



भारत हेवी इलेक्ट्रिकल्स लिमिटेड

(भारत सरकार का उपक्रम)

BHARAT HEAVY ELECTRICALS LIMITED

(A Govt. of India Undertaking)

TCN - 05

Ref: PSER:SCT:BRM:M1266:TCN-05

Date: 10-02-2012

Sub	Tender Change Notice (TCN)- 05	
Job	Design, engineering, manufacturing, supply, Testing, commissioning etc of TG hall EOT Crane for 2x250 MW BARAUNI Extension Project unit # 8 & 9 at BEGUSARAI, BIHAR.	
Ref	1.0	Tender no PSER:SCT:BRM:M1266:11
	2.0	BHEL's NIT, vide reference no PSER:SCT:BRM:M1266:2586 Date: 14-11-2011
	3.0	BHEL's TCN-01, vide ref. no. PSER:SCT:BRM-M1266:TCN-01 dated 05/12/2011.
	4.0	BHEL's TCN-02, vide ref. no. PSER:SCT:BRM-M1266:TCN-02 dated 19/12/2011.
	5.0	BHEL's TCN-03, vide ref. no. PSER:SCT:BRM-M1266:TCN-03 dated 05/01/2012.
	6.0	BHEL's TCN-04, vide ref. no. PSER:SCT:BRM-M1266:TCN-04 dated 25/01/2012.
	7.0	Other References,if any.

With reference to above, following points, relevant to tender, may please be noted and complied with while submitting the offer.

- 1) Revised Pre-Qualification criteria attached herewith, superseding earlier PQ criteria (Annexure-1) along with NIT.
- 2) **BOQ cum price schedule format VOL-III A, PRICE SCHEDULE, REV-0** has been revised as **VOL-III A-PRICE SCHEDULE, REV-01** which is enclosed herewith. As such you are requested to consider the revised BOQ/price schedule only and quote your price accordingly. Offer from bidders in superseded price schedule (Vol-III, REV-0) shall not be considered. Bidders are also requested to submit a declaration in techno-commercial offer that they have submitted their price bid in sealed envelope as per **REVISED price schedule format (VOL-III A , PRICE SCHEDULE , REV-01)**.
- 3) Revised Volume-IC (Rev-01)-(Special Conditions of Contract-Supply) , superseding Volume-IC issued earlier along with NIT.
- 4) Revised Volume-II (Rev-01)-(Tech. Spec.) , superseding Volume-II issued earlier along with NIT.

Bidders are requested to note that Evaluation of offer shall be based on revised PQ criteria.

Bidder/s are requested to submit their offer by **05/03/2012** at 1400 hrs. Revised 'No deviation certificate' is attached. Bidder to submit 'No deviation certificate' as per attached Format only.

All other terms & conditions shall remain unchanged

Thanking you,

Yours faithfully,
for BHARAT HEAVY ELECTRICALS LTD

ENGINEER (SCT)

पावर सेक्टर पूर्वी क्षेत्र (मुख्यालय)

POWER SECTOR EASTERN REGION, DJ-9/1, SALT LAKE CITY, KOLKATA - 700 091

फैक्स/Fax : (033) 23211960

फोन/Phone : बोर्ड/EPABX : 23211798/ 1691

Encl:

- 1.0 Revised Format of 'No deviation certificate'.
- 2.0 Revised Pre-Qualification criteria- PQ .
- 3.0 Revised BOQ cum price schedule format VOL-III.A.
- 4.0 Revised Volume-IC
- 5.0 Revised Volume-II

पावर सेक्टर पूर्वी क्षेत्र (मुख्यालय)

POWER SECTOR EASTERN REGION, DJ-9/1, SALT LAKE CITY, KOLKATA - 700 091

फैक्स/Fax : (033) 23211960 फोन/Phone : बोर्ड/EPABX : 23211798/ 1691

FORMAT FOR NO DEVIATION CERTIFICATE
(To be submitted in the bidder's letter head)

BHARAT HEAVY ELECTRICALS LIMITED,
Power Sector - Eastern Region,
Plot no 9/1, DJ Block, Sector – II, Salt Lake City,
Kolkata – 700 091

Sub	No Deviation Certificate.	
Job	Design, engineering, manufacturing, supply, Testing, commissioning etc of TG hall EOT Crane for 2x250 MW BARAUNI Extension Project unit # 8 & 9 at BEGUSARAI, BIHAR.	
Ref	1.0	Tender no PSER:SCT:BRM-M1266:11
	2.0	BHEL's NIT, vide ref no: PSER:SCT:BRM-M1266:2586 dated 14/11/2011
	3.0	BHEL's TCN-01 vide ref. no. PSER:SCT:BRM-M1266:TCN-01 dated 05/12/2011
	4.0	BHEL's TCN-02 vide ref. no. PSER:SCT:BRM-M1266:TCN-02 dated 19/12/2011
	5.0	BHEL's TCN-03 vide ref. no. PSER:SCT:BRM-M1266:TCN-03 dated 05/01/2012
	6.0	BHEL's TCN-04 vide ref. no. PSER:SCT:BRM-M1266:TCN-04 dated 25/01/2012
	7.0	BHEL's TCN-05 vide ref. no. PSER:SCT:BRM-M1266:TCN-05 dated 10/02/2012

Dear Sirs,

With reference to above, this is to confirm that as per tender conditions, we have visited site before submission of our offer and noted the job content & site conditions etc. We also confirm that we have not changed/ modified the tender documents as appeared in the website/ issued by you and in case of such observance at any stage, it shall be treated as null and void.

We hereby confirm that we have not taken any deviation from tender clauses together with other references as enumerated in the above referred NIT. We hereby confirm our unqualified acceptance to all terms & conditions, unqualified compliance to technical specification, Integrity Pact (If applicable) and acceptance to reverse auctioning process.

In the event of observance of any deviation in any part of our offer at a later date whether implicit or explicit, the deviations shall stand null & void.

We confirm to have submitted offer in accordance with tender instructions and as per aforesaid references.

Thanking you,

Yours faithfully,

(Signature, date & seal of authorized
representative of the bidder)

पावर सेक्टर पूर्वी क्षेत्र (मुख्यालय)

POWER SECTOR EASTERN REGION, DJ-9/1, SALT LAKE CITY, KOLKATA - 700 091

फैक्स/Fax : (033) 23211960 फोन/Phone : बोर्ड/EPABX : 23211798/ 1691

PRE-QUALIFYING CRITERIA

JOB	Design, Engineering, Manufacturing, Supply, Erection, Testing, Commissioning including Operation & Maintenance etc of TG hall EOT Crane for 2x250 MW Barauni Extension project unit # 8 & 9 at Begusarai, Bihar.
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SL NO	CRITERIA	REFERENCE ANNEXURE NO OF SUPPORTING DOCUMENT
1.0	BIDDERS SHOULD HAVE AVERAGE ANNUAL TURNOVER OF MINIMUM Rs 119.40 LACS IN LAST 3 (THREE) FINANCIAL YEARS, ENDING ON 31-03-2011. AUDITED FINANCIAL STATEMENTS OF THE COMPANY NEED TO BE SUBMITTED FOR LAST 3 (THREE) FINANCIAL YEARS, ENDING ON 31-03-2011 IN SUPPORT OF THIS REQUIREMENT. IN CASE AUDITED FINANCIAL STATEMENTS HAVE NOT BEEN SUBMITTED BY THE BIDDERS FOR ALL THREE YEARS INDICATED ABOVE THEN APPLICABLE AUDITED STATEMENTS SUBMITTED BY THE BIDDERS AGAINST REQUISITE 3 YEARS WILL BE AVERAGED FOR 3 YEARS.	
2.0	VENDOR SHOULD HAVE EXECUTED FOLLOWING WORK IN POWER PLANT/STEEL/CEMENT/FERTILIZER/ANY OTHER INDUSTRY, DURING LAST SEVEN YEARS ENDING ON LAST DATE OF BID SUBMISSION. DESIGN, ENGINEERING, MANUFACTURE, SUPPLY, ERECTION & COMMISSIONING OF AT LEAST 2 (TWO) ORDERS OF DOUBLE GIRDER EOT CRANE HAVING CAPACITY OF 100T OR MORE WITH SPAN OF 25 METERS OR MORE AND THE CRANE AGAINST EACH ORDERS MUST BE IN SUCCESSFUL OPERATION FOR ATLEAST 2 (TWO) YEARS AND THE VENDOR MUST BE OEM SUPPLIER OF THE MAIN CRANE. RELEVANT SUPPORTING DOCUMENT SHALL BE SUBMITTED.	
3.0	BIDDER SHOULD HAVE VALID PAN. RELEVANT SUPPORTING DOCUMENT SHALL BE SUBMITTED.	
4.0	NO CONSORTIUM BIDDING IS ALLOWED FOR THIS TENDER.	

NOTE

1.0	AFTER SATISFACTORY FULFILLMENT OF ALL THE ABOVE CRITERIA, OFFER SHALL BE CONSIDERED FOR FURTHER EVALUATION AS PER NIT AND ALL OTHER TERMS OF THE TENDER.
2.0	CONSIDERATION OF OFFER WILL BE SUBJECT TO CUSTOMER'S APPROVAL OF BIDDER.
3.0	BIDDER(S) ALREADY REGISTERED WITH BHEL-PEM FOR SUBJECT PACKAGE, NEED NOT SUBMIT CREDENTIALS FOR PRE-QUALIFYING CRITERIA INDICATED IN SL NO. 2.0 ABOVE. HOWEVER, THEY MUST SUBMIT THE RELEVANT DOCUMENTS AS THE PROOF OF THEIR REGISTRATION WITH BHEL-PEM FOR SUBJECT PACKAGE.

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The special conditions of contract (SCC) inscribed hereunder shall be read and construed along with general conditions of contract (GCC) and in case of any conflict or inconsistency, the provision of the SCC shall prevail.

CLAUSE NO	DESCRIPTION
1.0	NAME OF WORK
	The scope covers design, engineering, manufacturing, inspection, testing at manufacturer's/ vendor's/ sub-vendor's works proper packing, transportation to site including freight, delivery, supply of special tools & tackles for maintenance, start-up & commissioning spares, consumables, as required for total scope defined in technical specification along with other document of TG hall EOT Crane Package for 2x250 MW units at BARAUNI Extension Project,u#8 & 9 at Begusarai,BIHAR..
2.0	BROAD SCOPE OF WORK
2.1	The work to be done under this specification (Part-1) comprises of design, engineering, manufacturing, assembly, inspection, testing at manufacturer's/sub-vendor's works, painting, proper packing, transportation, delivery, handing over at site of equipments as stated above & detailed in the specification under Volume II and elsewhere in the tender document.
2.2	Splitting up of supply contract into two supply contracts one for Indian supply and other for the foreign supply would not be entertained.
2.3	The Scope of work broadly covers as per specification under Vol. II & elsewhere in the document but shall not be limited to the following:
2.3.1	Detail design of all equipments & sub-system and work as per specification.
2.3.2	Preparing the manufacturing quality plan.
2.3.3	Complete manufacturing of all the equipments/sub-system including shop, field testing and assembly as per specification.
2.3.4	Providing special tools & tackles and services necessary for the satisfactory execution of the contract.
2.3.5	Providing requisite sets (both hard & soft copy) of engineering drawings, RTF, data, operation & Maintenance manual, As built drg, Plant Handbook, Storage, Preservation & Painting Manual, Erection Manual etc. as specified elsewhere in this tender.
2.3.6	Arranging inspection of equipments and accessories etc. at manufacturer's/sub vendor's premises.
2.3.7	Packing & transportation of the goods from the manufacturer's works/sub vendor's works.
2.3.8	Any equipments not specified here but required to make the equipments complete shall be under the scope of the Vendor.
2.3.9	Providing preventive routine maintenance schedule of the equipment / sub-system.
2.3.10	Transportation of materials on FOR destination/site basis and door delivery of materials at site.
2.3.11	Preparing the schedules and furnishing progress report in requisite mode and number.
3.0	SITE VISIT
	Contractor should visit site and acquire full knowledge & information about site conditions prevailing at site and in & around the plant premises together with all the statutory, obligatory, mandatory requirements of various authorities before submission of the bid.
4.0	PROJECT MANAGEMENT
	To meet the need of project management, contractor shall provide the following services within quoted/ accepted prices.
4.1	PLANNING & MONITORING
4.1.1	The contractor shall prepare L1 schedule/ network of Engineering, manufacturing, testing, and procurement of sub-vendor items, as per completion schedule given in this document. This network must conform to the overall project schedule.
4.1.2	Based on L1 network the contractor will prepare L2 network which will indicate

	exhaustive list of activities of Engineering, procurement of raw materials, manufacturing, testing, procurement of sub-vendor items, and despatch as per completion schedule given in this document. This network must include all milestone and key activities for each subsystems/components in the areas of engineering (wherever applicable), procurement, manufacture (wherever applicable), dispatch, erection/ commissioning.
4.1.3	Based on L2 network the contractor will develop L3 network, which will indicate micro details of each activity of L2 network and also show customer/BHEL hold points, responsibility of the customers/BHEL and contractor.
4.1.4	Above schedules are to be preferably made in PRIMAVERA, so that the same is compatible with BHEL's project management software.
4.1.5	Above schedules/ networks would be submitted to BHEL sequentially by the contractor within 15 days from date of LOI and finalised within a month.
4.2	PROGRESS REPORTING
4.2.1	The contractor shall prepare and submit to BHEL monthly progress report indicating progress on key activities, management summary for critical activities, list of actions requiring attention of BHEL in floppies/ CD (compatible to BHEL software) and also in requisite number of hard copies. The input & output data for all such schedule shall be furnished to BHEL in a manner compatible with BHEL software available at site. A copy of the progress report must be submitted to Project Manager/ Kolkata latest by 7 th of every month covering the detailed progress achieved in the previous month.
4.2.2	The progress report shall indicate the progress achieved against planned with reasons indicating delays, if any, and shall give the remedial actions which the contractor intends to take to make good the slippage or lost time, so that further works again proceed as per the original program and the slippage's do not accumulate and effect the overall program.
4.2.3	Weekly progress review meetings will be held at site during which actual progress during the week vis-à-vis scheduled program shall be discussed or actions to be taken for achieving targets. The program of subsequent week shall also be presented by contractor for discussions. The contractor shall constantly update/revise his work program to meet the overall requirement.
4.2.4	Periodic progress reviews on the entire activities of execution in respect of supply and works in scope of bidder will be held once in a month at Kolkata/site. These meetings will be attended by reasonably higher officials of the contractor and will be used as a forum for discussing all areas where progress needs to be speeded up. The contractor shall be further responsible for ensuring that suitable steps are taken to meet various targets decided upon such meetings.
4.2.5	Still colour photography (matt paper, post card size, max 10 nos, 3 copies each, per month for the entire contract execution period) depicting progress of the work, damage to the machine parts, if any, as directed by BHEL site engineer is to be arranged by the successful bidder at his own cost.
4.2.6	Successful bidder has to provide electronic/ computerized storing and re-production/ printing/ plotting of various data, log sheets, protocols, measurements etc. These may be stored in virus free floppies (1.44 MB) & handed over to BHEL as per requirement.
4.2.7	Other provisions of Volume-IA of this tender would be applicable.
5.0	SERVICES TO BE RENDERED BY THE VENDOR
5.1	Services for complete engineering, coordination and project management as detailed elsewhere in this tender.
5.2	Services for shop test, quality assurance, as detailed elsewhere in this tender.
5.3	Supply of main equipment along with other items as per specification maintaining sequential dispatch.
5.4	Supply of first fill of lubricants for all equipment including second fill/ replenishment as necessary after commissioning till handing over of the plant/ equipment
5.5	Furnishing of all document, drawing, design basis, reports, instruction manuals, etc including "As Built Drawing".
5.6	Furnishing preservation schedule with all details of preservation method and preservatives required storing.

5.7	DOCUMENTS
5.7.1	The contractor shall furnish 15 (fifteen) sets of approved drawing & documents 6 months prior to commissioning.
5.7.2	The contractor shall furnish 15 (fifteen) sets of "operation & maintenance manuals" 3 months prior to commissioning.
5.7.3	The contractor shall furnish 15 (fifteen) sets of "Plant Handbook covering design, performance data, P&IDs, SLDs, flow charts, sequence, protection & Interlock Scheme, alarm & trip valves, performance curves, GA & Layout drawings, important Do's and Donot's" etc 3 months prior to commissioning.
5.7.4	The contractor shall furnish 15 (fifteen) sets of as-built drawing along with 4 copies of CD ROM.
5.7.5	The contractor shall furnish 15 (fifteen) sets of "storage, preservation & painting manual".
6.0	COMMUNICATION
	The contractor shall be responsible for arranging all communication facilities for himself at office. The contractor has to establish independent internet/e-mail facilities with mobile connection for all key site personnel and same shall have to be integrated with BHEL's voice/data network and database systems at site. The contractor's office must have facilities of communications like Fax, E-mail, and Telephone with STD facility etc.
7.0	GENERAL TECHNICAL REQUIREMENTS (CODES AND STANDARDS)
7.1	Except where otherwise specified, the plant/equipment shall comply with the appropriate Indian Standard or an agreed internationally accepted Standard Specification as mentioned elsewhere in contract 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 BHEL to identify all of the plant/equipment in the same detail as would be possible had there been a Standard Specification.
7.2	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.
7.3	In the event of any conflict between the codes & standards referred above, and requirements of this specification, the requirements which are more stringent shall govern.
7.4	Wherever specified or required the Plant/ equipment shall conform to various statutory regulation such as Indian Boiler Regulation, Indian Electricity Rules, Indian Explosive Act, Factories Act etc. wherever required, obtaining approval for Plant/Equipment supplied under the specification from statutory authorities shall be the responsibility of the contractor.
8.0	ENGINEERING SERVICES
	As part of the overall project management activity, the contractor shall be responsible for proper engineering and coordination activities during various phases of execution of the contract. The contractor shall identify one Engineering Manger with whom BHEL will interact on all matters on coordination between BHEL and the contactors. The Engineering Manager shall be the single point contact person on behalf of the contractor and shall be responsible for all engineering co ordination.
9.0	INSURANCE
9.1	BHEL shall arrange comprehensive MCE (marine cum erection) Insurance Policy for total project supply & services including balance of plant package covering transit risks & loss, destruction or damage during handling at Site, Storage, civil works, erection, testing and commissioning up to trial operation completion of each unit including theft, sabotage, fire, lightning and other natural calamities.
9.2	Contractor shall timely intimate despatches to the underwriter. The name of the underwriter and Policy No. shall be intimated in due course of time.
9.3	Contractor shall report to BHEL in writing any damages to equipments/components on receipt, storing and during withdrawal of the materials from stores, in transit to site and unloading at place of work and during erection and commissioning till trial operation completion. The above report shall be as prescribed by BHEL site management. Any consequential loss arising out of non-compliance of this stipulation will be borne by contractor.

9.4	The contractor will take necessary precautions/ due care to protect the material at Project site, while in his custody from any damage/ loss till the same is taken over by BHEL or customer at Project site. For lodging/ processing of insurance claim the contractor will submit necessary documents. BHEL will reserve the right to recover the loss from the contractor as detailed below in case the damage/loss is due to negligence/ carelessness on the part of the contractor. In case of theft of material under contractor's custody, the same shall be reported to police by the contractor immediately, and copy of FIR and subsequently police investigation report shall be submitted to BHEL/ customer for taking up with insurance. However this will not relieve the contractor of his contractual obligation for the material in his custody.
9.5	In case the claim is summarily rejected by the underwriters due to wilful negligence of the contractor, the entire cost of repair/ replacement will be recovered from the contractor.
9.6	It will be responsibility of contractor to replenish the items lost/ damaged in time without hampering the schedule of work and without waiting for settlement of insurance claim. Amount received from the underwriters on settlement of insurance claim shall be passed on to the contractor as and when available.
9.7	Other provisions of insurance are stipulated in Volume-IA of this tender (GCC).
10.0	TAXES AND DUTIES
10.1	EXCISE DUTY
10.1.1	Excise duty actually incurred by seller/ contractor on self manufactured items against the despatch made from his factory/ works constituting a sale under the order/ contract, alone shall be reimbursed at actual against requisite documentary evidence i.e. Original Excise Invoice .
10.1.1.1	The invoice cum Excise Duty gate pass (Excise Invoice) should contain the name of ultimate consignee as specified in the order/ contract.
10.1.1.2	No excise duty shall be payable by purchaser on inputs, bought out items, raw materials and components consigned directly to site from sources other than seller/ contractor's factory/ works.
10.1.1.3	The seller/ contractor is required to ensure that excise duty is properly calculated and paid and exemption and benefits are fully availed of.
10.1.1.4	Bidder to consider the benefit of CENVAT in their quoted basic price.
10.1.1.5	If the seller/ contractor claims/ obtains any refund of the excise duty paid and gets reimbursed, the same shall be refunded to the purchases immediately.
10.1.1.6	Excise duty shall be paid at actual. Additional excise duty due to statutory variation, if imposed after due date of submission of latest price offer and within contract period including extension, if any (provided reason for extension is not attributable to vendor), will be reimbursed at actual by BHEL.
10.1.1.7	No statutory variations shall be permissible beyond the contractual period.
10.2	CENTRAL SALES TAX
10.2.1	Central Sales tax shall be payable extra on submission of Tax Invoice, if the same is payable by the bidder to the respective Government Authorities meeting all statutory requirements and availing all exemption/ concessions under the Central Sales Tax Act, 1456. Bidder shall show CST separately in the Tax Invoice for inter-state sales at prevailing rate.
10.2.2	Sales tax on bought out items paid/ payable by bidder to the sub-vendors shall be borne by bidder and shall not be invoiced to / paid extra by BHEL.
10.2.3	BHEL proposes to make sale in transit as per Sec 6(2) (b) of the CST Act, 1456 where goods are moving inter-state. "C" Form shall be issued and exchanged against E-I/II Certificates based on quarterly transaction. The bidder is required to submit his request within 10 (ten) days from the end of the quarter in the specified format. No concessional forms shall be issued for goods moving within the state of West Bengal.
10.2.4	In order to obtain the benefit of Transit Sale exemption U/S 6(2), following mode of documentation shall be followed.
10.2.4.1	FOR SELF MANUFACTURED ITEMS OF VENDORS
	<i>In case of BOP, vendor's LR/ RR/ GR/ CN must the bear the name of BHEL as 'Consignee'. BHEL will endorse the following words on the back of dispatch documents, ie LR/ RR/ GR/ CN prior to the date of receipt of materials by BHEL at</i>

	<p>site, ie after movement commences and before it terminate.</p> <p><i>'Please deliver the goods to (State customer's name & address), (State customer's CST No).'</i></p> <p>Name of authorized signatory of BHEL's MM department: _____</p> <p>Date: _____</p> <p>Signature: _____</p>
10.2.4.2	FOR BOUGHT-OUT ITEMS OF VENDORS:
10.2.4.2.1	STEP-1
	<p>Sub-vendors' LR/ RR/ GR/ CN must the bear the name of vendor as <i>'Consignee'</i>. Vendor must endorse the following words on the back of 6uthoriz documents, ie LR/ RR/ GR/ CN prior to the date of receipt of materials by vendor, ie after movement commences and before it terminates.</p> <p><i>'Please deliver the goods to (State BHEL's site's name & address), (State BHEL's CST No-).'</i></p> <p>Name of authorized signatory of vendor: _____</p> <p>Date: _____</p> <p>Signature: _____</p>
10.2.4.2.2	STEP-2:
	<p>BHEL must endorse the following words on the back of 6uthoriz documents, ie LR/ RR/ GR/ CN prior to the date of receipt of materials by BHEL at site, ie after movement commences and before it terminates.</p> <p><i>'Please deliver the goods to (State customer's name & address), (State customer's CST No).'</i></p> <p>Name of authorized signatory of BHEL's MM department: _____</p> <p>Date: _____</p> <p>Signature: _____</p>
	NOTE
10.2.5	Original Excise Invoice must be in the name of project (E.S.E(Project) AT+PO-Barauni Thermal Power station, District:-Begusarai,PIN:-- 851116) , A/C BHEL for self manufactured items.
10.2.6	Original Excise Invoice must be in the name of project (E.S.E(Project) AT+PO-Barauni Thermal Power station, District:-Begusarai,PIN:-- 851116) , A/C Vendor, A/C BHEL for bought out items.
10.3	VALUE ADDED TAX
10.3.1	Contractor has to obtain Tax Clearance Certificate from the prescribed Authority in terms of SEC 42 OF BIHAR VALUE ADDED TAX ACT, 2005 read with Rule 28 of BIHAR VALUE ADDED TAX Rule , 2005 before issue of W.O to Contractor.
10.3.2	The bidder must be registered with the sales tax authority in the state of BIHAR for supply from the state of BIHAR . The bidder must produce copy of the Registration Certificate issued by the Sales Tax Authority. The bidder must issue "TAX INVOICE" showing VAT charged separately in case of supply from the State of BIHAR .
10.3.3	Bidder to consider the benefit of Input Credit of VAT in their offer.
	VAT shall be payable extra, on all items supplied from Bihar on submission of Tax

	Invoice & as per tariff applicable, if the same is payable by bidder to the respective Government authorities meeting all statutory requirements and availing all exemption/ concessions under the BIHAR Value Added Tax Act, 2005. The tax invoice pertaining to supplies made in a quarter must be presented within that quarter so as to enable BHEL to take input credit within that quarter. If BHEL is denied of the benefit of Input Credit due to late/ non submission of "TAX INVOICE", VAT shall not be paid at all.
10.3.4	BHEL is registered with Sales Tax authority in the state of BIHAR under the BIHAR Value Added Tax Act, 2005 having the Registration Certificate No. 10140432028
10.4	COMMON FOR CST AND VAT
10.4.1	Any variation on CST/ VAT, if imposed subsequent to latest due date of offer submission, as per NIT & TCN, as applicable, by statutory authority within the contract period including extension, if any (provided reason for extension is not attributable to vendor), shall be paid by BHEL on production of relevant supporting document to the satisfaction of BHEL.
10.5	CUSTOMS DUTY
10.5.1	Customs Duty element for imported items shall be included in basic prices. No variation in customs duty and exchange rate for imported items shall be payable by purchaser.
10.5.2	Seller/ contractor shall arrange for his own import license, if required, since purchaser will not provide any import license since purchaser will not provide any import license. Therefore, seller/ contractor alone shall be responsible for any delay in getting import license or non-availability of the same or completion of other related formalities. Purchaser shall not be responsible for any financial liability, whatsoever, on this account.
10.6	DIRECT TAX
	Purchaser shall not be liable towards income tax of whatever nature including variations thereof, arising out of this order/ contract, as well as tax liability of the seller/ contractor and his personnel.
10.7	ENTRY TAX :
10.7.1	Entry Tax: Contractor has to get Entry Tax Registration Certificate from Local Sales Tax Authority and has to pay Entry Tax on the Import Value for bringing scheduled goods to local area of Barauni for use, sale & consumption for this Project / Purchase Order . Entry Tax paid Challan / Invoice Copy shall be made available to BHEL-Site Finance on a monthly basis.
10.7.2	Entry tax shall be reimbursed by BHEL on Purchase/Import Value of the Scheduled Goods as per Entry Tax Act, paid by the vendor purchased inter-state or intrastate but not for any materials purchased from Barauni Local Area.
10.7.3	New tax & duties, if imposed subsequent to latest due date of offer submission, as per NIT & TCN, as applicable, by statutory authority after due date of submission of latest price offer and within the contract period including extension, if any (provided reason for extension is not attributable to vendor), shall be reimbursed by BHEL at actual on production of relevant supporting document to the satisfaction of BHEL. However, the vendor shall obtain prior approval from BHEL before depositing new taxes & duties.
11.0	COMPLETION PERIOD
	The contractor shall supply entire materials of crane along with materials for common system in such manner that supply will be completed within 8(Eight)months from the date of LOI.
12.0	SCHEDULE OF SUPPLY
	The contractor shall furnish the L-1, L-2/ L-3 schedule indicating break-up of supply of various items under this specification within the stipulated completion period.
13.0	MOBILISATION ADVANCE
	No mobilisation advance shall be given for this contract.
14.0	SECURITY DEPOSIT
	Security deposit for this part of specification shall be governed by the provision of GCC, Volume-IA. Alternately, bidder may submit bank guarantee equivalent to 100 % of security deposit amount.
15.0	PERFORMANCE BOND

	Performance bond for this part of specification shall be governed by the provision of GCC, Volume-IA.
16.0	PAYMENT TERMS
16.1	For all items of work as per rate schedule of main supply, payment shall be made as per following break-up of basic price.
16.1.1	5 % of basic price of materials on submission and approval of all basic design documents such as data sheets / drawings, quality plans etc. as per tender spec.
16.1.2	75 % of basic price of materials supplied along with 100 % ED & ST (as applicable) against dispatch document on prorata dispatch of material to site as per approved billing schedule. Documents (required sets) required, as applicable, for such payment are as follows.
16.1.2.1	Invoice/ excisable invoice in original.
16.1.2.2	LR / RR (consignee copy).
16.1.2.3	Packing list.
16.1.2.4	BHEL/ customer MDCC enclosing QS note, inspection & test certificate, wherever applicable.
16.1.2.5	Copy of letter, addressed to insurance company intimating dispatch.
16.1.3	10 % of basic price of materials received along with 100% freight & others, against Material Receipt Certificate (MRC) issued after receipt of materials and its physical verification at site on prorata basis. Collection of MRC from the site and its submission for claiming the payment shall be bidder's responsibility.
16.1.4	5 % of the basic price shall be released against supply completion, commissioning and trial run of the complete package.
16.1.5	5 % of basic price shall be released against (i) successful completion of PG (Performance Guarantee) test/ demonstration test of the system/ package, as applicable; (ii) submission of final documents, eg as-built drawings, O&M manual etc; (iii) handing over of the system/ package to the owner and (iv) on submission of BG of equivalent amount valid till completion of guarantee/ warranty period. However, bidder have to fulfil all formalities for final billing/ contract closing prior to drawing this payment.
16.2	Payment shall be made by BHEL site office within 30 days of receipt of invoice subject to its completeness in all respects as per BHEL's procedure. All admissible recovered/ adjustments etc shall be made from the interim payable amount. BHEL may release payment through electronic mode, for which bidder shall comply with necessary requirement.
16.3	Detail billing schedule for 'Supply' shall be submitted by the successful vendor to BHEL for approval within 60-days of LOI.
16.4	BHEL, at discretion, may further split up the above percentages and effect payment to suit the site condition, cash flow requirement, according to the progress of work.
16.5	Payment of supply bills against dispatch documents through bank, shall be admissible subject to compliance of relevant clauses of this tender.
16.6	No bills including RA bills will be paid to individual consortium partners in case of consortium arrangement.
17.0	ESCALATION/ PVC
	Bidder's quoted rates/ price for supply part of the contract shall remain firm throughout the contract including extension, if any, for any reason whatsoever and no escalation is admissible for this contract.
18.0	REVISION ON ACCEPTED CONTRACT RATE
	No revision of rate shall be applicable in the event the completion period is extended for any reason whatsoever.
19.0	GUARANTEE
19.1	The contractor shall warrant that the equipment will be new and in accordance with the contract documents and free from defects arising due to deficiencies in design and engineering and from defects in material and workmanship for a period of twelve (12) calendar months commencing immediately upon the satisfactory completion of trial operations and handing over. The equipment shall operate satisfactorily and reliably and the performance and efficiency of the equipment (s) shall not be less than the respective guaranteed values.
19.2	Other provision shall be as per the GCC.

20.0	LIQUIDATED DAMAGES
	Subject to force majeure, if contractor fails to supply all required materials/ equipments (stores) as per aforesaid completion period, BHEL shall have the right to recover as liquidated damages (LD) a sum equivalent to 0.25 % (quarter percent) of the contract price, including taxes and duties, of each unit (supply part of the price schedule) for delay of each week or part thereof. The liability for delay shall not in any case exceed 5 % (five percent) of the contract price, including taxes and duties, of each unit (supply part of the price schedule) where the contract price for each unit shall be considered as 50 % of the total contract price including taxes and duties (Supply part of the price schedule).
20.1	BHEL shall deduct the amount of such compensation from any money due or which may become due to the contractor and/or recover such compensation from the bank guarantees / security deposit of the contractor. To be entitled to impose such compensation, BHEL will not be required to prove that he has incurred such amount as actual damage.
20.2	BHEL reserve the right to purchase from elsewhere on account of and at the risk & cost of the contractor without notice to the contractor of the equipment/ materials not so delivered, without canceling the order/ contract in respect of the equipment/ materials not yet due for delivery.
20.3	BHEL reserve the right to cancel the order / contract or a portion thereof for the stores not so delivered at the risk & cost of the contractor and the contractor shall be liable to BHEL for any excess costs thereof.
20.4	The contractor shall continue the performance of the order/ contract under all circumstances, to the extent not cancelled.
20.5	Where action is taken as per above, the contractor shall be liable for any loss, which BHEL may sustain on that account. The contractor shall not be entitled to any gain on such purchase and the manner and the method of such purchase shall be at the discretion of BHEL. It shall not be obligatory on any part of BHEL to serve a notice of such purchase on contractor.
21.0	MATERIAL DESPATCH CLEARANCE CERIFICATE (MDCC)
21.1	MDCC shall be issued by BHEL/ owner or their authorized representative prior to dispatch. In case the tests are not witnessed by BHEL/ owner's representative, the test certificates shall be submitted to owner through BHEL and MDCC will be issued thereafter.
21.2	Copy of MDCC and other dispatch document shall accompany with every dispatch, failing which the consignment shall not be allowed to enter the project premises.
22.0	MATERIAL RECEIPT CERTIFICATE (MRC)
	MRC shall be issued by BHEL/ owner or their authorized representative after the material is received at site in good condition.
23.0	CONSIGNEE
	E.S.E(Project) AT+PO-Barauni Thermal Power station, District:- Begusarai, PIN:-- 851116
24.0	DESPATCH
23.1	All materials/ plants/ equipments shall be transported by road including ODC consignment. Despatch shall only be made after inspection and issue of MDCC by BHEL/ owner. Advance information by fax/ courier of despatch details shall be sent to Construction Manager, BHEL.
24.2	No consignment shall be dispatched on SELF basis. Material shall be despatched prepaid, door delivery basis, else ensure the clearance and collection of goods from lorry go down and arrangement to transport the same to site store shall be in the scope of vendor.
24.3	Each package should carry the packing slip / details of contents and should be put inside a metal enclosure, properly fixed to the packing from outside. The packing shall be such as to ensure prevention of damage, corrosion, pilferage, deterioration, loss in transit or storage and road-worthy.
24.4	The title of the ownership of goods to be supplied shall pass on to the owner on dispatch ex works/ FOR destination. However till the scope is completed in all

	respect and the plant / equipment is taken over by the owner the goods shall remain with the custody of the bidder.
25.0	BANKER The address of banker for negotiation of documents is. State Bank of India, NS Road, Kolkata – 700 001 Or shall be as per intimation given by BHEL on a later date.
26.0	BANK CHARGES
26.1	All bank charges for negotiation of documents through bank shall be to the account of the seller/ contractor.
26.2	No interest, whatsoever, shall be payable by purchaser on the security deposit, any bank guarantee submitted or any amount due to the seller/contractor.
27.0	PAYING AUTHORITY
	Construction Manager, BHEL site office 2 X250 MW Barauni TPS extension project Barauni TPS, P.O. BTPS Dist. Begusarai Bihar - 851116
27.4	Any change of above shall be intimated to the contractor accordingly.
28.0	APPROVED MANUFACTURER / SUB-VENDOR For other bought out items, bidder have to adhere to the list of sub-vendors, indicated elsewhere in the technical specification, Volume-II.
29.0	INSPECTION & JOINT VERIFICATION (AT CONTRACTOR'S WORKS) Prior to dispatch, the materials would be offered by the contractor for joint inspection at the contractor's works as detailed in this tender specification for which the contractor would serve the advance notice of 15 days for inspection call to BHEL.
30.0	INSPECTION & JOINT VERIFICATION (AT SITE) The contractor shall be intimated within 7 days from the date of receipt of each consignment at site to depute their representative for joint inspection and verification of the equipment/ materials received at site. The contractor shall depute their representative within 7 days from receipt of such intimation failing which BHEL shall proceed with the inspection and verification of equipment/materials and BHEL's decision in this regard shall be final and binding to the contractor.
31.0	QUALITY PLAN The bidder shall furnish the quality assurance plan which would be approved by BHEL/ owner.
32.0	QUALITY ASSURANCE PROGRAMME To ensure that the equipment & services under the scope of the contract whether manufactured/performed at contractor's works or at his subcontractor's premises or at any other place of work are in accordance with the specifications the contractor shall adopt suitable quality assurance programme to control activities as necessary. such programme shall be outlined by the contractor and shall be finally accepted by BHEL/ owner /authorised representative. A quality assurance programme of the contractor shall generally cover the following.
32.1	The organization structure and qualification data of key personnel for the management and implementation of the proposed quality assurance programme.
32.2	System for site erection control including process controls and fabrication and assembly controls.
32.3	The procedure for purchase of materials, parts, components and selection of subcontractor's service including vendor analysis, source inspection, incoming raw material inspection, verification of materials purchased etc.
32.4	System for shop manufacturing and site erection control including process control, fabrication and assembly controls.
32.5	Control of non-conforming items and system for corrective actions.
32.6	Inspection and test procedure for all site related works.

32.7	Control of calibration and testing of measuring and testing equipment.
32.8	System for quality audit.
32.9	System for indication and appraisal of inspection status.
32.10	System for authorizing release of manufactured product to BHEL.
32.11	System for handling storage and delivery.
32.12	System for maintenance of records.
32.13	Furnishing of Quality Plan for manufacturing and Field activities detailing out the specific quality control procedures adopted for controlling the quality characteristics relevant to each item of equipment /component.
33.0	GENERAL REQUIREMENTS - QUALITY ASSURANCE
33.1	All materials, components and equipment covered under this specification shall be procured, manufactured, 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 responsibility of the contractor to draw up and implement such programme duly approved by BHEL. The detailed quality plan for manufacturing should be drawn up by the bidder and will be submitted to BHEL for approval.
33.2	Manufacturing Quality plans will detail out for all the equipment and components, various tests/inspection to be carried out as per requirement of this specification and standards mentioned therein and the quality practices and procedures etc to be followed by the contractor's quality control organization during various stages of materials procurement, manufacturing, assembly and final testing /performance testing.
33.3	The bidder shall furnish the copies of the reference documents/ plant standards/ acceptance norms/ tests and inspection procedures etc as referred in Quality Plans along with Quality Plan. These Quality Plans and reference documents /standards etc will be subject to BHEL/ owner's approval without which manufacturing will not proceed. These approved documents will form part of the contract. In these approved Quality Plans BHEL/ authorised representative shall identify customer hold points, test/ checks which shall be carried out in presence of BHEL/ owner's representative and beyond which work will not proceed without consent of BHEL/ owner. All deviations to the specifications, approved Quality Plan and Applicable standards must be documented and referred to BHEL for approval & disposition.
33.4	Quality audit/ approval of the results of tests and inspection will not prejudice the right of BHEL 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.
33.5	Repair/ rectification procedures to be adopted to make any job acceptable shall be subject to the approval of BHEL/ owner.
34.0	QUALITY ASSURANCE DOCUMENTS
34.1	The contractor shall be required to submit the following Quality Assurance Documents within 2 weeks after dispatch of the equipment.
34.1.1	Test report of components.
34.1.2	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.
34.1.3	Non destructive examination results/ reports including radiography interpretation reports.
34.1.4	Welder identification list listing welder's and welding operator's qualification procedures and welding identification symbols.
34.1.5	Sketches and drawings used for indicating methods of traceability of the radiographs to the location of the equipment.
34.1.6	Stress relief time temperature charts.
34.1.7	Factory test results for testing required as per applicable codes and standards referred to in the specification.
34.1.8	Inspection Report duly signed by QA Personnel of BHEL and contractor for the agreed inspection hold points .During course of inspection the following will also be recorded.

34.1.8.1	When some important work repair work is involved to make the job acceptable.
34.1.8.2	The repair work remain part of the accepted product quality .
34.1.8.3	Letter of conformity certifying that that requirement is in compliance with finalised specification requirements.
35.0	INSPECTION, TESTING AND INSPECTION CERTIFICATES
35.1	The Engineer, his duly authorised representative and/ or an outside inspection agency acting on behalf of BHEL/ owner shall have access at all reasonable times to inspect and examine the materials and workmanship of the works during its manufacture 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 contractor's own premises or works. Necessary arrangement for carrying out inspection including supply of labour, IMTEs, area illumination and scaffolding, if required will be contractor's responsibility and same has to be carried out within the quoted price.
35.2	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 will be made for each 3 consecutive months and shall be furnished before beginning of each calendar month.
35.3	Before any plant/equipment leaves the place of manufacture BHEL shall be given the option of witnessing inspections inspections and tests for compliance with the specifications and related standards. The contractor shall give the Engineer/Inspector 15 days written notice of any material being ready for testing .Such test shall be to the contractor's account except for the expenses of the Inspector .The Engineer/Inspector ,unless the inspection is waived will attend such tests within 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 copies of test reports.
35.4	The Engineer or Inspector shall within 15 days from the date of inspection as defined herein give notice to the contractor of any objection wrt drawing/ equipment/ workmanship which in his opinion not in accordance with the specification/ contract. The contractor shall either make modification as may be necessary to meet the said objection or explain to the engineer/ inspector giving reasons that no modifications are necessary to comply with the contract.
35.5	When the factory tests have been completed at the contractor's or subcontractor's works, the engineer or Inspector shall issue a certificate to this effect within reasonable time after completion of tests but if the tests are not witnessed by the engineer or Inspector the certificate shall be issued within 15 days of the receipt of contractor's test certificate by the engineer Inspector. The completion of these tests or the issue of the certificates shall not bind BHEL to accept the equipment should it on further tests after erection be found not to comply with the contract.
35.6	In all cases where the contractor provides the tests at the premises of the contractor or any subcontractor, 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 to carry out effectively such tests on the equipment in accordance with the contract and shall give facilities to the Engineer/Inspector to accomplish testing.
36.0	OPERATING MANUAL AND MAINTENANCE INSTRUCTIONS
36.1	The contractor shall provide at least 6 months before the time of commissioning, all necessary operating & maintenance (O&M) manual. The O&M manual shall be submitted in the form of one reproducible original and 15 copies.
36.2	The information which shall be contained in loose stiff backed covers, shall include following in addition to whatever has been specified in Volume-II of this tender.
36.2.1	A complete inventory of all main items of plant/equipment with identification details.
36.2.2	A complete set of all drawings, schematics, data sheets, schedules etc.
36.2.3	Service Manuals for all plant and equipment giving full descriptions of the main items and auxiliary items.

36.2.4	A schedule of recommendations for routine maintenance of all equipment inspection point, information on detection, cause and rectification of troubles and faults.
36.2.5	A lubrication schedule with all necessary drawings.
36.2.6	Manufacturer's literature for all the self manufactured and bought out items.
36.3	Acceptance of O & M Manual is subject to approval of BHEL.
37.0	SPARES
37.1	This contract does not include supply of any spares for the maintenance of the Plant or equipment. The contractor shall submit their quotation for recommended spares for 3 years satisfactory operation, of their own make as well as recommended spares required for bought out items. The purchaser may place orders for supply of spares on the contractor separately on receipt of detailed quotation categorizing the spares as (1) fast moving, (2) medium moving and (3) slow moving spare parts. The unit prices of such individual parts shall be valid till completion of guarantee period.
37.2	The contractor shall give warranty that before going out of production of the spare-parts, he will give advance notice to purchaser/ owner so that purchaser/ owner order his requirement of spares in one lot if he so desires. The contractor shall further give guarantee that if he goes out of production of spare parts, then he will make available blue prints/ drawings of spare parts and specifications of materials at no cost to the purchaser/ owner, if required, by purchaser/ owner to enable him to fabricate or procure spare parts from other sources.
37.3	Commissioning/ start up spares which are required at any time during the equipment installation till commercial operation of the unit are included in the contract & shall be handed over by the supplier to the purchaser.
37.4	Each sub-supplier for bought out items shall provide a full spare parts package showing information for each part, component, assembly and consumable item for each parent equipment item. The package shall also include detailed drawings together with complete spare parts lists giving sizes, materials rating etc.
37.5	Spare parts Data package – each parent equipment item shall be listed by name, service, sub-suppliers sales order number, equipment plant tag no., manufacturer, model, size, serial no. and Contractors purchase order no. A full spare parts data package shall be submitted for each parent equipment item and shall clearly state which parent equipment it supports. Four hard as well as two soft copies of the complete spare parts data package for Contractors manufactured items /plant/equipment as well as sub-suppliers bought out items shall be furnished to the purchaser at least 3 months before the commissioning of the unit.
38.0	CONTRACT PRICE
38.1	Bidder shall quote their lumpsum & firm prices as per Volume-III, Price Schedule only.
39.0	PROJECT INFORMATION
	<p><u>Details of proposed stage/ units</u> Project name: BARAUNI THERMAL POWER PLANT -2x250 MW EXTENSION PROJECT No of units x capacity: 2 x 250 MW. Project setting up by: Bihar State Electricity Board (BSEB)</p> <p>Bihar State Electricity Board, hereafter referred to as BSEB, has awarded BHEL the job for establishing two numbers of coal fired of rating 250 MW each on Engineering, Procurement and Construction (EPC) package basis The units are proposed to be set up adjoining existing plant at Barauni Thermal Power Station, Extension unit 8 & 9 at district Begusarai in the state of Bihar, India. Project site is disposed at N25°23'13.5" to N N25°23'54"latitude and E 86°01'05" to 86°01'46.3" longitude,</p> <p>It is essential that the bidder visit site and acquaint with the conditions prevailing at site before submission of the bid . The information given hereunder is for general guidance and shall not be contractually binding on the/ BHEL.</p>
	APPROACH TO SITE
	LOCATION :Barauni Thermal Power Station, Begusarai, Bihar

	<p>NEAREST RAILWAY STATION :Hathidah Railway Station (Broad Gauge) on Howrah-Patna route is about 3.5 KM away from the site.</p> <p>:Barauni Railway Station (Broad Gauge) on Howrah-Muzzafarpur route is about 15 KM away from the site.</p> <p>ROAD DISTANCES : NH-31 is adjacent to site.</p> <p>NEAREST AIR PORT : Patna, 110 KM away from Barauni.</p> <p>MODE OF TRANSPORTATION : Rail/Road</p> <p>DESIGN AMBIENT TEMPERATURE: 35.2 Deg.C maximum, 12.1 Deg.C minimum,</p> <p>DESIGN RELATIVE HUMIDITY : 98% (Maximum)</p> <p>AVERAGE ANNUAL RAINFALL : 1003.4 MM</p> <p>SEISMIC ZONE : Zone-IV as per IS-1893 Part-I (2002)</p> <p>WIND SPEED : 47 m/s</p>
	Owner: Bihar State Electricity Board (BSEB)
40.0	<p>OTHER TERMS</p> <p>All other term & conditions of this specification shall be governed by the pertinent provisions of GCC, Volume-IA as applicable.</p>

BIHAR STATE ELECTRICITY BOARD


2 X 250 MW BSEB, BARAUNI TPP

**PROJECT SPECIFIC
TECHNICAL SPECIFICATION FOR TG HALL
(DOUBLE GIRDER) EOT CRANE**

SPECIFICATION NO.: PE-TS-374-501-A001 Rev. 01



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

	TECHNICAL SPECIFICATION FOR DOUBLE GIRDER EOT CRANE (FOR TG HALL) 2 X 250 MW BSEB, BARAUNI TPP	Specification no.: PE-TS-374-501-A001
		Rev. 01
		Date: January 25, 2012
		Sheet 1 of 1

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Note:

- 1.0 *The standard technical specification PE-TS-STD-501-A-001 Rev.03 shall be applicable for this project.*

Project Information
2x250 MW Barauni Unit# 8 &9

1.0.0 PROJECT INFORMATION

1.	Owner	Bihar Electricity Board (BSEB).
2.	Project	2 X 250 MW Unit # 8 & 9, Barauni-TPS, Begusarai
3.	Owner's consultant	M/s Evonik, Sec-16, Noida
4.	Location	Town: Barauni, District: Begusarai, State: Bihar
5.	Site	Existing ash dyke are of about 340 acres
6.	FFL/FGL	FFL EL+/- 0.0 corresponds to RL 45.50 M above MSL FGL corresponds to RL 45.00 M above MSL
7.	Nearest Airport	Patna-115 Kms.
8.	Nearest Rail Head	Simaria Railway Station on North Eastern railways
9.	Access to site	The site is at Barauni-Mokama section of National Highway (NH-31)
10.	Metrological data	(Refer as under)

Site Meteorological Data:

S.NO.	DESCRIPTION	DATA
A	Latitude	N 25 ⁰ 23'13.5" to N 25 ⁰ 23'54"
B	Longitude	E 86 ⁰ 01'05.1" to E 86 ⁰ 01'46.3"
1.	Maximum Ambient Air Temperature	35.2° C
2.	Minimum Ambient Air Temperature	11.4°C
	Dry Bulb Temperatures	
	Highest recorded :	35.3° .C
	Lowest recorded :	12.1° C
	Wet Bulb Temperatures	
1.	Design AMB WBT	Minimum – 12.0° .C Maximum- 29.0° .C
C	RELATIVE HUMIDITY	
	Design AMB WBT	Minimum- 26% Maximum- 98%
	Annual Mean	52 %
D	RAINFALL	
1.	Annual Total	1003.4 mm
E	WIND DATA	
1.	Wind Speed	47 m/sec
2.	Prevailing Wind Direction	East (blowing from)
3.	Wind Pressure	Minimum 990 hPa. Maximum 1011.5 hPa.
F	SEISMIC COEFFICIENT	Zone IV as per IS-1893 Part-I (2002)

SPECIFIC CONFIRMATION / COMMENTS REQUIRED FROM BIDDER		
TITLE: Double Girder EOT Cranes above 50T and up to 150T capacity (For TG Hall)		SPECIFICATION: PE-TS-374-501-A001
PROJECT: 2 X 250 MW BSEB, BARAUNI TPP		VOLUME-II B SECTION-C REVISION:01
		DATE: SEPTEMBER 2011 No. of SHEETS: 3
S.N.	DESCRIPTION	REPLY / COMMENTS BY BIDDER
1.00	MECHANICAL	
1.01	Bidder to confirm that the Data sheet -A / B attached along with Standard Technical Specification No. PE-TS-STD-501-A001 Rev. 03 and Data sheet A i.e Differences in Technical data sheet w r t Standard technical data sheet attached in Project Specific Technical Specification PE-TS-374-501-A001 Rev. 01 are acceptable without any deviation. Bidder to confirm the same.	CONFIRMED / NOT CONFIRMED
1.02	In case of any deviation, the same has been furnished in the separate Deviation schedule attached along with Standard Technical Specification. Bidder to note that deviation mentioned elsewhere will not be taken cognizance of in any case. Bidder to confirm the same.	CONFIRMED / NOT CONFIRMED
1.03	Bidder to confirm that there is no deviation from the QAP attached along with the Standard Technical Specification (PE-TS-STD-501-A002 Rev. 03) . Further, QAP for cranes is subject to customer approval during contract execution stage. In case of any additional test required to be carried out on any of the crane component, if commented by customer, will have to be complied by bidder without any commercial implication. Bidder to confirm	CONFIRMED / NOT CONFIRMED
1.04	Bidder to confirm that there is no deviation from the Crane Clearance Diagram for TG Hall EOT Crane (PE- DG -374-501-A001 Rev 01) attached with the Project Specific Technical Specification (PE-TS-374-501-A001). Bidder to specifically note that in no case any deviation from the Crane Clearance diagrams given by BHEL shall be accepted. Bidder to confirm the same.	CONFIRMED / NOT CONFIRMED

1.05	Bidder to confirm that there is no deviation from the makes of various sub vendors items as given in annexure-I "Makes of Sub-vendors Items" , volume II-B, section-C of Standard Technical Specification (PE-TS-STD-501-A001 Rev. 03). Bidder shall confirm the compliance	CONFIRMED / NOT CONFIRMED
1.06	The material offered is equal or better in grade than specified. Bidder shall confirm the compliance	CONFIRMED / NOT CONFIRMED
1.07	Bidder to note and confirm that there will be no price implication for variation in Span, Lift and Baylength upto ± 500 mm. Bidder to confirm	CONFIRMED / NOT CONFIRMED
1.08	Bush as a antifriction bearing shall not be used. Bidder shall confirm the compliance	CONFIRMED / NOT CONFIRMED
1.09	Bidder to confirm the compliance to the Painting Specification (for plains) and Color Coding Procedure attached in the standard technical specification no. PE-TS-STD-501-A001 (Rev. 03) - Annexure IVA of Section C Vol IIB	CONFIRMED / NOT CONFIRMED
1.10	Bidder to confirm that in case of award of order, Hook drawing shall be submitted to BHEL within one week of receiving the LOI. Bidder also to submit Unpriced Purchase Order copy of Hook within 15 days from LOI . Bidder to confirm	CONFIRMED / NOT CONFIRMED
1.11	Bidder to confirm that in case of award of order, Motor Sizing calculations shall be submitted within 15 days time of receiving the LOI by the bidder. Bidder to confirm the same.	CONFIRMED / NOT CONFIRMED
2.00	ELECTRICALS	
2.01	CABLES	
a	All CONTROL AND POWER cables shall be as per BHEL specification. Bidder shall confirm the compliance	CONFIRMED / NOT CONFIRMED
b	Cable required between isolating switch / change over switch and DSL included in the scope. Bidder to confirm the same.	CONFIRMED / NOT CONFIRMED
2.02	MOTORS	

a	Class of insulation of Sq. cage motors shall be "F" and the temperature rise to limited to class "B". Bidder shall confirm the compliance	CONFIRMED / NOT CONFIRMED
b	Motor size shall be subjected to the approval of motor calculation. Bidder shall confirm the compliance	CONFIRMED / NOT CONFIRMED
c	The successful bidder shall submit the data sheet -C of LV motors and power & control cables during detailed engineering and the same is subjected to customer approval without any cost implication on account of the same. Bidder shall confirm the compliance	CONFIRMED / NOT CONFIRMED
d	Bidder to confirm that there is no technical deviation on "Electrical portion of Technical specification" and "Data sheet of Electrical portion". Bidder to confirm the same.	CONFIRMED / NOT CONFIRMED



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DATA SHEET FOR TG HALL EOT CRANE WITH VVVF DRIVES

* Information's are to be furnished by bidder during contract stage

Sr. No.		DESCRIPTION	TECHNICAL PARTICULARS
1.0.0		General	
1.1.0		Name of manufacturer	*
	a.	EOT Crane	*
	b.	Crane motors	*
	c.	Runway conductors	*
1.2.0		Weight of equipments	
	a.	Bridge assembly	*
	b.	Trolley assembly	*
	c.	Total crane weight	*
	d.	Total weight of the gantry rail	*
	e.	Total weight of DSL	*
	f.	Total weight of all the equipments under this specification	*
1.3.0		Design, fabrication and testing of the crane confirm to standard / code number	IS: 3177-1999/800/807
1.4.0		Number of cranes	Two (2) nos. 125/25 T
1.5.0		Crane classification	Mechanism Class: M5 Electrical services: M5 of IS 3177
1.6.0		Suitable for outdoor or indoor duty	Indoor
1.7.0		Capacity and lift	
1.7.1		Main hoist	
	a.	Rated SWC – tonnes	125 T
	b.	Test load SWC – tonnes	Rated SWC and over load test : 125% of SWC
1.7.2		Aux. hoists	



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	a.	Rated SWC – tonnes	25T	
	b.	Test load SWC – tonnes	Rated SWC and over load test : 125% of SWC	
1.8.0		Span	As per crane clearance diagram	
1.9.0		Operation from	Cabin + Pendent Push Button	
2.00		CRANE PERFORMANCE		
2.1.0		Crane speed with full load	Full speed M/Min	Creep speed M/Min
	a.	Main hoist	1.60	10% to 100%of main speed (thru' VVVF drives)
	b.	Aux. hoist	7.50	10% to 100%of main speed (thru' VVVF drives)
	c.	Trolley travel (CT)	15.0	10% to 100%of main speed (thru' VVVF drives)
	d.	Longitudinal bridge travel (LT)	30.0	10% to 100%of main speed (thru' VVVF drives)
2.2.0		Acceleration values	LT motion (bridge travel)	CT motion (trolley travel)
			As per IS: 3177	As per IS: 3177
2.3.0		Lift in Metres		
	a.	Main Hoist	As per Crane clearance diagram	
	b.	Aux Hoist	As per Crane clearance diagram	
2.4.0		Hook Approaches		
	a.	Main hook (cabin end)	As per Crane clearance diagram	
	b.	Aux. Hook (cabin-end)	As per Crane clearance diagram	
	c.	Main hook (other end)	As per Crane clearance diagram	
	d.	Aux. Hook (other end)	As per Crane clearance diagram	
2.5.0		Hand Rail Pipes	32 mm NB Medium class of IS: 1161 having top and bottom rail at height of 1100 mm and 600 mm and vertical post spacing not exceeding 1500 mm with provision of kick plate (100 mm high and 6mm thick), (Access walkways of not less than 800mm with hand-railing of height of 1100 mm along the both side of bridge girder and cross over walkways)	
3.0.0		COMPONENT DETAILS		
3.1.0		Trolley		



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	a.	Type	Fabricated	
	b.	Method of fabrication	Fusion welded	
	c.	Material	IS: 2062 Gr. A up to 20mm thickness, Grade B Normalized for thickness above 20mm. High steel alloy steel confirming to IS: 8500 is also acceptable.	
	d.	Centre to centre distance of wheels (on the same rails)	*	
	e.	Whether jacking pads for lifting trolley provided or not	Yes	
3.2.0		Rope drums	Main hoist	Aux. Hoist
	a.	Dimensions in mm length and diameter (PCD)	*	*
	b.	Material (Indicate IS)	Seamless pipe ASTM -106 or fabricated Fe410w IS: 2062 & stress relieved	
	c.	Flange / flangeless	Flanged	
	d.	Numbers provided	One for each hoist	
	e.	Number of grooves	*	*
	f.	Type of grooves	Identical Right hand and Left hand	
	g.	Diameter on bottom of grooves	*	*
3.3.0		Rope details		
	a.	Construction	Extra flexible plough steel , 6 x 36 / 6 x 37 construction	
	b.	Grade	During detailed engineering	
	c.	Standard conforming to	IS: 2266	
	d.	Diameter in mm	*	*
	e.	Breaking strength	*	*
	f.	Tensile designation	*	*
	g.	Factor of safety	5.25 as per IS	5.25 as per IS
	h.	Type of core	Fibre	Fibre
	i.	Number of falls	*	Min. 4
	j.	Length of rope	*	*
3.4.0		Sheaves details	Main hoist	Aux. Hoist
	a.	Material	Fe 410 WA IS: 2062 Gr. A or B/ CS Gr. 280-520 IS: 1030	



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	b.	Diameter of main sheaves in mm on Root	*	*		
	c.	Diameter of Equalizing sheaves (in mm) on Root	Should not be less 62% of calculated main sheave diameter	Should not be less 62% of calculated main sheave diameter		
	d.	Type of guards provided	Fabricated from Sheet steel			
3.5.0		COUPLINGS & SHAFTING				
3.5.1		Coupling details (between motor and gear box)	Main hoist	Aux. Hoist	Cross Travel	Long Travel
	a.	Type	Flexible geared Type			
	b.	Size & Torque rating	*			
	c.	Guards and enclosures	Provided			
3.5.2		Coupling details (between gear box and wheels)	Cross Travel (CT)		Long Travel (LT)	
	a.	Type	Flexible geared type			
	b.	Size & Torque rating	*			
	c.	Guards and enclosures provided	Yes			
3.5.3		Coupling details (between gear box and rope drum)	Main hoist		Aux. Hoist	
	a.	Type	Flexible Built-in gear couplings			
	b.	Size	*			
	c.	Guards and enclosures provided	Yes			
3.5.4		Shafting (Output)	Cross Travel		Long Travel	
	a.	Diameter in mm	*		*	
	b.	Factor of Safety	As per IS: 3177-1999			
	c.	Number of support bearings	*		*	
	d.	Type of support bearing	*		*	
	e.	Arrangement of lubrication	Group lubrication			
	f.	Type of lubricant	Grease			
	g.	Max unsupported length of shaft in mm	*		*	



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3.6.0		Gear box details				
3.6.1		Hoist Motions	MH	MH Micro	AH	AH micro
	a.	Type of mounting of gear box	Horizontal / Vertical			
	b.	Classification	Suitable for M5 duty			
	c.	Total number of reductions	3	NA	3	NA
	d.	Type of gears	Helical	NA	Helical	NA
	e.	Reduction ratio	*			
	f.	Type of lubrication (grease / splash / pump lubrication)	Splash Lubrication			
	g.	Hardness (BHN) – gear	*			
	h.	Hardness (BHN) – pinion	*			
	i.	Difference in Gear and pinion hardness	Min 20 BHN			
	j.	Materials (gear/pinions)	Main Gears En 9/ 55C8/ IS2707 Gr. 1 or 2 Pinions En 19/ EN 24. Hardness conforming to IS: 3177			
	k.	Castings	Fabricated Fe 410w IS: 2062 & stress relieved			
	l.	Noise level	85 db	85 db (VVVF)	85 db	85 db(VVVF)
	m.	Standard conforming to	IS: 4460 / AGMA			
3.6.2		Travel Motions	CT	CT micro (VVVF)	LT	LT micro(VVVF)
	a.	Type of mounting gear box	Vertical			
	b.	Classification	M5 duty			
	c.	Total number of reduction	3	NA	3	NA
	d.	Type of gears	Helical	NA	Helical	NA
	e.	Reduction ratio	*	NA	*	NA
	f.	Type of lubrication (grease / splash / pump lubrication)	Splash Lubrication			
	g.	Hardness (BHN) – gear	*			
	h.	Hardness (BHN) – pinion	*			



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	i.	Difference in Gear and pinion hardness	Min 20 BHN	
	j.	Materials (gear / pinions)	Main Gears En 9/ 55C8/ IS2707 Gr. 1 or 2 Pinions En 19/ EN 24. Hardness conforming to IS: 3177	
	k.	Castings	Fabricated Fe 410w IS: 2062 & stress relieved	
	l.	Standard conforming to	IS: 4460 / AGMA	
3.7.0		Wheels details	Cross travel	Long travel
	a.	Material	C 55 Mn 75 IS:1570 / EN 9 (55 C 8)	
	b.	Hardness	300 – 350 BHN	
	c.	Depth of hardness	10 mm (min)	
	d.	Tread diameter in mm	*	*
	e.	Tread width in mm	*	*
	f.	Process of hardening	Volume hardening	
	g.	Type	Double flanged straight tread	
	h.	Numbers provided	4 nos.	8 nos.
	i.	Specification conforming to	IS: 3177	
	j.	Arrangement of lubrication	Group Lubrication	
3.8.0		Lifting hooks	MH	AH
	a.	Type	Rams-horn (as per IS:5749)	Shank Type as per IS 15560
	b.	Material	EN 3A-BS 970 Class 2 IS: 1875	
	c.	Standard conforming to	IS: 5749	IS: 15560
	d.	Hook can rotate	Yes	
	e.	Safety latch on hook provided	Yes	
	f.	Locking device on swivelling hook required or not	Provided	
3.9.0		Buffers	Cross travel	Long travel
	a.	Type	Spring loaded type. To be designed to bring the loaded crane to rest from speed of 50% of the rated speed. (To be fitted to each end of carriage assembly and crab)	
	b.	Numbers provided	4	4
	c.	Details of end stop	Fabricated Fe 410w IS: 2062	



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3.10.0	Brakes					
3.10.1	Hoist Motions	MH	MH micro(VVVF)	AH	AH micro (VVVF)	
	a.	Type of brake (ac / dc / thruster)	AC Electro-Hydraulic Thruster operated + DCEM operated			
	b.	Diameter of brake in mm	*	NA	*	NA
	c.	Torque rating Kg. M	*		*	
	d.	Number provided per motor	1+1		1+1	
	e.	Braking capacity	150%		150%	
	f.	Braking torque actually required	*		*	
	g.	Material				
		• Brake liners	Ferodo liners			
		• Drum	CS IS : 1030 / CL 4 IS : 1875			
		• Springs	As per manufacturers standard			
	h.	Braking distance in mm	*	NA	*	NA
3.10.2	Travel Motions	CT	CT micro	LT	LT micro	
	a.	Type of brake (ac / dc / thruster)	AC Electro-Hydraulic Thruster operated + DCEM Operated			
	b.	Dia of brake in mm	*	NA	*	NA
	c.	Torque rating Kg.M	*		*	
	d.	Number provided per motor	1+1		1+1	
	e.	Braking capacity	125%		125%	
	f.	Braking torque actually required	*		*	
	g.	Material				
		• Brake liners	Ferodo liners			
		• Drum	CS IS : 1030 / CL4 IS : 1875			
		• Springs	As per manufacturers standard			
		• Thrusters	*			
	h.	Braking distance in mm	*	NA	*	NA
3.11.0	Drive system for hoisting					



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	a.	Arrangement of drive from motor to rope drum (main)	Through geared coupling and gear box				
	b.	Arrangement of drive from motor to rope drum (creep speed)	Through VVVF Drive				
3.12.0		Bearings	Crane hook	Trolley wheels	Rope drum	Gear box	Any other assembly
	a.	Type	Antifriction ball / roller bearings				
	b.	Number provided for each	As per assembly requirements				
	c.	Method of lubrication	Centralised Grease lubrication with hand operated grease pump for all bearings.				
	d.	Bearing life	10,000 working hours.				
3.13.0		Bridge girder					
	a.	Type & Quantity	Box type – 2 nos. Material: IS 2062 Gr. A / B				
			Trolley stops of spring type to be mounted independently on bridge rails to prevent trolley from running off.				
	b.	Size	*				
	c.	Vertical Deflection	Span / 900				
	d.	Type of connection to end carriage	By fitted bolts				
	e.	Width	*				
	f.	Length	*				
3.14.0		Rails					
	a.	Type / section	Rails sections as per IS: 3443 Grade 50 C 12. Joint to be butt-welded by thermit welding & fusion welding .(CR-100)				
	b.	Standard conforming to	IS: 3443				
	c.	Weight per metre	*				
	d.	Material	Grade 50 C12, as per IS 3443				
	e.	Top width in mm	*				
	f.	Height in mm	*				
3.15.0		Type of platform required on the bridge	Chequered plate platform 6mm thick as per IS : 3502				
	a.	Position of access point	From cabin				
	b.	Emergency escape	Rung Ladder at ends				



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	c.	Type of access platform to cabin	By Rung Ladder			
	d.	Length	Full span length			
	e.	Provided on both side	Yes			
	f.	Width of platform	*On panel side: During detailed Engineering *On drive end side: During detailed Engineering (Min. 750mm clear space from electrical panels / equipments from the trolley on panel side and Min. 750 mm on drive end side from the trolley on drive end side)			
			A distinct type alarm with conspicuous warning lights on either side of the crane bridge to indicate overloading of crane.			
3.16.0		Type of operators cabin				
	a.	Type of construction	Open type to be located at B-row column.			
	b.	Area and minimum clear height	2500/1850 mm with a head room of 2000mm.			
	c.	Warning Gong	Foot operated Brass gong suspended outside the cabin and operated from inside. Suitable for 240 V AC of noise level 95 dBA at 3.5 m			
	d.	Seating arrangement	Revolving type chair			
	e.	Position of controllers	In front / side of operator's chair			
3.17.0		End carriage span (wheel base)	As per IS 807 (latest edition)			
3.18.0		Motors				
3.18.1		Hoist Motions	MH	MH micro	AH	AH micro
	a.	Type	SC, suitable for Inverter duty as per IS 325, IS 3177.	NA	SC, suitable for Inverter duty, as per IS 325, IS 3177.	NA
	b.	Enclosure	TEFC	NA	TEFC	NA
	c.	Numbers furnished	One per motion			
	d.	Voltage, phase and frequency	415V \pm 10%, 3 Ph, 50 Hz \pm 5% Combined voltage & frequency variation= 10% absolute			
	e.	Class of protection	IP – 55			



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	f.	Rated capacity (KW)	Selected motor rating should have minimum margin of 15% over maximum continuous load demand including voltage and frequency variation, temperature rise and other factor. Motor nameplate rating at 50 °C shall have at least 15% margin over the input power requirement of driven equipment at rated duty point.			
	g.	Duration factor/duty	40 % CDF / S-4			
	h.	Speed (rpm)	*			
	i.	Class of insulation	Class 'F' for sq. cage motors with temp rise limited to that of class B			
	j.	Number of starts/ hour	150 starts / hr			
	k.	Contactors for motor	*			
	l.	Overload protection for motors provided	Yes			
	m.	Space heater requirements	For motors of rating 30 KW and above			
3.18.2		Travel Motions	CT	CT micro	LT	LT micro
	a.	Type	SC, suitable for Inverter duty	NA	SC, suitable for Inverter duty	NA
	b.	Enclosure	TEFC	NA	TEFC	NA
	c.	Numbers furnished	1	NA	2	NA
	d.	Voltage, phase and frequency	415V \pm 10%, 3 Ph, 50 Hz \pm 5% Combined voltage & frequency variation = 10% absolute			
	e.	Class of protection	IP – 55			
	f.	Rated capacity (KW)	Selected motor rating should have minimum margin of 15% over maximum continuous load demand including voltage and frequency variation, temperature rise and other factor. Motor nameplate rating at 50 °C shall have at least 15% margin over the input power requirement of driven equipment at rated duty point.			
	g.	Duration factor/duty	40 % CDF / S-4			
	h.	Speed (rpm)	*			
	i.	Class of insulation	Class 'F' for sq. cage motors with temp rise limited to that of class B			
	j.	Number of starts/ hour	150 starts / hr			
	k.	Contactors for motor	*			



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	i.	Overload protection for motors provided	Yes			
3.18.3		Space heater requirement	For motors of rating 30 KW and above			
3.19.0		Limit switches	Main hoist	Aux. hoist	Cross Travel	Long Travel
	a.	Type	Rotary gear + Gravity		Two way lever type	
	b.	Number provided	1 + 1	1 + 1	1	1
	c.	Rating of contacts	*			
	d.	Material of contacts	Double break Silver Cadmium			
	e.	Control voltage	110V			
3.20.0		Power conductors (DSL)				
	a.	Type	LT: PVC shrouded conductor bus bar. CT: Festoon Cable arrangement			
	b.	Size	*			
	c.	Material	*			
	d.	Numbers	*			
	e.	Length	Suitable for bay length			
			(voltage drop should not exceed 2% , along the extreme ends of Bay length and from along the power cable from Isolator switch to DSL)			
3.21.0		Protective Panel				
	a.	Make	OEM			
	b.	Size	*			
	c.	Material	Sheet steel 2 mm size			
	d.	Numbers and location	One number located on Plate form			
3.22.0		Control panel				
	a.	Make	OEM			
	b.	Size	*			
	c.	Material	Rolled sheet steel 2mm size			
	d.	Numbers and location	One each for MH, AH, CT and LT located on bridge platform			
	e.	Degree of protection	IP 55			
3.23.0		Master Controllers	Main Hoist	Aux Hoist	Cross Travel	Long Travel



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	a.	Number of steps	5	5	4	4
	b.	Voltage & current rating	10 A, 415 V			
	c.	Type	Heavy duty type having DOP IP54			
	a.	Speed control	Thru' VVVF with minimum 6 pulse design			
	b.	Starting torque of VVVF	Up to 400 % typical with / without encoder			
	c.	Starting current	Less than 150 % of rated torque.			
	d.	Temperature	VVVF system shall be capable of withstanding upto 50 ° C without derating.			
3.25.0		Cable	EPR insulated, copper conductor trailing cables, as per IS: 9968, on the bridge			
	a.		Extruded PVC insulated, copper/Aluminium conductor, 1100 Volt grade power cables, this shall include cable lengths between changeover switch & DSL and isolating switch & DSL.			
	b.		Extruded PVC insulated, copper conductor 1100Volt grade control cables.			
	c.	Size	Min 2.5 mm ² for copper	Min 2.5 mm ² (Stranded minimum – 7 strands)		
	d.	Voltage grade	1100 V			
	e.	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 2% of rated voltage.			
3.26.0		Earthing				
	a.	Material of earthing	G.I / Copper			
	b.	Earthing as per specification	Yes			
3.27.0	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 bi metallic with single phasing preventer.			
3.28.0		Power supply	Two (2) nos. 415 V , 3 phase, 4 wire supply at operating floor at centre of bay length with change over switch.			
3.29.0		Transformer				
	a.	Quantity	2 X 100 % for Control and 1 no for Lighting			
	b.	Voltage Rating	Control 415/110V, Lighting 415/0-24-240V			
	c.	KVA rating	20% over loading to be considered while sizing the rating			
3.30.0		Illumination				



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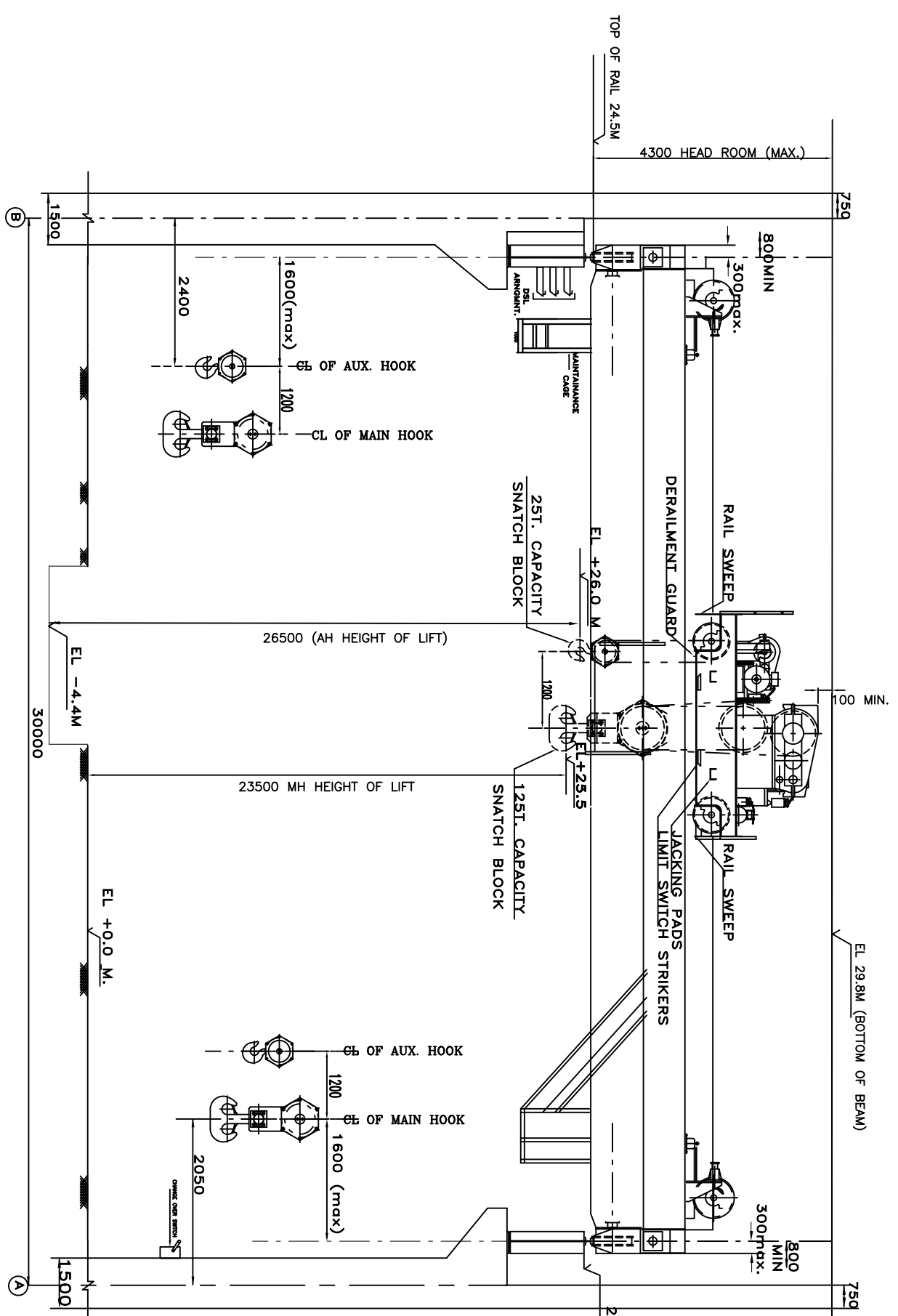
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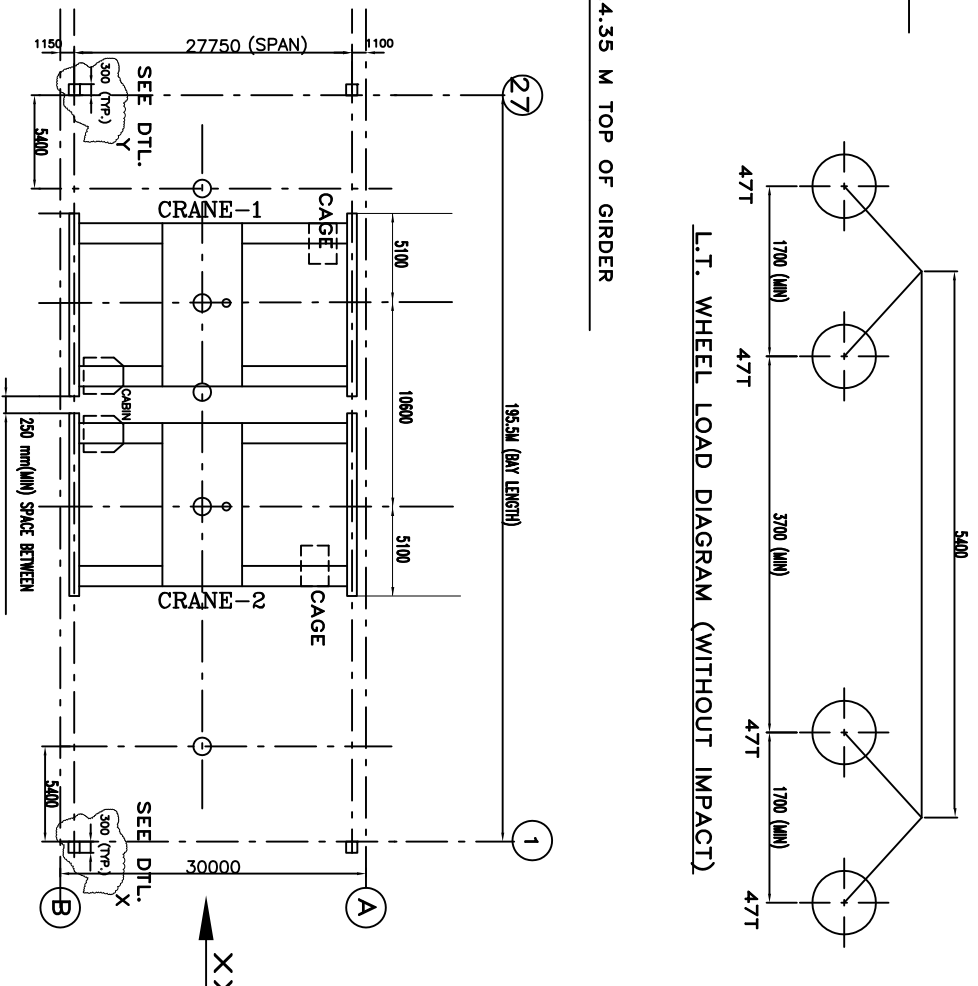
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	a.	In cabin	40W florescent tube + Bulk head fitting with 60W incandescent lamp – 1 each 2 nos. 24V - 5A - 3 pin industrial socket
	b.	Over Bridge	4 nos 100 W Bulk-head fittings with incandescent lamps and 4nos. 24V - 5A - 3 pin industrial socket
	c.	Under bridge	4 nos 250 W HPSV lamps
	d.	For inspection of crane components	One (1) portable 40 W hand lamp with min. half span length flexible cable for inspection of crane components
3.31.0		Fire Extinguisher	
	a.	Type and size	4.5 kg CO ₂ type
	b.	Location	One in cabin and Three on bridge
3.32.0		Ventilation	One (1) no. electric fan in cabin.



ELEVATION

XX



KEY PLAN

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1

FOR TENDER PURPOSE

DETAIL 'Y' DETAIL 'X'

- NOTES**
- 1) ALL DIMENSIONS ARE IN MM & ELEVATIONS IN METRES.
 - 2) HEAD ROOM (4300 mm) DISTANCE FROM TOP OF GANTRY RAIL TO BOTTOM OF ROOF INCLUDING 100 mm FOR CLEARANCE.
 - 3) DISTANCE BETWEEN CENTRELINE OF THE RAIL AND FACE OF THE COLUMN ABOVE THE BRACKET IS TO BE MAINTAINED AS 800MM (MIN).
 - 4) GROUND FLOOR IS CONSIDERED AS EL +0.0 M. IN CASE GROUND FLOOR IS DIFFERENT FROM EL +0.0 M THE ELEVATION OF CENTRELINE OF HOOK AND BOTTOM OF ROOF/BEAM SHALL CHANGE ACCORDINGLY.

JOB NO. 300		JOB NO. 300	
STATUS CONTRACT		STATUS CONTRACT	
SHE./REF. NO. (INTERNAL)		SHE./REF. NO. (INTERNAL)	
PRINT SCALE		PRINT SCALE	
REV. DATE	ALT. BY	REV. DATE	ALT. BY
10/01/08 VVN	ANB	10/01/08 VVN	ANB
Revised in line with IITPC's comments vide mail dated 4/11/08		Revised in line with IITPC's comments vide mail dated 8/11/08	
SUB-CONTRACTOR		SUB-CONTRACTOR	
CUSTOMER		CUSTOMER	
BHARAT STATE ELECTRICITY BOARD		BHARAT STATE ELECTRICITY BOARD	
2 X 250 MW BSBB BARAUNI TPP		2 X 250 MW BSBB BARAUNI TPP	
STEAG ENERGY SERVICES (I) PVT. LTD.		STEAG ENERGY SERVICES (I) PVT. LTD.	
BHARAT HEAVY ELECTRICALS LTD		BHARAT HEAVY ELECTRICALS LTD	
POWER SECTOR		POWER SECTOR	
PROJECT ENGINEERING MANAGEMENT		PROJECT ENGINEERING MANAGEMENT	
NEW DELHI		NEW DELHI	
DATE	DATE	DATE	DATE
15/07/12	15/07/12	15/07/12	15/07/12
CHK	CHK	CHK	CHK
APPD	APPD	APPD	APPD
ANB	ANB	ANB	ANB
DRAWING NO. PB-DG-368-601-A001		DRAWING NO. PB-DG-368-601-A001	
SHEET 1 OF 1		SHEET 1 OF 1	
DATE	DATE	DATE	DATE
15/07/12	15/07/12	15/07/12	15/07/12
REV. A	REV. A	REV. A	REV. A

CRANE CLEARANCE DIAGRAM OF TG HALL 125 / 25 T (DOUBLE GIRDER) E.O.T. CRANE

Annexure-C

(Part of technical specification no. PE-TS-374-501-A001 Rev. 01 for 2 X 250 MW BSEB, Barauni TPP)

VENDOR HAS TO SUBMIT ONLY FOLLOWING DOCUMENTS ALONG WITH THE OFFER, FOR TECHNICAL EVALUATION OF THE BID:-

- 1.0 Specific confirmation / Comments from the bidder as per BHEL Format.
- 2.0 'NO DEVIATION CERTIFICATE' – Clearly mentioning that bidder has considered 'No - Deviation' from the technical specification provided by BHEL.

OR

DEVIATION Sheet, indicating clause wise technical deviation, if any

- 3.0 Un-priced format with 'Quoted' mentioned against each serial number under each column.

Note1:- Any other standard document/ details furnished by the bidder i.e. Data sheet / GA Drawing/ QAP etc. shall not be taken in to consideration for evaluation.

Note 2:- Bidder to note that if the bidder does not submit the documents mentioned in Sl. No. 1.0 to 3.0 along with their offer then their offer is liable to be rejected.

VOLUME II B & III


STANDARD TECHNICAL SPECIFICATION

FOR DOUBLE GIRDER EOT CRANE
(CAPACITY ABOVE 50 T)

SPECIFICATION NO.: PE-TS-STD-501-A-001
(REV. 03)



BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR PROJECT ENGINEERING MANAGEMENT
NEW DELHI
INDIA

	Title STANDARD TECHNICAL SPECIFICATION FOR DOUBLE GIRDER EOT CRANE (CAPACITY ABOVE 50 T)	Specification no.: PE-TS-STD-501-A-001
		Rev. 03
		Date: Oct, 2007
		Sheet 1 of 2

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3.0	Volume II B	Section-C	Scope of work	12
4.0	Volume II B	Section-C	Procedure No. PEM (Q) / 01 – Gear Box Qualifying Criteria	4
5.0	Volume II B	Section-C	Typical Stator Lifting Arrangement Drawing (for reference)	1
6.0	Volume II B	Section-C	Annexure-I, Makes of sub vendor's items	2
7.0	Volume II B	Section-C	Annexure-II, Mandatory spares parts for EOT Crane	2
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13.0	Volume II B	Section-C	Manufacturing Quality Plan – EOT Crane	7
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19.0	Volume III	Section-D	<i>Schedule of deviation - <u>Second document to be submitted along with the offer, if applicable</u></i>	1
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21.0	Volume III	Section-D	Schedule of Dispatch	1
22.0	Volume III	Section-D	Schedule of Weights and Dimensions	1
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23.0	Volume II B	Section-C	Electrical scope between BHEL and vendor	1
24.0	Volume II B	Section-C	Equipment and services to be provided by bidder	2
25.0	Volume II B	Section-D	General Electrical Specification for LV motors	4
26.0	Volume II B	Section-D	General technical Requirements of PVC Power and control cables	4
27.0	Volume II B	Section-D	General technical Requirements for cabling installation.	5
28.0	Volume II B	Section-D	Technical specification for Cable Trays and Accessories (including typical details of cable trays)	3
29.0	Volume II B	Section-D	Quality Plan for AC motors below 75 KW (LV)	2
30.0	Volume II B	Section-D	Quality Plan for PVC Power and control cable	5
31.0	Volume II B	Section-D	Quality Plan for cable trays and accessories	2
32.0	Volume II B	Section-D	Load data format (Electrical)	1
33.0	Volume II B	Section-D	Data sheet-A – LV motors	1
34.0	Volume II B	Section-D	Data sheet-A – LT Control Cables	2
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SECTION – A
SCOPE OF ENQUIRY



TITLE

**STANDARD TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANE
CAPACITY ABOVE 50 T**

SPECIFICATION NO. PE-TS-STD-501-A-001

VOLUME II - B

SECTION -A

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A.0 SCOPE OF ENQUIRY

1.0 This specification includes, but is not limited to, the design, engineering, material selection, manufacturing and assembly, inspection, testing at manufacturer's works, packing, forwarding and transportation to site, unloading, storage & handling at Site, erection, commissioning and final load test at site of following EOT Cranes, as specified below.

A. One (1) / Two (2) Double box girder EOT Cranes with operator's cabin and necessary accessories.

2.0 Supplies and services shall be rendered in conformity with proven design principles, taking into account the current technology. The requirements of the contract must be fulfilled in its entirety.

3.0 It is not the intent to specify completely herein all the details of design and construction of equipments. However, all the equipment shall conform in all respect to high standard of engineering, design, workmanship and shall be capable of performing in continuous commercial operation up to the vendors / subcontractor's guarantees in a manner acceptable to the purchaser / engineer who will interpret the meaning of drawing and specifications and shall be entitled to reject any work or material which in his judgement is not in full accordance herewith.

4.0 The supplies and services shall be rendered inclusive of all appliances and interconnecting arrangements with other supplies, necessary for install at ion of all accessories, needed for proper and reliable continuous operation and for satisfactory maintenance and repair.

5.0 In case of any data / requirement stipulated in the drawings but not in the specification and vice-versa, such data / requirement shall be deemed to be contained in both. Contradictions between drawings and specifications, if any, shall be brought to the attention of the Purchaser / Consultant by the Bidder and the correct requirement shall be obtained.

6.0 In the event of any conflict between the various sections of the specification, Bidder shall obtain necessary confirmation in writing from the Purchaser.



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- 7.0 All necessary co-ordination with regard to sub-contracted equipment shall be carried out by the vendor. The Purchaser will communicate only with the vendor for all matters pertaining to this contract.
- 8.0 The general terms and conditions, instructions to bidder and other attachments referred to elsewhere are made a part of the tender specification. The equipment materials and works covered by this specification is subject to all the attachments referred in the specification. The bidder shall be responsible of and governed by all the requirements stipulated herein.
- 9.0 The standard quality plan is included in this specification to enable the bidder to understand the extent of inspection and testing requirements to execute this job. The successful bidder has to follow the agreed quality plan.

VOLUME - IIB
SECTION – C
SCOPE OF WORK



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CAPACITY ABOVE 50T

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SECTION – C

SPECIFIC TECHNICAL REQUIREMENTS



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1.0.0. SCOPE OF WORK

1.1.0. SUPPLIES

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

1.1.2 In the event of any conflict between the technical specification of equipment and the specified data sheet of the equipment, the data sheet will govern.

1.1.3 Compliance with this specification shall not relieve the bidder of the responsibility of furnishing material and workmanship to meet the specified conditions.

Crane shall include but not be limited to the following: -

- a. Bridge girders
- b. End carriages with wheels
- c. Crab
- d. CT/ LT drive arrangement
- e. All electrical equipments
- f. Ms angle type DSL with fixing accessories / PVC insulated shrouded Copper conductor cable (Project Specific)
- g. Earthing arrangement.
- h. First fill of lubricant
- i. Painting of cranes
- j. Temporary cable for operation of each crane during erection stage of the plant (Half the bay length + 30m)
- k. Rail
- l. Maintenance tools & Tackle
- m. Erection & Commissioning spares
- n. Mandatory spares (Project specific)
- o. Radio Remote Control (Project Specific)
- p. Lifting beam and sling for tandem operation (Project specific)
- q. Electric wire rope hoists. (Project specific)



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r. Operator's cabin

1.1.4 Maintenance Tools and Tackles

A complete unused new set of special purpose 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 to be identified, easy for its 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 plier	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.
10.	Tool Box.	1 No.

Note: - Each Crane shall be supplied with one set of tool and tackles with O&M manual in the toolbox.

1.1.5 Mandatory Spares (Project Specific)

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 its 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-C, volume II-B of this specification.



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1.1.6 Recommended spare parts (Optional)

Bidder is also required to furnish the list recommended spare parts required for two (2) years / Three (3) years successful operation of the equipments (with extended price variation for 12 months).

1.1.7 Erection and Commissioning spares

The Bidder shall also supply erection & commissioning spares along with his main equipment as per his experience, for replacement of damaged or unserviceable ones during the execution of the project at site, to avoid delay in the project schedule. This shall form part of the main equipment supply and a separate list for the same shall be furnished along with bid. The Purchaser reserves the right to retain the unutilized commissioning spares. The initial fill of lubricants, oil etc. shall also be supplied by the bidder.

Note:

Any Erection and Commissioning spares, if required over and above quoted items, the same shall be supplied by the vendor without any commercial implication to the purchaser.

1.1.8 Lifting Beam And Slings♦♦ (Project specific)

Bidder to include necessary sling also along with Lifting beam. A typical drawing of the lifting beam drawing number 0-139-38-01086 is being enclosed with this Technical Specification for reference. A reference drawing showing the "Lifting Arrangement of Stator with beam and sling (Drawing no. 2-135-01-31248 Rev. 00)" is also attached. The drawing indicates 4 nos. endless wire rope sling with Size= 56 dia. (Min.), grade of steel wire as 1770 kN / m². Type of construction: 6x36 or 6 x 41, with steel core conforming to IS: 2266 (latest edition). Length of sling should suit as indicated in the drawing. (minimum 22 meters.)

Bidder may be noted that in case, 66 mm dia size is not available as per IS: 2266, the next applicable higher size is to be provided.

1.2.0 Services to be provided by the bidder

1.2.1. Packing, forwarding and transportation to site, storage and handling at site.



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1.2.2. Arranging test load at site

Collecting the test load at site within a radius of 1 KM from the owner's storage to final testing bed of each crane shall be under bidder's scope of work. Test load in the form of rolled steel, plates, girder, angle etc., as available at the site shall be made available by the purchaser. The test load shall be put back to the place from where it was lifted by the vendor, after the load testing. Load testing sling and any other item required by the vendor during the load testing shall be arranged by the vendor at no extra cost to the purchaser. Slings will be allowed to take back by the vendor, after completion of the test at site.

1.3.0. Inspection and Testing

1.3.1. Inspection and testing at Manufacturer's works

Copy of documents approved with original stamp and signature (one set) shall be available at the place of Inspection. This is to be ensured by supplier.

A. Shop inspection and tests will include but not limited to the following -

- i) Identification, co-relation and verification of material test certificates for the important components like girders, major load carrying components, cross head, hooks, gears, shafts, wheels, wire rope drum, wire rope etc. In absence of Original copy of Mill Test Certificates/ photocopy certified by Mill in original, check test to be carried out and original test certificates to be furnished for each heat/ thickness. For other components supporting test certificates or random check tests shall be conducted / furnished. All test certificates shall be in original and legible. Photocopies certified by Mill/ manufacturer of raw material used, are acceptable.

For tensile testing of hooks/ forgings, samples shall be drawn from the full cross section of the shank diameter of hooks/ forgings Samples forged to reduced cross section for testing purposes is not acceptable. **Hooks shall be manufactured from Blooms, billets, rounds by forging with forging ratio of at least 3:1. Hooks manufactured from plates are not acceptable.**

- ii Welding procedures and welders shall be qualified as per ASME Sec IX . Only qualified welders shall be employed on the job.
- 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



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ASTM E 165/ ASTM E 109 with acceptance norms as per ASME Sec VIII Div.1 append.8. Radiographs shall be inspected to a sensitivity of 2%.

- 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 **cross head** (hook suspension block), Hooks, Shafts, Axles, Gears, Wheels, Pulleys etc. Ultrasonic test on forgings shall be carried out as per norms given below. UT shall be carried out in Proof machined condition (single diameter/ Flat surface without steps, keyways, teeth cutting or other profile machining which can create difficulty in ultrasonic testing). Components shall be identified with Heat number and serial number by punching). Hardening operation shall be carried out prior to Ultrasonic testing.

Unacceptable defects in forgings are as given below:

1. Cracks, flakes, seams and laps
2. Defects giving indication larger than '4 (four) mm diameter equivalent flaw' except for wheels for which Defects giving indication larger than '6 (six) mm diameter equivalent flaw.'
3. Group of defects with maximum indication less than that from a 4 mm dia equivalent flaw which cannot be separated at testing sensitivity if the back echo is reduced by 50% except for wheels for which Group of defects with maximum indication less than that from a 6 mm dia equivalent flaw which cannot be separated at testing sensitivity if the back echo is reduced by 40%.
4. Defects giving indication of 2 to 4 mm dia. equivalent flaw, separated by a distance less than 4 (four) times the size of the larger of the adjacent flaws except for wheels for which Defects giving indication of 3 to 6 mm dia. Equivalent flaw, separated by a distance less than 4 (four) times the size of the larger of the adjacent flaws Ultrasonic test on Castings shall be carried out as per ASTM E 609

Wherever, the Quality plan calls for witness of Ultrasonic test by BHEL or BHEL's representative, the material shall be offered for UT in proof machined condition as stated above and hard stamping and subsequent stamp transferring by BHEL shall be followed at subsequent stages to ensure trace ability.

- vi. Dye penetration check/ Magnetic particle check on surfaces subjected to hardening process as per ASTM E 165 / ASTM E 138 respectively with acceptance norms as per



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ASME Sec. VIII Div.1 append.7 for DP check and ASME Sec. VIII Append. 6 for Magnetic particle check.

- vii. Gear boxes shall be checked at No load for backlash, tooth contact, noise and vibration as per Procedure No. PEM (Q)/001 enclosed (attached after Section C)
- viii. Test certificates shall for furnished for verification for Type tests including environmental tests - for electrical and electro-mechanical items. If Type tests for items with similar / identical construction are not available, arrangement shall be made to conduct the same in the presence of BHEL/ Customer's representative (as required). Type test Certificates shall be considered valid if the date of test is within previous five years of the date on which ordered items are offered for inspection/ verification
- ix Acceptance and routine tests (HV and insulation) for all electrical and electro-mechanical components and system as per governing specification
- x. Functional and simulated operation test, sequencing, interlocks, safety, protection and alarm system shall be carried out for Control Panels. Test on CRANE / CRAB motors and other mechanical, electrical, electromechanical as per BHEL technical specification and / or as per applicable code.

B. Testing At Works.

Cranes shall be completely assembled at manufacturers works to check the misalignment of gears, shafts and other items. Gears shall be run idle for at least 4 (four) hours. Following minimum tests shall be conducted on the crane at the works of the manufacturer:

- a) No load running & speed check for LT drive.
- b) Deflection test of bridge girder at rated load. Crane shall rest on centerline of LT wheels.
- c) Overload test (running of CT and Hoisting mechanism at 125% of the rated load). Capability of crane to lift the overload from mid-air shall be demonstrated.
- c) Electrical tests for brakes, panel, electrical equipments etc as per IS - 3177
- d) No load run test of LT mechanism
- f) All Other tests as per IS-3177.

Based on the Quality Plan and witness stages of BHEL & customer, supplier shall submit an inspection plan clearly indicating the no. of hours/ man days required for inspection.



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Note: Refer annexue-III, section-C, volume II-B for “Shop test Procedure for Load/Overload testing of T.G. Hall EOT cranes at Manufacturer’s Works.

1.3.2 Testing at site

- a) All the tests as mentioned against S.N. 1.3.1 above with actual hook and wire rope.
- b) Speed test at rated load for hoisting / CT and LT mechanism
- c) Brake test and working of both electric hoist
- d) Any other test as per IS-3177-1999
- e) The test shall be carried out with actual panel

1.4.0. SURFACE PREPARATION, PAINTING & COLOUR SCHEME

Bidder to refer ANNEXURE-IV A25F SECTION –C VOLUME II

1.5.0. Drawing / design document for submission.

A. For Approval

- a) G. A. Drawing showing clearances, assembly, cross section details, wheel details, chequered plate marks, material of construction, lifts and hook approach. The G.A. drawing shall indicate the permissible tolerance on dimensions indicated
- b) G.A. drawing showing layout crab, cross section details, material of construction, lifts and hook approach, Chequered plate marks, dimensions with tolerances, CT wheel details.
- c) Lifting wheel assembly drawing with calculation and fabrication details. (Project specific)
- d) DSL fixing arrangement and supports.
- e) Hook block assembly drawings
- f) Motors HP/KW calculations, brake selection calculation, cable sizing calculations, voltages drop calculation etc.
- g) Gantry Rail fixing Arrangement with accessories.
- h) Write up on the crane control
- i) Wire rope selection, gearbox selection, rope drum selection and wheel size selection calculation.
- j) Electrical wiring diagram and control scheme along with control write-up.
- k) Quality Plan
- l) Test certificates and reports on various shop tests
- m) Field quality plans



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- n) O.M. Manuals
- o) Technical data sheet of all equipments / components

B For Reference

- a) Gearbox assembly drawing.
- b) Girder Assembly (without trolley) with LT Wheel details, chequered plate location, platform details, designed camber on girder and jacking pad location with details, rail fixing arrangement with details, critical dimensions with tolerances
- c) Rope drum assembly Drawing
- d) Cross conductor on bridge
- e) Crane lubrication arrangement
- f) LT & CT wheel Assembly drawing
- g) Manufacturers catalog
- h) Motor characteristics curves
- i) Structural Calculation
- j) Detailed erection drawing (For export job)

2.0.0. Works Excluded

2.1.0 The purchaser shall provide two (2) nos. 415V, 3 phase, and 50Hz. 3 wire Neutral solidly grounded power feeder at any point in the bay or in the middle of the bay as specified in the Data sheet A. Bidder shall provide main isolating switch / change over switch at 1.5 M above the 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. Number of drawing and documents for submission

The number of prints / copies required for various drawing and documents are listed in Annexure –V, section-C, volume II-B of this specification.

4.0.0. 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” furnishing full particular of such deviations. Deviations are to be furnished with mention to specific clause Number. Notes / comments etc. is not acceptable. If



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there are no deviations from the tender document, bidder shall indicate so. Reasons / explanations for such deviations shall be furnished.

5.0.0. Performance Guarantee

EOT crane along with its drives, controls and other accessories shall be guaranteed for the rated capacity against the rated speed of motions and for the service conditions specified

The bidder shall have the full responsibility for the safe and efficient operation of the crane with associated accessories as a single unit. If the shop/site performance tests indicate the failure of any of the components to achieve the guaranteed performance, the deficiency shall be made good at bidder's cost.

Performance tests shall be carried out each time after the rectification /modification is carried out.

PG test of the crane shall include load tests and speeds in various motions.

6.0.0. Makes of Sub - Vendor items

The makes of bought out items will be as per annexure-I, section C, volume II-B of the specification. No other make will be acceptable, until and unless specifically got it approved by the purchaser.

7.0.0. Drawing & Documents to be attached with Tender

7.1.0. SPECIFIC CONFIRMATION, AS PER ANNEXURE A, ATTACHED ALONG WITH THE TECHNICAL SPECIFICATION

7.2.0. DEVIATION, IF ANY, IN THE DEVIATION SCHEDULE ATTACHED ALONG WITH THE SPECIFICATION. IF THERE IS NO DEVIATION FROM THE TECHNICAL SPECIFICATION THE DEVIATION SCHEDULE SHALL BE SUBMITTED INDICATING – NO DEVIATION

7.3.0. UNPRICED FORMAT IN BHEL FORMAT PROVIDED ALONG WITH THE TENDER ENQUIRY

8.0.0 Specific Requirement

8.1.0 Panels

Fabricated out of 2.0 mm thick rolled sheet. Degree of protection shall be IP-54/ IP-55. Paint shade as per ENCLOSED PAINTING SPECIFICATION. Space heaters shall also to be provided.



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8.2.0 Suitable inspection cage to accommodate two persons to facilitate inspection of DSL
 8.3.0 Cables

- a) ERP insulated copper conductor trailing cable as per IS-9968, on the bridge.
- b) Extruded PVC insulated copper/Aluminum conductor 1100 grade power and control cables. This shall include cable length between change over switch and DSL as mentioned elsewhere.

NOTE- FOR ALL THE ELECTRICAL ITEMS REFER ELECTRICAL PORTION ENCLOSED WITH SPECIFICATION.

8.4.0 Parameter and tolerances for structural assembly is as per the relevant standards.
 8.5.0 The diameter of equalizer sheave should be 62% of calculated main sheave diameter.

9.0.0 Scope of Documentations

The supplier shall submit required number of copies of each document as per ANNEXURE-VI DRAWING AND DOCUMENTS FOR SUBMISSION

These documents shall be completed in all respects. These will be including but not limited to the following: -

- System Description
- System Performance
- Specification documents
- Design documents
- General layout drawings
- System block and level diagram
- Operation documents
- Maintenance and service documents
- As Built drawings
- Software documents
- All documents shall be available in electronic for accompanied by the accessories of software or PC.

10.0.0 Specific technical requirement for electrical



TITLE

STANDARD TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANE
CAPACITY ABOVE 50T

SPECIFICATION NO. PE-TS-STD-501-A-001

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10.1.0 Power supply

- a) The purchaser shall provide two (2) nos. 415V, 3 phase, and 50Hz. 3 wire Neutral solidly grounded power feeder at any point in the bay or in the middle of the bay as specified in the Data sheet A. Bidder shall provide main isolating switch / change over switch at 1.5 M above the operating floor level and cable required from isolating switch to DSL. Any other supply required by the bidder shall be arranged by the bidder him self by using suitable transformer as per the specification.
- b) Two numbers isolating switches in enclosure at extreme ends of operating floor for disconnecting supply to DSL while maintaining the crane.
- c) DSL is to be sized considering maximum length from changeover switch and with a margin of 10% / 15% over load requirement. The DSL shall be designed to limit voltage drop at motor terminals within 2%/3% for single length. The voltage drop in the power cable i.e. from changeover switch to DSL is also to be considered along with voltage drop in DSL and cable sizes shall be selected accordingly. Suitable guards of MS sheet to live electrical wiring down shop leads shall be provided.

	Technical specification for EOT crane Acceptance Norms for Crane Gear Boxes	Spec. No. PEM(Q)/001 Page 1 of 4
		Section –C

1.0.0	Scope:
1.1.0	This procedure lays down the Acceptance norms for the Gear boxes for EOT crane. This standard also covers vertical gear boxes.
2.0.0	The following dimensions shall be checked:
2.1.0	<ul style="list-style-type: none"> i. Diameter and keyway dimensions of input and output shafts. ii. Projection of input and output shafts beyond foundation holes and Centre lines of gear box. iii. Centre distance between input and output shafts. iv. Centre Height. v. Distance between foundation holes with respect to center line of the output shaft and distance of foundation holes from center line of the gearbox. vi. Overall dimensions
3.0.0	Backlash
3.1.0	The back lash shall be checked by dial gauge preferably (refer Figure –1). Lead wire may be also be used but final decision in case of dispute shall be taken by using dial gauge. The backlash shall be within the limits specified in the drawing. If the value of the backlash allowed is not specified in the drawing, the allowed backlash shall be a given in Table-1
4.0.0	Area of Contact:
4.1.0	<p>Area of contact shall be taken by applying Prussian blue. The contact area shall be within the limits mentioned below (refer Figure –2)</p> <p>For final stage of Hoist gearing:</p> <p>h / H shall be more than 30%</p> <p>$(a - c) / b$ shall be more than 40%</p> <p>For all other gears:</p> <p>h / H shall be more than 40%</p> <p>$(a - c) / b$ shall be more than 50%</p>
5.0.0	Running Test
5.1.0	<p>The gear boxes shall be run under no-load condition at the rated speed for minimum four hours in each direction and the following are to be checked:</p> <ul style="list-style-type: none"> i. All bolts at the joints remain tight ii. All gear mesh lines are getting enough lubrication

	Technical specification for EOT crane Acceptance Norms for Crane Gear Boxes	Spec. No. PEM(Q)/001 Page 2 of 4
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	<ul style="list-style-type: none"> iii. All bearings are getting enough lubrication iv. Bearing temperatures after running for four hours shall not exceed 50 deg. Centigrade or 15 deg. centigrade above ambient whichever is higher. Temperature shall be checked after every hour. v. Vibration : Maximum limit 125 microns (peak to peak) vi. Sound: The gearbox shall not emit unusual sound as obtained under conditions of hard meshing, high spots etc. Maximum sound level shall be 85 dBA at a distance of 1000mm and 91 dBA at a distance of 300 mm. vii. There shall be no Oil leakage at parting lines, bearing housings or inspection covers.
6.0.0	General
6.1.0	<p>In addition to the above specific points, the following general points shall be ensured:</p> <ul style="list-style-type: none"> i. Inspection pockets are provided as required. ii. Gear box casings are provided with at least two fit bolts/dowels at the parting line. iii. Dip sticks with minimum / maximum level markings are provided. iv. Drain plugs are provided at convenient locations preferably at vertical wall of the housing. v. Breathers are provided. vi. Lifting lugs or eye bolts are provided as required. vii. Wherever bearings have splash lubrication, oil retainers are provided. viii. Gear boxes are painted as per specification outside and inside. Inside surfaces shall be painted with Oil proof paint. ix. In case of vertical gear boxes having more than two stage reduction, forced lubrication is also provided. <p>Name plate should provide information eg. Ratio, KW rating, Bearing details and manufacturers name.</p>

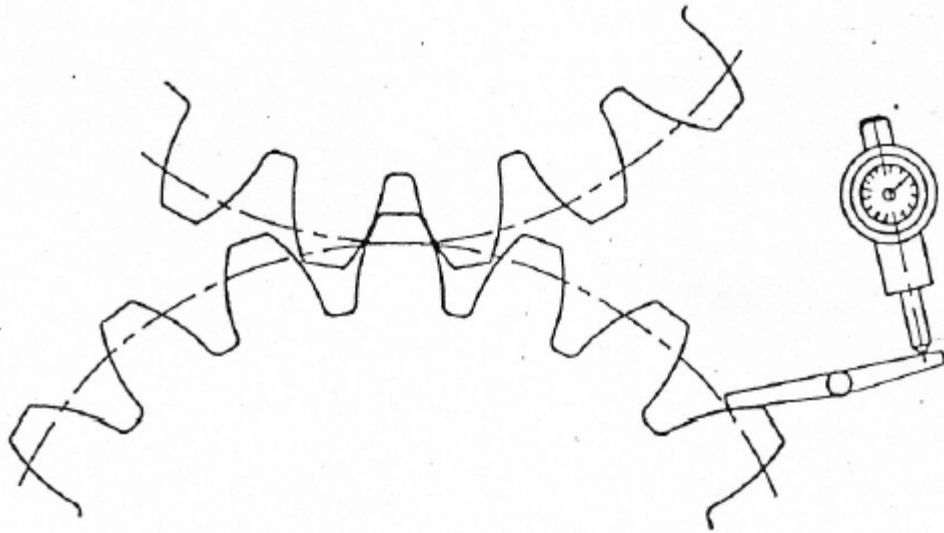


FIG.1 MEASUREMENT OF BACKLASH

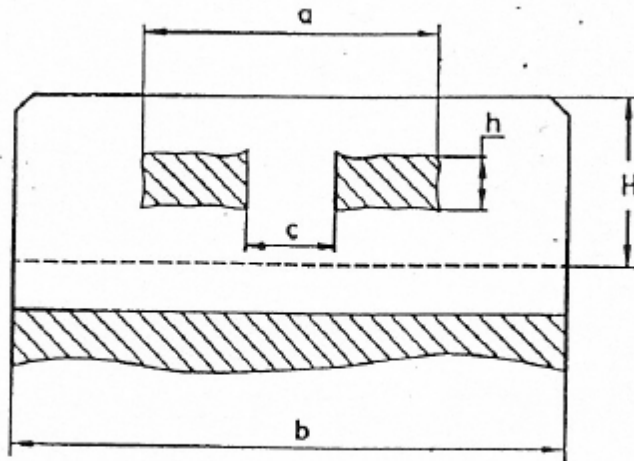



FIG.2 AREA OF CONTACT OF GEAR TEETH

	Technical specification for EOT crane Acceptance Norms for Crane Gear Boxes	Spec. No. PEM(Q)/001 Page 4 of 4
		Section –C

Table-1

**Backlash for Gearing specified by module
(Clause 3.1.0)**


Centre distance in mm		Tolerances in microns		
Above	Upto	Minimum	Maximum	
			For gears other than Drum gears	For Drum gears
			For all modules 1 to 50	For all modules 2.5 to 50
-	50	85	240	280
50	80	105	320	380
80	120	130	360	420
120	200	170	470	530
200	320	210	540	640
320	500	260	660	740
500	800	340	820	880
800	1250	420	970	1040
1250	2000	530	1200	1280
2000	3150	710	1500	1670
3150	5000	850	1810	1980

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ANNEXURE-I

MAKES OF SUB VENDORS ITEMS

S.N.	ITEM	MAKES
1.0	STEEL	SAIL / IISCO / TISCO / JINDAL
2.0	HOOKS	Up to 40 T capacity - MOOZUMDAR / KARACHIWALA / HARMAN MOHTA Above 40 T capacity - Steel Forging & Engg. Co., Kolkata/ SIMRITI FORGING
3.0	GEAR COUPLINGS	ALLIANCE / HICLIFF / OEM
4.0	WIRE ROPE	USHA MARTIN BLACK / BOMBAY WIRE ROPES // FORT WILLIAMS / UNITED WIRE ROPE / Bharat Wire Ropes.
5.0	BEARINGS	SKF/ FAG/ TATA/ NORMA / NBC
6.0	MOTORS	SIEMENS / NGEF/ CROMPTON / KIRLOSKAR / GECA / BHARAT BIJLI / ALSTOM / ABB
7.0	BRAKES	STROM CRAFT/ ELECTROMAG /SPEED-O- CONTROL
8.0	CONTACTOR	SIEMENS / L&T /TELE MECHANIQUE / BCH
9.0	OVER LOAD RELAYS	SIEMENS / L&T / TELE MACHANIQUE / ABB
10.0	HRC FUSES	SIEMENS / L&T/ ENGLISH ELECTRIC / GE Power
11.0	ISOLATING SWITCH	SIEMENS/ L&T./ GEC A / CONTROL & SWITCH GEAR
12.0	SWITCH FUSE UNITS	SIEMENS/ L&T/ CONTROL/ & SWITCH GEAR/ GEC A
13.0	TIME DELAY RELAYS	SIEMENS/ L&T/ ABB/ BCH/ GEC A /TELEMECHANIQUE
14.0	TRANSFORMERS	INDCOIL / LOGICSTAT/ KAPPA / AUTOMATIC ELECTRIC / PRECISE ELECTRICALS / SILKAAN ELECTRIC MFG. CO. LTD. / SOUTHERN ELECTRIC
15.0	BULB & FLOURESCENT TUBES/FITTINGS	PHILIPS/ BAJAJ/ CROMPTON
16.0	CABLE LUGS (HEAVY DUTY)	DOWELLS / UML ENGINEERS, KOLKATA
17.0	HOOTERS	BEACON / OSC/TARGET / KHERAJ
18.0	LIGHTING SWITCHES	ANCHOR / ELLORA
19.0	CABLES	

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a)	Power Cables	Nicco / Universal / Incab / Fort Gloster Torrent / CCI / ICL / Radiant
b)	Control cables	Nicco / Universal / Incab / Fort Gloster / Delton / Finolex / Torrent / CCI / ICL / Radiant
c)	Trailing Cables	Nicco / Universal / Incab / ICL
20.0	Cable gland	COMMET / SUNIL&CO. / ALLIED TRADERS / ARUP ENGINEERING / ELECTROMAC INDUSTRIES
21.0	PUSH BUTTONS	SIEMENS / L&T / BCH
22.0	Limit Switches	Speed-o-control / Electromag
23.0	Master Controller	Speed-o-control / Electromag
24.0	Safety switches	Alsthom / L&T / Siemens
25.0	Pendent Push button station	OEM
26.0	Indicating Lamps	Tecknic / BCH / Siemens / Standard
27.0	MCB	MDS / Indo Copp / Standard
28.0	Panels	OEM
29.0	Resistance boxes	OEM
30.0	Fire Extinguishers	BSI Approved Makes
31.0	Insulators & Copper Conductors	BHEL approved make
32.0	CASTING	KOLHAPUR STEEL / GNAT FOUNDARY / KIRTI ALLOYS
33.0	Fire Extinguisher	BIS approved / marked.
34.0	VVVF	YASKAWA (L&T) / ABB / SIEMENS/SCHNIEDER
35.0	Shrouded DSL	Susheel/ Stromag

Note: All the trailing cables shall be sourced from only one sub-vendor from the list



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ANNEXURE-II

MANDATORY SPARES PARTS (For Conventional drives)

S. NO.	DESCRIPTION	QUANTITY required for each spare	Total Quantity to be supplied
1)	MECHANICAL		
a)	Bearings for long travel wheels	1 Set for each type and size	100% bearings for one crane
b)	Bearings for cross travel wheels	1 Set for each type and size	100% bearings for one crane
c)	Bearings for gear boxes for each type of hoist	1 set	100% bearings for one crane
d)	Brake liner for all the brakes	100% of total population of each type, size and rating	100% liners for both cranes
e)	Hydraulic thruster for brakes	1 No. of each type, size, rating etc.	1 No. of each type, size, rating etc.
f)	Oil seals	100% of total population of each type, size and rating	100% oil seals for both cranes
g)	Break springs for all brakes	100% of total population of each type, size and rating	100% brake springs for both cranes
h)	Wire rope for auxiliary hook	100% for one crane, each type & size	100% rope for one cranes
2)	ELECTRICAL (For each type and size of crane)		
a)	Solenoid coils for brakes	1 Set	100% for one cranes (If applicable)
b)	MCBs / MCCBS / Fuse links for the whole crane	1 Set	100% for one cranes
c)	Overload relays for motors of EOT	1 No. of each type, size & rating.	1 No. of each type, size & rating
d)	Timer of each size, type and rating	1 set	100% for one cranes
e)	Limit switches for		
i)	Main hoist	1 sets	100% for one crane
ii)	Aux. Hoist	1 sets	100% for one crane
iii)	Cross traverse	1 sets	100% for one crane
iv)	Long travel	1 sets	100% for one crane
	Carbon brushes & brush holders	1 sets	100% for one crane
g)	Master controller for Aux. Hoist, cross traverse & long traverse	1 set each	100% for one crane
h)	Resistance box	1 no of each type, size & rating	1 no of each type, size & rating
i)	Motor for Aux. hoist ♦♦ (project specific)	1 No.	1 No.
j)	Motor for Main. hoist ♦♦ (project specific)	1 No.	1 No.

Note:

1. "One (1) Set" and "One (1) set of each type & size" is defined as 100% requirement for one crane for the entire crane of similar size & capacity.
Since both cranes are of same capacity, the total quantity for both cranes shall be 100% quantity required for one crane.
2. 100% of total population of each type, size and rating is defined as 100% requirement for one crane.



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ADDITIONAL MANDATORY SPARES PARTS (required for VVVF drive control cranes)

S. No.	DESCRIPTION	QUANTITY required for each spare	Total Quantity to be supplied
1	Control Fuse / MCB	1 no. of each type and rating	100% for one crane
2	MCCB / Power Fuse	1 no. of each type and rating	100% for one crane
3	Contacto Coil	1 no. of each type and rating	100% for one crane
4	Contacto	1 no. of each type and rating	100% for one crane
5	VVVF Drive Module	1 no. of each type and rating	100% for one crane
6	VVVF Braking Module	1 no. of each type (if applicable)	100% for one crane
7	Master Controller Contacts	1 sets	100% for one crane
8	Push Buttons	1 no. of each type	100% for one crane
9	Power Supply	1 no. (if applicable)	100% for one crane

Note:

3. "One (1) Set" and "One (1) set of each type & size" is defined as 100% requirement for one crane for the entire crane of similar size & capacity.
Since both cranes are of same capacity, the total quantity for both cranes shall be 100% quantity required for one crane.
4. 100% of total population of each type, size and rating is defined as 100% requirement for one crane.



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ANNEXURE-III

Procedure for Load/Overload testing of T.G. Hall EOT cranes at Manufacturer's Works

Objective: To demonstrate final NO load / Load / Overload / Deflection / Functional tests of assembled Crane for the purpose of acceptance.

Basic Assumptions / Inputs for testing at Works:

- Actual job hook shall be used for Load / Overload tests for hoisting. However load / overload test for cross travel shall be done with hook block (without hook).
- Standard wire ropes (Equivalent to actual rope) shall be used for load / overload testing.
- Shop cables shall be used for temporary connection for the purpose of showing various functional tests at shop.
- Interlock and limit switch operation check will be shown without load for hoisting and CT motion.

Procedure for Load / Overload testing:

The cranes shall be tested for NO load and load test at works generally in conformance with the IS – 3177 (latest edition). 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. Resistors in the circuit will be checked for any overheating of the element.
- Overload relays will be checked for proper functioning. (To be done at site)

Hoisting & Cross Travel motions:

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.




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For checking the cross travel, raise the load with hook block (without hook) 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.


Note: Complete No load / load / over load tests in line with IS-3177 (latest edition) shall be done after erection of EOT crane at site.

ANNEXUE – V
PAINTING SPECIFICATION


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**ANNEXURE-IV A
PAINTING PROCEDURE / SCHEME**

S.No	ITEM DESCRIPTION	SURFACE PREP.	PAINTING SCHEME										REMARKS
			PRIMER	No. of Coats	MIN DFT μ	INTER MEDIA TE	No. of Coats	MIN DFT μ	FINISH	No. of Coats	MIN DFT μ	TOTAL DFT	
a	Piping / Structures / Vessels etc. (Temp. up to 90 Deg. C)	Degreasing and Mechanical Cleaning with wire brushing / hand Tool (SA1 / ST2 / ST3 as applicable)	Red Oxide Zinc Chromate as per IS: 2074 (alkyd medium)	2	25-35 per coat	-	-	-	Synthetic Enamel I (alkyd Medium) as per IS : 2932	3	20 - 25 per coat	110-145	
b	Electrical / Control Panels	Seven Tank Process	zinc phosphate (alkyd medium)	2	25 - 35 per coat	-	-	-	Synthetic Enamel I (alkyd med.) as per IS: 2932	3	20 - 25 per coat	110-145	
c.	Various type of	Degreasing and surface	zinc phosph	2	25-35 per	-	-	-	Synthetic	3	20 - 25	110-145	


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	equipment, valves etc. (Temp. upto 90 Deg. C)	preparation to SA 2 1/2	hate (alkyd medium)		coat				Ename I (alkyd Medium) as per IS : 2932		per coat		
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	TITLE	STANDARD TECHNICAL SPECIFICATION	SPECIFICATION NO. PE-TS-STD-501-A-001	
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**ANNEXURE-IV B
PAINTING PROCEDURE / SCHEME (FOR COASTAL AREA)**

S.No	ITEM DESCRIPTION	SURFACE PREP.	PAINTING SCHEME										REMARKS
			PRIMER	No. of Coats	MIN DFT μ	INTER MEDIA TE	No. of Coats	MIN DFT μ	FINISH	No. of Coats	MIN DFT μ	TOTAL DFT	
a	Piping / Structures / Vessels etc. (Temp. up to 90 Deg. C)	Degreasing and surface preparation to SA 2 1/2	Epoxy based polyamide cured (2) pack HB zinc phosphate primer	1	50-75 per coat	Epoxy based MIO pigmented polyamide cured paint	1	50 per coat	Polyamide cured epoxy finishing	2	Min. 35 per coat	170-195	
b	Panels	Seven Tank Process	Epoxy based polyamide cured (2) pack zinc phosphate primer	1	35 per coat	Epoxy based TIO2 pigmented polyamide cured paint (shop)	1	40	Aliphatic Acrylic (2) pack polyurethane finish paint	2	30 per coat	135	

	TITLE STANDARD TECHNICAL SPECIFICATION DOUBLE GIRDER EOT CRANE AND EOT CRAB CAPACITY ABOVE 50T	SPECIFICATION NO. PE-TS-STD-501-A-001	
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			%VS=5 8 min.										
c.	Various type of equipment, valves etc. (Temp. upto 90 Deg. C)	Degreasing and surface preparation to SA 2 1/2	Epoxy based polyamide cured (2) pack HB zinc phosphate primer	1	50-75 per coat	Epoxy based MIO pigmented polyamide cured paint	1	50 per coat	Aliphatic Acrylic (2) pack glossy polyurethane paint	2	Min. 30 per coat	160-185	

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**ANNEXURE-IV
COLOR CODING PROCEDURE / SCHEME**

S.No	ITEM DESCRIPTION	REGION	SURFACE PREP.	PAINTING SCHEME							COLOUR SHADE	REMARKES
				PRIMER	MIN DFT μ	INTERMEDIATE	MIN DFT μ	FINISH	MIN DFT μ	TOTAL DFT		
				As per paint specification								
a	Crane structure	—	—	—	—	—	—	—	—	—	Lemon yellow, shade 356 as per IS-5	
B	Bottom block assembly	—	—	—	—	—	—	—	—	—	Lemon yellow, shade 356 as per IS-5	With black strip
C	Hooks	—	—	—	—	—	—	—	—	—	Lemon yellow, shade 356 as per IS-5	With 100 mm wide black zebra strip
d.	End carriage sweep	—	—	—	—	—	—	—	—	—	Lemon yellow, shade 356 as per IS-5	With black strip
e.	Panels and motors	—	—	—	—	—	—	—	—	—	Steel grey / as req. by purchaser	




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**ANNEXURE-V
DRAWING AND DOCUMENTS FOR SUBMISSION**


S.N.	Drawings and documents	Number of prints / copies
1.0	DRAWING FOR APPROVAL	
1.1	For approval	4
1.2	For customer approval	6
1.3	For final distribution	15
2.0	DRAWING FOR REFERENCE	
2.1	For reference	4
P2.2	For final distribution	15
3.0	CERTIFICATE, REPORTS ETC.	6
4.0	AS BUILD DRAWINGS (IF REQUIRED)	15
5.0	O&M MANUAL	
5.1	Draft for approval	2
5.2	For final distribution	12
6.0	QUALITY PLAN / Field quality plan / PG test	6


Note:

- 1.0 Quantity of prints may change during Engineering stage.
- 2.0 Soft copies shall also be submitted of all the documents.
- 3.0 All final drawings and documents shall also be submitted in 2 sets of CD.
- 4.0 In case the drawings for approval are required to be submitted in soft copies, the vendor shall submit all the drawings / documents in soft copies.


MANUFACTURER'S NAME & ADDRESS		STANDARD MANUFACTURING QUALITY PLAN						PROJECT: STANDARD					
				ITEM: EOT CRANE		QP_NO :	PE-VO-STD- 501-A101	PACKAGE : DOUBLE GIRDER TG HALL CRANE					
				SUB -SYSTEM		REV :	3	CONTRACTOR NO : PE-TS-STD-501-A001					
						DATE :	Oct ,07	CONTRACTOR : BHEL					
						PAGES :	7	VENDOR'S QAP No					
								Rev No.	3	R1			
SL. NO.	COMPONENTS & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORDS	AGENCY			REMARKS	
1	4	3	4	5	6	7	8	9	D*	P*	10	11	
1	Fabricated components												
	Box Girder, End Carriage, Crab Frame, Rope Drum												
a	Material	chemical/Physical Tensile yield, elongation & Composition	Major	Corelation with T.C. Check test in absence of T.C.	1/Heat/Batch	IS:2062-Gr A/B	IS:2062-Gr A/B	Mfr's T.C/ Vendor's T.C.	√	P	V	V	Up to 10 mm thick compliance certificate to be furnished Refer note: 1
		U.T. of plates.		Ultrasonic	100%	ASTM A435	ASTM A435	T.C.	√	P	V	V	U.T. ON ABOVE 25MM THICK PLATE
b	weld setup	dimensions	Major	Measurement butt joints	100% for	Components drawings	IS:9595	Vendor's inspection report		P			
2	Welding WPS (Welding procedure specification) in line with ASME sec. IX (QW - 482) - For Box Girder, End Carriage, Crab Frame, Rope Drum												
i	Check for welding procedure qualification, welder's performance	Welding parameters	Major	check & test	100%	ASME Sec-IX	ASME Sec-IX	QW-482,QW-483 QW-484 ASPER asme Sec-IX	√	P	V	V	Welder / procedure qualification will be witnessed by customer / BHEL as per approved WPS. In case the BHEL / NTPC / Looys / any other renowned approving agency already available & doing the job , requalification not required.
ii	Back chipping	surface defect	Major	DPT	100%	ASME Sec-VIII, Div-I, Appen - 8	ASME Sec-VIII, CLUW51	Vendor insp. Report	√	P	V	V	
iii	Butt Welds	Weld Quality	Critical	Gamma ray Radiography	100% in ten sion 25% in compression zones & 100% for butt weld of rope drum	ASME Sec - VIII	ASME Sec-VII, CL UW51	Vendor insp Repot Rad report & film	√	P	V	V	Review of inspection report & radiography report and RT films . Refer note: 2
			Critical	DPT	100%	IS: 3658	ASME Sec-VII, Appen - 8	Vendor insp Repot Rad. report & film	√	P	W	V	RT before stress relieving. DP test of filletweld for ropedrum to be conducted after final machining Random witness by BHEL
LEGEND :													
D * RECORDS IDENTIFIED WITH 'TICK'() SHALL BE ESSENTIALLY													
INCLUDED BY CONTRACTOR IN QA DOCUMENTATION													
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MANUFACTURER/ SUBCONTRACTOR	CONTRACTOR	C: BHEL-CQS											
INDICATE "P" PERFORM "W" WITNESS AND "V" DOCUMENT REVIEW													
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REVIEWED BY							NAME & SIGN OF APPROVING AUTHORITY & SEAL						


		MANUFACTURER'S NAME & ADDRESS		STANDARD MANUFACTURING QUALITY PLAN				PROJECT: STANDARD					
				ITEM: EOT CRANE		QP_NO :	PE-VO-STD- 501-A101		PACKAGE : DOUBLE GIRDER TG HALL CRANE				
						REV :	3		CONTRACTOR : BHEL				
						DATE :	Oct ,07		CONTRACT NO : PE-TS-STD-501-A001				
						PAGES :	7		VENDOR'S QAP No				
								Rev No.	3	R1			
SL. NO.	COMPONENTS & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORDS	AGENCY			REMARKS	
1	4	3	4	5	6	7	8	9	D*	10		11	
iv	fillet welds	Size and surface defects	Major	Visual	100%	Component Drg.	Component Drg.	Vendor insp. Report		P	V	V	
				DPT	10% RANDOM	ASME Sec VIII-Div1- Append 8	ASME Sec VIII-Div1- Append 8	Vendor insp. Report	√	P	W	V	
v	final inspection of fabricated components listed in Sr.2 above	Dimensions for Girder, and carriage rope drum etc. Camber, Verticality, bend etc	Major	Dimensional Measurement	100%	G.A. Drg. Cendor tolerance chart	G.A. Drg. Cendor tolerance chart	vendor route card/vendor insp report		P	V	V	
vi	Heat treatment of rope drum	stress relieving	Major	Review of SR chart	100%	ASME Sec-VIII, Div - 1	ASME Sec-VIII, Div - 1	SR Chart	√	P	V	V	
3	Gear box casing												
a	Material	Surface condition	Major	Visual	100%	Componet Drg.	Componet Drg.	Vendor insp Report		P			Refer note 1
		Chemical & mech		Measurement	100%	Componet Drg.	Componet Drg.	T.C. & I.R.					
				Correlation with T.C. Check test in absence of T.C. Correlation	100%	IS:2062	IS:2062		√	P	V	V	
b	welding	Welding & Dimensional conformity	Major	Measurement	100%	Componet Drg.	Componet Drg.	Vendor insp Report		P			
c	Heat treatment	stress relieving	Major	Review of SR chart	100%	Component Drg./ ASME Sec-VIII, Div - 1	Component Drg./ ASME Sec-VIII, Div - 1 for procedure.	Vendor insp Report	√	P	V	V	
4	PLATFORMS	Dimensional conformity	Minor	Measurement	100%	Components Drg.	Components Drg.	Vendor insp Report		P			Refer note: 1
5	L.T.FRAMES	Dimensional conformity	Minor	Measurement	100%	Components Drg.	Components Drg.	Vendor insp Report		P			
6	HAND RAILINGS	Dimensional conformity	Minor	Measurement	100%	Components Drg.	Components Drg.	Vendor insp Report		P			
7	CABIN	Dimensional conformity	Minor	Measurement	100%	Components Drg.	Components Drg.	Vendor insp Report		P	V		
LEGEND : D * RECORDS IDENTIFIED WITH 'TICK'() SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION ** M : MANUFACTURER/SUBCONTRACTOR MANUFACTURER/ CONTRACTOR C: BHEL-CQS SUBCONTRACTOR INDICATE "P" PERFORM "W" WITNESS AND "V" DOCUMENT REVIEW SIGNATURE N : TPCL													
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		ITEM: EOT CRANE		QP_NO :	PE-VO-STD- 501-A101		PACKAGE : DOUBLE GIRDER TG HALL CRANE								
		SUB -SYSTEM		REV :	3		CONTRACTOR : BHEL								
				DATE :	Oct ,07		CONTRACT NO : PE-TS-STD-501-A001								
				PAGES :	7		VENDOR'S QAP No								
1	4	3	4	5	6	7	8	9	D*	R1	10	11			
SL. NO.	COMPONENTS & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORDS	AGENCY			REMARKS			
8	Current collector arms	Dimensional conformity	Minor	Measurement	100%	Components Drg.	Components Drg.	Vendor insp Report		P					
9	DSL Guard	Dimensional conformity	Minor	Measurement	100%	Components Drg.	Components Drg.	Vendor insp Report		P					
10	Rails	Dimensional conformity,	Minor	Measurement, Check test, chemical, Hardness	100%	G.A.drg./DIN-536.	G.A.drg./DIN-536.	Vendor	√	P	V	V			
					One/Cast	Appd.Data Sheet	Appd.Data Sheet	Report							
11	MECHANICAL COMPONENTS														
A	a	wheels													
	j)	Materials		Chemicals composition and Mechanical Properties.	Major	Correlation with mfr's TC	100%	Drg.regmt/IS:1570 e55Mn75 / (55c8)	Drg.regmt/IS:1570 e55Mn75 / (55c8)	Test Certificate	√	P	V	V	Refer Note:1
	ii)	Machined		a) Dimensions	Major	Measurement	100%	Component Drawing	Component Drawing	Vendor insp.		P	V	V	
				b) Hardness		Mechanical	100%	Approved Data Sheet	Approved Data Sheet	Report	√	P	V	V	
				c) UT		NDT	100%	ASME Sec-VIII-App-8	ASME Sec-VIII-App-8		√	P	V	V	Refer note: 5
				d) DPT		NDT	100%	Refer Note 6	Refer Note 6		√	P	W	V	
	b	Gears , Pinions, Shafts, Axles etc		i) Chemicals Composition & heat treatment, Mech Properties.	Major	Correlation with mfr's TC	100%	Component Drawing, IS:1570 C55, Mn 75 (55C8)	Component Drawing, IS:1570 C55, Mn 75 (55C8)	Vendor insp.	√	P	V	V	
						Check test in absence of TC		Approved Data Sheet	Approved Data Sheet	Report					
						Correlation with									
				ii) UT (after proof machining)	Major	check for UT (above 50mm dia)	100%	ASME Sec-V	Refer Note 6	Vendor insp. Report	√	P	V	V	UT & Hardness witnessing before teeth cutting & co-relation to be mentioned in final stages by supplier. (on Gears, Pinions only). Refer Note: 6
				iii) Hardness	Major	check for UT	100%	Approved drg. &	Approved drg. &	Vendor insp.	√	P	V	V	
						Hardness		Approved Data Sheet	Approved Data Sheet	Report					
				iv) Dimensions	Major	Measurement	100%	Component Drawing	Component Drawing	Vendor insp.	√	P	V	V	
										Report					
				v) D.P.Test on teeth	Major	NDT	100%	ASTME-165	No Crack and line of indication	Vendor insp.	√	P	V	V	
										Report					
LEGEND :															
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				SUB -SYSTEM		REV :		CONTRACT NO : PE-TS-STD-501-A001				
						DATE :	Oct ,07	CONTRACTOR : BHEL				
						PAGES :	7	VENDOR'S QAP No				
SL. NO.	COMPONENTS & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORDS	AGENCY	REMARKS		
1	4	3	4	5	6	7	8	9	D*	3 R1	10	
B	Pulleys, Brake, drums, break, Gear, coupling & other major steel castings & forging											
	j) Materials	Physical/Chemical/Hardness except pulleys.	Major	Corelation with mfr's TC	100%	Components Drawing	Components Drawing	Mfr's T.C.	√	P	V	
	ii) Machined	a) Dimensions	Major	Measurement	100%	Components Drawing	Components Drawing	Vendor insp report		P	V	
		b) DPT in groove after machining for pulleys only.	Major	NDT	100%	ASTM E-165	No. crack /Liner indication	Vendor insp. Report	√	P	V	
C	Gear box assy & idle running	check for oil leakage, Noise level, backlash, rise in temp. after 2 Hrs. of running, tooth contact, vibration	Major	Visual & Measurement	100%	Vendor standard	Smooth running no oil leakage Noise 80 db at 1 Mtr. Vibrat. 75 Micron. Max. Temp. rise 40oC above amb.	Vendor insp. Report	√	P	W	
	D a) Top block, bottom block	dimensional conformity	Major	Masurement	100%	Assembly drawing	Assembly drawing	Vendor insp. Report		P	V	
	b) Hook	Heat treatment, chemical composition, physical properties on integral test bar	Major	Corelation with TC and testing	100%	Profile: IS:IS5749(80T), IS3815(25T) Material: Class II-IS:1875 (for 80T & 25T)	Test Certificate & Insp. Report		√	P	V	
		UT on raw material of hook	Major	UT	100%	ASME sec-v	Annex-1		√	P	V	
		Forging operation of hook	Major	Visual	100%	IS:3815/IS:5749	IS:3815/IS:5749		√	P	W	
		Proof load test	Major	Mechanical	100%	IS:3815/IS:5749	IS:3815/IS:5749		√	P	W	
		UT & MPI after proof load test (UT on shank portion only)	Major	UT & MPI	100%	ASME sec - v	Annex-1 for UT No crack & liner indication (For MPI)		√	P	W	
E	Rope drum assembly	Diemnsional conformity	Major	Measurement	100%	Component Drawing	Tolerance as per drg	Vendor insp Report		P	V	
		LEGEND :										
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MANUFACTURER/ SUBCONTRACTOR	CONTRACTOR	C: BHEL-CQS										
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				ITEM: EOT CRANE		QP_NO :	PE-VO-STD- 501-A101		PACKAGE : DOUBLE GIRDER TG HALL CRANE		
						REV :	3		CONTRACT NO : PE-TS-STD-501-A001		
				SUB -SYSTEM		DATE :	Oct ,07		CONTRACTOR : BHEL		
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1	4	3	4	5	6	7	8	9	D*	10	11
F	Other Misc. components										
	i) Material	Chemical composition	Major	Review mfr's TC	100%	Mfr's catalogue	Mfr's catalogue	Mfr's a T.C.	√	P	V
	ii) Machined	Dimensional conformity	Major	Measurement	100%	Component Drawings	Vendor insp. Report	Vendor insp. Report	P		
12	Electrical components										
	i) Motors (=< 50 KW)	Routine test	Major	Review mfr's TC	100%	IS:325	IS 325/Mfr's T.C.	Mfr's T.C.	√	P	V
											Refer Note 3.
	ii) Brakes	Routine test	Major	Review mfr's TC	100%	Mfr. Std	Mfr. Std	Mfr's T.C.	√	P	V
	iii) Control panel	interlocking functional, IR HV, Sheet thknss Overall diemsnions , painting shade, Panel surface finish, Thickness, adhesive test, Component fixing, Degree of protection by paper inserting method	CR	Test for HV functional & routine check	100%	Relevant drg & IS 8623 Generally confirm to IPSS-1-10-002-82	Relevant drg/ IS 8623	Vendrs insp Report	√	P	W
											Refer Note No. 4 VFD Test Certificate to be submitted from L&T/Yaskawa /Vendor for verification.
	iv) Resistance boxes	HV,IR,Temp,rise, measure ment f resistance values	Major	Verification	100%	Generally confirm to IPSS-1-10-002-82	Generally confirm to IPSS-1-10-002-82	Mfr's T.C.	√	P	V
	iv) Master controllers	HV, IR,Sequence Test	Major	Verification	100%	Approved drawings	Approved drawings	Mfr's T.C.	√	P	V
											Refer Note No. 4
	iv) Limit swotches	HV, IR & Functional	Major	Verification	100%	Approved drawings	Approved drawings	Mfr's T.C.	√	P	V
	iv) Trailing cable, Power and Control Cable.	Routing & acceptance test ment f resistance values	Major	Verification	100%	IS: 4289,IS: 9968 (IS7098,IS 1554)-Part-1	IS: 4289,IS: 9968	Mfr's T.C.	√	P	V
		LEGEND :									
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				ITEM: EOT CRANE		QP_NO :	PE-VO-STD- 501-A101	PACKAGE : DOUBLE GIRDER TG HALL CRANE				
						REV :	3	CONTRACT NO : PE-TS-STD-501-A001				
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SL. NO.	COMPONENTS & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORDS	AGENCY	REMARKS		
1	4	3	4	5	6	7	8	9	D*	10	11	
13	Brought our items											
	Wire rope	Identification, Grade & dimensional conformity breaking strength	Major	Visual correlation with TC	100%	IS:2266	IS:2266	T.C.	√	P	V	
	ii) Other Items	Dimensional conformity	Major	Review TC	100%	Relevant Drg.	Relevant Drg.	Vendor Confirmation		P	V	
	iii) Bearing	Type Size	Major	Verticatic		Appd drg./Mfr's catalogue	Appd drg./Mfr's catalogue		√	P	V	
14	Assembly of cranes											
	i) Bridge with LT	Diemions, wheel level alignment	Major	Measurement	100%	GA drg/IS:3177	GA drg/IS:3177	Vendor insp. report	√	P	W	
	ii) Crab assembly	Diemions, wheel level alignment	Major	Measurement/ Visual	100%	GA drg/IS:3177	GA drg/IS:3177	Vendor insp. report	√	P	W	
	iii) Inspection at Works	a) Span, Diagonal Dimensional Check , Equipment layout on Bridge Platform, No load running of LT Machinery for direction , and speed with VFD..	Major	Measurement	100%	GA drg/IS:3177	GA drg/IS:3177	Vendor insp. report	√	P	W	
	iv) Inspection at Works	No load functional test for MHA, AH, CT along with VFD. Load & Overload test		Speed, Direction etc	100%	GA drg/IS:3177	GA drg/IS:3177		√	P	W	
15	Review of QA documentation						As per approved QAP			V	V	
16	Cleaning and Painting	Sand, blasting, painting	Major	Visual		As per Client's specs	As per Client's specs	Vendor's Report		P	V	
	Note 1 :	1. Original TCs / Photocopies certified in original by mill shall be furnished for review. Test .In absence of correlated TCs Check test shall be carried out from each plate/ bar for above 10 mm thk., certificates shall be offered for review at the time of stage inspection of components / assembly. Supplier shall ensure that pitted material is not used.										
	Note 2 :	4. X-Ray to be taken for thickness upto 19 mm and Gamma Ray for thickness above 19 mm. If Gamma Ray is used for lower thickness slow speed film like D2 to be used for clarity. All NDT shall be carried out by Qualified Level II personnel.										
	Note 3 :	For Motors of 50 KW rating and above Routine Test will be witnessed by BHEL and Type Test Certificate will be reviewed for validity and conformance. For below 50 KW rating routine tests to be witnessed by supplier of crane and Type test reviewed for validity and conformance. Photocopies of Type Test certificates are acceptable but shall be duly authenticated by Manufacturer										
	Note:5	5. Acceptance norms for UT (Normal probe to be used of not less than 2 MHz frequency) : Following defects are not acceptable: (i) Cracks, flakes, seams and laps (ii) Defects giving indications larger than 6 mm diameter equivalent flaw. (iii) Groups of defects with maximum indication less than that from a 6 mm diameter equivalent flaw which cannot be separated at testing sensitivity if the back echo is reduced to less than 40%. (iv) Defects giving indications of 3 to 6 mm diameter equivalent flaw separated by a distance less than four time the length of the larger of the adjacent flaws										

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		SUB -SYSTEM			REV :	3	CONTRACT NO : PE-TS-STD-501-A001							
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1	4	3	4	5	6	7	8	9	D*	M	C	N	10	11
	Note:6	6. Acceptance norms for UT (Normal probe to be used of not less than 2 MHz frequency) : Following defects are not acceptable (i) Cracks, flakes, seams and laps (ii) Defects giving indications larger than 4 mm diameter equivalent flaw. (iii) Groups of defects with maximum indication less than that from a 4 mm diameter equivalent flaw which cannot be separated at testing sensitivity if the back echo is reduced to less than 50%. (iv) Defects giving indications of 2 to 4 mm diameter equivalent flaw separated by a distance less than four time the size of the larger of the adjacent flaws For hooks, for carrying out UT on the areas where there is loss of back wall echo due to geometry, the calibration shall be done on blocks of same material of similar thickness having Flat Bottom holes of required size as given above.												
	Note 4 :	Perfrmnaace of electrical & control devices along with the interlocks, protection & sequence to be checked during crane assembly and parked at works.												
	Note 7 :	A1 material of construction shall be as per apprived drg. / data sheet // specifications												
		LEGEND :												
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VOLUME - IIB
SECTION – D



TITLE	SPECIFICATION NO. PE-TS-STD-501-A001	
	VOLUME II - B	
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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.**

- b) Inverter construction and related devices :

Construction shall be divided in 3 broad sections. Section One converts AC Supply into DC supply. Section 2 Converts and controls DC supply into AC Supply with regulation. Section 3 shall be used for braking action of the motor and Dynamic Braking Unit (DBU) can be inbuilt or external depending upon the drive capacity. VVVF can be used in open loop (without external speed feed back) like in Travel motions or close loop (With external speed feed back) like in Hoist motions. Chokes on input supply side are generally used in crane application for power regulation. Like all other electronic / electric devices VVVF drives are also protected by MCB / MCCB / Fuses. VVVF drives are sensitive to temperature and hence drive internal as well as external cooling fans are provided.

- c) Programming of VVVF Drives.

VVVF drives shall be programmable and for that purpose detachable digital Operator display unit shall be supplied along with the VVVF having required buttons for setting the user constant, functions etc. The VVVF drive is to be fine tuned by matching the motor parameters and setting the parameters on full load.

- d) VVVF drives shall be connected with power supply and these drives generate their own low voltage control supply. Potential free contacts shall be connected to this control supply and few programmable control terminals. Starting / stopping / set speeds operations of VVVF drive shall be achieved by above control connection.

- e) VVVF shall give smooth control over acceleration and deceleration making the motion jerk free and using Variable voltage variable frequency limits the inrush current to the squirrel cage motors. VVVF provides controlled torque to the motor due to which crane operations are jerk free.

1.1 Experience

The Frequency Converter Manufacturer shall have adequate experience in frequency converter manufacturing and have adequate business volume in order to provide credibility in his commitments and a capability of long term support.



TITLE <u>TECHNICAL SPECIFICATION</u> <u>VVVF DRIVE</u>	SPECIFICATION NO. PE-TS-STD-501-A001	
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1.2 Local support

The Supplier shall have a permanent representative office with a trained and skilled support staff, in the country where the goods are delivered, in order to prove his commitment for local support and to provide a channel for communication.

The engineers employed by the Supplier's regional office shall be certified by the Manufacturer and provide start-up service including physical inspection of the drive, connected wiring and final adjustments, to ensure that the AC Drive meets the required performance.

The Supplier shall be able to give basic drives training to the Customer's engineers, preferably on the site. The training shall, as a minimum, include system concepts and basic troubleshooting.

2.0 Basic requirements for the AC Drives

2.1 General requirements

The AC Drive shall comply with National(country of origin) and International standards and the recommendations for electrical industrial control devices (IEC, EN, UL, NFC, VDE).

The AC Drive shall be of the most modern design, yet user friendly and be simple to install, commission and maintain. The AC Drive shall be able to start and control the speed of a standard squirrel cage induction AC motor. The AC Drives shall be : CE marked, conforming to European Low Voltage (73/23/CEE and 93/68/CEE) and EMC (89/336/CEE) Directives, UL/CSA marked according to UL 508C.

The AC Drives have to be built to comply with the IEC standards.

The AC Drive shall be a digitally controlled drive, using, at least, the Pulse Width Modulation (PWM) with flux vector control open loop(for travel) and closed loop(for hoist). It shall have diodes / thyristors in rectifier and IGBT's in the inverter section in their entire power range, and it shall have the following minimum specifications.

Rated Input Voltages	380V -15% 480V +10%, three-phase
Rated Input Frequency	50Hz +/- 5%
Output Voltage	0 – Input voltage, three-phase
Output Frequency Range	0 to 400 Hz
Acceleration / Deceleration Time	0.01 – 999s, adjustable, linear, with S, with U or customised shapes



TITLE <u>TECHNICAL SPECIFICATION</u> <u>VVVF DRIVE</u>	SPECIFICATION NO. PE-TS-STD-501-A001	
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Overload capability (Constant Torque)	150% of nominal current for 1min.
Operating ambient Temperature	-10°C up to 50°C (shall be derated suitably if not rated at 50°C)
Storage ambient Temperature	-25°C up to 70 °C
Maximum operating altitude	1000 m without de-rating, 1000...3000 (shall be de-rated suitably)
Max. Relative Humidity	95 %, without condensation and dripping water.
Main Protections	Over current, short circuit between phase, short circuit between phase and ground, input phase loss, output phase loss, motor overload, over speed, over voltage, under voltage, drive over temperature

The AC Drive shall be able to give a 100 % output current continuously in the above specified conditions. In order to ensure that the drive can provide the required output current in the specified ambient conditions, the Manufacturer shall inform the required derating, if the ambient temperature given in the project-specific specification is higher than rated ambient of the drive or if the installation altitude is more than 1000 m above the sea level. The de-rating factor shall be specified so that neither the lifetime of the AC Drive nor the unit's performance, overload capability included, nor the reliability of the AC Drive shall suffer.

Suitable encoder shall be provided for main hoist motion.

3.0 User interface

3.1 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.

3.2 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 $\pm 10V$, 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



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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

3.4 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



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- 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

3.5 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.

3.6 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.

4.0 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.

5.0 Preferred makes:

Schneider Electric, L&T-YASKAWA, Siemens, ABB, Allen Bradley (Rockwell Automation).



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DOUBLE GIRDER EOT CRANE

1.0.0 SCOPE

This specification covers the design, material, manufacture, assembly, inspection and testing at manufacturer works for EOT cranes and shall be applicable unless the requirements are addressed otherwise in BHEL / BHEL's Customer approved documents.

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.

- | | | |
|-------|-----------------|---|
| i) | IS 807: 1976 | Codes of Practice for Design, Manufacture, Erection and Testing (Structural Portion) of cranes and hoists |
| ii) | IS: 3177 (1999) | Code of Practice for Design of Overhead Travelling Cranes and Gantry Cranes other than steel work cranes. |
| iii) | IS: 2266 | Specification for steel wire ropes for general Engineering purposes. |
| iv) | IS: 4029 | Guide for testing induction motor (for temperature rise). |
| v) | IS: 15560 | Steel hooks for standard shank design. |
| vi) | IS: 3443 | Specification for crane rail section. |
| vii) | IS: 325 | Three phase induction motors. |
| viii) | IS: 900 | Code of practice for installation and maintenance of induction motors. |



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ix)	IS: 4237	General requirement of switchgear and Control gear for voltage not exceeding 1000 V.
x)	IS: 434 (Part I)	Copper conductors rubber insulated cables for voltage up to 1000V.
xi)	IS 1596	Polyethylene insulated PVC sheathed cables
xii)	IS 3043	Code of practice Earthing
xiii)	IS: 3938	Electric Wire Rope Hoists.
xiv)	IS: 2147	Degree of protection provided by enclosures for Low voltage switchgear and control gear.
xv)	IS: 1554 Part I	PVC insulated (Heavy-duty) electric cables for working voltages up to and including 1100 volts.
xvi)	IS: 691	Flexible trailing cables rubber insulated.
xvii)	IS: 1653	Steel conduits for general engineering purposes.
xviii)	IS: 2509	Rigid non-metallic conduit for electric - Installations
xix)	IS: 2062	Steel for General Engineering purposes.
xx)	IS: 1030	Carbon Steel castings for general engineering purposes.



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XXI)	IS: 1570	Schedules for Wrought steels.
xxii)	IS: 1875	Carbon steel billets, blooms, slabs and bars for forgings.
xxiii)	IS: 808	Dimensions for hot rolled steel beam, column, channel and angle sections.
xxiv)	IS: 1852	Rolling and cutting tolerances for Hot rolled steel products.
xxv)	IS: 2291	Tangential Keys and Keyways.
xxvi)	IS: 2292	Taper Keys and Keyways.
xxvii)	IS: 3961	Recommended current rating for cables.
xxviii)	IS: 694	PVC insulated cables for working voltages up to and including 1100V)
xxix)	IS: 1554 (part-I)	PVC insulated (heavy duty) electric cables: Part 1: for working voltages up to and including 1100 volts.
xxx)	IS: 4289	Flexible cables for lifts and other flexible connections: Part 1: Elastomer insulated cables.
xxxI)	BS: 970	Wrought steels in the form of blooms, billets, bars and forgings.



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xxxii) IS: 5749/ BS 3017 Specification for Forged Rams horn Hooks
Indian electricity rules - 1956.

In the event of any conflict between the specification and standards mentioned above, the specification shall govern.

3.0.0 **DOUBLE 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 For outdoor cranes, LT brakes and equipments on trolley shall be covered to suit outdoor operation. Electrical and other equipments, which are exposed to weather, shall be completely covered or made weather proof. Cover shall be suitable for easy dismantling and assembly.

3.1.3 Safety devices should be provided with all equipment/parts covered under this specification.

3.1.4 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.

3.1.5 For welded construction such as bridge girders, end carriages, rope drum, gearboxes etc. steel shall be conforming to IS-2062 quality. Welding shall be carried out only by qualified welders and subjected to NDT as specified in Quality Plan.

Welding shall be carried out by welders qualified as per ASME Boiler and Pressure vessel code Sec. IX. Radiographs shall be inspected to a sensitivity of 2%.

a. Welding shall be performed by shielded electric arc, gas or other approved methods. The electrodes used for welding shall conform to AWS A5.1.

b. Wherever lateral welding of the main plates of box girders are required, it shall be butt-welded.



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IS shall not apply to the following requirements, which would be governed by specification indicated.

- a. Qualification of welding procedure and welder: These shall be carried out as per ASME Boiler and Pressure vessel code Sec. IX - Welding and brazing qualifications.
- b. Electrode designations and qualifications shall be as per AWS A 5.1.
- c. Electrodes should be of radiography quality with heavy covering as per IS: 814 and relevant requirement of ASME Sec IX and IIC.
- d. Bare electrodes as per IS: 7280 and flux wire combination as per IS: 3613.

3.1.6 No cast iron part shall be used on the crane except electrical equipment. However, in case of gear boxes' casing, use of cast iron not less than IS 210- Gr. FG260 is acceptable.

3.1.7 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.

3.1.8 All cables shall be clamped individually. All trailing cables shall be clamped with PVC or non-metallic clamp.

3.1.9 Walkways of CT shall be of chequered plate minimum 6 mm thick O/P at least 750 mm clear inside with non skid toe plates 8mm thick, projecting 100 mm above the floor. Walkways shall be of rigid construction and designed to sustain a distributed load of not less than 300 kg/ sq. mm

Intermediate posts for supporting handrails shall not be spaced more than 1.5 meters apart.



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Ladders provided shall have at least 450mm clear width with 20 mm rungs (rods) spaced 300 mm apart.

3.1.10 All wheels, couplings, open gear etc. shall be provided with covers.

3.1.11 All bolts except those with locknut shall be provided with grip lock nuts or spring washers.

3.1.12 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.

3.1.13 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.

3.1.14 All parts of the crane shall be thoroughly cleaned of mill scales, rust or foreign matter and then painted as per the specification requirements.

Unless specified otherwise in approved drawings / data sheet, tolerance on overall dimensions of assembly of Crane girder and Trolley and operating characteristics shall be as per Procedure number PEM (Q) 002. In case of deviations with respect to this standard, separate tolerance chart shall be prepared and submitted for approval for all the parameters:

The permissible camber shall be shown in drawing or data sheet submitted for approval.

Permissible variations in speeds at full notch with rated load, voltage and frequency shall be as follows:

- Traveling and traversing: $\pm 10\%$
- Hoisting: $\pm 10\%$
- Lowering: $\pm 25\%$

3.2.0 **STRUCTURAL DETAILS**

3.2.1.0 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%.



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- 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 Nuts and Bolts will be as per IS:1363, IS: 1364 and IS: 1367
 High-tension friction grip bolts as per IS: 3757 and High- tension friction grip nuts as per IS: 6623
- 3.2.1.5 Transverse filled welding on load carrying member shall be avoided.
- 3.2.1.6 All butt welds on structural members subjected to tensile stress shall be of radiographic quality as ASME Sec VIII Div.1 acceptance norms.
- 3.2.1.7 Fillet welding on load carrying members shall be avoided.
- 3.2.1.8 For load carrying members the component plates, bars, angles and other rolled sections shall be minimum 8mm 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 8mm.
- 3.2.1.9 The cranes working out door or in corrosive environment, an allowance of 1.5 mm shall be added to the calculated thickness.
- 3.2.1.10 Minimum thickness of chequered plates for platform shall be over 6 mm over plain. Chequered plates shall not be considered for strength calculations of load carrying members.
- 3.2.1.11 Splice shall be designed to resist all the forces and moments to which it is subjected to plus 50% thereof.
- 3.2.1.12 However, in no case the strength developed by the splice shall be less than 50% of the effective strength of the material spliced. Splices shall be proportioned and arranged, so that the gravity axis of the splice in line with the gravity axis of the member joined so as to avoid the eccentricity of the loading.
- 3.2.1.13 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 material which are superior for the intended service. But in all the cases, prior concurrence of the purchaser is must.
- 3.2.1.14 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 2/3rd of the effective strength of the



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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 percent more than that of the material spliced. Splices shall be proportioned and arranged, so that the gravity axes of the splices are in line with the gravity axis of the member to avoid eccentricity.

3.2.2 **Bridge Girder**

3.2.2.1 The bridge girder shall consist of a box construction with double Web plate girders or lattice girders 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.

3.2.2.2 Maximum deflection of the bridge girder, with safe working load, shall not exceed 1/900 of the span or as specified in the specification keeping trolley stationed at middle of the span. The girder shall be supported on the centerline of LT wheels during the deflection check. The girder shall be cambered by an amount by an amount equal to the maximum deflection

3.2.2.3 Box section shall be adequately reinforced by internal diaphragms and ribs to withstand the most severe combination of load that may develop under different working conditions. Additional Internal diaphragms shall be provided at points where external members are welded for providing support to drives etc.

3.2.2.4 Box girders shall be provided with end plates sealing. Diaphragms inside the girder shall extend to the full - width & depth of the girder and the web plates shall be reinforced by angles all along the full length of the plates spaced midway between the diaphragms. Full depth diaphragms or stiffeners shall be furnished at bridge drive supports and below the line shaft bearings.

3.2.2.5 Short diaphragms shall be furnished and are required to transmit the trolley wheel loads to the web plates. Trolley rail section shall not be considered into design of bridge girders.

3.2.2.6 Full length chequered platforms on both side or one side full length & other side two short length platforms shall be provided on the side of bridge girders as specified in data sheet - A.



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3.2.2.7 For cabin operated crane, the access to operator's cabin or DSL maintenance cradle shall be from bridge platform. There should not be accumulation of water/oil inside the box girders. If required breathing holes can be provided for expansion / contraction, due to change in temperature. Tapped (threaded) holes shall be

provided with ½" NPT plug in the bottom of the girders, at both ends, to drain off any accumulation of water / Oil inside the girder. Instruction shall be painted on the girders to remove the plug and check for water/oil before lifting. Plug shall be replaced after installation.

3.2.2.8 All connection splices shall be designed for full strength of member of loads indicated unless otherwise approved. Beams and connections shall be designed for 60% of shear capacity of beam section plus additional axial load if any. Not more than one splice shall be provided to make up full length of member.

3.2.2.9 Maximum Span/ Depth ratio for Girder

- Plate Girder : 18
- Lattice Girder: 12

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. The length of the end carriages shall be such that no other part of the crane is damaged in collision. End carriage shall be so designed as to distribute the load evenly between the wheels from each bridge girders.

3.2.3.2 The wheel base shall not be less than 1/5th of the span. End carriage shall be fitted with safety stop to prevent the end carriage falling more than 25 mm in the event of breakage of a track wheel, bogies or axle.

3.2.3.3 Suitable jacking pads at a suitable height from rail level shall be provided on each crane for crane jacking. Jacking pad dimensions shall be suitable for full seating of the jacking pad seat without any instability. When changing the track wheel, jacking pads shall not interfere with replacement of track wheel.



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3.2.4 **Crab (Trolley)**

3.2.4.1 The crab frame shall be built from heavy steel section, welded properly to form single piece frame & to resist vertical, lateral and torsional strain and to support all loads without undue deflection. It should be properly machined to receive hoisting mechanism, cross traverse arrangement/mechanism, wheels etc. etc.

3.2.4.2 Sheaves, part of hoisting mechanism, shall be so arranged on trolley that rope reeling arrangement shall ensure lifting of load in vertical line with minimum of swing or side movement. Trolley shall be provided with chequered plates all over except for opening required for ropes and equipment foundation. Equipment foundation shall not be welded/ supported on chequered plates. Toe plates 100 mm high and 6mm thick shall be provided around opening provided for movement of ropes. Suitable railing shall also be provided around the opening for rope in case the opening is large.

3.2.4.3 **Platforms and Ladders**

a) Safe means of access shall be provided to the operator's cab and 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.

b) Every platform shall be provided with steel chequered plate top and be securely fenced with 1050 mm high double tier hand rails and toe boards. Platforms shall be of sufficient width to enable normal maintenance work to be undertaken safely

c) Safety hand railing of tubular construction 32 mm NB Medium class of IS: 1161 having top and bottom rail at height of 1050 mm and 600 mm and vertical post spacing not exceeding 1500 mm with provision of kick plate (100 mm high and 6 mm thick) shall be provided on bridge walkways and on end carriages, staircases, landing in cabin, trolley and at any other place where access is provided. Bends shall be neat and made by machine. The top rail should be so laid that there is no intermediate obstruction and hand need not be lifted from rail while walking

d) 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.



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e) Access to operator's cabin from bridge girder platform shall be by staircase having adequate width and proper sloping.

3.2.4.4 Operator's Cabin

3.2.5.1 Cabin shall have ample size and with clear headroom of 2m for accommodating controllers, main isolating switch and other accessories for the operation of the crane. All electrical equipment in crane cabin shall be suitably enclosed for the safety of the operator.

3.2.5.2 Cabin's platform shall be covered with an insulating carpet of 5mm thick.

3.2.5.3 An electric warning horn shall be provided and mounted on underside of the cabin. Control shall be arranged in such a way that the horn operates automatically when bridge travel motor is energised. In addition, manual control shall be provided on operator's cabin at a location ergonomically suitable to the operator.

3.2.5.4 Manual control shall not override automatic control and shall serve only to operate horn when the bridge is not in motion. Manual control shall be of the manual hold down type with automatic return to the open position. Horn shall be of heavy-duty howler type & adequate rating.

3.2.5.5 One number portable fire extinguished of 4.5 Kg capacity or as specified elsewhere in the specification shall be provided inside the cabin.

3.2.5.6 A swing-way operator's chair.

3.2.5.7 Adequate illumination as per date Sheet A or as specified else where in the spec.

3.2.5.8 A non-oscillating ventilating fan with 380 mm sweep with complete guard and regulator.

3.2.5.9 Brief description of crane operation, Maintenance and periodical lubrication etc. typed in English and in local language neatly framed in a permanent frame for easy reference.

3.2.5.10 Area of the cabin shall be 2500x1800 (min.), with headroom as 2000 mm clear.

3.2.5.11 A distinct type alarm with conspicuous warning light on either side of the crane bridge to indicate overloading of the crane.

3.2.5.12 Suitable inspection cages to accommodate two persons to facilitate inspection of DSL.

3.3.0 MECHANICAL



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3.3.1 Rope drums

Rope drums shall be of mild steel plate fabricated or of cast steel as the case may be. 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 is 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. One spare groove shall be provided 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 groove 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.

For evaluation of Radiography the designed thickness of the drum (top of crest to ID) shall be taken into consideration and not the thickness of plate selected.

3.3.2 Hoist ropes

Ropes of fibre /steel core as specified in Data sheet " A" shall be of right hand lay, 6x37 or 6x36 construction of best plough steel having minimum tensile strength as 160-175 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 (Castings to IS: 1030 Gr. II with Y.P. greater than 50% of UTS) or forged 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 & CT wheels shall be double flanged with taper/ straight tread. The wheels shall be capable of taking up misalignment in span as specified. Solid wheel shall either be of forged steel or as specified in Data sheet. The wheel rim shall be with minimum



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hardness of BHN 300-350. Wheels may be either hardened on tread portion as per IS -3177 or Volume hardened. 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. Buffer is to be fitted to each end of carriage assembly and crab so that buffer contact takes place before the bridge or trolley reaches the end of rail.

3.3.6 **LT drive**

The bridge motion shall be achieved by twin/single drive arrangement as specified elsewhere. When twin drives are used, these shall be operating in unison to avoid skewing effect. The drives shall be interlocked for simultaneous starting, stopping & speed control.

3.3.7 **CT drive**

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

3.3.8. **Gearing**

3.3.8.1 Gears in speed reducer unit for bridge drive, hoists and trolley drive gearing shall be enclosed in substantial housing and shall operate in oil bath. The housing shall be of sufficient design not to permit temperature. in excess of 90°C for the oil bath. 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 1.6 Micron finish or better and lapped with some minimum applied load to remove high spots and to improve tooth contact. Cast alloy steel is acceptable only for gears in the last stage of speed reduction. Surface hardening of teeth is not acceptable. Gear teeth shall preferably be cut in metric module system. Gears shall be designed to meet



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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. In case of totally enclosed gearboxes, splash or automatic lubrication system shall be used. Covers shall be split horizontally at each shaft centre line, so that top half can be removed for inspection and repair with out disturbing the bottom half. Gear shafts shall be supported on ball/roller bearings mounted in gearbox unless specially agreed otherwise. The gear boxes shall be provided with breather, air vent, oil level indicator, dip stick, drain plug and lugs for lifting.

Radial clearance between the gear boxes inner surface and outside diameter of the gears shall be at least 1.25 times the depth of larger gear tooth inside the gear box or 20mm whichever ever is higher. Facial clearance between inner surface of gearbox and face of gear or pinion shall be at least 20 mm. Gearbox shall be inspected in line with QP and as per PEM (Q)/001 enclosed.

3.3.9.2 The gearboxes shall be of mild steel or cast steel. All fabricated gearboxes shall be stress relieved at a temperature between 590 to 680 deg. C. The temperature shall be maintained within ± 20 deg. C and at no time during the soaking cycle the temperature shall fall below 590 deg. C or exceed 680 deg. C. Soaking shall be done for a period proportionate to 1 (one) hour/ 2.5 cm. of wall thickness.

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. Drive side bearing on Hoisting equipment shall be ball / roller bearing type. Rated life of ball and roller bearing shall be not less than total working life as per relevant Codes IS-3177. 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. Lubrication arrangement and clamping shall be done neatly. Bends in pipe shall be done with the help of machine. Bearing enclosures shall be designed as far as practicable to exclude dirt and shall prevent oil leakage. Accessibility should be such that parts may be safely lubricated from the walkway or ladder when the crane is not in motion.



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3.3.11. Shafts, Couplings and axles

3.3.11.1 Shafts and axles shall be made from solid rolled or forged steel bars and shall have ample strength and rigidity and adequate bearing surface. If shouldered, they shall be provided with fillets of ample radius and /or be tapered to avoid stress concentration.

Motor shafts shall be connected to gearbox input extension shafts through flexible

gear coupling. Solid coupling shall be used for connecting intermediate lengths of long travel shafts. For driving hoist drum full-gear couplings shall be used between hoists drum & hoist gearbox output shaft. Couplings shall be of cast steel/wrought steel conforming to IS: 210 grade 260 and shall be designed to suit service conditions.

3.3.11.2 Self-aligning type gear couplings shall be used between connection shafts to take care of transverse connection shafts to take care of transverse as well as axial movement whenever necessary. Whenever components of considerable amount of inertia are directly mounted on the high-speed shaft (e.g. brake drum, coupling etc.) they shall be balanced statically to minimise vibration.

3.3.12 Repair Cage

A repair cage shall be provided on the inside of the end carriage for attending the main current collectors. The repair cage shall be adequately sized to accommodate two persons. And guarded for safety and correctly located for the intended service. Suitable access to the cage shall be provided. Repair cage shall be provided at the corner of the crane.

3.3.13 Lifting hook

Standard hooks shall be used unless otherwise specified. These hooks shall conform to the latest edition. All hooks used shall be in normalized condition only.

3.3.14 LIFTING HOOK BLOCK ASSY



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3.3.14.1 Lifting hook block assembly shall be Ram shorn type or approved for capacity greater than 50 Tonnes and point hook with Shank for capacity below 50 Tonnes and shall be of forged steel construction. Hooks shall be manufactured from Blooms, billets, rounds by forging with forging ratio of at least 3:1. Hooks manufactured from plates are not acceptable. All hooks used shall be in normalized condition only. Each hook

shall be supported on ball or roller thrust bearing and shall rotate freely.

3.3.14.2 The sheaves of the hook block shall be enclosed in an oil tight casing permitting generous lubrication of wire ropes, sheaves and also preventing accidental tapping of hands.

3.3.15 Brakes

3.3.15.1 Selection and design of brakes shall be such as to meet the requirement. Brakes shall be designed to suit 150% FLT of motor for the hoist motions and 125% FLT of motor for LT/CT motion. Brakes shall be provided as specified in Data Sheet 'A'. Brake drum shall be separately mounted and coupling halves shall not be used as brake drum.

i) SERVICE BRAKE

Double shoe types 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.

ii) HOIST CONTROL

Hoist motion (both main & aux) shall be provided with a self-contained sturdy braking system to control the speed of hoisting as well as lowering down to 10% rated speed. The braking system shall be reasonably uniform and effective in all loads at any position.

3.4.0 **ELECTRICAL** For export contracts the voltage, frequency, environmental protection and safety requirements shall be specified as per the respective Contract requirements.)



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- 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 Disconnecting/Isolating Switch fuse unit shall be provided at 1.5M above the operating floor level at one end / at both the ends of bay length or in the middle as specified in the data sheet A. Termination of incoming power supplies cable to isolating switch fuse unit and further 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 or M.S. Angle type 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 3% or specified in data sheet "A". If MS angle sections are used as runway conductor, then current density shall not be more than 0.42 Amp/Sq mm. It shall be supplied with brackets. Maintenance cradle for DSL shall be provided on crane if asked in Data Sheet 'A'. Sufficient allowance of min 20% 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 cast iron type with 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 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 starting torque of motor shall not be less than 2.25 times the rated torque and pull out torque shall not be less than 275% of the rated full load torque of motor. In case of Conventional drive the motors for Main hoists, Auxiliary hoist, CT and LT will be slip ring type while motors for creep speed will be Squirrel cage type. In case of VVVF



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drive system, the creep speed will be achieved through VVVF and the main motors for Main hoists, Auxiliary hoist, CT and LT will be Squirrel cage instead of Slip ring. Hoisting drive motors shall be provided with antifriction roller / ball bearings on the drive side.

- 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 15% or as specified in data sheet "A"

shall be considered over the calculated rating of the motor. The protection class of the motors shall be as IP-54 for indoor duty / IP-55 for out door duty OR as specified in data sheet "A". Motors shall be tested at manufacturers 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 spec. 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 with standing 2.5 times the rated speed.
- 3.4.2.4 Motors shall be painted in line with painting instructions specified in Painting Scheme Annexure IV attached along with the technical specification.

3.4.3 **Limit switches**

The hoist mechanism of the crane shall be provided with rotary type limit switch to open the control circuit & 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 also be provided. This switch will operate in the event of failure of main limit switch. Lever operated limit switches shall be provided at both ends of longitudinal travel and cross traverse. These limit switches shall be self reset type. The limit switches shall be as per "Data Sheet A"

3.4.4 **Resistances**



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- 3.4.4.1 Resistances for starting and speed control of slip ring induction motor shall be such that temperature rises does not exceed 250 deg. C during crane operation under any condition. Resistances shall be heavy duty, punch grid type and of stainless steel with 10minutes rated and conforming to IS: 3177. Tolerance on resistances shall be within $\pm 10\%$.
- 3.4.4.2 The resistances shall be unbreakable, rust proof and housed in a well-ventilated expanded metal enclosure. The general arrangement of resistances shall be such as to permit easy removal or replacement of defective element. Sufficient space shall be provided around the resistors to ensure adequate cooling airflow.
- 3.4.4.3 The tapping shall comprise of copper strips and shall be brought out to an accessible terminal board for external connection. The resistances shall cut off automatically step-by-step with the help of contactors and timers to give smooth acceleration to the crane.
- 3.4.5 **Switch**
 All switches shall be hand operated; air break, heavy duty, quick make and quick break type. 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 be included.
- 3.4.6. **Contactors.**
 Contactors shall be suitable for heavy duty, with current rating not less than connected motor full load current. All reversing contactors shall be mechanically and electrically interlocked. Arc chutes shall be provided where necessary.
 Each contactor shall be provided with three positive acting ambient temp. Compensated thermal overload relay with adjustable setting to suit the motor current. The relay shall be hand reset type, suitable for current. The relays shall be replaceable from front.
- 3.4.7 **Push button and lamp**
 Push button shall be spring return type with 2 NO + 2 NC contacts, rated 10A, 240 V AC. Indicating lamps and lens shall be replaceable from front.
- 3.4.8 **Protective Panel**



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3.4.8.1 The electrical protective panel shall be a cubicle fabricated from 2 mm thick sheet steel with lockable-hinged door. The control cabinet's door shall be interlocked with the operating handles of isolating switches of supply circuits so as to prevent opening of the door when an isolating switch is closed. A device for bypassing the interlock shall also be provided. It shall be dust and vermin proof with degree of protection as IP-54 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) Emergency push button at convenient height for the operation for interruption of the entire power.
- d) Thermal overload relay for each drive. It shall be ambient temperature compensated and adjustable type.
- e) Contactors, timer and auxiliary contactors.
- f) Portable Lighting Transformer rated for 415/24V.
- g) Lighting Voltage Transformer with fuse 415/24V.
- h) Control transformer with fuses.
- i) Indicating lamps to indicate the live condition of all three phases.
- j) Main supply ON/OFF lamps on the door of the protective panel.
- k) Electrical interlock shall be provided to prevent the main contactor being closed unless all controllers are in OFF position.
- l) Other equipments as per supplier's standard practice. Air break contactors shall conform to category AC-4 duty. The main contacts shall have the rating for 5 Amps. or as specified in the data sheet A. The contactor drop off voltage shall be between 45-50% of rated voltage.



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- m) All internal wiring shall be identified with numbering rules at both ends as per the relevant wiring diagram.
- n) Each panel shall have internal illumination with fluorescent lamp. The inside of the panel shall be painted white.
- o) Separate terminal blocks shall be provided for terminating circuits of various voltage classes. At least 20% spare terminals for the wire terminations shall be provided in the cabinet.

3.4.9 **Master Controller**

3.4.9.1 The speed of each drive shall be controlled by master controller or as specified in the data Sheet 'A' Master Controller for hoisting motion shall have 5 steps and for LT/CT it shall have minimum 4 steps. Master controller contacts shall be fully enclosed in

dust and vermin proof enclosure.

3.4.9.2 The master controller is provided with spring to its "OFF" position. Master Controller in "OFF Position shall disconnect power supply to motors. Each controller shall bear suitably engraved inscription of motions in English and direction of motion by Arrow. Master controller shall be suitably located in operator's cabin as to provide maximum convenient and view to the operator. The master controller shall be provided with terminal block to facilitate external connection.

3.4.9.3 **Starter Panel**

Separate panels shall be provided for CT, LT & hoist motion (Main and Auxiliary), with following type of items.

- a) Contactors : AC4 duty for reversing applications
AC3 duty for non-reversing applications
- b) Switches : AC23 for motor application.
AC22 for other application
- c) Fuses : HRC
- d) Overload relays: Temperature compensated bi-metallic with single phasing preventor.

3.4.10 **MOTOR CONTROL PANEL**



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The motor control panels shall be dust and weatherproof to IP-54 or as specified in "Data Sheet A" & shall be provided for each motion. The panel shall contain minimum the following components.

- a) Switch fuse unit with contacts of adequate rating for each motion.
- b) Thermal overload relay for each drive. These shall be ambient temperature compensated adjustable type.
- c) Contactors, timers and auxiliary contactors.
- d) The panel shall be provided with space heater. The space heater with thermostat shall be located at the bottom of the panel and shall have individual ON/OFF switch.
- e) Terminal blocks shall be stud or snap on type. A protective cover shall be fixed on top of terminal blocks to prevent accidental contact. A minimum of 20% spare terminals shall be provided.
- f) Air break contactors shall be provided for main supply as well as for motors. They shall conform to category AC-4 as per IS-1322. These shall have three main contacts and 2 No. & 2 NC auxiliary contacts.
- g) The main contacts shall have the ratings as per duty requirement but auxiliary contact shall be rated for 5 amp 240V AC. The contactor drop off voltage shall be between 45-50% of rated voltage. The contactor coil shall be suitable for 240V AC supply.
- h) The auxiliary contactors shall have 4 No. + 4 NC contacts for control and interlocking purposes. The contacts shall be convertible. The contacts rating shall be suitable for 5 amps at 240 Volts AC.
- i) Adequate protection for overload and short circuit shall be provided for all the three phases of each motor.
- j) Double pole switch fuse unit for control circuit of the contractor 'START (push button and a pilot lamp with the red lens for indicating the contactor "CLOSED" shall be furnished.

3.4.11 Illumination



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Crane lighting and space heating system shall be de- signed for 240V, 1Phase 50Hz supply and receptacle system with 24V 1Phase 50Hz supply or as specified in the specification. Suitable dry type transformers shall be furnished for this purpose, complete with isolation facility and Primary/secondary fuses.

- a) Branch Circuits for lighting and receptacles shall be individually protected by switch fuse units.
- b) 40W fluorescent fixtures / 60W bulkhead fittings with incandesant lamp shall be used for lighting operator's cabin and bridge platform.
- c) Four (4) - 400 W / 250 W high bay Sodium vapour / Mercury vapour lamps shall be provided under the bridge as specified in the data sheet "A"
- d) All lighting fixtures shall be mounted with anti-vibration mounting and shall be easily accessible for maintenance.
- e) 24V - 5A - 3 pin industrial socket outlets shall be provided. Two (2) in operator's cabin and minimum four (4) on the bridge along the walk way on both sides of full length platforms.
- f) One (1) portable 40 W hand lamp with min. half span length flexible cable for inspection of crane components.
- g) Operator's cabin shall be provided with one (1) electric fan and one (1) heavy-duty industrial siren. Siren shall be foot operated.

3.4.13 **Grounding**

3.4.13.1 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.

3.4.13.2 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.

3.4.14 Red warning light 3 Nos. shall be provided at both ends of the gantry girder to indicate the aliveness of DSL.

3.4.15 **Wiring Systems**

- a) Power wiring to any motor shall be done with 1100v grade aluminium conductor, PVC insulated / armoured /FRLS cable of suitable sizes as specified in Data Sheet A.



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- b) 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.
- c) All control and auxiliary external circuit wiring shall be done with PVC insulated FRLS type 2.5mm stranded copper conductor.
- d) 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.
- e) Each motor shall be wired independently. Power and control wiring shall be effectively separated.
- f) Each wire shall be identified at both ends with wire designation in accordance with circuit wiring diagram.
- g) All wire termination to the panels shall be provided with clamp type connections screw. Screw Type terminals with screw directly impinging on conductors are not acceptable.
- h) Multi way terminal blocks complete with screw nut, washer and marking strips shall be furnished for terminating the panel wiring.
- i) 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
- j) Each terminal block shall be marked with designation in accordance with conductors wiring diagram.

3.5.0 Radio Remote Control

- a) The equipment should have facility to control EOT crane by radio frequency based wireless remote unit. The equipment should be supplied with transmitter unit, receiver unit, encoder unit, decoder unit, interface panel, coupling system, battery unit and any other control gear if required.
- b) The equipment should be based upon the microprocessor based digital technology with almost nil hard wiring.
- c) The remote unit should communicate up to the distance of approximately 100 meters.



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- d) The system has to integrate with the control system of crane, which operates at 110 V AC, Single phase.
- e) The remote unit should have transmitter which can be mounted on shoulder by suitable belt. Main controls can be of single joystick movement or double joystick movement type stepped control with spring return. The Micro control should be toggle switch type or push control type.
- f) Frequency allotment of radio remote unit from Govt. of India, Deptt. of Telecommunication or any other agency shall be the responsibility of supplier.
- g) The transmitter and receiver unit should have its own frequency and address code with each system having its own security code so that one particular set becomes unique and there is no interference from any other remote unit device. A microprocessor should check all security codes. The processor should have its own watchdog circuit. The receiver FM band should be sufficiently narrow to allow only passing of desired frequency and valid command. Any error should shut down the system immediately.
- h) The remote unit should have safety key to prevent any unauthorized operation. All the crane operations should stop at once the communication break down occurs.
- i) On local unit (receiver side), the system should be provided with one selector switch so that EOT crane can be operated either from Operator cabin or radio remote unit.
- j) In case tandem operation is envisaged, a suitable selector switch shall be provided in the cabin for selection of Tandem/normal operation.
- k) The receiver unit along with I/O interface unit should be able to bear the vibrations and shocks encountered in normal usage of EOT crane.
- l) The system should have very fast response time.



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* Information's are to be furnished by bidder during contract stage

Sr. No.		DESCRIPTION	TECHNICAL PARTICULARS
1.0.0		General	
1.1.0		Name of manufacturer	*
	a.	EOT Crane	*
	b.	Crane motors	*
	c.	Runway conductors	*
1.2.0		Weight of equipments	
	a.	Bridge assembly	*
	b.	Trolley assembly	*
	c.	Total crane weight	*
	d.	Total weight of the gantry rail	*
	e.	Total weight of DSL	*
	f.	Total weight of all the equipments under this specification	*
1.3.0		Design, fabrication and testing of the crane confirm to standard / code number	IS: 3177-1999
1.4.0		Number of cranes	One(1)/Two (2)
1.5.0		Crane classification	Mechanism Class: M5 Electrical services: M7 (PROJECT SPECIFIC)
1.6.0		Suitable for outdoor or indoor duty	Indoor
1.7.0		Capacity and lift	
1.7.1		Main hoist	
	a.	Rated SWC – tonnes	As per crane clearance diagram
	b.	Test load SWC – tonnes	Rated SWC and over load test : 125% of SWC



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1.7.2		Aux. hoists		
	a.	Rated SWC – tonnes	As per crane clearance diagram	
	b.	Test load SWC – tonnes	Rated SWC and over load test : 125% of SWC	
1.8.0		Span	As per crane clearance diagram	
1.9.0		Operation from	Cabin + Pendant Push Button + RADIO REMOTE CONTROL (PROJECT SPECIFIC)	
2.00		CRANE PERFORMANCE		
2.1.0		Crane speed with full load	Full speed M/Min	Creep speed M/Min
	a.	Main hoist	(Project Specific)	10% of main speed
	b.	Aux. hoist	(Project Specific)	10% of main speed
	c.	Trolley travel (CT)	(Project Specific)	10% of main speed
	d.	Longitudinal bridge travel (LT)	(Project Specific)	10% of main speed
2.2.0		Acceleration values	LT motion (bridge travel)	CT motion (trolley travel)
			As per IS: 3177	As per IS: 3177
2.3.0		Lift in Metres	The lifting rope shall be of sufficient length to permit the hook to reach the zero level.	
	a.	Main Hoist	As per Crane clearance diagram	
	b.	Aux Hoist	As per Crane clearance diagram	
2.4.0		Hook Approaches		
	a.	Main hook (cabin end)	As per Crane clearance diagram	
	b.	Aux. Hook (cabin-end)	As per Crane clearance diagram	
	c.	Main hook (other end)	As per Crane clearance diagram	
	d.	Aux. Hook (other end)	As per Crane clearance diagram	
2.5.0		Hand Rail Pipes	32 mm NB Medium class of IS: 1161 having top and bottom rail at height of 1050 mm and 600 mm and vertical post spacing not exceeding 1500 mm with provision of kick plate (100 mm high and 6mm thick)	
3.0.0		COMPONENT DETAILS		
3.1.0		Trolley		
	a.	Type	Fabricated	
	b.	Method of fabrication	Fusion welded	

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	c.	Material	IS: 2062 Gr. A up to 20mm thickness, Grade B Normalized for thickness above 20mm. High steel alloy steel confirming to IS: 8500 is also acceptable.	
	d.	Centre to centre distance of wheels (on the same rails)	*	
	e.	Whether jacking pads for lifting trolley provided or not	Yes / No	
3.2.0		Rope drums	Main hoist	Aux. Hoist
	a.	Dimensions in mm length and diameter (PCD)	During detailed engineering	During detailed engineering
	b.	Material (Indicate IS)	Seamless pipe ASTM -106 or fabricated Fe410w IS: 2062 & stress relieved	
	c.	Flange / flangeless	Flanged	
	d.	Numbers provided	One for each hoist	
	e.	Number of grooves	*	*
	f.	Type of grooves	Identical Right hand and Left hand	
	g.	Diameter on bottom of grooves	During detailed engineering	During detailed engineering
3.3.0		Rope details		
	a.	Construction	Extra flexible plough steel , 6 x 36 / 6 x 37 construction	
	b.	Grade	During detailed engineering	
	c.	Standard conforming to	IS: 2266	
	d.	Diameter in mm	*	*
	e.	Breaking strength	*	*
	f.	Tensile designation	*	*
	g.	Factor of safety	5.25 as per IS	5.25 as per IS
	h.	Type of core	Fibre	Fibre
	i.	Number of falls	*	Min. 4
	j.	Length of rope	*	*
3.4.0		Sheaves details	Main hoist	Aux. Hoist
	a.	Material	Fe 410 WA IS: 2062 Gr. A or B/ CS Gr. 280-520 IS: 1030	
	b.	Diameter of main sheaves in mm on Root	During detailed engineering	During detailed engineering



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	c.	Diameter of Equalizing sheaves (in mm) on Root	Should not be less 62% of calculated main sheave diameter	Should not be less 62% of calculated main sheave diameter		
	d.	Type of guards provided	Fabricated from Sheet steel			
3.5.0		COUPLINGS & SHAFTING				
3.5.1		Coupling details (between motor and gear box)	Main hoist	Aux. Hoist	Cross Travel	Long Travel
	a.	Type	Flexible geared Type			
	b.	Size & Torque rating	*			
	c.	Guards and enclosures	Provided			
3.5.2		Coupling details (between gear box and wheels)	Cross Travel (CT)		Long Travel (LT)	
	a.	Type	Flexible geared type			
	b.	Size & Torque rating	*			
	c.	Guards and enclosures provided	Yes			
3.5.3		Coupling details (between gear box and rope drum)	Main hoist		Aux. Hoist	
	a.	Type	Flexible Built-in gear couplings			
	b.	Size	*			
	c.	Guards and enclosures provided	Yes			
3.5.4		Shafting (Output)	Cross Travel		Long Travel	
	a.	Diameter in mm	*		*	
	b.	Factor of Safety	As per IS: 3177-1999			
	c.	Number of support bearings	*		*	
	d.	Type of support bearing	*		*	
	e.	Arrangement of lubrication	Grease cups / Nipple			
	f.	Type of lubricant	Grease			
	g.	Max unsupported length of shaft in mm	*		*	
3.6.0		Gear box details				



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3.6.1		Hoist Motions	MH	MH Micro	AH	AH micro
	a.	Type of mounting of gear box	Horizontal / Vertical			
	b.	Classification	Suitable for M5 duty			
	c.	Total number of reductions	3	1	3	1
	d.	Type of gears	Helical	Helical	Helical	Helical
	e.	Reduction ratio	*			
	f.	Type of lubrication (grease / splash / pump lubrication)	Splash Lubrication			
	g.	Hardness (BHN) – gear	*			
	h.	Hardness (BHN) – pinion	*			
	i.	Difference in Gear and pinion hardness	Min 20 BHN			
	j.	Materials (gear/pinions)	Main Gears En 9/ 55C8/ IS2707 Gr. 1 or 2 Pinions En 19/ EN 24. Hardness conforming to IS: 3177			
	k.	Castings	Fabricated Fe 410w IS: 2062 & stress relieved			
	l.	Noise level	85 dbA	85 dbA	85 dbA	85 dbA
	m.	Standard conforming to	IS: 4460 / AGMA			
3.6.2		Travel Motions	CT	CT micro	LT	LT micro
	a.	Type of mounting gear box	Vertical			
	b.	Classification	M5 duty			
	c.	Total number of reduction	3	1	3	1
	d.	Type of gears	Helical	Helical	Helical	Helical
	e.	Reduction ratio	*			
	f.	Type of lubrication (grease / splash / pump lubrication)	Splash Lubrication			
	g.	Hardness (BHN) – gear	*			
	h.	Hardness (BHN) – pinion	*			
	i.	Difference in Gear and pinion hardness	Min 20 BHN			



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	j.	Materials (gear / pinions)	Main Gears En 9/ 55C8/ IS2707 Gr. 1 or 2 Pinions En 19/ EN 24. Hardness conforming to IS: 3177	
	k.	Castings	Fabricated Fe 410w IS: 2062 & stress relieved	
	l.	Standard conforming to	IS: 4460 / AGMA	
3.7.0		Wheels details	Cross travel	Long travel
	a.	Material	C 55 Mn 75 / EN 9 (55 C 8)	
	b.	Hardness	300 – 350 BHN	
	c.	Depth of hardness	10 mm (min)	
	d.	Tread diameter in mm	*	*
	e.	Tread width in mm	*	*
	f.	Process of hardening	Volume hardening	
	g.	Type	Double flanged straight tread	
	h.	Numbers provided	4 nos.	8 nos.
	i.	Specification conforming to	IS: 3177	
	j.	Arrangement of lubrication	Grease	
3.8.0		Lifting hooks	MH	AH
	a.	Type	Ramshorn	'C' type
	b.	Safe lifting capacity	Project Specific	Project Specific
	c.	Material	EN 3A-BS 970 Class 2 IS: 1875	
	d.	Standard conforming to	IS: 5749/ BS 3017	IS: 15560
	e.	Hook can rotate	Yes / No	
	f.	Safety latch on hook provided	Yes / No	
	g.	Locking device on swivelling hook required or not	Provided	
3.9.0		Buffers	Cross travel	Long travel
	a.	Type	Spring loaded type. To be designed to bring the loaded crane to rest from speed of 50% of the rated speed.	
	b.	Numbers provided	4	4
	c.	Details of end stop	Fabricated Fe 410w IS: 2062	
3.10.0		Brakes		



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3.10.1		Hoist Motions	MH	MH micro	AH	AH micro
	a.	Type of brake (ac / dc / thruster)	AC Electro-Hydraulic Thruster operated			
	b.	Diameter of brake in mm	*			
	c.	Torque rating Kg. M	*			
	d.	Number provided per motor	2	1	2	1
	e.	Braking capacity	150%	150%	150%	150%
	f.	Braking torque actually required	*	*	*	*
	g.	Material	*			
		• Brake liners	Ferodo liners			
		• Drum	CS IS : 1030 / CL 4 IS : 1875			
		• Springs	As per manufacturers standard			
	h.	Braking distance in mm	*	*	*	*
3.10.2		Travel Motions	CT	CT micro	LT	LT micro
	a.	Type of brake (ac / dc / thruster)	AC Electro-Hydraulic Thruster operated			
	b.	Dia of brake in mm	*			
	c.	Torque rating Kg.M	*			
	d.	Number provided	2	1	2	1
	e.	Braking capacity	125%	125%	125%	125%
	f.	Braking torque actually required	*	*	*	*
	g.	Material	*			
		• Brake liners	Ferodo liners			
		• Drum	CS IS : 1030 / CL4 IS : 1875			
		• Springs	As per manufacturers standard			
		• Thrusters	*			
	h.	Braking distance in mm	*	*	*	*
3.11.0		Drive system for hoisting				
	a.	Arrangement of drive from motor to rope drum (main)	Through geared coupling and gear box			



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	b.	Arrangement of drive from pony motor to rope drum (creep speed)	Through geared coupling, planetary gear box and main gearbox				
3.12.0		Bearings	Crane hook	Trolley wheels	Rope drum	Gear box	Any other assembly
	a.	Type	Antifriction ball / roller bearings				
	b.	Number provided for each	As per assembly requirements				
	c.	Method of lubrication	Grease lubrication				
	d.	Bearing life	10,000 working hours.				
3.13.0		Bridge girder					
	a.	Type & Quantity	Box type – 2 nos. Material: IS 2062 Gr. A / B				
	b.	Size	*				
	c.	Vertical Deflection	Span / 900				
	d.	Type of connection to end carriage	By fitted bolts				
	e.	Width	*				
	f.	Length	*				
3.14.0		Rails					
	a.	Type / section	Rails sections as per IS: 3443 Grade 50 C 12. Joint to be butt-welded by thermit welding & fusion welding or by end clamping arrangement.				
	b.	Standard conforming to	IS: 3443				
	c.	Weight per metre	*				
	d.	Material	Rail Steel				
	e.	Top width in mm	*				
	f.	Height in mm	*				
3.15.0		Type of platform required on the bridge	Chequered plate platform 6mm thick as per IS : 3502				
	a.	Position of access point	From cabin				
	b.	Emergency escape	Rung Ladder at ends				
	c.	Type of access platform to cabin	By Rung Ladder				
	d.	Length	Full span length				
	e.	Provided on both side	Yes				



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	f.	Width of platform	<p>*On panel side: During detailed Engineering</p> <p>*On drive end side: During detailed Engineering</p> <p>(Min. 750mm clear space from electrical panels / equipments from the trolley on panel side and Min. 750 mm on drive end side from the trolley on drive end side)</p>			
3.16.0		Type of operators cabin				
	a.	Type of construction	Fixed / Open type			
	b.	Area and minimum clear height	2500/1800 mm with a head room of 2000mm.			
	c.	Warning Gong	Foot operated Brass gong suspended outside the cabin and operated from inside. Suitable for 240 V AC of noise level 95 dBA at 3.5 m			
	d.	Seating arrangement	Revolving type chair			
	e.	Position of controllers	In front / side of operator's chair			
3.17.0		End carriage span (wheel base)	As per IS 807 (latest edition)			
3.18.0		Motors				
3.18.1		Hoist Motions	MH	MH micro	AH	AH micro
	a.	Type	SR	SC	SR	SC
	b.	Enclosure	TEFC	TEFC	TEFC	TEFC
	c.	Numbers furnished	One per motion			
	d.	Voltage, phase and frequency	415V \pm 10%, 3 Ph, 50 Hz \pm 5% Combined voltage & frequency variation= 10% absolute			
	e.	Class of protection	IP – 54			
	f.	Rated capacity (KW)	<p>Selected motor rating should have minimum margin of 15% over maximum continuous load demand including voltage and frequency variation, temperature rise and other factor.</p> <p>Motor nameplate rating at 50 °C shall have at least 15% margin over the input power requirement of driven equipment at rated duty point.</p> <p>For Micro speed planetary gear and pony motor, arrangement will be provided to achieve speed of equal to 10% of main speed.</p>			
	g.	Duration factor/duty	40 % CDF / S-5			
	h.	Speed (rpm)	*			
	i.	Class of insulation	Class 'F/F' for Slip ring motors Class 'F' for sq. cage motors with temp rise limited to that of class B			



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	j.	Number of starts/ hour	150 starts / hr			
	k.	Contactors for motor	*			
	l.	Overload protection for motors provided	Yes			
	m.	Space heater requirements	For motors of rating 30 KW and above			
3.18.2		Travel Motions	CT	CT micro	LT	LT micro
	a.	Type	SR	SC	SR	SC
	b.	Enclosure	TEFC	TEFC	TEFC	TEFC
	c.	Numbers furnished	One per motion			
	d.	Voltage, phase and frequency	415V \pm 10%, 3 Ph, 50 Hz \pm 5% Combined voltage & frequency variation = 10% absolute			
	e.	Class of protection	IP – 54			
	f.	Rated capacity (KW)	<p>Selected motor rating should have minimum margin of 15% over maximum continuous load demand including voltage and frequency variation, temperature rise and other factor.</p> <p>Motor nameplate rating at 50 °C shall have at least 15% margin over the input power requirement of driven equipment at rated duty point.</p> <p>For Micro speed planetary gear and pony motor, arrangement will be provided to achieve speed of equal to 10% of main speed.</p>			
	g.	Duration factor/duty	40 % CDF / S-4			
	h.	Speed (rpm)	*			
	i.	Class of insulation	Class 'F/F' for Slip ring motors. Class 'F' for sq. cage motors with temp rise limited to that of class B			
	j.	Number of starts/ hour	150 starts / hr			
	k.	Contactors for motor	*			
	l.	Overload protection for motors provided	Yes			
	m.	Space heater requirement	For motors of rating 30 KW and above			
3.19.0		Limit switches	Main hoist	Aux. hoist	Cross Travel	Long Travel
	a.	Type	Rotary gear + Gravity		Lever type	
	b.	Number provided	1 + 1	1 + 1	2	2



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	c.	Rating of contacts	*			
	d.	Material of contacts	Double break Silver Cadmium			
	e.	Control voltage	110V			
3.20.0		Power conductors (DSL)				
	a.	Type	LT: PVC shrouded conductor bus bar. CT: Flexible trailing cable mounting on retracting support (Festoon type) ERP insulated Cu conductor as per IS: 9968			
	b.	Size	*			
	c.	Material	*			
	d.	Numbers	*			
	e.	Length	Suitable for bay length			
3.21.0		Protective Panel				
	a.	Make	OEM			
	b.	Size	*			
	c.	Material	Sheet steel 2 mm size			
	d.	Numbers and location	One number located in cabin			
3.22.0		Control panel				
	a.	Make	OEM			
	b.	Size	*			
	c.	Material	Rolled sheet steel 2 mm size			
	d.	Numbers and location	One each for MH, AH, CT and LT located on bridge platform			
	e.	Degree of protection	IP 52			
3.23.0		Master Controllers	Main Hoist	Aux Hoist	Cross Travel	Long Travel
	a.	Number of steps	5	5	4	4
	b.	Voltage & current rating	10 A, 415 V			
	c.	Type	Heavy duty type having DOP IP54			
	d.	Location	In cabin			
3.24.0		Additional Operation	Through Radio remote control			
	a.	Type	Microprocessor based digital technology			
	b.	Communication	Should communicate up to 100 m approx.			

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	c.	Operation	Main controls thru' single joystick movement or double joystick movement type stepped control with spring return. The Micro control should be toggle switch or push control type.	
	d.	Local unit	One local unit (receiver side) with selector switch for operation either from cabin or radio remote unit.	
3.25.0		Cable	Power	Control
	a.	Material	Copper / Aluminium H2 grade	Copper
	b.	Type	FRLS PVC	
	c.	Size	Min 2.5 mm ² for copper 16 mm ² for Aluminium	Min 2.5 mm ² (Stranded minimum – 7 strands)
	d.	Voltage grade	1100 V	
	e.	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.	
3.26.0		Earthing		
	a.	Material of earthing	G.I / Copper	
	b.	Earthing as per specification	Yes / No	
3.27.0	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 bi metallic with single phasing preventor.	
3.28.0		Power supply	Two (2) nos. 415 V , 3 phase, 4 wire supply at operating floor at centre of bay length with change over switch.	
3.29.0		Transformer		
	a.	Quantity	2 X 100 % for Control and 1 no for Lighting	
	b.	Voltage Rating	Control 415/110V, Lighting 415/0-24-240V	
	c.	KVA rating	20% over loading to be considered while sizing the rating	
3.30.0		Illumination		
	a.	In cabin	40W florescent tube + Bulk head fitting with 60W incandescent lamp – 1 each 2 nos. 24V - 5A - 3 pin industrial socket	
	b.	Over Bridge	4 nos 60 W Bulk-head fittings with incandescent lamps and 4nos. 24V - 5A - 3 pin industrial socket	
	c.	Under bridge	4 nos 250 W HPSV lamps	
	d.	For inspection of crane components	One (1) portable 40 W hand lamp with min. half span length flexible cable for inspection of crane components	
3.31.0		Fire Extinguisher		

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	a.	Type and size	4.5 kg CO ₂ type
	b.	Location	One in cabin and Three on bridge
3.32.0		Ventilation	One (1) no. electric fan in cabin.
3.33.0		Whether tandem operation required	<u>Project specific◆◆</u>
3.34.0		Lifting beam and string for tandem operation	<u>Project specific◆◆</u>
3.35.0		Electric wire rope hoists	<u>Project specific◆◆</u>

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* Information's are to be furnished by bidder during contract stage

Sr. No.	DESCRIPTION	TECHNICAL PARTICULARS
1.0.0	General	
1.1.0	Name of manufacturer	*
a.	EOT Crane	*
b.	Crane motors	*
c.	Runway conductors	*
1.2.0	Weight of equipments	
a.	Bridge assembly	*
b.	Trolley assembly	*
c.	Total crane weight	*
d.	Total weight of the gantry rail	*
e.	Total weight of DSL	*
f.	Total weight of all the equipments under this specification	*
1.3.0	Design, fabrication and testing of the crane confirm to standard / code number	IS: 3177-1999
1.4.0	Number of cranes	One(1)/Two (2)
1.5.0	Crane classification	Mechanism Class: M5 Electrical services: M7 (PROJECT SPECIFIC)
1.6.0	Suitable for outdoor or indoor duty	Indoor
1.7.0	Capacity and lift	
1.7.1	Main hoist	
a.	Rated SWC – tonnes	As per crane clearance diagram
b.	Test load SWC – tonnes	Rated SWC and over load test : 125% of SWC
1.7.2	Aux. hoists	

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	a.	Rated SWC – tonnes	As per crane clearance diagram	
	b.	Test load SWC – tonnes	Rated SWC and over load test : 125% of SWC	
1.8.0		Span	As per crane clearance diagram	
1.9.0		Operation from	Cabin + Pendant Push Button + RADIO REMOTE CONTROL (PROJECT SPECIFIC)	
2.00		CRANE PERFORMANCE		
2.1.0		Crane speed with full load	Full speed M/Min	Creep speed M/Min
	a.	Main hoist	(Project Specific)	10% of main speed (thru' VVVF drives)
	b.	Aux. hoist	(Project Specific)	10% of main speed (thru' VVVF drives)
	c.	Trolley travel (CT)	(Project Specific)	10% of main speed (thru' VVVF drives)
	d.	Longitudinal bridge travel (LT)	(Project Specific)	10% of main speed (thru' VVVF drives)
2.2.0		Acceleration values	LT motion (bridge travel)	CT motion (trolley travel)
			As per IS: 3177	As per IS: 3177
2.3.0		Lift in Metres	The lifting rope shall be of sufficient length to permit the hook to reach the zero level.	
	a.	Main Hoist	As per Crane clearance diagram	
	b.	Aux Hoist	As per Crane clearance diagram	
2.4.0		Hook Approaches		
	a.	Main hook (cabin end)	As per Crane clearance diagram	
	b.	Aux. Hook (cabin-end)	As per Crane clearance diagram	
	c.	Main hook (other end)	As per Crane clearance diagram	
	d.	Aux. Hook (other end)	As per Crane clearance diagram	
2.5.0		Hand Rail Pipes	32 mm NB Medium class of IS: 1161 having top and bottom rail at height of 1050 mm and 600 mm and vertical post spacing not exceeding 1500 mm with provision of kick plate (100 mm high and 6mm thick)	
3.0.0		COMPONENT DETAILS		
3.1.0		Trolley		
	a.	Type	Fabricated	
	b.	Method of fabrication	Fusion welded	
	c.	Material	IS: 2062 Gr. A up to 20mm thickness, Grade B Normalized for thickness above 20mm. High steel alloy steel conforming to IS: 8500 is also acceptable.	

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	d.	Centre to centre distance of wheels (on the same rails)	*	
	e.	Whether jacking pads for lifting trolley provided or not	Yes / No	
3.2.0		Rope drums	Main hoist	Aux. Hoist
	a.	Dimensions in mm length and diameter (PCD)	During detailed engineering	During detailed engineering
	b.	Material (Indicate IS)	Seamless pipe ASTM -106 or fabricated Fe410w IS: 2062 & stress relieved	
	c.	Flange / flangeless	Flanged	
	d.	Numbers provided	One for each hoist	
	e.	Number of grooves	*	*
	f.	Type of grooves	Identical Right hand and Left hand	
	g.	Diameter on bottom of grooves	During detailed engineering	During detailed engineering
3.3.0		Rope details		
	a.	Construction	Extra flexible plough steel , 6 x 36 / 6 x 37 construction	
	b.	Grade	During detailed engineering	
	c.	Standard conforming to	IS: 2266	
	d.	Diameter in mm	*	*
	e.	Breaking strength	*	*
	f.	Tensile designation	*	*
	g.	Factor of safety	5.25 as per IS	5.25 as per IS
	h.	Type of core	Fibre	Fibre
	i.	Number of falls	*	Min. 4
	j.	Length of rope	*	*
3.4.0		Sheaves details	Main hoist	Aux. Hoist
	a.	Material	Fe 410 WA IS: 2062 Gr. A or B/ CS Gr. 280-520 IS: 1030	
	b.	Diameter of main sheaves in mm on Root	During detailed engineering	During detailed engineering
	c.	Diameter of Equalizing sheaves (in mm) on Root	Should not be less 62% of calculated main sheave diameter	Should not be less 62% of calculated main sheave diameter
	d.	Type of guards provided	Fabricated from Sheet steel	

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3.5.0		COUPLINGS & SHAFTING				
3.5.1		Coupling details (between motor and gear box)	Main hoist	Aux. Hoist	Cross Travel	Long Travel
	a.	Type	Flexible geared Type			
	b.	Size & Torque rating	*			
	c.	Guards and enclosures	Provided			
3.5.2		Coupling details (between gear box and wheels)	Cross Travel (CT)		Long Travel (LT)	
	a.	Type	Flexible geared type			
	b.	Size & Torque rating	*			
	c.	Guards and enclosures provided	Yes			
3.5.3		Coupling details (between gear box and rope drum)	Main hoist		Aux. Hoist	
	a.	Type	Flexible Built-in gear couplings			
	b.	Size	*			
	c.	Guards and enclosures provided	Yes			
3.5.4		Shafting (Output)	Cross Travel		Long Travel	
	a.	Diameter in mm	*		*	
	b.	Factor of Safety	As per IS: 3177-1999			
	c.	Number of support bearings	*		*	
	d.	Type of support bearing	*		*	
	e.	Arrangement of lubrication	Grease cups / Nipple			
	f.	Type of lubricant	Grease			
	g.	Max unsupported length of shaft in mm	*		*	
3.6.0		Gear box details				
3.6.1		Hoist Motions	MH	MH Micro	AH	AH micro
	a.	Type of mounting of gear box	Horizontal / Vertical			
	b.	Classification	Suitable for M5 duty			

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	c.	Total number of reductions	3	NA	3	NA
	d.	Type of gears	Helical	NA	Helical	NA
	e.	Reduction ratio	*			
	f.	Type of lubrication (grease / splash / pump lubrication)	Splash Lubrication			
	g.	Hardness (BHN) – gear	*			
	h.	Hardness (BHN) – pinion	*			
	i.	Difference in Gear and pinion hardness	Min 20 BHN			
	j.	Materials (gear/pinions)	Main Gears En 9/ 55C8/ IS2707 Gr. 1 or 2 Pinions En 19/ EN 24. Hardness conforming to IS: 3177			
	k.	Castings	Fabricated Fe 410w IS: 2062 & stress relieved			
	l.	Noise level	85 db	NA	85 db	NA
	m.	Standard conforming to	IS: 4460 / AGMA			
3.6.2		Travel Motions	CT	CT micro	LT	LT micro
	a.	Type of mounting gear box	Vertical			
	b.	Classification	M5 duty			
	c.	Total number of reduction	3	NA	3	NA
	d.	Type of gears	Helical	NA	Helical	NA
	e.	Reduction ratio	*	NA	*	NA
	f.	Type of lubrication (grease / splash / pump lubrication)	Splash Lubrication			
	g.	Hardness (BHN) – gear	*			
	h.	Hardness (BHN) – pinion	*			
	i.	Difference in Gear and pinion hardness	Min 20 BHN			
	j.	Materials (gear / pinions)	Main Gears En 9/ 55C8/ IS2707 Gr. 1 or 2 Pinions En 19/ EN 24. Hardness conforming to IS: 3177			
	k.	Castings	Fabricated Fe 410w IS: 2062 & stress relieved			
	l.	Standard conforming to	IS: 4460 / AGMA			
3.7.0		Wheels details	Cross travel		Long travel	

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	a.	Material	C 55 Mn 75 / EN 9 (55 C 8)			
	b.	Hardness	300 – 350 BHN			
	c.	Depth of hardness	10 mm (min)			
	d.	Tread diameter in mm	*	*		
	e.	Tread width in mm	*	*		
	f.	Process of hardening	Volume hardening			
	g.	Type	Double flanged straight tread			
	h.	Numbers provided	4 nos.	8 nos.		
	i.	Specification conforming to	IS: 3177			
	j.	Arrangement of lubrication	Grease			
3.8.0		<u>Lifting hooks</u>	MH	AH		
	a.	Type	Ramshorn	'C' type		
	b.	Safe lifting capacity	Project Specific	Project Specific		
	c.	Material	EN 3A-BS 970 Class 2 IS: 1875			
	d.	Standard conforming to	IS: 5749/ BS 3017	IS: 15560		
	e.	Hook can rotate	Yes / No			
	f.	Safety latch on hook provided	Yes / No			
	g.	Locking device on swivelling hook required or not	Provided			
3.9.0		Buffers	Cross travel	Long travel		
	a.	Type	Spring loaded type. To be designed to bring the loaded crane to rest from speed of 50% of the rated speed.			
	b.	Numbers provided	4	4		
	c.	Details of end stop	Fabricated Fe 410w IS: 2062			
3.10.0		Brakes				
3.10.1		Hoist Motions	MH	MH micro	AH	AH micro
	a.	Type of brake (ac / dc / thruster)	AC Electro-Hydraulic Thruster operated			
	b.	Diameter of brake in mm	*	NA	*	NA
	c.	Torque rating Kg. M	*		*	
	d.	Number provided per motor	2		2	

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	e.	Braking capacity	150%		150%		
	f.	Braking torque actually required	*		*		
	g.	Material					
		• Brake liners	Ferodo liners				
		• Drum	CS IS : 1030 / CL 4 IS : 1875				
		• Springs	As per manufacturers standard				
	h.	Braking distance in mm	*	NA	*	NA	
3.10.2		Travel Motions	CT	CT micro	LT	LT micro	
	a.	Type of brake (ac / dc / thruster)	AC Electro-Hydraulic Thruster operated				
	b.	Dia of brake in mm	*	NA	*	NA	
	c.	Torque rating Kg.M	*		*		
	d.	Number provided	2		2		
	e.	Braking capacity	125%		125%		
	f.	Braking torque actually required	*		*		
	g.	Material					
		• Brake liners	Ferodo liners				
		• Drum	CS IS : 1030 / CL4 IS : 1875				
		• Springs	As per manufacturers standard				
		• Thrusters	*				
	h.	Braking distance in mm	*	NA	*	NA	
3.11.0		Drive system for hoisting					
	a.	Arrangement of drive from motor to rope drum (main)	Through geared coupling and gear box				
	b.	Arrangement of drive from pony motor to rope drum (creep speed)	NA				
3.12.0		Bearings	Crane hook	Trolley wheels	Rope drum	Gear box	Any other assembly
	a.	Type	Antifriction ball / roller bearings				
	b.	Number provided for each	As per assembly requirements				

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	c.	Method of lubrication	Grease lubrication
	d.	Bearing life	10,000 working hours.
3.13.0		Bridge girder	
	a.	Type & Quantity	Box type – 2 nos. Material: IS 2062 Gr. A / B
	b.	Size	*
	c.	Vertical Deflection	Span / 900
	d.	Type of connection to end carriage	By fitted bolts
	e.	Width	*
	f.	Length	*
3.14.0		Rails	
	a.	Type / section	Rails sections as per IS: 3443 Grade 50 C 12. Joint to be butt-welded by thermit welding & fusion welding or by end clamping arrangement.
	b.	Standard conforming to	IS: 3443
	c.	Weight per metre	*
	d.	Material	Rail Steel
	e.	Top width in mm	*
	f.	Height in mm	*
3.15.0		Type of platform required on the bridge	Chequered plate platform 6mm thick as per IS : 3502
	a.	Position of access point	From cabin
	b.	Emergency escape	Rung Ladder at ends
	c.	Type of access platform to cabin	By Rung Ladder
	d.	Length	Full span length
	e.	Provided on both side	Yes
	f.	Width of platform	*On panel side: During detailed Engineering *On drive end side: During detailed Engineering (Min. 750mm clear space from electrical panels / equipments from the trolley on panel side and Min. 750 mm on drive end side from the trolley on drive end side)
3.16.0		Type of operators cabin	
	a.	Type of construction	Fixed / Open type



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	b.	Area and minimum clear height	2500/1800 mm with a head room of 2000mm.			
	c.	Warning Gong	Foot operated Brass gong suspended outside the cabin and operated from inside. Suitable for 240 V AC of noise level 95 dBA at 3.5 m			
	d.	Seating arrangement	Revolving type chair			
	e.	Position of controllers	In front / side of operator's chair			
3.17.0		End carriage span (wheel base)	As per IS 807 (latest edition)			
3.18.0		Motors				
3.18.1		Hoist Motions	MH	MH micro	AH	AH micro
	a.	Type	SC, suitable for Inverter duty	NA	SC, suitable for Inverter duty	NA
	b.	Enclosure	TEFC	NA	TEFC	NA
	c.	Numbers furnished	One per motion			
	d.	Voltage, phase and frequency	415V \pm 10%, 3 Ph, 50 Hz \pm 5% Combined voltage & frequency variation= 10% absolute			
	e.	Class of protection	IP – 54			
	f.	Rated capacity (KW)	Selected motor rating should have minimum margin of 15% over maximum continuous load demand including voltage and frequency variation, temperature rise and other factor. Motor nameplate rating at 50 °C shall have at least 15% margin over the input power requirement of driven equipment at rated duty point.			
	g.	Duration factor/duty	40 % CDF / S-5			
	h.	Speed (rpm)	*			
	i.	Class of insulation	Class 'F' for sq. cage motors with temp rise limited to that of class B			
	j.	Number of starts/ hour	150 starts / hr			
	k.	Contactors for motor	*			
	l.	Overload protection for motors provided	Yes			
	m.	Space heater requirements	For motors of rating 30 KW and above			
3.18.2		Travel Motions	CT	CT micro	LT	LT micro
	a.	Type	SC, suitable for Inverter duty	NA	SC, suitable for Inverter duty	NA

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	b.	Enclosure	TEFC	NA	TEFC	NA
	c.	Numbers furnished	One per motion			
	d.	Voltage, phase and frequency	415V \pm 10%, 3 Ph, 50 Hz \pm 5% Combined voltage & frequency variation = 10% absolute			
	e.	Class of protection	IP – 54			
	f.	Rated capacity (KW)	Selected motor rating should have minimum margin of 15% over maximum continuous load demand including voltage and frequency variation, temperature rise and other factor. Motor nameplate rating at 50 °C shall have at least 15% margin over the input power requirement of driven equipment at rated duty point.			
	g.	Duration factor/duty	40 % CDF / S-4			
	h.	Speed (rpm)	*			
	i.	Class of insulation	Class 'F' for sq. cage motors with temp rise limited to that of class B			
	j.	Number of starts/ hour	150 starts / hr			
	k.	Contactors for motor	*			
	l.	Overload protection for motors provided	Yes			
3.18.3		Space heater requirement	For motors of rating 30 KW and above			
3.19.0		Limit switches	Main hoist	Aux. hoist	Cross Travel	Long Travel
	a.	Type	Rotary gear + Gravity		Lever type	
	b.	Number provided	1 + 1	1 + 1	2	2
	c.	Rating of contacts	*			
	d.	Material of contacts	Double break Silver Cadmium			
	e.	Control voltage	110V			
3.20.0		Power conductors (DSL)				
	a.	Type	LT: PVC shrouded conductor bus bar. CT: Flexible trailing cable mounting on retracting support (Festoon type) ERP insulated Cu conductor as per IS: 9968			
	b.	Size	*			
	c.	Material	*			
	d.	Numbers	*			
	e.	Length	Suitable for bay length			

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3.21.0		Protective Panel				
	a.	Make	OEM			
	b.	Size	*			
	c.	Material	Sheet steel 2 mm size			
	d.	Numbers and location	One number located in cabin			
3.22.0		Control panel				
	a.	Make	OEM			
	b.	Size	*			
	c.	Material	Rolled sheet steel 2mm size			
	d.	Numbers and location	One each for MH, AH, CT and LT located on bridge platform			
	e.	Degree of protection	IP 52			
3.23.0		Master Controllers	Main Hoist	Aux Hoist	Cross Travel	Long Travel
	a.	Number of steps	5	5	4	4
	b.	Voltage & current rating	10 A, 415 V			
	c.	Type	Heavy duty type having DOP IP54			
	d.	Location	In cabin			
3.24.0		Control for Hoists /CT/LT operations	Through Variable Voltage Variable frequency drive			
	a.	Speed control	Thru' VVVF with minimum 6 pulse design			
	b.	Starting torque of VVVF	Up to 400 % typical with / without encoder			
	c.	Starting current	Less than 150 % of rated torque.			
	d.	Temperature	VVVF system shall be capable of withstanding upto 50 ° C without derating.			
3.25.0		Additional Operation	Through Radio remote control			
	a.	Type	Microprocessor based digital technology			
	b.	Communication	Should communicate up to 100 m approx.			
	c.	Operation	Main controls thru' single joystick movement or double joystick movement type stepped control with spring return. The Micro control should be toggle switch or push control type.			
	d.	Local unit	One local unit (receiver side) with selector switch for operation either from cabin or radio remote unit.			
3.26.0		Cable	Power		Control	

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	a.	Material	Copper / Aluminium H2 grade	Copper
	b.	Type	FRLS PVC	
	c.	Size	Min 2.5 mm ² for copper 16 mm ² for Aluminium	Min 2.5 mm ² (Stranded minimum – 7 strands)
	d.	Voltage grade	1100 V	
	e.	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.	
3.27.0		Earthing		
	a.	Material of earthing	G.I / Copper	
	b.	Earthing as per specification	Yes / No	
3.28.0	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 bi metallic with single phasing preventor.	
3.29.0		Power supply	One(1)/Two (2) nos. 415 V , 3 phase, 4 wire supply at operating floor at centre of bay length with change over switch. (Project Specific)	
3.30.0		Transformer		
	a.	Quantity	2 X 100 % for Control and 1 no for Lighting	
	b.	Voltage Rating	Control 415/110V, Lighting 415/0-24-240V	
	c.	KVA rating	20% over loading to be considered while sizing the rating	
3.31.0		Illumination		
	a.	In cabin	40W florescent tube + Bulk head fitting with 60W incandescent lamp – 1 each 2 nos. 24V - 5A - 3 pin industrial socket	
	b.	Over Bridge	4 nos 60 W Bulk-head fittings with incandescent lamps and 4nos. 24V - 5A - 3 pin industrial socket	
	c.	Under bridge	4 nos 250 W HPSV lamps	
	d.	For inspection of crane components	One (1) portable 40 W hand lamp with min. half span length flexible cable for inspection of crane components	
3.32.0		Fire Extinguisher		
	a.	Type and size	4.5 kg CO ₂ type	
	b.	Location	One in cabin and Three on bridge	
3.33.0		Ventilation	One (1) no. electric fan in cabin.	
3.34.0		Whether tandem operation required	Project specific♦♦	

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STANDARD TECHNICAL SPECIFICATION

FOR DOUBLE GIRDER EOT CRANES

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3.35.0		Lifting beam and string for tandem operation	<u>Project specific♦♦</u>
3.36.0		Electric wire rope hoists	<u>Project specific♦♦</u>

SPECIFIC CONFIRMATION / COMMENTS REQUIRED FROM BIDDER		SPECIFICATION: PE-TS-STD-501-A001
TITLE: DOUBLE GIRDER EOT CRANE FOR TG HALL		VOLUME-II B SECTION-C REVISION:03
PROJECT: STANDARD		DATE: Oct 2007 No. of SHEETS: 2
S.N.	DESCRIPTION	REPLY / COMMENTS BY BIDDER
1.00	MECHANICAL	
1.01	Bidder to confirm that the Data sheet -A / B attached along with Technical Specification No. PE-TS-STD-501-A001 Rev. 03 is acceptable without any deviation. Bidder to confirm the same.	CONFIRMED / NOT CONFIRMED
1.02	In case of any deviation, the same has been furnished in the separate Deviation schedule attached along with the Technical Specification. Bidder to note that deviation mentioned elsewhere will not be taken cognizance of in any case. Bidder to confirm the same.	CONFIRMED / NOT CONFIRMED
1.02	Bidder to confirm that there is no deviation from the QAP attached along with the Technical Specification. Bidder to confirm	CONFIRMED / NOT CONFIRMED
1.03	Bidder to confirm that there is no deviation from the Crane Clearance Diagram attached with the Technical Specification. Bidder to specifically note that in no case any deviation from the Crane Clearance diagram given by BHEL shall be accepted. Bidder to confirm the same.	CONFIRMED / NOT CONFIRMED
1.04	Bidder to confirm that there is no deviation from the makes of various sub vendors items as given in annexure-I "Makes of Sub-vendors Items", volume II-B, section-C. Bidder shall confirm the compliance	CONFIRMED / NOT CONFIRMED
1.05	The material offered is equal or better in grade than specified. Bidder shall confirm the compliance	CONFIRMED / NOT CONFIRMED
1.06	Bidder to note and confirm that there will be no price implication for variation in Span upto ± 500 MM and variation in Lift upto ± 1 M. Bidder to confirm	CONFIRMED / NOT CONFIRMED
1.07	Bush as a antifriction bearing shall not be used. Bidder shall confirm the compliance	CONFIRMED / NOT CONFIRMED

1.08	Bidder to confirm the compliance to the Painting specification.(Annexure IV A /B). Bidder to confirm.	CONFIRMED / NOT CONFIRMED
1.09	Bidder to confirm that in case of award of order, Hook drawing shall be submitted to BHEL within one week of receiving the LOI and Unpriced Purchase Order copy within 15 days from LOI . Bidder to confirm	CONFIRMED / NOT CONFIRMED
1.10	Bidder to confirm that in case of award of order, Motor Sizing calculations shall be submitted within 15 days time of receiving the LOI by the bidder. Bidder to confirm the same.	CONFIRMED / NOT CONFIRMED
2.00	ELECTRICALS	
2.01	CABLES	
a	All CONTROL AND POWER cables shall be as per BHEL specification. Bidder shall confirm the compliance	CONFIRMED / NOT CONFIRMED
b	Makes of cables shall be as agreed in between BHEL / Customer during contract stage and approved make shall only be supplied. Bidder shall confirm the compliance	CONFIRMED / NOT CONFIRMED
c	Cable required between isolating switch / change over switch and DSL included in the scope. Bidder to confirm the same.	CONFIRMED / NOT CONFIRMED
d	The temporary cable for operation of crane during erection stage of the plant (equal to half the baylength plus 25 M) shall be in bidder's scope of work. Bidder to confirm	CONFIRMED / NOT CONFIRMED
2.02	MOTORS	
a	Class of insulation of Sq. cage motors shall be "F" and the temperature rise to limited to class "B". Bidder shall confirm the compliance	CONFIRMED / NOT CONFIRMED
b	Motor size shall be subjected to the approval of motor calculation. Bidder shall confirm the compliance	CONFIRMED / NOT CONFIRMED
c	The successful bidder shall submit the data sheet -C of LV motors and power & control cables during detailed engineering and the same is subjected to customer approval without any cost implication on account of the same. Bidder shall confirm the compliance	CONFIRMED / NOT CONFIRMED

d	The QPs related to electrical items shall be approved during detailed engineering. However , the monimum requirements indicated in the following QP's shall be complied. Bidder shall confirm the compliance	CONFIRMED / NOT CONFIRMED
e	Bidder to confirm that there is no technical deviation on "Electrical portion of Technical specification" and "Data sheet of Electrical portion". Bidder to confirm the same.	CONFIRMED / NOT CONFIRMED

VOLUME III
SCHEDULES



SCHEDULE OF DEVIATION
STANDARD TECHNICAL SPECIFICATION
DOUBLE GIRDER EOT CRANE

SPECIFICATION NO.: PE-TS-STD-501-A001

VOLUME III

SHEET OF

- () From general terms and conditions of contract and special condition of contract (Vol. I)
- () From technical specifications (Vol. II B)
- () From general terms and conditions of contract for erection (vol. I)
- () From general technical conditions (Vol. IIC)

Note: Each type of deviation shall be listed on a separate sheet.

-

We the undersigned hereby certify that the above-mentioned information's are the ONLY deviations.

PARICULARS OF BIDDER / AUTHORISED REPRESENTATIVE

NAME	DESIGNATION	SIGN DATE	COMPANY SEAL



SCHEDULE OF WEIGHTS AND DIMENSIONS

STANDARD TECHNICAL SPECIFICATION
DOUBLE GIRDER EOT CRANE

SPECIFICATION NO.: PE-TS-STD-501-A001

VOLUME III

SHEET OF

- () From general terms and conditions of contract and special condition of contract (Vol. I)
- () From technical specifications (Vol. II B)
- () From general terms and conditions of contract for erection (vol. I)
- () From general technical conditions (Vol. IIC)

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PARICULARS OF BIDDER / AUTHORISED REPRESENTATIVE


PARICULARS OF BIDDER / AUTHORISED REPRESENTATIVE			
NAME	DESIGNATION	SIGN DATE	COMPANY SEAL

ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR

PROJECT: STANDARD SPECIFICATION

PACKAGE: DOUBLE GIRDER EOT CRANE (MAX)

<u>S. NO</u>	<u>ITEM NO.</u>	<u>DETAILS</u>	<u>SCOPE SUPPLY</u>	<u>SCOPE E&C</u>	<u>REMARKS</u>
1	I	415V Local Starter Panel	Vendor	Vendor	BHEL will provide power supply feeder at 1.5 M from finish floor level.
3	III	Power cables, ordinary control cables and screened control cables between equipment supplied by vendor.	Vendor	Vendor	Any special cable required will be in bidders scope. Cables, cable trays, conduits & cabling etc for the system by Vendor
4	IX	Equipment Earthing	Vendor	Vendor	At two points on the equipments by vendor.
5	X	Motors	Vendor	Vendor	
6	XIII	Cable glands and lugs for equipment supplied by vendor	Vendor	Vendor	

COMPRESSED 	TITLE:	SPECIFICATION NO. PE-TS-STD-501-A001
	ELECTRICAL EQUIPMENT SPECIFICATION FOR DOUBLE GIRDER EOT CRANES STANDARD SPECIFICATION	VOLUME NO. : II-B
		SECTION: C
		REV NO. : 02 DATE: Aug; 07
		SHEET: 2 OF 2

1.0 EQUIPMENT & SERVICES TO BE PROVIDED BY BIDDER:

- 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 bidder without any extra charge shall provide the same.
- c) Supply of mandatory spares as specified in the specifications of mechanical equipments.
- d) Erection and commissioning spares.
- e) Erection & Maintenance tools & tackles.
- f) Electrical load requirement for CRANES.
- g) All equipment shall be suitable for the power supply fault levels and other climatic conditions mentioned in the enclosed project information.
- h) 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.
- i) Various drawings, data sheet 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 implications to BHEL.
- j) Motor shall meet minimum requirement of motor specification.

2.0 EQUIPMENT & SERVICES TO BE PROVIDED BY PURCHASER FOR ELECTRICAL & TERMINAL POINTS:

Refer “Electrical Scope between BHEL and Vendor”.

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 CRANES’ and sheet “Electrical Scope between BHEL and Vendor” with bidder’s signature and company stamp.
- b) List of Erection and Commissioning spares.
- c) List of Erection & Maintenance tools & tackles.
- d) Electrical load requirement.

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.
- 4.2 Technical specification, Data Sheets (A & C) for 415V Electric Motors.
- 4.3 Power cables and control cables specification & datasheets.
- 4.4 Cabling earthing & lightning protection specification & data sheets.
- 4.5 Quality Plan for motors, power & control cables, cabling & earthing material.

COMPRESSED 	TITLE: ELECTRICAL EQUIPMENT SPECIFICATION FOR DOUBLE GIRDER EOT CRANES STANDARD SPECIFICATION	SPECIFICATION NO. PE-TS-STD- 501-A001
		VOLUME NO. : II-B
		SECTION: C
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		SHEET: 2 OF 2

4.6 Load data format.



TITLE :
GENERAL TECHNICAL REQUIREMENTS

FOR

LV MOTORS

SPECIFICATION NO.
PE-TS-STD-501-A001
VOLUME NO. : **II-B**
SECTION : **D**
REV NO. : **02** DATE : Aug; 2007
SHEET : 1 OF 1

GENERAL TECHNICAL REQUIREMENTS

FOR

LV MOTORS



TITLE :
GENERAL TECHNICAL REQUIREMENTS
FOR
LV MOTORS

SPECIFICATION NO.
PE-TS-STD-501-A001
VOLUME NO. : **II-B**
SECTION : **D**
REV NO. : **02** DATE : August 07
SHEET : 1 OF 4

1.0 INTENT OF SPECIFICATION

The specification covers the design, materials, constructional features, manufacture, inspection and testing at manufacturer's work, and packing of Low voltage (LV) squirrel cage induction motors along with all accessories for driving auxiliaries in thermal power station.

Motors having a voltage rating of below 1000V are referred to as low voltage (LV) motors.

2.0 CODES AND STANDARDS

Motors shall fully comply with latest edition, including all amendments and revision, of following codes and standards:

IS:325	Three phase Induction motors
IS : 900	Code of practice for installation and maintenance of induction motors
IS: 996	Single phase small AC and universal motors
IS: 4722	Rotating Electrical machines
IS: 4691	Degree of Protection provided by enclosures for rotating electrical machines
IS: 4728	Terminal marking and direction of rotation rotating electrical machines
IS: 1231	Dimensions of three phase foot mounted induction motors
IS: 8789	Values of performance characteristics for three phase induction motors
IS: 13555	Guide for selection and application of 3-phase A.C. induction motors for different types of driven equipment
IS: 2148	Flame proof enclosures for electrical appliance
IS: 5571	Guide for selection of electrical equipment for hazardous areas
IS: 12824	Type of duty and classes of rating assigned
IS: 12802	Temperature rise measurement of rotating electrical machines
IS: 12065	Permissible limits of noise level for rotating electrical machines
IS: 12075	Mechanical vibration of rotating electrical machines

In case of imported motors, motors as per IEC-34 shall also be acceptable.

3.0 DESIGN REQUIREMENTS

3.1 Motors and accessories shall be designed to operate satisfactorily under conditions specified in data sheet-A and Project Information, including voltage & frequency variation of supply system as defined in Data sheet-A

3.2 Motors shall be continuously rated at the design ambient temperature specified in Data Sheet-A and other site conditions specified under Project Information
Motor ratings shall have at least a 15% margin over the continuous maximum demand of the driven equipment, under entire operating range including voltage & frequency variation specified above.

3.3 Starting Requirements

3.3.1 Motor characteristics such as speed, starting torque, break away torque and starting time shall be properly co-ordinated with the requirements of driven equipment. The accelerating torque at any speed with the minimum starting voltage shall be at least 10% higher than that of the driven equipment.

3.3.2 Motors shall be capable of starting and accelerating the load with direct on line starting without exceeding acceptable winding temperature.



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The limiting value of voltage at rated frequency under which a motor will successfully start and accelerate to rated speed with load shall be taken to be a constant value as per Data Sheet - A during the starting period of motors.

3.3.3 The following frequency of starts shall apply

- i) Two starts in succession with the motor being initially at a temperature not exceeding the rated load temperature.
- ii) Three equally spread starts in an hour the motor being initially at a temperature not exceeding the rated load operating temperature. (not to be repeated in the second successive hour)
- iii) Motors for coal conveyor and coal crusher application shall be suitable for three consecutive hot starts followed by one hour interval with maximum twenty starts per day and shall be suitable for minimum 20,000 starts during the life time of the motor

3.4 **Running Requirements**

3.4.1 Motors shall run satisfactorily at a supply voltage of 75% of rated voltage for 5 minutes with full load without injurious heating to the motor.

3.4.2 Motor shall not stall due to voltage dip in the system causing momentary drop in voltage upto 70% of the rated voltage for duration of 2 secs.

3.5 **Stress During bus Transfer**

3.5.1 Motors shall withstand the voltage, heavy inrush transient current, mechanical and torque stress developed due to the application of 150% of the rated voltage for at least 1 sec. caused due to vector difference between the motor residual voltage and the incoming supply voltage during occasional auto bus transfer.

3.5.2 Motor and driven equipment shafts shall be adequately sized to satisfactorily withstand transient torque under above condition.

3.6 Maximum noise level measured at distance of 1.0 metres from the outline of motor shall not exceed the values specified in IS 12065.

3.7 The max. vibration velocity or double amplitude of motors vibration as measured at motor bearings shall be within the limits specified in IS: 12075.

4.0 **CONSTRUCTIONAL FEATURES**

4.1 Indoor motors shall conform to degree of protection IP: 54 as per IS: 4691. Outdoor or semi-indoor motors shall conform to degree of protection IP: 55 as per IS: 4691 and shall be of weather-proof construction. Outdoor motors shall be installed under a suitable canopy

4.2 Motors upto 160KW shall have Totally Enclosed Fan Cooled (TEFC) enclosures, the method of cooling conforming to IC-0141 or IC-0151 of IS: 6362.

Motors rated above 160 KW shall be Closed Air Circuit Air (CACA) cooled

4.3 Motors shall be designed with cooling fans suitable for both directions of rotation.



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- 4.4. Motors shall not be provided with any electric or pneumatic operated external fan for cooling the motors.
- 4.5. Frames shall be designed to avoid collection of moisture and all enclosures shall be provided with facility for drainage at the lowest point.
- 4.6. In case Class 'F' insulation is provided for LV motors, temperature rise shall be limited to the limits applicable to Class 'B' insulation.
In case of continuous operation at extreme voltage limits the temperature limits specified in table-1 of IS:325 shall not exceed by more than 10°C.
- 4.7. **Terminals and Terminal Boxes**
- 4.7.1 Terminals, terminal leads, terminal boxes, windings tails and associated equipment shall be suitable for connection to a supply system having a short circuit level, specified in the Data Sheet-A.

Unless otherwise stated in Data Sheet-A, motors of rating 110 kW and above will be controlled by circuit breaker and below 110 kW by switch fuse-contactor. The terminal box of motors shall be designed for the fault current mentioned in data sheet "A".
- 4.7.2 Unless otherwise specified or approved, phase terminal boxes of horizontal motors shall be positioned on the left hand side of the motor when viewed from the non-driving end.
- 4.7.3 Connections shall be such that when the supply leads R, Y & B are connected to motor terminals A B & C or U, V & W respectively, motor shall rotate in an anticlockwise direction when viewed from the non-driving end. Where such motors require clockwise rotation, the supply leads R, Y, B will be connected to motor terminals A, C, B or V W & V respectively.
- 4.7.4 Permanently attached diagram and instruction plate made preferably of stainless steel shall be mounted inside terminal box cover giving the connection diagram for the desired direction of rotation and reverse rotation.
- 4.7.5 Motor terminals and terminal leads shall be fully insulated with no bare live parts. Adequate space shall be available inside the terminal box so that no difficulty is encountered for terminating the cable specified in Data Sheet-A.
- 4.7.6 Degree of protection for terminal boxes shall be IP 55 as per IS 4691.
- 4.7.7 Separate terminal boxes shall be provided for space heaters.. If this is not possible in case of LV motors, the space heater terminals shall be adequately segregated from the main terminals in the main terminal box. Detachable gland plates with double compression brass glands shall be provided in terminal boxes.
- 4.7.8. Phase terminal boxes shall be suitable for 360 degree of rotation in steps of 90 degree for LV motors.
- 4.7.9 Cable glands and cable lugs as per cable sizes specified in Data Sheet-A shall be included. Cable lugs shall be of tinned Copper, crimping type.
- 4.8 Two separate earthing terminals suitable for connecting G.I. or MS strip grounding conductor of size given in Data Sheet-A shall be provided on opposite sides of motor frame. Each terminal box shall have a grounding terminal.
- 4.9 **General**



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- 4.9.1 Motors provided for similar drives shall be interchangeable.
- 4.9.2 Suitable foundation bolts are to be supplied alongwith the motors.
- 4.9.3 Motors shall be provided with eye bolts, or other means to facilitate safe lifting if the weight is 20Kgs. and above.
- 4.9.4 Necessary fitments and accessories shall be provided on motors in accordance with the latest Indian Electricity rules 1956.
- 4.9.5 All motors rated above 30 kW shall be provided with space heaters to maintain the motor internal air temperature above the dew point. Unless otherwise specified, space heaters shall be suitable for a supply of 240V AC, single phase, 50 Hz.
- 4.9.6 Name plate with all particulars as per IS: 325 shall be provided
- 4.9.7 Unless otherwise specified, the colour of finish shall be grey to Shade No. 631 and 632 as per IS:5 for motors installed indoor and outdoor respectively. The paint shall be epoxy based and shall be suitable for withstanding specified site conditions.
- 5.0 INSPECTION AND TESTING**
- 5.1 All materials, components and equipments covered under this specification shall be procured, manufactured, as per the BHEL standard quality plan No. PED-506-00-Q-006/0 and PED-506-00-Q-007/2 enclosed with this specification and which shall be complied.
- 5.2 LV motors of type-tested design shall be provided. Valid type test reports not more than 5 year shall be furnished. In the absence of these, type tests shall have to be conducted by manufacturer without any commercial implication to purchaser.
- 5.3 All motors shall be subjected to routine tests as per IS: 325 and as per BHEL standard quality plan.
- 5.4 Motors shall also be subjected to additional tests, if any, as mentioned in Data Sheet A.
- 6.0 DRAWINGS TO BE SUBMITTED AFTER AWARD OF CONTRACT**
- a) OGA drawing showing the position of terminal boxes, earthing connections etc.
- b) Arrangement drawing of terminal boxes.
- c) Characteristic curves:
(To be given for motor above 55 kW unless otherwise specified in Data Sheet).
- i) Current vs. time at rated voltage and minimum starting voltage.
- ii) Speed vs. time at rated voltage and minimum starting voltage.
- iii) Torque vs. speed at rated voltage and minimum voltage.
For the motors with solid coupling the above curves i), ii), iii) to be furnished for the motors coupled with driven equipment. In case motor is coupled with mechanical equipment by fluid coupling, the above curves shall be furnished with and without coupling.
- iv) Thermal withstand curve under hot and cold conditions at rated voltage and max. permissible voltage.



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GENERAL TECHNICAL REQUIREMENTS
OF
PVC POWER AND CONTROL CABLES



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1.0 GENERAL

- 1.1 This section cover the specification, which are applicable in general to PVC insulated, PVC sheathed Power and control cables.
- 1.2 Specific requirements of cables as applicable to the project are given in Data Sheet - A of this section.

2.0 STANDARDS

The cable shall conform to the latest edition of following standard in general.

IS : 1554 Part - I PVC insulated (Heavy duty) Electric Cables

(For working voltage upto and including 1100V)

Other Standards are listed in Subsequent clauses.

3.0 DESIGN REQUIREMENTS

- 3.1 Cables shall be suitable for laying in metal trays, racks, conduits, ducts or for direct burial in ground both in wet and dry conditions.
- 3.2 As applicable to 'FRLS' cables, the overall serving (outer sheath) of the cables shall be of flame retardant low smoke (FRLS) type PVC material.
- 3.3 Cable shall be capable of operating satisfactorily under the power supply and frequency variations as specified under 'Project information' in Section-B.

4.0 CONSTRUCTION

- 4.1 Cable construction shall generally conform to the latest edition of applicable standard. For specific requirements refer DATA SHEET-A enclosed.

4.2 Identification marks on cable

The following particulars shall be embossed on the outer sheath at intervals of one meter throughout the length of cables.

- i) Manufacturer's name and/or trade name.
- ii) Year of manufacture
- iii) Type of cable and the voltage class.
- iv) Nominal cross sectional area of conductor and number of cores
- v) Letter HR in case of HR PVC insulated cables.
- vi) Letter FRLS Applicable in case of FRLS cables.



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5. CORE IDENTIFICATION**5.1 Power Cables**

Power cables shall be colour coded for more identification as per IS : 1554, (Part-I)

5.2 Control Cables

a) Control cables upto 5 crores shall be colour coded as per IS : 1554, (Part-I)

b) Control cables having more than 5 cores shall have core identification by numbering as per IS : 1554 (Part-I)

6.0 PACKING & MARKING

6.1 Cables shall be supplied in non-returnable drums. The drums shall be of heavy construction. All wooden parts shall be manufactured from durable quality wood duly seasoned and treated with copper Nephthenat or Zinc Nephthenates for preserving the wood (ref. IS : 401). All ferrous parts shall be treated with suitable rust protective finish or coating to avoid rusting during transit and storage.

6.2 Cable shall be wound and packed on drums in such a manner that it will be protected from injury during transit. Each end of the cables shall be properly sealed and firmly secured to the drum. The ends of each length, shall be capped by special PVC/rubber cap and end embedded in the cable drum flange. The embedded cable ends in drum flange shall be covered by metal sheet.

6.3 The standard drum lengths shall be as indicated in Data Sheet-A

6.4 The tolerance on the dispatched cable length on each drum verified and accepted by Inspector shall be limited to $\pm 5\%$ of the standard drum length, however the overall tolerance on the total dispatched of quantity of each size shall be $\pm 5\%$. Cables consumed for testing & inspection will be to bidder's account.

6.5 Short lengths, if offered, shall be considered for acceptance provided that

i) No single piece is less than 200 M in length.

ii) Cumulative of pieces in each size is with in 5% of the ordered quantities.

6.6 A layer of water proofed paper shall be applied to the surfaces of the drum and over the outer cable layer.

6.7 A clear space of min. 40 mm shall be left between the cables and logging.

6.8 A label shall be securely attached to each end of reel indicating the Purchaser's order number, length, type, voltage, grade, conductor size and number of cores of the cable. A tag containing the same information shall be attached to the leading end of the cable inside.

6.9 BIS Certification mark shall be stamped on each cable drum.

7.0 INSPECTION & TESTING QUALITY ASSURANCE

7.1 All materials components covered under this specification shall be procured, manufactured, inspected & tested as per BHEL standard quality plan No. CQS/SQP/101 enclosed with the specification, which shall be complied. Bidder is to put his seal of acceptance on this quality plan



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without making any alterations and return the same along with the bid, In case of any comments or deviations, the same are to be furnished in the form of a separate annexure.

7.2 The type, routine and acceptance tests shall be witnessed by inspection agency on one sample for each type as per applicable standards. The sample shall be drawn at the rate of one per type and size for every lot offered for inspection.

7.3 All testing instruments shall be periodically calibrated and calibration certificates shall be shown.

7.4 Special Tests

The following tests as applicable to 'FRLS' cable shall be conducted as type test on each size of each lot to establish the 'FRLS' characteristics of PVC material as applicable to inner sheath/outer sheath of finished cables :

Value for each test shall be as per Data Sheet-A.

- a) Oxygen Index Test : This test shall be carried out as per ASTM-D-2863 at room temperature (27°C).
- b) Temperature Index Test : The test shall be carried out as per ASTM-D-2863 for normal atmospheric oxygen (21% by volume).
- c) Acid gas Generation during Fire : The test shall be carried out as per IEC-754-1
- d) Smoke Generation Test Under Fire : The test shall be carried out as per ASTM-D-2863.
- e) Flammability Test : All finished cables shall pass the following tests :
 - i) Under fire conditions as per IEC-332-1.
 - ii) Swedish Chimney test for Class F3 as per SS:424:1475.
 - iii) Under fire conditions for bunched cables as per IEEE Std. 383/74 (test set up should have cables having at least 10 kg organic material per metre run)

7.5 The cable materials shall also pass the following additional type tests.

- a) Heat shock test as per IS : 5831
- b) Loss of mass test as per IS : 5831
- c) Thermal heat stability test as per IS : 5831
- d) Anti termite & antirodent test (on outersheath)

8.0 DRAWINGS, DATA & DOCUMENTS REQUIRED

The following information shall be furnished with technical bid

- a) Catalogue, cross-sectional drawings.
- b) Filled up schedule as per volume III including Data Sheet-B.



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- c) Quality plan with seal of acceptance
- d) Unfilled price schedule.

8.2 The following information shall be furnished within two weeks after award of contract, for purchaser's approval.

- a) Data Sheet-C
- b) Manufacturing drawings/details
- c) Recommended field quality plan covering site handling, storing, laying, testing etc.
- d) Final quality plan
- e) Packing drawing
- f) Bar chart
- g) Billing schedule
- h) Derating factors
 - i) For variation in ambient air temperature from 30 degree C to 50 degree C in steps of 5 degree C.
 - ii) For variation in ground temperature from 25 degree C to 50 degree C in steps of 5 degree C.
 - iii) Group derating factors for various configurations of cables laid in overhead trays, trenches, ducts, pipes, directly buried in ground.
 - iv) For variation in thermal resistivity of soil in the range of 600 mm to 1500 mm.

8.3 The following information shall be furnished after testing and inspection.

Requisite copies of Type test, special test, routine and acceptance test in bound volume.



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1.0 INTENT OF SPECIFICATION

1.1 This specification covers the activities mentioned below, as applicable to various areas of power station:

- a) Laying and termination of cables
- b) Testing and charging of cables
- c) Supply and erection of miscellaneous items for completion of the cabling system
- d) All associated work for completion of cabling system
- e) Receipt of cables and cabling materials supplied by purchaser/others
- f) Site handling and storage of material
- g) Minor civil works

1.2 The scope of supply of cabling materials as a part of cable installation work includes supply of all accessories including, but not limited to, cable clamps, ferrules, cable tags, nuts, bolts, and consumables like anti-corrosive paints, welding electrodes etc. required to complete the cabling system. All other sundry materials for minor civil work shall also be supplied by vendor.

1.3 WORKS EXCLUDED FROM VENDOR'S SCOPE

- a) Major civil works like excavation and concreting of concrete trenches, plate embedments on cable trenches, ceiling and floors.
- b) Civil works for ducting for crossing of roads & rail tracks
- c) Conduits and pipes embedded in walls, floors etc.

2.0 CODES AND STANDARDS

2.1 Installation of cabling work shall comply with the latest edition of following Indian standards rules, regulations and acts. However, if Data Sheet A specifies conformance to any other international standard, equivalent BS / IEC / ISO / any other standard shall be applicable.

- a) IS:1255 Code of practice for installation and maintenance of power cables up to and including 33 kV rating.
- b) IS:732 Electrical wiring installation (system voltage not exceeding 650 V).
- c) IS:5216 Guide for safety procedures and practices in electrical works.
- d) IS:226 Structural steel (Standard Quality).
- e) IS:800 Code of practice for use of structural steel.
- f) IS:316 Code of practice for use of metal arc welding for general construction in mild steel.
- g) IS:1363 Hexagonal bolts, nuts and screws.
- h) IS:1572 Electroplated coatings of cadmium on iron and steel.
- i) IS:2629 Code of practice for hot dip galvanizing for iron and steel.
- j) IS:2633 Method of testing uniformity of coating on zinc coated articles.
- k) Indian Electricity Act
- l) Indian Electricity Rules
- m) Fire insurance regulations.
- n) Regulations laid down by the Chief Electrical Inspector of the State.
- o) Regulations laid down by the Factory Inspector of the State.
- p) Any other regulations laid down by the authorities.

2.2 In case any clause of contradictory nature arises between standards and this specification, the latter shall prevail.



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3.0 CABLING MATERIALS TO BE PROVIDED

- 3.1 Trefoil Cable Clamps shall be provided for clamping single core cables carrying alternating current and shall be of aluminium alloy or nylon material as per Data Sheet A
- 3.2 Omega Cable Clamps shall be provided to fasten the individual multi-core cable above 35mm outer diameter and shall be of aluminium alloy or mild steel.
- 3.3 Strip Cable Clamps shall be provided to fasten the group of multi-core cables up to 35mm diameter and shall be of mild steel or aluminium
- 3.4 Self Locking Clamps shall be shall be provided of nylon material with self locking feature when the cord is looped and shall provided with manual lock release.
- 3.4 Steel clamps shall be hot dip galvanized as per the requirements given in Data Sheet A.
- 3.5 Ferrules shall be provided for individual core of control cables and shall be of plastic material.
- 3.6 Cables shall be provided with cable number tags for identification Cable tags shall be of durable fibre, aluminium or stainless steel sheets as per Data Sheet A.
- 3.7 Miscellaneous items required for the buried cables such as cable markers, bricks, sand, protective slabs etc. shall be to provided by the vendor.

4.0 CABLING CONCEPT

- 4.1 In the plant building, substations, switchgear rooms, control rooms etc., power and control cables shall generally be laid on cable trays installed in concrete trenches, tunnels, cable basements, cable vaults, cable shafts or along building and technological structures as the case may be.
- 4.2 In case of multicore cables of diameter up to 30 mm where not more than 3 cables are taken in one run, these can be taken directly along structures, walkways, platforms, galleries, walls, ceiling etc. by proper clamping at regular intervals of 750 mm or less.
- 4.3 Power & control cables installed along buildings, structures, ceilings, walls, etc., which are required to be protected against mechanical damage, shall be taken in GI conduits.
- 4.4 GI Conduits shall also be used for flameproof installations, wherever required, with sealing at both ends.
- 4.5 Entry of cables from trenches/tunnels into buildings shall be by means method duly approved by purchaser approved, which shall be informed to successful bidder during detailed engg stage.
- 4.6 Cables laid exposed in racks/trays and routed from trenches/tunnels/basements etc to individual drive/ control devices etc shall be taken in embedded/exposed/surface-grouted rigid GI conduits and / or flexible conduits unless directly terminated to the equipment in the panels located above trenches, tunnels or basement.
- 4.7 All cables routed along walls or in equipment rooms shall be protected by means of laying them through G.I. pipes or by providing sheet metal covers up to a height of 2000 mm from



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the working floor levels and platforms, for protection against mechanical damage. All vertical risers shall be enclosed type.

- 4.8 For 415 V power wiring in ancillary buildings, offices and laboratories, cables shall be taken through embedded/exposed GI conduits or rigid PVC pipes as applicable.
- 4.9 Wherever cables are to be laid below roads and railway tracks, the same shall be taken through ducts buried at a suitable depth.
- 4.10 At certain places where hazardous fumes/gases may cause fire to the cables, cable trenches after installation of cables shall be sand-filled.
- 4.11 In corrosive atmosphere, Epoxy painted G.I. conduits shall be used for cables.
- 4.12 Single core cables, when pulled individually, shall be taken through PVC pipes only.
- 4.13 Cables shall be avoided below oil pipes and near steam pipes.
- 4.14 Cable installation shall be properly coordinated at site with other services and wherever necessary suitable adjustment shall be made in the cable routings with a view to avoid interference with any part of the building, structures, equipment, utilities and services
- 4.15 All apparatus, connections and cable work shall be designed and arranged to minimise the risk of fire and ingress of water. All material required to achieve the same shall be included in the cost of installation of cables.

5.0 TRANSPORTATION & STORAGE OF CABLE DRUMS

- 5.1 Transportation and storage of cable drums shall generally conform to the requirements of IS:1255. The cable drums shall be transported on wheels to the place of work.
- 5.2 Transportation of all cables, which shall be provided by purchaser as free issue items, from purchaser's storage area to the work site shall be the responsibility of vendor. Empty cable drums shall be returned to purchaser.

6.0 LAYING OF CABLES

- 6.1 Laying and installation of power, control and special cables shall generally conform to IS: 1255.
- 6.2 The cables shall be paid-out in proper direction from the cable drums (opposite to the normal direction of rotation for transportation).
- 6.3 In case of higher size cables, the paid out cables shall run over rollers placed at close intervals and finally transferred carefully on the racks/trays. Care shall be taken so that kinks and twists or any mechanical damage does not occur to cables. Only approved cable pulling grips or other devices shall be used. Under no circumstances cables shall be dragged on ground or along structure while paying out from cable drums, carrying to site and straightening for laying purpose.
- 6.4 All possible care shall be given while handling un-armoured cables.
- 6.5 Additional length of power cables of one loop with permissible bending radius shall be provided. For control cables extra length of 1 - 1.5 metre shall be provided.



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- 6.6 The bending radius of various types of cables shall not be less than those specified by cable manufacturers and that specified in IS: 1255.
- 6.7 All cables shall be provided with identification tags indicating the cable numbers. Tags shall be fixed at both ends of cables, at each bend, and both sides of floor/wall crossings.
- 6.8 Single core cables for a. c. circuits shall form a complete circuit in trefoil formation supported by means of trefoil clamps of nonmagnetic material.
- 6.9 Multi-core cables above 1100 V grade shall be generally laid in ladder type trays in one layer with spacing not less than one cable diameter of bigger diameter cable.
- 6.10 All 1100 V grade multicore power cables and single core DC cables shall be placed in single layer, touching each other and clamped by means of single or multiple galvanized MS saddles/ aluminium strips/ nylon cable ties as specified in Data Sheet A. Cables above 35mm outer diameter shall be clamped individually.
- 6.11 Control cables shall be laid touching each other and may not preferably be taken in more than two layers.
- 6.12 Segregation of the cables based on their types and their functions shall be as under for horizontal formations:
 - a) HT cables shall be laid in the top tier(s).
 - b) LT power cables to be laid in the tray(s) below the HT cable trays.
 - c) LT control cables to be laid in the tray(s) next below to the LT power Cable tray(s).
 - d) Special control cables including screened control cables to be laid in the bottom most tray(s).
- 6.13 For vertical formations, the tray closest to the wall shall be considered as bottom most tray and the order indicated in clause just above shall be followed.
- 6.14 When it may not be possible to accommodate cables as per the criteria indicated in the clauses 6.12 & 6.13 above, the following rules in hierarchical order shall override the criteria:
 - a) Control cables are mixed up with the special control cables with clear minimum gap of 100mm between them.
 - b) LT power cables are mixed up with control cables with clear minimum gap of 150mm between them.
 - c) LT power cables are mixed up with HT power cables with clear minimum gap of 200mm between them.However, under no circumstances HT power cables can be mixed up with control cables of any type.
- 6.15 For laying cables along building steel structures and technological structures, the cables shall be taken by clamping with MS saddles screwed to the MS flats welded to the structure. MS saddles and flats shall be galvanized.
- 6.16 For laying cables along concrete walls, ceilings etc., the cables shall be taken by clamping with MS saddles screwed to the MS flats welded on the inserts. Where inserts are not available the saddles shall be directly fixed to the walls using rawl plugs and MS flat spacers of minimum 6mm thickness.



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- 6.17 To facilitate pulling of cables in GI conduits, powdered soft stone, plastic soap or other dry inert lubricant may be used but grease or other material harmful to the cable sheaths shall not be used.
- 6.18 No single core cable shall pass through a GI conduit or duct singly except DC single core cables. AC single core cables shall pass through GI conduits/pipes in trefoil formation only.
- 6.19 Entry of cables from underground trenches to the buildings or tunnels shall be by some approved method. Necessary precautions shall be taken to make the entry point fully water tight by properly sealing the pipe sleeves wherever they enter directly into the building at trench level. The sealing shall be by cold setting compound. Any alternative sealing arrangement may be suggested with the offer for purchaser's consideration.

7.0 CABLE TERMINATIONS AND JOINTING

- 7.1 All cable entries in the equipment shall be sealed by cable glands.
- 7.2 Power cable terminations shall be carried out in a manner such as to avoid strain on the terminals by providing suitable clamps near the terminals.
- 7.3 Control cable cores entering switchboard or control panels shall be neatly bunched and strapped with PVC perforated tapes/nylon ties and suitably supported to keep them in position at the terminal block. Spare cores shall be neatly dressed and suitably taped at both ends.
- 7.4 Cable joint, not more than one in a circuit, shall normally be made at an intermediate point in the straight run of the cable only when the length of the run is more than the standard drum length supplied by the cable manufacturer.
- 7.5 Junction boxes shall be used, wherever required, for jointing of control cables.
- 7.6 Termination and jointing shall generally conform to the requirements of IS: 1255 and shall strictly conform to the recommendations of termination and jointing kit supplier.
- 7.3 Cable installation shall be properly coordinated at site with other services and wherever necessary suitable adjustment shall be made in the cable routings with a view to avoid interference with any part of the building, structures, equipment, utilities and services
- 7.8 All apparatus, connections and cable work shall be designed and arranged to minimise the risk of fire and ingress of water. All material required to achieve the same shall be included in the cost of installation of cables.

10.0 DRAWINGS / DOCUMENTS TO BE SUBMITTED AFTER AWARD OF CONTRACT

- 10.2 The following documents shall be furnished after award of contract for purchaser's approval.
- a) Data Sheet-C
 - b) Final Field Quality Plan
 - c) Final Quality Plan



DOCUMENT TITLE

**TECHNICAL SPECIFICATION
FOR CABLE TRAYS AND
ACCESSORIES**

SPECIFICATION NO. PE-SS-999-507-E021

VOLUME II B

SECTION - D

REVISION 0

DATE: 23/03/2006

SHEET

OF

1.0 GENERAL

This specification covers the design, manufacture, inspection & testing at vendor's works, packing and delivery to site of cable trays and accessories.

2.0 CODES AND STANDARDS

The material, constructional features and various processes involved in manufacture shall comply with currently applicable Indian standards. All relevant parts of the applicable Indian standards shall be considered.

3.0 DESIGN REQUIREMENTS AND CONSTRUCTIONAL FEATURES

3.1 All items listed in the Bill of Quantities (Sec-C of the specification) shall be manufactured as per Datasheet-A and project drawings enclosed with this specification.

3.2 Cable trays and accessories shall be manufactured as per the drawings enclosed with this specification. Minor fabrication details changes, which do not affect the material/dimensional aspects of the equipment, shall be to BHEL/owner's approval without any commercial implications.

3.3 Cable Trays, Tray Covers and Fittings:

3.3.1 Cable trays shall be of two types, namely ladder type and perforated type as specified in Data Sheet A and drawings enclosed with this specification.

3.3.2 Tray ends shall be connected to other straight trays, horizontal elbows, vertical elbows, tees, cross, reducers etc. by using coupler plates.

3.3.3 The bending radius on inner side of bends shall as specified in Datasheet A / drawings enclosed.

3.3.4 Necessary fasteners shall be provided along with each piece of cable tray as per applicable drawing.

3.3.4 The width of the tray covers (where provided) shall be same as the width of trays. Suitable bolting arrangement shall be supplied for attaching the cover to the cable trays, elbows, reducers, tees etc.

3.3.5 All welded joints shall be smooth enough to provide a good appearance and shall not cause any injury to working personnel or any damage to the cable laid directly on it. All welding work shall be done by skilled personnel.

4.0 QUALITY/ INSPECTION:

4.1 The following stages of manufacture shall be stage inspected by purchaser or his duly authorised representative.

i) Inspection of raw materials including hardware items such as bolts, nuts etc.

ii) Inspection of manufacturing processes such as shearing, punching, bending, welding, galvanizing, painting etc.

iii) Inspection of finished products.

iv) Inspection of packing material and procedure.

4.2 The inspection will be carried out as per BHEL quality plan no. PED-507-00-Q-005/01.



DOCUMENT TITLE

**TECHNICAL SPECIFICATION
FOR CABLE TRAYS AND
ACCESSORIES**

SPECIFICATION NO. PE-SS-999-507-E021

VOLUME II B

SECTION - D

REVISION 0

DATE: 23/03/2006

SHEET

OF

5.0 TESTING:

5.1 The supplier shall perform all tests necessary to ensure that the material and workmanship conform to the relevant standards and comply with the requirements of this specification.

5.2 The tests shall be in accordance with appropriate Indian standards. The extent of the tests to be performed by the supplier shall include but not be limited to the following: -

a) Type Tests:

Load test as per clause 5.3.

b) Routine Tests:

(i) Dimension checks

(ii) Tests for painting and/ or galvanizing, as applicable.

c) Acceptance Test:

(i) Dimension checks

(ii) Tests for galvanizing

5.3 Load Test:

A 2.5 meter straight section of each type of cable tray of width 600mm or 450mm shall be simply supported at the two ends. A uniformly distributed load of 100 kg per meter shall be applied along the length of tray. The maximum deflection at mid span shall not exceed 7 mm.

Load test shall not be conducted on tray width of 300mm and below.

6.0 PACKING

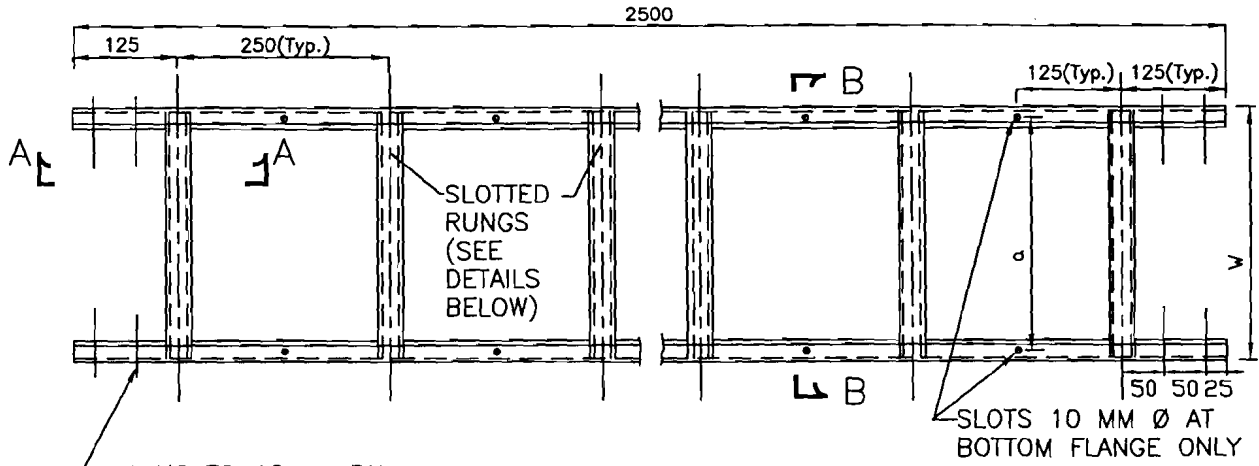
The material shall be packed to ensure protection against damage during transit, storage for prolonged periods and handling. Packing procedure shall be subject to the purchaser's approval.

7.0 DRAWING DATA AND DOCUMENTS REQUIRED (within two weeks of award of contract)

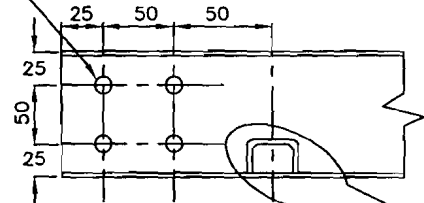
i) Manufacturing Drawings (if required).

ii) SQP/RQP/MQP.

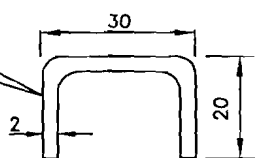
iii) Any other drawings / documents listed in Sec-C.



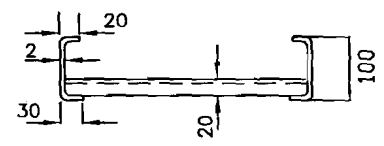
4 HOLES 10mm DIA.



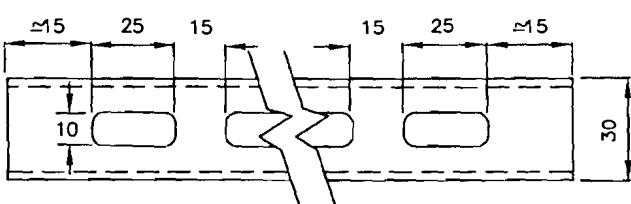
SECTION A-A



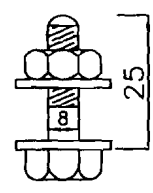
SECTION B-B



SLOTS 10 MM Ø AT BOTTOM FLANGE ONLY



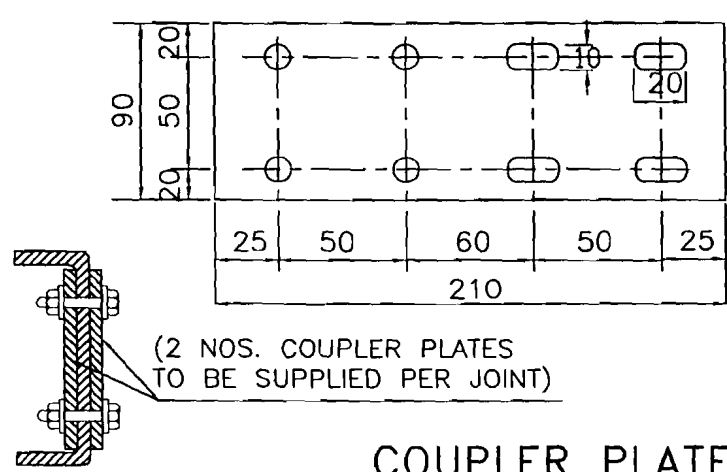
DETAILS OF SLOTTED RUNGS
(TO SUIT TRAY WIDTH)



4 NUMBERS BOLTS
8mm DIA 25mm LONG
WITH NUTS AND
WASHERS ARE TO BE
SUPPLIED WITH EACH
2.5M STRAIGHT PIECE
OF LADDER TYPE TRAY

TRAY WITH W (mm)	600	450	300	150
a (mm)	570	420	270	120

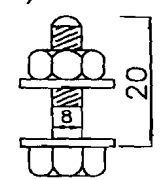
LADDER TYPE CABLE TRAY



(2 NOS. COUPLER PLATES
TO BE SUPPLIED PER JOINT)

COUPLER PLATE

COUPLER PLATE
(3mm THICK)



8 NUMBERS BOLTS
8mm DIA 20mm LONG
WITH NUTS AND
WASHERS ARE TO BE
SUPPLIED WITH EACH
COUPLER PLATE

SEE GENERAL NOTES IN SHEET 8.

**TYPICAL DETAILS OF CABLE TRAYS
AND ACCESSORIES**

DRG. No.
PE-DG-999-507-E021

DATE 23/03/06 REV. 0



QUALITY PLAN

SHEET 1 OF 2

CUSTOMER :

PROJECT

SPECIFICATION :

BIDDER/ VENDOR

TITLE
QUALITY PLAN
NUMBER PED-506-00-Q-006/0

NUMBER :
SPECIFICATION
TITLE

SYSTEM

ITEM AC ELECT. MOTORS BELOW 75KW (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			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
1.0	PAINTING	1.SHADE	MA	VISUAL	SAMPLE	MANUFR'S SPEC/BHEL SPEC./RELEVANT STANDARD	BHEL SPEC. SAME AS COL.7	LOG BOOK	3	-	-	
2.0	ASSEMBLY	1.WORKMANSHIP	MA	VISUAL	100%	MANUF'S SPEC	MANUF'S SPEC	-DO-	3	-	-	
		2.DIMENSIONS	MA	-DO-	-DO-	MFG. DRG./MFG. SPEC.	MFG. DRG./RELEVANT IS	-DO-	3	-	-	
		3.CORRECTNESS COMPLETENESS TERMINATIONS/ MARKING/COLOUR CODE	MA	VISUAL	100%	MFG.SPEC./RELEVANT IS	MFG.SPEC. RELEVANT IS	-DO-	3	-	-	
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	3	2,1	2,1	NOTE -1
		2.OVERALL DIMENSIONS & ORIENTATION	MA	MEASUREMENT & VISUAL	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET & RELEVANT IS	INSPN. REPORT	2	1	-	
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									
			DATE						BIDDER'S/VENDORS COMPANY SEAL			



QUALITY PLAN


CUSTOMER :
 BIDDER/ :
 VENDOR
 SYSTEM

PROJECT TITLE
 QUALITY PLAN
 NUMBER PED-506-00-Q-006/0
 ITEM AC ELECT. MOTORS BELOW 75KW (LV)

SPECIFICATION :
 NUMBER :
 SPECIFICATION :
 TITLE :
 SECTION VOLUME III

SHEET 2 OF 2

SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
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	3	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.										
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									
			DATE						BIDDER'S/VENDORS COMPANY SEAL			

		QUALITY PLAN		CUSTOMER :			PROJECT			SPECIFICATION : PE-TS-MOU-507-E004			
				BIDDER/ VENDOR			TITLE			NUMBER :			
SHEET 1 OF 5		SYSTEM			ITEM : PVC POWER & CONTROL CABLE			SPECIFICATION TITLE: STANDARD TECH. SPEC FOR 1.1 kV PVC CONTROL CABLES					
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	SECTION VOLUME III			REMARKS	
									P	W	V		
1	2	3	4	5	6	7	8	9	10			11	
1.0	RAW MATERIAL												Raw material verification as per approved sub-vendor list
1.1	PVC Compound(for insulation and sheath)	1. Physical properties	MA	Physical Tests	Sample	IS-5831/BHEL Specification	IS-5831/BHEL Specification	Log Book/ Test Cert.	3/2	-	2		
		2. FRLS Properties (outer sheath)	MA	Envir/ Chem	Sample	-do-	-do-	-do-	3/2	-	2		
1.2	Galvanised steel wire/strip	1. Phy.and Elec. Properties	MA	Physical & Electrical Tests	Sample*	IS-3975 BHEL Specification	IS-3975/BHEL Specification	-do-	3/2	-	2		* Sample from each Batch/Lot.
		2. Dimension	MA	Measurement	-do-	-do-	-do-	-do-	3/2	-	2		
		3.Galvanization Quality	MA	Galv. Tests	-do-	-do-	-do-	-do-	3/2	-	2		
1.3	Copper/Aluminium Rods/ Wires	1. Physical Properties	MA	Physical Tests	-do-	IS-613 IS-5484 IS-8130 AND BHEL Specification	IS-613 IS-5484 IS-8130 AND BHEL Specification	-do-	3/2	-	2		
		2. Chemical Composition & purity	MA	Chemical analysis	-do-	-do-	-do-	-do-	3/2	-	2		
		3.Electrical properties	MA	Electrical Tests	-do-	-do-	-do-	-do-	3/2	-	2		
		4.Dimension	MA	Measurement	-do-	-do-	-do-	-do-	3/2	-	2		
BHEL			PARTICULARS			BIDDER/VENDOR							
			NAME										
			SIGNATURE										
			DATE						BIDDER'S/VENDORS COMPANY SEAL				



QUALITY PLAN

SHEET 2 OF 5

CUSTOMER :

PROJECT

SPECIFICATION : PE-TS-MOU-507-E004

BIDDER/ VENDOR :

QUALITY PLAN
NUMBER PED-507-00-Q-002/03

NUMBER :
SPECIFICATION TITLE: STANDARD TECH. SPEC
FOR 1.1 KV PVC CONTROL CABLES

SYSTEM

ITEM :PVC POWER & CONTROL CABLE

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			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
2.0	IN PROCESS											
2.1	Wire Drawing , Tinning and Annealing	1. Physical, Electr. Finish & dimension	CR	Phy.&Elect. Tests Visual & Meas.	Sample	BHEL Specn. IS-8130	BHEL Specn. IS-8130	Log Book	2	-	1	
		2. Chemical test for Tinning	CR	Chemical Test	Sample	-do-	-do-	-do-	2	-	-	
2.2	Stranding of wires	1. No.of wires	MA	Counting	Sample	Vendors/BHEL Specn. & Apprd. Data Sheet & Relevant IS	Vendors/BHEL Specn. & Apprd. Data Sheet & Relevant IS	-do-	2	-	-	
		2. Sequence, lay length & Direction	MA	Visual, Meas	Sample	-do-	-do-	-do-	2	-	-	
		3 Surface Finish	MA	Visual	Sample	-do-	-do-	-do-	2	-	-	
		4.Dimension	MA	Measurement	Sample	-do-	-do-	-do-	2	-	-	
2.3	Core Insulation (No repair permitted)	1. Surface finish	MA	Visual	100%	-	Free from bulging burnt particles lumps, cuts & Scratches.	-do-	2	-	1	
		2 Insulation thickness	CR	Measurement	Sample	Appd.data sheet IS-1554	Appd.data sheet IS-1554	-do-	2	-	-	
PARTICULARS					BIDDER/VENDOR							
BHEL					NAME							
					SIGNATURE							
					DATE							
												BIDDER'S/VENDORS COMPANY SEAL



QUALITY PLAN

SHEET 3 OF 5

CUSTOMER :
BIDDER/ VENDOR :
SYSTEM

PROJECT TITLE
QUALITY PLAN
NUMBER PED-507-00-Q-002/03
ITEM :PVC POWER & CONTROL CABLE

SPECIFICATION : PE-TS-MOU-507-E004
NUMBER :
SPECIFICATION TITLE: STANDARD TECH. SPEC FOR 1.1 kV PVC CONTROL CABLES
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			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
2.4	Core Laying	3. Concentricity #	CR	Measurement	Sample	Mfr's Std./Appd. data sheet	Mfr's Std./Appd. data sheet	Log Book	2	-	1	# To be checked at starting & finish end of Extruded Length
		4 Dia over insulation	MA	Measurement	Sample	-do-	-do-	-do-	2	-	-	
		5. Spark Test or Water Immersion test	CR	Electrical	100%	Mfr's Std.	Mfr's Std.	-do-	2	-	1	
		6. Core identification	MA	Visual	100%	IS-1554	IS-1554	-do-	2	-	-	
		1. Dia over laidup core	MA	Measurement	Sample	-do-	-do-	Log Book	2	-	-	
2.5	InnerSheath Extrusion	2.Sequence of lay, Lay length & direction up core	MA	Visual & Meas.	Sample	Mfrs.Std./relevant IS	Mfrs.Std./relevant IS	-do-	2	-	-	
		1. Surface finish	MA	Visual	100%	--	Free from bulging, burnt particles, lumps cuts & scratches.	-do-	2	-	-	
		2. Sheath thickness	MA	Measurement	Sample	IS-5831, IS-1554 data sheet	IS-5831, IS-1554 data sheet	-do-	2	-	-	
2.6	Armouring	3.Dia over inner sheath	MA	-do-	-do-	-do-	-do-	-do-	2	-	-	
		1. No.of wires/Strips	MA	Counting	At the start of the process	BHEL Specn./ Appd. Data sheet IS-3975 & IS-1554	BHEL Specn./ Appd. Data sheet IS-3975 & IS-1554	-do-	2	-	-	
		2. Lay Direction	MA	Visual	-do-	-do-	-do-	-do-	2	-	-	

PARTICULARS
BHEL
SIGNATURE
DATE

BIDDER/VENDOR

BIDDER'S/VENDORS COMPANY SEAL



QUALITY PLAN

SHEET 4 OF 5

CUSTOMER :

BIDDER/ VENDOR SYSTEM :

PROJECT TITLE

QUALITY PLAN NUMBER PED-507-00-Q-002/03

SPECIFICATION : PE-TS-MOU-507-E004

NUMBER :
SPECIFICATION TITLE: STANDARD TECH. SPEC FOR 1.1 kV PVC CONTROL CABLES

SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
2.7	Outer Sheath Extrusion	3. Lay Length	MA	Visual, Meas.	At the start of the process	BHEL Specn./ Appd. Data sheet IS-3975 & IS-1554	BHEL Specn./ Appd. Data sheet IS-3975 & IS-1554	Log Book	2	-	-	
		4. Coverage	MA	Measurement	-do-	-do-	-do-	-do-	2	-	-	
		5. Dia over armouring	MA	Measurement	-do-	-do-	-do-	-do-	2	-	-	
		1. Surface Finish	MA	Visual	100%	-	Free from Bulging Burnt particles, lumps, cuts & scratches	Log Book	2	-	-	
2.8	Finished Cable	2. Sheath thickness	MA	Measurement	Sample	IS-5831 & IS-1554 Data Sheet	IS-5831 & IS-1554 Data Sheet	Log Book	2	-	-	Sequential marking shall be done by printing
		3. Dia over outer sheath	MA	Measurement	Sample	-do-	-do-	-do-	2	-	-	
		4. Marking	MA	Visual	100%	IS-1554 & BHEL Specn.	IS-1554 & BHEL Specn.	Test Report	2	-	-	
		1. Routine Test	CR	Elec. & Meas.	100%	IS-1554 & BHEL Specn	IS-1554 & BHEL Specn	Test Report	2	-	1	
3.0	Final Inspection	2. Type & FRLS Tests	CR	Elec., Phy & Meas.	Sample *	-do-/Apprd.data sheet	-do-/Apprd.data sheet	Test Report	2	-	1	* One Drum/Size/Lot
		1. Finish & Length	MA	Visual	(See remark)	BHEL specn. IS-1554	Free from Bulging Burnt particles, lumps, cuts & scratches	Test Report	2	1	-	One drum each for Power & control cables in a Lot
			PARTICULARS			BIDDER/VENDOR						
BHEL			NAME									
			SIGNATURE									
			DATE									BIDDER'S/VENDORS COMPANY SEAL



QUALITY PLAN

SHEET 5 OF 5

CUSTOMER :

PROJECT TITLE

SPECIFICATION : PE-TS-MOU-507-E004

BIDDER/ VENDOR

QUALITY PLAN NUMBER PED-507-00-Q-002/04

NUMBER : SPECIFICATION TITLE: STANDARD TECH. SPEC FOR 1.1 kV PVC CONTROL CABLES


SYSTEM

ITEM :PVC POWER & CONTROL CABLE

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			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
		2. Dimension	MA	Measurement	As per IS	Appd.Data Sheet/ IS-1554 & IS-10810	Appd.Data Sheet/ IS-1554 & IS-10810	Test Report	2	1	-	
		3. Armouring - Coverage No.of Wires/Strips	MA	Visual & Meas.	As per IS	-do-	-do-	-do-	2	1	-	/
		4. Marking/Colour Coding	MA	Visual	-do-	-do-	-do-	-do-	2	1	-	
		5. Acceptance Tests	CR	Phy & Elect. Tests	-do-	-do-	-do-	-do-	2	1	-	
		6. Type & FRLS Tests	CR	Measurement	(SEE REMARK)	BHEL Specn. Apprd.Data Sheet	BHEL Specn. Apprd.Data Sheet	-do-	2	1	-	Type Test shall be witnessed on one sample per type(Power/control) of every lot
<p>NOTES:-</p> <p>(A) JOINTS IN WIRE SHALL BE AS PERMITTED BY IS / BHEL SPECIFICATION. VENDOR TO CERTIFY THE SAME.</p> <p>(B) NO REPAIR OF CORE INSULATION PERMITTED</p> <p>(C) CABLE ENDS SHALL BE SEALED AS PER BHEL SPECIFICATION</p> <p>(D) PURCHASER SHALL HAVE RIGHT TO WITNESS THE SPARK TEST AT CORE STAGE</p> <p>(E) RECORD OF RAW MATERIAL, PROCESS & ALL STAGES SHALL BE CERTIFIED BY VENDORS QC. AND ARE LIABLE TO AUDIT CHECK BY PURCHASER.</p> <p>(F) FILLERS/DUMMY CORES ETC. SHALL BE AS PER BHEL SPECIFICATION</p> <p>(G) WHEREVER EXTENT OF CHECK FOR STAGE IS MENTIONED AS SAMPLES, THE SAME SHALL BE AS PER VENDORS SAMPLING PLAN,</p> <p>(H) VENDOR SHALL FURNISH COMPLIANCE CERTIFICATE TO THE INSPECTION AGENCY CONFIRMING THE PACKING AS PER BHEL SPECIFICATION.</p> <p>LEGEND : P : PERFORMER W: WITNESSER V: VERIFIER (1) BHEL/BHEL's CUSTOMER: 2-VENDOR : 3 SUB VENDOR</p>												

PARTICULARS			BIDDER/VENDOR		
BHEL			NAME		
			SIGNATURE		
			DATE		
BIDDER'S/VENDORS COMPANY SEAL					

		QUALITY PLAN			CUSTOMER :			PROJECT			SPECIFICATION :		
					BIDDER/ VENDOR :			TITLE			NUMBER :		
SHEET 1 OF 2		SYSTEM			QUALITY PLAN NUMBER PED-507-00-Q-005/02			SPECIFICATION TITLE			SECTION		
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	VOLUME III			REMARKS	
									AGENCY				
1	2	3	4	5	6	7	8	9	P	W	V	11	
1.0	RAW MATERIAL												
1.1	ROLLED SHEET	1.SURFACE FINISH	MA	VISUAL	100%	IS-1079/TECH. SPEC.	IS-1079/TECH. SPEC.	QC RECORD	2	-	-		
		2.DIMENSIONS	MA	MEASUREMENT	100%	-DO-/IS-1730	-DO-/IS-1730	-DO-	2	-	-		
		3.CHEM.& PHY. PROPERTY	MA	VERIFICATION OF TC	100%	IS1079/TECH SPEC	IS1079/TECH SPEC	MILL TC	3/2	-	-		
1.2	ZINC	CHEM.COMP.		CHEM TEST	EACH HEAT	IS-209	IS-209	TC	3/2	-	1/2		
2.0	IN-PROCESS												
2.1	FABRICATION	1.DIMENSIONS & DISTORTION	MA	MEASUREMENT	100%	APPD.DRG.	APPD.DRG.	QC RECORD	2	-	-		
		2.SURFACE FINISH	MA	VISUAL	100%		FREE FROM BURRS	-DO-	2	-	-		
		3.WELDING QUALITY	MA	VISUAL	100%	PLANT STANDARD	FREE FROM DEFECTS & SLAG	-DO-	2	-	-		
		4.RIGIDITY (CABLE TRAYS)	MA	DEFLECTION TEST	2 OF EACH SIZE	TECH. SPEC.	TECH. SPEC.	-DO-	2	-	-		
2.2	SURFACE PREPARATION	1.CLEANING PICKLING & RINSING, BATH STRENGTH/ PURITY & TEMPERATURE	MA	CHEM. & MEASUREMENT	PERIODIC IN EACH SHIFT	IS:2629	IS:2629	QC RECORD	2	-	-		
		2. SURFACE QUALITY	MA	VISUAL	100%	-DO-	-DO-	-DO-	2	-	-		
1. BHEL, 2. CONTACTOR, 3. SUPPLIER			PARTICULARS		BIDDER/VENDOR								
INDICATE 'P' PERFORM 'W' WITNESS & 'V' VERIFICATION			NAME										
			SIGNATURE										
			DATE					BIDDER'S/VENDORS COMPANY SEAL					



QUALITY PLAN		CUSTOMER :				PROJECT			SPECIFICATION :			
SHEET 2 OF 2		BIDDER/ VENDOR :				TITLE			NUMBER :			
SYSTEM		NUMBER PED-507-00-Q-005/02				QUALITY PLAN			SPECIFICATION :			
ITEM : CABLE TRAYS & ACCESSORIES		TITLE				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			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
2.3	GALVANISING	1.TEMPERATURE OF ZINC BATH	MA	TEMPERATURE INDICATOR	CONTINUOUS	IS-2629	IS-2629	-DO-	2	-	-	BOLT AND NUTS SHALL BE OF REPUTED & APPROVED MAKE
		2.DURATION OF DIP	MA	VISUAL	-DO-	MANUFS.PRACT	MANUFS.PRACT		2	-	-	
		3.SURFACE QUALITY	MA	VISUAL	100%	-DO-	FREE FROM BURRS ROUGHNESS, SLAG FLUX. STAIN. ETC.	-DO-	2	-	-	
		4.GROSS QUANTITY & AGITATION	MA	TEST	PERIODIC	RELEVANT:IS	RELEVANT:IS	-DO-	2	-	-	
3.0	FINISHED ITEMS											
3.1	(CABLE TRAY, ACCESSORIES & HARDWARES)	1.DIMENSIONS DISTORTION	MA	MEASUREMENT	IS-2500 (1) LEVEL IV	APPD. DRG	APPD. DRG	INSP.REPORT	2	1	-	
		2.SURFACE FINISH	MA	VISUAL	-DO-		FREE FROM BURRS, SLAG, ROUGHNESS, FLUX. STAIN. ETC.	-DO-	2	1	-	
		3.RIGIDITY (FOR TRAYS)	MA	DEFLECTION TEST	1 OF EACH TYPE OF 600MM OR 450MM	TECH. SPEC.	TECH. SPEC.	-DO-	2	1	-	
		4.WEIGHT OF ZINC COATING	MA	CHEM. TEST	IS-4759	IS-6745	TECH. SPEC.	-DO-	2	1	-	
		5.UNIFORMITY OF ZINC COATING	MA	-DO-	-DO-	IS-2633	IS-2633	-DO-	2	1	-	
		6.THICKNESS OF ZINC COATING	MA	ELCOMETER	-DO-	TECH. SPEC.	TECH. SPEC.	-DO-	2	1	-	
		7.ADHESION	MA	MECH.TEST	IS-4759	IS-2629	IS-2629	-DO-	2	1	-	
1. BHEL, 2. CONTACTOR, 3. SUPPLIER			PARTICULARS			BIDDER/VENDOR						
INDICATE 'P' PERFORM 'W' WITNESS & 'V' VERIFICATION			NAME									
			SIGNATURE									
			DATE						BIDDER'S/VENDORS COMPANY SEAL			



TITLE

LV MOTORS**DATA SHEET-A**

SPECIFICATION NO.


VOLUME II B

SECTION D

REV NO. DATE 16/05/2005

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%
 - 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 110 kW and above (Breaker controlled) : 50 KA for 0.20 sec.
 - o Below 110 kW (Contactor controlled) : 50 KA protected by fuse
 - f) LV System grounding : Solidly
- 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, 1ϕ , 50 Hz
- 10.0 Rating up to which Single phase motor : Acceptable below 0.20 kW
- 11.0 Locked rotor current
- a) Limit as percentage of FLC : 600%
 - b) Permissible tolerance, if any : ±20%
- 12.0 Additional tests : As per QP
- 12.1 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
- 12.0 Makes : ABB/ Bharat Bijlee/ CGL / KEC/ NGEF/ Siemens/ ALSTOM

	DOCUMENT TITLE TECHNICAL SPECIFICATION FOR LT CONTROL CABLES	SPECIFICATION NO. PE-TS- MOU-507-E004	
		VOLUME II B	
		SECTION-D - I	
		REVISION 01	DATE: 31.03.2006
		SHEET 2 OF 5	

DATA SHEET-A

DS-AI. SPECIFIC TECHNICAL REQUIREMENTS

1.0	Type of Cable	Flame Retardant Low Smoke (FRLS)
2.0	Standard applicable in general	IS: 1554 PART (I)
3.0	Voltage Grade	1.1kV
4.0	Number of cores, cross sectional area of conductors and quantities	As per BOQ, Annexure-A to Section-C
5.0	CONDUCTOR	
(a)	Material	Copper
	Grade and Class	Stranded, Un-tinned (plain) annealed high conductivity, Class 2
(b)	Standard Applicable	IS: 8130
(c)	Shape	Circular / shaped as per IS
(d)	Min. number of strands	7
6.0	INSULATION	
(a)	Material	PVC type-A
(b)	Standard Applicable	IS: 5831
(c)	Continuous withstand temperature	70°C
(d)	Short-circuit withstand temperature	160°C
(e)	Method of application	By extrusion; sleeve extrusion not permitted.
7.0	CORE IDENTIFICATION	
(a)	Control cables up to 5 core	Colour coded as per IS: 1554 (Part-I)
(b)	Control cables above 5 cores	By numbering as per IS: 1554 (Part-I) Insulation to have black colour.
8.0	INNER SHEATH (for all armoured cables & multi-core unarmoured cables)	
(a)	Material	PVC Type ST1 as per IS: 5831
(b)	Colour	Black
(c)	Whether FRLS	No
(d)	Fillers	Acceptable
(e)	Material of fillers (if permitted)	Same as inner sheath
(f)	Method of application	
(1)	Multi-core cables:	
(i)	With fillers	Pressure/Vacuum extruded
(ii)	Without fillers	Pressure extruded

	DOCUMENT TITLE TECHNICAL SPECIFICATION FOR LT CONTROL CABLES	SPECIFICATION NO. PE-TS- MOU-507-E004	
		VOLUME II B	
		SECTION-D - I	
		REVISION 01	DATE: 31.03.2006
		SHEET 3 OF 5	

9.0	ARMOUR (where applicable)	
(a)	Material:	
(i)	Multi-core cables	Galvanised Steel Round Wire / Formed wire armour conforming to (i) Type 'a' / 'b' as per Table- 5 of IS 1554-I and (ii) IS 3975 as per project requirements.
(b)	Minimum Coverage	90%
(c)	Gap between armour wires	Shall not exceed one armour wire space (No cross-over/ over-riding)
(d)	Breaking load of joint	95 % of normal armour
10.0	OUTERSHEATH	
(a)	Material	PVC Type ST1 as per IS: 5831
(b)	Colour	Black
(c)	Whether FRLS	Yes
(d)	Method of application	Extruded
(e)	Marking (by printing)	Cable size (cross section area and no. of cores) and voltage grade @ 5m Letters FRLS @ 5m Manufacturer's name and/ or trade name, and year of manufacture @ 5m Progressive sequential marking @ 1m..
11.0	FRLS CHARACTERISTICS	
(a)	Oxygen index	Min 29 (As per ASTM D 2863)
(b)	Temperature index	Min. 250°C
(c)	Acid gas generation	Max. 20% (as per IEC-754-1)
(d)	Smoke density rating	60% (As per ASTM D2843)
(e)	Flammability Test	As per IEC: 60332 Part-3 Cat-B/ IS-1554-I/ IEEE-383 & Swedish chimney (where applicable)
12.0	TOLERANCE ON OUTER DIAMETER	Up to 30mm; ± 1.5mm Above 30mm; + 5% or + 3mm, whichever is less.
13.0	MINIMUM BENDING RADIUS	12 x O.D.
14.0	SAFE PULLING FORCE	50 N/ sq. mm.
15.0	CABLE DRUMS	
(a)	Type & construction	As per IS 10418
(b)	Standard drum length	1000m (±) 5%. (as specified in BOQ)



DOCUMENT TITLE

**TECHNICAL SPECIFICATION FOR 1.1 KV
PVC POWER CABLES**

SPECIFICATION NO. PE-TS- MOU-507-E003

VOLUME II B

SECTION D - I

REVISION 1

DATE: 31.3.06

SHEET 3 OF 5

10.0	INNER SHEATH (applicable for multi core cables only)	
(a)	Material	PVC Type ST1/ ST2 as per IS: 5831
(b)	Colour	Black
(c)	Whether FRLS	No
(d)	Fillers	Acceptable
(e)	Material of fillers (if permitted)	Same as inner sheath (Material of filler to be compatible with that of inner sheath)
(f)	Method of application	
(1)	Multi-core cables:	
(i)	With fillers	Pressure/Vacuum extruded
(ii)	Without fillers	Pressure extruded
11.0	ARMOUR (where applicable)	
(a)	Material:	
(i)	Single core cables	Aluminium Round Wire H4 grade to IS: 8130
(ii)	Multi-core cables	Galvanised Steel Round Wire / Formed wire armour conforming to (i) Type 'a' / 'b' as per Table- 5 of IS 1554-I and (ii) IS 3975 as per project requirements.
(b)	Minimum Coverage	90%
(c)	Gap between armour wires	Shall not exceed one armour wire space (No cross-over/ over-riding)
(d)	Breaking load of joint	95 % of normal armour
12.0	OUTERSHEATH	
(a)	Material	PVC Type ST1/ ST2 as per IS: 5831
(b)	Colour	Black
(c)	Whether FRLS	Yes
(d)	Method of application	Extruded
(e)	Marking	Cable size (cross section area and no. of cores) and voltage grade @ 5m (by embossing) Letters FRLS @ 5m (by embossing) Manufacturer's name and/ or trade name, and year of manufacture @ 5m (by embossing) Progressive sequential marking @ 1m. (by embossing/ printing).
13.0	FRLS CHARACTERISTICS	
(a)	Oxygen index	Min 29 (As per ASTM D 2863)
(b)	Temperature index	Min. 250°C
(c)	Acid gas generation	Max. 20% (as per IEC-754-1)
(d)	Smoke density rating	60% (As per ASTM D2843)
(e)	Flammability Test	As per IEC: 60332 Part-3-23 Cat-B/ IS-1554-I/ Swedish chimney (where applicable)
14.0	TOLERANCE ON OUTER DIAMETER	Up to 30mm; ± 1.5 mm Above 30mm; $\pm 5\%$ or ± 2 mm, whichever is less.
15.0	MINIMUM BENDING RADIUS	
(a)	Single core cables	15 x O.D.



DOCUMENT TITLE

**TECHNICAL SPECIFICATION FOR 1.1 kV
PVC POWER CABLES**

SPECIFICATION NO. PE-TS- MOU-507-E003

VOLUME II B

SECTION D - I

REVISION 1

DATE: 31.3.06

SHEET 4 OF 5

(b)	Multi core cables	12 x O.D.
16.0	SAFE PULLING FORCE	
(a)	Aluminium conductor cable	30 N/ sq. mm.
(b)	Copper conductor cable	50 N/ sq. mm.
17.0	CABLE DRUMS	
(a)	Type & construction	As per IS 10418
(b)	Standard drum length	500m (±) 5% / 1000m (±) 5%. (as specified in BOQ)



DOCUMENT TITLE

**TECHNICAL SPECIFICATION
FOR CABLE TRAYS AND
ACCESSORIES**

SPECIFICATION NO. PE-SS-999-507-E021

VOLUME II B

SECTION -

REVISION 0

DATE: 23/03/2006

SHEET

OF

DATASHEET A

(SPECIFIC TECHNICAL REQUIREMENTS)

(DE TO STRIKE OUT OPTION NOT APPLICABLE FOR THE PROJECT)

1.0 APPLICABLE STANDARDS:

- a) IS: 2062 For Structural steel.
- b) IS: 1079 For hot rolled carbon steel sheet and strip.
- c) IS: 1730 For dimensions for steel sheet and strip.
- d) IS: 1363 Hexagon head bolts, screws and nuts.
- e) IS: 5 For colours of paint.
- f) IS: 6005 For surface pre-treatment.
- g) IS: 2629 For hot dip galvanising of steel.
- h) IS: 2633 For testing of zinc coating.
- i) IS: 6745 For determining of mass of zinc coating.
- j) IS: 513 For Cold Rolled Low carbon steels and strips.
- k) IS: 1367 Galvanised Coating on threaded Fasteners.
(Part-XIII)
- l) IS: 1852 For Rolling and Cutting Tolerances of hot rolled steel products.

2.0 CABLE TRAYS & ACCESSORIES:

- a) Material: Rolled Mild Steel.
- b) Type: Ladder type Perforated type ..
- c) Standard Length of
straight runs of cable trays 2.5 metres (Piece length).
- d) Standard width (mm): 600 450 300 150 100
- e) Construction: Conforming to enclosed drawings [PE-DG-----507-E-----]
- f) Bending radius of accessories 600 300 (Inner side of bends)
- g) Tolerance in length/width/height +/- 2 mm.

3.0 FITTINGS:

- End connections: Through Coupler plates
(Side Coupler Plates shall be provided as part of cable tray &
accessories supply) with bolts, nuts, washers etc for the two sides of
each of the 2.5 m long cable trays, elbow, cross, tee etc.)



DOCUMENT TITLE

**TECHNICAL SPECIFICATION
FOR CABLE TRAYS AND
ACCESSORIES**

SPECIFICATION NO. PE-SS-999-507-E021

VOLUME II B

SECTION -


REVISION 0

DATE: 23/03/2006

SHEET


OF

- 4.0 TRAY COVERS: **[APPLICABLE / NOT APPLICABLE FOR PROJECT].**
- a) Type: Non-Perforated type, Perforated type
- b) Material: Rolled mild steel
- c) Width: Same as cable trays
- d) Tolerance in length/ width/ height: Same as cable trays
- 5.0 SHEET THICKNESS:
- a) For trays accessories & covers: 2.0 mm
- b) For coupler plate: 3.0 mm
- c) Tolerance in thickness: (+/-0.2mm)
- 6.0 SURFACE TREATMENT:
- a) Painting: **[APPLICABLE / NOT APPLICABLE FOR PROJECT].**
- i) Pre-treatment: IS: 6005
- ii) Surface cleaning: Surface shall be cleaned with sand paper and/or cotton cloth to remove accumulated dust and dirt.
- iii) Surface finish: Complete surface shall be provided with one coat of red oxide paint followed by two coats of abrasion resistant, anti- corrosive synthetic enamel. Second coat shall be applied only when the first coat has completely dried-up. Surface finish after the painting shall be smooth, uniform and free from spots.
- iv) Tests for painting: As per IS: 1477 (Part 1 & Part 2) in general.
- b) Galvanizing: **[APPLICABLE / NOT APPLICABLE FOR PROJECT].**
- i) Pre-treatment: IS 6005 before galvanisation.
- ii) Type: Hot dip galvanization
- iii) Applicable Standard: IS 2629
- iv) Minimum thickness: 75 microns (minimum)
- v) Min. weight of:
Zinc deposit: 610 gms per square meter
- vi) Tests for galvanizing: Weight, thickness and uniformity of zinc coating as per IS: 6745 and IS: 2633.

	TITLE	SPECIFICATION NO.
	<p style="text-align: center;">LV MOTOR</p> <p style="text-align: center;">DATA SHEET - C</p>	VOLUME II B
		SECTION D
		REV NO. 00 DATE
		SHEET 1 OF 2

S. No.	Description	Data to be filled by successful bidder
A.	General	
1	Manufacturer & country of origin	
2	Motor type	
3	Type of starting	
4	Name of the equipment driven by motor & Quantity	
5	Maximum Power requirement of driven equipment	
6	Rated speed of Driven Equipment	
7	Design ambient temperature	
B.	Design and Performance Data	
1	Frame size & type designation	
2	Type of duty	
3	Rated Voltage	
4	Permissible variation for	
5	a) Voltage	
6	b) Frequency	
7	c) Combined voltage & frequency	
8	Rated output at design ambient temp (by resistance method)	
9	Synchronous speed & Rated slip	
10	Minimum permissible starting voltage	
11	Starting time in sec with mechanism coupled	
12	a) At rated voltage	
13	b) At min starting voltage	
14	Locked rotor current as percentage of FLC (including IS tolerance)	
15	Torque	
	a) Starting	
	b) Maximum	
16	Permissible temp rise at rated output over ambient temp & method	
17	Noise level at 1.0 m (dB)	
18	Amplitude of vibration	
19	Efficiency & P.F. at rated voltage & frequency	
	a) At 100% load	
	c) At 75% load	

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			

	TITLE	SPECIFICATION NO.
	<p style="text-align: center;">LV MOTOR</p> <p style="text-align: center;">DATA SHEET - C</p>	VOLUME II B
		SECTION D
		REV NO. 00 DATE
		SHEET 2 OF 2

S. No.	Description	Data to be filled by successful bidder
	c) At starting	
C.	Constructional Features	
1	Method of connection of motor driven equipment	
2	Applicable Standard	
3	DOP of Enclosure	
4	Method of cooling	
5	Class of insulation	
6	Main terminal box	
	a) Type	
	b) Power Cable details (Conductor, size, armour/unarmour)	
	c) Cable Gland & lugs details (Size, type & material)	
	d) Permissible Fault level (kArms & duration in sec)	
7	Space heater details (Voltage & watts)	
8	Flame proof motor details (if applicable)	
	a) Enclosure	
	b) suitability for hazardous area	
	i Zone	O / I / II
	ii Group	IIA / IIB / IIC
9	No. of Stator winding	
10	Winding connection	
11	Kind of rotor winding	
12	Kind of bearings	
13	Direction of rotation when viewed from NDE	
14	Paint Shade & type	
15	Net weight of motor	
16	Outline mounting drawing No (To be enclosed as annexure)	
D.	Characteristic curves/ drawings (To be enclosed for motors of rating $\geq 55KW$)	
	a) Torque speed characteristic	
	b) Thermal withstand characteristic	
	c) Current vs time	
	d) Speed vs time	

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			



TITLE :

CABLES
DATASHEET C

SPECIFICATION NO. PES-507-02

VOLUME NO. : **II-B**SECTION : **D**REV NO. : **01** DATE :

SHEET : 1 OF 7

**GUARANTEED TECHNICAL PARTICULARS
(TO BE SUBMITTED BY SUCCESSFUL BIDDER)****1.0 GENERAL**

1.1 Name of manufacturer :

1.2 Place of manufacture :

2.0 STANDARD APPLICABLE

2.1 IS-1554 (Part-I) : YES/NO

For general specification
PVC of cables

2.2 IS:8130 : YES/NO

For conductor material

2.3 IS-5831 : YES/NO

For material of insula-
tion, innersheath &
outersheath.

2.4 IS:3975/IS:8139 :

For armour multi core/
single core cables : YES/NO/NA

2.5 IS:10810

For method of tests : YES/NO

2.6 IS:10418 : YES/NO

For cable drums

2.7 ASTM-D-2863 : YES/NO

For oxygen index test

2.8 SS:424-14-75, IEC-332-1,
IEEE 383/74 : YES/NO

For flammability test

2.9 IEC-754-1 : YES/NO



TITLE :

CABLES
DATASHEET C

SPECIFICATION NO. PES-507-02

VOLUME NO. : **II-B**SECTION : **D**REV NO. : **01** DATE :

SHEET : 2 OF 7

For acid gas generation test

2.10 ASTM-D-2843 : YES/NO

For smoke generation test

2.11 IS:5831 : YES/NO

For heat shock test, loss of mass test and thermal heat stability test

2.12 Current rating of cables conforms to

2.13 Short circuit rating conforms to :

3.0 CABLE CONSTRUCTION

3.1 Conductor :

Conductor material to IS:8130 (Class/Grade)

- a) Power cables :
b) Control cables :

3.2 Insulation

- a) Material :
- b) Dielectric constant at normal frequency : KV/mm
- c) Insulation resistance constant (mini)
- i) at 27 deg. C : Mega-ohm km
ii) at 70/85 deg.C : Mega-ohm km
- d) Minimum volume resistivity :
- i) at 27 deg. C : Mega-ohm km
ii) at 70/85 deg.C : Mega-ohm km
- e) Minimum tensile strength : n/mm²



TITLE :

CABLES
DATASHEET C

SPECIFICATION NO. PES-507-02

VOLUME NO. : **II-B**SECTION : **D**REV NO. : **01** DATE :

SHEET : 3 OF 7

f) Minimum % Elongation
at rupture :

g) Tolerance on
thickness :

3.3 Inner Sheath

a) Material, type &
standard :

b) Whether FRLS : YES/NO/NA

c) Method of application

i) with fillers

ii) without fillers : Pressure extruded

d) Type & shape of
fillers (if used)

e) Colour

3.4 Armour

a) Galvanised steel : YES/NO
wire/strip control
to IS:3975 for multi-
core cables.

b) Hard drawn aluminium : YES/NO
wire/strip H4 grade
conforming to IS:8130

c) Method of joining

3.5 Outer Sheath

a) Material, type &
standard :

b) Whether FRLS : YES/NO

c) Method of application:

d) Minimum Tensile
strength : N/mm²



TITLE :

CABLES
DATASHEET C

SPECIFICATION NO. PES-507-02

VOLUME NO. : **II-B**SECTION : **D**REV NO. : **01** DATE :

SHEET : 4 OF 7

- e) Minimum % elongation at rupture :
- f) Colour
- g) Tolerance on thickness :
- h) Whether progressive sequential length marking provided :

4.0 PERMISSIBLE VOLTAGE AND FREQUENCY VARIATION

- a) Voltage : (\pm) %
- b) Frequency : (\pm) %
- c) Voltage-frequency combined : $|ABS|$ %

5.0 Permissible Conductor Temp. for

- a) Maximum Continuous Rating : °C
- b) Short Circuit : °C

6.0 Installation Conditions for specified current rating

- a) ambient air temperature deg. C : °C
- b) ground temperature : °C
- c) depth of laying of cables buried in ground : cm
- d) thermal resistivity of soil : °C cm/W
- e) thermal resistivity of insulation : °C cm/w

7.0 Formula for calculating :



TITLE :

CABLES
DATASHEET C

SPECIFICATION NO. PES-507-02

VOLUME NO. : **II-B**SECTION : **D**REV NO. : **01** DATE :

SHEET : 5 OF 7

short circuit current for
different durations

OR

Whether short time current
v/s: time curve for diff-
erent cables enclosed.

8.0 CHARACTERISTICS OF FRLS SHEATH

- a) Oxygen index :
- b) Temperature index :
- c) Acid gas generation :
- d) Smoke density rating :

9.0 CABLE DRUMS

- a) Type & construction :
- b) Standard drum length :
- c) Tolerance on drum
length :

10.0 DOCUMENTATION

Whether following enclosed

- a) X-sectional drawing : YES/NO
with construction
details
- b) BHEL's Quality Plan: YES/NO
with seal of accept-
ance
- c) Field Quality Plan : YES/NO
- d) Derating factors as : YES/NO
stipulated in
Section-D
- e) Packing drawing : YES/NO
- f) Bar chart : YES/NO



TITLE :

CABLES
DATASHEET C

SPECIFICATION NO. PES-507-02

VOLUME NO. : **II-B**SECTION : **D**REV NO. : **01** DATE :

SHEET : 6 OF 7

g) Billing Schedule : YES/NO

(TO BE FILLED IN FOR EACH SIZE OF CABLE IN THE FORM OF TABLE)

11.0 No. of cores x size :

12.0 Voltage grade (U_o/U) : kV13.0 Base current ratings (*)
based on cl.5.0,cl.6.0

a) In air : Amp

b) In ground : Amp

c) In ducts : Amp

14.0 Short circuit rating : kA, sec.

15.0 a) D.C. resistance of
cond. at 20oC : ohm/kmb) A.C. resistance of
cond. at 70o/85oC : ohm/km(*) For single core cables the continuous current rating shall be furnished separately for
armour earthed at one end and both ends.c) Reactance of cable
at normal frequency : ohm/kmd) Electrostatic
capacitance of
cable at normal
frequency : mF/km

e) Charging current : Amp/km

f) Loss tangent at
normal frequency &
voltage :

16.0 CONDUCTOR

a) Material, type &
grade :b) No & dia of wires
in each core before
stranding : no x mm



TITLE :

CABLES
DATASHEET C

SPECIFICATION NO. PES-507-02

VOLUME NO. : **II-B**SECTION : **D**REV NO. : **01** DATE :

SHEET : 7 OF 7

c)	Shape	:	mm
17.0	Nominal thickness of insulation	:	mm
18.0	Inner sheath thickness (min.)	:	mm
19.0	Sizes of armour	:	no. x mm
20.0	Nominal thickness of outersheath	:	mm
21.0	DIAMETERS		
a)	Diameter of insulated conductor	:	mm
b)	Cable diameter under armour	:	mm
c)	Cable diameter over armour	:	mm
d)	Overall diameter of cable	:	mm
22.0	Tolerance on overall diameter	:	(±)
23.0	Minimum bending radius	:	x O.D.
24.0	Safe pulling force	:	kg.
25.0	Weight of cable	:	kg./km
26.0	Dimension of drum	:	mm
27.0	Shipping weight	:	kg.

VOLUME-III PRICE SCHEDULE, REV-1	
Design, engineering, manufacturing, supply, Testing, commissioning etc of TG hall EOT Crane for 2x250 MW BARAUNI Extension Project unit # 8 & 9 at BEGUSARAI, BIHAR.	
TENDER NO - PSER:SCT:PSER:BRM-M1266:11	
PREAMBLE	
01	This preamble forms part of tender document and schedule of items. The tenderer should read this preamble carefully in rates for various items. Clauses under this preamble shall be read in conjunction with Volume-IA, Volume-IB, Volume-IC, Volume-ID, Volume-II together with subsequent changes/ modifications etc thereto as applicable as on date of submission of price offer.
02	The work shall be carried out strictly as per specifications, description of the items in these schedule and/ or engineer's instructions.
03	Items of work provided in this schedule but not covered in this specification shall be executed strictly as per instruction of the engineer.
04	Unless specifically mentioned otherwise in the tender document, the tenderer shall quote for the finished items and shall provide for the complete cost towards power, fuel, tools, tackles, equipment, constructional plants, temporary works, labour, dismantling of all temporary piping, structures, valves, pumps, tanks & other misc equipment, strengthening of roads/ culverts/ bridges etc including arranging all clearances etc required for carrying out different activities & tests, materials, levies, taxes, transport, layout, repairs, rectification, maintenance till handing over, supervisions, colonies, shops, establishments, overheads, profits and all incidental items not specifically mentioned but reasonably implied and necessary to complete the work according to the tender document and this schedule.
05	The rates quoted shall be inclusive of cleaning of site of any vegetation, dressing and leveling etc including fixing of grid pillars, benchmarks etc required for commencement of site activities. No separate payment will be made towards the same.
06	Rates shall be quoted in figures and in words in clear legible writing. No overwriting is allowed. All scoring and cancellations should be countersigned and in case of illegibility the interpretation of engineer shall be final. All entries shall be in English.
07	The tender shall be deemed to have visited site and made himself aware of all the site conditions, studied the specifications and details of work to be done within the time schedule attached and to have acquainted himself of the conditions prevailing at site.
08	Engineer's decision shall be final and binding on the contractor regarding clarification of items in the schedule with respect to the other sections/volumes of the contract.
09	Unless otherwise specified and in case of item rate based price schedule and not on lumpsum basis, the quantities of the various items mentioned in this schedule of items are approximate, based on very preliminary information and may vary to any extent or to be deleted altogether. The quoted/ accepted rates shall remain firm and valid as long as variation in total value of work executed under this contract including extra items, but excluding any price escalation, remains within +/- 30% (thirty percent) of the contract price given in the LOI/WO.

**VOLUME-IIIA
PRICE SCHEDULE, REV-1**

**Design, engineering, manufacturing, supply, Testing, commissioning etc of TG hall EOT Crane for 2x250 MW BARAUNI Extension Project unit # 8 & 9 at
BEGUSARAI, BIHAR.**

TENDER NO - PSER:SCT:PSER:BRM-M1266:11

SCH-1 - MAIN PRICE

SL NO	DESCRIPTION OF EQUIPMENT/ ITEM	TOTAL QUOTED PRICE ([₹])
1.0	Total price for design, engineering, manufacturing, inspection and testing, painting, supply/delivery duly packed at project site including unloading, storage and handling at site, erection and commissioning, trial run at site, and handing over to the customer in line with drawings/ documents/ test procedures approved by BHEL/Customer and operation & maintenance (O&M) etc. for Two nos. of 125/25 T capacity, Double grider EOT crane with 25.50 M lift of main hook, 30.40M lift of auxiliary hook, 28.4M span, 195.5 M bay length along with PVC Shrouded conductor type DSL and gantry rail complete with all accessories including Erection and commissioning spares and Maintenance Tools and Tackles for the total scope defined as per technical specification PE-TS-374-501-A001 Rev. 01, Crane Clearance Diagram Drg. No. PE-DG-374-501-A001 Rev. 01 and standard technical specification no. PE-TS-STD-501-A001 (Rev 03) taking into account all clarifications, confirmations and agreements till date.	
Note		
1.0	Bidder to note that total price indicated above at 1.0 shall be considered for evaluation and hence should be complete in all respect for the full scope defined and considering all terms and conditions agreed.	
2.0	While total price at sl no 1.0 as per above will be considered for evaluation, bidder shall furnish further break-up of price in the following schedules.	
2.1	SCH-2 - Main price break-up.	
2.2	SCH-3 - Supply price break-up.	
2.3	SCH-4 - Service price break-up.	
2.4	SCH-5 - Maintenance tools & tackles price break-up.	
2.5	SCH-6 - Commissioning spare price break-up.	
3.0	Any item as per scope of work if not included in the price quoted above and shown separately will not be taken cognizance of and the offer shall be liable for rejection.	
4.0	Total price of 1.1 & 1.2 should match with 1.0.	
5.0	Total price of supply price break up should match with 1.1.	
6.0	Total price of service price break up should match with 1.2.	
7.0	Any variation in length of DSL and gantry rail due to change in bay length will be adjusted based on unit rates arrived from 1.1.2 & 1.1.3 (for supply) and from 1.2.2 & 1.2.3 (for E&C) respectively.	
8.0	If freight component is not specifically indicated, 2 % of total amount will be considered as freight component against each item for further processing.	
9.0	Any item not included in the price quoted above and shown separately will not be taken cognizance of and the offer shall be liable for rejection.	

VOLUME-III**PRICE SCHEDULE, REV-1****Design, engineering, manufacturing, supply, Testing, commissioning etc of TG hall EOT Crane for 2x250 MW BARAUNI Extension
Project unit # 8 & 9 at BEGUSARAI, BIHAR.****TENDER NO - PSER:SCT:PSER:BRM-M1266:11****SCH-2 - MAIN PRICE BREAK-UP**

SL NO	DESCRIPTION OF EQUIPMENT/ ITEM	QUOTED PRICE (₹)			
		BASIC PRICE	CST (If any, as per tender)	FREIGHT	TOTAL
(1)	(2)	(3)	(4)	(5)	(6)=(3) ~ (5)
1.1	Total price for supply part for design, engineering, manufacturing, inspection and testing, painting, supply/delivery duly packed at project site for Two nos. of 125/25 T capacity, Double grider EOT crane with 25.50 M lift of main hook, 30.40M lift of auxiliary hook, 28.4M span, 195.5 M bay length along with PVC Shrouded conductor type DSL and gantry rail complete with all accessories including Erection and commissioning spares and Maintenance Tools and Tackles for the total scope defined as per technical specification PE-TS-374-501-A001 Rev. 01, Crane Clearance Diagram Drg. No. PE-DG-374-501-A001 Rev. 01 and standard technical specification no. PE-TS-STD-501-A001 (Rev 03) taking into account all clarifications, confirmations and agreements till date.				
1.2	Total price for service part for unloading, storage and handling at site, erection and commissioning, trial run at site, and handing over to the customer in line with drawings/ documents/ test procedures approved by BHEL/Customer and operation & maintenance (O&M) etc. for Two nos. of 125/25 T capacity, Double grider EOT crane with 25.50 M lift of main hook, 30.40M lift of auxiliary hook, 28.4M span, 195.5 M bay length along with PVC Shrouded conductor type DSL and gantry rail complete with all accessories including Erection and commissioning spares and Maintenance Tools and Tackles for the total scope defined as per technical specification PE-TS-374-501-A001 Rev. 01, Crane Clearance Diagram Drg. No. PE-DG-374-501-A001 Rev. 01 and standard technical specification no. PE-TS-STD-501-A001 (Rev 03) taking into account all clarifications, confirmations and agreements till date.				
TOTAL PRICE					

VOLUME-III A
PRICE SCHEDULE, REV-1

Design, engineering, manufacturing, supply, Testing, commissioning etc of TG hall EOT Crane for 2x250 MW BARAUNI Extension
Project unit # 8 & 9 at BEGUSARAI, BIHAR.

TENDER NO - PSER:SCT:PSER:BRM-M1266:11

SCH-3 - SUPPLY PRICE BREAK-UP

SL NO	DESCRIPTION OF EQUIPMENT/ ITEM	QUOTED PRICE (₹)			
		BASIC PRICE	CST (If any, as per tender)	FREIGHT	TOTAL PRICE
		(1)	(2)	(3)	(4)=(1) ~ (3)
Price break-up of 1.1 of SCH-2.					
1.1.1	Total price for Two nos. of 125/25 T capacity, Double grider EOT crane with 25.50 M lift of main hook, 30.40M lift of auxiliary hook, 28.4M span, with all accessories.				
1.1.2	Total price for 195.5 M bay length PVC shrouded conductor type DSL complete with all accessories.				
1.1.3	Total price for 195.5 M bay length Gantry rail complete with all accessories.				
1.1.4	Lump sum price of temporary cable for operation of crane during erection stage of the plant (equal to half the baylength plus 25 M) .				
1.1.5	Total price for maintenace tools & tackles.(Bidder to submit item-wise break-up in specific schedule)				
1.1.6	Total price for erection and commissioning spares. (Bidder to submit item-wise break-up in specific schedule)				
TOTAL PRICE					

VOLUME-III A
PRICE SCHEDULE, REV-1

Design, engineering, manufacturing, supply, Testing, commissioning etc of TG hall EOT Crane for 2x250 MW BARAUNI Extension Project unit # 8 & 9 at BEGUSARAI, BIHAR.

TENDER NO - PSER:SCT:PSER:BRM-M1266:11

SCH-4 - SERVICES PRICE BREAK-UP

SL NO	DESCRIPTION OF EQUIPMENT/ ITEM	QUANTITY		QUOTED PRICE (₹)	
				UNIT RATE	TOTAL PRICE
Price break-up of 1.2 of SCH-2					
1.2.1	PART-1 (Main scope)	(3)		(4)	(5)=(4)x(3)
1.2.1.1	Total price for service part for Two nos. of 125/25 T capacity, Double grider EOT crane with 25.50 M lift of main hook, 30.40M lift of auxiliary hook, 28.4M span, with all accessories.				
1.2.1.2	Total price for service part for 195.5 M bay length PVC shrouded conductor type DSL complete with all accessories.				
1.2.1.3	Total price for service part for 195.5 M bay length Gantry rail complete with all accessories.				
1.2.1.4	Total price of temporary cable for operation of crane during erection stage of the plant (equal to half the baylength plus 25 M), complete with all accessories.				
1.2.1.5	Total lump sum price of any other item included in 1.0.0 above				
1.2.2	PART-2 (Operation & maintenance (O&M))				
1.2.2.1	Providing O&M service including manpower, supervision, consumables etc for operation & maintenance of cranes after commissioning.	12 MONTHS			
1.2.2.2	Sub-total (1.2.2)				
TOTAL PRICE(1.2.1+1.2.2)					

