.2	LT wheel	1	One (1) set
2.2.3.2	**One set consisting of Two (2) brake linings with rivets for :**		
2.2.3.2.1	MH brake	1	One (1) set
2.2.3.2.2	CT brake	1	One (1) set
2.2.3.2.3	LT brake	2	Two (2) sets
2.2.3.2.4	MH creep brake	1	One (1) set
2.2.3.3	**ONE SET CONSISTING OF TWO (2) BRAKE SHOES WITH LINING FOR :**		
2.2.3.3.1	MH brake	1	One (1) set
2.2.3.3.2	CT brake	1	One (1) set
2.2.3.3.3	LT brake	2	Two (2) sets
2.2.3.3.4	MH creep brake	1	One (1) set
2.2.3.4	**ONE SET CONSISTING OF SIX (6) CARBON BRUSHES FOR :**		
2.2.3.4.1	MH motor	1	One (1) set
2.2.3.4.2	CT motor	1	One (1) set
2.2.3.4.3	LT motor	2	Two (2) sets
2.2.3.5	**ONE SET CONSISTING OF THREE (3) BRUSH HOLDERS FOR :**		
2.2.3.5.1	MH motor	1	One (1) set
2.2.3.5.2	CT motor	1	One (1) set
2.2.3.5.3	LT motor	2	Two (2) sets
2.2.3.6	**Fixed and moving contacts for each type of contactor**	1	One (1) set
2.2.3.7	**No volt coil for each type of contactor**	1	One (1) set
2.2.3.8	**OVERLOAD RELAY FOR**		
2.2.3.8.1	MH motor	1	Number(s)
2.2.3.8.2	CT motor	1	Number(s)
2.2.3.8.3	LT motor	2	Number(s)
2.2.3.9	**MOTOR BEARINGS**		
2.2.3.9.1	MH	2	Number(s)
2.2.3.9.2	CT	2	Number(s)
2.2.3.9.3	LT	4	Number(s)
2.2.3.10	**BEARING FOR**		
2.2.3.10.1	MH Main Pulley	2	Number(s)
2.2.3.10.2	MH Eq. Pulley	2	Number(s)
2.2.3.11	**Mandatory Spares for VVFD in Main Hoist**		
2.2.3.11.1	Thysrister	12	Number(s)
2.2.3.11.2	Ignition Transformer	12	Number(s)
2.2.3.11.3	Firing card	4	Number(s)
2.2.3.11.4	Control Transformer	2	Number(s)
2.2.3.11.5	Auxiliary contactor	2	Two (2) numbers each
2.2.4	**MANDATORY SPARES FOR SINLGE GIRDER CRANES (8T capacity)**		
2.2.4.1	**ONE SET CONSISTING OF TWO (2) BEARING FOR:**		
2.2.4.1.1	CT wheel	1	One (1) set
2.2.4.1.2	LT wheel	1	One (1) set
2.2.4.2	**One set consisting of Two (2) brake linings with rivets for :**		
2.2.4.2.1	MH brake	1	One (1) set

BOQ ANNEXURE-II LIST OF MANDATORY SPARES		Doc No:	PE-PF-415-524-A001
		Rev No:	0
		Date of issue	
NAME OF PROJECT:		1X660MW Bhusawal TPS-Unit: 6, Maharashtra,	
NAME OF PACKAGE:		SINGLE GIRDER EOT CRANE	
TECHNICAL SPECIFICATION:		PE-TS-415-524-A001	
Sl. No.	Description	QTY	UNIT
2.2.4.2.2	CT brake	1	One (1) set
2.2.4.2.3	LT brake	2	Two (2) sets
2.2.4.2.4	MH creep brake	1	One (1) set
2.2.4.3	**ONE SET CONSISTING OF TWO (2) BRAKE SHOES WITH LINING FOR :**		
2.2.4.3.1	MH brake	1	One (1) set
2.2.4.3.2	CT brake	1	One (1) set
2.2.4.3.3	LT brake	2	Two (2) sets
2.2.4.3.4	MH creep brake	1	One (1) set
2.2.4.4	**ONE SET CONSISTING OF SIX (6) CARBON BRUSHES FOR :**		
2.2.4.4.1	MH motor	1	One (1) set
2.2.4.4.2	CT motor	1	One (1) set
2.2.4.4.3	LT motor	2	Two (2) sets
2.2.4.5	**ONE SET CONSISTING OF THREE (3) BRUSH HOLDERS FOR :**		
2.2.4.5.1	MH motor	1	One (1) set
2.2.4.5.2	CT motor	1	One (1) set
2.2.4.5.3	LT motor	2	Two (2) sets
2.2.4.6	**Fixed and moving contacts for each type of contactor**	1	One (1) set
2.2.4.7	**No volt coil for each type of contactor**	1	One (1) set
2.2.4.8	**OVERLOAD RELAY FOR**		
2.2.4.8.1	MH motor	1	Number(s)
2.2.4.8.2	CT motor	1	Number(s)
2.2.4.8.3	LT motor	2	Number(s)
2.2.4.9	**MOTOR BEARINGS**		
2.2.4.9.1	MH	2	Number(s)
2.2.4.9.2	CT	2	Number(s)
2.2.4.9.3	LT	4	Number(s)
2.2.4.10	**BEARING FOR**		
2.2.4.10.1	MH Main Pulley	2	Number(s)
2.2.4.10.2	MH Eq. Pulley	2	Number(s)
2.2.4.11	**Mandatory Spares for VVFD in Main Hoist**		
2.2.4.11.1	Thysrister	12	Number(s)
2.2.4.11.2	Ignition Transformer	12	Number(s)
2.2.4.11.3	Firing card	4	Number(s)
2.2.4.11.4	Control Transformer	2	Number(s)
2.2.4.11.5	Auxiliary contactor	2	Two (2) numbers each
2.2.5	**MANDATORY SPARES FOR SINLGE GIRDER CRANES (10T capacity)**		
2.2.5.1	**ONE SET CONSISTING OF TWO (2) BEARING FOR:**		
2.2.5.1.1	CT wheel	1	One (1) set
2.2.5.1.2	LT wheel	1	One (1) set
2.2.5.2	**One set consisting of Two (2) brake linings with rivets for :**		
2.2.5.2.1	MH brake	1	One (1) set
2.2.5.2.2	CT brake	1	One (1) set
2.2.5.2.3	LT brake	2	Two (2) sets
2.2.5.2.4	MH creep brake	1	One (1) set
2.2.5.3	**ONE SET CONSISTING OF TWO (2) BRAKE SHOES WITH LINING FOR :**		
2.2.5.3.1	MH brake	1	One (1) set
2.2.5.3.2	CT brake	1	One (1) set
2.2.5.3.3	LT brake	2	Two (2) sets
2.2.5.3.4	MH creep brake	1	One (1) set
2.2.5.4	**ONE SET CONSISTING OF SIX (6) CARBON BRUSHES FOR :**		
2.2.5.4.1	MH motor	1	One (1) set
2.2.5.4.2	CT motor	1	One (1) set
2.2.5.4.3	LT motor	2	Two (2) sets
2.2.5.5	**ONE SET CONSISTING OF THREE (3) BRUSH HOLDERS FOR :**		
2.2.5.5.1	MH motor	1	One (1) set
2.2.5.5.2	CT motor	1	One (1) set
2.2.5.5.3	LT motor	2	Two (2) sets
2.2.5.6	**Fixed and moving contacts for each type of contactor**	1	One (1) set
2.2.5.7	**No volt coil for each type of contactor**	1	One (1) set
2.2.5.8	**OVERLOAD RELAY FOR**		
2.2.5.8.1	MH motor	1	Number(s)
2.2.5.8.2	CT motor	1	Number(s)
2.2.5.8.3	LT motor	2	Number(s)
2.2.5.9	**MOTOR BEARINGS**		
2.2.5.9.1	MH	2	Number(s)
2.2.5.9.2	CT	2	Number(s)

BOQ ANNEXURE-II LIST OF MANDATORY SPARES		Doc No:	PE-PF-415-524-A001
		Rev No:	0
		Date of issue	
NAME OF PROJECT:		1X660MW Bhusawal TPS-Unit: 6, Maharashtra,	
NAME OF PACKAGE:		SINGLE GIRDER EOT CRANE	
TECHNICAL SPECIFICATION:		PE-TS-415-524-A001	
Sl. No.	**Description**	**QTY**	**UNIT**
2.2.5.9.3	LT	4	Number(s)
2.2.5.10	**BEARING FOR**		
2.2.5.10.1	MH Main Pulley	2	Number(s)
2.2.5.10.2	MH Eq. Pulley	2	Number(s)
2.2.5.11	**Mandatory Spares for VVFD in Main Hoist**		
2.2.5.11.1	Thysrister	12	Number(s)
2.2.5.11.2	Ignition Transformer	12	Number(s)
2.2.5.11.3	Firing card	4	Number(s)
2.2.5.11.4	Control Transformer	2	Number(s)
2.2.5.11.5	Auxiliary contactor	2	Two (2) numbers each

Note:
1. Mandatory spares listed above is bare minimum requirement. In case any additional mandatory spares requirement is covered elsewhere in the tender specification apart from specified above, same shall be deemed to have been covered in bidders scope of supply.
2. Any variation in quantity of mandatory spares shall be adjusted from the unit rate deduced against the particular item.

Particulars of bidder / authorised representative

Name	**Designation**	**Signature & company seal**

610542/2021/PS-PEM-MAX

	PROJECT: 1X660 MW BHUSAWAL TPP	PE-PQ-415-524A-A001	
	PRE-QUALIFICATION REQUIREMENT	DATE	22/12/2021
	SINGLE GIRDER EOT CRANES	REV NO	00

1.0	Bidder should have capabilities for design, manufacturing and testing of Single Girder EOT crane with minimum 5T capacity in power station, commercial complex, industries etc.
2.0	Single Girder crane, meeting condition mentioned at s.no.1 above, should have been in successful operation for minimum one (1) year as on 06.08.2018.
3.0	The supplier has to submit either of following supporting documents meeting above mentioned pre-qualifying requirement a) Copy of minimum one (1) performance certificate in English from end user along with copy of related Purchase Order (PO) or letter of intent (LOI) or letter of award (LOA) or work order (WO) specifying that the product/ equipment is running successfully for one (1) year from date of commissioning meeting the minimum pre-qualifying requirement as on 06.08.2018. OR b) Minimum two PO/ LOI /LOA/ WO placed with a minimum gap of one (1) year from same purchaser meeting the minimum pre-qualifying requirement. OR c) Minimum one PO/ LOI /LOA/ WO after commissioning of first order from same purchaser meeting the minimum pre-qualifying requirement. OR d) Minimum three customer's/ third party's inspection reports/ test certificates/commissioning certificates meeting the minimum pre-qualifying requirement.
4.0	Notwithstanding anything stated above, BHEL / MAHAGENCO reserves the right to assess the capabilities and capacity of the Bidder to perform the contract, should the circumstances warrant such assessment in the overall interest of BHEL/ MAHAGENCO.
5.0	Bidder shall provide all necessary data such as type, design, make, capacity, duty conditions, date of commissioning / operation to substantiate the technical parameter specified in PQR.
6.0	Minimum one (1) no. Purchase order shall be submitted which should not be more than seven (7) years old as on date of bid submission, for establishing continuity in business. This is over and above the requirement of PO mentioned at S. No. 3.0 above.
7.0	Bidder to submit all supporting documents in English. If documents submitted by bidder are in language other than English, a self-attested English translated document should also be submitted.
8.0	Consideration of offer shall be subject to customer's approval of bidders, if applicable.
9.0	After satisfactory fulfilment of all the above criteria/ requirement, offer shall be considered for further evaluation as per NIT and all the other terms of the tender.

Maharashtra State Power Generation Co. Ltd. (MAHAGENCO)

1X660MW Bhusawal TPS-Unit: 6, Maharashtra, India

TECHNICAL SPECIFICATION
FOR
SINGLE GIRDER EOT CRANE

SPECIFICATION NO.: PE-TS-415-524-A001 Rev 0

BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR- PROJECT ENGINEERING MANAGEMENT
NOIDA
INDIA

610547/2021/PS-PEM-MAX

	1X660MW Bhusawal TPS-Unit: 6 SINGLE GIRDER EOT CRANE CONTENTS	SPECIFICATION No: PE-TS-415-524-A001 SECTION REV. 00 DATE: DEC 2021

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SECTION-I

SPECIFIC TECHNICAL REQUIREMENT

SUB-SECTION IA	SPECIFIC TECHNICAL REQUIREMENT (MECHANICAL)
SUB-SECTION IB	SPECIFIC TECHNICAL REQUIREMENT (ELECTRICAL)
SUB-SECTION IC	DATA SHEET A

SUB SECTION-IA

SPECIFIC TECHNICAL REQUIREMENT (MECHANICAL)

	1X660MW Bhusawal TPS-Unit: 6	SPECIFICATION No: PE-TS-415-524-A001
		VOLUME: II B
	SINGLE GIRDER EOT CRANE	SECTION-I
	SPECIFIC TECHNICAL REQUIREMENT	SUB-SECTION-IA
		REV 00 / DATE DEC 2021

INTENT OF SPECIFICATION

1.1 The specification is intended to cover design, engineering, manufacturing, inspection and testing, painting, supply/ delivery duly packed at FOR site including mandatory spares (as applicable), erection & commissioning spares, maintenance tools & tackles, all accessories (isolating switch and power cable from isolating switch to DSL), DSL, rails (as applicable) including freight in line with drawings/ documents/ test procedures approved by BHEL/ Customer for SINGLE GIRDER EOT CRANE.

1.2 The contractor shall be responsible for providing all material, equipment & services, which are required to fulfil the intent of ensuring operability, maintainability, reliability and complete safety of the complete work covered under this specification, irrespective of whether it has been specifically listed herein or not. **Omission of specific reference to any component / accessory necessary for proper performance of the equipment shall not relieve the contractor of the responsibility of providing such facilities to complete the supply, erection & commissioning and load testing of the cranes and its accessories**.

1.3 It is not the intent to specify herein all the details of design and manufacture. However, the equipment shall conform in all respects to high standards of design, engineering and workmanship and shall be capable of performing the required duties in a manner acceptable to purchaser who will interpret the meaning of drawings and specifications and shall be entitled to reject any work or material which in his judgement is not in full accordance herewith.

1.4 The extent of supply under the contract includes all items shown in the drawings, notwithstanding the fact that such items may have been omitted from the specification or schedules. Similarly, the extent of supply also includes all items mentioned in the specification and /or schedules, notwithstanding the fact that such items may have been omitted in the drawing.

1.5 The general term and conditions, instructions to tenderer and other attachment referred to elsewhere are made part of the tender specification. The equipment materials and works covered by this specification is subject to compliance to all attachments referred to in the specification. The bidder shall be responsible for and governed by all requirements stipulated herein.

1.6 While all efforts have been made to make the specification requirement complete & unambiguous, it shall be bidders' responsibility to ask for missing information, ensure completeness of specification, to bring out any contradictory / conflicting requirement in different sections of the specification and within a section itself to the notice of BHEL and to seek any clarification on specification requirement in the format enclosed under Section-III of the specification **within 10 days of receipt of tender documents.** In absence of any such clarifications, in case of any contradictory requirement, the more stringent requirement as per interpretation of Purchaser/Customer shall prevail and shall be complied by the bidder without any commercial implication on account of the same. Further in case of any missing information in the specification not brought out by the prospective bidders as part of pre-bid clarification, the same shall be furnished by Purchaser/ Customer as and when brought to their notice either by the bidder or by purchaser/ customer themselves. However, such requirements shall be binding on the successful bidder without any commercial & delivery implication.

1.7 The bidder's offer shall not carry any sections like clarification, interpretations and /or assumptions.

1.8 Deviations, if any, should be very clearly brought out clause by clause in the enclosed deviation schedule along with cost of withdrawal; otherwise, it will be presumed that the vendor's offer is strictly in line with NIT specification. If no cost of withdrawal is given against the deviation, it will be presumed that deviation can be withdrawn without any cost to BHEL/its customer.

1.9 In the event of any conflict between the requirements of two clauses of this specification documents or requirements of different codes and standards specified, more stringent requirement as per the interpretation of the owner shall apply.

1.10 In case all above requirements are not complied with, the offer may be considered as incomplete and would become liable for rejection.

1.11 Unless specified otherwise, all through the specification, the word contractor shall have same meaning as successful bidder /vendor and Customer/ Purchaser/Employer will mean BHEL and /or customer including their consultant as interpreted by BHEL in the relevant context. For details refer the relevant clause in GCC.

Scope of Single girder cranes:

SCOPE - SINGLE GIRDER CRANES									
S. No.	Location	Type	Duty	Qty (Nos.)	Capacity (T)	Span (m)	Lift (m)	Travel (m)	Remarks
1	Fuel oil (transfer) pump house	Overhead EOT	Indoor	1	2	6.9	4.6	22.25	Hazardous area
2	Fuel oil (pressurizing and heating) pump house	Overhead EOT	Indoor	1	2	12.8	8.5	26	Hazardous area
3	Air compressor house	Overhead EOT	Indoor	1	8	10.8	6	28	
4	Clarified Water Pump House (+ Electrical Panel handling)	Overhead EOT	Indoor	1	10	6.8	13	29	
5	DG Building	Overhead EOT	Indoor	1	8	12.3	6	21	
6	Raw Water Pump House (+ Electrical Panel handling)	Overhead EOT	Indoor	1	10	5.5	10	21.5	
7	CW pump house- Screen and Gates handling (+ Electrical Panel handling))	Semi Gantry EOT	Outdoor	1	5	5.55	16	40	
8	Existing (Abandoned) Pump House	Overhead EOT	Indoor	1	5	5.715	10	17.6	

PROJECT INFORMATION:

	1X660MW Bhusawal TPS-Unit: 6	SPECIFICATION No: PE-TS-415-524-A001
		VOLUME: II B
	SINGLE GIRDER EOT CRANE	SECTION-I
	SPECIFIC TECHNICAL REQUIREMENT	SUB-SECTION-IA
		REV 00 / DATE DEC 2021

1.0 INTRODUCTION

The proposed 1x 660 MW Bhusawal Thermal Power Project will be set up by Maharashtra State Power Generation Co. Ltd. (MAHAGENCO) in Dipnagar near Bhusawal, Maharashtra, India.

The Bidder shall acquaint himself by a visit to the site, if felt necessary, with the conditions prevailing at site before submission of the bid. The information given herein under is for general guidance and shall not be contractually binding on the Owner. All relevant site data/information as may be necessary shall have to be obtained /collected by the Bidder.

2.0 APPROACH TO SITE

Deepnagar is well connected by rail and road. By road, it is about 8 Km from Bhusawal city. Nearest railway station is at Bhusawal. The nearest Airport is at Aurangabad. The nearest sea port is at Mumbai. The site is located on the Mumbai-Nagpur Highway.

3.0 LAND

Bhusawal Thermal Power Plant is already having 1x62.5 MW + 2x210 MW Units and Two (2) Units of 500 MW each are under execution stage. About 108.94 Hectares of land is acquired by MAHAGENCO near existing TPS. It is proposed to install 1x 660 MW unit on this land.

4.0 SOURCE OF COAL

Indian coal would be sourced from Machaakata coal blocks in Orissa state. The Coal will be received at Plant site directly by rail. The coal from the railway wagons would be unloaded by means of wagon tipplers and will be either bunkered or stacked in the stock pile at site.

5.0 SOURCE OF WATER

The main source of water is considered Ozerkheda Reservoir which is located at around 18 km from plant site.

6.0 ASH DISPOSAL AREA

The ash generated from 1 x 660 MW unit shall be disposed off in slurry form to the existing Ash Pond located at Velhala, approx. 12 Km from the site.

7.0 PROJECT INFORMATION

7.1	Client / Owner	:	Maharashtra State Power Generation Co. Ltd.
7.2	Consultant	:	**Procon Engineers, Navi Mumbai** (Division of Nimoto Consulting Engineers Pvt. Ltd.)
7.3	Project Title	:	BHUSAWAL T.P.S. UNIT – 6 : 1X660 MW
7.4	Location	:	Dipnagar, Near Bhusawal, Maharashtra, India
7.5	Nearest railway station	:	Bhusawal
7.6	Nearest Airport	:	Aurangabad
7.7	Nearest Harbour	:	Mumbai
7.8	Access Roads	:	NH 6 (Mumbai-Nagpur Highway)
7.9	Elevation above MSL	:	210 M
7.10	Longitude/latitude	:	75° 51'10" East /21° 02' 30" North
7.11	Seismic Zone	:	Zone III as per IS:1893
7.12	AMBIENT TEMPERATURE		
7.12.1	Mean of daily maximum temperature	:	48.25 °C (during May)
7.12.2	Mean of daily minimum temperature	:	18 °C (during January)
7.12.3	Highest temperature recorded	:	48.7°C

7.12.4	Lowest temperature recorded	:	13°C
7.13	Wet bulb temperature	:	27°C (Maximum)
7.14	Rainfall	:	112 mm average annually
7.15	Wind Speed	:	0 to 39 Km/hr
7.16	Wind direction	:	East North East to West South West

ELECTRICAL

7.17 MAIN POWER SOURCE FROM GRID

7.17.1	Rated Voltage	:	400kV
7.17.2	Voltage variation	:	± 10 %
7.17.3	Frequency Variation	:	± 5 %
7.17.4	Rated Short Circuit Level	:	50 kA, Three Phase Symmetrical

7.18 AUXILIARY POWER SUPPLY

Auxiliary electrical equipment shall be suitable for operation on the following supply system:

7.18.1	Motors above 1000 kW & other Power devices	:	11kV,3Ph,3wire,50Hz system
7.18.2	Motors below 1000 kW & above 160kW & other power devices	:	3.3kV, 3 ph, 3 wire 50 Hz, Non Effectively earthed
7.18.3	Motors upto 160 kW & other power devices	:	415V, 3 ph, 4 wire 50 Hz
7.18.4	Motor Starting Methods	:	Direct on Line
7.18.5	(a) Lighting fixtures Space heaters, and single Phase motors	:	240V, 1 phase, 50 Hz Supply through suitably rated transformers to limit the short circuit level to 9kA – 1 sec.

(b) Control & Instrumentation : 240V, 1 Phase, 50 Hz from UPS

7.18.6 Short circuit levels of 11kV, 3.3 kV and 415V system equipments

The equipment shall be suitable for the following short circuit levels

(a)	11kV Switchgears	:	44 kA/3 sec
(b)	3.3kV Switchgears	:	40 kA/3sec
(c)	415V PCC/ PMCC/ MCC	:	50 kA/1sec
(d)	Lighting Distribution Boards & 240V A.C. supply	:	9 kA/1sec

7.18.7 Auxiliary DC supply

The auxiliary DC supply will be used for control, indication & protection, Turbine lube oil system, AVR, Emergency DC lighting of power plant and Control & Instrumentation etc.

(a)	Voltage	:	(i)	220V DC for utility purpose
			(ii)	24V DC for Control and Instrumentation
(b)	Voltage variation	:	+ 10 %, - 15 %	

7.18.8 Emergency power supply

(a)	Purpose	:	(i)	Standby power to normal incomer of emergency MCC
			(ii)	Alternate power source to Fire water Pumps
(b)	Rated voltage and frequency	:	415 V, 3 phase, 3 wire, 50 Hz.	

7.18.9 UPS power supply

(a) Purpose	:	(i)	Vital process loads
		(ii)	Critical lighting
		(iii)	Control and Instrumentation
		(iv)	Office for LAN power supply/Server etc.
(b) Rated Voltage	:	415V, 3 ph, neutral/240V single phase, 50Hz	

7.19 The variation in voltage and frequency may be ± 10% and ± 5% respectively. The combined voltage and frequency variation may be ± 10%. All devices shall be suitable for continuous operation over the entire range of voltage variation without any change in their performance

7.20 Power socket shall be 415V AC, 50 Hz, 4 pin 32/63 Amps. Power socket outlets for portable tools, hand lamps etc shall be 240 volts, single phase, 3 pin, metal clad industrial type

7.21 All electrical equipment shall be designed for the following ambient conditions

(a) Maximum ambient temperature : 50°C

(b) Minimum Ambient temperature : 13°C

1.0.0 SCOPE OF WORK

1.1.0 SUPPLIES

1.1.1 Equipment and services to be furnished by the bidder for the Single Girder EOT crane with accessories as per the details given in data sheet A. Any equipment / accessories not specified in the specification but required to make the crane units complete and efficient shall also be under the bidder's scope of work.

Each EOT crane shall include all necessary items but shall not be limited to the following (as applicable): -

1. Crane girder.
2. End carriages complete with wheels
3. Electric Hoist for EOT crane
4. CT / LT drive arrangement
5. VVVF drive as per datasheet A
6. Electrical equipments
7. Type of DSL:
   a) PVC Shrouded Conductor (GI) Bus Bar Type DSL with accessories for entire bay length (with current collector & mounting brackets) (except for semi gantry cranes).
   b) Cable Reeling Drum (CRD) along LT travel for semi gantry crane.
   c) Flexible cable with Taut wire / Festoon cable arrangement for CT motion for all cranes with support & brackets.
   d) LT DSL shall be flexible trailing cable type for hazardous area crane.
8. Rail as applicable.
9. Earthing arrangement.
10. Painting of crane.
11. First fill + one year's topping (not less than 10% of the full charge) of consumables such as oils, lubricants including grease, servo fluids, gases and essential chemicals etc.
12. Main isolating switch and power cable from 1.5M above ground / operating floor to down shop lead.
13. End stoppers

1.1.2 Maintenance Tools and Tackles

A complete unused new set of tools & tackles and accessories along with detailed instructions and maintenance manual for the crane shall be supplied. Each tool and wrench shall be stamped, so as it can be easily identified for use. The tools shall be supplied in steel toolbox and with a copy of instruction manual. The items supplied shall be of the best quality and specially protected against rusting in tropical climate and minimum the following shall be provided.

S. No.	Description	Qty.
1	Complete set of ring spanners (Indicate the sizes offered)	1 Set
2	Complete set of screwdrivers (Min. 6 nos. Indicate the sizes)	1 Set
3.	Adjustable Spanner	1 No.
4.	Insulated pliers	1 No.
5	Wrench spanner	1 No.
6.	Grease Gun	1 No.
7.	Oil Gun	1 No.
8.	Hand Lamp	1 No.
9	Line tester	1 No.

Note: All maintenance tools & tackles are to be supplied in a tool box.

1.1.3 Erection and commissioning spares

The Bidder shall also supply erection & commissioning spares along with his main equipment as per Table 1 given below, for replacement of damaged or unserviceable parts during the execution of the project at site, to avoid delay in the project schedule. This shall form part of the main equipment supply. The Purchaser shall retain the unutilized commissioning spares.

TABLE 1

S. No.	Description of equipment/item	Quantity
1	Overload Relay	1 set for each crane
2	Limit Switch	1 set for each crane
3	Fuse Link	1 set for each crane

1.1.4 Mandatory Spares -

A complete unused and new set of Mandatory Spare parts shall be supplied. Each part shall be stamped so as to be identified, easy for it use. The items supplied shall be of the best quality and specially protected against rusting in tropical climate. The minimum requirement of mandatory spare parts is listed in Annexure –II, Section IA of this specification.

1.2.0 Services to be provided by the bidder

1.2.1. Packing, forwarding and transportation to site.

1.2.2. Erection and commissioning procedure shall be submitted by successful bidder for carrying out the erection and commissioning at site by BHEL.

1.2.3. Supervision of Erection and Commissioning at site

1.3.0. Inspection and Testing

1.3.1. Inspection and testing at Manufacturer's works

A. **Shop inspection and tests will include but not limited to the following - (In-process)**

i. Identification, co-relation and verification of material test certificates for the important components like girders, major load carrying components, hooks, gears, shafts, wheels, wire rope drum, wire rope, gear box etc. For other components supporting test certificates or random check tests shall be conducted / furnished.

ii. Qualification of welder and welding procedure as per ASME section IX .

iii. 100% radiography of tension zone & 25% radiography of compression zone on butt welds of load bearing members shall be carried out with acceptance norms as per ASME Sec VIII Div.1 UW 51. DP test of all butt welds shall be carried out as per ASTM E 165/ ASTM E 109 with acceptance norms as per ASME Sec VIII Div.1

iv. For fillet welds visual inspection on all welds. Die- penetration test (DPT) for fillet welds in the load bearing members as per ASME-165/ASTME 109 and acceptance norm as per ASME section VIII Div. 1.

v. Ultrasonic test on forgings and casting of critical components like hook, shafts, axles, gears, wheels, pulleys, etc. Ultrasonic test for casting as per ASME Section III NB 2572 & for forging as per ASTM A388.

Unacceptable defects in forgings are as given below: -

1. Cracks, flaws, seams and laps.
2. Defects giving indication larger than 4mm diameter equivalent flaw.
3. Groups of defects with maximum indication less than that from a 4mm dia, equivalent flaw, which cannot be separated at testing sensitivity if the back echo is reduced by 50%.
4. Defects giving indication of 2 to 4 mm diameter equivalent flaw separated by a distance less than 4 the size of the larger of the adjacent flaws.

vi. PT/MT on component with surface hardening as per ASTME -165 and ASTME 138 respectively with no surface defects.

vii. Gearbox trial run test as per IS / AGMA standards.

viii. Acceptance and routine tests (HV and insulation) for all electrical and electromechanical components and system as per governing specification

ix. Functional and simulated operation test, sequencing, interlocks, safety, protection and alarm system. Test on CRANE / CRAB motors and other mechanical, electrical, electro-mechanical as per BHEL technical specification and or as per applicable code

x. Cranes shall be completely assembled at manufacturers' works to check the misalignment of gears, shafts and other items. Gear box shall have the idle run for minimum two (2) hours.

B. Testing At Works (Final)

i. Deflection test of bridge girder at rated load.

ii. No load (both hoisting & CT), load (SWL)(both hoisting & CT), Over load test (Hoisting at 125% of rated load.)

iii. Electrical tests for brakes, panel, electrical equipment etc as per IS - 3177

iv. Measurement of speed of CT & Hoisting (lowering & raising) at rated load.

v. All Other tests as per IS-3177.

Note: Refer Annexure-IV, Section-IA, Volume II-B for "Shop test Procedure for Load/Overload testing of EOT cranes at Manufacturer's Works.

1.3.2 Testing at site

The following tests shall be carried out at site by **BHEL** as a part of Erection and Commissioning:

a) All the tests as mentioned against S.N. 1.3.1 (B) above, with actual hook and wire rope.

b) No load, load test (SWL) for LT

c) Speed test at rated load for hoisting, CT and LT mechanism.

d) Brake test and working of electric hoist.

e) Any other test as per IS-3177-2020.

The successful bidder shall furnish their recommended procedure for carrying out the Erection, Commissioning & testing at site as mentioned above.

1.4.0 Surface Preparation, Painting & Colour Scheme

Detailed painting procedure has been attached as Annexure III, Section IA, Volume IIB. Bidder shall follow the same.

1.5.0. Drawing / design document for submission after award of contract

Drawing/ design documents to be submitted as per list & submission schedule attached as Annexure-V Section IA, Volume IIB.

Any other design document/ drawing as required by customer/ BHEL shall be submitted by bidder during detail engineering without any implication.

2.0.0. **Works Excluded**

2.1.0 Supply of steel gantry girders/ ISMB for crane travel

2.2.0 For EOT crane:

The purchaser shall provide single point 415V, 3 phase, 4 wire and 50Hz power feeder at any point of the bay or in the middle of the bay as specified in the Data sheet A. Vendor shall

provide main isolating switch at 1.5 M above the ground / operating floor level and cable required from isolating switch to DSL.

Any other supply required by the bidder shall be arranged by the bidder himself by using suitable transformer as per the specification.

3.0.0. **Deviations**

If the proposal submitted has got any deviation from the technical stipulations in the tender document, bidder shall tabulate the same in the appropriate "Schedule of Deviations- with cost of withdrawal" furnishing full particular of such deviations. Deviations are to be furnished with mention to specific clause number. Reasons / explanations for such deviations shall be furnished. Notes / comments etc. is not acceptable. If there are no deviations from the tender document, bidder shall indicate 'NO DEVIATION' in the deviation schedule.

4.0.0. **Make of Sub - Vendor items**

Make of bought out items will be as per Annexure-I, section IA, volume II-B of the specification. No other make will be acceptable, until and unless specifically got approved by BHEL/Customer during detail engineering. Acceptance/non acceptance of same shall not have any impact on manufacturing & delivery schedule and on cost of crane.

5.0.0 **INFORMATION TO BE FURNISHED BY BIDDER ALONG WITH THE OFFER**

As detailed in "List of documents to be submitted with bid", Section III

6.0.0 **OTHER REQUIREMENTS**

Successful bidder shall furnish detailed erection manual for each of the equipment supplied under this contract along with supply of concerned equipment / component.

Document approval by customer under Approval category or information category shall not absolve the vendor of their contractual obligations of completing the work as per specification requirement. Any deviation from specified requirement shall be reported by the vendor in writing and require written approval. Unless any change in specified requirement has been brought out by the vendor during detail engineering in writing while submitting the document to customer for approval, approved document (with implicit deviation) will not be cited as a reason for not following the specification requirement.

In case vendor submits revised drawing after approval of the corresponding drawing, any delay in approval of revised drawing shall be to vendor's account and shall not be used as a reason for extension in contract completion.

QUALITY ASSURANCE PLAN

610547/2021/PS-PEM-MAX

MANUFACTURER'S NAME & ADDRESS	MANUFACTURING QUALITY PLAN		PROJECT:
	ITEM: EOT CRANES - SINGLE GIRDER	REV Rev 00	PACKAGE: SG crane
		DATE	P.O.NO –
	CAPACITY: -	PAGE Page 1 of 4	BHEL NO:
			CONTRACTOR: BHEL

S.NO.	Component & Operation	Characteristics	Class	Type of check	Quantum of check	Reference Document	Acceptance Norms	Format of Record	Agency D	Agency M	Agency C	Agency N	Remark
1	2	3	4	5	6	7	8	9		10			11
`	***FOR EOT CRANE***												
1.0	**RECEVING INSPECTION**												
1.1	Structural-Plates/RSJ for Main Girders, End Carriages Trolley, Pulley, Gearbox housing , rope drum (if fabricated) etc.	Physical & Chemical	Major	Lab Analysis	100%	IS:2062 Gr. A or B / As per approved G.A.		MTC / Lab Report	_/	P/V	V	V	
1.2	Rope Drum (Seamless Pipe)	Chemical Mechanical	Major	Lab Analysis	1/pipe	Approved drg/DS ASTM A106 Gr A or B		Lab Report	_/	P	V	V	
		Flattening & Acid etching Test Surface defect	Major	Mech test Visual	1/pipe 100%	no cracks, pitting, rusting, damage ,etc		I.R.	_/	P	V	V	
1.3	Gears, pinions, shafts, axles & wheels (#)	Chemical& Mechanical,	Major Major	Lab Analysis UT	1/lot 100%	IS:2004 (45C8/55C8) (Relevant IS/appd drg) ASTM A388/NOTE 1		MTC I.R	_/ _/	P P	V V	V V	# If wheel, gears, pinions, shafts & axle diameter / thickness is equal to or more than 50 mm UT shall be carried out, ref & acceptance norm at S.no.1.4(UT of hook) to be followed
1.4	Hook	Chemical & Mechanical	Major	Lab Analysis	100%	IS: 15560 Related Std. As per appd. Drg./data sheet		MTC	_/	V	V	V	
		UT (above 50 mm dia)	Major	UT on shank portion only	100%	ASTM A388 / ASME Sec VIII Divn 2 – NOTE:1		MTC/ ALC/QCR /UT report	_/	P	V	V	
1.5	Wire Rope	Examination of report of breaking load Dimension &	Major	Review of TC Measurement	100% 100%	IS: 2266 Appd G A drg	IS: 2266 Appd G A drg	Mfr's TC QCR	_/	P P	V V	V V	

MANUFACTURER	CONTRACTOR
NAME & SIGNATURE	

LEGEND: CLASS A: Critical, B: Major, C: Minor

** M: MANUFACTURER / SUB-CONTRACTOR D: Records for Data Fold
C: CONTRACTOR /NOMINATED INSPECTION AGENCY, ND: NDT LAB
N: Customer R: Test / Dim Report, IR-Inspection Report
INDICATE "P" PERFORMS, "W" WITNESS, MTC: Mfr's Test Cert.
"V" VERIFICATION, ALC: Approved Laboratory Certificate,
QCR: Quality Control Report

DOC. NO.:

NAME & SIGN OF APPROVING AUTHORITY & SEAL

610547/2021/PS-PEM-MAX

	MANUFACTURER'S NAME & ADDRESS	MANUFACTURING QUALITY PLAN		PROJECT:
BHEL		ITEM: EOT CRANES - SINGLE GIRDER	REV Rev 00	PACKAGE: SG crane
			DATE	P.O.NO –
		CAPACITY: -	PAGE Page 2 of 4	BHEL NO:
				CONTRACTOR: BHEL

S.NO.	Component & Operation	Characteristics	Class	Type of check	Quantum of check	Reference Document	Acceptance Norms	Format of Record	Agency				Remark
									D	M	C	N	
1	2	3	4	5	6	7	8	9		10			11
		Type, construction											
1.6	Motors & cables. Brakes	Make/Type/Rating/ Routine test Make/ type / rating/ HV/IR functional test	Major	Visual / Measurement	100%	Appd drg/DS/Tech spec/Rel IS	I.R	STC	_/	P	V	V	For motor, ref. Note 2
1.7	Sheaves	Mech		Tensile & Hardness	1/lot	Approved Drg / Mfg drg		MTC	_/	P	V	V	
1.8	Limit switch, SFU, Relays, MCB, Fuses, Push buttons Etc Control transformer	Make/Type/Rating Functional /continuity Make , type, rating, input/output	Major	Review of TC	100%	Appd drg./DS/Scheme/NLC Spec./Manu.Std		QCR Routine TC/COC of mfgr	_/	V	V	V	
1.9	DSL	Make , type, rating, Dimension.	Major	Review of TC	100%	Appd drg./DS/Scheme /NLC Spec./ Manu.Std		QCR Routine TC/COC of mfgr.	_/	V	V	V	
2	**INPROCESS- INSPECTION**												
2.1	WPS,PQR & WPQ	Verification of approval				WPS,PQR & WPQ / Qualified by NTPC/ LLOYDS / EIL / TPL			_/	P	V	V	IN CASE OF NTPC/ LLOYDS / EIL / TPL QUALIFIED WELDERS AVAILABLE, REQUALIFICATION OF WELDER IS NOT REQUIRED
2.2	Assembled gear box	No load run test backlash & contact pattern, noise, vibration & oil temp rise (for oil lubrictd)	Major	Performance	100%	Apprvd drg/DS/Mfg std Noise 85dbA max, vibration 75 microns max, oil temp rise – 30 °C above ambient max			_/	P	V	V	

MANUFACTURER	CONTRACTOR
NAME & SIGNATURE	

LEGEND: CLASS A: Critical, B: Major, C: Minor

** M: MANUFACTURER / SUB-CONTRACTOR D: Records for Data Fold
C: CONTRACTOR /NOMINATED INSPECTION AGENCY, ND: NDT LAB
N: Customer R: Test / Dim Report, IR-Inspection Report
INDICATE "P" PERFORMS, "W" WITNESS, MTC: Mfr's Test Cert.
"V" VERIFICATION, ALC: Approved Laboratory Certificate,
QCR: Quality Control Report

DOC. NO.:

NAME & SIGN OF APPROVING AUTHORITY & SEAL

610547/2021/PS-PEM-MAX

MANUFACTURER'S NAME & ADDRESS	MANUFACTURING QUALITY PLAN		PROJECT:
	ITEM: EOT CRANES - SINGLE GIRDER	REV Rev 00	PACKAGE: SG crane
		DATE	P.O.NO –
	CAPACITY: -	PAGE Page 3 of 4	BHEL NO:
			CONTRACTOR: BHEL

S.NO.	Component & Operation	Characteristics	Class	Type of check	Quantum of check	Reference Document	Acceptance Norms	Format of Record		Agency			Remark
									D	M	C	N	
1	2	3	4	5	6	7	8	9		10			11
2.3	Welding of end carriage, Main Girder, Trolley , rope drum (if fabricated) etc.,	DPT of Welds(all)	Major	LPI	100% on butt&10% on fillet	ASTM E165 or Eq. / No crack or linear indication		I.R.	_/	P	V	V	
		RT of Butt weld	Major	RT	100%/10%	ASME Sec.VIII,Div.1, UW 51/52		RT film & report	_/	P	V	V	@RT-100%, for Butt weld in tension & 25% in compression. 100% RT on butt weld for fabricated rope drum
2.4	Hook	Dimension	Major	Measurement	100%	Mfr's drg / Related Std. As per appd. Drg./data sheet/ IS: 15560	IS: 15560	QCR	_/	P	V	V	
		Proof Load	Major	Load Test				QCR	_/	P	V	V	
		NDT after proof load	Major	LPI	100%	ASTME 165 or Eq. / No crack or linear indication		I.R.		P	V	V	
2.5	Gears, pinions, shafts, axles & wheels (#)	Hardness Surface Defect (after machining)	Major	DPT	100%	Approved Drg/ Data sheet ASTM E-165 No linear indication		MTC	_/	P	V	V	
3	**FINAL INSPECTION**												
3.1	Overall dimensions	Dimensions (span) level, alignment	Critical	Measurement	100%	Appd GA drg & IS: 3177/IS:3938		I.R.	_/	P	W	W	FUNCTIONAL CHECK OF PENDENT &
3.2a	Assembled Crane along with individual control panel & pendant station	Current & speed for Cross Travel & Hoisting, interlocking sequencing, inching operation, Limit switch operation	Critical	Measure /Verify	100%	Appd GA drg & IS: 3177/Appd data sheet		I.R.	_/	P	W	W	PANEL FOR SPECIFIC CRANE
		Deflection at SWL		Measurement					_/	P	W	W	
3.2b	Overload test at 125% of SWL	Holding capacity of brakes		Lifting from mid Air	100%	Appd GA drg & IS: 3177/ IS:3938/ Appd data sheet		I.R.	_/	P	W	W	

		LEGEND: CLASS A: Critical, B: Major, C: Minor		DOC. NO.:
		** M: MANUFACTURER / SUB-CONTRACTOR D: Records for Data Fold C: CONTRACTOR /NOMINATED INSPECTION AGENCY, ND: NDT LAB N: Customer R: Test / Dim Report, IR-Inspection Report INDICATE "P" PERFORMS, "W" WITNESS, MTC: Mfr's Test Cert. "V" VERIFICATION, ALC: Approved Laboratory Certificate, QCR: Quality Control Report		
MANUFACTURER	CONTRACTOR			NAME & SIGN OF APPROVING AUTHORITY & SEAL
NAME & SIGNATURE				

610547/2021/PS-PEM-MAX

MANUFACTURER'S NAME & ADDRESS	MANUFACTURING QUALITY PLAN	PROJECT:
	ITEM: EOT CRANES - SINGLE GIRDER CAPACITY: -	REV Rev 00 DATE PAGE Page 4 of 4	PACKAGE: SG crane P.O.NO – BHEL NO: CONTRACTOR: BHEL

S.NO.	Component & Operation	Characteristics	Class	Type of check	Quantum of check	Reference Document	Acceptance Norms	Format of Record	Agency				Remark
									D	M	C	N	
1	2	3	4	5	6	7	8	9		10			11
3.3	Control Panel & Pendant station	1. Make/type/rating of Bois. 2.IR-HV functional &interlocks 3.DOP by paper insertion for panel	Major Major do	Visual, Operational & Functional Measurement do	100% 100% 100%	Approved drawing / Data sheet / is: 3177 Paper should not go easily.		I.R.		P P	W W	W W	HV of power circuit at 2kV and control circuit at 1kV. IR of power & control circuit with 500V Meggar with acceptance norm of 0.5 Mega Ohm.
3.4	Painting	Examination – shade	Minor	Visual & measurement	100%	Customer's / Approved Painting Procedure				P	V	-	
		Dry Film Thickness	Major	Measurement	Sample					P	V	-	

NOTE1:'**' When back wall echo is set to 100% in sound area then,
a) defect echo shall not exceed 20%
b) Back echo shall be minimum 80% in any area

Note 2:- Less than 30 KW. Acceptance of motor less than 30 KW is based on COC of the manufacturer & the contractor confirming as follows: It is hereby confirmed that the above mentioned motor/motors was/were manufactured taking care of specification requirement regarding ambient temp, voltage & frequency variation, hot start, pull out torque, starting KVA/KW, temp rise, distance between center of stud and gland plate and tested in accordance with approved drawing/data sheet.

		LEGEND: CLASS A: Critical, B: Major, C: Minor		DOC. NO.:
MANUFACTURER	CONTRACTOR	** M: MANUFACTURER / SUB-CONTRACTOR D: Records for Data Fold C: CONTRACTOR /NOMINATED INSPECTION AGENCY, ND: NDT LAB N: Customer R: Test / Dim Report, IR-Inspection Report INDICATE "P" PERFORMS, "W" WITNESS, MTC: Mfr's Test Cert. "V" VERIFICATION, ALC: Approved Laboratory Certificate, QCR: Quality Control Report		NAME & SIGN OF APPROVING AUTHORITY & SEAL
NAME & SIGNATURE				

	1X660MW Bhusawal TPS-Unit: 6	SPECIFICATION No: PE-TS-415-524-A001
		VOLUME: II B
	SINGLE GIRDER EOT CRANE	SECTION-I
	SPECIFIC TECHNICAL REQUIREMENT	SUB-SECTION-IA
		REV 00 / DATE DEC 2021

CUSTOMER SPECIFICATION

1.0 INTRODUCTION

1.1 This section covers the Electric Overhead Traveling Cranes (EOT) which will be required for handling various power plant equipment for erection and maintenance purposes for 1 X660 MW Power project.

2.0 CODES AND STANDARDS

The design, manufacture and testing of the crane shall conform to the latest editions of the following codes and standards

2.1	CMAA Specification No. 70	:	Specification for Top Running Bridge & Gantry type Multiple Girder Electric Overhead Travelling Crane.
2.2	ANSI/AISC 360-05	:	Specification for Structural Steel Buildings.
2.3	IS : 807	:	Code of Practice for Design, Manufacture, Erection and Testing (Structural Portion) of Cranes and Hoists.
2.4	IS : 3177	:	Code of Practice for Design of Overhead Traveling Cranes and Gantry Cranes other than Steel Works Cranes.
2.5	IS : 1835	:	Round Steel Wires for Ropes.
2.6	IS : 2266	:	Steel Wire Ropes for General Engineering Purposes.
2.7	IS : 3443	:	Crane Rail Sections.
2.8	IS : 3815	:	Point Hook with Shanks for General Engineering Purpose.
2.9	IS : 5749	:	Forged Ramshorn Hooks.

2.10	IS : 816	:	Code of Practice for Use of Metal Arc Welding for General Construction in Mild Steel.
2.11	IS : 823	:	Code of Practice for Use of manual Metal Arc Welding of Mild Steel.
2.12	IS : 1181	:	Qualifying Tests for Metal Arc Welders (Engaged in Welding Structures other than pipes).
2.13	IS : 1323	:	Code of Practice for Oxy-Acetylene Welding for Structural Work in Mild Steel.
2.14	IS : 9595	:	Recommendations for metal arc welding of carbon & carbon - manganese steel.
2.15	IS : 3813	:	Specification for 'C' Hooks for use with Swivels.
2.16	Hooks shall conform to BS: 482/2903/3017	:	

2.17 All electrical installation work shall comply with the provisions of Indian Electricity Act and Indian Electricity Rules as amended upto date.

2.18 ANSI-B 30.2.0 - Safety codes for overhead and Gantry Cranes.

In case of any contradiction between the above mentioned codes and standards and this technical specification, the later shall prevail.

3.0 SCOPE OF WORK

3.1 The required number of E.O.T. cranes as indicated in Data Sheet-A having duty and service conditions as specified hereinafter along with all accessories.

3.2 Runway rails for entire runway length along with rail clamps, all inserts, insert plates, anchor bolts, nuts, buffers & stops, limit switches etc as required.

3.3 Runway conductors for the entire runway length complete with all insulators, supports, support brackets, fixing clamps, bolts, nuts etc and as required to complete the installation. Power supply cabling including isolating switch complete along with electrical items, attachments and accessories as required for feeding power to the runway conductor.

3.4 All protective devices, anti-collision limit switches etc as required for the crane.

3.5 All facilities, accessories and attachments for single and tandem operation of the cranes.

3.6 Bridge and trolley current collectors and bridge cross conductors along with all wirings etc for the crane as required.

3.7 Crane components shall be provided with lifting lugs, eye-bolts etc at suitable locations.

3.8 Down shop leads (DSL) with fire protection sheathing with all fixing arrangement & isolators.

3.9 Operator's Cabin or pendant push button, Radio Remote Control as applicable.

3.10 Illumination of crane and working area with lamp below trolley which shall be swiveling type.

3.11 Provision of monkey ladders for approach at convenient locations.

4.0 PERFORMANCE REQUIREMENTS

4.1 CAPACITY

4.1.1 The safe working load (Y) for E.O.T. cranes shall be computed as
Y = 1.25 a

Where a = Weight of single heaviest equipment expected to be handled. (Excluding Generator Stator subject to a minimum capacity of 130 Tonnes for EOT crane at TG Hall)

4.2 HIGHEST POSITION

The highest position reached by the lifting hooks shall be such that during operation, the minimum vertical critical clearance between bottom of the equipment being handled and the top of any permanent structure or equipment in the operating area shall be at least one meter.

4.3 LOWEST POSITION

4.3.1 The lifting hooks of the turbine hall cranes should reach up to the ground level (0 m). The auxiliary hooks should reach up to the condenser pit level.

4.3.2 In case of all other E.O.T. cranes, the lifting hooks shall reach up to the floor of its operating area or sump pits as necessary.

4.4 HORIZONTAL CLEARANCE

4.4.1 **The hook in vertical position should reach at least upto 1.0m from the runaway rails for all single girder cranes.**

4.4.2 **The hook in vertical position should reach at least upto 2.5m from the end stopper in case of all single girder cranes.**

4.5 If safe and reliable handling necessiates more operating space for the E.O.T. cranes, the same shall be provided.

5.0 DESIGN & CONSTRUCTION

5.1 GENERAL

5.1.1 In the design of components on the basis of strength, factor of safety shall not be less than five (5) based on ultimate strength. Impact, fatigue, wear and stress concentration factors shall be taken into account, wherever applicable. Mechanism class shall be as indicated in the Data Specification Sheet.

5.1.2 The crane shall be rigid in construction and all movements shall be smooth and non-jerky. Acceleration for cross travel and long travel motors shall be limited to reasonable values as to preclude any swinging of the load.

5.1.3 Drives shall be designed with adequate margin to give best performance and efficiency. Safety arrangements shall be incorporated to prevent damage to motors on account of mechanical overload and electrical faults and to gearing, shafts etc due to over-stressing and other detrimental conditions.

5.1.4 All materials shall be of tested quality and shall conform to the specification requirements and standards mentioned and shall be new and first class in all respects.

5.1.5 Castings and forgings shall be of tested quality and shall conform to their respective material specifications and shall be free from flaws and objectionable imperfections, machined true and in a workman like manner.

5.1.6 No wood or other combustible material shall be used unless specifically approved by the Owner/consultant.

5.1.7 Proposals for repair or any similar operations involving plugging, welding, boring or addition of metal to the original castings or forgings shall be submitted to the Owner and his approval must be obtained before any such work is carried out. Drawing showing details and location of such repairs shall be submitted to the Owner.

5.1.8 All fabrication by welding shall be carried out by qualified and certified welders as per IS: 1181. **DNV/ Lloyd/ EIL/ BHEL or Customer approved qualified welders will carry out welding.**

5.1.9 Design shall provide for easy maintenance of all parts, particularly the wheel bearings on end-trucks.

5.1.10 Temperature Effects

Where any portion of the structure is not free to expand or contract under variation of temperature, allowance shall be kept for stress resulting from these conditions; the co-efficient of expansion for each degree centigrade variation of temperature above and below normal being taken as 0.000012

for mild steel. Clause 8 of Section II of IS : 800-1962 Code of practice for use of structural steel in General Building construction - shall also apply.

5.1.11 Maximum use shall be made of shop fabricated sub-assemblies.

5.1.12 Alternative design to those prescribed in specifications will be considered only if found technically suitable and acceptable to the Owner in the light of requirements and accompanied by substantial reduction in cost.

5.1.13 Material of Construction

The material of construction of the major components of the crane shall be as indicated in the Data Sheet-A. Manufacturers are however free to use alternative material, which are superior for the intended service. But in all cases, they are required to obtain prior concurrence of Owner after furnishing chemical and physical properties of the offered material and any other information that may be asked for by the Owner.

5.1.14 Load Indication

The crane bridge shall have permanent inscription in English on each side, readily legible from operating floor, stating manufacturer's name, serial number, the year of manufacture and the safe working load.

5.2 STRUCTURAL DESIGN CONSIDERATION

5.2.1 Minimum thickness of metal

For load carrying members the component plates, bars, angles and other rolled sections shall be minimum 8 mm thick. For tubes having both ends sealed, the minimum thickness shall be 4.9 mm (6 SWG). For unsealed tubes, the minimum thickness shall be 8 mm. The chequered plates for platforms shall be minimum 6 mm thick.

5.2.2 Accessibility for maintenance

All structural parts shall be designed so that they are accessible for periodic cleaning, brushing and painting. All rivets/bolts shall also be accessible for periodic checking.

5.2.3 Ruling dimensions and ratio

(a) For compression members, the slenderness ratio shall not exceed 120. In case of other load carrying members and subsidiary members, the slenderness ratio shall not exceed 180.

(b) For girders, the following values of maximum span to depth ratio shall be governing :

Plate girders: 18

Lattice girders: 12

5.2.4 Connections

(a) Unless otherwise specified, only riveted or welded joints shall be used.

(b) Where welding or riveting is not practicable, turned and fitted bolts shall be used, preferably as per IS-1364 and IS-1367.

(c) Minimum number of rivets or turned and fitted bolts in a connection shall not be less than two.

(d) Black bolts shall not be used in main structures and high tensile bolts shall not be used unless approved by the Owner. Bolts shall preferably be not used in tension.

(e) Where bolts pass through sections having tapered flanges, tapered flats shall be welded to inside of the flanges. Tapered washers shall not be used.

(f) Transverse fillet welds on load carrying members shall be avoided. If side fillets are used in end connections, the length of each side fillet shall not be less than the edge distance between the fillets.

(g) Butt welds on structural members under tensile stress shall be checked by Radiographic examination as and when directed by the Owner/Consultant.

(h) Splices shall be designed to resist one and half times the forces and moments to which it is subjected, but in no case it shall be less than (2/3) rd of the effective strength of the material spliced except that splices in the webs of the plate girders shall be designed for full strength of the web in shear as well as bending. For splicing tension members, the net section of the splice plate shall be ten (10) percent more than that of the material spliced. Splices shall be proportioned and arranged, so that the gravity axis of the splices are in line with the gravity axis of the member to avoid eccentricity.

5.2.5 Deflections and Camber

(a) The total maximum vertical deflection of the girders for the live load plus trolley and not including impact or dead load of the girder shall not exceed limit of Span/900.

(b) The girders shall be cambered by an amount equal to the maximum deflection due to dead load plus one half the live load and trolley.

5.3 BRIDGE GIRDER AND END CARRIAGE

5.3.1 The crane shall have single girder or double girder as required.

5.3.2 The bridge girder shall be box section type or braced I beam type as per standard design of the manufacturer. The exterior surface shall be smooth and free from projections etc as far as possible to minimize dust collection on it.

5.3.3 Single girder cranes shall be provided with suitable truss for supporting the bridge drive machinery and motor.

5.3.4 The crane bridge shall be carried on end trucks of suitable design. Each end truck shall be built up from steel plates welded together to form a closed box section with opening at each end to receive the wheels. Steel sections shall be welded to the trucks to form bearings for the wheel axles and the driving shaft. End trucks shall be provided with rail sweep and bumper. They shall also be provided with suitable jacking pads for maintenance of the wheel and bearings. The location of the jacking pads shall be such that it will not interfere with the maintenance of the wheels and its bearing. Single

girder crane shall be provided with suitable truss for supporting bridge device machine & motor.

5.3.5 Driving wheels shall be of the double flange and taper tread type and shall be ground to equal diameter in pairs. Wheel axles may be either of the stationary or rotating type as per standard of the manufacturer. If stationary type, they shall be prevented from turning in the truck by means of a key plate fitting into a slot in the end of the axle and if rotating type, wheels shall be keyed to them.

5.3.6 Where more than two bridge wheels are used per end truck, the end truck shall be split into two sections, each carrying one bridge independent of other. Two sections of the end truck shall be joined by suitable joining device that will ensure uniform wheel loading. Steel pads shall be welded on the top of end trucks where the girder rests and shall be machined to receive the girder ends.

5.3.7 Trolley travel rail ends shall be curved upwards to stop the trolley smoothly and prevent it from leaving the rails in case of over travel at its maximum speed.

5.3.8 End trucks shall be equipped with spring/rubber buffers and rail sweep for bridge travel. The rail sweep shall be such that it can push away any object that may fall on the runway. The buffers shall be of substantial design and suitable for engaging the stops at the end of runway.

5.3.9 Breathing holes shall be provided in completely enclosed welded box type girders. Drain holes shall be provided in all places where water or oil is likely to collect. Where practicable, means of access shall be provided for inside inspection of completely enclosed box girders.

5.3.10 In bridge girder strength calculations, the trolley rails and chequered plates shall not be considered as load carrying members.

5.4 TROLLEY FRAME

5.4.1 The trolley frame shall be built up from heavy steel plates, angles and channels adequately braced to resist vertical, lateral and torsional strains,

welded to form a rigid one piece frame. Alternatively, it may be of cast steel construction. **Material of construction of trolley shall be as per IS: 2062 (Grade A/B).**

On bottom of trolley frame, on each side shall be a double spring bumper to engage stops at each end of the bridge.

5.4.2 Equalizer sheaves shall be mounted on the trolley frame in such a manner that deflection resulting from the force on the sheaves is not directly transmitted to the hoisting mechanism.

5.4.3 Sheaves shall be so arranged on the trolley that rope reeving arrangement resulting there from will ensure a lifting of the load in almost a vertical line with minimum of swing or side-movement.

5.5 PLATFORMS AND LADDERS

5.5.1 Safe means of access shall be provided to every place where any person engaged in the examination or maintenance of the crane has to work. Adequate handholds and footholds shall be provided, as necessary.

5.5.2 One meter high double tier handrail and suitable toe-boards shall be provided along the entire length of platform (on the bridge), which shall not be less than 750 mm wide. One platform for full span length on each side of the crane girder shall be provided

5.5.3 Every platform shall be provided with steel chequered plate top and be securely fenced with one to two metres high double tier hand rails of 32 mm diameter GI pipe and toe boards. Platforms shall be of sufficient width to enable normal maintenance work to be undertaken safely.

5.5.4 In case lattice riveted construction is offered for the bridge girder, full length chequered plate platform with adequate headroom shall also be provided at bottom chord level for periodic checking of all rivets/bolts and other items.

5.6 OPERATION

The crane shall be operated either from cabin in the crane bridge or from a pendant control station or from Radio Remote Control (for TG floor crane) as specified in Data Specification Sheet.

5.6.1 Operator's Cabin

(a) The operator's cabin shall be open type, suitable for indoor service and complete with light, fan and seat. The cabin shall be located on one end of the crane bridge and under one of the bridge girders, so that it is offset to one side. The cabin shall be provided with guarding hand rails and the floor shall be covered with electric insulating carpet. Clear headroom of 2000 mm shall be ensured within the cabin.

(b) A foot operated type warning gong shall be provided within the cabin. The cabin shall be of ample size to contain controllers, protective panel, main isolating switch and other accessories required for operating the crane. A ten (10) lbs. capacity portable CO_2 fire extinguisher shall be provided in the cabin.

(c) Provision shall be made at three convenient positions for emergency exit of the Crane Operator, in case of power failure.

5.6.2 Pendant Station

(a) The pendant station shall locate the push buttons for controlling the various motions of the crane and shall be hung from the crane trolley to a height of approximately 1 metre above the operating floor.

(b) With pendant operation, foot operated bridge travel brake and the drum controllers need not be provided.

5.7 REPAIR CAGE

5.7.1 A repair cage shall be provided on the inside of the end carriage for attending the main current collectors. In case, the trolley current collectors are located below trolley rail level on the inside webs of the bridge girders,

guards shall be provided on the trolley to prevent the hoisting ropes from coming in contact with conductors. Also a repair cage shall be provided on the trolley to attend these conductors.

5.7.2 Repair cages shall also be provided at the corners of the crane, if required, to facilitate removal and replacement of long travel wheels.

5.7.3 The repair cages shall be adequately sized, guarded for safety and correctly located for the intended service. Suitable access to the cages shall be provided.

5.8 LIFTING HOOK BLOCK ASSEMBLY

The lifting hook block assembly shall be ramshorn type or approved equal for capacity greater than 40 Tonnes and point hook with shank for capacity below 40 Tonnes and shall be of steel construction. Each hook shall be supported on ball or roller thrust bearing and shall rotate freely on its bearings. Safety latch shall be provided in the hook.

The sheaves of the hook block shall be encased in an oil tight casing permitting generous lubrication of wire ropes and sheaves and also preventing accidental tapping of hands. Sheave pulley block shall be provided with ball/roller bearings.

All sharp edges on the hooks shall be eliminated to prevent damage to the sling ropes. The hooks shall conform to the requirements of IS: 3177.

5.9 GEARING

5.9.1 Gears in the speed reducer unit for bridge drive and also all hoists and trolley drive gearing shall be enclosed in substantial housing and shall operate in oil bath. The oil shall have additives of approved quality and shall be of approved viscosity at standard temperature (say 60°C). The housing shall be of sufficient design not to permit a temperature in excess of 90°C for the oil bath and shall be adequately supported and readily removable without disturbing the gear assembly.

5.9.2 Gears shall be of cast or forged steel and pinions shall be forged steel and shall be machine cut. Gear and pinion teeth shall be treated for resistance to wear.

5.9.3 Gears shall have tooth form and modules as recommended in IS-3681 and they shall be adequately designed to stand shock load and vibration and shall not be excessively noisy in operation. The ratings of gears shall be established as per IS: 4460.

5.9.4 Spur and helical gears only shall be used for reduction gearing.

5.9.5 Mounting of the gears shall be such that axial thrust on the bearing is minimum. Centre distance of the connecting shafts shall be as close as possible to the theoretical value. Shafts shall be designed to keep their deflections within permissible limits.

5.10 BEARING

5.10.1 The type of bearings for various parts shall be as per IS-3177 and standard of manufacturer.

5.10.2 Provision shall be made for service lubrication of all bearings. Bearing enclosures shall be designed as far as practicable to exclude dirt and prevent leakage of oil or grease. Arrangement for centralized lubrication of bearings shall be provided to the maximum extent possible and a detailed scheme for the same shall be furnished along with the tender.

5.10.3 Suitable drip pans shall be provided as required to collect oil and grease which may drop from operating parts. All drip pans shall be accessible for draining and cleaning.

5.10.4 All bearings of the gearing shall be antifriction type. Angular contact ball or taper roller bearings shall be used wherever necessary. The bearings shall correctly locate the shafts while allowing for thermal expansion of the shafts. Bearings shall be enclosed in suitable housing with proper holes and plugs to prevent any ingress of dirt and to permit easy lubrication of the bearings.

5.11 GUARDING

Guards of an approved design, which will push forward or off the rail track any object placed across it, such as person's foot or arm, shall be attached to each end of the end carriage.

5.11.1 Protection guards to live electrical wirings/conductors shall be provided. Top and bottom of DSL (down shop lead) for the entire routs of DSL shall be covered by 14 SWG M.S. sheet with adequate structure duly painted to avoid accident.

5.11.2 Suitable guards to revolving shafts and coupling, long travel cross shafts and gears shall be provided.

5.11.3 The sheaves of the hook block fitted with two sheaves or fewer shall be guarded to prevent trapping of hand between a sheave and the running rope.

5.11.4 Effective means of guiding the wire ropes over the sheaves shall be provided so as to prevent dismounting of rope from the sheave grooves even when a slack rope condition is developed.

5.11.5 All openings in foot walk flooring, for access to bottom chord platform, if any, and to other inspection platforms, shall be provided with covers having suitable locking means to avoid any accidental opening.

5.11.6 All electrical panels, resistance boxes shall have suitable rain/ dust hoods over them to prevent water and building construction material falling on them, as it is apprehended that erection and commissioning of the crane might have to be taken up before completion of the building roof.

5.12 RUNWAY RAILS

5.12.1 Crane runway rails with bolts and nuts and complete with shims, anchor bolts, inserts and other fixtures for fixing the rails to crane girders shall be under the scope of supply.

5.12.2 The length of the rail supplied shall be sufficient to cover the whole of runway length. Gap between successive rails shall not exceed 2 mm and end rails shall be provided with stoppers to prevent longitudinal shifting.

5.12.3 The rail section shall be as per IS: 3443.

5.13 WIRE ROPES

5.13.1 The wire ropes shall be of suitable diameter as per Suppliers design of crane. The rope shall confirm to I.S. 1835, I.S. 1804 and I.S. 2266. The rope shall be parallel right hand lay having 6 x 37 constructions with hemp core. However, this should be in relation with Drum diameter as per IS: 3177. The rope selection procedure shall be as per IS 3177 cl. no. 8.3.2.

5.14 ROPE DRUMS

5.14.1 The drum shall be fabricated from Mild Steel Plate of weldable quality IS: 2062. All fabricated rope drums shall be stress relieved. All butt welds shall be subjected to 100% radiography. The plate material for this drum shall be accepted only after this plate has been successfully passed in ultrasonic testing. It should be sufficiently wide to accommodate in one layer the length of rope required for specified lift and in addition not fewer than two dead turns at each anchored end and one spare groove at opposite end.

The drum shall be flanged at both ends and flanges shall project a distance not less than two rope diameters above the rope. A spur or other wheel secured to the drum may be regarded as forming one of the flanges.

Rope anchorage shall be readily accessible.

(a) Strength of drum

Drums shall be designed to with-stand the compressive stress caused by wound on rope and the local bending stress caused in the drum at the groove when the rope is wound on. The bending stress due to the beam action of the drum shall also be taken into consideration.

(b) Diameter

The drum diameter measured at the bottom of the groove shall be not less than the appropriate value specified in IS: 3177.

(c) Drum Grooves

The lead angle of rope shall not exceed 5° (1 in 12) on either side of helix angle of groove in the drum.

Rope drums shall be machine grooved and the contour at the bottom of groove shall be circular over an angle of 120°. The radius of the groove shall be larger than the radius of rope as per IS: 3177.

The depth of groove shall not be less than 0.35 times diameter of rope.

The clearance between the adjacent turns of ropes shall be as per of IS: 3177.

The drum gear shall be cast steel as per IS: 2707 Gr. II. It shall be suitably heat treated for resistance to wear.

5.15 ROPE SHEAVES

(a) Material

The sheaves (Pulleys) shall be of carbon steel casting having chemical and mechanical properties as per IS: 1030 (Class 11).

(b) Grooving

Sheaves shall be machine grooved to a depth not less than 1.5 times the diameter of rope. The grooves shall be preferably hardened and finished smoothly and be free from surface defects liable to injure the rope. The contour at bottom of the groove shall be circular over an angle of approximately 130° +5°. The radius of this part of groove shall be larger than the radius of rope by an appropriate amount as per IS: 3177.

(c) Diameter of Sheaves

The diameter of the sheaves at the bottom of the groove shall not be less than that of the drums as specified in IS: 3177.

(d) Lead Angle

The angle between the rope and a plane perpendicular to the axis of the pulley shall not exceed 5° (1 in 12).

(e) Sheave Guards

Sheaves shall be provided with guards to retain the ropes in the grooves, if necessary.

5.16 TROLLEY RAIL

5.16.1 The specification includes the supply of trolley travel rails complete with fixtures for fixing the rails to the body of crane.

5.16.2 The length of the rail supplied shall be adequate for maximum permissible trolley travel. Gap between successive rails shall not exceed 2 mm and end rails shall be provided with stoppers to prevent longitudinal shifting.

5.17 RAIL JOINTS AND FIXING

5.17.1 The rails shall be butt jointed by either thermit welding or fusion welding process. The Contractor shall get his proposal for edge-preparation of rails, welding procedure and sequence, approved in advance by the Owner/ Consultant.

5.17.2 The schemes of securing the rails to the gantry girder/bridge structure with clamps, bolts and nuts, their alignment etc. shall be subject to the approval of the Owner/Consultant.

5.18 TOLERANCES

The limits of tolerance as specified in the Data Sheet-A shall be observed.

5.19 RAIL END STOPS

Rail end stops of adequate design shall be provided on both ends of the runway. The end stop location and arrangement shall be such that the unavailable length of runway (for crane operation) on any end is a minimum.

5.20 DRIVE MECHANISM

5.20.1 Equal driving effort shall be applied at each drive wheel of bridge and trolley to prevent one end from travelling faster than the other.

5.20.2 For bridge, the torsional deflection in the cross shaft shall be limited to safe value as per applicable code.

5.20.3 For bridge drive, the motor shall be located at mid position of the span. If twin motors are used for drive, motors shall be equidistantly located at each wheel end. Suitable interlock shall be provided to prevent single motor operation at any time.

5.20.4 Trolley drive shall be achieved by single motor in which the motor shall drive a common output shaft through proper gearbox and tractive power shall be transmitted to the geared wheels by means of pinions mounted on both ends of the output shaft.

5.20.5 All machineries for the drive unit shall be properly aligned. Self-aligning type gear couplings shall be used between connection shafts to take care of transverse as well as axial movement wherever necessary. Wherever components of considerable amount of inertia is directly mounted on the high speed shaft (e.g. brake drum, couplings, etc.) they shall be balanced statically to minimise vibration.

5.20.6 Motor ratings shall be calculated keeping margin of at least 25% over the maximum power requirement. Further, the hoist motors shall be rated to lift 125% of the design load on the hook at the rated speed. For other details the clause no. : 5.22.00 below shall be referred to.

5.20.7 Along with the drive mechanisms adequate brakes shall be provided as detailed in clause no. : 5.23 bellow selection and design of brakes shall be

complete responsibility of the manufacturer. The brakes shall be of accurate rating to stop each motion within a very short distance and in a safe and smooth manner.

5.21 CRANE ELECTRICALS

5.21.1 The crane(s) shall be furnished complete with all electrical equipment, accessories and cabling/wiring; as may be necessary for the efficient and safe operation of the crane.

5.21.2 The crane electricals shall be designed for satisfactory operation from the available power supply as given in the Data Sheet-A.

5.21.3 All electrical equipment, accessories and wiring shall have tropical protection involving special treatment of insulation and metal against fungus, insects and corrosion.

5.21.4 All electrical equipment shall be laid out so that they are readily accessible for inspection and maintenance..

5.22 DRIVE MOTORS

5.22.1 All crane motors shall be totally enclosed, fan cooled type, having class-B stator insulation and class-F rotor insulation for slip ring motors & class-B insulation for squirrel cage motor with temperature rise limited to class-B operation in all cases.

5.22.2 Motor enclosures shall conform to the degree of protection IP-55.

5.22.3 Motors shall be slip ring wound rotor type, designed for crane duty requirement of frequent starting, reversing and plugging.

5.22.4 Motors shall suit the duty class S4, cyclic duration factor 40% and number of cycles per hour 150. Motor pull out torque shall not be less than 2.75 times rated torque.

5.22.5 Each motor more than 30 KW rating shall be provided with space heater, sized to maintain motor internal temperature above dew point when the motor is idle.

5.22.6 Motor shall be selected as per electrical service class-M8 as per IS-3177 (latest edition).

5.23 BRAKES

Selection and design of brakes shall be such as to meet the following requirements

5.23.1 Service Brake

(a) Double-shoe type service brakes shall be provided for each motion of the crane and its hoists. The service brakes shall apply automatically when power supply to the drive motor is cut-off or fails.

(b) Service brakes for main hoist motion shall be ~~electro-hydraulic thrustor type, for all double girder cranes either cabin or pendant operated and~~ electromagnetic disc type for single girder crane; adequately sized to arrest motion and hold at rest any load upto and including test load at any position of the lift.

5.23.2 Hoist Control Braking Means

Hoist motion ~~(both~~ main ~~and auxiliary~~) shall be provided with a self-contained sturdy braking system, ~~preferably of electro-hydraulic thrustor type,~~ to control the speed of hoisting as well as lowering down to 10% rated speed. The braking system shall be reasonably uniform and effective with all loads (from no-load to full-load) on hooks.

5.24 MAIN DISCONNECT SWITCH

5.24.1 Main disconnect switch shall be: metal-clad, 3-pole, load-break type in IP-54 enclosure, complete with compression brass glands and lugs to suit Owner's power supply connection.

5.24.2 The switch shall be provided with "Power On" red indication lamp (LED type) and shall be suitably located so that it can be manually operated from the operating floor level.

5.24.3 Power leads shall run from the main disconnect switch to the runway conductors.

5.25 RUNWAY CONDUCTORS (DOWN SHOP LEADS)

5.25.1 The runway conductors shall be four (4) in numbers for three phase supply and ground.

5.25.2 The runway conductors shall be of M.S. angle sections, liberally sized so as not to exceed current density of 0.42 Amps/mm^2. 14 SWG M.S. sheet protection guard shall be provided for the entire routes of DSL conductors (top & bottom) with adequate structures.

5.25.3 Sufficient allowance (minimum 20%) for wear and tear shall be provided over the calculated conductor size.

5.25.4 The runway conductors shall be supported on brackets and insulators from the crane girder with sufficient spacing in between the conductors.

5.25.5 The collector system per conductor shall be top-running type having spring loaded cast iron/carbon metallic shoes to maintain adequate contact pressure.

5.26 CROSS-CONDUCTORS ON BRIDGE

5.26.1 Cross conductors on bridge shall be flexible trailing cable system mounted on retracting supports (festoon type).

5.26.2 Alternatively, cross conductors of M.S. angles with shoe collectors, similar to the arrangement of runway conductors may be offered.

5.27 POWER DISTRIBUTION EQUIPMENT

5.27.1 From the main collector shoes, wiring shall be extended to one (1), 3-pole, load-break, safety disconnect switches -at the bridge near the collector.

5.27.2 The safety switches shall be capable of cutting-off the supply to all power driven and associated equipment of the crane but not the auxiliary loads such as fans, lights etc.

5.27.3 From the safety disconnect switches, wiring shall be extended to a protective panel, containing the following as a minimum :

(a) One triple pole incoming supply disconnect switch.

(b) One triple pole main magnetic contactor with HRC fuse backup, ON-OFF push buttons and RED-GREEN indication lamps (LED type).

(c) Motor feeders, each comprising of triple pole fuse switch unit with thermal overload (hand reset) relays for short circuit and over load protection in all three phases of the motor.

(d) Outgoing feeders with double-pole switch fuse units for auxiliary loads such as control supply, lights, fans, etc with atleast one spare feeder.

5.28 VOLTAGE DROP

5.28.1 All conductors and cables/wires shall be so sized that the voltage drop measured between the main disconnect switch and motor terminals shall not exceed 3% of rated voltage.

5.28.2 The voltage drop shall be computed using the total running current of all crane motors that can operate simultaneously and with rated crane load.

5.29 SAFETY INTERLOCKS

5.29.1 Disconnect Switch

(a) The operating handle of the main/ safety disconnect switch shall be mechanically interlocked with enclosure cover such that the same cannot be opened unless the switch is in OFF position.

(b) Main/safety disconnect switch shall have provision of pad-locking in OFF position.

5.29.2 Main Contactors

(a) The main contactor shall be electrically interlocked so that it can not close unless all the motor overload relays are RESET and all controllers are in OFF position.

(b) The main contactor shall be also opened by means of emergency push buttons and hoist limit switches.

5.30 EMERGENCY SWITCH

Mushroom type emergency STOP push buttons to open the main contactor shall be furnished - at least two on bridge platform within easy reach.

5.31 CRANE CONTROLS

Fully magnetic control shall be furnished complete with master controller (applicable for pendent operated controlled cranes) for each motion, complete with contactors, time lag relays, plugging protections, resistors and other accessories to meet the following control requirement :

5.31.1 Hoist Motions **(main hoist), auxiliary hoist not applicable for single girder cranes**

VVFC for both hoisting and lowering directions with 10% creep speed in Single Girder Cranes is offered.

(a) VVFC ~~or Conventional rotor resistance control shall be used in both hoisting and lowering directions, with a minimum of five (5) speed steps in each direction~~.

(b) Hoist control shall be designed to achieve "Inching Speed" of 10% the rated speed in both hoisting and lowering directions with loads (no-load to full-load) on hook.

5.31.2 Travel Motions (both bridge and trolley)

Conventional rotor resistance control shall be used in both forward and reverse directions, with a minimum of four (4) speed steps in each direction.

~~For double girder cranes having slip ring hoist, CT & LT motors, the speed steps are basically occurring during starting. In normal operation, there are~~

~~no speed steps in between rated speed & micro speed in hoist motion and no speed steps in CT/LT motion~~. For single girder cranes, there are no speed steps in CT/LT motion and no speed steps between rated speed and micro speed in hoist motion.

5.31.3 General

(a) All controls shall be designed to be fail-safe on loss of power.

(b) Control circuits shall be suitable for 240V, single phase, 50 Hz supply and complete with suitable dry type control transformer with isolation facility and primary/secondary fuses.

(c) Individual control/resistor panel shall be furnished for each motion for ease of inspection and maintenance.

5.32 CONTROLLERS

5.32.1 All controllers shall be provided with spring return to OFF position feature. When in OFF position, the controller shall disconnect power supply to the respective motor.

5.32.2 Each controller shall bear suitably engraved inscription of motions controlled in English and of direction of motions by arrows.

5.33 RESISTORS

5.33.1 The resistors shall be heavy duty, punch-grid type of stainless steel. Resistors shall be rated for 10 minutes and the maximum temperature at any time shall not exceed 250° C.

5.33.2 The resistor grids shall be housed in expanded metal enclosures IP-23 and shall be so mounted as to prevent vibration. Sufficient space shall be provided around the resistors to ensure adequate cooling air flow. Adequate weatherproof protection shall be provided for resistor enclosure.

5.34 LIMIT SWITCHES

5.34.1 The limit switches shall be totally enclosed type IP-55 with properly designed actuators and shall be readily accessible for adjustment and repair.

5.34.2 Each hoist shall be furnished with two (2) limit switches:

(a) A screw type limit switch with self resetting features which will act in case of over hoisting.

(b) A gravity operated hand-reset type limit switch as a back-up protection against over-hoisting.

5.34.3 Track type limit switches shall be provided on the bridge and trolley to prevent over travelling in either directions.

5.35 PANELS

5.35.1 Protective and control panels shall have IP-54 gasketed enclosure, fabricated from sheet steel, minimum 2 mm thick, suitably reinforced to provide structural rigidity.

5.35.2 The panels shall be front connected type with front hinged door for access to wiring and terminals. Engraved name plates shall be furnished for all panels and also for the equipment and device mounted thereon.

5.35.3 All panels shall be factory wired and terminated on suitable terminal blocks for external cable connection. All internal wiring shall be identified with numbering ferrules at both ends as per relevent wiring diagram. Terminal blocks shall have 20% spare terminals.

5.35.4 Control wiring shall be carried out with 1100 Volt grade flexible, heat resistant, insulated switchboard wires with minimum 2.5 sq.mm stranded copper conductor.

5.35.5 Each panel shall have internal illumination with fluorescent lamp and thermostat controlled space heater, suitable for operation on 240V 1-ph 50

Hz supply. Lamps and heater circuits shall have individual ON-OFF switches.

5.36 SWITCH

5.36.1 All switches shall be hand operated, air break, heavy duty, quick make-quick break type, capable of safely breaking the full load current of connected motor/feeder.

5.36.2 Incoming supply disconnect switch shall be interlocked with panel door so that the same cannot be opened unless the switch is in OFF position. Device to defeat this interlock shall also be included.

5.37 FUSE

5.37.1 All fuses shall be of HRC cartridge type, mounted on plug-in fuse base and provided with visible operation indicator.

5.37.2 All accessible live parts shall be adequately shrouded so as to eliminate the danger of accidental contacts with live parts while changing the fuse.

5.38 CONTACTORS

5.38.1 Contactor shall be suitable for crane duty, with current rating not less than connected motor full load current. All reversing contactors shall be mechanically and electrically interlocked.

5.38.2 Contactors shall have facility for easy inspection and replacement of parts. Arc chutes shall be provided where necessary.

5.38.3 Each contactor shall be provided with three positive acting, ambient temperature compensated, thermal overload relays with adjustable settings to suit the motor current.

5.38.4 The relays shall be hand-reset type, suitable for resetting with compartment door closed.

5.39 PUSH BUTTON AND LAMP

5.39.1 Push button shall be spring return type, with 2 NO + 2 NC contacts, rated 10A 240V A.C.

5.39.2 Indicating lamps shall be LED type with series resistor. Lamps and lens shall be replaceable from front.

5.40 ILLUMINATION

5.40.1 Crane lighting and space heating systems shall be designed for 240V, 1ph, 50 Hz supply and receptacle system for 240V, 1ph, 50 Hz supply. Suitable dry type transformers shall be furnished for the purpose, complete with isolation facility and primary/secondary fuses.

5.40.2 40W Fluorescent fixtures shall be used for lighting bridge platform. Four (4) 250W high-bay sodium vapour fixtures shall be provided below bridge for illumination of the working zones.

5.40.3 All lighting fixtures shall be mounted with anti-vibration mounting and shall be easily accessible for maintenance.

5.40.4 24V - 5A - 3 pin industrial socket outlets shall be provided - minimum four (4) on the bridge along the walkway.

5.40.5 One (1) portable 40W hand lamp with plug shall be furnished with adequate length of flexible cable for inspection of crane components.

5.40.6 One (1) heavy duty type industrial siren shall be provided with each crane.

5.40.7 Conduit wiring system shall be used for lighting circuits.

5.41 WIRING

5.41.1 All power, control and auxiliary circuit wiring shall be furnished and installed as per best installation practice. The design shall be such as to maximise shop wiring and minimise field wiring.

5.41.2 All wiring shall be done with 1100 V grade PVC insulated wire in conduits or by 1100 V grade PVCA PVC cables with extruded inner sheath.

5.41.3 Conductors shall be stranded aluminium for power and stranded copper for control. Minimum conductor size shall be not less than 2.5 mm^2 copper or equivalent.

5.41.4 Conduits shall be heavy gauge, rigid steel, hot-dip galvanised, cut square, reamed, threaded and screwed tight at all joints. Conduit entry to pull box or enclosure shall have double locknuts and insulating bushing. No running thread shall be used.

5.41.5 Solderless connectors shall be used for all connections. No splices shall be permitted in wire or cable. No taps or connections shall be made in fittings or junction boxes.

5.41.6 All wires and cables shall be identified with permanent markers at terminations as per approved wiring diagram.

5.42 GROUNDING

5.42.1 The crane rails, structures, motor frames, metal enclosures of all electrical equipment, conduit and tray system shall be effectively grounded in accordance with Indian Electricity Rules.

5.42.2 Bonding of structures and crane rails shall be provided as required to ensure electrical continuity.

5.42.3 The crane grounding system shall be connected to station ground mat. For this purpose, the Owner will provide ground conductor (50 x 6mm M.S. flat) at two agreed locations.

DATA SPECIFICATION SHEETS

DATA SHEET- A

SR. NO.	ITEM		
1.0	**GENERAL INFORMATION**		
1.1	Location	As per Datasheet-A	
1.2	Type		
1.3	Quantity		
1.4	Working condition		
2.0	**GUARANTEED PERFORMANCE REQUIRED**	Crane at Sr. No. 1 in Annexure I	Single Girder Cranes
2.1	CAPACITY: (Safe working load)		
2.1.1	Main Hoist (T)	** To be decided by the bidder.	
2.1.2	Aux. Hoist (T)	** To be decided by the bidder.	
2.2	RATED SPEED : (for any load from zero to SWL)		
2.2.1	Main hoist	1 m/min	3 m/min
~~2.2.2~~	~~Auxiliary hoist~~	~~3 m/min~~	~~5 m/min~~
2.2.3	Trolley travel	10 m/min	15 m/min
2.2.4	Bridge travel	15 m/min	25 m/min
2.3	Range of speed control for main and ~~auxiliary hoist~~ each motions (for any load from zero to SWL)	Down to 10% of corresponding rated speed.	Down to 10% of corresponding rated speed.

SR. NO.	ITEM	
3.0	DESIGN AND CONSTRUCTION	
3.1	DUTY CLASS	
3.1.1	Mechanism class	Class 2 as per IS-3177 and IS-807
3.1.2	Electrical Service class	Class 4 as per IS-3177
3.2	Operation	Pendent Station
3.3	Span between runway rail centres	To be decided by the bidder.
3.4	Net runway length	To be decided by the bidder.
3.5	Elevation of top of runway rails	To be decided by the bidder.
3.6	Elevation of bottom of building roof structures	To be decided by the bidder.
3.7	MAIN HOOK POSITIONS -	
3.7.1	Elevation- Highest	To be decided by the bidder.
3.7.2	- Lowest	To be decided by the bidder.
3.7.3	Min. approach from runway rail centre lines	To be decided by the bidder.
3.7.4	Min. approach from runway rail stops	To be decided by the bidder.
3.7.5	Clear space between runway rail centre line and nearest side obstruction/wall	To be decided by the bidder.
3.8	AUXILIARY HOOK POSITIONS -	
3.8.1	Elevation- Highest	To be decided by the bidder.

SR. NO.	ITEM	
3.8.2	- Lowest	To be decided by the bidder.
3.8.3	Min. approach from runway rail centre lines	To be decided by the bidder.
3.8.4	Min. approach from runway rail stops	To be decided by the bidder.
3.8.5	Clear space between runway rail centre line and nearest side obstruction/wall	To be decided by the bidder.
3.9	RUNWAY CONDUCTORS -	
3.9.1	Material	As specified earlier
3.9.2	Maximum allowable current density	Bidder to indicate
3.10	END TRUCK	
3.10.1	I-Section acceptable	No
3.10.2	Single flanged wheels acceptable	No
3.11	PERMISSIBLE TOLERANCE -	
3.11.1	Difference in levels of crane rail top measured between two adjacent columns	1.0 mm
3.11.2	Crane rail gauge	± 3.0 mm
3.11.3	Relative shift of ends of adjacent rails in plan and elevation after welding	1.0 mm
3.11.4	Deviation of crane rail axis from centre line of web of supporting girder	± 3.0 mm
3.12	Schedule of Brakes	
	Holding torque for control brakes shall be 150% of rated torque and that of service brake shall be 125%. The schedule of brakes shall be as under:	

SR. NO.	ITEM	
3.12.1	Main Hoist	**One (1) electromagnetic disc brake**
~~3.12.2~~	~~Auxiliary Hoist~~	~~Two (2) Electro-hydraulic thruster type brake~~
3.12.3	Cross Traverse	**One (1) electromagnetic disc brake**
3.12.4	Long Traverse	**One (1) electromagnetic disc brake**
		~~(b) Two (2) Hydraulic thrusters (foot operated)~~
~~3.12.5~~	~~Main Hoist (creep)~~	**Not applicable as VVFD is being offered for creep speed in main hoist. Mandatory spares for VVFD shall be offered.**
~~3.12.6~~	~~Auxiliary Hoist (creep)~~	~~One (1) electro hydraulic thruster type brake~~
	~~The aforesaid brake schedule is applicable for double girder either cabin or pendent operated crane.~~ For single girder cranes and single girder under slung cranes, one (1) electromagnetic disc brake for each motion shall be provided.	
4.0	**MATERIAL OF CONSTRUCTION**	
4.1	Bridge girder	IS-2062 Grade B
4.2	Other structural members	IS-2062 Grade B
4.3	Lifting hooks	As per IS-15560/ or As per IS-8610
4.4	Sheaves, drums	Cast steel/MS/C.I. as per IS 3938 (or) C.I. (IS-210, FG-260)
5.0	**SCOPE OF SUPPLY**	
5.1	Crane structures complete	Yes

SR. NO.	ITEM	
5.2	All drive motors and driving gears	Yes
5.3	Running rails including all clamps, anchors, bolts, nuts, sheams, inserts, end stops and other fixtures	Yes
~~5.4~~	~~Operator's Cabin~~	~~Yes, for crane no.1 (as applicable~~ for others)
5.5	Pendant Station	**Single Girder Cranes**
~~5.6~~	~~Portable fire extinguisher/CO_2 bottle in~~ operator's cabin	~~Yes, for crane nos. 1~~
5.7	Runway conductors (D.S.L.) and power collectors complete with all supports, insulators, brackets, fixtures etc	Yes
5.8	Complete electrical work including main disconnect switch, all controls and interlocks, with necessary wiring, grounding, protective panels etc.	Yes
5.9	Lower limit switches for hoists	Yes
~~5.10~~	~~Illumination of crane, operator's cabin~~ etc.	~~Yes, for crane no. 1(as applicable~~ for others)
~~5.11~~	~~Fan in operator's cabin~~	~~Yes, for crane no. 1(as applicable~~ for others)
5.12	Lifting lugs, eye bolts etc. for handling of crane parts	Yes
5.13	Erection and commissioning service	Yes
5.14	All equipment, accessories and consumables required for erection, testing and commissioning	Yes

SR. NO.	ITEM	
5.15	Final painting	Yes
5.16	First charge of oil, lubricants, grease etc.	Yes
5.17	Spare parts	Yes
5.18	Tools & Tackles	Yes
5.19	Suitable arrangement below gear box shall be provided for collection of oil spillage	Yes

VOLUME II

SECTION – 4

GENERAL TECHNICAL REQUIREMENTS

CONSULTANT : PROCON ENGINEERS

MAHAGENCO	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
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CONSULTANT : PROCON ENGINEERS

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1.0 CODES AND STANDARDS

1.1 Except where otherwise specified, the Plant shall comply with the appropriate Indian Standard or an agreed internationally accepted Standard Specification as listed in the Annexure to this Section and mentioned in detailed Specifications, each incorporating the latest revisions at the time of tendering. Where no internationally accepted standard is applicable, the Bidder shall give all particulars and details as necessary; to enable the Owner to identify all of the Plant in the same detail as would be possible, had there been a Standard Specification.

1.2 Where the Bidder proposes alternative codes or standards, he shall include in his tender one copy (in English) of each Standard Specification to which materials offered shall comply. In such case, the adopted alternative standard shall be equivalent or superior to the standards mentioned in the specification.

1.3 Wherever specified or required, the Plant shall conform to various statutory regulations such as Indian Boiler Regulations, Indian Electricity Rules, Indian Explosives Act, Factories Act etc. Wherever required, approval for the plant supplied under the specification from statutory authorities shall be the responsibility of the Bidder.

1.4 In the event of any conflict between the codes and standards referred above and the requirements of this specification, the requirements, which are more stringent, shall govern.

1.5 In case of any change of code, standards and regulations between the date of purchase order and the date the Contractor proceeds with manufacturing, the Owner shall have the option to incorporate the changed requirements. It shall be the responsibility of the Contractor to advise Owner of the resulting effect.

1.6 Successful Bidder shall furnish two (2) sets of latest of national/international codes and standards to owner.

2.0 RESPONSIBILITY FOR DESIGN

2.1 The Bidder shall assume full responsibility for the design of the whole and every part of the Plant, whether or not the design work was undertaken specifically in relation to the Contract and whether or not the Contractor was directly involved in the design work.

2.2 Notwithstanding the Owner's wish to receive the benefits of new, advanced and improved technologies, a prime requirement is that all the systems and components proposed shall have been already adequately developed and shall have demonstrated good reliability under similar or more arduous conditions elsewhere, at least for continuous two (2) years in two different power stations.

2.3 The successful bidder shall have to carry out surge analysis and other transient condition studies as may be necessary and as required by the Owner as per proven engineering practice.

2.4 The Bid shall include a detailed discussion on the development status of and the reasons for any changes made in proposed systems or components for the Plant, as compared with similar items previously supplied in other installations cited by the bidder as reference plants.

2.5 The Bidder may also make alternate offers, provided such offers are superior in his opinion in which case adequate technical information, operating feed back etc are to be enclosed with the offer, to enable the Owner to assess the superiority and reliability of the alternatives offered. In case of each alternative offer, its implications on the performance, guaranteed efficiency, auxiliary power consumptions etc shall be clearly brought out to the Owner to make an overall assessment. In any case, the base offer shall necessarily be in line with the specifications i.e. Base offer shall be as per the technical specifications and the same will be considered for techno-commercial evaluation.

3.0 NAME PLATES (RATING PLATES)

3.1 Instruction plates, nameplates or labels shall be permanently attached to each main and auxiliary item of Plant in a conspicuous position. These plates shall

be engraved with the identifying name, type and manufacturers serial number, together with the loading conditions under which the item of Plant has been designed to operate.

3.2 Items such as valves etc which are subject to hand operation, shall be provided with nameplates so constructed as to remain clearly legible throughout the life of the plant giving due consideration to the difficult climatic conditions to be encountered. Nameplates shall be securely mounted where they will not be obscured in service by insulation, cladding, actuators or other equipment. Direction of flow is also to be engraved.

3.3 All trade nameplates and labels shall be in English language. All measurements shall be in M.K.S. Units.

3.4 The size and location of nameplates shall be subject to Approval of the Engineer.

4.0 SAFETY AND SECURITY

4.1 The design shall incorporate every reasonable precaution and provision for the safety of all personnel and for the safety and security of all persons and property. The design shall comply with all appropriate statutory regulations relating to safety. All structures and equipment shall be designed and constructed to withstand every foreseeable static and dynamic loading condition, including loading under earthquake conditions, with an adequate margin of safety.

4.2 Ready and safe access with clear head room shall be provided to all parts of the plant for operation, inspection, cleaning and maintenance.

4.3 Escape routes and clear ways shall be provided to allow speedy evacuation of the plant in the event of fire or explosion and the plant layout shall allow for ease of access to all parts of the Works by rescue and fire fighting teams. The plant layout shall be designed to localize and minimise the effects of any fire or explosion. The recommendations of NFPA, OSHA and TAC etc as necessary shall be followed in all respects.

4.4 The use of corrosive, explosive, toxic or otherwise hazardous materials shall be kept to a minimum during construction and the design of the plant shall

minimise the requirement for such materials during operation and maintenance. Where such materials must be used, all necessary precautions shall be taken in the design, manufacture and layout of equipment to minimise the resulting hazard and all equipment necessary for the protection and first-aid treatment of personnel in the event of accidents shall be provided. Particular attention is drawn to avoid the use of materials containing asbestos in any form.

5.0 GUARDS

5.1 Effective guards and fences must be provided to prevent injury to operators through accident or malpractice.

5.2 Mesh guards which allow visual inspection of equipment with the guard in place are generally preferable. The guards shall be constructed of mesh attached to a rigid framework of mild steel rod, tube, or angle and the whole galvanised to prevent loss of strength by rusting or corrosion. The guards shall be designed to facilitate removal and replacement during maintenance.

5.3 All drive belts, couplings, gears, sharp metallic edges and chains must be safely guarded. Any lubricating nipple requiring attention during normal running must be positioned where they can be reached without moving the guards.

5.4 Guards for couplings and rotating shafts shall be in accordance with BS 5304-1975 or similar approved standard. All rotating shafts and parts of shafts must be covered.

5.5 Suitable fencing shall be provided to enclose all openings or doorways used for the hoisting and lowering of machinery etc. This fencing must be securely fixed but quickly detachable when required. A secure hand hold must be provided on each side of the opening or doorway.

6.0 LOCATION AND LAYOUT REQUIREMENTS

The majority of plant and equipment shall all be of indoor installation. Layout should facilitate access for operation-maintenance and inspection of any one or more equipment / components at a time without disturbing the operation or installation of rest of the plant. Further, Bidder should comply with the criteria

given under the various equipment and system specifications as well as those stipulated in Annexure-B attached to this section.

Enclosed General Layout and other tender layout drawings show the location of major installations and auxiliary buildings. The Bidder shall try to retain these locations as far as practicable. The layout of equipment within the powerhouse as shown in the tender drawings is indicative. The Bidder may, subject to Owner's approval alter the same to suit the space requirement of the equipment offered.

Bidder may give as an alternative his own preferred layout clearly indicating the advantages and other implications, if any. Such alternative will not be considered for evaluating the bid, but may be considered with the successful Bidder if Owner / Engineer find the proposal more attractive in terms of techno-economic consideration.

6.1 While developing the layout of buildings the following criteria shall be given effect:

6.1.1 The minimum width of clear access corridors around equipment shall be one (1) meter.

6.1.2 Each building shall have an identified vacant space for equipment unloading and maintenance and preferably a separate bay altogether in buildings housing heavy equipment. Provision for handling equipment by monorail hoist and/or overhead crane shall be made as specified.

6.1.3 The plinth level with respect to the existing grade level shall be as indicated elsewhere in this specification. Finished Grade Level (FGL) above Mean Sea Level (MSL) for the plant area, CHP area and for PWS area inside plant to be developed. Mean sea level for the plant is 210 m.

6.1.4 The minimum clear height available between two consecutive floor slabs shall not be less than five (5) meters. A clear head room of two (2) meters shall be maintained between the floor and any overhead piping/cables or other obstruction. Adequate provision for natural ventilation and illumination shall be made as per good engineering practices.

6.1.5 There shall be at least two (2) main access doors, one on either side of each building, of which one shall be minimum three (3) meters wide with rolling shutters for equipment entry. For multistoried buildings, at least two (2) regular staircases diagonally opposite to each other shall be provided connecting all the floors and roof. These minimum requirements shall be augmented as required depending on the floor area, statutory requirements and TAC recommendations.

6.1.6 All buildings shall have provision for toilet and associated effluent discharge system together with facility for drinking water. The criteria for ventilation, fire protection and illumination of building spaces specified elsewhere in this specification shall be complied with.

6.1.7 All rail/road crossings for pipe/cable racks shall be done with minimum Seven (7) meters headroom from top of rail/road to bottom of rack. Similarly, top cover over underground pipes/cables shall be minimum one (1) meter.

6.1.8 Cubicle for operating personnel shall be located at safe place near the equipment.

6.1.9 Cable racks / pipe racks shall have hand railings in walkways on both sides at appropriate heights.

6.1.10 Concept of various mechanical and electrical equipment location and building dimensions (including column-row spacing) as shown in Plot Plan/Floor Plan drawing are to be adhered as far as possible. Any departure from this suggestive layout is primarily not recommended.

6.2 The following requirements for equipment layout shall be complied with:

6.2.1 The regular basement floor is not acceptable in Boiler & Mill Bunker bay building. Further, local pits/trenches shall be avoided as far as possible.

6.2.2 Mills shall be located by the side of Boiler. The width of Mill/Bunker building shall be 12.5 M and the length of the same shall be 10.5 M per Mill. A clear walkway of 1200 mm (min) shall be ensured between the mills/ its foundation/ mill reject vessel edge and inner face of mill bay column. Raw coal bunker shall be circular in shape unless otherwise approved.

6.2.3 Interconnecting walkways (minimum 2 m width) between main plant building and boiler (on either side of boiler) at Ground, Mezzanine, Operating, PRDS and Deaerator floor levels shall be provided. Also inter-connecting platform between Boiler and Coal Tripper floor level and roof of Mill maintenance floor level, Feeder floor level, Bunker Building at Mill bay shall be provided. Number of interconnecting platforms between Boiler and Coal Bunker building for each level / floor specified above shall be two (2) on each side of Boiler i.e. four (4)/floor.

6.2.4 Two of the landing levels of the Goods Elevator shall preferably coincide with the feeder and tripper floor elevations. In case of difference in levels, electric hoists to shift goods from elevator floors to feeder/ tripper floors shall be provided.

6.2.5 Fuel Oil (F.O.) piping shall be routed over trestles. The headroom for F.O. trestle in Boiler/ESP/ID fan/Chimney area shall be 8.0 M till the road behind chimney and 7.0 M in CD bay area. The headroom for F.O. trestle in outlying area shall be 3.0 M except at rail/road crossing where the headroom shall be 8.0 M.

6.2.6 Clear walkways along A-row & B-row of TG building shall be provided as indicated below:

(a) 1.5 m at all levels of AB Bay.

(b) 3.5 m along B-row at operating floor level for interconnection with service Building & in front of control room.

6.2.7 The layout of the steam turbine unit shall permit sufficient lay down area for all the parts/components to enable carrying out maintenance and overhauling operations.

6.2.8 Steam turbine and generator (except stator) and other equipments located in the turbine hall shall be accessible by the EOT cranes for their handling during erection and maintenance. For all other equipment/components, suitable handling arrangement for erection and maintenance shall be provided.

6.2.9 In TG bay at crane rail level, walkway with handrails is envisaged for entire column sectional depth for full length of the building. In addition, it shall be ensured that on A-row and B-row columns, through walkway (without hindrance) of minimum 600 mm clear width is available from the face of the column to the handrail of the platform.

6.2.10 Layout of facilities and equipment shall allow removal of Generator Stator, Generator transformers, Station & Unit transformers without disturbing equipments, piping, cabling, duct routed in the area.

6.2.11 Adequate space and handling arrangement shall be provided for handling/ removal of pumps, heaters, heat-exchanger, fans, mills during maintenance.

6.2.12 Valves shall be located in accessible positions and operating/maintenance platforms shall be provided along with approach ladders & handrails for the same.

6.2.13 While developing the layout, all fresh air ventilation louvers shall be considered 1000 mm from floor level and directed downwards at an angle. Ventilation fans on AB bay roof shall be kept staggered and shall not be near the centerline of turbo generator set.

6.2.14 Each equipment room shall be provided with alternate exits in case of fire/ accidents as per requirements of factory Act and Statuary bodies/Insurance companies.

6.2.15 All other safety requirements as per the factories Act, Rules/regulations made under Electricity Act, 2003 and applicable codes/standards shall be observed while developing the layout.

7.0 OPERATION, MAINTENANCE & AVAILABILITY CONSIDERATIONS

7.1 Equipment/works offered shall be designed for high availability, high reliability, low maintenance and ease of operation & maintenance. The Bidder shall specifically state the design features incorporated to achieve high degree of reliability, availability, operability and ease of maintenance. He shall also furnish details of availability records in plants stated in his experience list.

7.2 Ample space for ease of operation and maintenance including equipment removal, tube bundle / cartridge / rotor pulling etc shall be provided. All valves, gates, dampers and other devices shall be located and oriented in such a way that they are accessible from operating floor levels. Where this cannot be adhered to, platforms and walkways with access ladders shall be provided to facilitate operation and maintenance.

7.3 Motorised lifting devices, i.e. hoists, chain pulleys, jacks, etc. shall be provided for handling and carrying out maintenance of any equipment and/or part. Suitable beams, hooks etc. for this purpose shall be provided in the Buildings.

7.4 Lifting devices like lifting tackles, slings etc. to be connected to hook of the hoist/crane shall be provided by the Bidder for lifting the equipment, accessories covered under this specification.

7.5 All similar parts of the equipment shall be made to gauge and shall be interchangeable with and shall be made of same material and workmanship as the corresponding parts of the equipment. Where ever feasible, common components shall be employed in different pieces of equipment in order to optimize the spares inventory and utilization.

8.0 MATERIALS

8.1 In selecting materials of construction of equipment, the Contractor shall pay particular attention to the atmospheric conditions existing at the Site and the nature of material/ fluid handled. Wherever deviations are taken in respect of materials specified, the reasons shall be spelt out clearly in the proposal.

All materials shall be new, and shall be of the quality most suited to the proposed application.

8.2 In as far as is possible; materials shall be in accordance with Indian or international standard specifications and shall be used in accordance with Indian or International codes of practice. Where such standards or codes of practice are not available, sufficient information shall be provided to allow the Engineer to assess the suitability of the material for the particular application.

All materials used shall have performed lengthy satisfactory service in similar or more arduous conditions to those proposed by the Contractor.

8.3 All parts which could deteriorate or corrode under the influence of the atmospheric, meteorological or soil conditions at the Site, or under the influence of the working conditions shall be suitably and effectively protected so that such deterioration or corrosion is a minimum over the life of the plant.

9.0 LUBRICATION

9.1 Provision shall be made for suitable efficient lubrication where necessary to ensure smooth operation free from undue wear.

9.2 Non ferrous capillary tubing shall be used throughout.

9.3 Gear boxes and oil baths shall be provided with filling and drain plugs, both of adequate size. An approved means of oil indication including level switches and temperature indication shall be provided.

9.4 All high speed gears shall be oil bath lubricated. Low speed gears shall be lubricated by means of soft grease. Removable and accessible drip pans shall be provided to collect lubricant which may drop from operating parts.

9.5 All lubrication points shall be conveniently situated for maintenance purposes. It must be possible to carry out lubrication from a gangway or landing and without the removal of guarding or having to insert the hand into it. Where accessibility to a bearing for oiling purposes would be difficult a method of remote lubrication shall be fitted.

9.6 The Contractor shall supply grease gun equipment suitable to service each type of nipple fitted.

10.0 LUBRICANTS AND CONTROL FLUIDS

10.1 The Contractor shall provide a detailed and comprehensive specification for all lubricating oils, greases and control fluids required for the entire plant. A sufficient supply of these shall be provided by the Contractor for initial commissioning, first fill and till COD of unit.

10.2 The Contractor shall supply a detailed schedule giving the lubricant testing, cleaning and replacement procedures. All equipment and facilities necessary for the testing, cleaning and changing of lubricants and control fluids shall be provided. The Contractor shall endeavor to reduce the varieties and grades of required lubricants and control fluids to a minimum, matching them where possible to those already in use in the generating station in order to simplify procurement and minimise storage requirements. All lubricants and control fluids shall be of internationally recognized standards and shall be easily obtainable from a large number of Indian suppliers. Bidder shall also indicate the equivalent Indian Standard for the above for easy procurement in future.

10.3 No lubricant or control fluid shall have toxic or other harmful effects on personnel or on the environment.

11.0 OPERATION AND MAINTENANCE

11.1 The plant shall be designed and constructed so that operation and maintenance manpower requirements are minimized.

The design and layout shall facilitate inspection, cleaning, maintenance and repair. The importance of continuity of operation is second only to that of safety.

11.2 Spare parts for equipment shall be interchangeable with the original components and, so far as possible, be of common design and manufacture.

11.3 All similar standard components/parts of similar standard equipment provided shall be interchangeable with one another. Further, identical equipments shall be provided for similar duties so that the same are interchangeable with one another in totality and component wise.

11.4 All heavy parts (500 Kg and above) must be provided with a convenient arrangement for slinging and handling during erection and overhaul. Any item of plant normally stripped or lifted during periods of maintenance and weighing one tonne or above, shall be clearly marked with its weight.

11.5 On completion of commissioning, a complete set of tools for the maintenance of the entire plant shall be provided by the Contractor. This shall include all necessary spanners, special wrenches, extraction equipment and any special tools reasonably required by the Engineer. Tools used during erection and commissioning shall not be accepted except with the specific approval of the Engineer.

11.6 All equipment and major valves should be provided with adequate maintenance approach and facility.

12.0 PLANT LIFE AND MODE OF OPERATION

The complete plant including all the equipment and systems individually and collectively shall be designed for continuous operation for an economic service life of thirty (30) years under the prevailing site conditions and for the type of duty intended.

The critical components of the major equipments like Steam Generator, Turbine-Generator and Auxiliary equipment, the life of which is limited by time and temperature dependent mechanisms such as thermal stress, creep and low cycle fatigue, are to be designed considering expected (hot, warm and cold) start-up, shut-down and cyclic load variations.

The unit would be operated on base load with cyclic load variation. The load variation is expected to be as per schedule depending on power demand. The units shall also be suitable for two shift operation, if required.

The expected start-ups should be considered as minimum
(Based on HPT metal temperature)

(a)	Cold start-up (>50 hrs. shutdown)	:	20 per year
(b)	Warm start-up (between 10 to 50 hrs. of shutdown)	:	40 per year
(c)	Hot start-up (Less than 10 hrs. shutdown)	:	180 per year

The allowable stresses shall be so selected so that life expectancy to minimum 2,00,000 hours of operation can be achieved. The Bidder shall

discuss this aspect in his technical proposal.

13.0 PACKAGING & MARKING

All the equipment shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at site till the time of erection. While packing all the materials, the limitations from the point of view of availability of railway wagon sizes in India shall be taken into account. Bidder shall consider the details of various wagons normally available with Indian Railways for transportation of heavy equipment. The Contractor shall be responsible for all loss or damage during transportation, handling and storage due to improper packing.

As per the information available, the dimensions of OD consignment for transportation of the equipment by rail (if any equipment to be handled through rail transportation) are as below:

(a)	Width of the Package (from centre-line of rails-1.6 metres on both sides)	:	3.2 Meters
(b)	Height of the package from rail top	:	4.47 Meters

The above indicates the dimensions, which can be normally transported on the wagons without infringement of the "moving gauge". This is however not indicative of the consignment which can be carried out with infringement of "moving gauge" duly authorised and approved by the Indian Railways. There may be difference between the "moving gauge" and the "fixed structure gauge" and consignments infringing the "moving gauge" can be moved after investigation regarding possible infringement with the fixed structures. As the critical fixed structures in each route are different, consignments infringing moving dimensions have to be individually investigated to select a route and also determine the restrictions under which such movement is to be carried out. Such routes selected or other mode of transport envisaged is to be clearly brought out in the proposal wherever transport of over dimensional equipment is involved.

Bidder shall consider unloading of material delivered through rail transportation, at near by railway station/ site unloading siding. The subsequent transportation up to project work place shall be considered by

road only. All unloading and handling equipment both at railway station siding and at project site shall be arranged by the Bidder. Necessary arrangement to be organized with the railway authority for such purpose shall also be under the scope of services of the Bidder. Bidder may consider entire material delivered up to site through rail transportation only.

The identification marking indicating the name and address of the consignee shall be clearly marked in indelible ink on two opposite sides and top of each of the packages. In addition, the Contractor shall include in the marking gross and net weight, outer dimension and cubic measurement. Each package shall be accompanied by a packing note (in weather proof paper) quoting specifically the name of the Contractor, the number and date of contract and names of the office placing the contract, nomenclature of contents and Bill of Material.

For imported equipment and material, suitable port facilities may be used in which case material may be transported from the port by tractor-trailer. Bidder may consider this aspect.

Specification of Packaging and Marking has been described in detail in Volume I: General Condition of Contract of the Specification.

14.0 PROTECTION

Equipment having antifriction or sleeve bearings shall be protected by weather-tight enclosures. Coated surfaces shall be protected against impact, abrasion, discoloration and other damages. Surfaces that are damaged shall be repainted.

Electrical equipment controls and insulations shall be protected against moisture and water damages. All external gasket surfaces and flange faces, couplings, rotating equipment shafts, bearings and like items shall be thoroughly cleaned and coated with rust preventive compound as specified above and protected with suitable wood, metal or other substantial type covering to ensure their full protection. All exposed threaded parts shall be greased and protected with metallic or other substantial type protectors.

All piping, tubing and conduit connections on equipment and other equipment openings shall be closed with rough usage covers or plugs. Female threaded

openings shall be closed with forged steel plugs. The closures shall be taped to seal the interior of the equipment. Open ends of piping, tubing and conduit shall be sealed and taped.

Returnable containers and special shipping devices shall be returned by the manufacturer's field representative at the Contractor's expense.

15.0 PAINTING

15.1 GENERAL

All exposed metallic surfaces subject to corrosion shall be protected by shop application of suitable coatings. Surfaces not easily accessible after shop assembly shall be treated before-hand and protected for life of the equipment. Surfaces to be finish painted after installation shall be shop painted with at least two (2) coats of primer. Steel surfaces, which are not to be painted, shall be coated with suitable rust preventive compound subject to the approval of the Owner.

All paints shall be used in accordance with the manufacturer's instructions. No thinners or other substance shall be added to the coating material without the approval of the Engineer. The quality and vendor of the paints shall require approval of the Owner.

All paints, when applied in a normal full coat, shall be free from runs, sags, wrinkles, patchiness, brush marks or other defects.

All primers shall be well marked into the surface, particularly in areas where pitting is evident, and the first priming coat shall be applied as soon as possible after cleaning, within four hours maximum. The paint shall be applied by brush, roller or airless spray, according to the manufacturer's instructions. Spray painting shall be carried out by operators trained and thoroughly experienced in the use of the equipment. If the drying interval between successive coats, which should not exceed one week, has been so long as to endanger the adhesion of the following coat, the paint already applied shall be lightly rubbed down with fine abrasive paper before putting on the next coat.

Paint spraying on large surfaces shall not normally be done indoors, except with the approval of the Engineer. Spray guns shall not be used outdoors in

windy weather or near unprotected surfaces of a contrasting colour and under no circumstances shall spray guns be used where spray may be carried into or onto exposed electrical equipment.

Paint containers shall not be opened until required and the paint shall be mechanically mixed thoroughly before use, and agitated occasionally during use.

Electrical equipment shall be shop finished with one or more coats of primer and two coats of high-grade oil resistant enamel. The interior of all panels' cabinets and enclosures shall be finished with gloss white enamel.

The Contractor shall furnish sufficient touch-up paint for one complete finish coat on all exterior factory surfaces of each item of equipment. The touch-up paint shall be of the same type and colour as the factory applied paint and shall be carefully packed to avoid damage during shipment. Complete painting instructions shall be furnished.

The Contractor shall select shop primer for steel and iron surfaces, which will have a continuous operating temperature below 35°C, in accordance to the relevant standard. Special high temperature primer shall be used on surface exposed to operating temperature above 35°C.

The Owner/Engineer shall submit the colour scheme during execution of contract for approval.

15.2 PREPARATION

Oil and grease shall be removed from the surface by washing with a suitable detergent, rinsing with clean water, and drying.

Surfaces to be shot blasted shall be cleaned to Swedish Standard SA 2.5 or equivalent, and all dust remaining after cleaning shall be removed.

The priming coat shall be applied without delay.

15.3 DAMAGED PAINTWORK

Any damaged paintwork shall be made good as follows:

15.3.1 The damaged area, together with an area extending 25 mm around its boundary, shall be cleaned down to bare metal.

15.3.2 A priming coat shall be immediately applied, followed by a full paint finish equal to that originally applied and extending 50 mm around the perimeter of the original damage.

15.3.3 The repainted surface shall present a smooth surface. This shall be obtained by carefully chamfering the paint edges before and after priming

15.4 PAINTING SYSTEMS

The requirements for the Dry Film Thickness (DFT) of paint and the materials to be used shall be as stated below, unless otherwise specified elsewhere in this specification.

15.4.1 Surfaces subject to Weathering

All surfaces shall have a minimum of four coats of paint made up as follows:

(a)	Primer coat	:	35 micron DFT
(b)	Tie coat	:	35 micron DFT
(c)	Finishing coat (Two Nos.)	:	35 micron DFT per coat
(d)	The total minimum DFT	:	140 micron

15.4.2 Surfaces Inside Buildings

All surfaces shall have a minimum of three coats of paint made up as follows:

(a)	Primer coat	:	35 micron DFT
(b)	Tie coat	:	35 micron DFT
(c)	Finishing coat (Two Nos.)	:	25 micron DFT per coat
(d)	The total minimum DFT	:	120 micron

The Contractor shall select the type and colour of primer & finish coat after approval by the Owner.

For detail painting on building & structural steel elements, please refer **Volume VI / A & B** of this specification.

16.0 COLOUR CO-ORDINATION & FINISH

16.1 Exterior surfaces throughout the plant shall be finished in colours and textures which will blend harmoniously together and with the surrounding landscape.

16.2 Interior surfaces throughout the plant shall be finished in colours and textures which will blend harmoniously together and which will be conducive to; the comfort, well-being and high productivity of the operators. Operating plant and services provided shall be colour coded for ease of identification.

16.3 All finishes shall be durable and as far as possible maintenance free. Finishes shall be easily cleaned.

16.4 Final colours and finishes shall be to the Approval of the Engineer.

17.0 ENVIRONMENT PROTECTION AND NOISE LEVEL REQUIREMENT

17.1 ENVIRONMENT PROTECTION

The plant shall be designed for installation and operation in harmony with the surrounding environment and all measures of pollution control shall be ensured by the Bidder to restrict pollution from the liquid effluent and Stack emission within the limits as given below with due consideration of Environment (Protection) Rules 1986 as amended till date.

In case the Ministry of Environment & Forest stipulates any other conditions not specified hereunder while clearing the project, same shall be complied with by the Contractor.

17.1.1 For Liquid Effluent

(a) Provision laid down in schedule-I for Thermal Power Plants and also in Schedule-VI: General Standards for discharge of Environmental pollutants Part-A: Effects of Environmental (Protection) Rules 1986, as amended till date.

(b) Any specific requirement of State Pollution Authorities over and above the above stipulation

17.1.2 For Air Emission

(a) Suspended Particulate Matter i.e. dust burden at Chimney outlet - Maximum 50 mg/Nm^3 (with worst coal and one field out).

(b) NOx : 365 ppm (maximum) or 750 mg/Nm^3 (Equivalent NO_2).

(c) SO_2 : As per prevailing Indian/ World Bank standards

The Bidder shall include in his scope all necessary equipment and measuring instruments to comply with above requirements. Location and accessibility of the instruments shall be properly coordinated.

17.2 NOISE LEVEL REQUIREMENT

The plant shall be designed, constructed and provided with suitable acoustic measures to ensure the noise level criteria as per the following stipulations.

17.2.1 Maximum noise level shall not exceed 85 dB (A) when measured at 1.0 M away from the noise emission source.

17.2.2 Maximum noise level from its source within the premises shall not exceed 70 dB (A) as per Environment (Protection) Rules 1986, Schedule-III, `Ambient Air Quality Standards' in respect of noise.

17.2.3 Any statutory changes in stipulations regarding noise limitation that may occur in future according to Maharashtra Pollution Control Board or Central Pollution Control Board or Ministry of Environment & Forest regulation

during tenure of the contract, the Contractor shall comply with the requirement.

An exception will be made for the plant at startup operations and other big pressure reducing devices operating during emergency periods and for the safety valves.

18.0 INSPECTION AND TESTING

18.1 GENERAL:

18.1.1 An indicative list of Inspection and testing requirements for each package has been given for equipments across various volumes of this specification. Bidder shall note that these testing and inspections listed herein are the minimum requirements as perceived by the Owner; the bidder shall consider this only as a general guidance and is not meant to be exhaustive. The bidder shall consider requisite testing and inspections across the equipments / systems forming the proposed power plant unit based on his own experience and in line with the current industry practices for identically rated power plant for the technology under consideration. The comprehensive list of tests considered for each of the equipment/ systems shall be furnished as part of the bid.

18.2 INSPECTION AND TESTS DURING MANUFACTURE

18.2.1 The method and techniques to be used by the Contractor for the control of quality during manufacture of all plant and equipment shall be agreed with the Owner prior to the Award of Contract.

18.2.2 The Owner's general requirements with respect to quality control and the required shop tests are set out elsewhere in this Specification.

18.2.3 Before any item of plant or equipment leaves its place of manufacture, the Owner shall be given the option of witnessing inspections and tests for compliance with the specification and related standards.

18.2.4 Advance notice shall be given to the Owner as agreed in the Contract, prior to the stage of manufacture being reached, and the piece of plant must be held at this stage until the Owner has inspected the piece, or has advised in

writing that inspection is waived. If having consulted the Owner and given reasonable notice in writing of the date on which the piece of plant will be available for inspection, the Owner does not attend the Contractor may proceed with manufacture having forwarded to the Owner duly certified copies of his own inspection and test results.

The Contractor shall forthwith forward to the engineer duly certified six (6) copies of the Test Certificates. Distribution of six (6) copies of Test Certificates for approval will be two (2) copies to Owner and four (4) copies to Consultant. These four (4) copies will be further distributed by Consultant after approval to Owner, site and bidder. One copy will be retained with the Consultant for record purpose.

Further, nine (9) copies of Shop Test Certificates shall be bound with Instruction Manuals referred to elsewhere. Distribution of nine (9) copies of Shop Test Certificates for approval will be Two (2) copies to Owner, Three (3) copies to site, Two (2) copies to Consultant, Two (2) copies to Owner's library / record.

18.2.5 Under no circumstances any repair or welding of castings shall be carried out without the consent of the Engineer. Proof of the effectiveness of each repair by radiographic and/or other non-destructive testing technique, shall be provided to the Engineer.

18.2.6 All the individual and assembled rotating parts shall be statically and dynamically balanced in the works.

Where accurate alignment is necessary for component parts of machinery normally assembled on site, the Contractor shall allow for trial assembly prior to despatch from place of manufacture.

18.2.7 All materials used for the manufacture of equipment covered under this specification shall be of tested quality. Relevant test certificates shall be made available to the Owner. The certificates shall include tests for mechanical properties and chemical analysis of representative material.

18.2.8 All pressure parts connected to pumping main shall be subjected to hydraulic testing at a pressure of 150% of shut-off head for a period not less than one

hour. Other parts shall be tested for one and half times the maximum operating pressure, for a period not less than one hour.

18.2.9 All necessary non-destructive examinations shall be performed to meet the applicable code requirements.

18.2.10 All welding procedures adopted for performing welding work shall be qualified in accordance with the requirements of Section-IX of ASME code or IBR, as applicable. All welded joints for pressure parts shall be tested by liquid penetrant examination according to the method outlined in ASME Boiler and Pressure Vessel code. Radiography, magnetic particle examination, magnuflux and ultrasonic testing shall be employed wherever necessary/ recommended by the applicable code. At least 10% of all major butt welding joints shall be radiographed.

18.2.11 Statutory payments in respect of IBR approvals including inspection for design and manufacturer of equipment shall be made by the Bidder. All payment for erection and testing at site (i.e. under IBR Maharashtra Jurisdiction) shall also be made by the Bidder. In such case, Contractor's scope shall also be extended to preparation of all necessary documents, co-ordination and follow-up with IBR authorities for above approval.

18.3 PERFORMANCE TESTS AT SITE

18.3.1 The full requirements for testing the system shall be agreed between the Owner and the Bidder prior to Award of Contract. The completely erected system shall be tested by the Contractor on site under normal operating conditions. The Contractor shall also ensure the correct performance of the system under abnormal conditions, i.e. the correct working of the various emergency and safety devices, interlocks etc.

18.3.2 The Bidder shall provide complete details of his normal procedures for testing, for the quality of erection and for the performance of the erected plant. These tests shall include site pressure test on all erected pipe work to demonstrate the quality of the piping and the adequacy of joints made at site.

18.3.3 The Contractor shall furnish the quality procedures to be adopted for assuring quality from the receipt of material at site, during storage, erection,

pre-commissioning to tests on completion and commissioning of the complete system/equipment.

18.4 For details of specific tests required on individual equipment, refer to respective section of this specification.

19.0 TRAINING OF OWNER'S PERSONNEL

The Contractor shall extend all possible assistance and co-operation to the Owner regarding the transfer of technology and developing expertise in the area of engineering operation and maintenance of the Plant.

Number of man-days of training as mentioned below shall be included in Tender.

19.1 TRAINING AT CONTRACTOR'S PREMISES

The Contractor shall conduct training of Thirty (30) engineers of the Owner on engineering, operation and maintenance of the Plant at the Contractor's or Associates or Sub-contractor's premises where adequate training facilities are available during the design and manufacturing stage of the Contract.

The total man-months for training of engineers shall be maximum Thirty (30), having following indicative break-up:

	Discipline	Number of Engineers	Number of Man-month
(a)	Operation	10 heads	10
(b)	Maintenance (Boiler & Turbine)	10 heads	10
(c)	Electrical Maintenance	4 heads	4
(d)	Control & Instrumentation	4 heads	4
(e)	Maintenance Planning	2 heads	2
		30 heads	30

However, the details of the training programme will be discussed and finalised with the successful Bidder.

The training may also be arranged by the Contractor in any Plant where the equipment manufactured by the Contractor or his Associates is under installation, operation or testing to enable the trainees to become familiar with the equipment being furnished by the Contractor. All expenses inherently related to the training shall be borne by the Contractor and shall include but not limited to travel expenses (international and inland fares), lodging and per diem charges as well as medical insurance, instructors fee, programme and miscellaneous cost to be incurred during the training.

The training programme shall be adequate for the trainees to acquire the necessary expertise and competence in the area of engineering, operation and maintenance and as trainers for in-house technology transfer programme of the Owner.

The Contractor shall be responsible for the development of the Training Module and Programme Schedule, which shall be submitted to the Owner for approval.

The components of the training modules shall include but not be limited to the training procedures/methodology, instructional materials such as audio visual materials, CDs and slides and manuals for each trainee.

Three (3) sets of the materials included in the training modules shall be handed over to the Owner upon completion of the training. An evaluation shall be jointly undertaken by the Contractor and the Owner's representative on the adequacy, appropriateness and relevance of the training and the programme effectiveness after the training. The training material shall be in English language only.

The content of the training programme shall include but not be limited to:

(a) Coal fired thermal plant principles in management and practice for operators, technicians and maintenance personnel.

(b) Plant operation and systems training for operators including simulator training as applicable.

(c) Maintenance training programme covering electrical, mechanical and instrumentation and control.

Said training programme shall be submitted to the Owner for approval.

The timing of the training should be such that the participants will be conversant with sufficient know-how to participate in the pre-commissioning and commissioning tests of the Plant.

The Contractor shall provide qualified English speaking instructors and training coordinator (s) during the tenure of the training programme.

19.2 OPERATION AND MAINTENANCE TRAINING AT SITE

The Contractor shall provide a comprehensive training programme related to design application, plant management, operation and maintenance, including trouble shooting of the Contractor's supplied system and equipment at the Site starting from Start of Commissioning and thereafter up to the Final Acceptance of the Unit.

The following instructors shall be at the Site continuously during the training:

(a) One (1) for Steam Generator and Auxiliaries ;

(b) One (1) for Turbine Generator and Auxiliaries ;

(c) One (1) for Electrical Works ;

(d) One (1) for Instrumentation and Control (Boiler and Auxiliaries) ;

(e) One (1) for Instrumentation and Control (Turbine and Auxiliaries).

Instructors shall also be available for Coal handling Plant, Ash Handling Plant, Water Treatment Plant and other specific areas as per requirement.

19.3 ON-THE-JOB TRAINING

During the period of pre-commissioning, commissioning and trial operation, the Owner shall provide operation and maintenance personnel to assist the Contractor in the operation and maintenance of his supply and work under the direction of the Contractor for the purpose of on-the-job training.

The Owner shall have the right to send to the Site his employees later intended to operate and maintain the equipment supplied under this Contract. The Contractor shall, without additional cost, use his site staff to instruct these employees on the operation and maintenance of the equipment. All instructions shall be in the English language.

LIST OF STANDARDS FOR REFERENCE

ANNEXURE – A

1.0	International Standards Organisation (ISO)
2.0	International Electro-technical Commission (IEC)
3.0	American Society of Mechanical Engineers (ASME)
4.0	American National Standards Institute (ANSI)
5.0	American Society for Testing and Materials (ASTM)
6.0	American Institute of Steel Construction (AISC)
7.0	American Welding Society (AWS)
8.0	Architecture Institute of Japan (AIJ)
9.0	National Fire Protection Association (NFPA)
10.0	National Electrical Manufacturer's Association (NEMA)
11.0	Japanese Electro-technical Committee (JEC)
12.0	Institute of Electrical and Electronics Engineers (IEEE)
13.0	Federal Occupational Safety and Health Regulations (OSHA)
14.0	Instrument Society of America (ISA)
15.0	National Electric Code (NEC)
16.0	Heat Exchanger Institute (HEI)
17.0	Tubular Exchanger Manufacturer's Association (TEMA)

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18.0	Hydraulic Institute (HIS)
19.0	International Electro-Technical Commission (IEC) Publications
20.0	Power Test Code for Steam Turbines (PTC)
21.0	Applicable German Standards (DIN)
22.0	Applicable British Standards (BS)
23.0	Applicable Japanese Standards (JIS)
24.0	Electric Power Research Institute (EPRI)
25.0	Standards of Manufacturer's Standardization Society (MSS)
26.0	Bureau of Indian Standards (BIS)
27.0	Indian Electricity Rules
28.0	Indian Boiler Regulations (IBR)
29.0	Indian Explosives Act
30.0	Indian Factories Act
31.0	Tariff Advisory Committee (TAC) rules
32.0	Emission regulation of Central Pollution Control Board (CPCB)
33.0	Pollution Control regulations of Dept. of Environment, Govt. of India
34.0	Central Board of Irrigation and Power (CBIP) Publications
35.0	The Air Prevention and Control of Pollution Act
36.0	The Environmental Protection Act
37.0	The Public Liability Insurance Act

38.0 The Forest Conservation Act

39.0 The Wildlife protection Act

40.0 The EIA Notification, 1994

41.0 IS: 14665-Specification for Electric Traction Lift

42.0 Any other statutory Codes/Standards/Regulation

VOLUME II

SECTION – 6

ENGINEERING SERVICES

CONSULTANT : PROCON ENGINEERS

CONTENT

1.0 GENERAL

1.1 As part of the overall project management activity, the Contractor shall be responsible for proper engineering and co-ordination of activities during various phases of execution of the contract. The Contractor shall identify a person, designated as Project Manager, with whom the Owner, the Consulting Engineer or the Review Consultant shall interact on matters related to engineering as well as execution of the contract. The Project Manager shall be the single-point contact person on behalf of the Contractor and shall be responsible for all engineering co-ordination. The Owner/Consultant/ Review Consultant shall interact with the Project Manager only on all matters of co-ordination between the Owner and the Contractor or on matters involving the Contractor, his manufacturing units and sub-vendors. For the purpose of expediting, the Owner or his representative may sometimes interact with the manufacturing units or sub-vendors of the contractors. However, such interaction will not, under any circumstance, dilute the responsibility of the Contractor to provide a fully engineered and co-ordinated package under this contract.

1.2 On finalization of the contract, a procedure for exchange of engineering information will be mutually agreed and finalized between the Owner and the Contractor.

2.0 DESIGN COORDINATION MEETING

The Contractor and his sub-vendors will be called upon to attend design co-ordination meetings with the Engineer, other Contractors and the Consultants of the Owner during the period of execution of contract. The Contractor including his sub-vendors shall attend such meetings at their own cost at Owner's or Consultant's office in Mumbai or at Bhusawal site or at mutually agreed venue as and when required and fully cooperate with such persons and agencies involved during those discussions.

3.0 GUIDELINES FOR ENGINEERING SERVICES

3.1 Prior to commencement of the engineering work as part of design submissions, all aspects of design viz criteria for selection and sizing of all equipment and systems, design margins etc including that for structural steel

and civil work shall be outlined and these shall form the basis for the detailed engineering work.

3.2 Engineering work shall be performed on modern and proven concepts and internationally accepted good engineering practices but fully compatible with the Indian environments. Owner shall have the right to review and approve the engineering work by themselves and/or through consultant and ask for any clarifications and changes/modifications to the work performed by Contractor.

3.3 At any stage during the performance of assignment, the Contractor may be required to make certain changes/modification/improvements in design/drawing/other documents which are applicable to any unit of 660 MW individually or severally, which in the opinion of the Owner could result in better improved design, layout, operability, plant availability, maintainability, reliability or economy of the plant and its systems/ sub-systems in view of revised and more accurate information/data available at a later date (s) or feedback (s) received during execution/operation of similar units. Such changes/modifications/improvements required could be identified by Owner and/or consultant and mutually discussed. Owner requires the Bidder to incorporate such action in the subject assignment appropriately without any additional cost liability and time implication to the Owner and same shall be within the responsibilities and scope of the Contractor.

3.4 During the course of review of detailed engineering stages, it may be essential in the opinion of Owner to obtain certain classified data for review purposes only. In case Owner so desires, the Bidder shall submit such data to Owner.

3.5 During the course of review of detailed engineering, it may be essential in Owner's opinion to obtain data and information on similar equipment and plants engineered by the Bidder. In case Owner so desires, the Bidder shall submit such data and information to the Owner.

3.6 It is not the intent to give details of every single task covered in the total engineering work to be carried out by Contractor, however, all engineering work required for the satisfactory completion of the plant/systems as

specified shall be carried out by the Contractor. Broadly, the following are the minimum requirements in respect of scope of major items of work:

4.6.1 Preparation, updating and finalisation of scheme drawings, control and interlock diagrams, detailed and fully dimensioned layout drawings (plant layout and equipment layout detailed plan, elevation and cross-sectional drawings at different elevations/ floor levels) covering all mechanical, electrical, C&I, civil and structural items, equipment, systems and facilities. Drawings and Schedules prepared by the Contractor from time to time, as detailed designs are developed, shall be submitted for Owner's/ Consultant's approval before the work is taken up. Revisions, corrections, additions to drawings and schedules shall not be considered to change the scope of work.

4.6.2 Preparation of detailed technical specifications including data sheets, tender drawings and bill of material for all bought out items and also finalisation of corresponding sub-contractors.

4.6.3 Review of sub-contractor's data, drawings, design calculations, schedules, bill of materials, instruction manuals etc. for all equipment, before forwarding them to Owner /Consultant for approval.

4.6.4 Preparation of civil construction drawings for all equipment showing foundation details and full details regarding equipment loads, floor openings, details of embedments etc required for preparation of civil construction drawings and also as referred at relevant sections of Scope, Terminal Points & Exclusions. These documents shall be preceded by appropriate design calculations, static and dynamic analysis, as necessary.

4.6.5 Preparation and finalisation of process piping and instrumentation diagrams and schematics, complete in all respects for all systems/packages of the power plant.

4.6.6 Preparation of consolidated schedules and bills of materials, including line numbers, tag numbers, source of supply, service conditions, specifications, materials, types and connections details, quantities for items of the plant including dampers, steam traps, strainers, instrumentations, ducting.

4.6.7 Sizing of all piping and equipment as per the stipulated design criteria, carrying out the flexibility analysis/dynamic analysis as necessary, hangers & support engineering.

4.6.8 Final revision of all documents including preparation and compilation of Instruction Manuals for installation, commissioning, operation and maintenance for all equipment and systems. Refer clause 5.0 for the specific requirement in this regard.

4.6.9 Certification and submission of final as-built drawings for all areas.

4.6.10 Preparation and compilation of all drawings, schedules and instructions which may be required at site, whether separately mentioned or not.

4.6.11 All erection and assembly drawings which may be required at site.

4.6.12 For all bought out item packages, the Contractor shall provide complete material/ component list along with detail specification, drawings, component part number etc during detail engineering stage prior to final approval. Such approved drawing / document shall be made available at site in adequate number prior to commencement of work. Moreover, such document/drawing shall be provided in soft form (CD).

4.6.13 Preparation of necessary documentation, design calculations etc required for submission to statutory authorities like IBR, Chief Electric Inspector etc.

4.0 OPERATING MANUALS AND MAINTENANCE INSTRUCTIONS

4.1 The Contractor shall provide all necessary maintenance manuals and operating instructions at least six (6) months before the time of commissioning and before taking over of the plant and equipment. The instruction manual shall be submitted in the form of one (1) soft copy in CD and 15 hard copies.

4.2 The information provided, which shall be contained in loose leaf stiff backed covers, shall include :

4.2.1 A complete inventory of all main items of plant, with identification details.

4.2.2 Service manuals for all plant and equipment giving full descriptions of the main items and auxiliary items such as power packs, hydraulic equipment, actuators, lubricating pumps etc.

4.2.3 A separate electrical manual covering items such as switchgear, cabling, instrumentation, controls, cabling layouts and wiring diagrams.

4.2.4 A schedule of recommendations for routine maintenance of all electrical and mechanical equipment, recommended inspection point, information on detection, cause and rectifications of troubles & faults.

4.2.5 A lubrication schedule with all necessary drawings, diagrams to identify the lubrication points.

4.2.6 Manufacturer's literature.

4.3 The instruction manual shall be subject to the approval of Owner.

4.4 The contractor shall submit the complete equipment list. The list shall be updated every three (3) months.

5.0 PLANT HANDBOOK

The Contractor shall submit to the Engineer, a preliminary plant handbook preferably in A-4 size sheets which shall contain the design and performance data of various plant, equipment and systems, covering the complete project including single line flow diagrams, within twenty four (24) months from the date of his acceptance of the Letter of Award. The final plant handbook complete in all respects shall be submitted by the Contractor six (6) months before start-up and commissioning activities. The plant handbook shall be submitted in the form of two (2) soft copy in CD/DVD (one to Owner and one to Consultant) and twenty five (25) hard copies in decent bound forms.

6.0 CONTRACT STAGE DOCUMENT SUBMISSION AND APPROVAL PROCEDURE

6.1 Within fifteen (15) days of issue of Letter of Award (LOA) by the Owner, the Contractor shall furnish a schedule of drawings and design document to be submitted by him to the Owner/Engineer indicating dates against each document.

The documents shall be divided into two categories:

(a) for approval and

(b) for information/further engineering and co-ordination by the Owner.

This document submission schedule shall require approval by the Owner/Engineer.

6.2 All contract documents shall be marked, without fail, with the name of the Owner, the Project, the specification title and number and the unit designation.

All dimensions shall be in metric units.

All notes, markings etc. shall be in English.

6.3 Documents/Drawings, submitted during tender stage, shall be revalidated or revised as required and submitted as certified contract document for approval/information of the Owner/Engineer.

6.4 Unless specified otherwise, the following categories of documents/drawings would require approval of the Owner/Consultant:

6.4.1 List of sub-vendors (from Owner only)

6.4.2 System scheme and instrumentation diagrams

6.4.3 Design basis justifying selection of equipment & process parameters where not specified in the Contract

6.4.4 Equipment data sheets and general arrangement drawings

6.4.5 Predicted performance curves of equipment**

6.4.6 Materials of construction

6.4.7 Layout drawings

6.4.8 Operation logic diagrams

6.4.9 Typical control circuit

6.4.10 Drawings of Instrumentation and Control

6.4.11 Any deviation from contract (by Owner)

** For all critical equipments (boiler and turbine auxiliaries etc), submission of this data shall be mandatory for approval of equipment data sheets / GA drawings.

6.5 Unless specified otherwise, the following categories of documents/ drawings would be treated for information/further engineering by the Owner/Engineer. The Contractor shall, however, incorporate all additional information and clarifications in these documents/ drawings as and when desired by the Owner/Engineer.

6.5.1 Equipment foundation drawings

6.5.2 Equipment cross-section drawings, product literature etc which are of proprietary nature

6.5.3 Various bills of quantity, schedules etc

6.5.4 Piping fabrication drawings, isometrics etc

6.5.5 Panel wiring diagrams

6.5.6 Instruction/Operation manuals

6.5.7 Service manuals and troubleshooting guide for C & I system including field instruments

6.5.8 Cable schedule and interconnection chart

6.5.9 Drive/feeder wise control scheme showing all external interfaces.

In essence, the Contractor is solely responsible for corrections and adequacy of design & engineering for documents under this category.

6.6 Upon review, the Owner/Engineer shall put his remarks and one of the following action stamps on the drawing/document:

6.6.1 Approved

6.6.2 Approved except as noted, forward final drawing

6.6.3 Approved except as noted, resubmission required

6.6.4 Disapproved

6.6.5 For information/reference only

For action stamps in category (c) & (d), documents must be resubmitted for review by the Owner / Engineer. For action stamp in category (b), further review by Owner / Engineer would not be necessary provided the Contractor agrees & incorporates the minor comments made on the document.

Except for action stamp under category (c) & (d), the Contractor can proceed with manufacturing and other sequential activities for those areas of a drawing/document which do not have any review comment by the Owner/Engineer.

The Owner/Engineer may accord approval in category (c) or (d) in more than one submission of a document till he is satisfied that the intent of the specification has been fully complied with. The Contractor shall be responsible for delay in such cases and no extension of time shall ordinarily be allowed on such grounds. Approval of contract documents by the Owner/Engineer shall not relieve the Contractor of his responsibility for any errors and fulfillment of contract requirements.

The Contractor's work shall be in strict accordance with the finally approved drawings and no deviation shall be permitted without written approval of the Owner/Engineer.

6.7 Except key plan/general yard plan, any layout drawing requiring scrutiny shall not be drawn to a scale less than 1:50.

6.8 For review by the Consulting Engineer, the Contractor shall furnish three (3) prints of each drawing. Two (2) prints of such submission shall also be sent to the Owner. After review, one (1) stamped print will be returned to the Contractor. Upon action under category (a) or (e), the Contractor shall directly distribute the documents to the various offices of the Owner and other agencies in number of copies as specified in the contract document. Such distribution copies shall be marked with the reference and date of the letter by which the Owner/Engineer has accorded his final approval. Penal action shall be taken against the Contractor for any unauthorised revision in the drawings so distributed from the drawings approved by the Owner/Engineer. The contractor shall furnish three (3) CD's of all as built/final drawings for Owner / Consultant site.

6.9 In case of contradiction between the stipulations above and those stated elsewhere in the specification, the stipulations herein shall prevail.

6.10 For details of documentation for Civil, Structural and Architectural works, **Volume VI** may be referred.

7.0 TENDER STAGE DOCUMENT SUBMISSION

8.1 The Bidder shall submit along with his bid all documents/drawings as requested in respective specifications. The documents shall include but not be limited to the following:

8.1.1 All Bid proposal sheets duly filled up. (The data mentioned in Bid proposal sheets is minimum required only. The Bidder shall submit the additional data asked for at any later stage).

8.1.2 Detailed experience list and financial resources of the prime bidder, his collaborators/ associates in this bid as well as the sub-vendors proposed.

8.1.3 Scheme drawings indicating scope of supply and service as offered by the Bidder indicating clearly exclusions, if any.

8.1.4 List of terminal points of the package offered together with quality and quantity of various input (i.e. water, air, electricity etc.) as required from the Owner at such interfaces.

8.1.5 Equipment GA, Layout, Design Calculations, interlock and other write-up, catalogues/ literature etc as required for clear understanding of the bid submitted.

8.1.6 L-1 network indicating target dates for intermediate milestones and final commissioning of equipment supplied. This network shall be supplemented by a detailed write-up on proposal procedure of project implementation, deployment schedule for Key personnel with their bio-data, schedule of construction machinery etc.

8.1.7 List of suppliers for all bought out items.

VOLUME II

SECTION – 7

QUALITY ASSURANCE REQUIREMENTS

CONSULTANT : PROCON ENGINEERS

CONTENT

1.0 QUALITY ASSURANCE PROGRAMME

1.1 To ensure that the equipment and services under the scope of Contract whether manufactured or performed within the Contractor's works or at his Sub-contractor's premises or at the Owner's site or at any other place or work are in accordance with the specifications, the Contractor shall adopt suitable quality assurance programme to control such activities at all points, as necessary. Such programmes shall be outlined by the Contractor and shall be finally accepted by the Owner/Authorised representative after discussions before the award of contract. A quality assurance programme of the Contractor shall generally cover the following:

1.1.1 His organisation structure for the management and implementation of the proposed quality assurance programme.

1.1.2 Documentation control system.

1.1.3 Qualification data for Bidder's key personnel.

1.1.4 The procedure for purchase of materials, parts, components and selection of Sub-contractor's services including vendor analysis, source inspection, incoming raw-material inspection, verification of materials purchased etc.

1.1.5 System for shop manufacturing and site erection control including process controls and fabrication and assembly controls.

1.1.6 Control of non-conforming items and system for corrective actions.

1.1.7 Inspection and test procedure both for manufacture and all site related works.

1.1.8 Control of calibration and testing of measuring and testing equipments.

1.1.9 System for quality audit.

1.1.10 System for indication and appraisal of inspection status.

1.1.11 System for authorising of release of manufactured product to the Owner.

1.1.12 System for handling storage and delivery.

1.1.13 System for maintenance of records.

1.1.14 Furnishing of quality plans for manufacturing and field activities, detailing out the specific quality control procedure adopted for controlling the quality characteristics relevant to each item of equipment/component.

2.0 GENERAL REQUIREMENTS - QUALITY ASSURANCE

2.1 All materials, components and equipment covered under this specification shall be procured, manufactured, erected, commissioned and tested at all the stages, as per a comprehensive Quality Assurance Programme. An indicative programme of inspection /tests to be carried out by the Contractor for some of the major items is given in the respective technical specification. This is however, not intended to form a comprehensive programme as it is the Contractor's responsibility to draw up and implement such programme duly approved by the Owner/Consultant. The detailed Quality Plans for manufacturing and field activities shall be drawn up by the Bidder, separately in the format attached at Annexures and shall be submitted to Owner/ Authorised representative for approval. Schedule of finalisation of such quality plans will be finalised before award.

2.2 Manufacturing Quality Plan shall detail out for all the components and equipment, various tests/inspection to be carried out as per the requirements of this specification and standards mentioned therein and quality practices and procedures followed by Contractor's Quality Control organisation, the relevant reference documents and standards, acceptance norms, inspection documents raised etc, during all stages of materials procurement, manufacture, assembly and final testing/performance testing.

2.3 Field Quality Plans shall detail out for all the equipment, the quality practices and procedures etc to be followed by the Contractor's site Quality Control organisation, during various stages of site activities from receipt of materials/equipment at site.

2.4 The Bidder shall also furnish copies of the reference documents / plant standards / acceptance norms/tests and inspection procedure etc as referred

in Quality Plans along with Quality Plans. These Quality plans and reference documents/standards etc shall be subject to Owner's approval without which manufacture shall not proceed. These approved documents shall form a part of the contract. In these approved quality plans, Owner/Authorised representative shall identify Customer Hold Points (CHP), test/ checks which shall be carried out in presence of the Owner's Engineer or his authorised representative and beyond which the work will not proceed without consent of Owner/Authorised representative in writing. All deviations to this specification, approved quality plans and applicable standards must be documented and referred to Owner/Authorised representative for approval and disposal.

2.5 No material shall be despatched from the manufacturer's works before the same is accepted subsequent to pre-despatch final inspection including verification of records of all previous tests/inspections by Owner's Engineer/Authorised representative and duly authorised for despatch issuance of Material Despatch Clearance Certificate (MDCC).

2.6 All materials used or supplied shall be accompanied by valid and approved materials certificates and tests and inspection report. These certificates and reports shall indicate the sheet numbers or other such acceptable identification numbers of the material. The material certified shall also have the identification details stamped on it.

2.7 Castings and forgings used for construction shall be of tested quality. Details of results of chemical analysis, heat treatment record and mechanical property test results shall be furnished.

2.8 All welding and brazing shall be carried out as per procedure drawn and qualified in accordance with requirements of ASME Section-IX/BS-4870 or other International equivalent standard acceptable to the Owner.

All brazers, welders etc employed on any part of the contract at Contractor's / Sub-Contractor's works or at site shall be qualified as per ASME Section-IX or BS- 4871 or equivalent international standard approved by the Owner. Such qualification tests shall be conducted in presence of Owner/his authorised representative.

For welding of pressure parts and high pressure piping, the requirements of IBR shall also be complied with.

2.9 All Non-Destructive Tests (NDT) shall be carried out in accordance with approved International Standard. The NDT operator shall be qualified as per SNT-TC-IA (of American Society of non- destructive examination). Results of NDT shall be properly recorded and submitted for approval.

2.10 List of all the sub-vendors proposed by the Contractor for procurement of major bought out items including castings, forgings, semi-finished and finished components/ equipment shall be drawn up by the Contractor and finalised with the Owner. Such list shall be subject to Owner's approval. Quality Plans of the successful vendors shall be discussed, finalised and approved by the Owner/Authorised representative and form part of the Purchase Order between the Contractor and the Vendor.

2.11 All the purchase specifications for the major bought-out items, list of which shall be drawn up by the Contractor and finalised with the Owner shall be furnished to the Owner for comments and subsequent approval before orders are placed.

Owner reserves the right to carry out quality audit and quality surveillance of the systems and procedures of the Contractor's or their sub-vendor's quality management and control activities. The Contractor shall provide all necessary assistance to enable the Owner carry out such audit and surveillance.

Quality audit/approval of the results of tests and inspection will not prejudice the right of the Owner to reject equipment not giving the desired performance after erection and shall not in no way limit the liabilities and responsibilities of the Contractor in earning satisfactory performance of equipment as per specification.

2.12 Quality requirements for main equipment shall equally apply for spares and replacement items.

2.13 Repair/rectification procedures to be adopted to make any job acceptable shall be subject to the approval of the Owner.

2.14 For quality assurance of all civil works refer to the specifications for civil works.

3.0 QUALITY ASSURANCE DOCUMENTS

3.1 The Contractor shall be required to submit two (2) copies and two (2) sets of softcopies in the form of CD of the following Quality Assurance documents within three (3) weeks after despatch of the equipment :

3.1.1 Material mill test reports on components as specified by the specification.

3.1.2 The inspection plan with verification, inspection plan check points, verification sketches, if used and methods used to verify that the inspection and testing points in the inspection plan were performed satisfactorily.

3.1.3 Non-destructive examination results/reports including radiography interpretation reports.

3.1.4 Factory tests results for testing required as per applicable codes and standards referred in the specification.

3.1.5 Welder identification list incorporating welder's and welding operator's qualification procedure and welding identification symbols.

3.1.6 Sketches and drawings used for indicating the method of traceability of the radiographs to the location on the equipment.

3.1.7 Stress relief time temperature charts.

3.1.8 Inspection reports duly signed by QA personnel of the Owner and Contractor for the agreed inspection hold points. During the course of inspection, the following shall also be recorded :

(a) When some important repair work is involved to make the job acceptable.

(b) The repair work remains part of the accepted product quality.

3.2 Letter of conformity certifying that the requirement is in compliance with finalised specification requirements.

4.0 INSPECTION, TESTING AND INSPECTION CERTIFICATES

4.1 The Engineer, his duly authorised representative and/or an outside inspection agency acting on behalf of the Owner shall have access at all reasonable times to inspect and examine the materials and workmanship of the works during its manufacture or erection and if part of the works is being manufactured or assembled on other premises or works, the Contractor shall obtain for the Engineer and for his duly authorised representative permission to inspect as if the works were manufactured or assembled on the Contractor's own premises or works.

4.2 The Contractor shall give the Engineer/Inspector fifteen (15) days written notice of any material being ready for testing. Such tests shall be to the Contractor's account except for the expenses of the Inspector. The Engineer/Inspector, unless the witnessing of the tests is virtually waived, shall attend such tests within fifteen (15) days of the date on which the equipment is notified as being ready for test/inspection failing which the Contractor may proceed with test which shall be deemed to have been made in the Inspector's presence and he shall forthwith forward to the Inspector duly certified Six (6) copies of test reports.

4.3 The Engineer or Inspector shall within fifteen (15) days from the date of Inspection as defined herein give notice in writing to the Contractor, on any objection to any drawings and all or any equipment and workmanship which is in his opinion not in accordance with the contract. The Contractor shall give due consideration to such objections and shall either make modifications that may be necessary to meet the said objections or shall confirm in writing to the Engineer/Inspector giving reasons therein, that no modifications are necessary to comply with the contract.

4.4 When the factory tests have been completed at the Contractor's or sub-contractor's works, the Engineer/Inspector shall issue a certificate to this effect within fifteen (15) days after completion of tests but if the tests are not witnessed by the Engineer/ Inspectors, the certificate shall be issued within fifteen (15) days of the receipt of the Contractor's test certificate by the Engineer/Inspector. Failure of the Engineer/ Inspector to issue such a

certificate shall not prevent the Contractor from proceeding with the works. The completion of these tests or the issue of the certificates shall not bind the Owner to accept the equipment should it, on further tests after erection be found not to comply with the contract.

4.5 In all cases where the contract provides for tests whether at the premises or works of the Contractor or any sub-contractor, the Contractor, except where otherwise specified shall provide free of charge such items as labour, materials, electricity, fuel, water, stores, apparatus and instruments as may be reasonably demanded by the Engineer/ Inspector or his authorised representatives to carry out effectively such tests on the equipment in accordance with the Contractor and shall give facilities to the Engineer/ Inspector or to his authorised representative to accomplish testing.

4.6 To facilitate advance planning of inspection in addition to giving inspection notice, the Contractor shall furnish quarterly inspection programme indicating schedule dates of inspection at customer hold point and final inspection stages. Updated quarterly inspection plans shall be made for each three consecutive months and shall be furnished before beginning of each calendar month.

FORMAT OF QUALITY ASSURANCE PROGRAMME

ANNEXURE – A

Name of Company/ Contractor	NAME OF CONTRACT PACKAGE			QUALITY PLAN FOR						
	Package No. : _____ Contractor : _____			QP No. : _____ Date _____ Rev. No.: _____ Date _____						
Sl. No.	Component & Operation	Characteristics	Class	Type of Check	Quantum of Check	Reference Document	Acceptance Norm	Format of Record	Agency	Remark

CONSULTANT : PROCON ENGINEERS

2.5.12 The railway tracks within plant area shall be bonded across fish plates and the rail tracks shall be connected to grounding grid at different locations. The rail tracks leaving the plant boundary shall be made electrically discontinuous from the rail tracks inside the plant area by providing suitable arrangements at fish plate joints.

2.5.13 The overhead crane rails shall be grounded at both ends. In addition all joints shall be bonded to provide electrical continuity.

2.5.14 The flexible earthing connection of jumpering wire shall be provided where flexible conduits are connected to rigid conduits to ensure continuity.

2.6 EARTHING OF CABLE

2.6.1 The metallic sheaths, screens and armour of cables shall be earthed at both switchgear/MCC/DB and equipment ends.

2.7 JOINTING AND CONNECTION

2.7.1 All ground conductor connections below ground level shall be done by electric arc welding with low hydrogen content electrode. The contact surfaces shall be thoroughly cleaned to provide good electrical continuity.

2.7.2 The bending of the large diameter ground conductor where necessary shall be done by gas heating.

2.7.3 The projected portion of riser/pigtail above ground shall be coated with two coats of bitumen paints (anti-corrosive paints) with a minimum thickness of 1 mm after connection.

2.7.4 The connections between the riser/pigtail and earthing conductors (galvanised steel flats) and between the earthing conductors above ground level shall be made by electric arc welding.

2.7.5 The portion of galvanised steel flats, which undergoes welding at site, shall be coated with two (2) coats of cold galvanising anti-corrosive paint after welding.

ANNEXURES

BHEL	1X660MW Bhusawal TPS-Unit: 6 SINGLE GIRDER EOT CRANE SPECIFIC TECHNICAL REQUIREMENT	SPECIFICATION No: PE-TS-415-524-A001 VOLUME: II B SECTION-I SUB-SECTION-IA REV 00 DATE DEC 2021

ANNEXURE-I

MAKES OF SUB VENDORS ITEMS

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
1.	STEEL	SAIL		
		TISCO		
		JINDAL		
		ESSAR		
2.	HOOKS	STEEL FORGING & ENGG. CO.,	KOLKATA	
		SIMRITI FORGING		
		KARACHIWALA		UP TO 25T CAPACITY
3.	GEAR COUPLINGS	ALLIANCE		
		FLEX-TRANS (formerly known as HICLIFF)		
		SAHARA		
		NUTECH		
		OEM		
4.	WIRE ROPE	USHA MARTIN		
		FORT WILLIAMS		
		BHARAT WIRE ROPES		
5.	BEARINGS	SKF		
		FAG		
		TATA		
		NBC		
6.	MOTORS	SIEMENS		
		NGEF (up to 15KW)		
		CROMPTON		
		KIRLOSKAR		
		BHARAT BIJLI		
		MARATHON		
		ABB		
		LHP		
7.	BRAKES	ELECTROMAG		
		SPEED-O- CONTROL		
		BCH		FOR DCEM BRAKES ONLY
		KAKKU		
		PETHE		
8.	CONTACTOR	SIEMENS		
		L&T		
		SCHNEIDER (Earlier TELE MECHANIQUE)		
		BCH		
9.	OVER LOAD RELAYS	SIEMENS		
		L&T		

BHEL	1X660MW Bhusawal TPS-Unit: 6 SINGLE GIRDER EOT CRANE SPECIFIC TECHNICAL REQUIREMENT	SPECIFICATION No: PE-TS-415-524-A001 VOLUME: II B SECTION-I SUB-SECTION-IA REV 00 DATE DEC 2021

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		ABB		
		SCHNEIDER (Earlier TELE MACHANIQUE)		
10.	HRC FUSES	SIEMENS		
		L&T		
		ENGLISH ELECTRIC		
		GE POWER		
		EATON (BUSSMANN)		
		ABB		
11.	ISOLATING SWITCH	SIEMENS		
		L&T		
		CONTROL & SWITCH GEAR		
		ABB		
12.	SWITCH FUSE UNITS	SIEMENS		
		L&T		
		CONTROL & SWITCH GEAR	-	
		ABB		
13.	TIME DELAY RELAYS	SIEMENS		
		L&T		
		ABB		
		BCH		
		SCHNEIDER (Earlier TELE MACHANIQUE)		
14.	TRANSFORMERS	INDCOIL		
		LOGICSTAT		
		KAPPA		
		AUTOMATIC ELECTRIC		
		PRECISE ELECTRICALS		
		SILKAAN ELECTRIC MFG. CO. LTD.		
		SOUTHERN ELECTRIC		
		NEC		
15.	CABLE LUGS (HEAVY DUTY)	DOWELLS		
		UML ENGINEERS	KOLKATA	
		JAINSON		
16.	PVC POWER CABLES	APAR INDUSTRIES LTD.	MUMBAI	
		CORDS CABLE INDUSTRIES LTD.	NEW DELHI	
		DIAMOND POWER INFRASTRUCTURE LTD	VADODARA	
		GOYOLENE FIBRES (INDIA) PVT.LTD	MUMBAI	
		GOVIND CABLE INDUSTRIES	KOLKATA	
		GUPTA POWER	BHUBNESWAR	

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		INFRASTRUCTURE LIMITED		
		HAVELLS INDIA LIMITED	NOIDA	
		KEI INDUSTRIES LTD.	NEW DELHI	
		KRISHNA ELECTRICAL INDUSTRIES LTD	GWALIOR	
		KEC INTERNATIONAL LIMITED	MUMBAI	
		MANSFIELD CABLES COMPANY LTD.	NOIDA	
		NICCO CORPORATION LTD.	KOLKATA	
		PARAMOUNT COMMUNICATIONS LTD.	NEW DELHI	
		POLYCAB WIRES PVT. LTD.	MUMBAI	
		RADIANT CORPORATION PRIVATE LIMITED	HYDERABAD	
		RAVIN CABLES LIMITED	MUMBAI	
		SUYOG ELECTRICALS LTD.	VADODARA	
		SRIRAM CABLES PVT. LTD.	NEW DELHI	
		SCOT INNOVATION WIRES AND CABLES PVT. LTD.	SOLAN	
		SAM CABLES & CONDUCTORS (P) LTD	UDHAM SINGH NAGAR	
		THERMO CABLES LTD	HYDERABAD	
17.	PVC CONTROL CABLES	ADVANCE CABLE TECHNOLOGIES (P) LTD	BANGALORE	
		APAR INDUSTRIES LTD., CMI LTD	MUMBAI	
		CMI LIMITED	FARIDABAD	
		CORDS CABLE INDUSTRIES LTD	NEW DELHI	
		CRYSTAL CABLE INDUSTRIES LTD	KOLKATA	
		DELTON CABLES LTD	NEW DELHI	
		DIAMOND POWER INFRASTRUCTURE LTD	VADODARA	
		ELKAY TELELINKS LTD	NEW DELHI	
		GEMSCAB INDUSTRIES LTD	NEW DELHI	
		GOVIND CABLE INDUSTRIES	KOLKATA	
		GUPTA POWER INFRASTRUCTURE LIMITED	BHUBNESWAR	
		HAVELLS INDIA LIMITED	NOIDA	
		INCOM CABLES (P) LTD	NEW DELHI	
		KEI INDUSTRIES LTD	NEW DELHI	
		KRISHNA ELECTRICAL	GWALIOR	

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		INDUSTRIES LTD		
		KEC INTERNATIONAL LIMITED	MUMBAI	
		MANSFIELD CABLES COMPANY LTD	NOIDA	
		NICCO CORPORATION LTD	KOLKATA	
		PARAMOUNT COMMUNICATIONS LTD	NEW DELHI	
		POLYCAB WIRES PVT. LTD	MUMBAI	
		RAVIN CABLES LIMITED	MUMBAI	
		SUYOG ELECTRICALS LTD	VADODARA	
		SPECIAL CABLES PVT. LTD	NEW DELHI	
		SCOT INNOVATION WIRES AND CABLES PVT. LTD	SOLAN	
		SAM CABLES & CONDUCTORS (P) LTD	UDHAM SINGH NAGAR	
		SPM POWER & TELECOM PVT. LTD	HYDERABAD	
		TORRENT CABLES LTD	AHMEDABAD	
		THERMO CABLES LTD	HYDERABAD	
		TIRUPATI PLASTOMATICS PVT. LTD	JAIPUR	
		UNIVERSAL CABLES LTD	SATNA	
18.	TRAILING CABLES	NICCO	KOLKATA	
		UNIVERSAL	SATNA	
		INCAB		
		ICL	NEW DELHI	
		APAR INDUSTRIES LTD	MUMBAI	
		CMI LTD	FARIDABAD	
		KEI INDUSTRIES LTD	NEW DELHI	
		SUYOG ELECTRICALS LTD	VADODARA	
19.	XLPE POWER CABLES	APAR INDUSTRIES LTD	MUMBAI	
		CORDS CABLE INDUSTRIES LTD	NEW DELHI	
		CRYSTAL CABLE INDUSTRIES LTD	KOLKATA	
		DIAMOND POWER INFRASTRUCTURE LTD	VADODARA	
		GEMSCAB INDUSTRIES LTD	NEW DELHI	
		GOVIND CABLE INDUSTRIES	KOLKATA	
		GUPTA POWER INFRASTRUCTURE LIMITED	BHUBNESWAR	
		HAVELLS INDIA LIMITED	NOIDA	
		KEI INDUSTRIES LTD	NEW DELHI	

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SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		KRISHNA ELECTRICAL INDUSTRIES LTD	GWALIOR	
		KEC INTERNATIONAL LIMITED	MUMBAI	
		MANSFIELD CABLES COMPANY LTD	NOIDA	
		PARAMOUNT COMMUNICATIONS LTD	NEW DELHI	
		POLYCAB WIRES PVT. LTD	MUMBAI	
		RAVIN CABLES LIMITED	MUMBAI	
		SUYOG ELECTRICALS LTD	VADODARA	
		SPECIAL CABLES PVT. LTD	NEW DELHI	
		SCOT INNOVATION WIRES AND CABLES PVT. LTD	SOLAN	
		SRIRAM CABLES PVT. LTD	NEW DELHI	
		TORRENT CABLES LTD	AHMEDABAD	
		THERMO CABLES LTD	HYDERABAD	
		TIRUPATI PLASTOMATICS PVT. LTD	JAIPUR	
20.	XLPE CONTROL CABLES	APAR INDUSTRIES LTD	MUMBAI	
		CABLE CORPORATION OF INDIA LTD	MUMBAI	
		CRYSTAL CABLE INDUSTRIES LTD	KOLKATA	
		DIAMOND POWER INFRASTRUCTURE LTD	VADODARA	
		GEMSCAB INDUSTRIES LTD	NEW DELHI	
		HAVELLS INDIA LIMITED	NOIDA	
		KEI INDUSTRIES LTD	NEW DELHI	
		KRISHNA ELECTRICAL INDUSTRIES LTD	GWALIOR	
		KEC INTERNATIONAL LIMITED	MUMBAI	
		PARAMOUNT COMMUNICATIONS LTD	NEW DELHI	
		POLYCAB WIRES PVT. LTD	MUMBAI	
		RADIANT CORPORATION PRIVATE LIMITED	HYDERABAD	
		RAVIN CABLES LIMITED	MUMBAI	
		SUYOG ELECTRICALS LTD	VADODARA	
		SRIRAM CABLES PVT. LTD	NEW DELHI	
		TORRENT CABLES LTD	AHMEDABAD	
		UNIVERSAL CABLES LTD	SATNA	
21.	CABLE GLAND	COMMET		
		SUNIL&CO		

BHEL	1X660MW Bhusawal TPS-Unit: 6 SINGLE GIRDER EOT CRANE SPECIFIC TECHNICAL REQUIREMENT	SPECIFICATION No: PE-TS-415-524-A001 VOLUME: II B SECTION-I SUB-SECTION-IA REV 00 DATE DEC 2021

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		ARUP ENGINEERING		
		JAINSON		
		DOWELL		
22.	PUSH BUTTONS	SIEMENS		
		L&T		
		BCH		
		SCHNEIDER		
23.	LIMIT SWITCHES	SPEED-O-CONTROL		
		ELECTROMAG		
24.	PENDENT PUSH BUTTON STATION	OEM		
25.	INDICATING LAMPS	TECKNIC		
		BCH		
		SIEMENS		
		STANDARD		
26.	MCB	MDS		
		INDO COPP		
		STANDARD		
		SIEMENS		
		L&T		
		ABB		
		SCHNEIDER		
27.	PANELS	OEM		
		RITTAL		
		PYROTECH		
28.	RESISTANCE BOXES	ENAPROS		
		OEM		
		SAFEX FIRE SERVICES LTD		
		UNITED FIRE EQUIPMENTS PVT. LTD		
		ZENITH FIRE SERVICES (INDIA) PVT LTD		
29.	VVVF	YASKAWA		
		ABB		
		SIEMENS		
		SCHNIEDER		
		FUJI ELECTRIC		
		MITSUBISHI ELECTRIC		
		CG POWER & INDUSTRIAL SOLUTIONS LTD		
30.	SHROUDED DSL	SUSHEEL		
		STROMAG		
31.	LOAD CELL	IPA		
		SARTORIUS		

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
32.	GEAR BOX	OEM		* = Applicable for Geared Motors only
		ELECON ENGINEERS		
		SHANTI GEARS		
		PBL*		
		NAW*		
		NORD*		
		SEW*		
		BONGFILIOLI*		
33.	RAIL	JSPL		
		SAIL		

NOTE:

1. THE SUB VENDOR LIST ABOVE IS INDICATIVE ONLY AND IS SUBJECT TO BHEL AND CUSTOMER APPROVAL DURING DETAILED ENGINEERING STAGE WITHOUT ANY COMMERCIAL & DELIVERY IMPLICATION TO BHEL.

2. THE INSPECTION CATEGORY WILL BE INTIMATED AFTER AWARD OF CONTRACT BY BHEL/CUSTOMER. HOWEVER, THE SAME WILL BE ADHERED BY THE BIDDER WITHOUT ANY COMMERCIAL AND DELIVERY IMPLICATION TO BHEL/ CUSTOMER.

ANNEXURE II

MANDATORY SPARES LIST FOR SINGLE GIRDER EOT CRANE (FOR EACH TYPE AND RATING)

SR. NO.	EQUIPMENT/PACKAGE NAME	Qty	Unit of Measurement
1.1	**ONE SET CONSISTING OF TWO (2) BEARING FOR:**		
1.1.1	CT wheel	1	One (1) set
1.1.2	LT wheel	1	One (1) set
1.2	**One set consisting of Two (2) brake linings with rivets for :**		
1.2.1	MH brake	1	One (1) set
1.2.2	CT brake	1	One (1) set
1.2.3	LT brake	2	Two (2) sets
1.2.4	MH creep brake	1	One (1) set
1.3	**ONE SET CONSISTING OF TWO (2) BRAKE SHOES WITH LINING FOR :**		
1.3.1	MH brake	1	One (1) set
1.3.2	CT brake	1	One (1) set
1.3.3	LT brake	2	Two (2) sets
1.3.4	MH creep brake	1	One (1) set
1.4	**ONE SET CONSISTING OF SIX (6) CARBON BRUSHES FOR :**		
1.4.1	MH motor	1	One (1) set
1.4.2	CT motor	1	One (1) set
1.4.3	LT motor	2	Two (2) sets
1.5	**ONE SET CONSISTING OF THREE (3) BRUSH HOLDERS FOR :**		
1.5.1	MH motor	1	One (1) set
1.5.2	CT motor	1	One (1) set
1.5.3	LT motor	2	Two (2) sets
1.6	**Fixed and moving contacts for each type of contactor**	1	One (1) set
1.7	**No volt coil for each type of contactor**	1	One (1) set
1.8	**OVERLOAD RELAY FOR**		
1.8.1	MH motor	1	Number(s)
1.8.2	CT motor	1	Number(s)
1.8.3	LT motor	2	Number(s)
1.9	**MOTOR BEARINGS**		
1.9.1	MH	2	Number(s)
1.9.2	CT	2	Number(s)
1.9.3	LT	4	Number(s)
1.10	**BEARING FOR**		
1.10.1	MH Main Pulley	2	Number(s)
1.10.2	MH Eq. Pulley	2	Number(s)
1.11	**Mandatory Spares for VVFD in Main Hoist**		

1.11.1	Thysrister	12	Number(s)
1.11.2	Ignition Transformer	12	Number(s)
1.11.3	Firing card	4	Number(s)
1.11.4	Control Transformer	2	Number(s)
1.11.5	Auxiliary contactor	2	Two (2) numbers each

Notes

a) One (1) set means 100% requirement for one crane.

b) In case spares indicated in the list are not applicable to the particular design offered by the bidder, the bidder should offer spares applicable to offered design with quantities generally in line with the approach followed as per the list.

c) Any item which is quoted as "not applicable" in the above list and is found to be "applicable" at a later date shall be supplied by the Bidder without any commercial implications.

d) Any change or variation in equipment or systems during detailed engineering stage which would cause changes / variations in the essential spares, shall be supplied by Bidder without any commercial implications.

e) Mandatory spares shall not be dispatched before dispatch of corresponding main equipment.

f) The spares shall be treated and packed for a long storage under the climatic condition prevailing at site.

g) Each spare part shall be clearly marked and labelled on the outside of the packing with its description. When more than one spare part is packed in a single case, a general description of the content shall be shown on the outside of such case and a detailed list enclosed. All cases, containers, and other packages must be suitably marked and numbered for the purpose of identification.

h) The Bidder shall note that if there in any change/ variation in equipment/ system during detail engineering which causes any change/ variation in the essential spares quantity, the same shall be supplied without any commercial implications. The price indicated for the mandatory spares shall be considered for the purpose of evaluation.

ANNEXURE III

PAINTING SPECIFICATION

Surface Preparation: Degreasing and Mechanical cleaning with wire brush or hand tool (SA1/ ST2/ ST3 as applicable).
Primer coat: - Painting with inorganic Zinc phosphate primer (DFT -75 microns, No. of coat-1).
Intermediate coat: Epoxy based finish polyamide cured painting (DFT-75 Micron, No. of coat-3, i.e. 25 microns per coat).
Finish coat: Final coat of epoxy based finish polyamide cured painting (DFT-75 micron, no. of coat-3, i.e. 25 microns per coat).

Total DFT: 220 microns.

Color Shade:

SL. No.	Item Description	Color Shade	Remarks
1	Crane Structure	Golden Yellow shade 356 as per IS-5	Colour band-Black
2	Trolley and hook	Crimson shade 540 as per IS-5	-
3	Motors	Light Gray shade 631 as per IS-5	-
4	Control Panels	Light Gray (Powder coated) as per IS-5	-
5	Gear Box	Light Blue (RAL : 5012)	-

ANNEXURE IV

Procedure for Load/Overload testing of Single Girder EOT Underslung crane at Manufacturer's Works

Objective: To demonstrate final No load, Load, Overload, Deflection & Functional tests of assembled Crane for the purpose of acceptance in line with IS 3177.

Basic Assumptions / Inputs for testing at Works:

- Actual job hook shall be used for load, overload tests for hoisting.
- Actual wire ropes shall be used for load, overload testing.
- Shop cables can be used for temporary power supply for the purpose of showing various functional tests at shop.
- Interlock and limit switch operation check will be shown for hoisting and CT motion.

Procedure for Load / Overload testing:

- The cranes shall be tested for no load and load /overload test at works generally in conformance with the IS – 3177 (1999). Specifically with respect to the load / overload testing of crane, the following tests as per the outlined procedures shall be done at works.
- Deflection of the girder will be measured at SWL when the trolley with load is at the middle of the girder.
- No load and full load current of the motors will be measured to verify whether it is as per the approved data sheet of the motor. Resisters in the circuit will be checked for any overheating of the element.
- The load will be gradually raised to 125 percent of the rated capacity (SWL) with actual hook. The load will be lifted upward to about 1 meter height above its support and stop again. Check for any undue drift in the load. If load drifts, check the adjustment of brakes and repeat the above procedure. Then lower the load to rest on support/ground.
- For checking the cross travel, raise the load up to one (1) meter height above supports and then move the trolley with load about one (1) meter in either direction of the bridge. Then lower the load to rest on support/ground.
- Creep speed motions shall be checked over a distance of about 500 mm.

ANNEXURE A

MINIMUM TESTING AND INSPECTION REQUIREMENTS

MAHAGENCO	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-I
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	
REV: R0	MATERIAL HANDLING AND MISCELLANEOUS EQUIPMENTS	Page 318 of 328

CONSULTANT : PROCON ENGINEERS

1.0 GENERAL

The testing and inspections listed herein are the minimum requirements as perceived by the owner; the bidder shall consider this only as a general guidance and is not meant to be exhaustive. The bidder shall consider requisite testing and inspections across the equipments/systems forming the proposed power plant unit based on his own experience and in line with the current industry practices for identically rated power plant for the technology under consideration and relevant codes and standards. The comprehensive list of tests considered for each of the equipment/systems shall be furnished as part of the bid.

2.0 E.O.T CRANES

2.1 TESTS AT SHOP

2.1.1 The cranes shall be subject to full load and overload tests as per IS-3177. Otherwise the crane shall be subject to 'no-load' test after complete assembly and wiring.

2.1.2 The crane shall be subject to deflection test as per IS : 3177.

2.1.3 If the hoisting drum offered is of welded construction. The seams shall be fully radio graphed.

2.1.4 The inspection and testing of butt welded joints shall be performed in accordance with the provisions of the relevant Indian Standards or other equivalents. Butt welded joints subject to direct tension shall be 100% radio graphed. All 'T' joints shall be covered with spot radiography. Should any of the spots be found defective then radiography to be extended to 100% area.

2.1.5 All electrical equipment and components thereof shall be subject to routine tests as per relevant Indian Standards. Type test certificate on any electrical equipment shall be submitted if desired by the Owner. Otherwise, type tests shall have to be performed on the equipment to prove the design.

2.1.6 Reports of all shop tests shall be submitted to the Owner/ Consulting Engineer for review.

2.2 TESTS AT SITE

2.2.1 After assembly and erection at site, the crane shall be subject to the following tests :

(a) All tests as per IS-3177, including insulation test and tests for operation.

(b) Deflection tests as per IS-3177

(c) Overload tests at 125% of working load as per IS-3177

2.2.2 Dead loads as required for conducting the tests at site shall have to be arranged by the Contractor at his own cost.

2.3 ERECTION AND COMMISSIONING

All cranes shall be erected and commissioned after satisfactory shop & site test.

3.0 ELEVATORS

3.1 SITE TESTS

3.1.1 After installation of complete elevator, necessary trial run and tests shall be carried out by the Contractor in the presence of Owner to determine that the equipment supplied is satisfactorily installed and commissioned.

3.1.2 It shall also be the responsibility of the Contractor to demonstrate the operation of the safety interlocks provided to the full satisfaction of the elevator inspector.

3.1.3 The following specific test as applicable shall be carried out by the Contractor as minimum requirement for the elevators.

(a) All materials used in manufacture of various components shall be of tested quality and shall conform to relevant standards/ specifications.

4.0 HOISTS

4.1 HOOKS

4.1.1 All Tests including proof load test as per relevant IS shall be carried out.

4.1.2 MPI / DPT shall be done after proof load test.

4.2 STEEL CASTINGS

4.2.1 DPT on machined surface shall be carried out.

4.3 GIRDERS, END CARRIAGE, CRAB, GEAR-BOX AND ROPE DRUM

4.3.1 The plates of thickness 25 mm and above shall be ultrasonically tested.

4.3.2 NDT requirements on weldments shall be as follows

(a) Butt welds in tension: - 100% RT & 100% DPT

(b) Butt welds in compression: - 10% RT & 100% DPT

(c) Butt weld in rope drum: - 100% RT & 100% DPT

(d) Fillet welds:- random 10% DPT

4.4 FORGINGS (Wheel, Gears, Pinions, Axles, Hooks & Hook Trunion)

4.4.1 All forgings greater than or equal to 50mm dia. or thickness shall be subjected to Ultrasonic Testing.

4.4.2 DPT/MPI shall be done after hard facing and machining.

4.5 WIRE ROPE SHALL BE TESTED AS PER RELEVANT STANDARD

4.6 Reduction Gears shall be tested for reduction ratio, backlash & contact pattern. Gear Box shall be subjected to No load run test to check for oil leakage, temp. rise, noise and vibration.

4.7 The cranes shall be completely assembled at shop for final testing. All tests for dimension, deflection, load, overload, hoisting motion, cross travel etc. as per IS-3177 shall be carried out at shop.

4.8 All Electric Hoist shall be tested as per IS-3938 and Chain Pulley Blocks shall be tested as per IS-3832.

5.0 WEIGH BRIDGE

5.1 Weigh Bridge will be tested for full Capacity and certified to be accurate before dispatch.

5.2 After erection at site, Bidder shall arrange for inspection of Weigh Bridge by Inspector of Weight and measures and get the weighbridge stamped by him. The requisite test loads shall be arranged by the Bidder.

6.0 HORIZONTAL/VERTICAL SERVICE WATER PUMPS

6.1 MATERIAL IDENTIFICATION AND TESTING

6.1.1 All materials used for pump construction shall be of tested quality. Material shall be tested as per the relevant standards. Components on which material test has been done shall be stamped for identification.

6.1.2 Tests for each pump included under this section shall also include but shall not be limited to the following:

(a) The entire surface of the impeller castings shall be subjected to Dye Penetration Test as per ASTM Specification number: E165-65.

(b) Shaft shall be subjected to Dye Penetration and Ultrasonic Tests.

(c) Wearing rings shall be subjected to Dye Penetration Test.

(d) Verification of material, witnessing of pouring, casting and inspection of finalised fabricated/cast castings.

(e) Inspection of finished castings for impeller and verification of materials

ANNEXURE – V

A.0 DRAWINGS/DESIGN DOCUMENTS FOR SUBMISSION (during detailed engineering)

BHEL Drawing No	Drawing Title	Primary/ Secondary	Drg Sch for Vendors
PE-V0-415-524-A001	Manufacturing Quality Plan with sub vendor list OF SG CRANE	Primary	R-0 within 21 days from PO & subsequent revisions within 10 days of comments received from BHEL. BHEL shall furnish comments / approval on each submission within 18 days from receipt.
PE-V0-415-524-A002	Data sheet of Single Girder Crane with painting details	Primary	
PE-V0-415-524-A004	Mechanism Sizing Calculation OF SG CRANE	Primary	
PE-V0-415-524-A008	Schematic Circuit Diagram for a) Main Protective panel & BOM b) Main hoist panel & BOM c) Cross Traverse and Long Travel panel & BOM d) Pendent and earthing.	Primary	
PE-V0-415-524-A003	G.A. of Single Girder CRANE with CT DSL arrangement OF SG CRANE	Primary	
PE-V0-415-524-A015	Sea worthy packing(if applicable) OF SG CRANE	Secondary	R-0 within 30 days from PO & subsequent revisions within 10 days of comments received from BHEL. BHEL shall furnish comments / approval on each submission within 18 days from receipt.
PE-V0-415-524-A009	Long travel Machinery Assembly with LT wheel assembly OF SG CRANE	Secondary	
PE-V0-415-524-A016	Erection procedure OF SG CRANE	Secondary	
PE-V0-415-524-A012	Cable sizing calculation and schedule OF SG CRANE	Secondary	
PE-V0-415-524-A010	Detailed BOM/BOQ for crane	Secondary	
PE-V0-415-524-A007	General arrangement for LT cable trailing/ DSL system for Single Girder crane	Secondary	
PE-V0-415-524-A006	Bottom Block assembly OF SG CRANE	Secondary	
PE-V0-415-524-A014	Mandatory spare parts list (if applicable) OF SG CRANE	Secondary	
PE-V0-415-524-A005	G.A. drg of Hoist with trolley wheel assembly OF SG CRANE	Secondary	
PE-V0-415-524-A019	O&M Manual	Secondary	within 30 days of issuance of MDCC

Notes:

1. INCOMPLETE DRAWINGS/DOCUMENTS SHALL NOT BE TREATED AS SUBMITTED.
2. MANUFACTURING SHALL BE STARTED ON RECIEPT OF CAT-2 APPROVED DRAWINGS.

B.0 NO.OF DRAWINGS/DOCUMENTS FOR SUBMISSION

A.	Drawing for Approval	No. of prints/copies (hard prints)
i.	For approval	8
ii.	For final distribution (after the vendor obtains final approval from the customer).	12
B.	Certificate, reports etc. (Material test, inspection report and all other type of tests etc.)	6
C.	O&M Manual	
I.	Draft for approval	2
ii.	For final distribution	12

Note:

a) The number of prints/hard copies are indicative and may change on project to project basis.

b) Bidder to note that all the drawings and documents shall also be submitted on CD's (compact dics) in following software.

I. All the drawings shall be prepared in AutoCAD.
II. All the documents shall be prepared MS word / EXCEL.
III. PDF files for all drawings/documents shall also be submitted.

C.0 DOCUMENT MANAGEMENT SYSTEM

1.0 Bidder to note that BHEL reserves the right for drawing/document submission through web based Document Management System. Bidder would be provided access to the DMS for drawing/document approval and adequate training for the same. Detailed methodology would be finalized during the kick-off meeting. Bidder to ensure following at their end.

- Internet explorer version – Minimum Internet Explorer 7.
- Internet speed – 2 mbps (Minimum preferred).
- Pop ups from our external DMS IP (124.124.36.198) should not be blocked.
- Vendor's Internal proxy setting should not block DMS application's link (https://www.bhelpem.com/wrenchweb).

	1X660MW Bhusawal TPS-Unit: 6	SPECIFICATION No: PE-TS-415-524-A001
		VOLUME: II B
	SINGLE GIRDER EOT CRANE	SECTION-I
	SPECIFIC TECHNICAL REQUIREMENT	SUB-SECTION-IA
		REV 00 / DATE DEC 2021

ANNEXURE -VI

Check List for Operation & Maintenance Manual

0Project name :
1Project number :
2Package Name :
3PO reference :
4Document number :
5Revision number :

Sl.no. & Sections	Description	Tick (√)if included in Manual			Remarks
		Yes	No	Not Applicable	
1.	**Cover page**				
1.1	Project Name				
1.2	Customer/consultant Name				
1.3	Name of Package				
1.4	Supplier details with phone, FAX ,email address , Emergency Contact number				
1.5	Name and sign of prepared by , checked by & approved by				
1.6	Revision history with approval Details				
2.0	**Index**				
2.1	showing the sections & related page nos All the pages should be numbered section wise				
3.0	**Description of Plant/System**				
3.1	Description /write up of operating principle of system equipment/ associated sub-systems & accessories/controls system , operating conditions, performance parameters under normal , start up and special cases				
3.2	Equipment list and basic parameter with Tag numbers				
3.3	Data sheets approved by Customer/for information and catalogues provided by original manufacturer				
3.4	Associated other packages and Interface /terminal points				
3.5	P&ID & Process Diagrams				
3.6	GA Layout drawings, As-built drawings , Actual photograph of items/system (Drawings of A2 & bigger sizes are to be attached in the last)				
3.7	Single line/wiring diagrams				
3.8	Control philosophy /control write-ups				
4.0	**Commissioning Activities (if not covered**				

	in separate document i.e. erection manual, commissioning manual)				
4.1	Pre-Commissioning Checks				
4.2	handling of items at site				
4.3	Storage at site				
4.4	Unpacking & Installation procedure				
5.0	**Operation Guidelines for plant personal/user/operator**				
5. 1	Interlock & Protection logic along with the limiting values of protection settings for the equipment along with brief philosophy behind the logic, drawings etc. to be provided.				
5. 2	Start up, normal operation and shut down procedure for equipments along with the associated systems in step by step mode. Valve sequence chart, step list, interlocks etc. with Equipment isolating procedures to be mentioned.				
5. 3	Do's & Don't of the equipments.				
5. 4	Safety precautions to be taken during normal operation. Safety symbols, Emergency instructions on total power failure condition/lubrication failure/any other condition				
5. 5	Parameters to be monitored with normal values and limiting values				
5. 6	Trouble shooting with causes and remedial measures				
5. 7	Routine operational checks, recommended logs & records				
5. 8	Changeover schedule if more than one auxiliary for the same purpose is given				
5. 9	Painting requirement and schedule				
5. 10	Inspection, repair , Testing and calibration procedures				
6.0	**Maintenance guidelines for plant personal**				
6.1	List of Special Tools and Tackles required for Overhaul/Trouble shooting including special testing equipment required for calibration etc.				
6.2	Stepwise dismantling and re-assembly procedure clearly specifying the tools to be used, checks to be made, records to be maintained, clearances etc. to be mentioned. Tolerances for fitment of various components to be given.				
6.3	Preventive Maintenance & Overhauling schedules linked with running				

	hours/calendar period along with checks to be given				
6.4	Long term maintenance schedules especially for structural, foundations etc.				
6.5	Consumable list along with the estimated quantity required during commissioning, normal running and during maintenance like Preventive Maintenances and Overhaul. Storage/handling requirement of consumables/self-life.				
6.6	List of lubricants with their Indian equivalent, Lubrication Schedule, Quantity required for each equipment for complete replacement is to be given				
6.7	List of vendors & Sub-vendors with their latest addresses, service centres ,Telephone Nos., Fax Nos., Mobile Nos., e-mail IDs etc.				
6.8	List of mandatory and recommended spare parts list				
.9	Tentative Lead time required for ordering of spares from the equipment supplier				
6.10	Guarantee and warranty clauses				
7.0	**Statutory and other specific requirements considerations.**				
8.0	**List of reference documents**				
9.0	**Binding as per requirement**				

Checked by
Dealing Engineer

Key Resource Person

Section Head

ANNEXURE –VII

PACKING PROCEDURE

Packing and Marking

All the equipment shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at site till the time of erection. The Contractor shall be responsible for all loss or damage during transportation, handling and storage due to improper packing.
The identification marking indicating the name and address of the consignee shall be clearly marked in indelible ink on two opposite sides and top of each of the packages. In addition the Contractor shall include in the marking gross and net weight, outer dimension and cubic measurement.
Each package shall be accompanied by a packing note (in weather proof paper) quoting specifically the name of the Contractor, the number and date of contract and names of the office placing the contract, nomenclature of contents and Bill of Material.

DOMESTIC PACKING

COMMON GUIDELINES

1 GENERAL:

This standard lays down packing instructions for domestic packing of Components/ Assemblies/ Equipment to be despatched against Customer's contracts, for which there are no special instructions issued by the Engineering Departments. For Seaworthy Packing refer standard AA0490004 wherever applicable.

The Components/Assemblies need to be packed suitably to avoid physical damage & corrosion during transit & storage. For specific applications the concerned engineering department shall issue a product standard. Reference of this product standard, must appear in the Shipping list/Packing List.

2 SCOPE:

This procedure gives minimum guidelines to be complied with for domestic packing of Components /Assemblies/ Equipment. This domestic packing shall be suitable for different handling operations and for the adverse conditions during transportation and during indoor / outdoor storage of materials.

3 WOOD SPECIFICATION

Based on availability, the wood shall conform to specification AA51401 or AA51402.

4 TYPES OF PACKING:

The following 5 types of packing have been standardized for packing of General Components/ Assemblies.

1) **'OP'** - Open Type.
2) **'PP'** - Partially Packed.
3) **'CP'** – Crate/Box Packing - Components/Equipment requiring physical protection.
4) **'CQ'** - Case Packing – Machined components-Small & Medium Components/ Assemblies/ Equipment which require corrosion & physical protection.
5) **'CR'** - Case Packing – Electrical/Electronic Components/ Assemblies, which require special packing viz. Water Proof, Shock Proof etc...

5 DESCRIPTION OF TYPES OF PACKING:

The various types of packing, as standardized above, are described below.

5.1 'OP' - Open Type

In case, of components which are not affected by water & dust and do not require special protection, are generally not machined, shall be sent as open packages. However, these components may be sent in crates, wherever necessary.

5.2 'PP' - Partially Packed

Components which need special protection at selected portions only shall be despatched partially packed. Machined surfaces should not be allowed to come directly in contact with the wood. Such surfaces should be protected with 100GSM(Colourless) Multi Layered Cross Laminated Polyethylene

Film to Specification No. AA51420. All sharp corners and edges shall be protected by rubber mats to prevent damage to the polyethylene film

5.3 'CP' - Crate Packing

Assemblies/Components which need only physical protection from the point of view of handling shall be despatched duly packed in crates.

5.4 'CQ' - Case Packing - Machined Components/Assemblies/Equipment

Small and medium sized components/assemblies/equipment due to size/weight and to avoid handling and pilferage problems shall be packed in Case/Containers. Wherever required adequate quantity of silica gel to AA55619 or VCI Powder/Tablets, packed in thin muslin cloth cotton bags shall be suitably placed. Small machines/components of less weight shall be provided with suitable cushioning by Rubberised coir. The components inside the case shall be entirely covered with 100GSM(Colourless) Multi Layered Cross Laminated Polyethylene Film Specification No. AA51420, wherever required. This may be prescribed for electronic parts/critical machined components/surfaces.

For mechanical product like valves where motors are separately securely wrapped in polyethylene, the requirement of individual component wrapping shall be exempted.

5.5 'CR' - Case Packing - Electrical & Electronic Components/Assemblies

Delicate components likely to be damaged e.g. Gauges, Instruments etc. are to be wrapped in waxed paper or polyethylene air bubble film and packed in cartons. Adequate quantity of Silica gel to AA55619 packed in cotton bags of 100grams each are to be suitably placed in the cartons. The cartons shall be entirely covered with 100GSM(Colourless) Multi Layered Cross Laminated Polyethylene Film Specification No. AA51420 before being packed in the cases. VCI Powder/Tablets can be used as an alternative to Silica Gel to AA55619.

Empty space in the cartons shall be filled with rubberized coir to get proper cushioning effect. The cartons shall be manufactured from corrugated Fiber Board, meeting requirements of AA51414.

6 PREPARATION OF PACKING CASES

6.1 DIMENSIONS:

a) Thickness of planks for Front, rear, top and bottom sides and binding, jointing battens shall be 25/20mm +2/-3 mm as per applicable drawings of the respective units.

b) Width of all planks including the tongue shall be more than 125mm and after plaining it shall be minimum 100mm.

c) Minimum number of planks shall be used for a shook.

d) Horizontal, vertical, diagonal planks shall be given for binding (number of such planks depend on the dimension of panel.

e) Width of binding planks shall be minimum 100mm.

f) Distance between any 2 binding planks shall be less than 750mm.

g) diagonal planks shall be used in between vertical binding planks when distance between inner to inner of vertical planks is more than 750mm

h) Distance of the outer edges of these planks from the edge of case shall be less than 250mm.

i) Diagonal planks are not required for top planks and width side, if the width of pallet is less than 750mm.

6.2 JOINTING OF PLANKS

Single length planks shall be used for cubicles whose overall length is less than 2400mm. For cubicles of length more than 2400mm, jointing is permitted. The jointing shall be done with one single or maximum of 2 planks of wood same as other planks of width 250 mm (minimum) with two rows of nails on either side of the joint in zigzag manner. From the joint along height side, it shall be of lap joint with overlap of at least the width of plank.

6.3 TONGUE AND GROOVE JOINTS

Two consecutive planks shall be joined by tongue and groove joint. Depth of tongue shall be 12+1 mm, thickness of tongue shall be 8 +1 mm. The groove dimensions shall be such that the tongue fits tightly into the groove to make a good joint. This type of joint can be done based on the product requirement wherever required.

6.4 PERMISSIBLE DEFECTS

Wood shall be free from knots, bows, visible sign of infection and any kind of decay caused by insects, fungus, etc.

End splits: Longest end splits at each end shall be measured and lengths added together. The added length shall not exceed 60mm per meter run of shook's. Wood pins shall be used to prevent further development of split.

Surface cracks: Surface cracks with a maximum depth of 3mm are permissible. A continuous crack of any depth all along the length is not allowed.

6.5 OTHER MATERIALS

6.5.1 NAILS

The dia. of the nails shall be 3.15mm. The length of the nails shall be 65mm wherever two planks of 25mm thickness are joined and 75mm wherever a 25mm planks is joined to a 50mm plank.

6.5.2 BLUE NAILS

These are used for nailing bituminized Kraft paper/hessian cloth to the planks. The length of the nails shall be 16mm.

6.5.3 HOOP IRON STRIPS

These are used for strapping the boxes. The width of the strips shall be 19+1mm and thickness 0.6+0.01mm. The material shall be free from rust.If sufficient nailing is done for bigger boxes, strapping need not be done.

6.5.4 CLIPS

These shall be used for strapping the hoop iron strips on the boxes.

6.5.5 BRACKETS

These brackets are used for nailing to the corners of cubicle boxes. The brackets shall be of mild steel of thickness min 2mm and width 25+1mm. The brackets shall be of "L" shape, the length of each side being 100+2mm. Two holes shall be provided towards the end of each side for screwing /nailing.

6.5.6 FASTENERS

Bolts, double nuts, spring washers will have to be used for packing of some special items like transformers, reactors, breakers, etc., to hold the job to the bottom plank of the box. The bolts, nuts, washers will be provided by the vendor. Drilling of holes will have to be done using contractor's tools.

6.5.7 MULTI LAYERED CROSS LAMINATED POLYTHELENE FILM

100GSM (Colourless) Multi Layered Cross Laminated Polythelene Film Specification No: AA51420 are used to make covers to the jobs individually. The cross lamination gives qualities of extra toughness, together with flexibility and lightness coupled with good weather resistance to ultra violet rays.

6.5.8 RUBBERISED COIR:

The rubberized coir is used as cushioning material. For the packing of loose items, items are to be arrested by using rubberized coir. For the packing of cubicles rubberized coir of thickness 25mm and width 75mm shall be used.

6.5.9 FOAM RUBBER / 'U' FOAM:

This is used for covering the delicate items. This material is provided by the vendor.

6.5.10 MARKING PLATE:

This shall be of anodized aluminium sheet. Size of the marking plate shall be maintained minimum of size as per the details specified in the Figure 4.

6.5.11 PACKING SLIP HOLDER:

This shall be of galvanized iron tinned sheet /Aluminium sheet

6.5.12 SILICA GEL:

This shall be of indicating type to conform to IS: 3401/AA55619.Silical gel shall be used for such products only where moisture needs to be avoided.

6.5.13 COTTON BAGS:

These are used for holding silica gel. The bags shall have the following matter indicated on them:

BHEL-UNIT NAME	PLACE-PINCODE
SILICA GEL	INDICATING TYPE
BLUE :	ACTIVE
ROSE :	REDUCED ACTIVITY
WHITE :	NO ACTIVITY. TO BE REPLACED WITH FRESH SILICA GEL

6.5.14 COTTON/ PLASTIC TAPE:

This is used for tying small items. And also to prevent vibrations of moving parts within the cubicles.

6.5.15 MARKING INK:

The ink used normally is black in color. In some special cases other color also will have to be used. The ink shall be non-fading/indelible and non-washable by water.

6.5.16 POLYETHYLENE BAGS:

These are to be used for keeping the Packing slips. The bag shall be of size 70mm X 100mm (minimum).

6.5.17 Hessian cloth, twine thread, paint will have to be used in packing certain items.

6.5.18 Mechanical Latching clamps:

For CLW Railway panels and similar Panels self-locking clamps can also be used on need basis in conjunction with or apart from regular bolt and nut fixing arrangement. For reusable boxes, these clamps provide easy locking and unlocking arrangement. These clamps will be made available from BHEL in some cases.

6.5.19 STICKERS

The following stickers to be put by the vendor on cubicles/Boxes after packing.

1) Case No sticker: 2 nos. Size 25.Cm x 0.45Cm
2) BHEL Monogram sticker: 1 no. Size 1.75Cm x 2.3Cm
3) Address sticker: 2 nos. Size 3.8Cm x 3.0Cm
4) Direction sticker "Front" & "Back" - 4 nos. Size 2.0Cm x 0.75Cm
5) Chain Mark Sticker: 4 Nos. Size – 3.0Cm x 0.75Cm
6) "Fragile" sticker: 2 Nos. Size. 2.1Cm x 1.5Cm
7) "DO NOT STACK" sticker - 2 Nos. Size 3.0Cm x 2.2Cm

In place of stickers, writing all the details legibly with paint shall be allowed & respective units may take decision accordingly.

7 PACKING OF CUBICLES:

7.1 The packing is to be done as per clause 5 in all respects.

7.2 The cubicles are already fixed on wooden pallets. Hence the contractor need not arrange the bottom pallets normally.

7.3 The cubicles will be of different sizes both width wise and lengthwise. The cubicles may be made up of single suite, 2 Suite, 3 Suite, 4 Suite, etc., The width of the cubicles generally varies from 400 mm to 1650mm.The length of the cubicle, generally varies from 1500 mm to 4800 mm. The height is normally 2430 mm. In some cases, the height may be less/more.

7.4 MULTI LAYER CROSS LAMINATED POLY FILM

The inner surface of 4 sides of shook's shall be nailed with Multi-layer cross laminated poly film (as per 6.5.7) using blue nails (as per 6.5.2) wherever 2 pieces of Cross laminated poly film are used, the joint shall have an overlap of minimum 20mm.

The inner surface of top cover shall be nailed with Multi-layer cross laminated poly film (as per 6.5.7). This sheet shall project outside on 4 sides by at least 100mm and shall be nailed properly on sides. Joining of sheets should have overlap of minimum 20mm.

The cubicles shall be covered with Multi-layer cross laminated poly film (as per 6.5.7).

7.5 SILICA GEL:

Silica gel (as per 6.5.12) packed in cotton bags shall be kept at different places inside the cubicle as per BHEL-Unit directions. Each suit of cubicle shall be provided with 1 kg of Silica gel (for a 4 suit cubicle 4 kgs of Silica Gel to be used. The bag containing silica gel to be as per 6.5.13).

7.6 LOOSE PARTS:

Any loose parts in the cubicles shall be tied using cotton/ plastic tape. Wooden battens shall be provided wherever necessary.

7.7 WOODEN BATTENS:

In case of cubicle which are not rectangular in shape like control desks, sufficient number of wooden rafters/battens of proper size shall be provided to give strength to the package.

7.8 RUBBERISED COIR:

Gap between the cubicle and the case shall be filled with rubberized coir (as per 6.5.8) with distance between consecutive layers less than 500mm.

7.9 CLAMPING:

Packing shall be bound at edges by nailing M.S. Clamps / Brackets (as per 6.5.5). Each vertical edge shall have minimum 3 clamps. Top horizontal edges will have one clamp for every meter length of package. However, minimum 4 clamps shall be nailed at the top for any cubicle.

7.10 PACKING SLIP:

Packing slip kept in the polyethylene bag (As per 6.5.16) shall be placed in the box at appropriate place. In addition, one more packing slip covered in polyethylene cover and packing slip holder (as per 6.5.11) shall be nailed to front / rear of case.

7.11 MARKING PLATE:

One no. (As per 6.5.10) shall be nailed to the front side of the case.

7.12 CASE MOUNTING:

After complete packing, stencil marking of various details and marking of symbols shall be done as per BHEL instructions using indelible / non washable marking ink.

7.13 Different types (Typical) of Cubicles with sizes for Packing

1. Single suite cubicle - 900 x 950 x2500
2. Two suite cubicle - 1650 x 950 x 2500
3. Three suite cubicle - 2400 x 950 x2500
4. Four suite cubicle - 3150 x 950 x 2500
5. Regulation cub - 1300 x 1350 x 2500
6. Thy cub - 2870 x 1350 x 2500
7. VFD Cub - 3800 x 1550 x 2500

7.14 PACKING OF CUBICLES FOR EXPORT

Refer Corporate Standard AA0490009.

8 PACKING OF LOOSE ITEMS/SPARES

1) Shape of cases shall be square, rectangular with single gabled roof or with double gabled roof depending on the nature of the job to be packed. Construction shall be as per drawings enclosed. Only gable will be additional as required.
2) Wood shall conform to specification AA51401 or AA51402 with Tongue and Groove joint as per clause 6.3.
3) Width of planks shall be at least 100 mm. Width of binding planks (battens) shall be at least 75mm.
4) External surface of planks on front and rear shall be plane 100% (except bottom plank).
5) Inner surfaces of all 6 sides shall be lined with Multi Layered Cross Laminated Polythelene Film (as per clause 6.5.7) using blue nails.
6) Rubberized coir of minimum 25mm thickness and 100 mm width shall be nailed to inner surfaces of bottom and 4 sides of box.
7) Internal packing: Items that go into the box shall be packed using 100GSM, (Colourless) Multi Layered Cross Laminated Polyethylene Film Specification No: AA51420. Any space left between the job and the sides and the top of the box shall be filled with rubberized coir to get proper cushioning effect.
8) Certain items like transformers, reactors, breakers, etc., shall be bolted to the bottom of the box using bolts, nuts and washers.
9) Silica gel as per clause 6.5.12 held in cotton bags as per clause 6.5.13 shall be kept at proper places in the box.
10) Packing slip kept in polyethylene bag (clause 6.5.16) shall be placed in the box.
11) Marking plate as per clause 6.5.10 shall be nailed to side of the box.
12) Two numbers of hoop iron strips as per clause 6.5.3 shall be strapped tightly on the case using clips.
13) Stencil marking of various details and marking of various symbols shall be done as per BHEL instructions using indelible/non-washable marking ink.
14) Loose items to be kept inside the cubicle

- The components which are removed from cubicle for shipping purpose only, such as meters shall be kept inside the cubicle individually, kept in wooden box and tied firmly in bottom of Cubicle.

- Other items which are given loose in addition to cubicle shall be packed in separate boxes.

9 BOX SIZES

9.1 BOX SIZES

Table 1 – SPARES WOODEN BOX DETAILS

SNO	BOX TYPE	BOX SIZE (in mm)	BOX Wt (in KG)	Carrying Capacity
1	A	800 X 200 X 200	15	
2	B	1500 X 200 X 200	22	
3	C	2000 X 200 X 200	27	
4	D	1100 X 200 X 200	15	
5	E	200 X 200 X 200	5	
6	F	320 X 250 X 260	13	
7	G	320 X 250 X 430	16	
8	H	430 X 370 X 430	23	
9	I	1100 X 400 X 400	45	
10	J	1500 X 500 X 400	65	
11	K	2000 X 500 X 400	93	
12	L	2500 X 500 X 400	88	
13	M	900 X 600 X 600	100	
14	N	3000 X 400 X 400	60	
15	P	600 X 500 X 400	35	
16	Q	710 X 630 X 600	90	
17	R	850 X 630 X 670	102	
18	S	1000 X 770 X 670	140	
19	T	2500 X 850 X 800	180	
20	U	1500 X 700 X 700	120	
21	W	1200X900X600	120	
22	Y	450 X 200 X 200	10	

Table 2 – WOODEN BOX DETAILS

BOX TYPE	BOX SIZE (In MM)	BOX Wt (In KG)	Carrying Capacity
1	320X250X260	10	
2	320X250X430	15	
3	430X370X430	25	
4	670X670X470	65	
5	720X630X600	75	
6	1000X770X660	100	
7	1100X430X670	80	
8	1200X1200X900	80	
9	1300X770X1050	155	
10	2500X850X800	225	
11	2000X1500X1200	305	
12	1850X1050X1250	260	
13	2000X800X800	180	
14	2600X1500X1600	470	
15	250X250X600	20	
16	250X250X880	30	
17	300X300X700	25	
18	380X380X880	45	
19	510X510X1400	60	
20	570X570X1400	80	
21	575X575X1875	105	
22	3600X1100X1100	390	
23	900X500X800	110	
24	2000X950X740	225	
25	1600X1120X700	220	
26	2500X2000X1200	490	
27	2900X1900X1400	525	
28	3000X1000X900	370	
29	3200X2200X950	450	
30	2150X1100X750	325	
31	2000X2000X700	130	
32	700X1200X1325	130	

Table 3 – STEEL BOXES

SL NO	TYPE	DIMENSION IN MM			WEIGHT	CARRYING CAPACITY (KGS)
		LENGTH	BREADTH	HEIGHT		
1	I	2480	1680	1500	339	4500
2	II	1200	900	800	081	2000
3	IIB	1800	850	950	115	2500
4	III	900	600	600	029	1000
5	IV	600	450	500	019	750
6	V	400	350	300	011	500

TYPICAL PATTERN OF WOODEN BOX

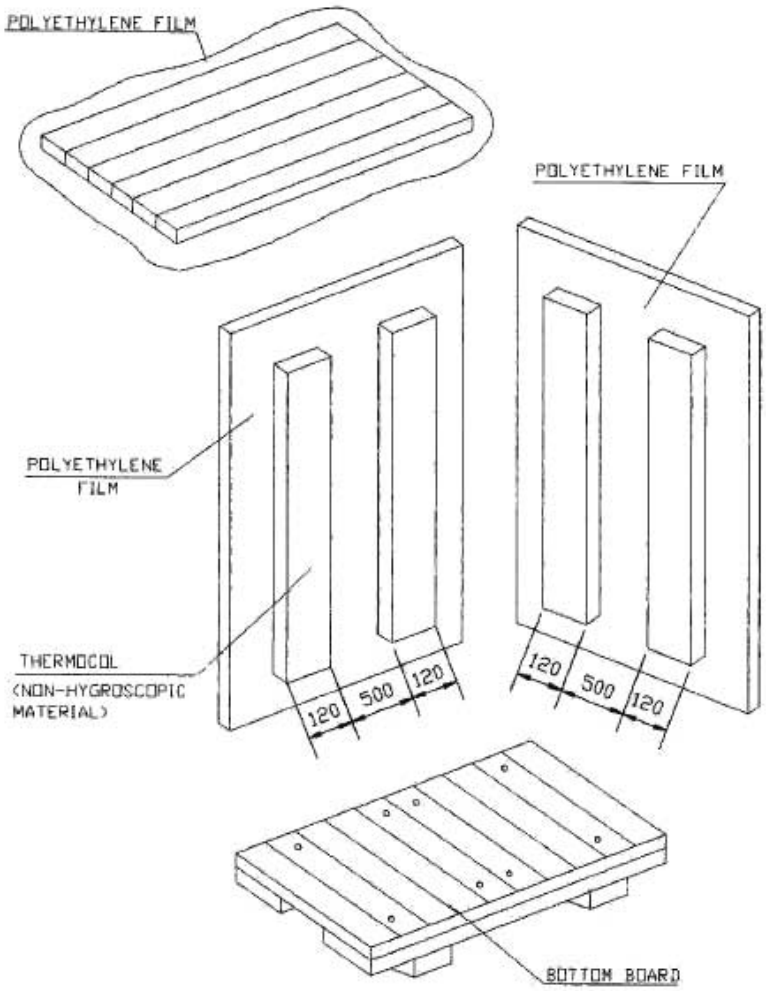


Figure 1

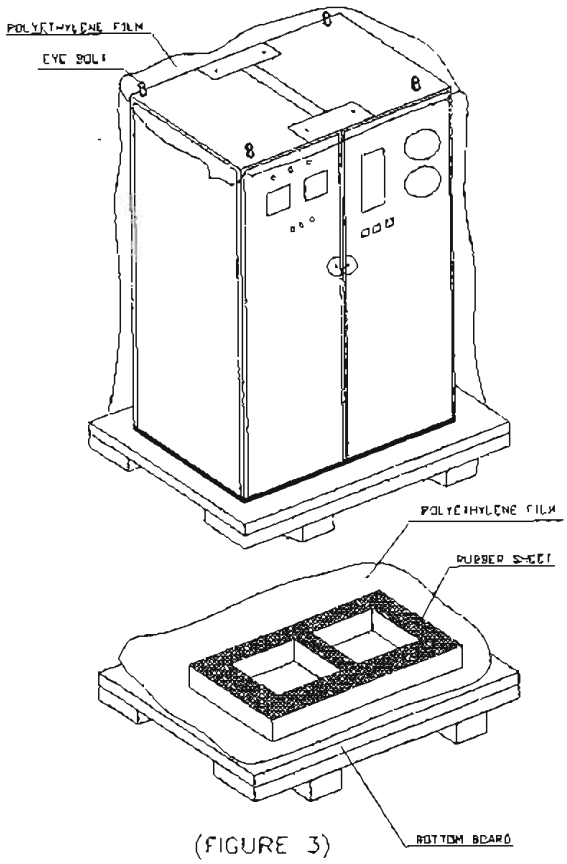


Figure 2

9.2 STEEL CONTAINERS:

Steel containers for packing can be used in case of repeated supplies of the same equipment. Empty steel containers are to be returned back from customer's end and to be reused for the next supplies. The containers are to be made of structural steel as per AA10108 with proper reinforcement with I, C and T Sections. Depends on the availability of resources & requirements units may be allowed to use standard cargo containers also instead of fabricated steel boxes.

a) Following precautions are to be taken during packing: -

b) Put the machine in the steel container properly,

c) Cover the machine with polythene.

d) To arrest the movement in the steel container necessary wooden Blocks/Battons may be put.

e) Put cover on steel, container and Bolt Properly

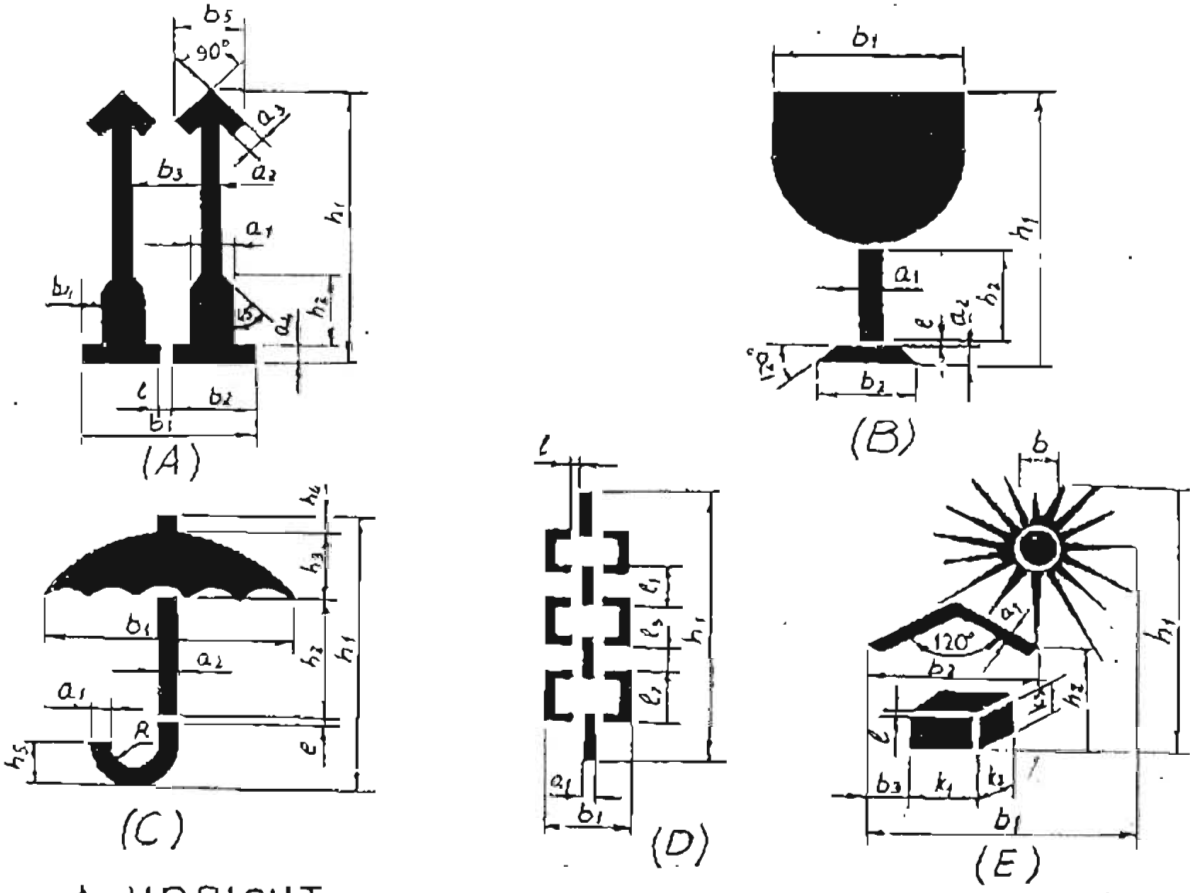
9.3 SEALED PACKING:

Components sub-assemblies and assemblies sensitive to climatic conditions shall be packed seal tight. All the openings of the sensitive components, sub-assemblies and assemblies shall be blanketed to prevent the ingress of dust and moisture. The components sub-assemblies and assemblies are completely covered with 2 layers of polyethylene sheet. All sharp corners and edges are to be protected by rubber mats to prevent the polyethylene sheet from damage. Top surface of the case shall be free from dents to prevent rain water pockets.

10 MARKINGS/STENCILINGS

MARKINGS ON PACKING CASES

1. THIS PLANT STANDARD PRESCRIBES THE VARIOUS CAUTION SIGNS AND OTHER MARKINGS ON PACKING CASES.
2. DIMENSIONS IN THE TABLE 1 SHALL BE USED FOR MAKING STENCILS ONLY.



A. UPRIGHT
B. FRAGILE
C. PROTECTION FROM FALLING OR CONDENSING MOISTURE.
D. SLINGING POSITION
E. PROTECTION FROM DIRECT RADIATIONS.

Center of Gravity

Figure 3

DESIGN-ATION		DIMENSION IN MM																						
		a1	a2	a3	a4	b1	b2	b3	b4	b5	b	l	h1	h2	h3	h4	h5	k1	k2	k3	l1	l2	l3	R
A	1	12	5	5	4	52	25	19	8	21		2	84	23										
	2	17	7	7	6	75	36	29	11	30		3	119	33										
	3	24	10	10	8	104	50	38	16	42		4	168	46										
	4	34	14	14	11	147	71	59	23	60		5	239	65										
B	1	5	5			50	33					2	84	25										
	2	7	7			71	47					3	119	36										
	3	10	10			100	66					4	168	50										
	4	14	14			142	94					5	239	71										
C	1	4	3			66						2	60	39	19	5	11							6
	2	6	4			85						3	114	55	27	7	16							9
	3	8	6			120						4	160	78	38	10	22							12
	4	11	9			170						5	227	110	54	14	31							17
D	1	6				30						4	148								30	30	10	
	2	9				42						5	209								42	42	14	
E	1	3				69	47	10			16	2	91	26				17	6	11				
	2	4				98	67	15			23	3	128	33				24	11	16				
	3	8				138	94	20			32	4	182	82				34	16	22				

Table 4

Black and Red Marking Ink to IS:1234 "Ink, Stencil, Oil Base, For Marking Porous Surfaces" or duplicating ink stencilling, oil base for marking porous surfaces.

All cases containing fragile items are to be stencilled with red marking and stencilling paint/ink

"HANDLE WITH CARE", "FRAGILE DO NOT TURN OVER".

Besides the caution signs the product information's shall be stencilled of letters with 13mm to 50mm height.

In case of consignment consists of more than one package, each package shall carry its package no as given in shipping list. All caution signs shall be stencilled in high quality full glossy out door finishing paint red in colour (AA56126). All other markings shall be carried out in black enamel(AA56126).

Caution signs & other markings shall be stencilled on both the end shooks & the side shooks.

Caution sign (for slinging) shall be stencilled only on side shooks at the appropriate place.

Note: Incase the size of package is small for using the stencils, then hand written letters/figures shall be allowed.

	BHEL – <unit> - <location> - <pin>				
CONSIGNEE					
MATERIAL					
CUSTOMER REF.				MO. NO.	
DESPATCH ADVICE NOTE NO				CASE NO	
DIMENSIONS(MM) L x B x H				NET WT –KGS	GROSS WT –KGS
SPECIAL INSTRUCTIONS	HANDLE WITH CARE - KEEP DRY DO NOT DROP - DO NOT TILT				

Figure 4 – TYPICAL MARKING PLATE (225 X 170)

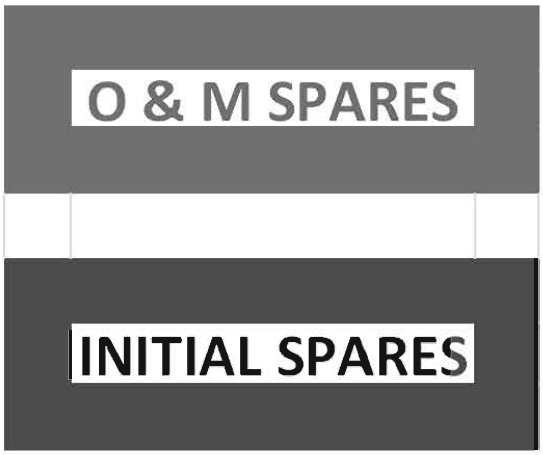


Figure 5

Easy spares [Initial and O&M] Traceability and Identification at units and as well as at sites:

11 RECYCLING OF INCOMING WOODEN PACKING CASES

OBJECTIVES

- To utilize useable wood of incoming packing cases, for manufacturing of new packing boxes.
- To recycle incoming wooden packing cases, as such, wherever possible.

1) All incoming wooden packing cases received from suppliers /customers will be opened carefully, with the intention of reusing them, by Shop.
2) After carefully taking out the contents, the empty wooden packing cases will be shifted by Shop to the specified locations i.e. bin / nearly spaces, already earmarked in stores.
3) Material shifting contractor engaged by store, will collect all such wooden packing cases and scrap wood from specified points, on a regular basis.
4) After collecting / loading the empty packing cases/ scrap wood, contractor will take the carrier first to Weighment Bridge for weighment, thereafter; he will go to Carpentry, where Carpentry representative will identify the packing cases which can be used by Carpentry for manufacturing of New Packing Boxes. All such identified packing boxes will be unloaded and handed over to Carpentry by contractor.
5) These packing boxes will be made re-useable after necessary rectification and additional work.
6) Contractor will again take the carrier for weighment and this second reading will also be recorded on the same "Weighment Slip".
7) Weight of empty packing cases / scrap wood taken will be calculated on the basis of 1st and 2nd weighment readings recorded on the "Weighment Slip". A copy of"Weighment Slip" (where both the weighment readings are recorded) will be given by the contractor to the carpentry representative. Based on this "Weighment Slip", carpentry will maintain a register in which details of quantity received will be recorded.
8) All "Weighment Slips" will invariably be signed by carpentry representative (even when no boxes have been unloaded by carpentry). Store will accept the scrap wood only if "Weighment Slips" are signed by carpentry representative.
9) Balance empty packing cases / scrap wood will be handed over by contractor to Store, for storing in scrap yard.
10) A separate area in Scrap yard will be provided, for executing the work of denailing of wooden packing cases, under supervision of carpentry.
11) Carpentry contractor will identify packing cases / scrap wood for denailing, which will behanded over to him by Store, at Scrap yard, for denailing and further operation.
12) Quality and Carpentry will jointly inspect the wood generated by de-nailing process and will prepare "INSPECTION CUM RECEIPT REPORT OF USEABLE WOOD RECEIVED FROM TPS – STORE BY CARPENTRY".
13) After acceptance of the wood by Quality and Carpentry, the same will be shifted to carpentry for receipt and its record will be maintained by carpentry.
14) This will be a Permanent Productivity Project executed by carpentry. "Productivity Savings "duly verified at the current Purchase Order rate of wood, will be sent every month to Resource Management Department, for highlighting it in their monthly progress report.

12 STANDARD METHOD OF PACKING

Table 5 - Standard Method of Packing

DESCRIPTION	CASE	CRATE	SKID	BUNDLE	BARE	DRUM	METAL DRUM	FIBRE DRUM
PRESSUE VESSELS								
TOWERS					O			
TANKS					O			
VESSELS					O			
GASKETS	O							
FASTENERS	O							
COVERS		O						
EXCHANGERS								

CORPORATE STANDARD

DESCRIPTION	CASE	CRATE	SKID	BUNDLE	BARE	DRUM	METAL DRUM	FIBRE DRUM
HEAT EXCHANGERS					O			
TUBE BUNDLE	O							
SHELL					O			
AIR FIN COOLERS					O			
COLOUMNS, MOTOR SUSPENSIONS, PLENUM CHAMBERS, SCREEN GUARDS, ETC					O			
BEARING BLOCKS	O							
FANS	O	O						
MOTORS	O							
GASKETS	O							
FASTENERS	O							
TEST FLANGES			O					
TEST RINGS			O					
COVERS			O					
CRYOGENIC VESSELS								
COLD CONVERTERS					O			
HORIZONTAL STORAGE TANKS					O			
TRANSPORTATION TANK					O			
COLD BOX					O			
DRYING UNIT					O			
DRYING BOTTLES					O			
MOISTURE SEPARATORS					O			
SILENCERS					O			
ONGC SKIDS					O			
VAPORISER		O						
SPECIAL PRODUCTS								
SI/VI PIPING		O						
CRO BIO CONTAINERS	O							
AIR BOTTLES	O							
TITANIUM BOTTLE	O							
WAR HEAD CONTAINER	O							
MISSILE CONTAINER	O							
FUEL CONTAINER	O							
AIR LOCK ASSEMBLY	O							
BOILER DRUMS					O			
BOILER ITEMS								
COILS			O					
PANELS					O			
HEADERS			O		O			
FEEDERS								
MACHINED ITEMS								
SHELL SEGMENTS					O			

DESCRIPTION	CASE	CRATE	SKID	BUNDLE	BARE	DRUM	METAL DRUM	FIBRE DRUM
SHELL SEGMENTS IN STACKS					O			
SPHERE PETALS								
COLOUMNS, BASE PLATES, TIERCOS, PIPES, NOZZLE E1, F1, INTERNAL PIPES, PADS ETC.					O			
ROLLERS	O							
VALVE TRAYS								
VALVE TRAY COMPONENTS	O							
LATTICE GIRDERS		O						
FASTENERS	O							
GASKETS	O							
SUB CONTRACTS								
FAB STRUCTURALS					O			
SUPPORTING STRUCTURALS					O			
STRUCTURE SUB ASSEMBLY					O			
FAB PIPES					O			
GRATINGS					O			
STAIR CASES					O			
HANDRAILS/ PLATFORMS					O			
BOUGHT OUT COMPONENTS								
IRON & STEEL (LIKE PLATES, BEAMS, ANGLES, CHANNELS ETC.)					O			
PIPE FITTINGS								
CS PIPES, TUBES					O			
SS PIPES, TUBES					O			
FIN TUBES	O							
ELBOWS		O			O			
FLANGES	O	O						
VALVES	O							
GAUGES	O							
DEMISTERS		O						
ABSCRBANTS (LIKE MOLECULAR SIEVES, ACTIVATED ALUMINA, MOBILE SORBID)						O		
PAINT TINS		O						
PAINT DRUMS						O		
IGNITORS	O							
SPRAY NOZZLES	O							
ELECTRICAL INSTRUMENTATION								
MOTORS, PUMPS, COMPRESSORS, TURBINES	O							
SWITCH BOARDS, DISTRIBUTION BOARDS, STARTERS, JUNCTION BOXES		O						
INDICATORS, VIBRATOR SWITCHES	O							

DESCRIPTION	CASE	CRATE	SKID	BUNDLE	BARE	DRUM	METAL DRUM	FIBRE DRUM
CABLE BUNDLES, CABLE DRUMS					O			
CABLE TRAYS, CABLE RACKS, EARTHING MATERIAL		O						
OPERATIONAL SPARES	O							

13 PROCEDURE FOR HANDLING OF COMPONENTS

The purpose of this procedure is to protect the quality of the components/equipment while handling in various stages of manufacturing packing & despatching.

13.1 Adequate care shall be taken in handling the material, and components to avoid damage during receipts, storage issue manufacture & despatch operations.

13.2 Appropriate material handling equipment like fork lifters, cranes etc. shall be used where needed.

13.3 Lifting by crane and transportation by trolley of critical items and large components like rotors castings etc. shall be done carefully.

13.4 For critical items, where specified, special handling fixtures shall be used for lifting.

13.5 Slings and shackles used for lifting the components/equipment shall be checked for fitness and suitability before use.

13.6 Slings used on machined surfaces shall be suitably padded. No slings shall be used on journal surfaces.

13.7 Precision machined components like blades, catches, rollers etc. shall be lifted using suitable wooden pallets.

13.8 HANDLING OF COMPONENTS ON RECEIPT/DESPATCH

Before loading/unloading a packing case from the carrier look for the following shipping instructions painted on the packing case.

a) The markings showing the upright position.

b) The markings showing the sling position

c) Markings showing the fragile contents.

d) Other required markings as per clause no.10

13.8.1 Appropriate cranes and slings should be used for different components/ cases. Slings should normally make an angle as minimum as possible (width wise) but in no case more than 15°.

13.8.2 Handling and lifting should be done without jerks or impacts.

13.8.3 Immediately after receipt of the goods, the packing should be examined all-round for any sign of damage. If necessary, lift the cover or a number of boards of the case so as to make the contents visible. In the event of sealed packing being used the plastic sheeting should not be damaged. It is imperative that the packing material is restored in original condition after the inspection.

13.8.4 On receipt of the equipment it should be checked with the shipping list and missing or damage if any should be reported immediately. It is important to arrange for immediate examination to determine the extent of the damage, the cause of the damage and where applicable the person or persons responsible for the damage. According to general practice when transporting by railway or by road vehicle the carrier concerned should be immediately called upon (within specified periods) for jointly establishing a statement of the damage. This is essential as a basis for a subsequent claim and possible damage report to the insurance company.

13.8.5 Protective coating applied on machined surfaces should not be disturbed. The plastic covering should be put back carefully so that it prevents ingress of dust and moisture. Some packing may have vapour phase inhibitor (VPI) paper enclosed inside the packing cases. This should be restored to its original place as far as possible.

13.8.6 Silica gel and such other chemicals kept in the box as desiccants and indicators should also be left in the box itself.

14 GENERAL GUIDELINES FOR ODC TRANSPORTATION/DESPATCH

Based on the Dimensions/Weight indicated in the Transportation Sketch, the type of Trailer is decided and indicated in the Tender Enquiry.

14.1 TRANSPORTATION:

1. LOW BED TRAILERS (LB 8):
   - Well Bed Length : 10000mm
   - Over Gooseneck : 13000mm
   - Width : 3000mm
   - Carrying Capacity : 40MT

2. LOW BED TRAILERS (LB 16):
   - Well Bed Length : 12000mm
   - Over Gooseneck : 16000mm
   - Width : 3000mm
   - Carrying Capacity : 75MT

3. TOW TYPE TRAILERS (WITH FRONT DOLLEY 16 TYRES): 12000MM length
   (for Exceptional equipment length: 30000mm and above)

   Bigger Dia equipment are loaded in the Well with overhanging.

   Smaller Dia equipment with excess length are loaded over Gooseneck with rear hanging.
   The Vehicle Dimensions are defined above are only guidelines for selection based on actual Dimensions/ Weight of the Consignment

14.2 PACKING:

For all ODCs, Wooden Saddles are cut to the diameter of equipment as per the Transportation Sketch.

Wooden Saddles	For Diameter up to 4000mm	For Diameter above 4000mm
Length:	1836/2743mm (6'0"/9'0")	3353mm (11'0")
Width:	300mm (1'0")	300mm (1'0")
Height:	Saddle + one/two wedges a top	Saddle + three/four wedges a top

Number of Saddles:	
Minimum	3 in case of Loading inside Well +1 when loaded on Gooseneck
Maximum:	4 in case of Loading inside Well +2 when loaded on Gooseneck

For Securing the equipment firmly on the Trailer, 19mm (3/4"), wire rope with 25mm (1") Heavy Duty Turn Buckles / BD Clamps are used as Lashing for the equipment.

14.3 NUMBER OF LASHINGS:

	CONSIGNMENT LOADED INSIDE WELL BED	CONSIGNMENT LOADED OVER GOOSENECK
a) up to 40MT	4 (2 Single Line lashing 2 Double Line Lashing)	5 (3 Single Line Lashing 2 Double Line Lashing)
b) 40MT to 60MT	5 (3 Single Line Lashing 2 Double Line Lashing)	5 (Single Line Lashing 3Double Line Lashing)
c) 60MT and above	5 (2 Single Line Lashing 3 Double Line Lashing)	6 (3 Single Line Lashing 3 Double Line Lashing)

15 GUIDELINES FOR HANDLING/LOADING/LASHING

15.1 HANDLING

Figure 6

Before unloading the jobs Completely painted and neatly stencilled will be checked.

Pipes with split type end cover will be checked

Figure 7

All Coil Tubes to be provided with End Caps.

Figure 8

Neatly stacked Coil Assemblies.

Figure 9

Columns to be lifted with Nylon belts. This protect painting, edges and attachments.

Figure 10

15.2 LOADING

All the components to be transported by putting inside the properly fabricated Crating

Figure 11

Small components may fall down while transporting without closed crating and there are chances of missing of small parts. Hence, it is always better to transport small components in closed containers/crating. Loose to be being shipped in a closed crating.

Figure 12

No component loaded over the crating.

Figure 13

Headers supported with wooden V blocks at 3 meters interval.

Figure 14

Spacers in between each coil assembly.

Figure 15

Goose pipe to be provided with rubber pad protects removal of painting and damage to the job.

Figure 16

15.3 LASHING

Use Nylon belts only for lashing of all components. It prevents removal off painting and cut in the materials.

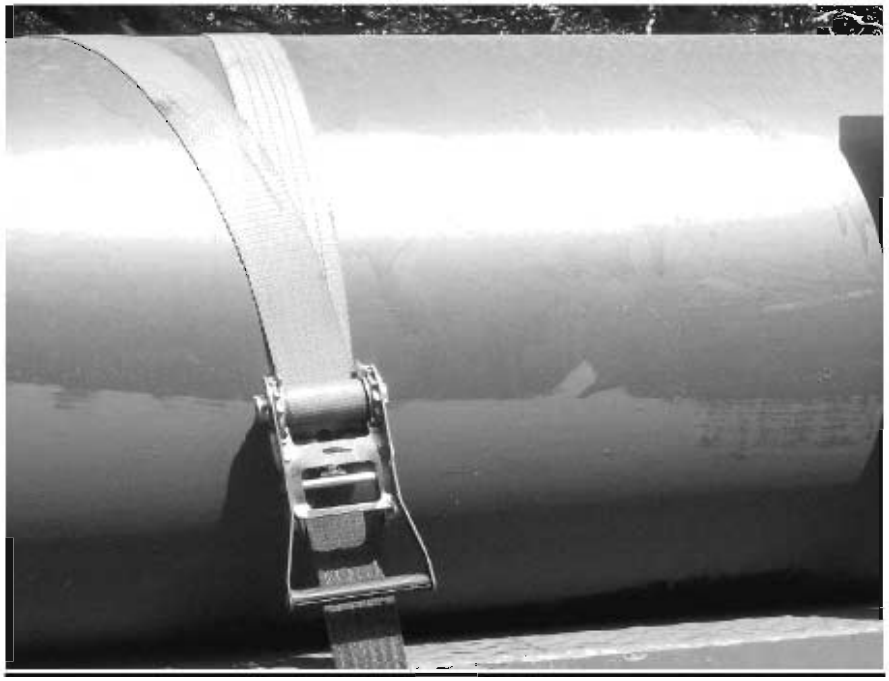


Figure 17

Nylon Belts used for lashing the beams.

Figure 18

16 PRODUCT WISE SPECIAL INSTRUCTION

Additional instructions of packing not included in this standard shall be covered by individual product standard.

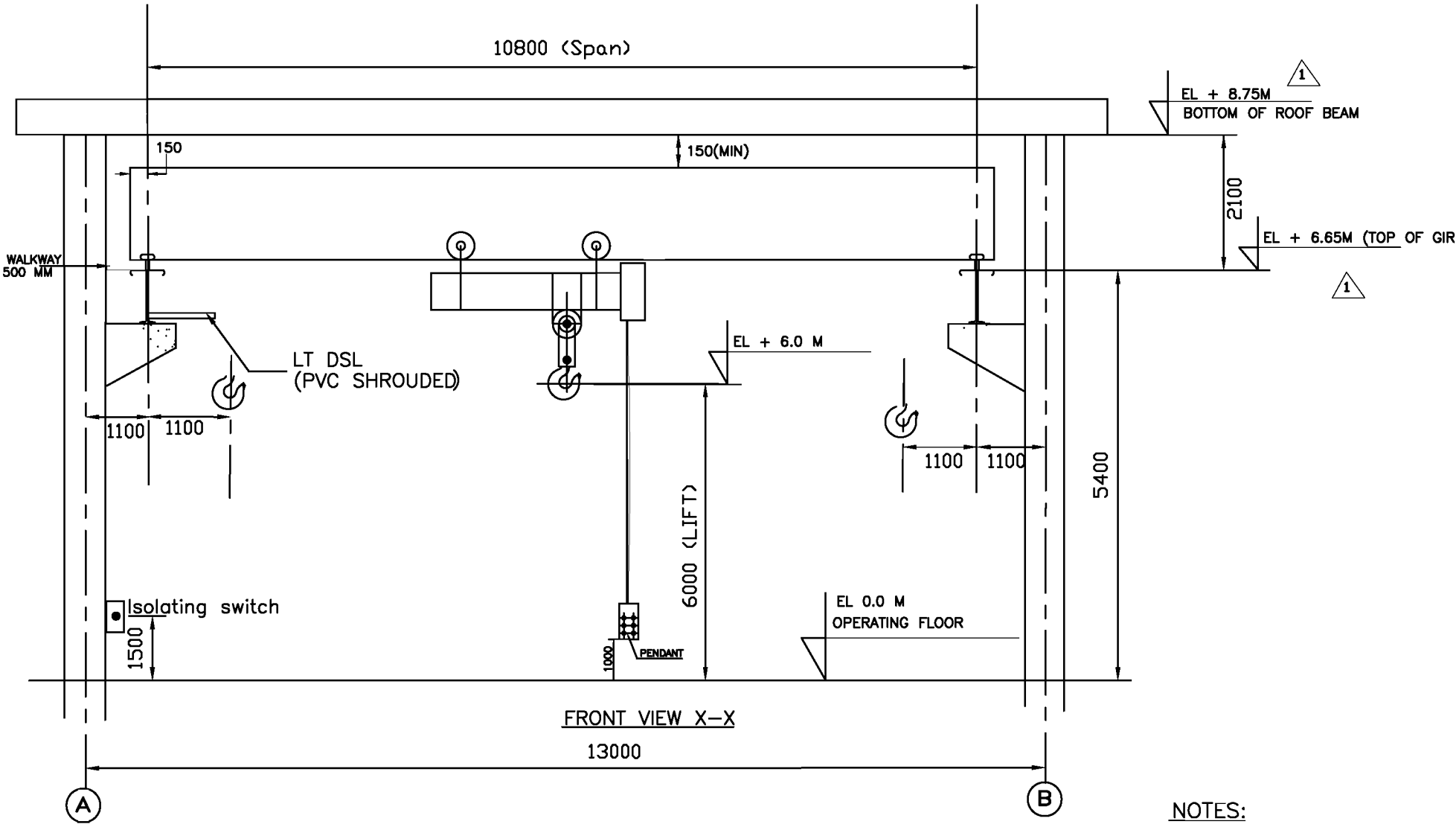
17 REFERRED STANDARDS (Latest publications including amendments):

1) AA51420	2) AA55619	3) AA51414	4) IS:3401	5) AA10108
6) AA56126	7) AA51402	8) AA51401	9) IS:1234	

ANNEXURE –VIII

CRANE CLEARANCE DIAGRAMS

FIRST ANGLE PROJECTION

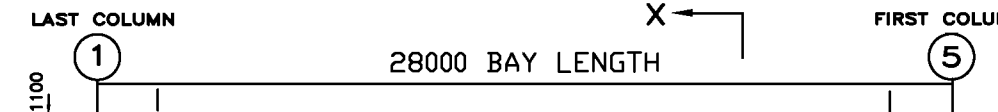


FRONT VIEW X–X

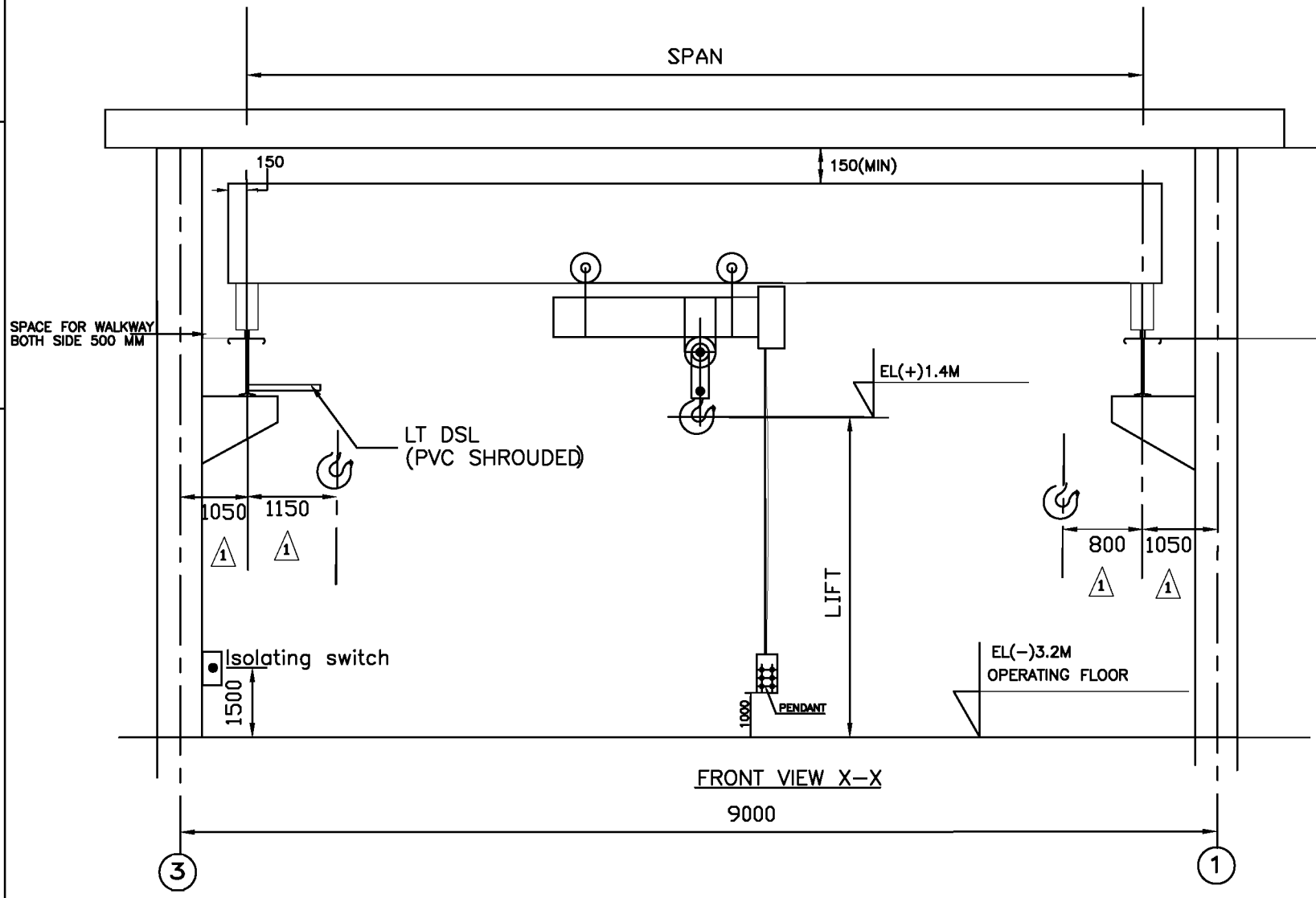
13000

NOTES:

1. ALL DIMENSIONS



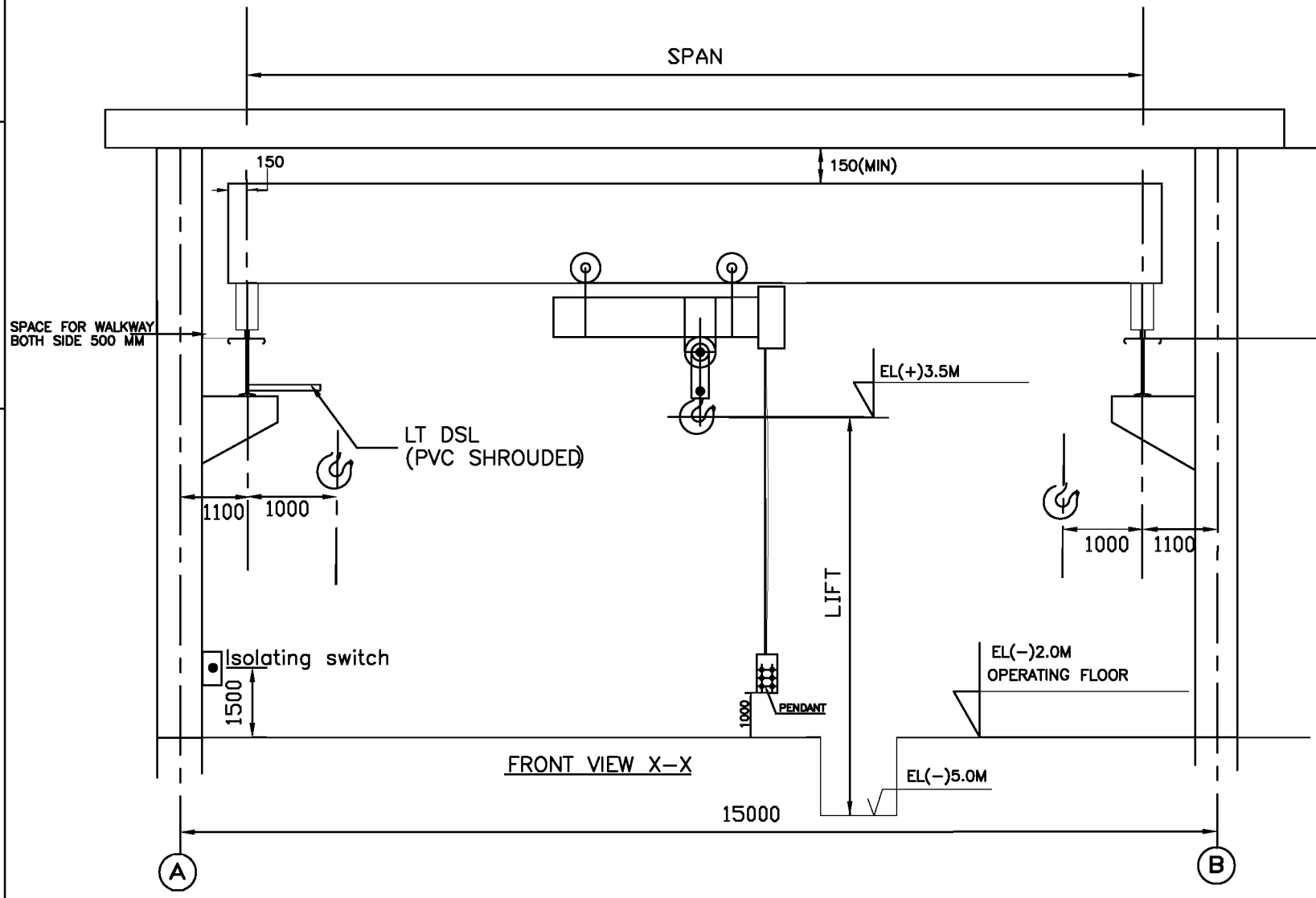
FIRST ANGLE PROJECTION



NOTES:

1. ALL DIMENSIONS

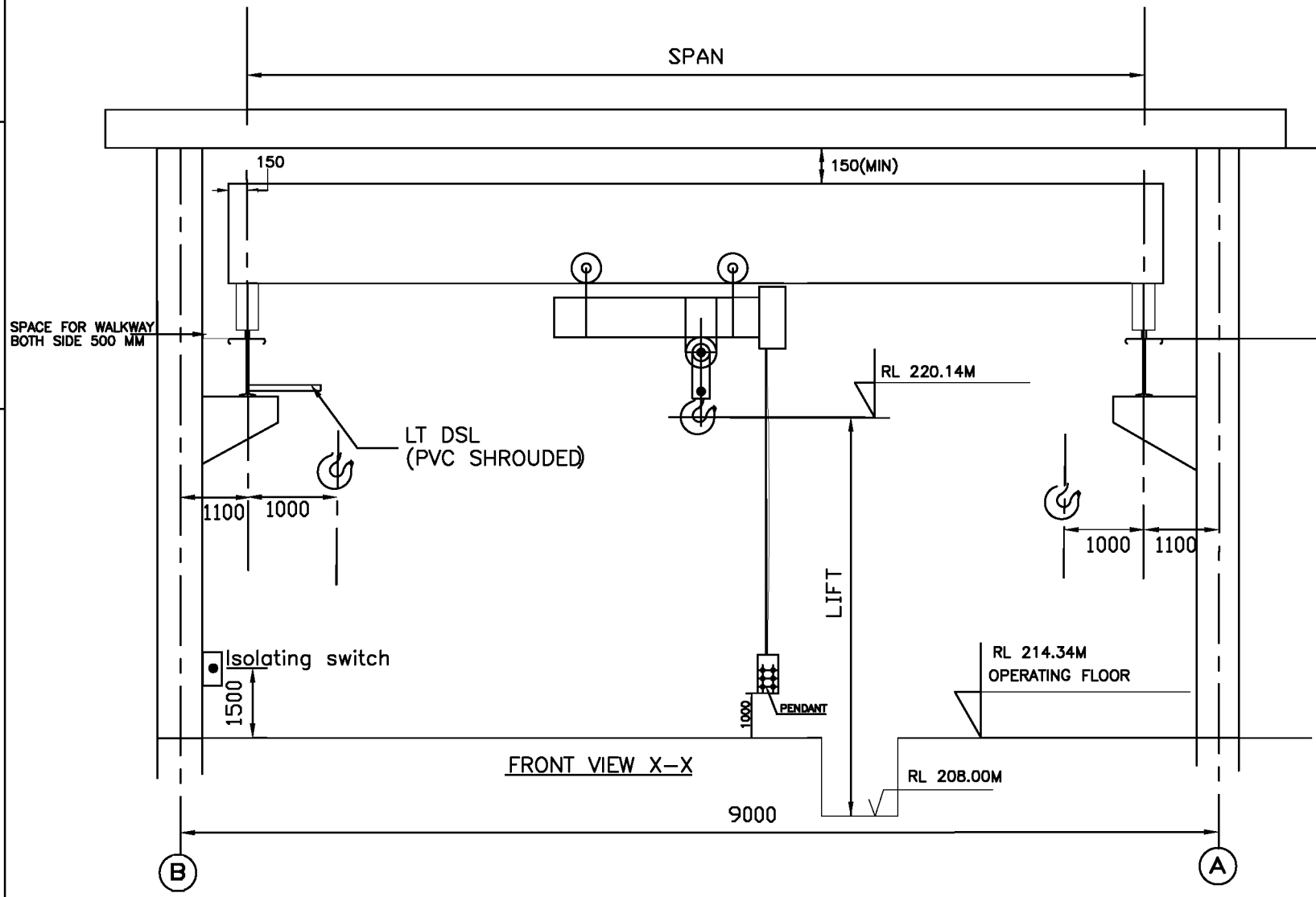
FIRST ANGLE PROJECTION



NOTES:

1. ALL DIMENSIONS

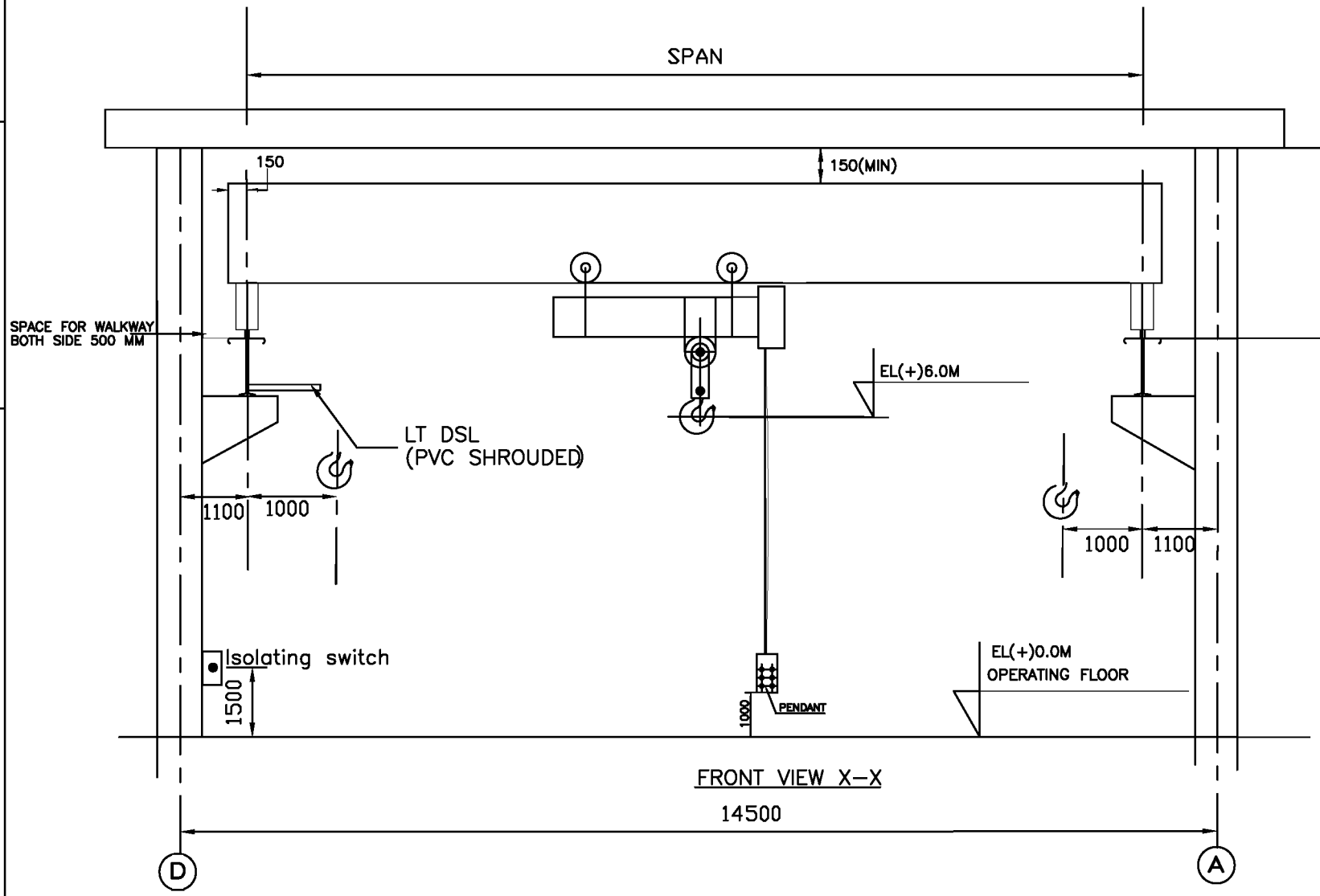
FIRST ANGLE PROJECTION



NOTES:

1. ALL DIMENSIONS A

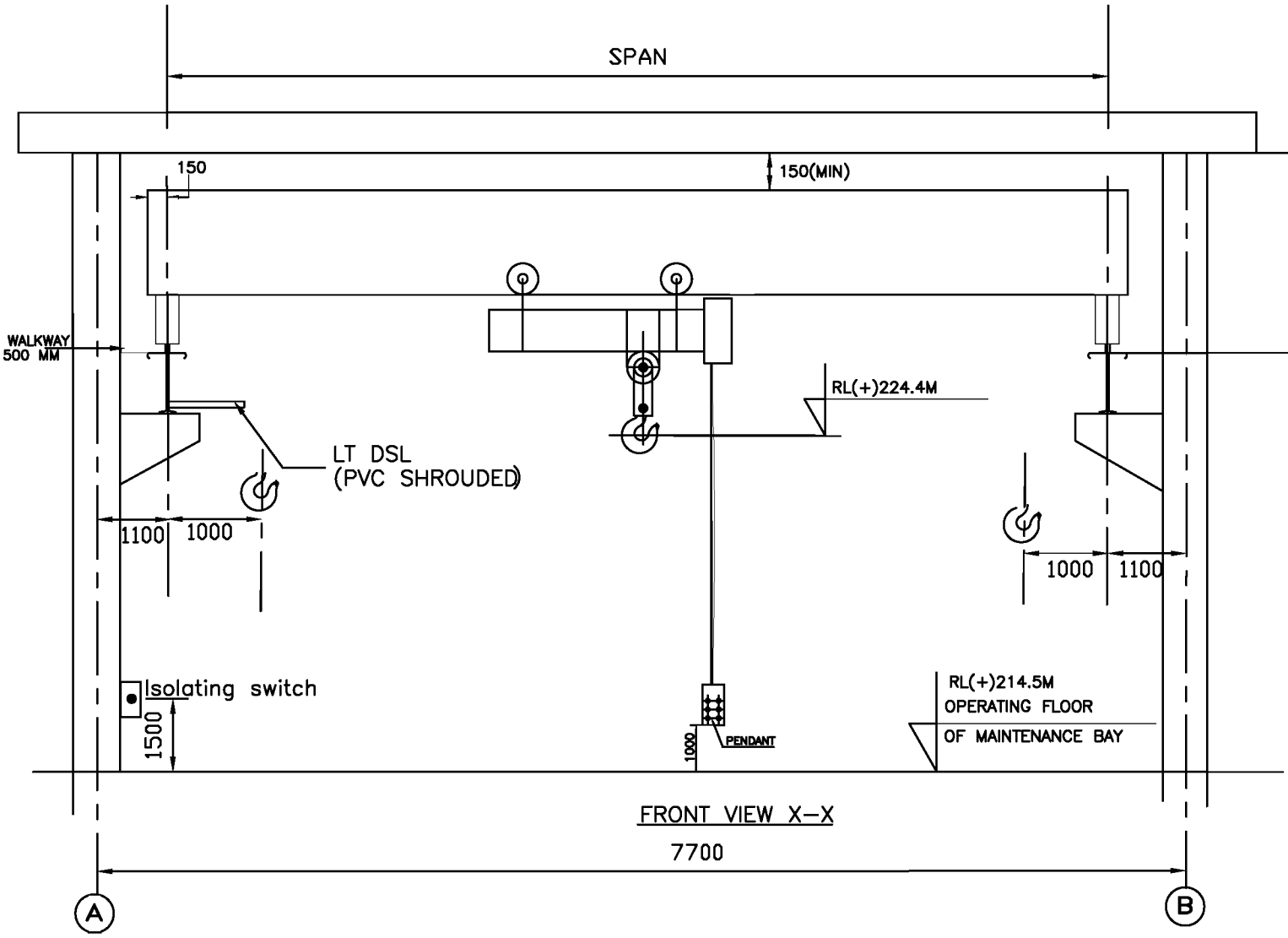
FIRST ANGLE PROJECTION



NOTES:

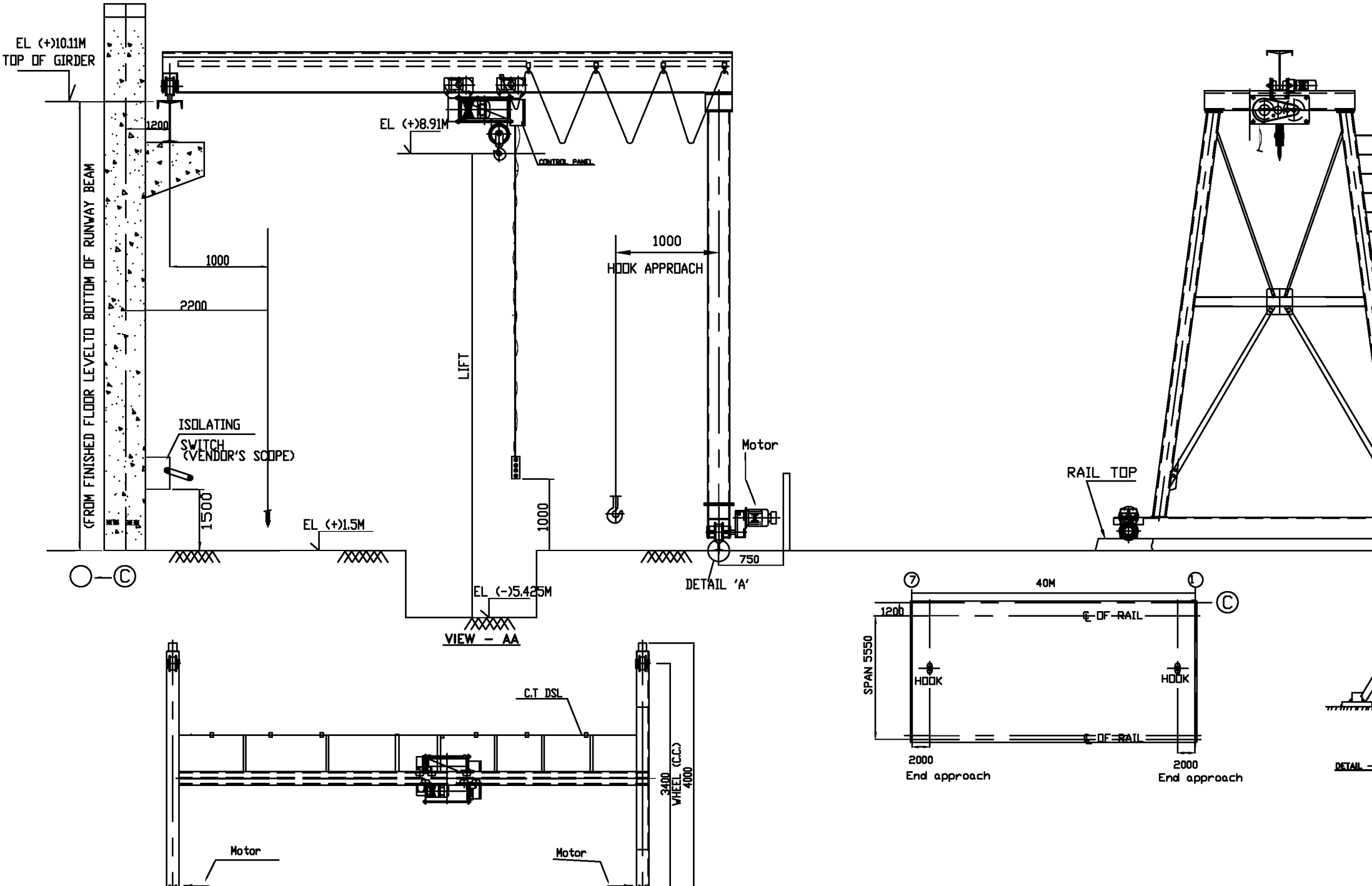
1. ALL DIMENSIONS

FIRST ANGLE PROJECTION

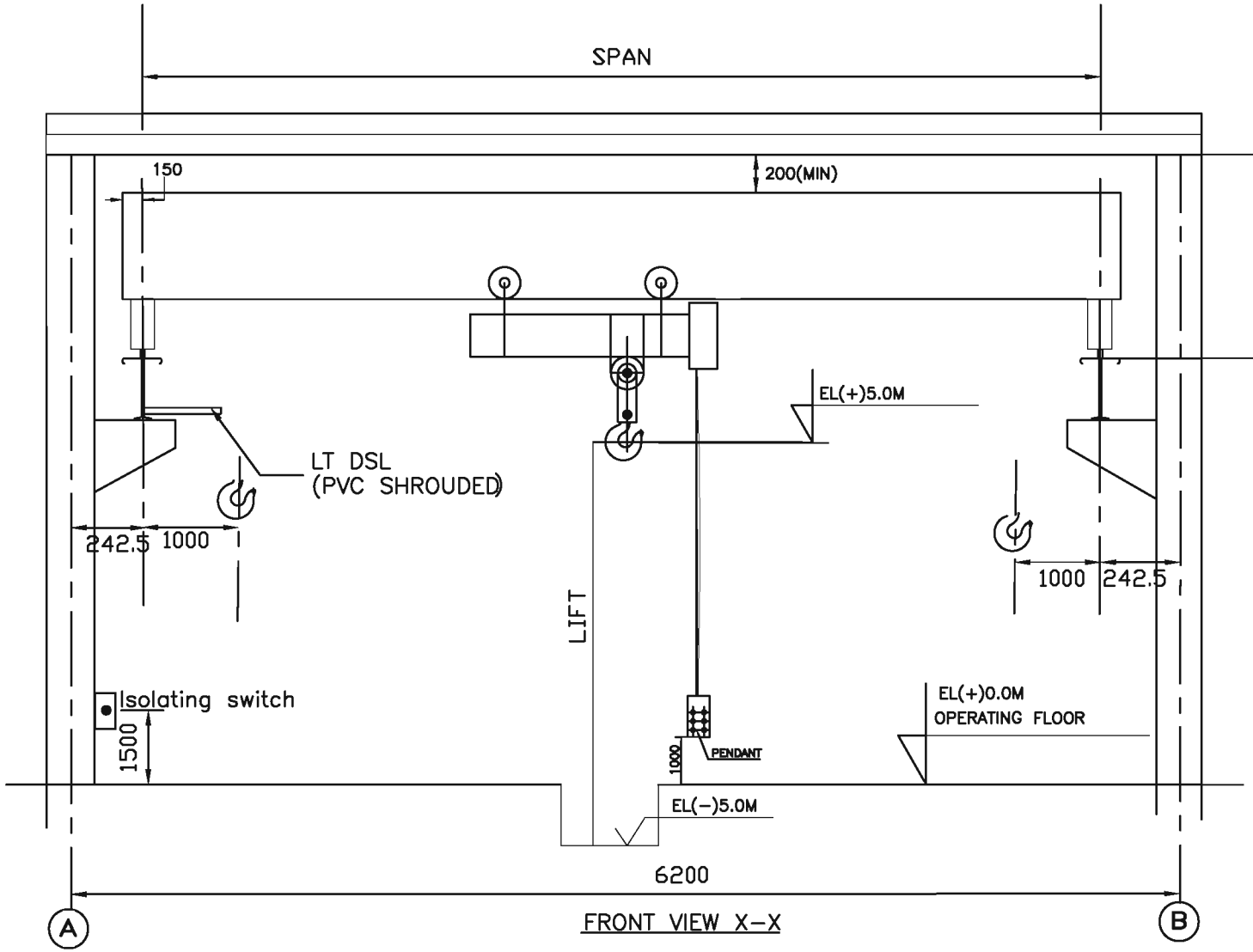


NOTES:

1. ALL DIMENSIONS


EL (+)10.11M
TOP OF GIRDER
(FROM FINISHED FLOOR LEVELTO BOTTOM OF RUNWAY BEAM
1200
EL (+)8.91M
CONTROL PANEL
1000
2200
1000
HOOK APPROACH
LIFT
ISOLATING
SWITCH
(VENDOR'S SCOPE)
1500
EL (+)1.5M
1000
Motor
750
DETAIL 'A'
EL (-)5.425M
VIEW - AA
RAIL TOP
7
1
40M
C
1200
℄ OF RAIL
SPAN 5550
HOOK
HOOK
℄ OF RAIL
2000
End approach
2000
End approach
C.T DSL
3400
WHEEL (C.C.)
4000
Motor
Motor

FIRST ANGLE PROJECTION



FRONT VIEW X–X

NOTES:

1. ALL DIMENSIONS

NOTE: This cran
detailed engineer
dimensions (like

SUB SECTION-IB

SPECIFIC TECHNICAL REQUIREMENT (ELECTRICAL)

	TECHNICAL SPECIFICATION FOR SG CRANE (ELECTRICAL PORTION)	SPECIFICATION NO. SECTION-C REV 00 DATE 30.08.19 PAGE 1 OF 1

SPECIFIC TECHNICAL REQUIREMENTS: ELECTRICAL

1.0 EQUIPMENT & SERVICES TO BE PROVIDED BY BIDDER/ PURCHASER

a) Services and equipment as per "Electrical Scope between BHEL and Vendor".
b) Any item/work either supply of equipment or erection material which have not been specifically mentioned but are necessary to complete the work for trouble free and efficient operation of the plant shall be deemed to be included within the scope of this specification. The same shall be provided by the bidder without any extra charge.
c) Supply of mandatory spares as specified in the specifications of mechanical equipments.
d) Electrical load requirement for SG CRANE.
e) All equipment shall be suitable for the power supply fault levels and other climatic conditions mentioned in the enclosed project information.
f) Bidder to furnish list of makes for each equipment at contract stage, which shall be subject to customer/BHEL approval without any commercial and delivery implications to BHEL
g) Various drawings, data sheets as per required format, Quality plans, calculations, test reports, test certificates, operation and maintenance manuals etc shall be furnished as specified at contract stage. All documents shall be subject to customer/BHEL approval without any commercial implication to BHEL.
h) Motor shall meet minimum requirement of motor specification.
i) Vendor to clearly indicate equipment locations and local routing lengths in their cable listing furnished to BHEL.
j) Cable BOQ worked out based on routing of cable listing provided by the vendor for "both end equipment in vendor's scope" shall be binding to the vendor with +10 % margin to take care of slight variation in routing length & wastages.
k) Technical requirements shall be as per specifications listed in Clause 4.1, 4.2, 4.3, 4.4 & 4.5 below.

3.0 DOCUMENTS TO BE SUBMITTED ALONG WITH BID

3.1 Bidder shall confirm total compliance to the electrical specification without any deviation from the technical/ quality assurance requirements stipulated. In line with this, the bidder as technical offer shall furnish two signed and stamped copies of the following:

a) A copy of this sheet "Electrical Equipment Specification for SG CRANE' and sheet "Electrical Scope between BHEL and Vendor" with bidder's signature and company stamp.
b) Electrical load requirement in the load data format.

3.2 No technical submittal such as copies of data sheets, drawings, write-up, quality plans, type test certificates, technical literature, etc, is required during tender stage. Any such submission even if made, shall not be considered as part of offer.

4.0 LIST OF ENCLOSURES

4.1 Electrical scope between BHEL & vendor (Annexure-A).
4.2 Technical specification for Motors DG/BSL U-6/2011/T-1
4.3 Data Sheet- A along with Annexure-I.
4.4 Constructional details of cables & cabling.
4.5 Quality Plan
4.6 Load data format (Annexure-B).

REV: 00 DATE: 12.03.2015

STANDARD ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR (FOR EPC PROJECTS)

PACKAGE: SINGLE GIRDER EOT CRANES & ELECTRIC HOISTS

SCOPE OF VENDOR: SUPPLY

PROJECT: 1 X 660 MW BHUSAWAL TPS

S. NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
1	Isolating Switch	Vendor	BHEL	BHEL will provide one number 415 V (3ph, 4W) supply feeder only up to isolating switches for cranes/hoists. Any other voltage level (AC/DC) required will be derived by the vendor. Motor starter shall be part of crane/ hoist control panel.
2	Power cables, control cables, screened control cables and any special cables (if required) between equipment supplied by vendor.	Vendor	BHEL	Cable from supply feeder to isolating switch shall be in BHEL scope.
3	Cabling material (cable trays, accessories, cable tray supporting system, conduits etc)	Vendor	BHEL	
4	Equipment Earthing	BHEL	BHEL	All equipment metallic enclosures / frames, metal structure etc. shall be grounded at two points each to the nearest grounding points / risers provided by BHEL
5	Motors	Vendor	BHEL	
6	Cable glands and lugs for equipment supplied by vendor	Vendor	BHEL	1. Double compression Ni-Cr plated brass cable glands 2. Solder less crimping type heavy duty tinned copper lugs for power & control cables.
7	a) Input cable schedules (C & I) b) Cable interconnection details for above c) Cable block diagram	Vendor Vendor Vendor	- - -	Cable listing for Control and Instrumentation Cable in enclosed excel format shall be submitted by vendor during detailed engineering stage.
8	Equipment layout drawings	Vendor	-	
9	Electrical Equipment GA drawing	Vendor	-	For necessary interface review.

MAHAGENCO	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: IV-A
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 10
REV: R0	ELECTRICAL EQUIPMENT & ACCESSORIES	Page 365 of 440

1.0 SCOPE

1.1 This section covers the general requirements of the drive motors for power station auxiliary equipment.

1.2 Motors shall be furnished in accordance with both this general specification and the accompanying driven equipment specification.

1.3 In case of any discrepancy, the driven equipment specification shall govern etc.

2.0 STANDARDS

2.1 All motors shall conform to the latest applicable IS, IEC and CBIP Standards/ Publications except when otherwise stated herein or in the driven equipment specification.

2.2 Major standards, which shall be followed, are listed below other applicable Indian Standards for any component part even if not covered in the listed standards shall also be followed

(a) IS-325

(b) IS-12615

(c) IEC-34

3.0 SERVICE CONDITIONS

3.1 The motors will be installed in hot, humid and tropical atmosphere, highly polluted at places with coal dust and/or fly ash canopy to be provided to all outdoor install motors.

3.2 Unless otherwise noted, electrical equipment/system design shall be based on the service conditions and auxiliary power supply given in the annexure to this specification.

3.3 For motor installed outdoor and exposed to direct sunrays, the effect of solar heat shall be considered in the determination of the design ambient temperature

4.0 TYPE AND RATING

4.1 A.C. MOTORS

4.1.1 Motors shall be general purpose, constant speed, squirrel cage, three phase, induction type.

4.1.2 All motors shall be rated for continuous duty. They shall also be suitable for long period of inactivity.

4.1.3 The motor name-plate rating at 50°C shall have at least 10% margin over the input power requirement of the driven HT equipment at rated duty point unless stated otherwise in driven equipment specification or in general electrical specification.

4.1.4 The motor characteristics shall match the requirements of the driven equipment so that adequate starting, accelerating, pull up, break down and full load torques are available for the intended service.

4.1.5 All LT motors used in this project are proposed to be energy efficient type suitable for EFF1 efficiency rating.

4.1.6 The motor name plate rating shall have at least 10% margin over the input power requirement of the HT driven equipment and 15% for LT driven equipments at rated duty point.

4.1.7 Motors located in hazardous area shall be flame proof type.

4.2 D.C. MOTORS

4.2.1 D.C. Motor provided for emergency service shall be shunt/compound wound type.

4.2.2 Motor shall be sized for operation with fixed resistance starter for maximum reliability.

4.2.3 Starter panel complete with all accessories shall be included in the scope of supply.

4.3 For equipment installed outdoor and exposed to direct sun rays, the effect of solar heat shall be considered in determining the design ambient temperature.

5.0 PERFORMANCE

5.1 RUNNING REQUIREMENTS

5.1.1 Motor shall run continuously at rated output over the entire range of voltage and frequency variations as given in the annexure.

5.1.2 The motor shall be capable of operating satisfactorily at full load for 5 minutes without injurious heating with 75% rated voltage at motor terminals.

5.1.3 The motor shall be designed to withstand momentary overload of 60% of full load torque for 15 second without any damage.

5.1.4 Motor shall not be stalled if the supply voltage drops to 70% of the rated voltage for 2 seconds duration.

5.2 STARTING REQUIREMENTS

Motor shall be designed for direct online starting at full voltage. Starting current shall not exceed 6 times full load current for all auxiliaries except boiler feed pump where the starting current shall be limited to 4.5 times. No further tolerances are applicable on starting current specified above for HT motors

5.2.1 The motor shall be capable of withstanding the stresses imposed if started at 110% rated voltage

5.2.2 Motor shall start with rated load and accelerate to full speed with 80% rated voltage at motor terminal except BFP motor. In case of BFP motor, it shall

be 75% rated voltage. Minimum starting requirement for mill motor (double cage) shall be 85% rated voltage at motor terminals.

5.2.3 Motor shall be capable of three equally spread starts per hour, two starts in quick succession from cold condition and one restart from hot condition.

Cranking motor shall be capable of six equally spread starts per hour, three starts in quick succession from cold condition and one restart from hot condition. The coal conveyor and crusher motors shall be suitable for 3 consecutive hot starts with maximum 20 starts per day.

Pump motor subject to reverse rotation shall be designed to withstand the stresses encountered when starting with shaft rotating at 125% rated speed in reverse direction.

5.2.4 HT pump motors shall be suitable to start with forward rotation.

5.2.5 The motors shall be designed to withstand 120% of rated speed for 2 minutes without any mechanical damage

5.3 STRESS DURING BUS TRANSFER.

5.3.1 The motor may be subjected to sudden application of 150% rated voltage during bus transfer, due to the phase difference between the incoming voltage and motor residual voltage.

5.3.2 The motor shall be designed to withstand any torsional and/or high current stresses, which may result, without experiencing any deterioration in the normal life and performance characteristics.

5.4 LOCKED ROTOR WITHSTAND TIME

5.4.1 The locked rotor withstand time under hot condition at 110% rated voltage shall be more than motor starting time by at least 2.5 seconds for motors up to 20 seconds starting time and by 5 seconds for motor with more than 20 seconds starting time.

5.4.2 Starting time mentioned above is at minimum permissible voltage of 80% rated voltage.

5.4.3 Hot thermal withstand curve shall have a margin of at least 10% over the full load current of the motor to permit relay setting utilizing motor rated capacity

6.0 SPECIFIC REQUIREMENTS

6.1 ENCLOSURE

6.1.1 All indoor motor enclosures shall conform to the degree of protection IP-55 unless otherwise specified and outdoor motor enclosure shall confirm to degree of IPW-55.Motor for outdoor or semi-outdoor service shall be of weather-proof construction.

6.1.2 For hazardous area approved type of increased safety enclosure shall be furnished.

6.2 COOLING

6.2.1 The motor shall be self ventilated type, either totally enclosed fan cooled (TEFC) or closed air circuit air- cooled (CACA).

6.2.2 In case water cooling is required for very large motors, prior approval of the customer is to be obtained before proceeding ahead with design & manufacture.

6.3 WINDING AND INSULATION

6.3.1 All insulated winding shall be of copper.

6.3.2 All motors shall have class F insulation but limited to class B temperature rise.

6.3.3 Windings shall be impregnated to make them non-hygroscopic and oil resistant.

6.4 TROPICAL PROTECTION

6.4.1 All motors shall have fungus protection involving special treatment of insulation and metal against fungus, insects and corrosion.

6.4.2 All fittings and hardwares shall be corrosion resistant.

6.5 BEARINGS

6.5.1 Motor shall be provided with antifriction bearings, unless sleeve bearings are required by the motor application.

6.5.2 Vertical shaft motors shall be provided with thrust and guide bearings. Thrust bearing of tilting pad type is preferred.

6.5.3 Bearings shall be provided with seals to prevent leakage of lubricant or entrance of foreign matters like dirt, water etc. into the bearing area.

6.5.4 Sleeve bearings shall be split type, ring oiled, with permanently aligned, close running shaft sleeves.

6.5.5 Grease lubricated bearings shall be prelubricated and shall have provisions for in-service positive lubrication with drains to guard against over lubrication.

6.5.6 Oiled bearing shall have an integral self cooled oil reservoir with oil ring inspection ports, oil sight glass with oil level marked for standstill and running conditions and oil fill and drain plugs.

6.5.7 Forced lubricated or water cooled bearing shall not be used without prior approval of Owner.

6.5.8 Lubricant shall not deteriorate under all service conditions. The lubricant shall be limited to normally available types with IOC equivalent.

6.5.9 Bearings shall be insulated as required to prevent shaft current and resultant bearing damage.

6.6 NOISE & VIBRATION

6.6.1 The noise level shall be as per statutory acceptance (IS/IEC).

6.6.2 The peak amplitude of the vibration shall be within IS/IEC specified limits.

6.7 MOTOR TERMINAL BOX

6.7.1 Motor terminal box shall be phase segregated (PSTB) type and located in accordance with Indian Standards clearing the motor base- plate/ foundation.

6.7.2 Terminal box shall be capable of being turned 360 Deg. in steps of 180 Deg. For HT motors and 90 Deg. for LT motors unless otherwise approved.

6.7.3 The terminal box shall be split type with removable cover with access to connections and shall have the same degree of protection as motor.

6.7.4 The terminal box shall have sufficient space inside for termination/connection of XLPE insulated armoured aluminium cables.

6.7.5 Terminals shall be stud or lead wire type, substantially constructed and thoroughly insulated from the frame.

6.7.6 The terminals shall be clearly identified by phase markings, with corresponding direction of rotation marked on the non-driving end of the motor.

6.7.7 The terminal box shall be capable of withstanding maximum system fault current for duration of 0.25 sec.

6.7.8 For 11kV and 3.3kV motor, the terminal box shall be phase-segregated type. The neutral leads shall be brought out in a separate terminal box (not necessarily phase segregated type) with shorting links for star connection.

6.7.9 Motor terminal box shall be furnished with suitable cable lugs and double compression brass glands to match with cable used.

6.7.10 The gland plate for single core cable shall be non-magnetic type.

6.7.11 Due to any reason, if the terminal box is found to be not suitable for the approved cable size for either HT/LT motors, then the bidder shall arrange necessary adopter box to facilitate the termination of cables. The adopter box shall be of the same short circuit rating and specifications as the main terminal box. The adopter box shall be located as near as possible to the main terminal box. The interconnecting cabling between adopter box and main terminal box along with providing suitable cable glands and termination kits as applicable shall also be done by the bidder.

6.8 GROUNDING

6.8.1 The frame of each motor shall be provided with two separate and distinct grounding pads complete with tapped hole, GS bolts and washer

6.8.2 The grounding connection shall be suitable for accommodation of ground conductors as follows :

Motor above 90 kW	:	75 x 10 mm GS Flat
Motor above 30 kW up to 90 kW	:	50 x 6 mm GS Flat
Motor above 5 kW up to 30 kW	:	25 x 6 mm GS Flat
Motor up to 5 kW	:	8 SWG GS Wire

6.8.3 The cable terminal box shall have a separate grounding pad

6.9 RATING PLATE

In addition to the minimum information required by IS, the following information shall be shown on motor rating plate:

(a) Temperature rise in Deg.C under rated condition and method of measurement.

(b) Degree of protection.

(c) Bearing identification no. and recommended lubricant.

(d) Location of insulated bearings.

6.10 CONSTRUCTION

6.10.1 Stator Core

The Stator Core Lamination shall be made of high-grade silicon/magnetic steel sheet varnished on both sides and pressed to form rigid core.

6.10.2 Rotor

The rotor construction shall be such that in case of dislodging of the rotor bar from the end ring, it should not come out and hit the stator core/stator winding and damage.

7.0 ACCESSORIES

7.1 GENERAL

Accessories shall be furnished, as listed below, or if otherwise required by driven equipment specification or application

7.2 SPACE HEATER

7.2.1 Motor of rating 30 kW and above shall be provided with space heaters, suitably located for easy removal or replacement.

7.2.2 The space heater shall be rated 240 V, 1 phase 50 Hz and sized to maintain the motor internal temperature above dew point when the motor is idle.

7.3 TEMPERATURE DETECTORS

7.3.1 All 11kV and 3.3kV motors shall be provided with twelve (12) nos. Simplex type winding temperature detectors, four (4) nos. per phase.

7.3.2 11kV and 3.3kV motor bearing shall be provided with duplex type temperature detectors.

7.3.3 The temperature detector mentioned above shall be resistance type, 3 wire, platinum wound, 100 Ohms at 0°C.

7.3.4 Leads of all simplex type motor winding RTDS and motor bearing RTDS shall be wired up to respective switchgear metering & protection compartment. From which one set of RTDS will be connected to numerical protection relay and another set shall be kept free for DCS connectivity.

7.3.5 Five numbers of Temperature detectors / thermisters shall be provided for L.T. Motors above 90 kW (3 nos. Winding temperatures & 2 nos. bearing temperatures).

7.4 INDICATOR/SWITCH

7.4.1 Dial type local indicator with alarm contacts shall be provided for the following :

(a) 11kV and 3.3kV motor bearing temperature

(b) Hot and cold air temperature of the closed air circuit for CACA and CACW motor

7.4.2 Flow switches shall be provided for monitoring cooling water flow of CACW motor and oil flow of forced lubrication bearing, if used.

7.4.3 Alarm switch contact rating shall be minimum 0.5 A at 220V D.C. and 5A at 240V A.C.

7.5 CURRENT TRANSFORMER FOR DIFFERENTIAL PROTECTION

7.5.1 Motor 1000 KW and above shall be provided with three differential current transformers mounted over the neutral leads within the enclosure. Loose 3 nos. CT for mounting on switchgear side shall be in bidder's scope.

7.5.2 The arrangement shall be such as to permit easy access for C.T. testing and replacement. Current transformer characteristics shall match Owner's requirements to be intimated later.

7.6 ACCESSORY TERMINAL BOX

7.6.1 All accessory equipment such as space heater, temperature detector, current transformers etc., shall be wired to and terminated in terminal boxes, separate from and independent of motor (power) terminal box.

7.6.2 Accessory terminal box shall be complete with double compression brass glands and pressure type terminals to suit cable connections.

7.7 DRAIN PLUG

Motor shall have drain plugs so located that they will drain the water, resulting from the condensation or other causes from all pockets of the motor casing.

7.8 LIFTING PROVISIONS

Motor weighing 25 Kg. or more shall be provided with eyebolt or other adequate provision of lifting.

7.9 DOWEL PINS

The motor shall be designed to permit easy access for drilling holes through motor feet or mounting flange for installation of dowel pins after assembling the motor and driven equipment.

7.10 PAINTING

Motor including fan shall be painted with corrosion proof paints of colour shade (RAL-7032).

8.0 TESTS

8.1 ROUTINE AND TYPE TEST:

Tests are to be conducted for HT and LT motors 60kW and above in presence of Mahagenco representative and contractor as per IS: 325 and required copies of test certificates are to be furnished for approval and despatch clearance. In addition, following tests shall have to be carried out on the motors in presence of MAHAGENCO representative & contractor on LT & HT motors. For Motors below 60kW type and routine test conducted as per IS325 shall be witnessed by contractor and test certificate shall be submitted for review of Mahagenco & Dispatch clearance

8.1.1 FOR HT MOTORS:

(a) Impulse test by 1.2 / 50 micro sec. On sample coil of Stator winding insulation as type test as per IEC-671/IS 14422,1995 test voltages as under

Voltage rating of motor		Impulse Test Voltage
3.3 kV	:	18 kV peak
11 kV	:	49 kV peak

(b) Tan delta, charging current and dielectric loss measurements on each phase of motor stator winding as routine test

(c) Polarization Index Test as per IS:7816 as routine test

(d) Tan delta measurement on coils

(e) Surge withstand test for inter turn insulation.

(f) Test to diagnose rotor bar failure during manufacture.

Tests indicated at (d), (e), (f) shall be carried out during manufacture of the coils and shall be furnished for verification .

8.1.2 FOR HT & LT MOTORS:

(a) Test for suitability of IP55/ IPW– 55 as per IS 4691 as type test. Type test certificate for first numeral shall be acceptable in lieu to test,

provided the test motor is identical to motor being supplied. Second numeral test shall be carried out on one motor of each type and rating.

(b) Fault Withstand Test for main terminal box as type test. Type test certificate shall be acceptable, if the test is conducted on exactly identical terminal box within last three years.

(c) Test for noise level as routine test.

(d) Test for vibration as routine test.

(e) Overspeed test as type test.

8.2 TEST WITNESS:

Test shall be performed in presence of Owner/Purchaser's representative so desired by the Owner/Purchaser. The Contractor shall give at lest fifteen (15) days advance notice of the date when the tests are to be carried out.

CONSULTANT : PROCON ENGINEERS

AC & DC MOTOR

SR. NO.	ITEM	UNIT	
1.0	**AUXILIARY POWER SUPPLY**		
1.1	H.T. SUPPLY		
	11kV, 3Ø, 3W, 50 Hz non-effectively earthed		Motors rated 1000 kW and above
	Fault level 44 kA symm		
	3.3kV, 3Ø, 3W, 50 Hz, non-effectively earthed		Motors above 160 kW and below 1000kW
	Fault level 40 kA symm		
1.2	L.T. SUPPLY		
	415V, 3Ø, 3W, 50 Hz effectively earthed		Motors below and including160kW
	Fault level 50 kA symm		
	240V, 1Ø, 2W, 50 Hz effectively earthed		Lighting, space heating, A.C. control & protective devices
1.3	D.C. SUPPLY		
	220V, 2W, unearthed		D.C. alarm, control & protective devices
	Fault level 25* kA.		
	Indicative only, the actual value will be decided by the Bidder, after substantiating the same by calculation		
2.0	**RANGE OF VARIATION**		

SR. NO.	ITEM	UNIT	
2.1	A.C. SUPPLY:		
	Voltage		± 10%
	Frequency		± 5%
	Combined Voltage & frequency		± 10% (absolute sum)
	During starting of large motor, the voltage may drop to 80% of the rated voltage for a period of 60 seconds. All electrical equipment while running shall successfully ride over such period without affecting system performance		
2.2	D.C. SUPPLY		
	Voltage		198 to 240 Volt

TITLE	SPECIFICATION NO.
LV MOTORS **DATA SHEET-A** **1X660 MW BHUSAWAL TPP**	VOLUME II B SECTION D REV NO. 00 DATE 30.08.2019 SHEET 1 OF 1

1.0	Design ambient temperature	:	50 °C
2.0	Maximum acceptable kW rating of LV motor	:	160KW
3.0	Installation (Indoors/ Outdoors)	:	As required
4.0	Details of supply system		
	a) Rated voltage (with variation)	:	415V ± 10%
	b) Rated frequency (with variation)	:	50 Hz (+5% and -5%)
	c) Combined voltage & freq. variation	:	10% (sum of absolute values)
	d) System fault level at rated voltage	:	50 kA for 1 sec
	e) Short time rating for terminal boxes		
	o 90 kW and upto 160kW (Breaker controlled)	:	50 KA for 1 sec.
	o Below 90 kW (SFU + Contactor controlled)	:	50 KA protected by fuse for 0.2 sec
	f) LV System grounding	:	Effectively grounded
5.0	Class of insulation	:	Class 'F', with temp rise limited to class B.
6.0	Minimum voltage for starting (As percentage of rated voltage)	:	80% of rated voltage
7.0	Power cables data	:	Shall be given during Detailed engg
8.0	Earth Conductor Size & Material	:	Shall be given during Detailed engg
9.0	Space heater supply	:	240 V, 1¢ , 50 Hz
10.0	Rating up to which Single phase motor	:	Acceptable below 0.20 kW
11.0	Additional tests	:	As per QP and customer motor spec
12.0	Flame-proof motor		
	a) Enclosure suitable (As per IS:2148)	:	As per requirement
	b) Classification of Hazardous area (As per IS: 5572 part-I)	:	As per requirement
13.0	Makes	:	As per ANNEXURE-I
14.0	Paint shade	:	RAL 7032
15.0	Degree of Protection of enclosure (motors):		INDOOR IP-55 OUTDOOR IPW-55
16.0	Energy efficiency	:	IE3 as per IS:12615: 2011

❖ **Also detail Customer spec. for Motors to be referred as enclosed with spec.**

ANNEXURE-I

SUB-VENDOR LIST

The list of approved make of the LT Motors are as mentioned below:

S.No.	LIST OF LT MOTORS
1.	BHARAT BIJLEE LTD.
2.	CROMPTON GREAVES
3.	ASEA BROWN BOVERI
4.	KIRLOSKAR ELECTRIC CO LTD.
5.	NGEF
6.	SIEMENS
7.	MARATHON
8.	GE-POWER
9.	RAJINDRA ELECT INDUSTRIES
10.	LAXMI HYDRAULICS PVT. LTD

However, the final list of makes for the LT Motors is subjected to BHEL/Customer approval, during contract stage, without any commercial implications.

	Design Calculations For LT Cable Selection & Sizing	
	1 x 660MW BHUSAWAL T.P.S UNIT-6	

CONSTRUCTIONAL DETAILS OF CABLES SELECTED

(A) LT POWER & CONTROL CABLES

S.NO.	PARTICULARS	DETAILS	
		LT POWER CABLES	LT CONTROL CABLES
1	**REFERENCE STANDARD**	IS: 7098 -PART -1	IS -1554 PART -1
2	**SYSTEM**	415 V AC , 240 V AC & 220V DC	220V DC & 110 V AC
3	**VOLTAGE GRADE**	1.1 KV	1.1 KV
4	**CONDUCTOR**		
4.1	MATERIAL	STRANDED COMPACTED PLAIN ALUMINIUM CONDUCTOR OF H2 GRADE CLASS 2 / STRANDED HIGH CONDUCTIVITY ANNEALED PLAIN COPPER.	STRANDED,NON COMPACTED, HIGH CONDUCTIVITY ANNEALED PLAIN COPPER
4.2	REFERENCE STANDARD	IS 8130	IS 8130
4.3	SHAPE	CIRCULAR/ SHAPED	CIRCULAR
4.4	MINIMUM SIZE	ALUMUNIUM- 16 SQ.MM. COPPER- 2.5 SQ. MM.	2.5 SQ.MM.
4.5	MAXIMUM CONDUCTOR TEMPERATURE WHEN CARRYING CONTINUOSLY CURRENT	90°C	70°C
4.6	MAXIMUM CONDUCTOR TEMPERATURE AT THE TERMINATION OF SHORT CIRCUIT CURRENT	250°C	160°C
5	**NO. OF CORES**	1C,2C,3C,3.5C,4C	AS PER CLAUSE 4.2.1
6	**INSULATION**	EXTRUDED XLPE	EXTRUDED HRPVC, TYPE-C
6.1	REFERENCE STANDARD	IS: 7098 -PART -1	IS -5831 & IS-1554 PART-I
7	**CORE IDENTIFICATION**	BY COLOR CODING AS PER IS: 7098 - PART -1	i) CONTROL CABLES UPTO 5 CORE- COLOR CODING AS PER IS 1554 (Part-1) (ii) CONTROL CABLES ABOVE 5 CORES- BY NUMBERING AS PER IS 1554 (Part-1). INSULATION TO HAVE BLACK COLOR.
8	**INNER SHEATH**	EXTRUDED HRPVC FRLS TYPE -ST2 FOR MULTI CORE CABLES. SINGLE CORE SHALL HAVE NO INNER SHEATH.	EXTRUDED HRPVC TYPE -ST2 FRLS FOR MULTI CORE CABLES. SINGLE CORE SHALL HAVE NO INNER SHEATH.
8.1	REFERENCE STANDARD	IS: 5831 & IS-7098 PART-I	IS: 5831 & IS-1554 PART I
9	**ARMOUR**	NON-MAGNETIC HARD DRAWN ALUMINIUM ROUND WIRE ARMOUR OF H4 GRADE FOR SINGLE CORE CABLES AND GS ROUND STEEL WIRE ARMOUR FOR MUTI- CORE CABLES	GS ROUND STEEL WIRE ARMOUR FOR TWIN & MULTICORE CABLES
9.1	REFERENCE STANDARD	IS:3975 & IS 7098 PART I	IS 3975 & IS-1554 PART I
10	**OUTER SHEATH**	EXTRUDED FRLSH HRPVC TYPE ST2	EXTRUDED FRLSH HRPVC TYPE ST2
10.1	REFERENCE STANDARD	IS: 5831 & IS-7098 PART-I	IS: 5831
11	**MARKING**	(i) CABLE SIZE (CROSS SECTION AREA AND NO. OF CORES, VOLTAGE GRADE, WORD 'FRLS', REF. IS, TYPE OF CABLE, TYPE OF INSULATION/ SHEATH, MANUFACTURER'S NAME AND/OR TRADE NAME, YEAR OF MANUFACTURE-AT EVERY 5M (BY EMBOSSING), 'BHEL-PEM' and 'CUSTOMER' Name @5m (by embossing), (ii) PROGRESSIVE SEQUENTIAL MARKING OF LENGTH OF CABLE IN METERS- AT EVERY 1M (BY EMBOSSING/PRINTING)	
12	**CABLE DRUMS**		
12.1	TYPE OF DRUM	WOODEN (HEAVY CONSTRUCTION) AS PER IS 10418	
12.2	STANDARD DRUM LENGTH	500M FOR LARGER SIZES / 1000M FOR SMALLER SIZES (±) 5% (AS SPECIFIED IN BOQ)	
12.3	PAINTING	ENTIRE SURFACE TO BE PAINTED. ALL FERROUS PARTS USED SHALL BE TREATED WITH SUITABLE RUST PREVENTIVE FINISH OR COATING TO AVOID RUSTING DURING TRANSIT OR STORAGE. WOODEN CABLE DRUMS SHALL BE TREATED BY IMMERSING IN COPPER-NITRATE SOLUTION. DRUM NUMBER SHALL BE INDICATED ON EACH DRUM.	
12.4	OUTERMOST LAYER	TO BE COVERED WITH WATERPROOF POLYETHYLENE	
12.5	CONSTRUCTION	ALL WOODEN PARTS FROM SEASONED WOOD AND FERROUS PARTS SHALL BE TREATED WITH SUITABLE RUST PREVENTIVE FINISH OR COATING. WOODEN DRUM SHALL BE TREATED BY IMMERSING IN COPPER NITRATE SOLUTION.	

12.6	PARTICULAR INFORMATION ON DRUM	BOTH THE END OF CABLES SHALL BE PROPERLY SEALED WITH HEAT SHRINKABLE SEAL. THE CABLE DRUMS SHALL CARRY THE FOLLOWING DETAILS IN PRINTED FORM: A) MSPGCL B) MANUFACTURER'S NAME OR TRADE MAKE C) TYPE OF CABLE & VOLTAGE GRADE D) YEAR OF MANUFACTURE E) TYPE OF INSULATION E.G. XLPE/HRPVC/IE2 F) NO. OF CORE AND SIZES OF CABLES G) CABLE CODE E.G. FRLS/FS H) SINGLE LENGTH OF CABLE ON DRUM I) DIRECTION OF ROTATION, BY ARROW J) APPROX GROSS MASS

(B) SCREENED CONTROL CABLES

S.NO.	PARTICULARS	DETAILS
1	**VOLTAGE GRADE**	1100V
2	**TYPE OF CABLES**	TYPE F (INDIVIDUAL & OVERALL SCREENED) & TYPE G (OVERALL SCREENED)
3	**CODES AND STANDARD**	IS-1554 PART-1, IS-5831, IS-8130, IS-694, SEN-4241475, IEC-60332 (I).
3(i)	**CONDUCTOR**	
(a)	CROSS SECTION AREA	0.5 sq.mm
(b)	CONDUCTOR MATERIAL	STRANDED, TINNED ANNEALED HIGH CONDUCTIVITY COPPER
(c)	CONDUCTOR GRADE	ELECTROLYTIC
(d)	NO. & DIA OF STRANDS	7 X 0.3 mm
(e)	NO. OF PAIRS	0.5 sq.mm. - 2P, 4P, 8P,12P, 24P
(f)	REFERENCE STANDARD	IS-8130
(ii)	**INSULATION**	
(a)	MATERIAL	EXTRUDED HR PVC TYPE-C AS PER IS-5831
(b)	THICKNESS IN mm	0.6 (NOMINAL) AS PER IS-694
(c)	VOLUME RESISTIVITY (MIN) IN ohm-cm	i. 1 x 10^13 Ohm-cm at 27 deg.C / room temp. (Min). ii. 1 x 10^10 Ohm-cm at 85 deg.C (Min.)
(d)	VOLTAGE RATING	1100V
(e)	REFERENCE STANDARD	IS-1554 PART-1 & IS-5831
(f)	OD OF COND. INCLUDING INSULATION	AS PER MANUFACTURER'S CALCULATIONS / STD. PRACTICE
(iii)	**PAIRING & TWISTING**	
(a)	MAX. LAY OF PAIRS (mm)	60
(b)	CONDUCTOR /PAIR IDENTIFICATION	AS PER ATTACHED **ANNEXURE D**
4	**SHIELDING**	
(a)	TYPE OF SHIELDING	AL-MYLAR TAPE
(b)	INDIVIDUAL PAIR SHIELDING	TO BE PROVIDED FOR TYPE-F CABLE ONLY
(c)	OVERALL SHIELDING	TO BE PROVIDED FOR BOTH TYPE-F & TYPE-G CABLES
(d)	MINIMUM THICKNESS OF INDIVIDUAL PAIR SHIELDING	28 MICRONS
(e)	MINIMUM THICKNESS OF OVERALL CABLE ASSEMBLY SHIELDING	60 MICRONS
(f)	SHIELDING COVERAGE	100% WITH AT LEAST 25% OVERLAP
5	**DRAIN WIRE (To be provided separately for individual pair shield and overall shield.)**	
	Material	Multi stranded Annealed tinned copper drain wire.
	Size (No. of strands/ Dia. of each strand)	0.5 sq. mm. (7/0.3 mm.)
6	**FILLERS (if applicable)**	
(a)	TYPE	NON -HYGROSCOPIC WITH FRLS PROPERTY (AS REQUIRED FOR MAINTAINING CABLE CIRCULARITY)
7	**INNER SHEATH**	
(a)	MATERIAL	EXTRUDED HR PVC TYPE ST-2 AS PER IS-5831
(b)	THICKNESS	AS PER IS-1554 PART-1
(c)	Whether FR-LSH Applicable	YES
(d)	COLOUR	**BLACK**
(e)	REFERENCE STANDARD	IS-1554 PART-1 & IS-5831
8	**RIP CORD**	NON-METALLIC RIP CORD UNDER THE INNER SHEATH
9	**ARMOUR**	GALVANISED STEEL ROUND WIRE / STRIP AS PER IS-3975 & IS-1554 PART-1

10	**OUTER SHEATH**		
(a)	MATERIAL	EXTRUDED HR PVC TYPE ST-2 AS PER IS-5831	
(b)	THICKNESS	AS PER IS-1554 PART-1	
(c)	Whether FR-LSH Applicable	YES	
(d)	COLOUR	**GREY**	
(e)	REFERENCE STANDARD	IS-1554 PART-1 & IS-5831	
(f)	MARKING	(i) CABLE SIZE (CROSS SECTION AREA AND NO. OF CORES, VOLTAGE GRADE, WORD 'FRLS', REF. IS, TYPE OF CABLE, TYPE OF INSULATION/ SHEATH, MANUFACTURER'S NAME AND/OR TRADE NAME, YEAR OF MANUFACTURE-AT EVERY 5M (BY EMBOSSING), 'BHEL-PEM' and 'CUSTOMER' Name @5m (by embossing), (ii) PROGRESSIVE SEQUENTIAL MARKING OF LENGTH OF CABLE IN METERS- AT EVERY 1M (BY EMBOSSING/PRINTING)	
11	**TECHNICAL PARAMETERS (C & I) AT 20 DEG C**	0.5 sqmm (IS & OS) Type F	0.5 sqmm (OS) Type G
(a)	MUTUAL CAPACITANCE (MAX.) AT 0.8 KHz, nF / Km	120	100
(b)	CONDUCTOR LOOP RESISTANCE (MAX.), Ohm / Km	78	78
(c)	INSULATION RESISTANCE (MIN.), M Ohm / Km	100	100
(d)	CROSS TALK ATTENUATION (MIN.) AT 0.8KHz, dB / Km	60	60
(e)	CHARACTERISTIC IMPEDANCE (MAX.) AT 1KHz, Ohm	320	340
(f)	ATTENUATION (MAX.) AT 1KHz, dB / Km	1.2	1.2
12	**FR-LSH CHARACTERISTICS**		
(b)	SMOKE DENSITY RATING	Max. 60% (As per ASTM D 2843): Area under coverage.	
(c)	ACID GAS EMMISION	Max. 20% by weight (As per IEC-60754-1)	
(d)	OXYGEN INDEX	Min 29 at room temperature (As per ASTMD 2863)	
(e)	TEMPERATURE INDEX	Min. 250 deg.C at oxygen index value of 21 (As per ASTMD 2863)	
13	**FLAMMABILITY TEST**	(1) AS PER IEC-332-1 (2) Swedish Chimney test SEN-SS-424-1475-F3	
14	**TEST VOLTAGE & DURATION (High Voltage Test)**		
(a)	Core to core	1.5 kV for 1 minute	
(b)	Core to shield	1 kV for 1 minute	
15	**CABLE DRUM DETAILS**		
(a)	Material Type	Wooden, as per IS 10418	
(b)	Standard drum length	1000 metres: upto and including 12 Pairs. 500 metres: above 12 pairs.	
(c)	Tolerance on drum length	±5%	
(d)	Painting	ENTIRE SURFACE TO BE PAINTED. ALL FERROUS PARTS USED SHALL BE TREATED WITH SUITABLE RUST PREVENTIVE FINISH OR COATING TO AVOID RUSTING DURING TRANSIT OR STORAGE. WOODEN CABLE DRUMS SHALL BE TREATED BY IMMERSING IN COPPER-NITRATE SOLUTION. DRUM NUMBER SHALL BE INDICATED ON EACH DRUM.	
(e)	Outermost layer	TO BE COVERED WITH WATERPROOF POLYETHYLENE	
(f)	Construction	ALL WOODEN PARTS FROM SEASONED WOOD AND FERROUS PARTS SHALL BE TREATED WITH SUITABLE RUST PREVENTIVE FINISH OR COATING. WOODEN DRUM SHALL BE TREATED BY IMMERSING IN COPPER NITRATE SOLUTION.	

	DOCUMENT TITLE **CONDUITS AND PIPES**	SPECIFICATION NO. PES-507-27
		VOLUME II B
		SECTION D
		REVISION 0 / DATE: 27/10/2010
		SHEET 1 OF 6

GENERAL TECHNICAL REQUIREMENTS
OF
CONDUITS AND PIPES
SPECIFICATION NO. PES-507-27
REV 0

	DOCUMENT TITLE	SPECIFICATION NO. PES-507-27	
BHEL	**CONDUITS AND PIPES**	VOLUME II B	
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1.0 GENERAL

1.1 This specification covers the manufacture, inspection & testing at vendor's works and delivery to site of conduits, pipes and their fittings for electrical installation.

2.0 CODES AND STANDARDS

2.1 The material, constructional features and various processes involved in manufacture shall comply with currently applicable Indian Standards.

2.2 The following Indian Standards shall be applicable, in general. However if Data Sheet A specifies conformance to other international standards, the equivalent IEC/BS/other standards shall be considered.

a) IS:9537 (All Parts) Conduits for electrical installation.

b) IS:3480 Flexible steel conduits for electrical wiring.

c) IS:6946 Flexible non-metallic conduits for electrical installation.

d) IS:1239 Mild steel tubes, tubulars and other wrought steel fittings. (for size above 63mm dia of rigid conduits)

e) IS:2667 Fittings for rigid steel conduits for electrical wiring.

f) IS:3837 Accessories for rigid steel conduits for electrical wiring.

g) IS:3419 Fittings for rigid non-metallic conduits.

h) IS:6005 Code of practice for phostating iron & steel.

i) IS:2629 Recommended practice for hot dip galvanizing on iron and steel.

j) IS:4759 Specification for hot dip zinc coatings on structural steel and allied products.

k) IS:6745 Methods for determination of mass of zinc coating on zinc coated iron and steel articles.

3.0 DESIGN REQUIREMENTS AND CONSTRUCTIONAL FEATURES

The conduit and conduit accessories shall include conduit plugs & caps, gaskets and box cover etc in addition to any specific requirement given in Data Sheet A. The diameter of conduits and accessories shall be uniform throughout the length.

3.1 Rigid Conduits and Fittings

3.1.1 Rigid conduits shall generally conform to the requirements of IS:9537 (Part I & Part II). However conduits above 63mm diameter shall conform to the requirements of IS:1239. Unless specified otherwise in Data Sheet A, all conduits and pipes shall be of medium duty.

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3.1.2 The rigid conduits shall be hot dip galvanized inside and outside. Weight of zinc shall be as per IS:4759. Conduits shall be thoroughly cleaned and pretreated, conforming to IS:6005.

3.1.3 Conduits shall be supplied in approximate length as specified below

a) Rigid Conduits 5 metres

b) Flexible Conduits 10 - 30 metres

3.1.4 Each end of conduit length shall be threaded. The ends of conduits shall be sealed with protective caps to prevent damage to threaded portions and entrance of moisture and foreign material.

3.1.5 The inside surface of all conduits shall be smooth and suitable for pulling insulated cables and wires without damage.

3.1.6 Conduit fittings shall be made out of tube or cast to the shape as to match with corresponding conduit sizes and meet their purpose without any special adjustment.

3.1.7 All fittings shall be screwed type and hot dip galvanized inside and outside.

3.2 Flexible Metallic Conduits and Fittings

3.2.1 Flexible metallic conduits shall generally conform to the requirements of IS:3480.

3.2.2 Flexible conduits shall be made of strip steel which shall be of cold rolled mild steel. The strip shall be of uniform width and thickness throughout.

3.2.3 The strip shall be electro galvanized to a minimum thickness of 25 microns as specified in IS:3480. The surface of the strip shall be thoroughly cleaned before application of protective coating. Pretreatment, before galvanization, shall conform to IS:6005.

3.2.4 The strip for making flexible conduit shall be wound tightly and so overlapped in subsequent helicals that no openings are seen in normal position.

3.2.5 Flexible conduits shall be lead coated for application in high temperature zones, if specifically mentioned in Data Sheet A.

3.2.6 The conduit shall have uniform diameter throughout its length. The internal surface of all conduits shall be smooth and suitable for pulling insulated cables and wires without damage.

3.3 PVC Conduits

3.3.1 PVC conduits shall generally conform to the requirements of IS:9537(Part I & Part III).

4.0 INSPECTION

4.1 The following stages of manufacture shall be stage inspected by Purchaser or his duly authorized representative.

4.1.1 Inspection of manufacturing processes such as shearing, punching, bending, welding, galvanizing etc.

4.1.2 Inspection of packing material and procedure.

4.1.3 Inspection of finished product.

4.2 The inspection will be carried out as per agreed quality plan.

5.0 TESTING

5.1 Rigid Conduits

a) Acceptance Tests - as per IS:9537 Part 1 & 2 upto 63mm OD
- as per IS:1239 above 63mm OD

i) Dimension checks

ii) Bending test (below 32mm OD)

iii) Compression test

b) Special Tests (as acceptance test) as applicable to galvanizing.

5.2 Flexible Steel Conduits

a) Acceptance Tests - as per IS:3480

i) Dimension checks

ii) Linear breaking test

iii) Test for flexibility

iv) Bend fracture test

v) crushing test

b) Special Tests (as acceptance test) as applicable to galvanizing.

5.3 PVC Conduits

a) Type Tests - as per IS : 9537 (Part 1 & 3)

i) Dimension checks

ii) Bending test

iii) Compression test

iv) Impact test

v) Collapse test

vi) Resistance test

vii) Resistance to burning

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viii) Electrical Characteristics

b) Acceptance tests - as per IS:9537 (Part 1 & 3)

i) Dimension checks

ii) Bending test

iii) Compression test

iv) Collapse test

v) Resistance to burning

vi) Electrical characteristics

5.4 Sampling for the tests shall be done as per applicable standards mentioned above.

5.5 The testing shall be carried out as per agreed quality plan.

6.0 PACKING

6.1 The material shall be packed as per manufacturer's standard. Packing procedure shall be to the purchaser's approval.

7.0 DRAWING, DATA AND DOCUMENTS REQUIRED

7.1 The following information shall be furnished within two weeks of award of contract, for purchaser's approval.

a) Manufacturing drawings/details.

b) Recommended Field quality plan covering site handling, storing, laying etc.

c) Final quality plan.

7.3 The following information shall be furnished after testing and inspection

Type Test, routine test and special test certificates in bound volume in requisite number.

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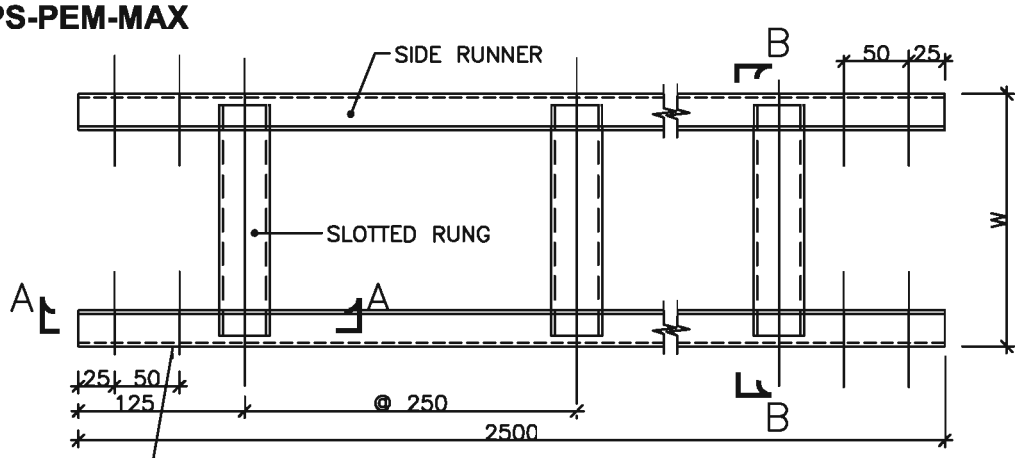
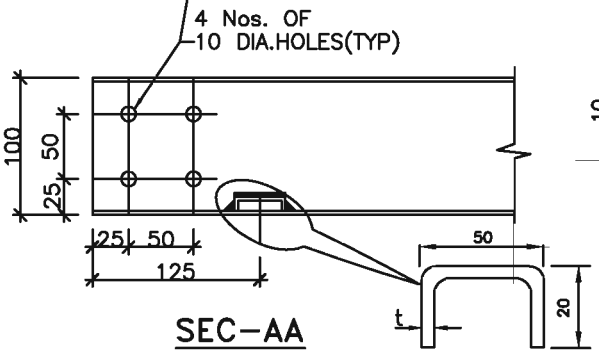
SPECIFIC TECHNICAL REQUIREMENTS

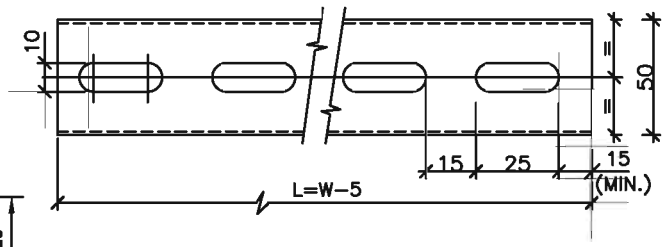
1.0	APPLICABLE STANDARDS:		IS:9537,IS: 1239, IS:3480
2.0	RIGID STEEL CONDUITS & STEEL PIPES		
	a)	Material:	Cold rolled mild steel to IS:226
	b)	Applicable standard	
		i) Upto 63mm OD:	IS:9537 Part I & II
		ii) Above 63mm OD:	IS:1239
	c)	Surface treatment:	Hot dip galvanizing inside & outside as per IS:2629
	d)	Wt. of zinc:	as per IS 4759
	e)	Duty:	Medium
	f)	Fittings:	Screw type as per IS:2667
3.0	FLEXIBLE CONDUITS:		
	a)	Material:	Strip steel cold rolled and annealed
	b)	Standard applicable:	IS: 3480
	c)	Surface treatment:	Electro galvanized as per IS: 3480
	d)	Whether lead coated:	YES
	e)	Minimum thickness: of zinc coating	25 microns
4.0	PVC CONDUITS		
	a)	Material:	PVC
	b)	Applicable standard:	IS: 9537 (Part I & III)



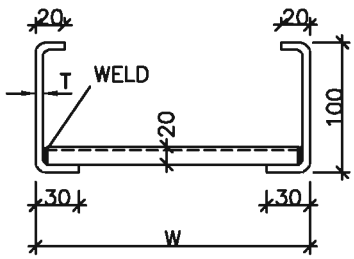
LADDER TYPE CABLE TRAY



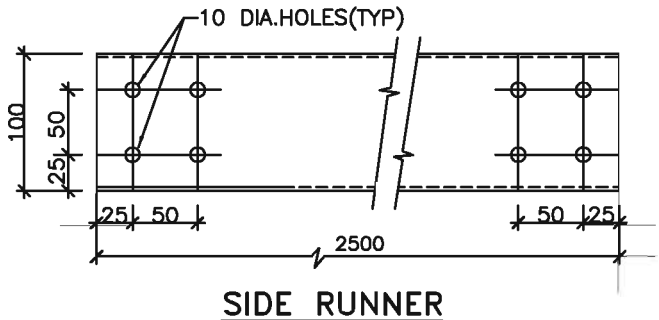
SEC–AA



SLOTTED RUNG



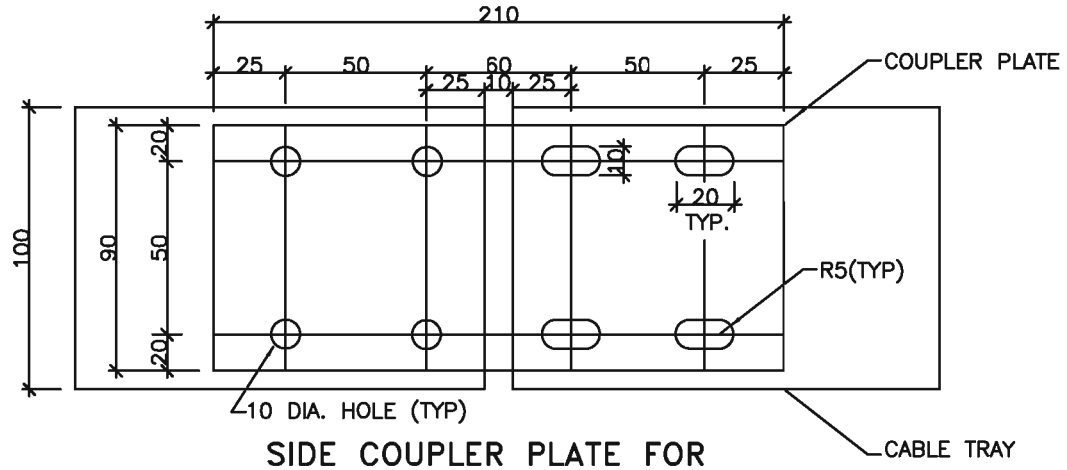
SEC–BB



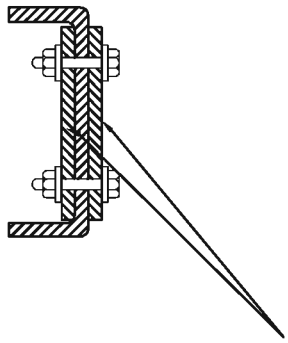
SIDE RUNNER

W	150	300	450	600
L	145	295	445	595
T	2.0	2.0	2.0	2.0
t	2.0	2.0	2.0	2.0

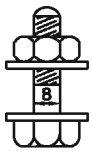
TYPICAL DETAILS OF CABLE TRAYS AND ACCESSORIES



SIDE COUPLER PLATE FOR
LADDER/PERFORATED TYPE TRAYS
(600/450/300/150W TRAYS)
QTY. REQUIRED/TRAY SECTION : 4 NOS.

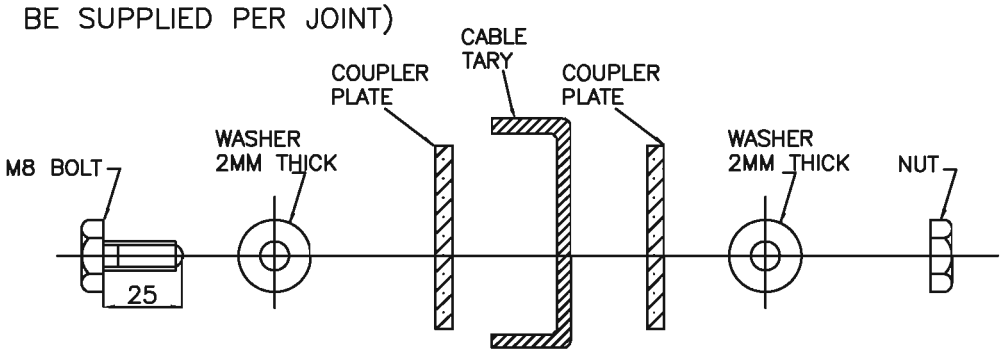


(2 NOS. COUPLER PLATES
OF 3 MM THICKNESS TO
BE SUPPLIED PER JOINT)



QTY. REQD/TRAY SECTION

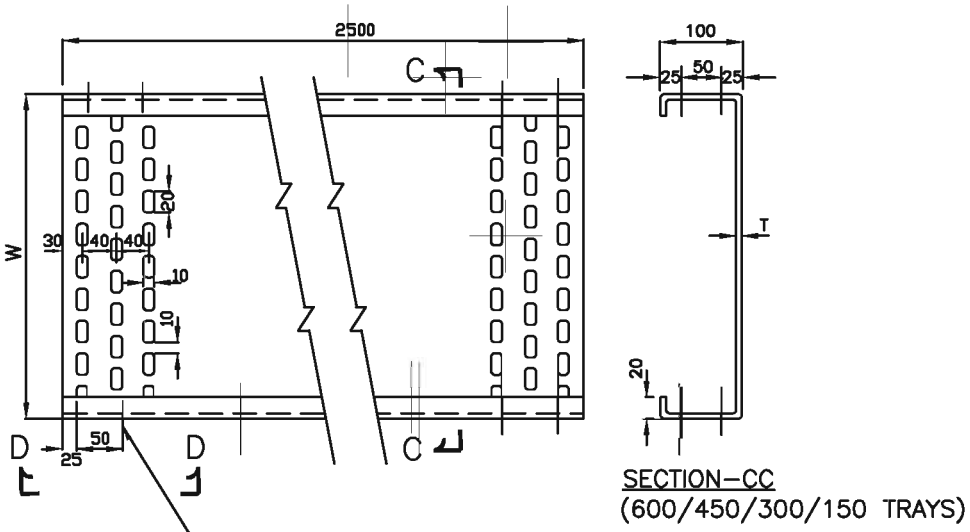
A) 16 NOS. M8 BOLTS
B) 16 NOS. NUTS
C) 32 NOS. WASHERS



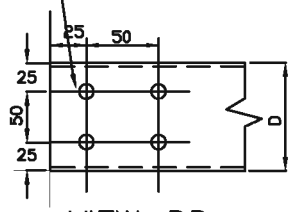
SEQUENCE OF M8 BOLT, WASHER, NUT, COUPLER PLATE & CABLE TRAY

FOR TYPICAL CABLE TRAY JOINT

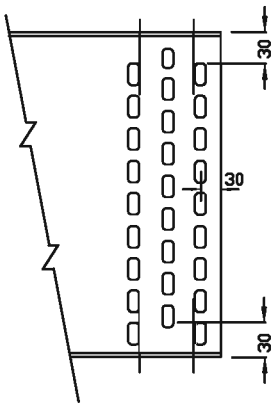
TYPICAL DETAILS OF CABLE TRAYS AND ACCESSORIES



SECTION–CC
(600/450/300/150 TRAYS)



VIEW–DD
(600/450/300/
150W TRAYS)



ARRANGEMENT OF
PERFORATIONS

TRAY WIDTH W (mm)	600	450	300	150
TRAY DEPTH D (mm)	100	100	100	100
T (mm)	2.0	2.0	2.0	2.0

PERFORATED TYPE TRAY

TYPICAL DETAILS OF CABLE TRAYS AND ACCESSORIES

BHEL	QUALITY PLAN	CUSTOMER : MAHAGENCO			PROJECT 1X660 MW BHUSAWAL TPP TITLE			SPECIFICATION : NUMBER :			
		BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-506-00-Q-006, REV-01			SPECIFICATION TITLE			
	SHEET 1 OF 2	SYSTEM			ITEM AC ELECT. MOTORS BELOW 55KW (LV)			SECTION			VOLUME III

SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
1.0	ASSEMBLY	1.WORKMANSHIP	MA	VISUAL	100%	MANUF'S SPEC	MANUF'S SPEC	-DO-	2	-	-	
		2.DIMENSIONS	MA	-DO-	-DO-	MFG. DRG./ MFG. SPEC.	MFG. DRG./ MFG. SPEC.	-DO-	2	-	-	
		3.CORRECTNESS COMPLETENESS TERMINATIONS/ MARKING/COLOUR CODE	MA	VISUAL	100%	MFG.SPEC./ RELEVANT IS	MFG.SPEC. RELEVANT IS	-DO-	2	-	-	
2.0	PAINTING	1.SHADE	MA	VISUAL	SAMPLE	MANUFR'S SPEC/BHEL SPEC./RELEVANT STANDARD	BHEL SPEC. SAME AS COL.7	LOG BOOK	2	-	-	
3.0	TESTS	1.ROUTINE TEST INCLUDING SPECIAL TEST AS PER BHEL SPEC.	MA	-DO-	100%	IS-325/ BHEL SPEC./ DATA SHEET	SAME AS COL.7	TEST REPORT	2	1		NOTE -1 & NOTE-3
		2.OVERALL DIMENSIONS & ORIENTATION	MA	MEASUREMENT & VISUAL	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET & RELEVANT IS	INSPN. REPORT	2	1	-	NOTE -1 & NOTE-3

BHEL	PARTICULARS	BIDDER/VENDOR
	NAME	
	SIGNATURE	

	QUALITY PLAN	CUSTOMER : MAHAGENCO		PROJECT TITLE 1X660 MW BHUSAWAL TPP				SPECIFICATION : NUMBER :			
		BIDDER/ : VENDOR		QUALITY PLAN NUMBER PED-506-00-Q-006, REV-01				SPECIFICATION : TITLE :			
	SHEET 2 OF 2	SYSTEM		ITEM AC ELECT. MOTORS BELOW 55KW (LV)				SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	W	V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
		3.NAMEPLATE DETAILS	MA	VISUAL	100%	IS-325 & DATA SHEET	IS-325 & DATA SHEET	INSPN. REPORT	2	1	-	

NOTES:

1 ROUTINE TESTS ON 100% MOTORS SHALL BE DONE BY THE VENDOR. HOWEVER, BHEL SHALL WITNESS ROUTINE TESTS ON RANDOM SAMPLES. THE SAMPLING PLAN SHALL BE MUTUALLY AGREED UPON

2 WHERE EVER CUSTOMER IS INVOLVED IN INSPECTION, (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER.

3 FOR EXHAUST/VENTILATION FAN MOTORS OF RATING UPTO 1.5KW , ONLY ROUTINE TEST CERTIFICATES SHALL BE FURNISHED FOR SCRUTINY.

Legends for Inspection agency

1. BHEL/CUSTOMER
2. VENDOR (MOTOR MANUFACTURER)
3. SUB-VENDOR (RAW MATERIAL/COMPONENTS SUPPLIER)

P. PERFORM
W. WITNESS
V. VERIFY

BHEL	PARTICULARS	BIDDER/VENDOR	
	NAME		
	SIGNATURE		
	DATE		BIDDER'S/VENDORS COMPANY SEAL

	QUALITY PLAN	CUSTOMER : MAHAGENCO	PROJECT 1X660 MW BHUSAWAL TPP	SPECIFICATION : NUMBER :								
		BIDDER/ VENDOR :	QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03	SPECIFICATION : TITLE								
	SHEET 1 OF 9	SYSTEM	ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)	SECTION	VOLUME III							

SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
1.0	RAW MATERIAL & BOUGHT OUT CONTROL											
1.1	SHEET STEEL, PLATES, SECTION, EYEBOLTS	1.SURFACE CONDITION	MA	VISUAL	100%	-	FREE FROM BLINKS, CRACKS, WAVINESS ETC	LOG BOOK	3	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANFR'S DRG./SPEC	MANFR'S DRG./SPEC	-DO-	3	-	-	
		3.PROOF LOAD TEST (EYE BOLT)	MA	MECH. TEST	-DO-	-DO-	-DO-	INSPEC. REPORT	3	-	2	
1.2	HARDWARES	1.SURFACE CONDITION	MA	VISUAL	100%		FREE FROM CRACKS, UN-EVENNESS ETC.	-DO-	3	-	-	
		2.PROPERTY CLASS	MA	VISUAL	SAMPLES	MANFR'S DRG./SPEC BOOK	RELEVENT IS/SPEC.	SUPPLIERS TC & LOG	3	-	2	PROPERTY CLASS MARKING SHALL BE CHECKED BY THE VENDOR
1.3	CASTING	1.SURFACE CONDITION	MA	VISUAL	100%		FREE FROM CRACKS, BLOW HOLES ETC.	LOG BOOK	3	-	2	
		2.CHEM. & PHY. PROP.	MA	CHEM & MECH TEST	1/HEAT NO.	MANFR'S DRG./SPEC	RELEVENT IS/	SUPPLIER'S TC	3	-	2	HEAT NO. SHALL BE VERIFIED
		3.DIMENSIONS	MA	MEASUREMENT	100%	MANUFR'S DRG.	MANUFR'S DRG.	LOG BOOK	3	-	2	
1.4	PAINT & VARNISH	1.MAKE, SHADE, SHELF LIFE & TYPE	MA	VISUAL	100% CONTINUOUS	MANFR'S DRG./SPEC	MANFR'S DRG./SPEC	LOG BOOK	3	-	2	

BHEL	PARTICULARS	BIDDER/VENDOR	
	NAME		
	SIGNATURE		
	DATE		BIDDER'S/VENDORS COMPANY SEAL

BHEL	QUALITY PLAN		CUSTOMER : MAHAGENCO			PROJECT TITLE 1X660 MW BHUSAWAL TPP			SPECIFICATION : NUMBER :			
			BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE			
	SHEET 2 OF 9		SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
1.5	SHAFT (FORGED OR ROLLED)	1. SURFACE COND.	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	-	VENDOR'S APPROVAL IDENTIFICATION SHALL BE MAINTAINED
		2. CHEM. & PHYSICAL PROPERTIES	MA	CHEM. & PHYSICAL TESTS	1/HEAT NO. OR HEAT TREATMENT BATCH NO	MFG. DRG. SPEC.	RELEVANT IS	SUPPLIER'S TC	3	-	2	
		3. DIMENSIONS	MA	MEASUREMENT	100%	-DO-	MANUFR'S DRG.	LOG BOOK	3	-	2	
		4.INTERNAL FLAWS	CR	UT	-DO-	ASTM-A388	MANUFR'S SPEC. BHEL SPEC.	-DO-	3	2	1	FOR DIA OF 55 MM & ABOVE
1.6	SPACE HEATERS, CONNEC-TORS, TERMINAL BLOCKS, CABLES, CABLE LUGS, CARBON BRUSH TEMP. DETECTORS, RTD, BTD'S	1. MAKE & RATING	MA	VISUAL	-DO-	MANUFR'S DRG. SPEC.	MANUFR'S DRG. SPEC.	-DO-	3	-	2	
		2. PHYSICAL COND.	MA	-DO-	-DO-	-	NO PHYS. DAMAGE, NO ELECTRICAL DISCONTINUITY	-DO-	3	-	2	
		3.DIMENSIONS (WHEREVER APPLICABLE)	MA	MEASUREMENT	SAMPLE	MANUFR'S DRG./ SPEC.	MANUFR'S DRG. / SPEC.	-DO-	3	-	2	
		4.PERFORMANCE/ CALIBRATION	MA	TEST	100%	-DO-	-DO-	INSP. REPORT	3	-	2	

BHEL	PARTICULARS	BIDDER/VENDOR	
	NAME		
	SIGNATURE		
	DATE		BIDDER'S/VENDORS COMPANY SEAL

	QUALITY PLAN		CUSTOMER : MAHAGENCO			PROJECT TITLE 1X660 MW BHUSAWAL TPP			SPECIFICATION : NUMBER :			
			BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE			
	SHEET 3 OF 9		SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
1.7	OTHER INSULATING MATERIALS LIKE SLEEVES, BINDINGS CORDS, PAPERS, PRESS BOARDS ETC.	1. SURFACE COND. ETC.	MA	VISUAL	100%	-	NO VISUAL DEFECTS	INSPT. REPORT	3	-	2	
		2. OTHER CHARACTERISTICS	MA	TEST	SAMPLE	MANUF'S SPEC.	MANUF'S SPEC.	LOG BOOK AND OR SUPPLIER'S TC	3	-	2	
1.8	SHEET STAMPING (PUNCHED)	1. SURFACE COND.	MA	VISUAL	100%	-	NO VISUAL DEFECTS (FREE FROM BURS)	LOG BOOK	3	-	-	
		2.DIMENSIONS INCLUDING BURS HEIGHT	MA	MEASUREMENT	SAMPLE	MANUFR'S DRG. .	MANUFR'S DRG.	-DO-	3	-	2	FOR MV MOTOR INSULA-TION/VARNISH THICKNESS SHALL BE MORE THAN THE BURS HEIGHT
		3. ACCEPTANCE TESTS	MA	ELECT. & MECH TESTS	-DO-	MANUF'S SPEC./ RELEVANT IS	RELEVANT IS	SUPPLIER'S TC	3	-	2	
1.9	CONDUCTORS	1. SURFACE FINISH	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	LOG BOOK	3*	-	2*	* MOTOR MANUFACTURER TO CONDUCT VISUAL CHECK FOR SURFACE FINISH ON RANDOM BASIS (10% SAMPLE) AT HIS WORKS AND MAINTAIN RECORD FOR VERIFICATION BY BHEL/CUSTOMER.
		2.ELECT. PROP, & MECH. PROP	MA	ELECT. & MECH.TEST	SAMPLES	RELEVANT IS/ BS OR OTHER STANDARDS	RELEVANT IS/ BS OR OTHER STANDARDS	SUPPLIERS TC & VENDOR'S INSPN. REPORTS	3	-	2	

BHEL	PARTICULARS	BIDDER/VENDOR	
	NAME		
	SIGNATURE		
	DATE		BIDDER'S/VENDORS COMPANY SEAL

	QUALITY PLAN		CUSTOMER : MAHAGENCO			PROJECT 1X660 MW BHUSAWAL TPP TITLE			SPECIFICATION : NUMBER :			
			BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE			
	SHEET 4 OF 9		SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
		3.DIMENSIONS	MA	MEASUREMENT	-DO-	-DO-	-DO-	Log Book	3	-	2	
1.10	BEARINGS	1.MAKE & TYPE	MA	VISUAL	100%	MANFR'S DRG./ APPROVED DATASHEET	MANFR'S DRG./ APPROVED DATASHEET	-DO-	3	-	2	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	BHEL DATA SHEET	BHEL DATA SHEET BEARING MANUF'S CATALOGUES	-DO-	3	-	2	
		3.SURFACE FINISH	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	2	
1.11	SLIP RING (WHEREVER APPLICABLE)	1.SURFACE COND.	MA	VISUAL	100%	-	-DO-	-DO-	3	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANUF'S DRG	MANUF'S DRG	-DO-	3	-	-	
		3.TEMP.WITH-STAND CAPACITY	MA	ELECT.TEST	-DO-	MANUF'S SPEC./ BHEL SPEC.	MANUF'S SPEC./ BHEL SPEC.	-DO-	3	-	2	
		4.HV/IR	MA	-DO-	100%	-DO-	-DO-	-DO-	3	-	2	
1.12	OIL SEALS & GASKETS	1.MATERIAL OF GASKET	MA	VISUAL	100%	MANUF'S DRG/SPECS	MANUF'S DRG./ SPECS.	-DO-	3	-	-	
		2.SURFACE COND.	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	-	
		3.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANUF'S DRG	MANUF'S DRG	-DO-	3	-	-	

BHEL	PARTICULARS	BIDDER/VENDOR	
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	SIGNATURE		
	DATE		BIDDER'S/VENDORS COMPANY SEAL

	QUALITY PLAN		CUSTOMER : MAHAGENCO			PROJECT 1X660 MW BHUSAWAL TPP TITLE			SPECIFICATION : NUMBER :			
			BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE			
	SHEET 5 OF 9		SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
2.0	IN PROCESS											
2.1	STATOR FRAME WELDING (IN CASE OF FABRICATED STATOR)	1.WORKMANSHIP & CLEANNESS	MA	VISUAL	100%	-DO-	GOOD FINISH	LOG BOOK	3/2	2	-	
		2.DIMENSIONS	MA	MEASUREMENT	-DO-	MANUF'S DRG	MANUF'S DRG	-DO-	2	-	-	
2.2	MACHINING	1.FINISH	MA	VISUAL	100%	-DO-	GOOD FINISH	LOG BOOK	2	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	-DO-	MANUF'S DRG	MANUF'S DRG	-DO-	2	-	-	
		3.SHAFT SURFACE FLOWS	MA	PT	-DO-	RELEVENT SPEC./ ASTM-E165	MANUFR'S SPEC./ BHEL SPEC./	-DO-	2	-	1	
2.3	PAINTING	1.SURFACE PREPARATION	MA	VISUAL	100%	MANFR'S SPEC/BHEL SPEC./ RELEVANT STAND	BHEL SPEC. SAME AS COL.7	LOG BOOK	2	-	-	
		2.PAINT THICKNESS (BOTH PRIMER & FINISH COAT)	MA	MEASUREMENT BY ELCOMETER	SAMPLE	-DO-	-DO-	-DO-	2	-	-	
		3.SHADE	MA	VISUAL	-DO-	-DO-	-DO-	Log Book	2	-	-	
		4.ADHESION	MA	CROSS CUTTING & TAPE TEST	-DO-	-DO-	-DO-	Log Book	2	-	-	

BHEL	PARTICULARS	BIDDER/VENDOR	
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	SIGNATURE		
	DATE		BIDDER'S/VENDORS COMPANY SEAL

	QUALITY PLAN		CUSTOMER : MAHAGENCO			PROJECT 1X660 MW BHUSAWAL TPP TITLE			SPECIFICATION : NUMBER :			
			BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE			
	SHEET 6 OF 9		SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
2.4	SHEET STACKING	1.COMPLETENESS	MA	MEASUREMENT	SAMPLE	MANUFR'S SPEC.	MANUFR'S SPEC.	Log Book	2	-	-	
		2.COMPRESSION & TIGHTENING	MA	MEASUREMENT	100%	-DO-	-DO-	Log Book	2	-	-	
		3.CORE LOSS & HOTSPOT	MA	ELECT.TEST	-DO-	-DO-	-DO-	Log Book	2	1*	1	(FOR MOTORS OF 2MW AND ABOVE) * ON 10% RANDOM SAMPLE
2.5	WINDING	1.COMPLETENESS	CR	VISUAL	100%	MANUFR'S SPEC./BHEL SPEC.	MANUFR'S SPEC./BHEL SPEC.	Log Book	2	-	-	
		2.CLEANLINESS	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	-	
		3.IR-HV-IR	CR	ELECT. TEST	-DO-	-DO-	-DO-	Log Book	2	-	1	
		4.RESISTANCE	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1	
		5.INTERTURN INSULATION	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	-	
		6.SURGE WITH STAND AND TAN. DELTA TEST	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1	FOR MV MOTOR
2.6	IMPREGNATION	1.VISCOSCITY	MA	PHY. TEST	AT STARTING	-DO-	-DO-	Log Book	2	-	-	
		2.TEMP. PRESSURE VACCUM	MA	PROCESS CHECK	CONTINUOUS	-DO-	-DO-	Log Book	2	-	-	
		3.NO. OF DIPS	MA	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1	THREE DIPS TO BE GIVEN
BHEL			PARTICULARS		BIDDER/VENDOR							
			NAME									
			SIGNATURE									
			DATE						BIDDER'S/VENDORS COMPANY SEAL			

	QUALITY PLAN	CUSTOMER : MAHAGENCO			PROJECT TITLE 1X660 MW BHUSAWAL TPP			SPECIFICATION : NUMBER :			
		BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE			
	SHEET 7 OF 9	SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	W	V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
		4.DURATION	MA	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1	
2.7	COMPLETE STATOR ASSEMBLY	1.COMPACTNESS & CLEANLINESS	MA	VISUAL	100%	-DO-	-DO-	Log Book	2	-	-	
2.8	BRAZING/COMPRESSION JOINT	1.COMPLETENESS	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	-	
		2.SOUNDNESS	CR	MALLET TEST & UT	-DO-	-DO-	-DO-	Log Book	2		1	
		3.HV	MA	ELECT. TEST	-DO-	-DO-	-DO-	Log Book	2		1	
2.9	COMPLETE ROTOR ASSEMBLY	1.RESIDUAL UNBALANCE	CR	DYN. BALANCE	-DO-	MFG SPEC./ ISO 1940	MFG. DWG.	Log Book	2		1	VERIFICATION FOR MV MOTOR ONLY
		2.SOUNDNESS OF DIE CASTING	CR	ELECT. (GROWLER TEST)	-DO-	MFG. SPEC.	MFG. SPEC.	Log Book	2		1	
2.10	ASSEMBLY	1.ALIGNMENT	MA	MEAS.	-DO-	-DO-	-DO-	Log Book	2	-	-	
		2.WORKMANSHIP	MA	VISUAL	-DO-	-DO-	-DO-	Log Book	2	-	-	
		3.AXIAL PLAY	MA	MEAS.	-DO-	-DO-	-DO-	Log Book	2	-	1	
		4.DIMENSIONS	MA	-DO-	-DO-	MFG.DRG./ MFG SPEC.	MFG. DRG/ RELEVANT IS	Log Book	2	-	-	
		5.CORRECTNESS, COMPLETENESS TERMINATIONS/ MARKING/ COLOUR CODE	MA	VISUAL	100%	MFG SPEC. RELEVANT IS	MFG SPEC. RELEVANT IS	Log Book	2	-	-	
		6. RTD, BTD & SPACE HEATER MOUNTING.	MA	VISUAL	100%	MFG SPEC. RELEVANT IS	MFG SPEC. RELEVANT IS	Log Book	2		1	

BHEL	PARTICULARS	BIDDER/VENDOR	
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	SIGNATURE		
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	QUALITY PLAN	CUSTOMER : MAHAGENCO			PROJECT 1X660 MW BHUSAWAL TPP TITLE			SPECIFICATION : NUMBER :			
		BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE			
	SHEET 8 OF 9	SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
3.0	TESTS	1.TYPE TESTS INCLUDING SPECIAL TESTS AS PER BHEL SPEC CLAUSE 8.1.2	MA	ELECT.TEST	1/TYPE/SIZE	IS-325/ BHEL SPEC./ DATA SHEET	IS-325/ BHEL SPEC./ DATA SHEET	TEST REPORT	2	1	1	
		2.ROUTINE TESTS INCLUDING SPECIAL TEST AS PER BHEL SPEC.	MA	-DO-	100%	-DO-	-DO-	-DO-	2	1[$]	1	[$] NOTE - 2
		3.VIBRATION & NOISE LEVEL	MA	-DO-	100%	IS-12075 & IS-12065	IS-12075 & IS-12065	-DO-	2	1[$]	1	[$] NOTE - 2
		4.OVERALL DIMENSIONS AND ORIENTATION	MA	MEASUREMENT & VISUAL	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET & RELEVANT IS	INSPC. REPORT	2	1	-	
		5.DEGREE OF PROTECTION	MA	ELECT. & MECH. TEST	1/TYPE/ SIZE	RELEVANT IS	BHEL SPEC. AND DATA SHEET	TC	2	1*	1	* REFER NOTE-3
		6. MEASUREMENT OF RESISTANCE OF RTD & BTD	MA	-DO-	100%	-DO-	-DO-	-DO-	2	1[$]	1	[$] NOTE - 2
		7. MEASUREMENT OF RESISTANCE, IR OF SPACE HEATER	MA	-DO-	100%	-DO-	-DO-	-DO-	2	1[$]	1	[$] NOTE - 2
		8. NAMEPLATE DETAILS	MA	VISUAL	100%	IS-325 & DATA SHEET	IS-325 & DATA SHEET	INSPC. REPORT	2	1[$]	1	[$] NOTE - 2
		9.EXPLOSION FLAME PROOF NESS (IF SPECIFIED)	MA	EXPLOSION FLAME PROOF TEST	1/TYPE	IS-3682 IS-8239 IS-8240	IS-3682 IS-8239 IS-8240	TC	2	-	1	TC FROM AN INDEPENDENT LABORATORY ON SIMILAR TYPE, SIZE AND DESIGN OF MOTOR.
		10. PAINT SHADE, THICKNESS & FINISH	MA	VISUAL & MEASUREMENT BY ELKOMETER	SAMPLE	BHEL SPEC. & DATA SHEET	BHEL SPEC. & DATA SHEET	TC	2	1[$]	1	SAMPLING PLAN TO BE DECIDED BY INSPECTION AGENCY [$] NOTE - 2

BHEL	PARTICULARS	BIDDER/VENDOR	
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	SIGNATURE		
	DATE		BIDDER'S/VENDORS COMPANY SEAL

	QUALITY PLAN		CUSTOMER : MAHAGENCO			PROJECT 1X660 MW BHUSAWAL TPP TITLE			SPECIFICATION : NUMBER :			
			BIDDER/ : VENDOR			QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE			
	SHEET 9 OF 9		SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11

NOTES:

1 DEPENDING UPON THE SIZE AND CRITICALLY, WITNESSING BY BHEL SHALL BE DECIDED.

2 ROUTINE TESTS ON 100% MOTORS SHALL BE DONE BY THE VENDOR. HOWEVER, BHEL SHALL WITNESS ROUTINE TESTS ON RANDOM SAMPLES. THE SAMPLING PLAN SHALL BE MUTUALLY AGREED UPON.

3 IN CASE TEST CERTIFICATES FOR THESE TESTS ON SIMILAR TYPE, SIZE AND DESIGN OF MOTOR FROM INDEPENDENT LABORATORY ARE AVAILABLE, THESE TEST MAY NOT BE REPEATED FOR FIRST NUMERAL OF IP-XX. SECOND NUMERAL TEST SHALL BE CARRIED OUT ON ONE MOTOR OF EACH TYPE & RATING.

4 WHEREVER CUSTOMER IS INVOLVED IN INSPECTION, AGENCY (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER.

Legends for Inspection agency

1. BHEL/CUSTOMER
2. VENDOR (MOTOR MANUFACTURER)
3. SUB-VENDOR (RAW MATERIAL/COMPONENTS SUPPLIER)

P. PERFORM
W. WITNESS
V. VERIFY

BHEL	PARTICULARS	BIDDER/VENDOR	
	NAME		
	SIGNATURE		
	DATE		BIDDER'S/VENDORS COMPANY SEAL

LOAD TITLE	RATING (KW / A)		UNIT (U)/STN (S)	Nos.		VOLTAGE CODE*	FEEDER CODE**	EMER. LOAD (Y)	CONT.(C)/ INTT.(I)	STARTING TIME >5 SEC (Y)	LOCATION	BOARD NO.	CABLE		BLOCK CABLE DRG. No.	CONTROL CODE	REMARKS	LOAD No.
	NAME PLATE	MAX. CONT. DEMAND (MCR)		RUNNING	STANDBY								SIZE CODE	NOs				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19

NOTES: 1. COLUMN 1 TO 12 & 18 SHALL BE FILLED BY THE REQUISITIONER (ORIGINATING AGENCY); REMAINING COLUMNS ARE TO BE FILLED UP BY PEM (ELECTRICAL)

2. ABBREVIATIONS : * VOLTAGE CODE (7):- (ac) A=11 KV, B=6.6 KV, C=3.3 KV, D=415 V, E=240 V (1 PH), F=110 V (cc): G=220 V, H=110 V, J=48 V, K=+24V, L=-24 V

: ** FEEDER CODE (8):- U=UNIDIRECTIONAL STARTER, B=BI-DIRECTIONAL STARTER, S=SUPPLY FEEDER, D=SUPPLY FEEDER (CONTACTER CONTROLLED)

भेल BHEL	LOAD DATA (ELECTRICAL)	JOB NO.	415	ORIGINATING AGENCY		PEM (ELECTRICAL)
		PROJECT TITLE	1X660MW BHUSAWAL TPS	NAME		DATA FILLED UP ON
		SYSTEM / S	SG CRANE	SIGN.		DATA ENTERED ON
		DEPTT. / SECTION	ELECTRICAL	SHEET 1 OF 1	REV. 00	DE'S SIGN. & DATE

ANNEXURE - B

SUB SECTION-IC

DATA SHEET A

BHEL	1X660MW Bhusawal TPS-Unit: 6 SINGLE GIRDER EOT CRANE SPECIFIC TECHNICAL REQUIREMENT	SPECIFICATION No: PE-TS-415-524-A001	
		VOLUME: II B	
		SECTION-I	
		SUB-SECTION-IC	
		REV 00	DATE DEC 2021

TECHNICAL DATA SHEET FOR SINGLE GIRDER OVERHEAD EOT CRANE

Sr. No.	DESCRIPTION	TECHNICAL PARTICULARS
1	**Design, duty, fabrication and testing of the crane confirm to standard / code number**	Mechanical and Electrical as per IS: 3177-2020, IS 3938 & Structure design in accordance to IS 807 (all latest editions). Mechanism class - M5 as per IS-3177-2020 and IS-807. Electrical Service class - M8 as per IS-3177-2020 IS 3443 - Crane Rail Sections.
2	**Area of installation, quantity, rated capacity (Safe Working Load) of cranes**	As per Annexure A
3	**Margin**	The crane/hoist capacity shall be selected considering 25% margin over the weight of heaviest component/ equipment to be handled.
4	**Overload Test**	125% of Rated capacity (Safe Working Load)
5	**Deflection test of crane**	Shall be carried out at Safe Working Load
6	**Operation from**	Pendant station - It shall locate the push buttons for controlling the various motions of the crane and shall be hung from the crane trolley to a height of approximately 1 metre above the operating floor
7	**Design Ambient temperature**	50° C
8	**PERFORMANCE**	
8.1	Crane speed with full load	Full speed M/Min
8.1.1	Main hoist	3 (Creep speed - 10% of main speed, that is, 0.3m/min through VVVF drive)
8.1.2	Trolley travel (CT)	15
8.1.3	Longitudinal bridge travel (LT)	25
8.2.1	Acceleration values	LT motion (bridge travel) as per IS: 3177
8.2.2		CT motion (trolley travel) as per IS: 3938
9	**Lift in Metres**	The lifting rope shall be of sufficient length to permit the main hook to reach the zero level.
9.1	Main Hoist	Shall be suitable as per approved layout
9.2	Hook Approaches	To suit the lifting requirement.
	COMPONENT DETAILS	
10	**Trolley**	
10.1	Type	Fabricated steel / Cast steel

10.2	Material	Rolled structural steel with side plates extended beyond wheel flanges to protect wheels. Material of construction as per IS: 2062 (Grade A/B).
10.3	Whether jacking pads for lifting trolley provided or not	Yes
11	**Rope drums**	
11.1	Material (Indicate IS)	Rope drums shall be made of seamless pipe or welded steel as per IS 3177. Rope drum shall be stress relieved if fabricated
11.2	Flange / flangeless	Flanged
11.3	Numbers provided	One
11.4	Type of grooves	Machined grooved identical Right hand and Left hand of proper shape for the rope used. Additional grooves shall be provided as per IS 3177/3938 in rope drum
12	**Rope details**	
12.1	Construction / Core	The wire ropes shall be of suitable diameter as per Suppliers design of crane. The rope shall confirm to I.S. 1835, 1804 and 2266. The rope shall be parallel right hand lay having 6 x 37 constructions with hemp core. However, this should be in relation with Drum diameter as per IS: 3177. The rope selection procedure shall be as per IS 3177 cl. no. 8.3.2.
12.2	Tensile designation (Rope Grade)	1770 or 1960 (in N/sq. mm)
12.3	Factor of safety	5.25 as per IS 3177
13	**Sheaves details**	
13.1	Material	The sheaves (Pulleys) shall be of carbon steel casting having chemical and mechanical properties as per IS: 1030 (Class 11).
13.2	Type of guards provided	Fabricated from Sheet steel
14	**Gear box details**	
14.1		Fabricated steel gear boxes which shall be dust proof and firmly sealed to prevent oil leakages. Gearboxes shall have covers split horizontally and arranged such that top half can be removed for inspection. The gear boxes shall be fitted with bolted type machined inspection covers. Gear box casing shall be stress relieved if fabricated
14.2	Hoist Motion / Cross Travel / Long Travel	
14.2.1	Type of mounting of gear box	Horizontal / Vertical
14.2.2	Classification	Suitable for M5 duty
14.2.3	Type of gears	Spur / Helical, hardened and tempered with machine cut teeth

14.2.4	Type of lubrication	Oil splash/ grease lubricated
14.2.5	Hardness (BHN) – gear	568+/-20BHN for alloy steel.
14.2.6	Hardness (BHN) – pinion	568+/-20BHN for alloy steel.
14.2.7	Difference in Gear and pinion hardness	Min 20 BHN
14.2.8	Materials (gear/pinions)	Gears shall be of cast or forged steel and pinions shall be forged steel and shall be machine cut. Gear and pinion teeth shall be treated for resistance to wear.
14.2.9	Casings	Fabricated steel gear boxes which shall be dust proof and firmly sealed to prevent oil leakages. Gearboxes shall have covers split horizontally and arranged such that top half can be removed for inspection. The gear boxes shall be fitted with bolted type machined inspection covers.
14.2.10	Noise level	85 db
14.2.11	Standard conforming to	IS: 4460
15	**Wheels details**	**Cross Travel / Long Travel**
15.1	Material	EN-8/9
15.2	Hardness	Wheels for under-slung crane shall have hardness of 200 BHN (max) as per IS 3938. In case of overhead cranes and semi-gantry cranes the long travel wheels shall have hardness of 300-350 BHN (max) as per IS 3177. For cross travel motion the wheel hardness shall be 200 BHN (max) as per IS 3938.
15.3	Type	Double flanged and taper thread for overhead/semi-gantry crane Single flanged taper/ straight tread for underslung cranes.
15.4	Numbers provided	As per manufacturer's standard.
15.5	Specification conforming to	In case of Overhead cranes and semi-gantry cranes the long travel wheels shall confirm to IS 3177. However in case of cross travel of overhead and semi - gantry cranes, all travel wheels of under-slung cranes shall be as per IS 3938.
15.6	Arrangement of lubrication	Grease
16	**Lifting hooks**	
16.1	Type	'C' type (Trapezoidal section with swivelling Type)
16.2	Safe lifting capacity	As per Safe Working Load
16.3	Material	Solid, forged, heat treated alloy steel/ carbon steel of rugged construction as per IS:15560
16.4	Standard conforming to	IS: 15560 IS 3815 - Point Hook with Shanks for General Engineering Purpose IS 3813 - Specification for 'C' Hooks for use with Swivels Hooks shall conform to BS: 482/2903/3017

16.5	Hook can swivel	Yes
16.6	Safety latch on hook provided	Yes
16.7	Locking device on swivelling hook	Provided
16.8	Hook suspension	Ball or roller thrust bearing
17	**Buffers**	**Cross Travel / Long Travel**
17.1	Type	Spring or rubber buffers shall be provided on the trolley & end carriage
17.2	Numbers provided	4
17.3	Details of end stop	Suitable end stops welded to the bridge girder shall be provided to contact the buffers.
18	**Brakes**	
18.1		**Hoist Motion / Cross Travel / Long Travel**
18.2	Type of brake (ac / dc)	DCEM/ ACEM disc type (fail to safety)
18.3	Number provided per motor	1
18.4	Braking capacity (% of full load torque)	150% / 125% / 125%
19	**Drive system for hoisting**	
19.1	Arrangement of drive from motor to rope drum (main)	Through geared steel coupling and gear box
20	**Bearings**	**Hook / Trolley wheels / Rope drum / Gear box / Sheave / Any other assembly**
20.1	Type	Antifriction ball / roller bearings
20.2	Lubrication	Grease lubrication
20.3	Bearing life	10,000 working hours.
21	**Bridge girder**	
21.1	Type & Quantity	Box section type or braced I-beam type. One no for each crane. Rolled steel sections shall be used for under-slung crane main girders having adequate strength. Bridge girders of electric overhead travelling crane shall be of fabricated steel construction.
21.2	Vertical Deflection and Camber	(a) The total maximun vertical deflection of the girders for the live loadplus trolley and not including impact or dead load of the girder shallnot exceed limit of Span/900.(b) The girders shall be cambered by an amount equal to the maximumdeflection due to dead load plus one half the live load and trolley.

21.3	Type of connection to end carriage	As per manufacturer's standard.
21.4	**End carriage span material**	Structural steel.
22	**Motors**	
22.1	**Hoist Motions**	**MH / CT / LT**
22.2	Type	Motors shall be slip ring wound rotor type, designed for crane dutyrequirement of frequent starting, reversing and plugging.Motors shall suit the duty class S4, cyclic duration factor 40% and number of cycles per hour 150. Motor pull out torque shall not be less than 2.75 times rated torque.
22.3	Enclosure	TEFC
22.4	Numbers furnished	One
22.5	Voltage, phase and frequency	Suitable for rated frequency of 50 Hz with a voltage variation of +/-10% and frequency variation of +/-5% occurring separately or combined voltage and frequency variation of 10%.
22.6	Class of protection	IP-55
22.7	Margin	Motor ratings shall be calculated keeping margin of at least 25% over the maximum power requirement. Further, the hoist motors shall be rated to lift 125% of the design load on the hook at the rated speed.
22.8	Class of insulation	All motors shall be totally enclosed, fan cooled type, having class-B stator insulation and class-F rotor insulation for slip ring motors & class-B insulation for squirrel cage motor with temperature rise limited to class-B operation in all cases.
22.9	Overload protection for motors provided	In built feature of VVVF drives provided for main hoist motor. For CT and LT motor, One main electro-magnetic contactor together with magnetic overload relay (hand reset) for each motor circuit shall be housed in the protection paneL The operation of overload relay shall interrupt the main magneticcontactor. Adequate short circuit protection shall be provided for main and individual circuits.
23.10	Space heater requirements	Not required
24	**Limit switches**	**Main Hoist / Cross Travel / Long Travel**
24.1	In hoisting motion	Each hoist shall be provided with 2 limit switches. 1. A screw type limit switch with self resetting features which will act in case of over hoisting.2. A gravity operated han d-reset type limit switch as a back-up protection against over-hoist

24.2	In CT/LT motion	Track type limit switches shall be provided on the bridge and trolley to prevent over travelling in either direction
24.3	Material of contacts	Double break Silver Cadmium
24.4	Control voltage	110V
24.5	Construction	The limit switches shall be housed in robust metallic oil and dust tight enclosure conforming to IP:65. At least 2 NO and 2 NC contacts shall be provided for each limit switch.
25	**Power conductors (DSL)**	Shrouded GI type runway conductor
25.1	Type	LT: PVC shrouded GI conductor bus bar with fire protection sheathing CT : Flexible trailing cable mounting on retracting support (Festoon type) EPR insulated type a. PVC Shrouded Conductor (GI) Bus Bar Type DSL with accessories for entire bay length (with current collector & mounting brackets) (except for gantry crane). b. Cable Reeling Drum (CRD) along LT travel for gantry crane. c. Flexible cable with Taut wire / Festoon cable arrangement for CT motion for all cranes. d. Down shop leads (DSL) with fire protection sheathing with all fixing arrangement & isolators.
25.2	Size	Shall be sized with a margin of 10% over load requirement. Voltage drop at motor terminal shall be limited to 3% at extreme positions of cranes. Protective cover over DSL shall be provided.
25.3	Length	Suitable for entire bay length.

26	**Isolation switch & Control Panel**	Isolation switch shall be provided at operating floor. Protective and control panels shall have IP-54 gasketed enclosure, fabricated from sheet steel, minimum 2 mm thick, suitably reinforced to provide structural rigidity. The panels shall be front connected type with front hinged door for access to wiring and terminals. Engraved name plates shall be furnished for all panels and also for the equipment and device mounted thereon. All panels shall be factory wired and terminated on suitable terminal blocks for external cable connection. All internal wiring shall be identified with numbering ferrules at both ends as per relevent wiring diagram. Terminal blocks shall have 20% spare terminals. Control wiring shall be carried out with 1100 Volt grade flexible, heat resistant, insulated switchboard wires with minimum 2.5 sq.mm stranded copper conductor. Each panel shall have internal illumination with fluorescent lamp and thermostat controlled space heater, suitable for operation on 240V I-ph 50Hz supply. Lamps and heater circuits shall have individual ON-OFF switches.
26.1	Material & size	Rolled sheet steel 2mm size
26.2	DOP	IP 54
26.3	Qty	1 no. per crane
27	**Control for Hoisting operations**	
27.1	Creep speed	VVFD for creep speed in main hoist of Single Girder Cranes, * Speed control - Through VVVF with at least with 1024 pulse incard, droop control for synchronization and crane software. The rating of VVVF shall be decided considering 250% of full load current of respective drive motor based on in panel rating with derated at 50 Deg C ambient temperature. * Starting torque of VVVF drive - Up to 200% typical * Starting current - Less than 150% of rated torque * Temperature - Capable of withstanding up to 50 Deg C without derating * Additional feature - In-built electrical overload/short-circuit protection for drive
27.2	Starting torque of VVVF	Up to 400% without encoder.
27.3	Starting current	Less than 150 % of rated torque.
27.4	Temperature	VVVF system shall be capable of withstanding upto 50° C without derating.
28	**Cable**	**Power / Control / Trailing**

28.1	Type	All wiring shall be done with 1100V grade PVC insulated wire in conduits or by 1100 V grade PVCA PVC cables with extruded inner sheath. Conductors shall be stranded aluminium for power and stranded copper for controL Minimum conductor size shall be not less than 2.5 m2 copper or equivalent.
28.2	Voltage drop	Cable from main isolating switch (1.5M above operating floor) to motor terminal shall be so sized that the voltage drop does not exceed 3% of rated voltage with cranes at extreme position.
29	**Earthing**	Crane structures, motor frames and metal cases of all electrical equipment including metal conduit and cable guards shall be effectively earthed. Electrical system shall be designed for a fault level of 50 kA. Earthing system adopted shall be type TN-CS.
29.1	Material of earthing	G.I. / Copper
30	**Contactors**	AC 4 duty for reversing application. AC 3 duty for non -reversing application. In case the feature of reversing - no-reversing is inbuilt in VVVF drives then the contactors shall not be required.
31	**Switches**	AC 23 for motor application, AC 22 for other application.
32	**Fuses**	HRC
33	**Power supply**	415 V, 3 phase, 3 wire supply at 1.5m above operating floor.
34	**Transformer**	Dry type, with insulation class B or better.
34.1	Quantity	2 X 100 % for control
34.2	Voltage Rating	Control 415/110V
34.3	KVA rating	Min. 20% over loading to be considered while sizing the rating

Note:

- In case of discrepancy between the Data sheet and requirement given elsewhere in the technical specification, the more stringent of the two as per the interpretation of purchaser shall be applicable.
- 4/2 rope winding arrangement with Centre hook for CW Pump House crane. This semi-gantry crane shall be outdoor duty. Canopy to be provisioned for all electrical equipment and instruments.

NOTE: SPECIAL HAZARDOUS AREA REQUIREMENT FOR 2T CAP. SINGLE GIRDER EOT CRANE IN FUEL OIL PUMP HOUSES

1. All wheels shall be provided with phosphor bronze type.
2. Any other mechanism where two non-lubricated parts mate, one of them shall be for non-ferrous material like phosphor bronze aluminum bronze.
3. All electrical components/ equipment for EOT cranes (motors, panels, VFD drive etc.) shall meet the requirements of hazardous area & shall be explosion proof type.
4. Coupling guards shall be non-sparking (i.e. non-ferrous/non-metallic) type.
5. LT DSL shall be flexible trailing cable type (Cu).

SECTION-II

STANDARD TECHNICAL REQUIREMENT

SUB-SECTION IIA STANDARD TECHNICAL REQUIREMENT (MECHANICAL)

SUB SECTION-IIA

STANDARD TECHNICAL REQUIREMENT (MECHANICAL)

SINGLE GIRDER EOT CRANE

1.0.0 SCOPE

This specification covers the design, material, manufacture, assembly, inspection and testing at manufacturer works for single girder EOT crane. The equipment shall include all the accessories required for the trouble free operation.

The crane shall be complete with trolley and truck, wheels and axles, Drive mechanisms, Hoisting Drums, Brakes, Creep Speed Arrangement, Lifting tackles, Buffers, Electric Motors, Controls, Switch Board and cabling, horns, warning lights, Limit switches etc. Any item not mentioned herein but required to make the system complete for the satisfactory performance of the crane shall also be included.

2.0.0 CODES AND STANDARDS

The equipment to be supplied under this specification shall conform to the following codes and standards (latest revisions) unless otherwise specified hereinafter.

a)	IS 807	Codes of Practice for Design, Manufacture, Erection and Testing (Structural Portion) of cranes and hoists
b)	IS: 3177	Code of Practice for Design of Overhead Travelling Cranes and Gantry Cranes other than steel work cranes
c)	IS: 2266	Specification for steel wire ropes for general Engineering purposes.
d)	IS: 4029	Guide for testing induction motor (for temperature rise)
e)	IS: 15560	Steel hooks for standard shank design
f)	IS: 1554 Part I	PVC insulated (Heavy-duty) electric cables for working voltages up to and including 1100 volts.
g)	IS: 325	Three phase induction motors.
h)	IS: 900	Code of practice for installation and maintenance of induction motors
i)	IS: 694 (Part-I)	Copper conductors PVC insulated cables for voltage up to 1000 V.
k)	IS: 434 (Pt I)	Copper conductors rubber insulated cables for voltage up to 1000V.
m)	IS: 691	Flexible trailing cables rubber insulated.

n)	IS 3043	Code of practice Earthing.
o)	IS: 3938	Electric Wire Rope Hoists.
p)	IS: 2147	Degree of protection provided by enclosures for Low voltage switchgear and control gear.
q)	IS: 1554	Polyethylene insulated PVC sheathed cables.

Indian electricity rules - 1956.

In the event of any conflict between the specification and standards mentioned above, the specification shall govern.

3.0.0 **SINGLE GIRDER EOT CRANE**

3.1.0 **DESIGN REQUIREMENTS**

3.1.1 The crane shall be designed in accordance with the latest edition of IS-3177/IS-807 & hoist block shall be as per IS-3938 and any other standard as referred there in and subject to any modification and requirement as specified herein after.

Class of crane mechanism shall correspond to that of the crane requirement and as specified elsewhere.

3.1.2 Safety devices should be provided with all equipment/parts covered under this specification.

3.1.3 Parts requiring replacement or lubrication shall easily be accessible without dismantling the other equipment or structures. All electrical cables shall be laid to comply with recognized standards and purchaser's requirements.

3.1.4 For welded construction such as bridge girders, end carriages, rope drum, gearboxes etc; steel shall be conforming to IS-2062 quality.

3.1.5 No cast iron part shall be used on the crane.

3.1.6 Guard shall be provided on crane to prevent the hoist ropes coming in contact with down shop leads. Guards of an approved design, which will push forward or off the track any object such as a person foot or arm, placed across it. Guards shall be attached to each end of the end carriages. Suitable guards shall be provided to revolving shafts, coupling etc.

3.1.7 All cables shall be clamped individually. All trailing cables shall be clamped with PVC or non-metallic clamp.

3.1.8 All wheels, couplings, open gear etc. shall be provided with covers.

3.1.9 All bolts except those with locknut shall be provided with grip lock nuts or spring washers.

3.1.10 Fasteners for pedestal blocks, motors, gearboxes etc. shall be easily removable from the top. Studs shall not be used as fasteners for mechanical items except for fixing covers.

3.1.11 Defects in the material like fractures, cracks, blowholes, pitting etc. are not allowed. Rectification of any such flaw is permissible only with the approval of the purchaser.

3.1.12 All parts of the crane shall be thoroughly cleaned of mill scales, rust or foreign matter and then painted as per the specification requirements

3.1.13 The crane shall be manufactured as per the tolerances specified below

a)	Span over LT wheels	± 3mm
b)	Diagonal on wheels	± 3mm
c)	Long travel wheel alignment	± 1mm
d)	Tilt of wheels or balancer axle	±1/1000mm(horizontal and vertical)
e)	Permissible variation in Speeds at full notch with rated load, voltage and frequency shall be as follows.	
	i) Travelling and traversing	±10%
	ii) Hoisting Lowering	±10%

3.1.14 Proper allowance shall be made for impact and wear in the design of the crane and in no case shall the factor of safety in any part be less than six (6), as per IS: 3177 based on the ultimate strength of the materials used at design duty.

3.2.0 **STRUCTURAL DETAILS**

3.2.1 Crane structure shall be designed in accordance with the latest edition of IS-807 after taking the following additions/deviations as applicable.

3.2.1.1 Black bolts shall not be used in the main structure of the crane. The calculated strength of other bolted joints in structural members shall not be less than net strength of member plus 25%.

3.2.1.2 The calculated strength of riveted joint or joints made by friction grip bolts in structure members shall be not less than the calculated net strength of the member.

3.2.1.3 Bolts used in shear shall be fitted in to reamed hole.

3.2.1.4 Transverse filled welding on load carrying member shall be avoided.

3.2.1.5 All butt welds on structural members subjected to tensile stress shall be X - rayed.

3.2.1.6 Fillet welding on load carrying members shall be avoided.

3.2.1.7 Plates, angles and other rolled section used in the load bearing members of the structure shall not be less than 6mm thick.

3.2.1.8 The cranes working out door or in corrosive environment, an allowance of 1.5 mm shall be added to the calculated thickness.

3.2.1.9 Minimum thickness of chequered plates for platform shall be over 5mm over plain. Chequered plates shall not be considered for strength calculations of load carrying member.

3.1.1.10 The material of construction of the major components shall be as specified in the specification/data sheet. Manufacturer are however free to use alternate material which are

superior for the intended service. But in all the cases, prior concurrence of the purchaser is must.

3.2.2 **Girder / Beam**

3.2.2.1 The girder / beam shall be fabricated from rolled steel (Box section/ I-section) and shall be of adequate strength to withstand the rolling loads and other stresses it is subjected to. The design of the girder shall be in accordance with latest edition of IS- 807 with the following deletion / addition as applicable.

3.2.2.2 The maximum vertical deflection of the girder produced by the dead load, the weight of the trolley and the rated load shall not exceed 1/750 of the span of the crane (if the span of the cranes is more than 12m), and 1/600 of the span (if the span of the crane is less than 12m) as per IS 807 (latest edition). Girders shall be cambered to an amount approximately equal to the dead load maximum deflection plus one-half the live load deflection.

3.2.3 **End carriage**

3.2.3.1 End carriages shall be fabricated from rolled steel section or plates or as the case may be. End carriage shall be of ample strength to resist all stresses likely to be imposed on them under service conditions including collision with other cranes or stops.

3.3.0 **MECHANICAL**

3.3.1 Rope drums

Rope drums shall be of mild steel plate fabricated/ of seamless pipe or of cast steel. Seamless pipe shall be procured from BHEL approved makes & TC shall be furnished. All fabricated rope drums shall be stress relieved. The drum shall be so designed to take full length of hoisting rope in single layers. The end of the rope shall be anchored to the drum in such a way that the charger in readily accessible. Each rope shall have not less than two (2) full turns on the drum when the hook is at lowest position not taking into consideration the turns covered by the rope in charge. There shall be one spare groove for each rope lead when the hook is at the highest position. Each rope end shall be clamped with minimum two clamping wedges with at least two bolts on each clamping arrangement.

The pitch diameter of the drum shall be as per IS -3177 or as specified elsewhere. The depth of the grove shall not be less than 0.35 times the rope diameter. Each rope shall be clamped to drum with two clamp wedges with at least two numbers of bolts on each clamping arrangement.

3.3.2 Hoist ropes

Ropes of steel core as specified in Data Sheet – A/B shall be of right hand lay, of 6x36 construction of best plough steel having minimum tensile strength as 160-180 kg/mm2. Left hand lay wire ropes shall not be used (Reverse bend ropes shall be avoided as far as possible).

3.3.3 Rope sheaves

Sheaves shall be of cast steel. All sheaves shall be identical, however, exception may be made for equalizer sheave. Sheave groove shall be ground finished for getting increase rope life. Equalizer sheave shall be arranged to turn and swivel in order to maintain rope alignment under all circumstances.

3.3.4 Wheels

LT wheels shall be single flanged for underslung EOT crane and double flanged with tread (to suit the rail) for overhead EOT cranes. The wheels shall be capable of taking up misalignment in span as specified. Solid wheel shall either be of forged steel or as specified. The wheel shall be with hardness of BHN 300-350 for overhead EOT cranes and BHN 200 (max) for underslung EOT cranes. Contact stresses between wheels and rails should be within permissible limits.

3.3.5 Buffer

Each End carriage shall be provided with buffer as per data sheet 'A'. Buffers should be so located that removal is not required while changing wheels or bogies. Buffers shall have sufficient tension on energy absorption capacity to bring the unloaded crane to rest from the speed of 50% of the rated speed to zero speed.

3.3.6 LT drive

One pair of wheels in each end carriage shall be driven by motor through reduction gear.

3.3.7 CT drive

The CT mechanism of the electric hoist shall consist of 2pairs of wheels which shall be driven by motor through reduction gear.

3.3.8. Gearing

Spur and helical gearing shall normally be used for all motions. Worms and bevel gears shall not be used. First high-speed reduction shall be through helical gears. All gears shall be hardened and tempered and of alloy steel with machine cut teeth. Surface hardening of teeth

is not acceptable. Gear teeth shall preferably be cut in metric module system. Gears shall be designed to meet requirement of crane duty as per IS: 3177. The ratings of gears shall be established as per IS: 4660.

3.3.9 Gear Box

3.3.9.1 All gears shall be completely covered and enclosed in oil tight casing & sealed with gasket.

3.3.9.2 The gearboxes shall be of mild steel or cast steel. All fabricated gearboxes shall be stress relieved.

3.3.10 Bearing

3.3.10.1 Ball and roller antifriction bearing of FAG, SKF, NBC, NORMA make shall be used throughout, except where specified otherwise. Rated life of ball and roller bearing shall be not less than total working life as per relevant codes. Life of bearing shall be calculated in accordance with manufacturers recommendations.

3.3.10.2 Provision shall be made for service lubrication of all bearings. Bearing enclosures shall be designed as far as possible to exclude dirt and prevent oil leakage.

3.3.11. Couplings

3.3.11.1 Motor shafts shall be connected to gear box input extension shafts through flexible gear coupling. Solid coupling shall be used for connecting intermediate lengths of long travel shafts, if applicable.

3.3.12 Lifting hook

Standard hooks shall be used unless otherwise specified. These hooks shall conform to the latest edition of IS 15560 as specified in the data sheet “A”.

3.3.13 Brakes

3.3.13.1 Selection and design of brakes shall be such as to meet the requirement. Electro mechanical brakes shall be provided for each motions. Brakes shall be designed to suit 150% FLT of motor for the hoist motion and 125 % FLT of motor for LT/CT motion. Brakes shall be provided as specified in Data Sheet ‘A’

3.4.0 **ELECTRICAL**

3.4.1 The scope of supply shall cover all electrical equipments comprising from Main isolating switch, down shop leads, trolley conductors, current collectors etc.

3.4.1.1 Main isolating Switch fuse unit shall be provided at 1.5M above the operating floor level at one end of bay length or in the middle as specified in the data sheet A. Supply of cable from switch to down shop leads shall be included in the bidder’s scope of work.. The switch shall be provided with Power ON Red indication lamp.

3.4.1.2 Run way conductors (Down shop leads) shrouded conductor as specified in the data sheet A shall have four conductors. One of the conductors shall be connected to earth grid for earthing connections of all electrical equipments on the crane and shall be connected to suitable collecting gear of earth conductor. Voltage drop across the down shop leads shall be less than 2%. Maintenance cradle for DSL shall be provided on crane if asked in Data Sheet 'A'. Sufficient allowance of min. 10% for wear & tear shall be considered while sizing the conductor. The runway conductors shall be supported on brackets and insulators.

3.4.1.3 The current collectors shall be of adequate current carrying capacity and shall maintain adequate contact pressure. Spacing between current collectors shall be such as to provide sufficient quenching area for sparks coming out of collectors surface. The collector system per conductor shall be top-running type having spring loaded CI/carbon metallic shoes to maintain adequate contact pressure.

3.4.1.4 The cable, supplying power to crane trolley / electric hoist shall be flexible trailing cable as per IS-9968 Part I (latest edition) and mounted on retracting supports (festoon type)

3.4.2 **DRIVE MOTORS**

3.4.2.1 Crane motors shall be totally enclosed, fan cooled and as per data sheet 'A'. The break down torque of the motors shall not be less than 225 percent of the full load torque with rated voltage and frequency applied and pull out torque shall not be less than 250% of the rated full load torque of motor.

3.4.2.2 Ambient correction factors as well as voltage /frequency correction factors depending upon the ambient temperature and voltage /frequency variation shall be applied to derate the motors. The minimum margin of 10% or as specified in the section C of specification shall be considered over the calculated rating of the motor. The protection class of the motors shall be as per data sheet A. Motors shall be tested at manufacturer's works in accordance with IS-325/as per agreed Quality plan & Reports shall be submitted for approval. Motors shall comply with the requirement of IS-325-1978 or as per the motor specification if enclosed here with.

3.4.2.3 All the motors shall be provided with lifting lugs, two earth terminals of adequate size to accept the earthing conductors shall be provided at diametrically opposite points unless specifically designed for higher speeds, motors shall be capable of withstanding 2.5 times the rated speed.

3.4.3 **Limit Switch**

The hoist mechanism of the crane shall be provided with rotary/gravity/snap action type limit switch to open the control circuit and in order to prevent the crane hook from over hoisting

and over lowering. One gravity type back-up limit switch of hand-reset type shall be provided. This switch shall operate in the event of failure of main limit switch if called for in data sheet "A".

Lever operated limit switches shall be provided at both ends of longitude travel and cross traverse. These limit switches shall be self-reset type.

3.4.8 **Protective Panel / Controls**

3.4.8.1 The electrical protective panel shall be a cubicle fabricated from 2 mm thick sheet steel with lockable-hinged door. It shall be dust and vermin proof with degree of protection as IP-55 or as specified in data sheet A. All the equipment inside the panel shall have permanent identification. The panels shall be front connected type with front-hinged door for access to wiring and terminals. Engraved nameplate shall be furnished for all panels and also for the equipments and devices mounted there on.

The following minimum equipments shall be provided.

a) One triple pole air break type main contactor with thermal overload relay.

b) One triple pole main line connecting/disconnecting switch.

c) Switch fuse unit with D.O.L. starter for each motion.

d) Thermal overload relay for each drive. It shall be ambient temperature compensated and adjustable type.

e) Contactors, timer and auxiliary contactors.

f) Control transformer with fuses.

g) Indicating lamps to indicate the live condition of all three phases.

h) Other equipments as per supplier's standard practice. Air break contactors shall conform to category AC-4 duty. The contactor drop off voltage shall be between 45-50% of rated voltage.

i) All internal wiring shall be identified with numbering ferrules at both ends as per the relevant wiring diagram.

3.4.9 **Pendent Push button station**

It shall be suspended by wire rope to prevent pull on the cables. The following minimum push buttons key operated type.

a) Main" ON", "OFF" push button key operated and lockable in "OFF" position.

This push button will operate the main contactor.

b) Hoist and lower directions. (2Nos.)

c) Trolley travels both directions. (2 Nos.)

d) Bridge travels both directions. (2 Nos.)

e) Inching speed for hoisting & lowering

f) Inching speed for bridge motion.

g) Inching speed for trolley motion.

h) Creep speeds

i) Emergency stop push button (mushroom type).

j) Alarm bell push button.

3.4.10 **Grounding**

3.4.10.1 The crane structure, motor frame and all other electrical equipments shall be grounded in accordance with the Indian Electricity Rules. The connections from Crane Bridge to 4th conductor of down shop leads shall be by means of current collector.

3.4.10.2 The equipment fed by flexible cables shall be grounded by means of fourth core provided in the flexible trailing cable. Pendent push button station shall be earthed separately.

3.4.10.3 Red warning light 3 Nos. shall be provided at both ends of the gantry girder to indicate the aliveness of DSL.

3.4.11 **WIRING SYSTEM**

The supplier shall furnish all power, control and auxiliary circuit wiring of the equipment and the panel located on the trolley or bridge.

The wiring shall be complete in all respect to ensure the proper functioning of the equipment.

Power wiring to any motor shall be done with 1100V grade Cu conductor, PVC insulated / armoured /FRLS cable of suitable sizes as specified in Data Sheet A.

d) For selecting the cable rating, cable for power wiring, consideration shall be given to the motor duty, ambient temperature grouping and disposition of the cables voltage drop etc.

e) All control and auxiliary external circuit wiring shall be done with PVC insulated FRLS type 2.5mm stranded copper conductor.

f) Armoured cables or un-armoured running through the flexible conduits may be used for power wiring / control and auxiliary circuit wiring shall run through flexible conduits.

g) Each motor shall be wired independently. Power and control wiring shall be effectively separated.

h) Each wire shall be identified at both ends with wire designation in accordance with circuit wiring diagram.

i) All wire termination to the panels shall be provided with clamp type connections screw. Type terminals with screw directly impinging on conductors are not acceptable.

j) Multi-way terminal blocks complete with screw nut, washer and marking strips shall be furnished for terminating the panel wiring and outgoing.

k) Not more than two wires shall be connected to any terminal on either side of terminal block. If necessary number of terminals shall be jumped together to provide the wiring points

l) Each terminal block shall be marked with designation in accordance with conductors wiring diagram.

4.0.0 **LOAD INDICATION:**

The crane shall have a permanent inscription of English on each side, readily visible from the ground level, stating the safe working loads in tonnes, year of manufacture, crane serial number and manufacturer's name.

BHEL	1X660MW Bhusawal TPS-Unit: 6 SINGLE GIRDER EOT CRANE STANDARD TECHNICAL REQUIREMENT	SPECIFICATION No: PE-TS-415-524-A001 VOLUME: II B SECTION-II SUB-SECTION-IIA REV 00 / DATE DEC 2021

TECHNICAL SPECIFICATION FOR VVVF DRIVE

1.0 General

a) This part of the specification describes the general requirements for the Variable Voltage Variable frequency Drives, herein referred to as AC Drives, for use with standard IEC design AC squirrel cage induction motors. The nominal values, the standard documents and the drive's minimum performance are defined in this part. **To avoid any mismatch between the motor and its control equipment, the AC Drive shall be capable of auto adjustment by automatic measurement of the motor parameters with/without motor rotation.**

i. Speed control of EOT crane shall be through Variable Voltage Variable Frequency System (VVVF) with minimum 6 (six) pulse design.

ii. Necessary input & output devices to be provided to reduce harmonics, as per IEE519, at supply side of the drive at the switchgear.

iii. All necessary protections e.g. Input Phase Loss, Earth Fault, Over Voltage, Output Short Circuit, Load Loss, Input Transient Protection, Overload etc. to be provided.

iv. VVVF system shall be capable of generating suitable starting torque (220% typical) with / without encoder, however starting current shall not exceed 150% of the rated torque.

v. VVVF system shall be capable of withstanding upto 50 deg C. ambient temp without derating

vi. Squirrel cage Induction motor with VPI insulation shall be provided with VVVF system.

vii. Protective Pane Provided with isolating switch, power contactor control and indication to switch ON/OFF power to starter panels, control and lighting transformer.

viii. Starter Panel:

Separate VVVF system panels to be provided for CT, LT and hoist motion

(a) Contactors: AC 4 duty for reversing application AC 3 duty for non-reversing application

(b)Switches: AC 23 for motor application, AC 22 for other application.

(c)Fuses: HRC

(d)Overload relay: Temperature compensated, bimetallic with single phasing preventor.

ix. Panel shall be fabricated out of 1.6 mm thick rolled sheet steel. IP 52degreeof protection. Paint shade shall be RAL 9002 for front & rear and RAL 5012 for side

covers. Space heaters to be provided.

2.0 User interface

2.1 General

The user interface shall be identical throughout the power range and type to avoid confusion amongst the users and need for training in several different units.

2.2 Inputs and outputs

A. At least, the following standard Inputs and Outputs shall be provided, to be used in interface with the control system:

Analogue Inputs : 1 x Programmable differential voltage input ± 10V,
1 x Programmable current input 0(4) - 20mA
1 x Programmable voltage input 0 – 10V

Analogue Output : 1 x Programmable analogue outputs 0(4) - 20mA or 0 – 10V

Logic inputs : 6 x Programmable logic Inputs isolated from the mains

Relay Outputs : 2 x Programmable Digital outputs with a changeover dry contact

All the control terminals shall be clearly marked.

B. At least, it shall be possible to assigned the following functions to the I/Os:

Analogue input	**Analogue outputs**
Speed reference Summing reference	Motor current Motor frequency Motor torque Motor power
Logic input	**Relay or logic outputs (open collector)**
Forward Reverse Jog Preset speeds Reference switching Ramp switching Parameter sets selection Fast stop Freewheel stop + speed - speed External fault	Ready Drive running High speed attained Drive fault Frequency threshold attained Motor thermal state attained Torque or current limitation attained Brake control

2.3 Programming terminal

A. The AC drive shall have a keypad /display for programming and controlling purposes. An IP54 or IP65 remote mounting shall be possible at a distance of 10m.

B. Password protection shall be provided to avoid unauthorized tampering with the set parameters.

C. The programming terminal shall be able to display the commercial reference of the AC drive and of the options, the software version, the serial number

D. Direct keypad entry shall be provided to observe the following actual parameters. Any one of the following parameters or actual values shall be selected to be always displayed:-

i. Input Voltage
ii. Input Frequency
iii. Output Frequency
iv. Output Power
v. Output Current
vi. Motor Speed

The following parameters shall always be displayed during normal operation:-

i. Drive Status

The following drive control functions at least shall be available from the keypad:-

i. Run
ii. Stop
iii. Local / Remote selection.
iv. Forward/Reverse (if function enabled)
v. Accelerate
vi. Decelerate
vii. Parameter setting

2.4 Application programming

The AC Drive shall be designed for both simple and the most complicated applications, yet it shall be user friendly. It shall be possible to reset the parameter settings back to the original factory settings through the keypad.

2.5 PC Tools

The AC Drive Supplier shall have a Windows based PC software available for monitoring and controlling the AC Drives, and the software shall be offered as an option. The software shall be supplied with the necessary hardware and a provision for connecting a PC with the AC Drives. It shall be possible to set and modify parameters, control the drive, read actual values and make trend analysis using the software.

3.0 Software features

A. Restart

In the event of a fault trip due to over voltage, over current or loss of analogue signal, the AC DRIVE shall be programmable to attempt an automatic restart. For safety reasons, the maximum number of attempts shall be within a selectable time. If the fault does not clear after the attempts, the drive shall lock out.

B. Brake logic control

The AC Drive shall have a built-in function to control a mechanical brake in order to move the load in a smooth and safe way. The brake logic control shall be adapted to the different movements: hoisting, travel, orientation.

4.0 Preferred makes:

As per attached sub-vendor list.

610548/2021/PS-PEM-MAX

SECTION-III

DOCUMENTS TO BE SUBMITTED BY BIDDER

IIIA	LIST OF DOCUMENTS TO BE SUBMITTED ALONG WITH BID
IIIB	COMPLIANCE CUM CONFIRMATION CERTIFICATE
IIIC	ELECTRICAL LOAD DATA
IIID	PRE BID CLARIFICATION SCHEDULE

	1X660MW Bhusawal TPS-Unit: 6	SPECIFICATION No: PE-TS-415-524-A001
		VOLUME: III
	SINGLE GIRDER EOT CRANE	SECTION-III
		SUB-SECTION-IIIA
	DOCUMENTS TO BE SUBMITTED BY BIDDER	REV 00 / DATE DEC 2021

SUB SECTION-IIIA
LIST OF DOCUMENTS TO BE SUBMITTED ALONG WITH BID

	1X660MW Bhusawal TPS-Unit: 6	SPECIFICATION No: PE-TS-415-524-A001
		VOLUME: III
	SINGLE GIRDER EOT CRANE	SECTION-III
		SUB-SECTION-IIIA
	DOCUMENTS TO BE SUBMITTED BY BIDDER	REV 00 / DATE DEC 2021

DRAWINGS / DOCUMENTS TO BE SUBMITTED WITH THE BID:

Bidder shall submit the following drawings / documents along with their bid

a) Deviation schedule with reference to specific clauses of the specification along with reason for such deviation in GCC format given on online procurement portal. In case of no deviation, bidder to mention “No deviation”.

b) Copy of pre-bid clarifications, if any, duly signed & stamped

c) Signed/ Stamped copy of Compliance cum Confirmation Certificate (Vol-III)

d) Un priced copy of price format indicating quoted/ not quoted against each row/column along with cost of withdrawal / price implication format for deviations.

e) Electrical load list, duly signed and stamped

OFFER WILL BE CONSIDERED AS INCOMPLETE IN ABSENCE OF ANY OF ABOVE DOCUMENTS. DOCUMENT OTHER THAN ABOVE, IF ANY, SUBMITTED WITH THE OFFER WILL NOT FORM PART OF CONTRACT AND ACCORDINGLY WILL NOT BE CONSIDERED FOR BID EVALUATION.

	1X660MW Bhusawal TPS-Unit: 6	SPECIFICATION No: PE-TS-415-524-A001
		VOLUME: III
	SINGLE GIRDER EOT CRANE	SECTION-III
		SUB-SECTION-IIIB
	DOCUMENTS TO BE SUBMITTED BY BIDDER	REV 00 / DATE DEC 2021

SUB SECTION-IIIB
COMPLIANCE CUM CONFIRMATION CERTIFICATE

	1X660MW Bhusawal TPS-Unit: 6 SINGLE GIRDER EOT CRANE DOCUMENTS TO BE SUBMITTED BY BIDDER	SPECIFICATION No: PE-TS-415-524-A001	
		VOLUME: III	
		SECTION-III	
		SUB-SECTION-IIIB	
		REV 00	DATE DEC 2021

COMPLIANCE CUM CONFIRMATION CERTIFICATE

The bidder shall confirm compliance with following by signing/ stamping this compliance certificate (every sheet) and furnish same with the offer.

a) The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusions other than those mentioned under "exclusion" and those resolved as per 'Schedule of Deviations', if applicable, with regard to same.

b) There are no other deviations w.r.t. specifications other than those furnished in the 'Schedule of Deviations'. Any other deviation, stated or implied, taken elsewhere in the offer stands withdrawn unless specifically brought out in the 'Schedule of Deviations'.

c) Bidder shall submit QP in the event of order based on the guidelines given in the specification & QP enclosed therein. QP will be subject to BHEL/ CUSTOMER approval & customer hold points for inspection/ testing shall be marked in the QP at the contract stage. Inspection/ testing shall be witnessed as per same apart from review of various test certificates/ Inspection records etc. This shall be within the contracted price with no extra implications to BHEL after award of the contract.

d) All drawings/ data-sheets / calculations etc. submitted along with the offer shall not be taken cognizance

e) The offered materials shall be either equivalent or superior to those specified in the specification & shall meet the specified / intended duty requirements. In case the material specified in the specifications is not compatible for intended duty requirements then same shall be resolved by the bidder with BHEL during the pre-bid discussions, otherwise BHEL / Customer's decision shall be binding on the bidder whenever the deficiency is pointed out. For components where materials are not specified, same shall be suitable for intended duty, all materials shall be subject to approval in the event of order.

f) The commissioning spares shall be supplied on 'As Required Basis' & prices for same included in the base price itself.

g) All sub vendors shall be subject to BHEL / CUSTOMER approval in the event of order.

h) Guarantee for plant/equipment shall be as per relevant clause of GCC / SCC / Other Commercial Terms & Conditions.

i) In the event of order, all the material required for completing the job at site shall be supplied by the bidder within the ordered price even if the same are additional to approved billing break up, approved drawing or approved Bill of quantities within the scope of work as tender specification. This clause will apply in case during site commissioning, additional requirements emerges due to customer and / or consultant's comments. No extra claims shall be put on this account

j) Schedule of drawings submissions, comment incorporations & approval shall be as stipulated in the specifications. The successful bidder shall depute his design personnel to BHEL's / Customer's / Consultant's office for across the table resolution of issues and to get documents approved in the stipulated time.

k) As built drawings shall be submitted as and when required during the project execution.

l) The bidder has not tempered with this compliance cum confirmation certificate and if at any stage any tempering in the signed copy of this document is noticed then same shall be treated as breach of contract and suitable actions shall be taken against the bidder.

m) Successful bidder shall furnish detailed erection manual for each of the equipment supplied under this contract at least 3 months before the scheduled erection of the concerned equipment / component or along with supply of concerned equipment / component whichever is earlier.

n) Document approval by customer under Approval category or information category shall not absolve the vendor of their contractual obligations of completing the work as per specification requirement. Any deviation from specified requirement shall be reported by the vendor in writing and require written approval. Unless any change in specified requirement has been brought out by the vendor during detail engineering in writing while submitting the document to customer for approval, approved document (with implicit deviation) will not be cited as a reason for not following the specification requirement.

o) In case vendor submits revised drawing after approval of the corresponding drawing, any delay in approval of revised drawing shall be to vendor's account and shall not be used as a reason for extension in contract completion.

	1X660MW Bhusawal TPS-Unit: 6	SPECIFICATION No: PE-TS-415-524-A001
		VOLUME: III
	SINGLE GIRDER EOT CRANE	SECTION-III
		SUB-SECTION-IIIC
	DOCUMENTS TO BE SUBMITTED BY BIDDER	REV 00 / DATE : DEC 2021

SUB SECTION-IIIC
ELECTRICAL LOAD DATA

LOAD TITLE	RATING (KW / A)		UNIT (U)/STN (S)	Nos.		VOLTAGE CODE*	FEEDER CODE**	EMER. LOAD (Y)	CONT.(C)/ INTT.(I)	STARTING TIME >5 SEC (Y)	LOCATION	BOARD NO.	CABLE		BLOCK CABLE DRG. No.	CONTROL CODE	REMARKS	LOAD No.
	NAME PLATE	MAX. CONT. DEMAND (MCR)		RUNNING	STANDBY								SIZE CODE	NOs				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
8T Compressor House – Single Girder EOT Crane	9KW		S	1	0	D	S	N	I		Main Plant Compressor House							
2T Fuel Oil Transfer Pump House – Single Girder EOT Crane	5KW		S	1	0	D	S	N	I		Fuel Oil Transfer Pump House							
2T Fuel Oil Pressurizing Pump House – Single Girder EOT Crane	5KW		S	1	0	D	S	N	I		Fuel Oil Pressurizing Pump House							
10T Clarified Water Pump House – Single Girder EOT Crane	12KW		S	1	0	D	S	N	I		Clarified Water Pump House							
8T DG Building – Single Girder EOT Crane	9KW		S	1	0	D	S	N	I		DG Building							
10T Raw Water Pump House – Single Girder EOT Crane	12KW		S	1	0	D	S	N	I		Raw Water Pump House							
5T CWPH – Semi-gantry crane outside CWPH	7KW		S	1	0	D	S	N	I		CWPH							
5T Existing (Abandoned) Pump House – Single Girder EOT Crane	7KW		S	1	0	D	S	N	I		Existing (Abandoned) Pump House							

NOTE:- Signed and stamped copy of this electrical load data shall be furnished by bidder along with bid. In event of ordering, above load data shall be considered as final and inputs for switchgear sizing shall be furnished to concerned electrical agency based on this electrical load data. Hence, no change in this load data shall be accommodated during detail engineering.

NOTES:
1. COLUMN 1 TO 12 & 18 SHALL BE FILLED BY THE REQUISITIONER (ORIGINATING AGENCY); REMAINING COLUMNS ARE TO BE FILLED UP BY PEM (ELECTRICAL)
2. ABBREVIATIONS : * VOLTAGE CODE (7):- (ac) A=11 KV, B=6.6 KV, C=3.3 KV, D=415 V, E=240 V (1 PH), F=110 V (cc): G=220 V, H=110 V, J=48 V, K=+24V, L=-24 V
: ** FEEDER CODE (8):- U=UNIDIRECTIONAL STARTER, B=BI-DIRECTIONAL STARTER, S=SUPPLY FEEDER, D=SUPPLY FEEDER (CONTACTER CONTROLLED)

BHEL	LOAD DATA (ELECTRICAL)	JOB NO.	415	ORIGINATING AGENCY		PEM (ELECTRICAL)
		PROJECT TITLE	1X660MW Bhusawal TPS-Unit:6	NAME		DATA FILLED UP ON
		SYSTEM	SINGLE GIRDER EOT CRANES	SIGN.		DATA ENTERED ON
		DEPTT. / SECTION	MAX / MH	SHEET 1 OF 1	REV. 00	DE'S SIGN. & DATE

BHEL	1X660MW Bhusawal TPS-Unit: 6 SINGLE GIRDER EOT CRANE DOCUMENTS TO BE SUBMITTED BY BIDDER	SPECIFICATION No: PE-TS-415-524-A001 VOLUME: III SECTION-III SUB-SECTION-IIID REV 00 / DATE : DEC 2021

SUB SECTION-IIID
PRE BID CLARIFICATION SCHEDULE

BHEL	1X660MW Bhusawal TPS-Unit: 6 SINGLE GIRDER EOT CRANE DOCUMENTS TO BE SUBMITTED BY BIDDER	SPECIFICATION No: PE-TS-415-524-A001 VOLUME: III SECTION-III SUB-SECTION-IIID REV 00 / DATE : DEC 2021

PRE-BID CLARIFICATION SCHEDULE

S. No.	Section/Clause /Page No.	Statement of the referred clause	Clarification Required

The bidder hereby certifies that above mentioned are the only clarifications required on the technical specification for the subject package.

SIGNATURE: _____

NAME: _____

DESIGNATION: _____

COMPANY: _____

DATE: _____

COMPANY SEAL