

**NEYVELI LIGNITE CORPORATION LIMITED
(NLC LTD)**


**NEYVELI NEW THERMAL POWER PROJECT
2x500 MW LIGNITE FIRED UNITS AT NEYVELI**

**PROJECT SPECIFIC
TECHNICAL SPECIFICATION FOR
105/25T TG HALL EOT CRANES
(DOUBLE GIRDER)**

SPECIFICATION NO.: PE-TS-402-501-A001



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

	TECHNICAL SPECIFICATION FOR 105/25T TG HALL EOT CRANE 2X500 MW NNTPS (TG)	Specification no.: PE-TS-402-501-A001
		Rev. 00
		Date: JULY 14
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Note:

1.0 Bidder to note that BHEL reserves the right for drawing/document submission through web based Document Management System. Bidder would be provided access to the DMS for drawing/document approval and adequate training for the same. Detailed methodology would be finalized during the kick-off meeting. Bidder to ensure following at their end.

- Internet explorer version – Minimum Internet Explorer 7.
- Internet speed – 2 mbps (Minimum preferred).
- Pop ups from our external DMS IP (124.124.36.198) should not be blocked.
- Vendor's Internal proxy setting should not block DMS application's link (<http://124.124.36.198/wrenchwebaccess/login.aspx>).



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SCOPE OF ENQUIRY/INTENT OF SPECIFICATION

- 1.1 This specification includes, but not limited to 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 **Two (2) no. 105/25T capacity double girder EOT Crane** and necessary accessories including supply of mandatory spares.
- 1.2 The contractor shall be responsible for providing all material, equipment & services, which are required to fulfil the intent of ensuring operability, maintainability, reliability and complete safety of the complete work covered under this specification, irrespective of whether it has been specifically listed herein or not. Omission of specific reference to any component / accessory necessary for proper performance of the equipment shall not relieve the responsibility of providing such facilities to complete the supply, erection and commissioning of the cranes and its accessories.
- 1.3 It is not the intent to specify herein all the details of design and manufacture. However, the equipment shall conform in all respects to high standards of design, engineering and workmanship and shall be capable of performing the required duties in a manner acceptable to purchaser who will interpret the meaning of drawings and specifications and shall be entitled to reject any work or material which in his judgement is not in full accordance herewith.
- 1.4 The extent of supply under the contract includes all items shown in the drawings, notwithstanding the fact that such items may have been omitted from the specification or schedules. Similarly, the extent of supply also includes all items mentioned in the specification and /or schedules, notwithstanding the fact that such items may have been omitted in the drawing.
- 1.5 The general term and conditions, instructions to tenderer and other attachment referred to elsewhere are made part of the tender specification. The equipment materials and works covered by this specification is subject to compliance to all attachments referred to in the specification. The bidder shall be responsible for and governed by all requirements stipulated herein.
- 1.6 While all efforts have been made to make the specification requirement complete & unambiguous, it shall be bidders' responsibility to ask for missing information, ensure completeness of specification, to bring out any contradictory / conflicting requirement in different sections of the specification and within a section itself to the notice of BHEL and to seek any clarification on specification requirement in the format enclosed under Vol-III of the specification. In absence of any such clarifications, in case of any contradictory requirement, the more stringent requirement as per interpretation of Purchaser/Customer shall prevail and shall be complied by the bidder without any commercial implication on account of the same. Further in case of any missing information in the specification not brought out by the prospective bidders as part of pre-bid clarification, the same shall be furnished by Purchaser/ Customer as and when brought to their notice either by the bidder or by purchaser/ customer themselves. However, such requirements shall be binding on the successful bidder without any commercial & delivery implication.
- 1.7 The bidder's offer shall not carry any sections like clarification, interpretations and /or assumptions.
- 1.8 Deviations, if any, should be very clearly brought out clause by clause in the enclosed schedule; otherwise, it will be presumed that the vendor's offer is strictly in line with NIT specification.
- 1.9 In case all above requirements are not complied with, the offer may be considered as incomplete and would become liable for rejection.
- 1.10 Unless specified otherwise, all through the specification, the word contractor shall have same meaning as successful bidder /vendor and Customer/ Purchaser/Employer will mean BHEL and /or customer including their consultant as interpreted by BHEL in the relevant context.



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1.11 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 quality plan as minimum requirement during manufacturing and testing.

1.12 Other requirements

Successful bidder shall furnish detailed erection manual for each of the equipment supplied under this contract at least 3 months before the scheduled erection of the concerned equipment / component or along with supply of concerned equipment / component whichever is earlier.

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

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



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2 GENERAL PROJECT INFORMATION

2.1 Introduction

The project site at Neyveli has distinct location advantages, being at pit-head distance from the source of lignite supply from Mines, making it convenient for transportation of lignite by belt conveyor. Water source is readily available from the nearby mines lake. Besides, other infrastructure such as access road, railway connection etc, already exist.

2.2 Power Plant Site

The power plant site is located at Neyveli, opposite to the now defunct Fertilizer and Briquetting & Carbonization Plant, near TPS-1 Expansion and TPS-II.

2.3 Project & Site Information

- | | | |
|---------|---------------------------------|--|
| (i). | Owner/Purchaser | : Neyveli Lignite Corporation Limited (NLC Ltd), Neyveli, Cuddalore District, Tamil Nadu State, India |
| (ii). | Consultant | : Lahmeyer International (India) Pvt. Ltd (LII), Gurgaon, NCR, India. |
| (iii). | Project Title | : 2x500 MW Neyveli New Thermal Power Station (NNTPS) |
| (iv). | Location | : 200 kms south of Chennai and 50 kms south-west of Cuddalore |
| (v). | Latitude | : 11° 34' 00" N to 11° 35' 00" N |
| (vi). | Longitude | : 79° 26' 00" E to 79° 27' 00" E |
| (vii). | Elevation above MSL | : +67 m |
| (viii). | Nearest Railway Station | : Neyveli, |
| (ix). | Nearest Sea Port | : Chennai, at a distance of 200 km |
| (x). | Nearest Airport | : Chennai, at a distance of 200 km |
| (xi). | Road Access/Approach to Site | : Connected by Chennai-Thanjavur NH 45C road and state highway connecting Cuddalore – Virudhachalam via Neyveli. Both NH and state high way roads are well connected to NLC township roads. The approach road is approximately 15 kms from Chennai–Thanjavur NH – 45C road |
| (xii). | Site Meteorological Data | |
| | • Max ambient temperature | : 42.8° C |

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- Min Ambient Temperature : 26.9° C
 - Wet bulb temp : 29° C
 - Max. Relative Humidity : 92 % in the month of September
 - Min. Relative Humidity : 23 % in the month of May
 - Rainfall : About 1265.7 mm annually (average)
 - Wind direction : South West to North East direction
 - Wind Speed : 97.2 km/hr (maximum recorded)
4.3 km/hr (average wind speed)
 - Seismicity : As per IS: 1893 (part 4) (Zone-II)
Importance factor: 1.75.
- (xiii). Languages spoken in the region : English, Tamil

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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 CRANES 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 cranes** complete and efficient operation shall also be under the bidder's scope of work.

1.1.2 Compliance with this specification shall not relieve the bidder of the responsibility of furnishing material and workmanship to meet the specified working/duty 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 including cables and panels.
- f. PVC insulated shrouded bus bar DSL
- g. Earthing arrangement.
- h. Initial fill of lubricant .
- i. Painting of cranes and accessories.
- j. Temporary cables for operation od crane during erection stage of the plant (Half the baylength + 25m)
- k. Rail
- l. Maintenance tools & Tackle
- m. Erection & Commissioning spares
- n. Mandatory spares
- o. Operator's cabin
- p. Isolating switch in enclosure at operating floor for disconnecting supply to DSL while maintaining the crane.

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.



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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.

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

1.1.5 Mandatory Spares

A complete unused and new set of Mandatory Spare parts shall be supplied. 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.

1.1.6 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 parts during the execution of the project at site, to avoid delay in the project schedule. This shall form part of the main equipment supply. The Purchaser shall retain the unutilized commissioning spares. The initial fill of lubricants, oil etc. shall also be supplied by the bidder.



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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

1.2.0 Services to be provided by the bidder

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

1.2.2. Arranging test load at site

Collecting the test load at site within a radius of 1 KM from owner's storage to final testing bed of 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, cradles 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 & cradles will be allowed to be taken back by the vendor, after completion of the test at site.

1.2.3 Erection and Commissioning

1.2.4 Functional/Demonstration test

1.2.5 Operation & maintenance

1.2.6 Obtaining clearance and acceptance certificate from the concerned competent authority after site test. Necessary fees/expenditure as required shall be borne by the supplier.

1.3.0. Inspection and Testing**1.3.1. Inspection and testing at Manufacturer's works**

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

Shop inspection and tests will include but not limited to the following –

A. STAGE INSPECTION.

- 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



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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 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.'



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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 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 be furnished for verification of 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



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and other mechanical, electrical, electromechanical as per BHEL technical specification and / or as per applicable code.

B. FINAL INSPECTION- Testing At Works.

Cranes shall be completely assembled at manufacturer's 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) Deflection test of bridge girder at rated load. Crane shall rest on centerline of LT wheels.
- b) Load test and 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) All Other tests as per IS-3177.

Based on the Quality Plan and witness stages of BHEL & customer, supplier shall submit an inspection plan.

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 (B) above.
- b) Speed test at rated load for hoisting / CT and LT mechanism.
- c) Brake test.
- d) Any other test as per IS-3177
- e) The test shall be carried out with actual panel etc.

1.4.0. PAINTING & COLOUR SCHEME

Bidder to refer ANNEXURE-IV ,SECTION –C VOLUME II B

2.0.0. Works Excluded

- 2.1.0 The purchaser shall provide one (1)/ two (2) no. 415V, 3 phase, and 50Hz. 4 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.



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Any other supply required by the bidder shall be arranged by the bidder 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 offer submitted has got any deviation from the technical stipulations in the tender document, bidder shall tabulate the same in the format of “ Schedule of Deviations” attached in the section D, volume II-B, furnishing full particular of such deviations. Deviations are to be furnished with mention to specific clause number (reasons / explanations for such deviations shall be furnished). Notes / comments etc. is not acceptable. If there are no deviations from the tender document, bidder shall furnish **NO DEVIATION** certificate.

5.0.0. Functional/Demonstration tests

EOT crane along with its drives, controls and other accessories shall be checked 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 desired performance, the deficiency shall be made good at bidder’s cost.

Functional/Demonstration shall be carried out each time after the rectification /modification is carried out.

Demonstration test of the crane shall include load tests and speeds in various motions at bidder’s works as well as site.

6.0.0. Makes of Sub - Vendor items

Makes of bought out items as per Annexure-I, section C, volume II-B of the specification is for reference only. Sub vendor list shall be subject to customer approval and same shall not have any impact on manufacturing, delivery schedule and cost of the crane.

7.0.0. Drawing & Documents to be attached with Tender:-



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Refer Annexure-VI

8.0.0 Parameter and tolerances for structural assembly is as per the relevant standards.

9.0.0 Special technical requirement of electrical

DSL is to be sized considering maximum length from changeover switch and with a margin of 10% over load requirement. The DSL shall be designed to limit voltage drop at motor terminals within 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. Further DSL shall be sized to cater load requirement of both the cranes. Also, isolating switch / changeover switch shall be sized to take care of load of both the cranes. Suitable guards of MS sheet to live electrical wiring down shop leads shall be provided.

2 X 500 MW NNTPS (TG), 2 no.s 105/25T TG HALL EOT CRANE
OPERATION AND MAINTENANCE SERVICES SHALL
INCLUDE BUT NOT LIMITED TO FOLLOWING

- 1.0 For Operation of the Crane
 An experienced crane operator shall be available as and when required by BHEL for at least 16hrs a day, daily.

- 2.0 For Maintenance of the Crane
 - a) Break-Down Maintenance
 - i) In case of any break-down of the crane during the contract period, service engineer shall be made available at site within 72 hrs.
 - ii) All the critical spares and consumables, as deemed necessary by the manufacturer shall be made available at the site. No delay in crane maintenance shall be allowed by BHEL due to non-availability of required spare at site.

 - b) Preventive Maintenance
 - i) Following work should be carried out quarterly

Bridge and Trolley wheel assy	Checking for wear, flat spots and cracks in flange. Ensure drive wheels are of the same diameter.
Runway	Checking alignment and elevation of gantry track. Checking rail clamp bolts.
Machine Bolts	Checking all foundation bolts of Electrical and Mechanical equipments for tightness.
Structural Bolts	Checking for tightness. They should also be checked after the first month of operation.
Flexible Couplings	Checking pins and teeth for wear, cleaning and greasing.
Cross-shaft Plummer Blocks	Dismantling cap. Cleaning and checking oil seals and to be packed with fresh grease.
Trolley Collectors	Checking of cable trolleys / cabling / chain. Ensuring connection of trolley wheels is kept through entire length of span.
Brakes	All Brake assembly will be checked for loose connection, earthing connection, linings for wear, leakages and adjustments to ensure brake is not rubbing the brake drum during operation. Greasing pins and operation adjustment of brakes.
Resistor Connections	Checking, tightening connections at grid joints and at cable terminations.
Control Station	Clean out control cabinets. Checking of all connection at push buttons, master controllers contact tips, cams and terminals.

Control Panels	All Control Panels will be checked for loose connection and cleaning the contactor contacts, if required will be replaced.
Electrical Motors	All motion motors connection will be checked for loose contacts in terminal box loose crimping of wire lugs, loose contacts on slip ring assembly with carbon brush. Earthings connection with motor.
Safety Switches	All limit switches will be checked for desired operation and limits. Emergency switches will be checked.
Main Collectors	Checking of worn collector shoes, sag in main runway wiring, ensuring contact is kept through entire length runway properly.
Electrical connections	Checking throughout electrical equipments for loose connection such as selector switches, junction boxes, min isolator switch etc.
Lubrication	All gear box and thrusters' oil level will be checked. All bearings, couplings' grease will be checked.
Testing	After completion of checking and required rectification, trolley will be checked for idle operation, for brake operation, limit switch operation & safety switch operation. All motor currents will be checked on no load.

ii) Following work should be carried out annually

Gear Boxes	Oil seals will be checked, if required will be replaced. Gear and pinion teeth will be checked. Drain the oil cleaning gear box and refill fresh oil.
Motor	All motors' insulation test and meager test will be carried out.
Resistance Box	All resistance boxes' step resistance value will be checked.

iii) Besides the quarterly and annual preventive maintenance schedule mentioned above, operator shall carry out any daily, weekly, monthly maintenance schedule as deemed necessary and shall operate the crane only when the fitness of the crane for operation has been ensured.



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1.0.0	Scope: Acceptance Norms for Crane Gear Boxes
1.1.0	<p>This procedure lays down the Acceptance norms for the Gear boxes for EOT crane. This standard also covers vertical gear boxes.</p> <p>Reduction Gears shall be tested for reduction ratio, backlash & contact pattern. Gear Box shall also be subjected to No load run test to check for oil leakage, temp. rise, noise and vibration.</p>
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	<p>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</p>
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	The gear boxes shall be run under no-load condition at the rated speed for minimum



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	<p>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 tightii. All gear mesh lines are getting enough lubricationiii. All bearings are getting enough lubricationiv. 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>

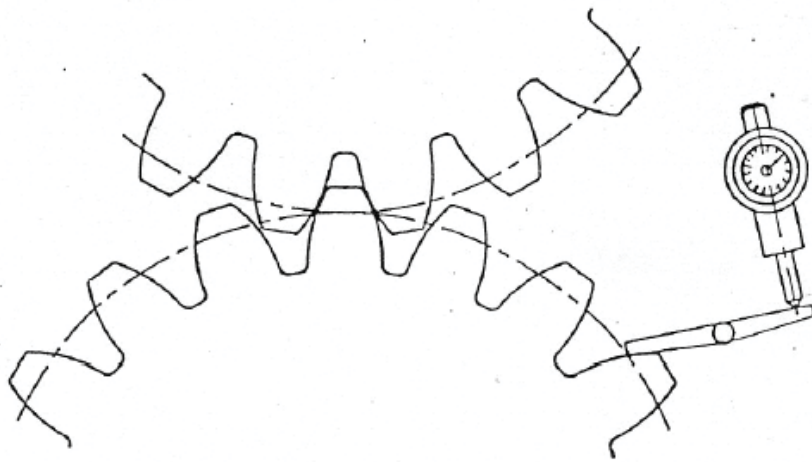


FIG.1 MEASUREMENT OF BACKLASH

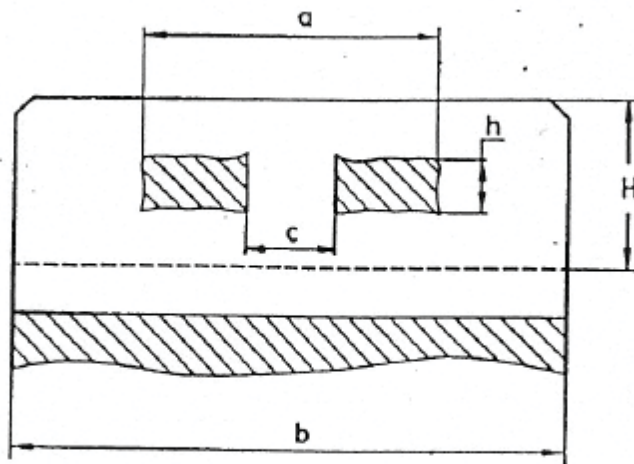


FIG.2 AREA OF CONTACT OF GEAR TEETH

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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/ESSAR/ISPAT
2.0	HOOKS	KARACHIWALA / HARMAN MOHTA Steel Forging & Engg. Co., Kolkata/ SIMRITI FORGING
3.0	GEAR COUPLINGS	ALLIANCE / HICLIFF / OEM/SAHARA/NUTECH
4.0	WIRE ROPE	USHA MARTIN / BOMBAY WIRE ROPES / /FORT WILLIAMS / UNITED WIRE ROPE / Bharat Wire Ropes.
5.0	BEARINGS	SKF/ FAG/ TATA/ NORMA / NBC/ZKL
6.0	MOTORS	SIEMENS / NGEF/ CROMPTON / KIRLOSKAR / BHARAT BIJLI / ALSTOM / ABB (NGEF UPTO 15kW only)
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 / 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/JAINSON
17.0	HOOTERS	BEACON / OSC/TARGET / KHERAJ
18.0	LIGHTING SWITCHES	ISI MARKED
19.0	CABLES	
a)	Power Cables	Nicco / Universal / Incab / Torrent / CCI / ICL / Radiant/POLYCAB
	Control cables	Nicco / Universal / Incab / Delton / Finolex / Torrent /



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b)		CCI / ICL / Radiant
c)	Trailing Cables	Nicco / Universal
20.0	Cable gland	COMMET / SUNIL&CO. / ARUP ENGINEERING
21.0	PUSH BUTTONS	SIEMENS / L&T / BCH
22.0	Limit Switches	Speed-o-control / Electromag
23.0	Master Controler	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/Telemechanique
27 .0	MCB	MDS / Indo Copp / Standard/Siemens/L & T
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 FOUNDRY / KIRTI ALLOYS
33.0	VVVF	YASKAWA (L&T) / ABB / SIEMENS/SCHNIEDER
34.0	Shrouded DSL	Susheel/ Stromag

Note:

- 1. All the trailing cables shall be sourced from only one sub-vendor from the list**
- 2. Make is indicative, subject to customer's / consultant approval during detail engineering. Acceptance/non acceptance of same shall not have any impact on manufacturing, delivery schedule and on cost of the crane/s.**

Annexure II

MANDATORY SPARES PARTS TO BE SUPPLIED ALONG WITH E.O.T.CRANE (Quantity indicated is for each type / size /rating)

5	SPARES – EOT Crane & Other Hoisting & Handling facilities		
5.1	EOT CRANE		
1.	All bearings used in all Gear Boxes of the crane	Set	1
2.	Main Hook Bearings	Set	1
3.	Aux. Hook Bearings	Set	1
4.	Bearings of LT Wheels	Sets	1
5.	Bearings for CT Wheels	Sets	1
6.	Brake lining with rivets for each size of brake used in the crane	Pair of each size	1
7.	Brake shoes with lining for each size of brake used in the crane	Pair of each size	1

1 “One (1) Set” and “One (1) set of each type & size” is defined as 100% requirement for one electric hoist for the entire electric hoist of similar size & capacity.

2 100% of total population of each type, size and rating is defined as 100% requirement for one electric hoist



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ANNEXURE-III

Procedure for Load/Overload testing of TG 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 and overload tests for hoisting.
- Actual ropes shall be used for load and overload testing.
- Shop cables can be used for temporary connection for the purpose of showing various functional tests at shop.
- Interlock and limit switch operation check will be shown with load for hoisting and CT motion.

Procedure for Load / Overload testing:

The cranes shall be tested for no load ,load test & overload test at works generally in conformance with the IS – 3177 (latest edition). Specifically with respect to the load and 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.

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.

For checking the cross travel, raise the load up to one (1) meter height above supports and then move the trolley with load about one (1) meter in either direction of the bridge. Then lower the load to rest on support/ground.

Creep speed motions shall be checked over a distance of about 500 mm.



VOLUME-IIA
SECTION XVII
PAINTING SCHEME



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17.1 General

17.1.1 This specification covers the materials, tools, facilities and quality requirement for surface preparation and painting of steel structures, mechanical & electrical equipments, technological structures, piping, ducts, chutes etc. for 2 X 500 MW Thermal Power Plant as elaborated in the further text.

This specification will be read in conjunction with other parts/ volumes of the Tender specification where other related project requirements have been indicated.

The term "Painting" referred herein covers rust preventive, preventive and decorative coating along with surface preparation of the following areas.

- a) All Mechanical equipment, Technological structures, chutes, piping, ducts etc. unless otherwise specifically indicated in the relevant section
- b) Various types of static and rotary equipment inclusive of electric motors etc. +
- c) Steel tanks and vessels
- d) Pipe work including trestles, supports, hangers, etc.
- e) Metallic duct work such as ventilation ducts, gas ducts including supports, hangers, etc.

This is a general guideline to the painting scheme to be followed. However, in case if a specific painting procedure is stipulated in any tendering specification, then this general guideline will be superseded. Any special case which may arise from time to time will be dealt with individually on the merits of each case.

17.1.2 Surfaces made of aluminium, brass, bronze, stainless steel, and other corrosion resistant alloys are not required to be painted unless specified except for identification bands or for aesthetic purposes.

17.1.3 All machined mating surfaces (e.g. flanges) will be properly cleaned, and will be provided with protective coating before despatch.

17.1.4 The complete painting scheme for any item includes the following basic activities:

- i) Proper surface preparation
- ii) Application of primer coats
- iii) Application of intermediate coats and
- iv) Application of finish coats

All the above coats will be of quality paint products and of approved make as stipulated in this specification. The scope of work will also include supply of all paint materials as per specification described herein and of approved quality/ specifications.

17.2 Painting For Mechanical & Electrical And Other Equipment, Mechanical Structures, Piping, Ducts Etc.



17.2.1 This section covers the painting requirements for the power plant equipment, structures, piping etc. and any other surface required to be painted.

17.2.2 Codes and Standards

Painting of equipment will be carried out as per the specifications indicated below and will conform to the relevant IS specification for the material and workmanship.

The following Indian Standards may be referred to for carrying out the painting job :

IS:5	:	Colours for ready mixed paints and enamels
IS:1303:		Glossary of terms relating to paints
IS:2379:		Colour code for identification of pipelines
IS:1477:		Code of practice for painting of ferrous metals in buildings (Parts I & II)
IS:2524:		Code of practice for painting of non-ferrous metals in buildings (Parts I & II)
IS:2395:		Code of practice for painting of concrete, masonry and plaster surfaces (Parts I & II)
IS:2338:		Code of practice for finishing of wood and wood based materials (Parts I & II)
IS:6278 :		Code of practice for white washing and colour washing
IS:3140:		Code of practice for painting asbestos cement building products
IS:158 :		Ready mixed paint, brushing, bituminous, black, lead free, acid, alkali, water and heat resisting
IS : 2074:		Ready mixed paint, air drying, red Oxide Zinc Chrome, priming
IS : 104:		Ready mixed paint, brushing, Zinc Chrome, priming
IS : 2932:		Enamel , synthetic, exterior (a) undercoating (b) finishing specification.

17.2.3 Preparation of Surfaces

- a) Surface preparation being a pre requisite for any paint application, will be such as to clean the surface thoroughly of any materials which will be conducive to premature failure of the paint substrates.
- b) All surfaces to be painted will be thoroughly cleaned of all grease, oil, loose mill scale, dust, rust and any other foreign matter. Mechanical cleaning by power tool and scrapping with steel wire brushes will be adopted to clear the surfaces. However, in certain locations where power tool cleaning cannot be carried out, sand scrapping may be permitted with steel wire brushes and/or abrasive paper. Cleaning with solvents will be resorted to only in such areas where other methods specified above have not achieved the desired results.



Cleaning with solvents will be adopted only after written approval of the Purchaser/ consultant.

- c) The workmanship will, in general, be in accordance with IS: 1477-1971. Surface of all the steel works to be painted will be thoroughly cleaned and degreased in accordance with IS:1477(Part-I) by means of mechanical and power tool cleaning or shot blasting. The cleaning quality will conform to second quality blast cleaning as per BS-4332 or to SA 2.5 of Swedish Standards Institution SIS 055900. Cleaning of surface will ensure primer coat is rigidly anchored to the virgin metal surface. Primer paint will be applied not later than 2-3 hours after preparation of surface, unless otherwise specified.

17.2.4 The acceptable surface preparation quality/grade are described under each painting scheme. The procedures covered are solvent cleaning, hand tool cleaning, power tool cleaning and blast cleaning

- a) **Solvent cleaning (SP 1) (If applicable)**

The surface will be cleaned by wiping, immersion, spraying or vapour contacting of a suitable solvent or washing with an emulsion or alkaline solution to remove oil, grease, dirt, old paint, etc. Solvent cleaning will not remove rust, scales, mill scales or weld flux. Therefore, before application of paint, solvent cleaning will be followed by other cleaning procedures as stated below.

- b) **Hand tool cleaning (SP 2)**

The surface will be cleaned by vigorous wire brushing done manually to St-2 quality. This method effectively removes loosely adherent materials, but would not affect residues of rust or mill scales that are intact and firmly adherent.

- c) **Power tool cleaning (SP 3)**

The surface will be cleaned by electric or pneumatic tools to St-3 quality. The tools will be used carefully to prevent excessive roughing of surface and formation of ridges and burns. This method will remove loosely adherent materials but would not affect residues of rust or mill scales that are firmly adherent.

- d) **Blast cleaning (SP 4)**

The surface will be cleaned by impingement of abrasive materials, such as graded sand at high velocity created by clean and dry compressed air blast. This method will remove loosely adherent materials as well as adherent scales and mill scales. Prior to application of blast, heavy deposit of oil and grease are removed by solvent cleaning and excessive surface scales are



removed by hand tools or power tool cleaning. The surface will be cleaned to Sa-2 1/2 quality which means that to 95% of surface area is free from all rust, mill scales and visible residues, foreign materials, etc. The blast cleaning is not recommended for sheet metal work.

17.2.5 Primer Paints (P)

After the surface is prepared in a manner acceptable to purchaser/ consultant, two (2) coats of Primer paints will be applied only on dry and clean surfaces. Second coat of red oxide primer will be applied only after first coat has dried up completely. Coating of primer will in general conform to IS:2074-92 and will be applied by brushing to ensure a continuous film without “holidays”.

a) Primer paint P1: (Epoxy based)

A two pack air drying epoxy polyamide resin based red oxide –zinc phosphate (primer):

Epoxy content (% wt)	15 to 18
Air drying time	About 30 minutes (touch dry) Over night (hard dry)
Dry film thickness (DFT/coat)	30 microns (min)
Temperature resistance	Upto 120 deg.C dry heat

b) Primer paint P2 (Epoxy based)

A two pack air drying epoxy polyamide with zinc dust of at least 92% zinc dust on the dry film.

Epoxy content (% wt)	8 to 10
Air drying time	About 10 minutes (touch dry) 2 hours (hard dry)
Dry film thickness (DFT/coat)	40 microns (min)
Temperature resistance	Upto 300 deg.C dry heat

c) Primer paint P3 (Ethyl zinc silicate, EZS, based)

A two pack heavy duty zinc dust rich silicate primer:



Total solids (% wt)	84 \pm 2
Air drying time	16 hours
Density	3.07 \pm 0.005
Dry film thickness (DFT/coat)	60 microns (min)
Temperature resistance	Upto 450 deg.C dry heat

17.2.6 Intermediate paints (N)

These paints will be applied over primer coats as an intermediate layer to provide weatherproof seal of primer coats.

a) Intermediate paint N1

A two pack air drying high build epoxy resin based paint with MIO.

Air drying time	6 to 8 hours (touch dry) 7 days (full cure)
Dry film thickness (DFT/coat)	80 microns
Temperature resistance	Upto 180 deg.C dry heat
Compatible with	Primer P1

17.2.7 Finish Paint (F)

Finish paint coats will be applied over primer coats and intermediate coats after proper cleaning and touch up of primed coats. Synthetic enamel paint comprising of IS:2932-95 will be used for finish coats.

a) Finish paint (F1)

A two pack air drying epoxy polyamide enamel suitably pigmented.

Air drying time	2 to 3 hours (touch dry) 7 days (full cure)
Dry film thickness (DFT/coat)	30 microns
Temperature resistance	Upto 130 deg.C dry heat



Compatible with	Primers P1 and P2 Intermediate N1
Colour	Generally all shades

b) Finish paint (F2)

A single pack synthetic rubber based enamel paint.

Air drying time	2 hours (touch dry) 24 hours (hand dry)
Dry film thickness (DFT/coat)	25 microns
Temperature resistance	Upto 200 deg.C dry heat
Compatible with	No primers
Colour	Generally all shades

c) Finish Paint F3

A single pack heat resistant silicon Aluminum paint.

Air drying time	3 to 4 hours (touch dry) 24 hours (hard dry)
Dry film thickness (DFT/coat)	25 microns (min)
Temperature resistance	upto 400 deg.C dry heat
Compatible with	Primer paint P3
Colour	smooth aluminium

Heat resistant Silicone Aluminium Paint with suitable air drying time as per IS 13183 Gr I, 25 microns per coat.

- d) After cleaning the dust on the dried up primer/ intermediate paint, first coat of synthetic enamel will be applied. After this first coat dries up hard, the surface is wet scrubbed cutting down to a smooth finish and ensuring that at no place the first coat is completely removed. After allowing the water to get evaporated completely, the second finish coat of synthetic enamel paint



will be applied only after gently removing the gloss of first coat from entire surface and it is dusted off the surface. The requirement of workmanship will be as per IS:1477-71.

- e) Equipment No. and the name of the equipment will be painted on the surface of the equipment on visible locations in English. Service of the Pipe/Line designation with arrow identification for the direction of flow will be painted on all pipes at visible locations at an interval of 20 metres. Wherever pipelines are insulated, the service of the piping and arrow mark will be painted over the clad surface.
- f) For painting of structure, equipment, tanks & vessels etc. suggested colour code is given in clause 17.2.8. For items not specified, the colour code to be followed for piping will be in line with IS 9404:2002 (Identification of pipelines used in Thermal Power Plants – Colour Code).
- g) For insulated pipeline the finish paint will be applied at that place where colour band is to be painted on the aluminium sheeting. The finished paint (colour band) will be of 1m length at that place.
- h) Colour band for piping will be applied at these following locations-
 - At start and end point.
 - At every 10m intervals.
 - At every T joints and cross connection of piping.
 - At every battery limit of pipeline
 - Near valves before connection with the consumer.
- i) Width of band

Size of pipe including insulated Pipe line outside diameter	Width of band
80 mm and below	25 mm
Above 80 mm upto 150 mm	50 mm
Above 200 mm upto 300 mm	75mm
Above 350 mm	100 mm



- j) Direction of flow will be indicated by black or white arrow in contrast to the base colour on the pipeline. Length of the arrow will be minimum 125 mm and width will be minimum 65 mm. These will be put at an interval of 10 m.

17.2.8 Suggested Colour Codes For Painting of Structures, equipments, tanks & vessels etc.

SL. NO.	ITEM/SERVICE	COLOUR	IS-5	COLUR (BAND	IS-5
1.	Structures, platforms, galleries, ladders and handrails	Dark admiralty grey	632	-	-
2.	Fans, pumps, motors, compressors.	Light grey	631	-	-
3.	Outdoor ,Stand pipes, vent pipes	Aluminium	-	-	-
4.	Indoor Tanks	Aluminium	-	-	-
5.	Vessels & all other proprietary equipment (without insulation & cladding)	Light grey	631	-	-
6.	Tanks (without insulation and cladding)	Aluminium			
7.	Switchgear	Light grey	631	-	-
8.	MCC/ PDB, Control, relay panels, Bus duct	Light grey	631/7078 of IS:1650	-	-



9.	Transformers	Dark admiralty grey	632	-	-
10.	Machinery guards	Signal red	537	-	-
11.	Turbine	Golden Yellow	356		
12.	Generator & exciter	Light grey	631		
13.	Piping (without insulation and cladding)				
14	Feed water	Sea green	217	Light brown	410
15	Condensate	Sea green	217	Light brown	410
16	D M Water	Sea Green	217	Light orange	557
17	Soft water	Sea green	217	French blue	166
18	Bearing cooling water	Sea green	217	French blue	166
19	Potable & filtered water	Sea green	217	French blue	166
20	Service & clarified water	Sea green	217	French blue	166
21	Condenser and Auxiliary Cooling water	Sea green	217	French blue	166
22	Service air	Sky Blue	101	-	-
23	Instrument air	blue	101	White	-
24	Lubricating oil	Light brown	410	Light grey	631
25	Control oil	Light brown	410	Light	557



				orange	
26	Transformer oil	Light brown	410	Light orange	557
27	Hydrogen	Canary yellow	309	Post office red	538
28	Carbon dioxide	Canary yellow	309	Light grey	631
29	Vacuum pipes	Sky blue	101	Black	-
30	Drainage	Black	-	-	-
31	Stand pipes and all Vent pipes	Aluminium	-	-	-

Notes:

Where band colour is specified, same will be provided at 10 meter intervals on long uninterrupted lines and also adjacent to valves and junctions.

17.2.9 Paint Application

- a) Paint will be applied in accordance with manufacturer's recommendations. The work will generally follow IS 1477 (Part II) for jobs carried out in India and SSPC-PA-I or DIN 55928 or equivalent for jobs carried out outside India. Touch up paint to be applied to cover scratches after erection and assembly of equipment at site.
- b) Paint will not be applied when the ambient temperature is 5 deg. C and below. Also paint will not be applied in rain, wind, fog or at relative humidity of 80% and above.
- c) Each coat of paint will be continuous, free of pores and of even film thickness without thin spots. The first coat of finish paint at site will be applied preferably within three months of the shop paint.
- d) Each coat of paint will be dry sufficiently before application of next coat.
- e) Surface which cannot be painted but require protection will be given a coat of rust inhibitive grease according to IS:958-75 or solvent deposited compound according to IS:1153-75 or IS:1674-60.



- f) Surface which will be inaccessible after assembly will receive minimum coats of specified primer. Surfaced to be in contact with wood, brick or other masonry will be given one shop coat of the specified primer.
- g) Parts of steel structure to be embedded in concrete will be given a protective coat of Portland cement slurry immediately after fabrication and thoroughly cleaning the surfaces from grease, rust, mill scales etc. No paint will be applied on this part.
- h) The Contractor will furnish paint manufacturer's test report or technical data sheet pertaining to the paint selected. The data sheet will indicate among other things the relevant standards, if any, composition in weight percent of pigments, vehicles, additives, drying time, viscosity, spreading rate, flash points, methods of application quality of surface preparation required, corrosion resistance properties and colour.
- i) Rust preventive coating will be given to HSTG bolt and nut threads.
- j) Machined surfaces / weld edges will be applied with a coating of temporary rust preventive oil.
- k) All threaded and other surfaces of foundation bolts and its materials, insulation pins, anchor channels, sleeves will be coated with temporary rust preventive fluid and during execution of civil works; the dried film of coating will be removed using organic solvents.
- l) The temporary rust preventive coating that already been applied on any components, tubes, pipes etc., will be removed by suitable solvents/ heating to 350-400 Deg.C for an hour before primer paint application-but, in case, it will be ensured that the minimum surface cleanliness required for primer paint application will be Sp2 (equivalent to hand tool cleaning).
- m) All weld edge preparation for site welding will be applied with one coat of weldable primer.
- n) For internal protection of pipes/tubes, VCI pellets will be used at both ends after sponge testing and ends capped. VCI pellets will not be used for SS components and composite assemblies.
- o) Wherever inside surfaces of ducts need protection till erection, two coats of red oxide zinc phosphate primer (P1) paint to IS 12744 to a DFT of 60 microns will be applied after power tool cleaning.

17.2.10 Painting scheme

- a) For a complete painting scheme of any item being painted, all types of paints are to be procured from the same manufacturer as approved by the purchaser.
- b) The painting scheme to be followed for various mechanical/ electrical equipment / structures is briefly given below for guidance to the Contractor.



Legend

SP	Surface preparation quality
P	Primer Paint
2P1 stands for	Two (2) coats of primer paint type P1
N	Intermediate paint
1N 1	One (1) coat of intermediate paint type 1
F	Final Paint
2F1 stands for	Two (2) coats of finish paint type F1
DFT	Dry film thickness
CRT	Clean and retouch
Sa - 2.5	Quality of surface cleaning (i.e. 95 % of the surface area is free from all rust, mill scales and visible residues, foreign materials etc.

c) Painting Scheme

Sl no.	Description	Surface Preparation	Painting Scheme		Total DFT in micron
			At shop	At site	
1.	Steel Structure	Sa 2½	2P1 + 1N1	2F1	200
2.	Mechanical equipment (temp. not over 80 deg. C) Both static and rotary equipment	Sa 2½	2P1 + 1 N1	2F1	200
3.	Equipment with hot surfaces (temp. upto 400	Sa 2½	2P2	2F2	130



	deg. C)				
4.	Equipment with hot surfaces (temp. above 400 deg.C)	Sa 2 ½	2P3	2F3	170
5.	Non insulated pipe/ duct works - Temperature not over 80 °C - Temperature upto 200 °C - Temperature upto 400 °C	Sa 2 ½	2P1 + 1N1 2P2 2P3	2F1 2F2 2F3	200 50 170
6.	Insulated pipe/duct works	St3	2 coats of Alkyd Red Oxide Zinc Phosphate primer to IS 12744 – DFT 30μ/ coat	Not required	60
7.	Condensate piping, ACW, DMCW, service water, potable water and minor structures etc.	Hand tool/ Power tool cleaning to SSPC-SP2	2 coats of HB Chlorinated rubber based red oxide zinc phosphate primer each 50μ	2 coats of Chlorinated rubber based finish paint each	160



				30μ	
--	--	--	--	-----	--

PAINTING SCHEME (METALLIC STRUCTURAL WORKS)				
SURFACES TO BE PAINTED	SURFACE PREPARA TION	PAINTING SCHEME		
		PRIMER AT SHOP	INTERM . AT SHOP	FINISHIN G AT SITE
1) CARPENTRY ANCHOR PLATES AND PIPELINE SUPPORT				
- OUTSIDE	SA 2.5	2P1	1N1	2F1
- INSIDE	SA 2.5	2P1	1N1	2F1
2) BRIDGE CRANE				
- STRUCTURE FOR BEAMS	SA 2.5	P1 + P1(S)	1N1 (S)	2F1
- TROLLEY	SA 2.5	2P1	1N1	2F1
3) HOISTS AND MONORAILS				
- MONORAILS	SA 2.5	2P1	1N1	2F1
- HOISTS	SA 2.5	2P1	1N1	2F1

PAINTING SCHEME (THERMAL CYCLE)
--



SURFACES TO BE PAINTED	SURFACE PREPARATION	PAINTING SCHEME		
		PRIME R AT SHOP	INTER M. AT SHOP	FINISHI NG AT SITE
1) INSULATED PIPE LINE AND VALVES				
STEAM	SA 2.5	2P1/2P 2/2P3	--	--
FEEDWATER	SA 2.5	2P1/2P 2/2P3	--	--
DEAERATOR AND FEED TANK				
FEED TANK - INSIDE - <u>OUTSIDE</u>	<u>SA 2.5</u> <u>SA 2.5</u>	<u>Temporary rust preventive paint</u> <u>2P3 or 2 coats of Heat resistant aluminium paint.</u>		
DEAERATOR - <u>OUTSIDE</u>	<u>SA 2.5</u>	<u>2P2 or 2 coats of Heat resistant aluminium paint.</u>		
3) HEAT EXCHANGER				
- INSIDE	SA 2.5	--	--	--
- OUTSIDE	SA 2.5	2P1	1N1	--
4) HEATER				



PAINTING SCHEME (THERMAL CYCLE)				
SURFACES TO BE PAINTED	SURFACE PREPARATION	PAINTING SCHEME		
		PRIME R AT SHOP	INTER M. AT SHOP	FINISHI NG AT SITE
- INSIDE	SA 2.5	--	--	--
- OUTSIDE	SA 2.5	Heat resistant Aluminum paint	--	--
5) PUMPS	SA 2.5	2P1/2P2	1N1	2F1/2F2
6) VENT				
7) NON INSULATED PIPELINE AND VALVES	SA 2.5	2P1/2P2/ 2P3	--	2F1/2F2/2F3
8) DRAINS, PIPELINE AND VALVES TRAPS ETC				
- INSULATED	SA 2.5	2P1/2P2/ 2P3	--	--
- NON INSULATED	SA 2.5	2P1/2P2/ 2P3	--	2F2
8) TANKS				
- OUTSIDE	SA 2.5	2P1/2P2	--	--
- INSIDE	--	--	--	--



PAINTING SCHEME (OIL + GAS-OIL CYCLE)				
SURFACES TO BE PAINTED	SURFACE PREPARATI ON	PAINTING SCHEME		
		PRIME R AT SHOP	INTERM. AT SHOP	FINIS HING AT SITE
1) CLEAN / DIRTY OIL TANK				
- INSIDE	SA 2.5	2P4	--	--
- OUTSIDE	SA 2.5	2P1	1N1	2F1
2) PIPE LINE AND VALVES				
- OUTSIDE	SA 2.5	2P1/2P 2	1N1	2F1/2 F2
- INSIDE	--	--	--	--
3) PUMPS				
- PUMPS	SA 2.5	2P1	1N1	2F1
4) FILTERS				
- OUTSIDE	SA 2.5	2P1/2P 1	1N1	2F1/2 F2
- INSIDE	--	--	--	--



PAINTING SCHEME (CIRCULATING WATER AND SERVICE WATER)				
SURFACES TO BE PAINTED	SURFACE PREPARATI ON	PAINTING SCHEME		
		PRIME R AT SHOP	INTERM . AT SHOP	FINISHI NG AT SITE
1) CONDENSER - INSIDE - OUTSIDE	SA 2.5 SA 2.5	-- 2P1	-- 1N1	-- 2F1
- WATER BOX AND TUBE SHEET	SA 2.5	As per specification Volume IIA		
2) PUMPS	SA 2.5	2P1	1N1	2F1
3) PIPELINE AND VALVES - INSIDE - OUTSIDE (OVER GROUND)	SA 2.5 SA 2.5	-- 2P1	-- 1N1	-- 2F1

PAINTING SCHEME (DEMINERALISED WATER)				
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SURFACES TO BE PAINTED	SURFACE PREPARATION	PAINTING SCHEME		
		PRIMER AT SHOP	INTERMEDIATE AT SHOP	FINISHING AT SITE
1) PIPELINE AND VALVES - INSIDE - OUTSIDE	-- SA 2.5	-- 2P1	-- 1N1	-- 2F1
2) PUMPS - PUMPS	SA2.5	2P1	1N1	2F1

PAINTING SCHEME (AIR CYCLE)				
SURFACES TO BE PAINTED	SURFACE PREPARATION	PAINTING SCHEME		
		PRIMER AT SHOP	INTERMEDIATE AT SHOP	FINISHING AT SITE
1) PIPE LINE AND VALVES (SA) - OUTSIDE - INSIDE	SA 2.5 --	2P1 --	1N1 --	2F1 --
2) FILTERS / STRAINERS - OUTSIDE	SA 2.5	2P1	1N1	2F1



PAINTING SCHEME (AIR CYCLE)				
SURFACES TO BE PAINTED	SURFACE PREPARATI ON	PAINTING SCHEME		
		PRIME R AT SHOP	INTERM . AT SHOP	FINISHI NG AT SITE
- INSIDE	--	--	--	--

Note : For Piping, Supports, Hangers, CLH, VLH & Other piping system components/ items Painting Scheme as indicated in following table is also acceptable.



Sl. No.	Description	Surface Preparation & Surface Profile	Primer Coat		Finish Coat			
			Primer Coat	No of coats & DFT	Paint	No of coats & DFT	Shade	Total DFT Micro ns (Min.)
1	Insulated Piping, Components (MS/HRH/CRH/Aux Steam lines,.....)	SSPC-SP3/Power Tool cleaning	Red oxide Zinc Phosphate Primer (Alkyd Base) to IS 12744	2 (30 micro ns per coat)	-----	-----	-----	60
2	Uninsulated Piping, components (Condensate, Boiler Filling, HP/LP dosing, Lube oil, Piping.....)	Hand Tool/Power Tool Cleaning to SSPC-SP2	HB Chlorinated Rubber based Red Oxide Zinc Phosphate Primer	2 (50 micro ns per coat)	Chlorinated Rubber based finish Paint	2 (30 micro ns per coat)	Smoke Grey Shade No 692 of IS 5	160
3	Structures	Hand Tool/Power Tool Cleaning to SSPC-SP2	HB Chlorinated Rubber based Red Oxide Zinc Phosphate	2 (50 micro ns per coat)	Chlorinated Rubber based finish Paint	2 (30 micro ns per coat)	Smoke Grey Shade No 692 of IS 5	160



			Primer)		
4	Hangers & Supports- (CLH,VLH)	Abrasive Blast cleaning to Sa 2 (35-50 microns)	Epoxy Zinc rich primer to IS 14589 Gr.II, % VS = 35 Min	1 (40 microns per coat)	Aliphatic Acrylic Polyurethane paint, % VS = 40 min	1 (30 microns per coat)	Phirozi Blue Shade No. 176 of IS 5	70
5	Pipe Clams	SSPC-SP3/Power Tool cleaning	Red oxide Zinc Phosphate Primer (Alkyd Base) to IS 12744	1 (30 microns per coat)	Synthetic enamel paint long oil alkyd to IS 2932	1 (20 microns per coat)	Smoke Grey Shade No 692 of IS 5	70
6	Stainless steel/Galvanized items	No Paint	No Paint	No Paint	No Paint	No Paint	No Paint	No Paint

17.3 Painting Of Steel Structural Works

17.3.1 All structural steel works covered in the civil scope in Volume V will be painted as specified in Volume V (Design, Fabrication and erection of Structural steel works)

17.4 Submission Of Painting Schedule

Contractor will submit a comprehensive painting schedule indicating surface preparation quality, paint applied, total DFT, colour code etc. for Customer/consultant's approval before the painting of any equipment/ component/ structure etc.



TECHNICAL SPECIFICATION FOR
105/25T TG HALL EOT CRANE
2X500 MW NNTPS (TG)

SPECIFICATION NO. PE-TS-402-501-A001

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ANNEXURE-V

DRAWINGS/ DOCUMENTS TO BE SUBMITTED AFTER AWARD OF CONTRACT

The successful bidder shall submit the following drawings / documents during detail engineering for customer's approval /information:

S.N.	BHEL drawing No.	Title	Approval category	Schedule date of submission from date of LOI.
1	PE-VO-402-501-A001	Manufacturing Quality plan including bought out items list for 105/25 T TG Hall EOT Crane crane.	A	15 days
2	PE-VO-402-501-A101	Data sheet of 105/25 T TG Hall EOT Crane (Double Girder)	A	15 days
3	PE-VO-402-501-A102	Data sheet of motors	A	25 days after approval of Mechanism Sizing Calculation in Cat II/Cat I.
4	PE-VO-402-501-A103	Mechanism Sizing Calculation for 105/25 T TG Hall EOT cranes	A	15 days
5	PE-VO-402-501-A104	General arrangement for 105/25 T TG Hall EOT crane (Crane No.:1 & 2)	A	15 days
6	PE-VO-402-501-A105	Crab sub assembly for 105/25T TG Hall EOT crane (Crane 1 and 2)	A	15 days
7	PE-VO-402-501-A106	Gantry Rail installation for 105/25T TG Hall EOT cranes	A	15 days
8	PE-VO-402-501-A107	General arrangement for PVC shrouded conductor type DSL for 105/25T TG Hall EOT crane	A	15 days
9	PE-VO-402-501-A108	105 T main hook block assembly (Crane 1 and 2)	I	30 days
10	PE-VO-402-501-A109	25 T Aux Hook Block Assembly (Crane 1 and 2)	I	30 days
11	PE-VO-402-501-A110	LT Drive wheel assembly	I	30 days
12	PE-VO-402-501-A111	LT idle wheel assembly	I	30 days
13	PE-VO-402-501-A112	CT Drive wheel assembly	I	30 days
14	PE-VO-402-501-A113	CT idle wheel assembly	I	30 days
15	PE-VO-402-501-A114	Long travel Machinery Assembly for 105/25T TG Hall EOT crane	I	30 days
16	PE-VO-402-501-A201/1	Electrical equipment layout in cabin for 105/25T TG Hall EOT crane No. -1	I	30 days
17	PE-VO-402-501-A201/2	Electrical equipment layout in cabin for 105/25T TG Hall EOT crane No. -2	I	30 days
18	PE-VO-402-501-A202/1	Schematic circuit diagram of protective panel and lighting circuit for 105/25T TG Hall crane (Crane no 1 & 2)	A	30 days
19	PE-VO-402-501-A202/2	Schematic circuit diagram of Main hoist panel for 105/25 T TG Hall crane(Crane no 1 & 2)	A	30 days
20	PE-VO-402-501-A202/3	Schematic circuit diagram of Aux. hoist panel for 105/25T TG Hall crane(Crane no 1 & 2)	A	30 days
21	PE-VO-402-501-A202/4	Schematic circuit diagram of Cross Traverse for 105/25T TG Hall crane(Crane no 1 & 2)	A	30 days



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105/25T TG HALL EOT CRANE
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22	PE-VO-402-501-A202/5	Schematic circuit diagram of Long Traverse panel for for 105/25T TG Hall crane(Crane no 1 & 2)	A	30 days
23	PE-VO-402-501-A202/6	Bill of material for Main, Aux. Hoist, CT circuit, LT circuit and main (Pro) circuit for 105/25T TG Hall (Crane-1 & 2)	A	30 days
24	PE-VO-402-501-A203	G.A. of Main hoist, Aux Hoists , cross travel,long travel , protective & transformers panels for 105/25 T TG Hall crane (Crane-1 & 2)	A	30 days
25	PE-VO-402-501-A204	Cable Schedule for 105/25T TG Hall crane	A	30 days
26	PE-VO-402-501-A205	Crane contrlol write up	I	30 days
27	PE-VO-402-501-A206	Cable size calculation for 105/25T TG Hall crane	A	30 days
28	PE-VO-402-501-A251	Crane lubrication	I	30 days
29	PE-VO-402-501-A252	Structural calculations for 105/25T TG Hall crane	I	15 days
30	PE-VO-402-501-A253	Type test report of motors above 50 KW. (if applicable)	I	15 days after approval of Data sheet of motors in Cat II/Cat I.
31	PE-VO-402-501-A256	105 T main hook nut and check plate	A	15 days
32	PE-VO-402-501-A257	25T aux. hook nut and check plate	A	15 days
33	PE-VO-402-501-A212	Electrical feeder diagram	A	25 days
34	PE-VO-402-501-A213	Earthing details	I	25 days
35	PE-VO-402-501-A255	Painting Schedule	A	25 days
38	PE-VO-402-501-A217	O & M manual	I	45 days
39	PE-VO-402-501-A254	Mandatory Spares list	A	30 days
LEGENDS				
A= Approval category				
I= Information category				

Notes:

- The above drawing list is tentative and shall be finalized with the successful bidder after placement of order. While some of the drawings indicated above may not be applicable, some additional drawings may also be required based on scope of work.
- Drawings shall be prepared in Auto-Cad latest edition. Required no. of hard and soft copies (editable) of the drawings shall be furnished as per requirement specified elsewhere in the specification.
- Only manual calculation with authentic supporting literature (e.g. extracts of hand Book/ standard/codes) shall be acceptable. All design calculations and drawings shall be in SI system only.
- Bidder to note that all values/dimensions/elevations etc. without supporting back up data adopted/assumed by the successful bidder (during contract stage) in the design calculation/drawings shall be taken by the customer/owner to be correct unless they are stipulated in the specification. Any problem arising later in this regard shall be made good by the successful bidder at his cost and no extension of time shall be granted for the same.
- All the drawings and documents including general arrangement drawing, data sheet, calculation etc. to be furnished to the customer during detailed engineering stage shall include / indicate the following details for clarity w.r.t. Inspection, construction, erection and maintenance etc.:-
 - All drawings and documents shall indicate the list of all reference drawings including general arrangement.
 - All drawings shall include / show plan, elevation, side view, cross - section, skin section, blow - up view; all major self-manufactured and bought out items shall be labeled and included in BOQ / BOM in tabular form.
 - Painting schedule shall also be made as a part of general arrangement drawing of each equipment / items indicating at least 3 trade names.
 - All the drawings required to be furnished to customer during detailed engineering stage shall include technical parameters, details of paints and lubrication, hardness and BOQ / BOM in tabular form indicating



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2X500 MW NNTPS (TG)

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all major components including bought out items and their quantity, material of construction indicating its applicable code / standard, weight, make etc.

- e) Drawings/ documents to be submitted for purchasers review/ approval shall be under Revision A, B, C... etc. while drawings /documents to be submitted thereafter for customer's approval after purchaser's approval shall be under R-0, 1, 2, 3etc.
6. Drawings and documents not covered above but required to check safety of machines/ system, shall be submitted during detailed engineering stage without any commercial implication.
 7. All drawings shall include "B.O.M" and indicate quantity, material of construction, make along with IS/BS No., Technical parameters, dimensions, hardness, machining symbol and tolerance, requirement of radiography and hydraulic tests, painting details, elevation, side view, plan, skin section and blow-up view for clarity.
 8. All drawings shall be prepared as per BHEL's title block and shall bear BHEL's drawing No.
 9. Schedule of drawings submissions, comment incorporations & approval shall be as stipulated in the specifications. The successful bidder shall depute his design personnel to BHEL's/ Customer's/ Consultant's office for across the table resolution of issues and to get documents approved in the stipulated time.
 10. Bidder to follow the following the drawing submission schedule:
 - 1st submission of drawings from date of LOI as per the submission schedule.
 - Every revised submission incorporating comments – within 7 days.
 - Bidder to submit revised drawings complete in all respects incorporating all comments. Any incomplete drawing submitted shall be treated as non-submission with delays attributable to bidder's account. For any clarification/ discussion required to complete the drawings, the bidder shall himself depute his personal to BHEL for across the table discussions/ finalizations/ submissions of drawings.

MANUFACTURER'S NAME & ADDRESS		MANUFACTURING QUALITY PLAN										PROJECT : IX500 WWFGUTPP STAGE IV,					
		CLASS		QUANTUM OF CHECK		REFERENCE DOCUMENT		ACCEPTANCE NORMS		FORMAT OF RECORDS		AGENCY		REMARKS			
		4		6		7		8		9		M C I N					
		3		5		6		7		8		9		10		11	
		4		5		6		7		8		9		10		11	
COMPONENTS & OPERATION		CHARACTERISTICS		TYPE PF CHECK		REFERENCE DOCUMENT		ACCEPTANCE NORMS		FORMAT OF RECORDS		AGENCY		REMARKS			
4		3		5		7		8		9		M C I N					
1	Fabricated components																
1	Box Girder, End Carriage, Crab Frame, Rope Drum																
a	Material	Chemical & Physical Properties	Major	Correlation with T.C. Check test in absence of T.C.	1/Heat/Batch	IS:2062-Gr B	IS:2062-Gr B	IS:2062-Gr B	IS:2062-Gr B	Mfr's T.C/ Vendor's T.C.	V	P	V	V			
																Refer note:1	
																UT, ON ABOVE 25MM THICK PLATE	
b	weld setup	dimensions	Major	Measurement	100%	ASTM A435	Components drawings	ASTM A435	Components drawings	Vendor's inspection report		P					
1A	Seamless pipe for rope drum	Chem,physical,	major	Co relation with TC, check in absence of TC	100%	ASTM A106Gr B	ASTM A106Gr B	ASTM A106Gr B	ASTM A106Gr B	MTC/Lab TC	V	P	V	V		Refer note:1	
		NDT	Major	,macro etching & flattening	100%	ASTM A106Gr B	ASTM A106Gr B	ASTM A106Gr B	ASTM A106Gr B	MTC/Lab TC	V	P	V	V			
		NDT	Major	UT	100%	ASTM E-213-2007	notch depth shall not be more than 12.5% of thickness of pipe			IR	V	P	V	V			
2	Welding WPS (Welding procedure specification) in line with ASME sec. IX (QW - 482) - For Box Girder, End Carriage, Crab Frame, Rope Drum																
a	Check for welding procedure qualification, welder's performance	Welding parameters	Major	check & test	100%	ASME Sec-IX	ASME Sec-IX	ASME Sec-IX	ASME Sec-IX	QW-482,QW-483 QW-484 ASPER asme Sec-IX	V	P	V	V		CUSTOMER APPROVED WPS AND QUALIFIED WELDERS ACCEPTABLE.	
b	Back chipping	surface defect	Major	DPT	100%	ASME Sec-VIII, Div-I, Appen - 8	ASME Sec-VIII, Div-I, Appen - 8	ASME Sec-VIII, Div-I, Appen - 8	ASME Sec-VIII, Div-I, Appen - 8	Vendor insp. Report		P	V	V			




MANUFACTURER'S NAME & ADDRESS		MANUFACTURING QUALITY PLAN										PROJECT : IX500 WWW FGUTPPP STAGE IV,	
SL. NO.	COMPONENTS & OPERATION	CHARACTERISTICS	CLASS	TYPE PF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORDS	AGENCY	REMARKS			
1	c	Butt Welds	4	5	6	7	8	9	10	11			
		NDT	Critical	Gamma ray	100% in tension	ASME Sec - VIII	ASME Sec-VIII, CL UW51	Vendor insp	P	V	Review of inspection report & radiography report and RT films . Refer note: 2		
				Radiography	25% in compression			Repot					
					100% in rope drum			RT film					
			Critical	DPT	100%	IS: 3658	ASME Sec-VII,	Vendor insp	P	W	DP test of filletweld for ropedrum to be conducted after final machining		
							Appen - 8	Repot			Random witness by BHEL		
d		fillet welds	Major	Visual	100%	Component Drg.	Component Drg.	Vendor insp. Report	P	V			
			Major	DPT	10% RANDOM	ASME Sec VIII- Div1- Append 8	ASME Sec VIII- Div1- Append 8	Vendor insp. Report	P	W			
e		final inspection of fabricated components listed in Sr.1 above	Major	Dimensional Measurement	100%	Vendor Mfg. Drg.	Vendor Mfg. Drg.	vendor route card/vendor insp report	P	V			
			Major	Review of SR chart	100%	ASME Sec-VIII, Div-1	ASME Sec-VIII, Div-1	SR Chart	P	V	If fabricated from M.S Plate		
3	a	Gear box casing	Major	Visual	100%	Component Drg.	Component Drg.	Vendor insp Report	P		Refer note 1		
		Material	Major	Measurement	100%	Component Drg.	Component Drg.	T.C. & I.R.	P	V			
			Major	Correlation with T.C. Check test in absence of T.C.	100%	IS:2062	IS:2062						
				Correlation									


MANUFACTURER'S NAME & ADDRESS		MANUFACTURING QUALITY PLAN											
		CLASS		TYPE PF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORDS	AGENCY	REMARKS			
		3	4	5	6	7	8	9	M C I N	11			
		CHARACTERISTICS		Measurement	100%	Component Drg.	Component Drg.	Component Drg.	Vendor insp Report	P			
		COMPONENTS & OPERATION		Review of SR chart	100%	Component Drg./	Component Drg./	ASME Sec-VIII, Div - I for procedure.	Vendor insp Report	V	V		
b	welding	Welding & Dimensional conformity	Major	Measurement	100%	Component Drg.	Component Drg.	Vendor insp Report	P				
c	Heat treatment	stress relieving	Major	Review of SR chart	100%	Component Drg./	Component Drg./	Vendor insp Report	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	Current collector arms	Dimensional conformity	Minor	Measurement	100%	Mfr. Catalog	Mfr. Catalog	Vendor insp Report	P				
8	DSL Guard	Dimensional conformity	Minor	Measurement	100%	Components Drg.	Components Drg.	Vendor insp Report	P				
9	Rails	Dimensional conformity,	Minor	Measurement	100%	G.A.drg./S : 3443 Vendor T.C./Appd.Data Sheet	G.A.drg./S : 3443 Vendor T.C./Appd.Data Sheet	IR	V	V			
10	MECHANICAL COMPONENTS	Chemical , tensile & hardness	Major	Chemical & hardness	100%	IS:3443	IS:3443	IR	V	V			
A	wheels	Chemicals composition and Mechanical Properties.	Major	Correlation with mfr's TC	100%	Mfg.drg./S:1570	Mfg.drg./S:1570	Test	V	V Refer Note:1			
	i) raw material	Chemicals composition and Mechanical Properties.	Major	mfr's TC	100%	/BS- 970	/BS- 970	Certificate					
	ii) Machined	a) Dimensions	Major	Measurement	100%	Component Drawing	Component Drawing	Vendor insp. Report	P	V			
		b) Hardness		Mechanical	100%	Approved Data Sheet / Mfg. Drg.	Approved Data Sheet / Mfg. Drg.	Report	V	V			
		c) UT		NDT	100%	Refer Note : 6	Refer Note 6		V	V			
		d) DPT		NDT	100%	8	App-8		V	V			

MANUFACTURER'S NAME & ADDRESS		MANUFACTURING QUALITY PLAN										PROJECT : IX500 WWWFGUTPPP STAGE IV,	
ITEM:		Q.P. NO. : PE-TS-404-501-A001	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORDS	AGENCY	REMARKS	CONTRACT NO. :		CONTRACTOR :		VENDOR'S QAP No. :	
MANUFACTURER'S NAME & ADDRESS		CLASS	TYPE PF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORDS	AGENCY	REMARKS	CONTRACT NO. :		CONTRACTOR :	
SL. NO.	COMPONENTS & OPERATION	CHARACTERISTICS	TYPE PF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORDS	AGENCY	REMARKS	CONTRACT NO. :		CONTRACTOR :	
1	4	3	5	6	7	8	9	10	11	CONTRACT NO. :		CONTRACTOR :	
	b) Raw material for Gears ,	i) Chemicals Composition	Correlation with	100%	Component Drawing, BS : 970 / IS : 1570	Component Drawing, BS : 970 / IS : 1570	Vendor insp. Report	P V V		CONTRACT NO. :		CONTRACTOR :	
	Pinions, Shafts, Axles etc	& heat treatment, Physical Properties.	mfr's TC		Approved Data Sheet	Approved Data Sheet	Report			CONTRACT NO. :		CONTRACTOR :	
			Check test in							CONTRACT NO. :		CONTRACTOR :	
			absence of TC check for UT (above 50mm dia)	100%	ASME Sec-V	Refer Note 6	Vendor insp. Report	P V V		CONTRACT NO. :		CONTRACTOR :	
			check for Hardness	100%	Mfg. drg. & Approved Data	Mfg. drg. & Approved Data	Vendor insp. Report	P W V		CONTRACT NO. :		CONTRACTOR :	
			Measurement	100%	Component Drawing	Component Drawing	Vendor insp. Report	P V V		CONTRACT NO. :		CONTRACTOR :	
			V) D.P. Test on teeth	100%	ASTME-165	No Crack and line of indication	Vendor insp. Report	P V V		CONTRACT NO. :		CONTRACTOR :	
B	Pulleys, Brake drums, coupling & other major steel castings & forging									CONTRACT NO. :		CONTRACTOR :	
	i) Materials	Physical/Chemical/Hardness	Corelation with	100%	Components Drawing	Components Drawing	Mfr's T.C.	P V V		CONTRACT NO. :		CONTRACTOR :	
	ii) Machined	a) Dimensions	mfr's TC	100%	Components Drawing	Components Drawing	Vendor insp. report	P V V		CONTRACT NO. :		CONTRACTOR :	
		b) DPT after machining.	NDT	100%	ASTM E-165	No. crack /Liner indication	Vendor insp. Report	P V V		CONTRACT NO. :		CONTRACTOR :	
C	Gear box assy & idle running	Check for oil leakage, Noise level, vibration backlash, rise in temp. after 2 Hrs. of running.	Visual & Measurement	100%	Vendor standard	Smooth running no oil leakage, Noise	Vendor insp. Report	P V V		CONTRACT NO. :		CONTRACTOR :	
			Measurement			85 db at 1 Mtr. Max. Temp. rise				CONTRACT NO. :		CONTRACTOR :	
						40°C above amb				CONTRACT NO. :		CONTRACTOR :	

PROJECT : IX500 WWFGUTPP STAGE IV,		MANUFACTURING QUALITY PLAN									
MANUFACTURER'S NAME & ADDRESS		ITEM:									
PACKAGE : 50T CWPH DOUBLE GIRDER CRANES		CONTRACT NO : PE-TS-404-501-A001									
CONTRACTOR :		REV : 0									
VENDOR'S QAP No. :		DATE : 28.3.14									
SL. NO.	COMPONENTS & OPERATION	CHARACTERISTICS	CLASS	TYPE PF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORDS	AGENCY	REMARKS	
1	4	3	4	5	6	7	8	9	M C N	11	
D	a) Top block, bottom block	dimensional conformity	Major	Measurement	100%	Assembly drawing	Assembly drawing	Vendor insp.	P V V	11	
	b) Hook	i) Chemical composition, Heat treatment, Mechanical properties on integral test bar ii) UT on raw material of hook iii) Forging operation of hook iv) Proof load test v) UT & MPI after proof load test	Major	Chemical, heat treatment & Tensile, % elongation UT Visual Mechanical UT & MPI	100%	IS:1875 ASME sec-v IS:5749 /S:15560 IS:5749 /S:15560	IS:1875 Annex-1 (Attached) IS:5749 /S:15560 IS:5749 /S:15560	Test Certificate, HT chart & Insp. Report Report Vendor insp	V P V V P V V P W W P W W		
E	Rope drum assembly	Diemnsional conformity	Major	Measurement	100%	Component Drawing	Tolerance as per drg	Vendor insp Report	P V V		
11	Electrical components										
a)	Motors (=< 50 KW)	make , type , rating, Routine test	Major	Review mfr's TC	100%	IS:325	IS 325/Mfr's T.C.	Mfr's T.C.	V P V	Refer Note 3. For Motor above 50KW separate QP shall be followed	
b)	Brakes	Make, t,ype , rating, dia , IR, HV , Functional test /Routine test	Major	Review mfr's TC	100%	Appd drgs	Appd drgs	Mfr's T.C.	V P V V		

PROJECT : IX500 WWW EGUTPPP STAGE IV,		MANUFACTURING QUALITY PLAN									
MANUFACTURER'S NAME & ADDRESS		ITEM:									
PACKAGE : 50T CWPB DOUBLE GIRDER CRANES		CONTRACT NO : PE-TS-404-501-A001									
CONTRACT NO :		REV : 0									
CONTRACTOR :		DATE : 28.3.14									
VENDOR'S QAP No. :											
SL. NO.	COMPONENTS & OPERATION	CHARACTERISTICS	CLASS	TYPE PF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORDS	AGENCY	REMARKS	
1	2	3	4	5	6	7	8	9	10	11	
c)	Control panel	Interlocking functional, IR, HV, Sheet thickness, cable laying, dressing, ferruling Overall dimensions , 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 & Generally confirm to IS : 3177 / App. Panle Drg. & BOM	Relevant drg. & IS : 3177 / App. Panle Drg. & BOM	Vendors insp Report	P W W	Refer Note No. 4 VFD Test Certificate to be submitted from app. Vendor for verification.	
d)	Radio remote, Master controllers	HV, IR, Functional	Major	Verification	100%	BOM/ Mfr. Catalog	BOM/ Mfr. Catalog	Mfr's T.C.	P V V	Refer Note No. 4	
e)	Pendent, switches Limit switches	HV, IR & Functional	Major	Verification	100%	Approved drawings	Approved drawings	Mfr's T.C.	P V V		
f)	Trailing cable, Power	Make, type, rating, Routine & acceptance test	Major	Verification	100%	,IS: 9968	,IS: 9968	Mfr's T.C.	P V V		
g)	Control Cable & DSL	insulation resistance values	Major	Verification	100%	IS 1554-Part-1	IS 1554-Part-1				
h)	Transformer SFU, MCCB, MCB, Contactors, DSL, relays, fuses, resistance bank	make rating , routine test make, t type , rating size, functional, continuity check	Major	visual	100%	Appd drg	Appd drg	IR	P V V		
i)	VVVF drives	make , type , rating, routine test	Major	visual	100%	Appd drg	Appd drg	IR	P V V		
j)	Anti collision devices , cable gland , lugs , r ectifier, indicating lamps, terminal blocks, load cell.	make, type	Major	visual	100%	Appd drg	Appd drg	IR	P V V		
12	Bought our items										
a)	Wire rope	Visual , tensile	Major	Type, grade, dia breaking strength Review TC	100%	IS:2266	IS:2266	T.C.	P V V		
b)	Other Items	Dimensional conformity	Major	Verification	100%	Relevant Drg.	Relevant Drg.	Vendor Confirmation	P V V		
c)	Bearing	Type & Size	Major	Verification		Appd drg/Mfr's catalogue	Appd drg/Mfr's catalogue		P V V		
13	Assembly of cranes										
a)	Bridge with LT	Dimesions, wheel level alignment	Major	Measurement	100%	GA drg/IS:3177	GA drg/IS:3177	Vendor insp. report	P W V		

MANUFACTURER'S NAME & ADDRESS		MANUFACTURING QUALITY PLAN															
		CLASS		TYPE PF CHECK		QUANTUM OF CHECK		REFERENCE DOCUMENT		ACCEPTANCE NORMS		FORMAT OF RECORDS		AGENCY		REMARKS	
		4		5		6		7		8		9		M C N			
COMPONENTS & OPERATION		CHARACTERISTICS		CHECK		OF CHECK		DOCUMENT		NORMS		RECORDS		AGENCY		REMARKS	
1	b)	Crab assembly	Dimensions, wheel level alignment	Measurement/Visual	100%	GA drg/IS:3177	GA drg/IS:3177	GA drg/IS:3177	Vendor insp. report	Vendor insp. report	Vendor insp. report	Vendor insp. report	Vendor insp. report	Vendor insp. report	Vendor insp. report	Vendor insp. report	Vendor insp. report
	c)	Final inspection (at works) with actual panel, RRC and pendent	Overall dimension Diagonal dimension check, headroom, lift, Eqp. Layout on bridge platform, No Load running of LT machinery for	Measurement	100%	Approved drgs./IS :3177	Approved drgs./IS :3177	Approved drgs./IS: 3177	Vendor insp. report	Vendor insp. report	Vendor insp. report	Vendor insp. report	Vendor insp. report	Vendor insp. report	Vendor insp. report	Vendor insp. report	Vendor insp. report
			No Load & Load Tests	Measurement	100%	Approved drgs	Approved drgs	Approved drgs	Vendor insp. report	Vendor insp. report	Vendor insp. report	Vendor insp. report	Vendor insp. report	Vendor insp. report	Vendor insp. report	Vendor insp. report	Vendor insp. report
			a) No load: Hoists,CT,LT speed & current measurement..	Measurement	100%	Approved drgs	Approved drgs	Approved drgs	Vendor insp. report	Vendor insp. report	Vendor insp. report	Vendor insp. report	Vendor insp. report	Vendor insp. report	Vendor insp. report	Vendor insp. report	Vendor insp. report
			b) SWL: Hoists, CT speed, current & Deflection measurement	Measurement	100%	GA drg/IS:3177	GA drg/IS:3177	GA drg/IS:3177	Vendor crane test report	Vendor crane test report	Vendor crane test report	Vendor crane test report	Vendor crane test report	Vendor crane test report	Vendor crane test report	Vendor crane test report	Vendor crane test report
			c) Overload: Hoisting, CT movement & current measurement (at 125% SWL)	Operational		GA drg/IS:3177	GA drg/IS:3177	GA drg/IS:3177	Vendor crane test report	Vendor crane test report	Vendor crane test report	Vendor crane test report	Vendor crane test report	Vendor crane test report	Vendor crane test report	Vendor crane test report	Vendor crane test report
			d) Operation check of brakes and limit switches .	Check		Tech. Specification	Tech. Specification	Tech. Specification	report	report	report	report	report	report	report	report	report
14		Review of QA documentation						As per approved QAP									
15		Cleaning and Painting	Surface preparation & Painting	Visual		Approved drgs/doc	Approved drgs/doc	Approved drgs/doc	Vendor's Report	Vendor's Report	Vendor's Report	Vendor's Report	Vendor's Report	Vendor's Report	Vendor's Report	Vendor's Report	Vendor's Report
		Note 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 :	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 or equivalent which gives enough readable and interpretable film quality to be used for clarity. All NDT shall be carried out by Qualified Level II personnel.														
		Note 3 :	LESS THAN 30KW: ACCEPTANCE OF MOTOR LESS THAN 30 KW IS BASED ON COC OF THE MANUFACTURER & THE CONTRACTOR CONFIRMING AS FOLLOWS: IT IS HEREBY CONFIRMED THAT THE ABOVE MENTIONED MOTOR /MOTORS WAS/ WERE MANUFACTURED TAKING CARE OF NTPC SPECIFIC REQUIREMENTS REGARDING AMBIENT TEMP., VOLTAGE & FREQUENCY VARIATION, HOT STARTS, PULL OUT TORQUE, STARTING KVA/KW, TEMP. RISE, DISTANCE BETWEEN CENTRE OF STUD & GLAND PLATE AND TESTED IN ACCORDANCE WITH APPROVED DRAWING /DATA SHEETS.														

MANUFACTURER'S NAME & ADDRESS		MANUFACTURING QUALITY PLAN					PROJECT : IX500 WWFGUTPP STAGE IV,	
		ITEM:		Q.P. NO. : PE-TS-404-501-A001		PACKAGE : 50T CWPH DOUBLE GIRDER CRANES		
		CLASS		REV : 0		CONTRACT NO. :		
COMPONENTS & OPERATION		CHARACTERISTICS		DATE : 28.3.14		CONTRACTOR :		
4		3		7		VENDOR'S QAP No. :		
4		4		6		FORM OF RECORDS		
				5		AGENCY		
				8		M C N		
				9		D++ 10		
				11		REMARKS		
30 KW to 50KW : ACCEPTANCE OF MOTOR RATING BETWEEN 30 KW & 50 KW IS BASED ON NTPC REVIEW OF ROUTINE TEST INSPECTION REPORT AS PER IS 325 ALONG WITH COC OF THE MANUFACTURER & THE CONTRACTOR CONFIRMING AS FOLLOWS: <input type="checkbox"/> IT IS HEREBY CONFIRMED THAT THE ABOVE MENTIONED MOTOR /MOTORS WAS/ WERE MANUFACTURED TAKING CARE OF NTPC SPECIFIC REQUIREMENTS REGARDING AMBIENT TEMP., VOLTAGE & FREQUENCY VARIATION, HOT STARTS, PULL OUT TORQUE, STARTING KVA/KW, TEMP. RISE, DISTANCE BETWEEN CENTRE OF STUD & GLAND PLATE, SPACE HEATER AND TESTED IN ACCORDANCE WITH APPROVED DRAWING /DATA SHEETS.								
Note 4 :	Performance of electrical & control devices along with the interlocks, protection & sequence to be checked during crane assembly and parked at works.							
Note 5 :	Acceptance norms for UT (Normal probe to be used of not less than 2 MHz frequency) : Following defects are not acceptable./ Vendor's UT Procedure approved by BHEL may also be used.							
	<ul style="list-style-type: none"> (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 							
Note 6 :	Acceptance norms for UT (Normal probe to be used of not less than 2 MHz frequency) : Following defects are not acceptable./ Vendor's UT Procedure approved by BHEL may also be used.							
	<ul style="list-style-type: none"> (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 <p>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.</p>							
Note 7 :	All material of construction shall be as per approved drg. / data sheet / specifications							
LEGEND :								
D * RECORDS IDENTIFIED WITH 'TICK'(✓) SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION								
** M : MANUFACTURER/SUBCONTRACTOR								
C: BHEL-CQS/THIRD PARTY								
INDICATE "P" PERFORM "W" WITNESS AND "V" DOCUMENT REVIEW								
N : CUSTOMER/NTPC								
MANUFACTURER/	CONTRACTOR							
SUBCONTRACTOR								
SIGNATURE						REVIEWED BY		
						NAME & SIGN OF APPROVING AUTHORITY & SEAL		



**TECHNICAL SPECIFICATION FOR
105/25T TG HALL EOT CRANE
2X500 MW NNTPS (TG)**

SPECIFICATION NO. PE-TS-404-501-A002

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REV 00

DATE

DATA SHEET FOR TG HALL EOT CRANE WITH VVVF DRIVES

* Information's are to be furnished by bidder during detail engineering stage only.

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	Mechanical and Electrical as per IS: 3177-2006 & Structure design in accordance to IS 807:2006.
1.4.0	Number of cranes	Two (2) nos.
1.5.0	Crane classification	M5 Mechanical and M5 Electrical as per IS: 807-2006 and 13834 (part-5)-1993
1.6.0	Suitable for outdoor or indoor duty	Indoor
1.7.0	Capacity and lift	105/25T for TG hall
1.7.1	Main hoist	
a.	Rated SWC – tonnes	105T
b.	Test load SWC – tonnes	Rated SWC and over load test : 125% of SWC
1.7.2	Aux. hoists	
a.	Rated SWC – tonnes	25T
b.	Test load SWC – tonnes	Rated SWC and over load test : 125% of SWC
1.8.0	Span	32.22 m
1.9.0	Operation from	Cabin + Pendent Push Button+ Radio remote control
2.00	CRANE PERFORMANCE	
2.1.0	Crane speed with full	Full speed M/Min Creep speed M/Min



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2X500 MW NNTPS (TG)

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		load		
	a.	Main hoist	1.0	0.1 (10% of main speed thru' VVVF drives)
	b.	Aux. hoist	5.0	0.5 (10% of main speed thru' VVVF drives)
	c.	Trolley travel (CT)	15.0	1.5 (10% of main speed thru' VVVF drives)
	d.	Longitudinal bridge travel (LT)	25.0	2.5 (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		
	a.	Main Hoist		29.5m
	b.	Aux Hoist		35.85 m
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: 1239 having top and bottom rail at height of 1050 mm and 600 mm and vertical post spacing not exceeding 1750 mm with provision of kick plate (100 mm high and 6mm thick)	
3.0.0		COMPONENT DETAILS		
3.1.0		Trolley	The trolley frame shall be built up from heavy steel plates, angles and channels adequately braced to resist vertical, lateral and torsional strains, welded to form a rigid one piece frame. Alternatively, it may be of cast steel construction and should be covered by flooring as far as possible. On bottom of trolley frame, on each side a double spring bumper shall be provided to engage stops at each end of the bridge.	
	a.	Type	Fabricated	
	b.	Method of fabrication	Fusion welded	
	c.	Material	IS: 2062 Gr. A or B	
	d.	Centre to centre distance of wheels (on the same rails)	*	
	e.	Whether jacking pads for lifting trolley provided or not	Yes	



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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 Gr. B or fabricated rolled section to IS: 2062 Gr A/B & 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 or 6x37 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	Steel	Steel		
	i.	Number of falls	*	*		
	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 Design as per IS: 3177- 1999			
	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 rolled steel plate			
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 shock absorbing coupling excepting pin bush type			
	b.	Size & Torque rating	*			
	c.	Guards and enclosures	Provided			
	d.	Coupling material and hardness	All couplings shall be of cast, wrought or from forged steel, tooth portion to be heat treated to hardness HB241-280			



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2X500 MW NNTPS (TG)

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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	One of the following arrangements will be adopted for connecting the rope drum with the gear- box. 1. Flexible joint, incorporating flexible geared coupling housed within the drum. 2. Fully flexible geared coupling between the drum & gearbox.			
	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: 3177-2006			
	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			
	c.	Total number of reductions	*	Thru' VVVF drive	*	Thru' VVVF drive
	d.	Type of gears	Helical / Spur		Helical / Spur	
	e.	Reduction ratio	*			
	f.	Type of lubrication (grease / splash / pump lubrication)	Splash Lubrication			
	g.	Hardness (BHN) – gear	*			
h.	Hardness (BHN) – pinion	*				



TECHNICAL SPECIFICATION FOR
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2X500 MW NNTPS (TG)

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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. 1or 2. Pinions En 19/EN 24. Hardness conforming to IS: 3177 (latest edition) Gears to be hardened, tempered & heat treated as per IS 4460			
	k.	Casings	Fabricated Fe 410w IS: 2062 Gr A/B & 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/ Horizontal	NA	Vertical/ Horizontal	NA
	b.	Classification	M5 duty			
	c.	Total number of reduction	*	Thru' VVVF drive	*	Thru' VVVF drive
	d.	Type of gears	Helical / Spur		Helical / Spur	
	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. 1or 2. Pinions En 19/EN 24. Hardness conforming to IS: 3177 (latest edition) Gears to be hardened, tempered & heat treated as per IS 4460			
	k.	Casings	Fabricated Fe 410w IS: 2062 Gr A/B & stress relieved			
	l.	Standard conforming to	IS: 4460 / AGMA			
3.7.0		Wheels details	Cross travel		Long travel	
	a.	Material	forged rolled / cast steel			
	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			
	h.	Numbers provided	4 nos.		16 nos.	
	i.	Specification conforming to	IS: 3177			
	j.	Arrangement of lubrication	Grease			



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3.8.0		Lifting hooks	MH		AH	
	a.	Type	Ramshorn shank with safety latch swiveling type as per latest edition of IS: 5749		Plain with safety latch swiveling type as per latest edition of IS: 15560	
	b.	Safe lifting capacity	105 T as per IS 5749		30 T as per IS: 15560	
	c.	Material	✓ Class 2 as per IS 1875:1992 (re affirmed 2004) for hooks conforming to IS : 5749 ✓ Class 1A or class 3 for hook of grades L & M respectively as per IS 1875:1992 for hooks conforming to IS : 15560			
	d.	Standard conforming to	IS: 5749		IS: 15560	
	e.	Hook can rotate	Yes			
	f.	Safety latch on hook provided	Yes			
	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 100% of the rated speed.			
	b.	Numbers provided	4		4	
	c.	Details of end stop	Mild steel, grade 'B' of IS 2062 in 100% killed, normalised and ultrasonically tested quality or high strength steel of IS 8500 as appropriate.			
3.10.0		Brakes				
3.10.1		Hoist Motions	MH	MH micro	AH	AH micro
	a.	Type of brake	AC Electro-Hydraulic Thruster operated + DC electro magnetic			
	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 (% of torque transmitted to the brake drum with full load.)	150%		150%	
	f.	Braking torque actually required	*		*	
	g.	Material				
		• Brake liners	Ferrodo liners			
		• Drum	CS IS : 1030 / CL 4 IS : 1875			
		• Springs	As per manufacturers standard			
	h.	Braking distance in mm	*	NA	*	NA



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3.10.2		Travel Motions	CT	CT micro	LT	LT micro	
	a.	Type of brake (ac / dc / thruster)	AC Electro-Hydraulic Thruster operated + DC electro magnetic				
	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 (% of motor rated torque before derating)	125%		125%		
	f.	Braking torque actually required	*		*		
	g.	Material					
		• Brake liners	Ferrodo liners				
		• Drum	CS IS : 1030 / CL4 IS : 1875				
		• Springs	As per manufacturers standard				
		• Thrusters	*				
	h.	Braking distance in mm	*	NA	*	NA	
		Storm brake	2 No's LT parking brake (storm brake) shall be provided				
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				
	c.	Method of lubrication	Grease lubrication with separate pumps				
	d.	Bearing life	10,000 working hours.				
3.13.0		Bridge girder					
	a.	Type & Quantity	Box type – 2 nos. Material: Mild steel, grade 'A/B' of IS 2062 in 100% killed, normalised and ultrasonically tested quality or high strength steel of IS 8500 as appropriate.				
	b.	Size	*				
	c.	Vertical Deflection	Span / 900				



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	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.			
	b.	Standard conforming to	IS: 3443			
	c.	Weight per metre	*			
	d.	Material	50C12 or 55C11			
	e.	Top width in mm	*			
	f.	Height in mm	*			
3.15.0		Type of platform required on the bridge	Chequered plate platform 6mm thick over plain as per IS : 3502			
	a.	Length	Full span length			
	b.	Type of access from gantry girder level to crane bridge	Rung ladder at ends from gantry girder level walkway to crane bridges walkway			
	c.	Type of access to maintenance cage from crane bridges walkway	Rung ladder			
	d.	Type of access to Cabin from crane bridges walkway	By Staircase			
	e.	Provided at both ends	Yes			
3.16.0		Type of operators cabin				
	a.	Type of construction	Closed type, Air conditioned Cabin**			
	b.	Area and minimum clear height	2500x2000 mm with a head room of 2300 mm			
	c.	Operator's seat	Revolving type			
	d.	Warning gong	A foot operated type-warning gong suspended outside the cabin** with control inside the cabin will be provided and an additional 300 mm dia hand operated metal gong			
	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



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a.	Type	Three phase squirrel cage induction motors to be operated from VFD system. Motors shall be provided with VPI insulation and insulated bearing on one side and shall be suitable for inverter duty	Thru VVVF drive	Three phase squirrel cage induction motors to be operated from VFD system. Motors shall be provided with VPI insulation and insulated bearing on one side and shall be suitable for inverter duty.	Thru VVVF drive
b.	Enclosure	TEFC	NA	TEFC	NA
c.	Numbers furnished	One per motion			
d.	Voltage, phase and frequency	415V + 10%, 3 Ph, 4 wire, 50 Hz, ±5 % Combined voltage & frequency variation = 10% absolute			
e.	Class of protection	IP – 55			
f.	Rated capacity (KW)	The motor shall be suitable for 150 starts / hr and 40% CDF. Motor nameplate rating at 500 C shall have Motor rating will be calculated keeping margin of at least 15% over the maximum power requirement in the duty condition specified. Further, the hoist motors will be rated to lift 125% of the design load on the hook at the rated speed.			
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	Three phase squirrel cage induction motors to be operated from VFD system. Motors shall be provided with VPI insulation and insulated bearing on one side and shall be suitable for inverter duty.	Thru VVVF drive	Three phase squirrel cage induction motors to be operated from VFD system. Motors shall be provided with VPI insulation and insulated bearing on one side and shall be suitable for inverter duty.	Thru VVVF drives
b.	Enclosure	TEFC	NA	TEFC	NA
c.	Numbers furnished	1	NA	2	NA



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	d.	Voltage, phase and frequency	415V + 10%, 3 Ph, 4 wire, 50 Hz, $\pm 5\%$ Combined voltage & frequency variation = 10% absolute			
	e.	Class of protection	IP – 55			
	f.	Rated capacity (KW)	The motor shall be suitable for 150 starts / hr and 40% CDF. Motor nameplate rating at 500 C shall have Motor rating will be calculated keeping margin of at least 15% over the maximum power requirement in the duty condition specified.			
	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 requirement	For motors of rating 30 KW and above			
3.18.3		Motor Duty and pullout torque	Duty S4 and pullout torque 275% of full load torque			
3.19.0		Limit switches	Main hoist	Aux. hoist	Cross Travel	Long Travel
	a.	Type	Rotary gear + Gravity		Lever type (one way/ two way)	
	b.	Number provided	1+1	1+1	2/1	2
	c.	Rating of contacts	*			
	d.	Material of contacts	Double break Silver Cadmium			
	e.	Control voltage / Enclosure	110 V/ IP 54			
3.20.0		Power conductors (DSL)				
	a.	Type	LT: PVC shrouded Cu conductor bus bar. CT: Flexible trailing cable mounting on retracting support (Festoon type) 1100V-(E) grade power & control flexible trailing, annealed tinned copper conductor, EPR insulated, EPR inner sheathed, CSP outer sheathed and shall have conductor screen of rubber. Cables shall conform to IS requirements and any other applicable standards.			
	b.	Size	Shall be sized with a margin of 20% over load requirement. Voltage drop at motor terminal shall be limited to 3% at extreme positions of cranes. Protective cover over DSL to be provided.			
	c.	Material	*			
	d.	Numbers	*			
	e.	Length	Suitable for bay length			
3.21.0		Protective Panel				
	a.	Make	OEM			



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	b.	Size	*			
	c.	Material	Sheet steel 2 mm size			
	d.	Numbers and location	One number located in cabin			
	e.	DOP	IP 54			
3.22.0		Control panel				
	a.	Make	OEM			
	b.	Size	*			
	c.	Material	Cold Rolled sheet steel 2mm size			
	d.	Numbers and location	One each for MH, AH, CT and LT located on bridge platform with space heaters.			
	e.	Degree of protection	IP 54			
3.23.0		Master Controllers (Desk Type)	Main Hoist	Aux Hoist	Cross Travel	Long Travel
	a.	Number of steps	5	5	4	4
	b.	Voltage & current rating	415 V/10 A			
	c.	Type	Heavy duty type having DOP IP54. Release of operators' hand from the controls shall stop motion and set brakes automatically.			
	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 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	Power	Control		
	a.	Material	Copper	Copper		
	b.	Type	LT power cable: 1.1 kV, heavy duty power cable, 4/3.5 core with stranded sector shaped (sm) or with compact circular stranded (rm/V) or circular stranded (rm) Copper conductors as applicable, PVC insulated suitable for type – ST2 operation as per IS:5831-1984, core stranded together provided with a common covering of Extruded PVC inner sheath, galvanized round steel wire / strip armoured and Extruded FRLS PVC outer sheathed, multi core conforming to IS:1554 (Part-I – 1988) Type TWY			



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			Control Cables: 1.1 kV, circular stranded (rm), annealed copper conductor, PVC insulated suitable for type ST1 (70°C) operation, as per IS:5831-1984, cores stranded together provided with a common covering of PVC inner sheath, galvanised round steel wire armoured and Extruded FRLS PVC outer sheathed, multi-core similar to IS:1554- (Part-I)-1988, Type YWY.	
			Flexible Trailing Cable: 1.1 kV grade, heavy duty type with tinned annealed high conductivity flexible copper conductors, ethylene propylene (EPR) insulated and chlorosulphorated polyethylene (CSP) sheathed conforming to IS:8130-1984, IS:6380-1984 and IS:9968 (Part-I)-1988.	
	c.	Size	Min. 4 mm ² for Cu.	Min. 2.5 mm ² for Cu.
	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	
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	Owner shall provide one (1) no. 415 V, 3 phase, 3 wire supply at operating floor near A row column at centre of bay length shall be provided. Bidder shall provide change over switch in enclosure to receive above power supply.	
3.29.0		Transformer		
	a.	Quantity	2 X 100 % for control, 1 no for lighting & 1 no for hand lamp.	
	b.	Voltage Rating	Control 415/110V, Lighting 415/240V and hand lamp 415/24V.	
	c.	KVA rating	20% over loading to be considered while sizing the rating	
3.30.0		Illumination		
	a.	In cabin	40W florescent fixture + Bulk head fitting with 60W incandescent lamp – 1 each, 2nos. 24V – 5A – 3 pin industrial socket. 15A/20A socket outlet shall be provided for A/C	
	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. 400 W HPSV lamps along with shock absorbing and anti swing suspension arrangement	
	d.	For inspection of crane components	One (1) portable 160W (SLS lamp with enclosed type battery and wire guard) hand lamp with min. half span length flexible cable for inspection of crane components	



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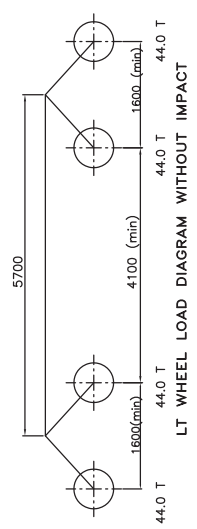
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	e.	Hand lamp socket and hand tool sockets	Hand lamp socket outlets (2 pin, 10A, 24V) and power socket outlets (3 pin, 20A, 240V) shall be provided for use of hand tools along with switches.
3.31.0		Fire Extinguisher	
	a.	Type and size	4.5 kg CO ₂ type
	b.	Location	One in cabin and Three on bridge
3.32.0		Ventilation	One no non oscillating ventilating electric fan in cabin.
3.33.0		Type of control for Hoists/ CT/LT operation	Through VVVF drive
3.34.0		Painting	As per Annexure- IV
3.35.0		Mandatory Spares	As per Annexure- II

Note: Other requirements for the system.

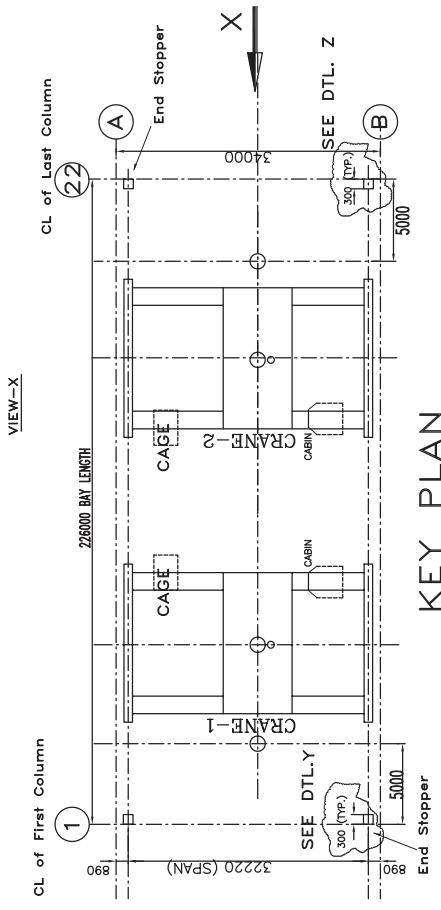
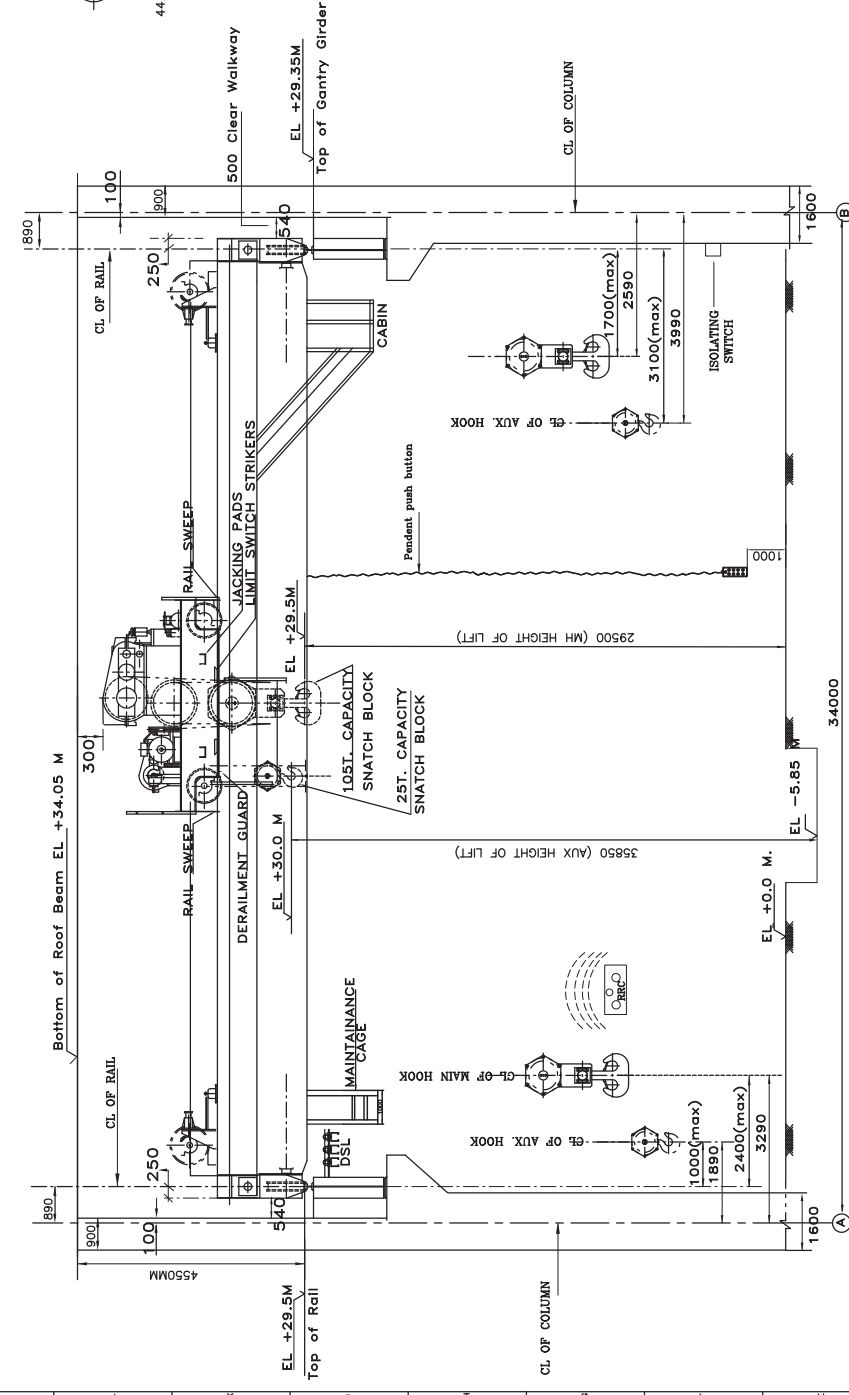
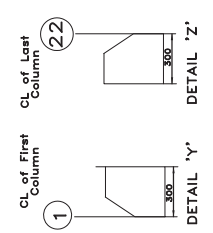
- Suitable anti- collision devices of the two cranes along with stoppers at both gable ends.
- Centralized grease lubrication with hand operated grease pump for all bearings.
- Two (2) nos. isolating switches in enclosure shall be provided at extreme ends of operating floor for disconnecting supply to DSL during crane maintenance.
- The crane electrical shall be designed for ambient air temperature of 50 Deg. C relative humidity of 100%. The equipment shall operate in highly polluted environment.
- All electrical equipment, accessories and wiring shall have tropical protection involving special treatment of insulation and metal against fungus, insects and corrosion.
- Emergency Switch-Mushroom type emergency STOP push buttons to open the main contactor shall be furnished at least one in operator's cabin and two on bridge platform within easy reach.
- DSL phase indicating lamps to be provided.
- Pull out torque of motor at rated voltage shall be 275% of full load torque.
- Two nos. (For each crane) fail safe LT storm/parking brakes, truck end mounted, hydraulic rail clamp type of adequate capacity (depending on wind pressure) to be provided. The setting shall include automatic engagement of clamps in case of crane is left idle for five minutes (adjustable).
- The following parameters shall be considered for design and selection of LT storm /parking brakes.
 - a) The basic wind speed "Vb" at ten metres above the mean ground level: 50 meters /second
 - b) The risk coefficient "K1" 1.07
 - c) Category of terrain Category-1
 - d) Other factors in line with IS 875.



WEIGHT OF HEAVIEST COMPONENT TO BE LIFTED (LP ROTOR) = 95T (approx)
 TAKING MARGIN AS 10 % = 9.5T
 TOTAL = 104.5T
 HENCE CRANE CAPACITY CONSIDERED = 105T
 No OF CRANES = TWO(2)

NOTES

- 1) DRAWING IS NOT AS PER THE SCALE.
- 2) ALL DIMENSIONS ARE IN MM & ELEVATIONS IN METRES.
- 3) GROUND FLOOR IS CONSIDERED AS EL +0.0 M. IN CASE ELEVATION OF CENTRELINE OF HOOK AND BOTTOM OF ROOF/BEAM SHALL CHANGE ACCORDINGLY.
- 4) DISTANCE B/W CENTRE LINE OF RAIL & CENTRE LINE OF COLUMN CONSIDERED AS 800 MM ON BOTH A & B ROW & OFFSET ABOVE BRACKET CONSIDERED AS 100MM.
- 5) LT END STOPPERS ARE OF 300 MM SIZE & CONSIDERED OUTSIDE THE FIRST & LAST COLUMN.
- 6) SIZES OF A ROW COLUMN & B ROW COLUMN CONSIDERED AS 1600MM AND SHALL BE SUBJECTED TO FINAL CIVIL STRUCTURE.



	CUSTOMER	शेरेली लिग्नाइट कॉर्पोरेशन लिमिटेड (शाहदारी लिमिटेड)
	CONSULTANT	भारत इंटरनेशनल इंडिया प्राइवेट लिमिटेड M/s LAHMEYER INTERNATIONAL (INDIA) PVT LTD
PACKAGE :		TURBINE GENERATOR AND AUXILIARIES (NT42)
PROJECT		NEYVELI NEW THERMAL POWER PROJECT (NTPP)
DISTRIBUTION		NEYVELI NEW THERMAL POWER PROJECT (NTPP)
TITLE		CRANE CLEARANCE DIAGRAM OF TG HALL 105/25 T (DOUBLE GIRDER) E.O.T. CRANE
REV	DATE	BY
2		
1		
APPROVED	DATE	BY
DRAWING NO.		PE-07-402-01-A001
SHEET		1 OF 1

JOB NO.	402	
STATUS	CONTRACT	
REV	DATE	BY
2		
1		
APPROVED	DATE	BY
All bay width changed to 34m and height of crane structure increased as per customer comment received on dated 27.8.14		

1007-10-2014-15-24 (M. 2014)

KEY PLAN



Part A

EOT CRANE

Two (2) Nos – Pendant / remote / Cabin controlled 105/25 tonnes capacity (minimum), indoor double girder electric over head travelling crane complete with runway rails, down shop leads and all other necessary related accessories and mountings in conformity with the technical particulars as specified herein to make the installation complete in every respect will be provided in the station TG building for initial installation and subsequent maintenance of various equipment located in the Power House.

11.2. CODES AND STANDARDS

The design, manufacture and testing of the crane(s) will conform to the latest editions of the following codes and standards in general.

S.No	Code	Description
1	IS: 807	Code of Practice for Design, Manufacture, Erection and Testing (Structural Portion) of Cranes and Hoists.
2	IS:3177	Code of Practice for Design of Overhead Travelling Cranes and Gantry Cranes other than Steel Works cranes
3	IS:1835	Steel wires for Ropes
4	IS:2266	Steel Wire Ropes for General Engineering Purposes
5	IS:3443	Crane Rail Sections
6	IS:15560	Point Hook with Shanks for General Engineering Purpose
7	IS:5749	Forged Ramshorn Hooks
8	IS:816	Code of Practice for use of metal Arc Welding for General Construction in Mild Steel
9	IS 9595	Code of practice for Use of Metal Arc Welding of Mild Steel



S.No	Code	Description
10	IS: 7318(P1)	Qualifying Tests for Metal Arc Welders (Engaged in Welding Structures other than pipes)
11	IS:1323	Code of Practice for Oxy
12	NEC:1985	National Electrical Code
13	CMAA	Codes & Standards for design, manufacture, erection & testing of Cranes
14	IS:325	Inductor Motor

- a) All electrical installation work will comply with the provisions of Indian Electricity Act and Indian Electricity Rules as amended upto date.
- b) ANSI-B30.2.0- Safety codes for overhead and Gantry Cranes
- c) Equipment and materials conforming to any other standard that ensures equal or better quality may be accepted. IN such case, copies of the English version of the standard adopted will be submitted along with the bid.
- d) In case of any contradiction between the above-mentioned codes and standards technical specification requirements, will prevail.
- e) The electrical installation will meet the requirements of Indian Electricity Rules as amended up to date.
- f) ANSI-B30.2.0 – Safety codes for overhead and Gantry Cranes
- g) Equipment and materials conforming to any other standard that ensures equal or better quality may be accepted. In such case, copies of the English version of the standard adopted will be submitted along with the bid.
- h) The electrical installation will meet the requirements of Indian Electricity Rules as mentioned up to date and relevant IS Codes of Practice. In addition, other rules or regulations applicable to the work will be followed. In case of any discrepancy, the more restrictive rule will be binding.

11.3. SCOPE of EOT CRANE

11.3.1. Scope of Work

Scope of Work includes supply of the following:

- a) Two (2) Nos. – 105/25 tonne capacity double girder EOT cranes will be installed in A-B bay over operation floor for the TG hall. These cranes will work independently without tandem operation. Each crane will be supplied complete with all accessories under this specification and will include, but not be limited to the following for each crane.



- One (1) set of bridge girders complete with bridge rails, end stops, walkway platforms, access ladders, curved rail bent wheel stoppers for trolley etc.
- One (1) set of end carriages complete with minimum four (4) wheels for each end carriage and access ladders from gantry platforms, spring buffers etc.
- One (1) trolley with wheels and drive equipment for hoists and trolley drives complete with motors, gear reduction boxes, brakes, shaft bearings, limit switches etc.
- One (1) – set of crane longitudinal drive equipment complete with motor, gear reduction boxes, brakes, shaft bearings, gear pinions, limit switches etc.
- One (1) – Lot crane runway gantry rails complete with fixtures comprising of fixing clamps (machined to suit rail flange contour) bolts, nuts etc. for effective crane longitudinal runway length specified.
- Runway conductors (DSL) for the entire runway length complete with all insulators, supports, support brackets, fixing clamps, bolts, nuts etc. as specified and as required to complete with installation. Power supply cabling including isolating switch complete with electrical items, attachments and accessories as required to feed power to the runway conductor from Employer's terminal point.
- End stops & curved rail bends for crane longitudinal travel.
- Set of electrical conductors thru festooned/flexible trailing cables with Coburn track and trolley complete with fixtures arranged along bridge for power supply to trolley.
- Set of limit switches, electrical protective gear and various other needed electrical/control accessories.
- Complete electrical works including main disconnect, distribution boards, protective and control panel, controllers, pendent PB stations, resistors, conductors, insulators, protective and operating devices, cables, current collectors, cabling/wiring, grounding and illumination as may be necessary for the efficient, safe and satisfactory operation and maintenance of the crane.
- One (1) – Operator's cabin complete with accessories and attachments of the operation of the crane.
- Bridge and trolley current collectors and bridge cross conductors along with all wirings etc. for the crane as specified and as required to complete the scope of work.
- Operation and maintenance instruction manuals and drawings.
- Flushing oil and lubricants will be provided by the Contractor till commissioning.



- Crane components will be provided with lifting lugs, eye-bolts etc. at suitable locations for handling, assembling, lifting and placing into position.
- Paints and primers for painting at shop and at site and final painting will be as per the details given in painting section of NTA2 package.
- Training of Employer's personnel during testing and commissioning till the crane is taken over by the Employer.
- Hoist assembly will be provided with motors for creep & inching operations.
- Complete cleaning, protection and painting.
- Any additional equipment and materials or work which are not specifically mentioned, but are required to make the installation complete in every respect, will lie under the scope of this specification.

11.4. DUTY AND CAPACITY OF EOT CRANE

The EOT cranes will be used for unloading, erection, maintenance and general station service of steam Turbo-Generator and other associated auxiliary equipment to be installed in the TG Building.

The service duty is classified as 'Intermittent and standby service'

- Number of hours in service per annum : above 2000
- Number of cycles for fatigue calculations : 2x10⁵ in IS:3177/807 and relevant IS

Two (2) identical capacity EOT cranes will be installed in A-B bay over operating floor of the Power house. These cranes will work independently without tandem operation. Crane capacity will be designed for the single heaviest equipment to be handled in the TG hall (including lifting beam and slings) with a 10% margin (except generator stator).

The performance of the EOT cranes will be restricted to the following:

- | | Tolerance limit |
|---|--|
| a. Main hoist | |
| - Safe working load (SWL) | 105.0 T |
| -(With a margin of 125 percent of SWL) | |
| (Specified speeds need not be attained) | 131.25 |
| b. Specified speeds for all motions | 10 percent of value with main and
Creep speeds at full load |
| c. Deflection of main girder with SWL | Max. 1/900 of crane span |

Normally the cranes are operated intermittently for one (1) shift only, however during overhaul and maintenance of the equipment, the EOT crane may be required to work for all three (3) shifts on intermittent duty and should therefore be capable of such operation.



11.5. SPECIFIC REQUIREMENTS OF EOT CRANE

The specific requirements for individual cranes are given in the Data specification sheet and crane clearance diagram enclosed with this specification. In case of conflict between this specification and the data specification sheet, the latter will prevail.

11.6. DESIGN REQUIREMENTS AND CONSTRUCTIONAL FEATURES OF EOT CRANE

11.6.1. General

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

The crane will be rigid in construction and all movements will be smooth and non-jerky.

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

Casting and forgings will be of testes quality and will conform to their respective material specifications and will be free from flaws and objectionable imperfections, machined true and in a workman like manner.

No wood or other combustible material will be used unless specifically mentioned and approved by purchaser.

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

All fabrication by welding will be carried out by qualified and certified welders as per IS: 7318 (part 1).

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

The Contractor / Supplier will ensure that the crane will be manufactured as per the tolerances specified below:

i)	Span over LT wheels	:	± 6 mm upto 40 meters
ii)	Wheel base		
	LT	:	± 5 mm
	CT	:	± 3 mm



iii)	Difference in diagonal	
	LT	: ± 5 mm
	CT	: ± 3 mm
iv)	Long travel wheel alignment	: ± 1 mm
v)	Tilt of wheels or balancer axle	: ± 1 mm/ 1000 mm (Horizontal & Vertical)
vi)	Trolley wheel gauge	: ± 3 mm upto 7500 mm span ± 5 mm above 7500 mm span
vii)	Trolley track gauge	: ± 3 mm upto 7500 mm span ± 5 mm above 7500 mm span
viii)	Difference in height between trolley rails (H) in relation to the trolley track gauge (S) will be within the following tolerances.	
	'S' (mm)	'H' (mm)
	Upto 2500	: 4
	Above 2500 and upto 4500	: 6
	Above 4500	: 10
ix)	Horizontal bend of girder in plan	: Span/2000
x)	Shift of the web plates of main & end girders from vertical over height 'H' measured near the mid span & close to the main diaphragm.	: H / 200
xi)	Twist of the main girder	: Span/1500
xii)	Axis of the flange plates from the axis of the beam	: H / 250
xiii)	Tolerances on camber	
	Upto 4 mm	: + 4 - 0
	Above 4 mm and upto 8 mm	: + 5 - 0



	Above 8 mm and upto 16 mm	:	+ 6.3	
			- 0	
	Above 16 mm and upto 31.5 mm	:	+ 8	
			- 0	
	Above 31.5 and upto 63 mm	:	+ 10	
			- 0	
xiv)	Over buffer length (Over buffer dimension on two sides will be same)	:	± 5 mm	
xv)	Height of centre of buffer (from the top of track rail)	:	+ 5mm	

11.6.2. Temperature Effects

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

Maximum use will be of shop fabricated sub-assemblies.

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

11.6.3. Material of Construction

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

11.6.4. Load Indication

The crane bridge will have permanent inscription in English on each side, readily legible from operating floor, stating manufacturers name, serial no, the year of manufacture and the safe working load.

11.6.5. Structural Design Consideration

a) Minimum thickness of metal

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



the minimum thickness will be 8mm. The chequered plates for platforms will be minimum 6 mm thick over plane.

b) Accessibility for maintenance

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

Foot walks will be of sufficient width to give at least 500 mm clear passage on both sides of the girder except between railing and bridge drive Access stair case from the operating floor of the TG hall upto the crane girder level will be provided.

The platforms along the bridge girders and over the crab will allow convenient access for replacement, inspection, lubrication etc. for different mechanical and electrical components.

c) Ruling dimensions and ratios

- For compression members, the slenderness ratio will not exceed 120. In case of other load carrying members and subsidiary members the slenderness ratio will not exceed 180.

- For girders, the following values of maximum span to depth ratio will be governing as per IS: 807:

Plate girders : Span/depth = 18

Lattice girders : Span/depth = 12

d) Connections

- Unless otherwise specified and agreed by purchaser, only riveted or welded joints will be used.
- Where welding or riveting is not practicable, turned or fitted bolts will be used with the approval of Purchaser/consultant.
- Minimum number of rivets or turned or fitted bolts in a connection will not be less than two.
- Black bolts will not be used in main structures and high tensile bolts will not be used unless approved by the Employer. Bolts will preferably be not used in tension.
- Where bolts pass through sections having tapered flanges, tapered flats will be welded to inside of the flanges. Tapered washers will not be used.
- Transverse fillet welds on load carrying members will be avoided. If side fillets are used in end connections, the length of each side fillet should be not less than the edge distance between the fillets.
- Butt welds on structural members under tensile stress will be checked by Radiographic examination as and when directed by the Employer.
- Splices will be designed to resist one and half times the forces and moments to which it is subjected, but in no case it will be less than



2/3rd of the effective strength of the material spliced except that splices in the webs of the plate girders will 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 will be ten percent more than that of the material spliced. Splices will 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.

e) Deflections and Camber

- The total maximum vertical deflection of the girders for the live load plus trolley and not including impact or dead load of the girder will not exceed limit of Span/900.
- The girders will be cambered by an amount equal to the maximum deflection due to dead load plus one half the live load and trolley.

11.6.6. Mechanical Details

Material of Construction will be selected for cranes operating in non hazardous area and relevant IS for each part. The capacity, the rail length, span mentioned are indicative However the loads and the other dimensions will be taken from the layouts and weights of the equipments to be lifted in A-B Bay of TG Hall.

a) Rope drums

Rope of drums will be as per IS 3177. It will be either Seamless pipe of cast steel or fabricated out of rolled steel plates. Fabricated drums will be 100% radiographed and stress relieved before machining. The grooves of the drum will be machine grooved and smooth finished. Rope drum will be flanged at both ends. The cable reeling drums (wherever provided) will be positively driven.

b) Rope sheaves

Rope sheaves will be of cast steel or fabricated out of rolled steel plates.

c) Wire rope and Hook Block Assembly

- One (1) set of wire rope of entire length required for the lifting of main and auxiliary hooks will be provided.
- The lifting main hook block assembly will be ramshom type or approved equal of capacity greater than 40 Tonnes and auxiliary point hook with shank of capacity below 40 Tonnes and will be of steel construction. Each hook will be supported on ball or roller thrust bearing and will rotate freely on its bearings. The hooks will have locking arrangement.
- The sheaves of the hook block will be encased in an oil tight casing permitting generous lubrication of wire ropes and sheaves and also preventing accidental tapping of hands.
- All sharp edges on the hooks will be eliminated to prevent damage to the sling ropes. The hooks will conform to the requirements of IS: 3177 and IS: 15560.



- TG hall Main hook shall be of IS 5749 and Auxiliary hook shall be of IS 15560
- The ropes will be hemp cored for all cranes. Ropes will be regular right hand lay as per IS: 2266-1989. The construction of the ropes will be 6 x 37 upto 16 mm diameter and 6 x 36 above 16mm diameter. The rope length will be sufficient so that 2 full lap will remain on drum at the extreme low position of the hook. The braking loads for the hoist rope will not be less than the load factor specified in IS 3177.

a) Gears & gear- boxes

Straight and helical spur gearing will be used for all motions. Worm & bevel gearing may be used in exceptional cases with the specific approval of the Purchaser. All first reduction gears will have helical teeth. All pinion will be integral with the shaft.

All gears will be hardened and tempered alloy steel, heat treated and conforming to IS: 4460 having metric module. Overhung gears will not be used.

Surface hardness for pinion will be 255 to 300 BHN and for gears it will be 215 to 260 BHN. Difference in hardness of pinion and gear will not be less than 20 BHN. All cast steel gear will be tested by Gamma Ray. All gears will be enclosed in oil tight gear boxes. Gear-boxes will be of high Grade/cast steel or fabricated and split at each shaft centre lines. Fabricated gear boxes will be stress relieved before machining. For cross travel and long travel motion, vertical gear-boxes with 'T' split may be used.

b) Connection between rope drum & gear-box

One of the following arrangements will be adopted for connecting the rope drum with the gear- box.

- Flexible joint, incorporating flexible geared coupling housed within the drum.
- Fully flexible geared coupling between the drum & gearbox.

Drive of the drum by means of spring mounted on the drum will be avoided as far as practicable.

c) Wheels

Crab/crane wheels will be double flanged. Wheels will be mounted in anti-friction roller bearing housed in 'L' shaped bearing brackets for easy removal during maintenance. Flangeless wheels with guide rollers are also acceptable.

Solid wheels will be of forged rolled / cast steel. Wheels from 400 mm diameter and above may consist of hardened, rolled / forged steel tyre of not less than 60 mm thickness, shrunk on to cast iron center.

The hardness of the wheels shall be between 300-350 BHN with a depth of hardening 10mm.



d) Coupling

Motor shaft will be connected to the gear-box input shaft through flexible shock absorbing coupling excepting pin bush type. Rotating parts will be suitably covered by minimum 3.15 mm thick sheet steel hinged covers for safety. In case of single motor central drive for long travel motion, output shaft of the gear-box will be connected to the line shaft through half geared couplings. Intermediate lengths of the line shaft may be connected through solid flange couplings. Half geared couplings with floating shaft will be provided between the wheel and the line shaft.

e) Bearings & bearing housing

Anti-friction bearings will be used throughout except where required otherwise for technical reasons.

f) Buffers

Spring loaded/hydraulic type rubber buffers will be provided on all the 4 corners of the bridge girders and the end carriages for cross and long travel motions respectively based on the duty class of the crane whereas rubber buffer may be used for class M3 and M5 duty cranes. Amount of impact forces will be decided depending upon the type of buffers selected.

g) Bridge Girder and End Carriage

- The crane will have double girder.
- The bridge girder will be box section type or braced i - beam type as per standard design practice. The exterior surface will be smooth and as free as possible from projections etc. to minimize dust collection on it.
- The crane bridge will be carried on end trucks of suitable design. Each end truck will be built up from steel plates welded together to form a closed box section with opening at each end to receive the wheels. Welded to the trucks will be steel sections to form bearings for the wheel axles and the driving shaft. End trucks will be provided with rail sweep and bumper. They will also be provided with suitable jacking pads for maintenance of the wheel and bearings. The location of the jacking pads will be such that it will not interfere with the maintenance of the wheels and its bearing.
- Driving wheels will be of the double flange and taper tread type and will be ground to equal diameter in pairs. Wheel axles may be either of the stationary or rotating type as per standard practice. If stationary type, they will be prevented from turning in the truck by means of a key plate fitting into a slot in the end of the axle and if rotating type, wheels will be keyed to them.
- Where more than two bridge wheels are used per end truck, the end truck will be split into two sections, each carrying one bridge independent of other. Two sections of the end truck will be joined by suitable joining device that will ensure uniform wheel loading. Steel



pads will be welded on the tops of end trucks where the girder rests and will be machined to receive the girder ends.

- Trolley travel rail ends will be curved upwards to stop the trolley smoothly and prevent it from leaving the rails in case of over travel at its maximum speed.
- End trucks will be equipped with spring/rubber buffers and rail sweep for bridge travel. The rail sweep will be such that it can push away any object that may fall on the runway. The buffers will be of substantial design and suitable for engaging the stops at the end of runway.
- Breathing holes will be provided in completely enclosed welded box type girders. Drain holes will be provided in all places where water or oil is likely to collect where practicable, means of access will be provided for inside inspection of completely enclosed box girders.
- In bridge girder strength calculations, the trolley rails and chequered plates will not be considered as load carrying members.

h) Wheel Stops

Bridge and trolley wheel stops will be provided before the end stops. These will match to wheel radius. Wheel stops to prevent rails from creeping and trolley from running off the bridge will be abutted against ends of rails. Wheel stops will be welded to the girder.

Sweeps will be attached to the end carriages and to the trolley, to remove foreign material from the rails.

i) Brakes

All brakes will be of 'fail-safe' design and will operate automatically in case of power failure. Two brakes will be provided for all motions (One Electro hydraulic Thruster brake and One DC Electromagnetic brake) for double girder EOT cranes and one DC electromagnetic brake shall be provided for single girder cranes. Out of the two (2) brakes provided for hoisting motion, one will be provided at the gear box input shaft and other on motor side. Hoisting brakes will be designed to hold 1.5 times full load torque while cross travel and long travel brakes will be designed to hold 1.25 times full load torque.

j) Lubrication

Grouped lubrication system will be used for the cranes. Lubrication of the gears and pinions in the gear-boxes will be splash fed from the sump. In case of three reduction, vertical mounted gear-box (having limited motion), are used, an oil pump will be fitted to ensure lubrication of all gears.

k) Trolley Frame

- The trolley frame will be built up from heavy steel plates, angles and channels adequately braced to resist vertical, lateral and torsional strains, welded to form a rigid one piece frame. Alternatively, it may be



of cast steel construction and should be covered by flooring as far as possible.

- On bottom of trolley frame, on each side a double spring bumper will be provided to engage stops at each end of the bridge.
- Equalizer sheaves will be mounted on the trolley frame in such a manner that deflection resulting from the force on the sheaves is not directly transmitted to the hoisting mechanism.
- Sheaves will be so arranged on the trolley that rope reeling arrangement resulting there from will ensure a lifting of the load in almost a vertical line with minimum of swing or side-movement.

I) Platforms and Ladders

- Maintenance platform of 1m width at the crane girder level connecting A-B bay for maintenance purpose.
- Safe means of access will be provided at every place where any person engaged in the examination or maintenance of the crane has to work. Adequate handholds and footholds will be provided as necessary.
- One metre high double tier handrail and suitable toe-boards will be provided along the entire length of platform (on the bridge), which will not be less than 930 mm wide.
- Access ladders one (1) each for access (a) on either side from gantry girder level walkway to crane bridges walkway (b) from crane bridge walkway to Operator's cabin (c) from crane bridge walkway to suspended cradle.
- Every platform will be provided with steel chequered plate top and will be securely fenced with one metre high double tier hand rails and toe boards. Platforms will be of sufficient width to enable undertake of normal maintenance work.
- In case lattice riveted construction is offered for the bridge girder, full length chequered plate platform with adequate headroom will also be provided at bottom chord level for periodic checking of all rivets/bolts and other items.
- Access to operator's cabin from bridge girder platform will be by staircase having adequate width and proper sloping.
- Handrails will be of galvanized steel PVC coated pipe of flush welded construction, ground smooth using 32 mm nominal bore medium class pipe to IS: 1239. Hand-railing construction will be with double horizontal pipe runs, with top run about one (1) metre above walkway level. Toe plates of 100x6 mm thick or approved equal flat will be provided. Pipe posts will not be spaced more than 1.75 metre apart.
- All ladders will have 450 mm clear width and provided with 20 mm dia steel rod rungs spaced at 300 mm apart. Safety cage in steel welded



construction will be provided for ladders higher than 2.5 metres in height.

m) Runway Rails

- Crane runway rails with bolts and nuts and complete with shims, taper flats, anchor bolts, inserts and other fixtures for fixing the rails to crane girders will lie under the scope of supply of the present specification. Erection of LT rails & fixing of the same is included in the scope of the Contractor.
- The length of the rail supplied will be sufficient to cover the whole of runway length. Crane-runway rails of the sections will be joined by welding to make it continuous and there should not be any gap between the successive rails. End rails will be provided with stoppers to prevent longitudinal shifting.
- The rail section will be as per IS: 3443.

n) Trolley Rail

- The specification includes the supply of trolley travel rails complete with fixtures for fixing the rails to the body of crane.
- The length of the rail supplied will be adequate for maximum permissible trolley travel. Gap between successive rails will not exceed 2 mm and end rails will be provided with stoppers to prevent longitudinal shifting.

o) Rail Joints and Fixing

- Rail joints will be properly located and will be joined through flanged bolting/welding. All rail-to-rail joints should be butt welded except the building expansion joint. The rails will be butt jointed by either Thermit welding or Fusion welding process. The Crane vendor will get his proposal for edge preparation of rails, welding procedures and sequence approved in advance by the Employer.
- The schemes of securing the rails to the Gantry girder/bridge structure with dampers, bolts and nuts, their alignment etc. will be subjected to the approval of the Employer. Rail fixing arrangement will be such that the profiles of damp match the rail flange.

p) Tolerances

The limits of tolerance as specified in the Data Specification Sheet will be observed.

q) Rail End Stops

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

r) Drive Mechanism



- Equal driving effort will be applied at each drive wheel of bridge and trolley to prevent one end from travelling faster than the other.
- For bridge, the torsional deflection in the cross shaft will be limited to safe value.
- For bridge drive if twin motors are used, these motors will be equidistantly located at each wheel end. Suitable interlock will be provided to prevent single motor operation at any time.
- Trolley drive will be achieved by single motor in which the motor will drive a common output shaft through proper gearbox and traction power will be transmitted to the geared wheels by means of pinions mounted on both ends of the output shaft.
- All machineries for the drive unit will be properly aligned. Self-aligning type gear couplings will be used between connection shafts to take care of transverse as well as axial movement wherever necessary. Wherever components of considerable amount of inertia is directly mounted on the high speed shaft (e.g. brake drum, couplings, etc.) they will be balanced statically to minimize vibration.
- Motor rating will be calculated keeping margin of at least 15% over the maximum power requirement in the duty condition specified. Further, the hoist motors will be rated to lift 125% of the design load on the hook at the rated speed.
- Along with the drive mechanisms adequate brakes will be provided as detailed elsewhere in this specification. Selection and design of brakes will be the complete responsibility of the manufacturer. The brakes will be of accurate rating to stop each motion within a very short distance and in a safe and smooth manner.

ELECTRICAL DETAILS:

Scope of Supply

The scope of supply covers all electrical equipment commencing from Power Distribution Board (PDB), Isolator, cables, complete down shop leads (DSL) system in the shop and main current collectors on the crane and all other electrical items beyond the main current collectors of the crane i.e. DSL main current collectors, power disconnecting switch on bridge platform after main current collectors, protective and control switch gear, motors, VVFD, control and brake panels, resistors, brakes, limit switches, all power and control cables, socket outlets, lighting distribution panel and lighting fixtures with lamps, festoon cable system for crane trolley magnet/ grab and cable reeling drum, if specified for grab/magnet, master controllers, indicating lamps, push buttons, earthing materials etc. The scope of work also includes complete assembly and wiring of crane and testing at manufacture's works, erection and testing and commissioning of all electrical equipment, supply of all commissioning spares with minimum quantities as indicated in T.S.



All sundry erection materials required for installation and connecting up of electrical equipment with cable laying and fixing accessories will be included in scope of supply by Contractor.

Power supply to the crane will be from the 415V station PDB/ACDB meant for Crane/Hoist etc., as shown in the Electrical SLD.

Power supply and Standard voltage levels

The following standardized voltage levels will be adopted:

- a) LTAC : 415V, 3 phase, 50 Hz, 4 wire solidly earthed system. Power supply be made available at this voltage only. Other voltages will be obtained by providing transformer/ transformer – rectifier unit with MCBs on both primary and secondary side and $\pm 5\%$ and $\pm 10\%$ taps on transformers secondary.
- b) AC control and signalling voltage : 240 V, 110 V AC
- c) Socket outlets for Hand lamps : 24 V, single phase, 50 Hz, AC obtained through suitable transformers
Hand tools : 240 V, 15A, 2 pin plus earth with plug interlocked switch
- d) Electro-magnetic brakes : 220 V, DC obtained through individual brake control panels.
- e) Monitoring and signaling in electronic installations, mimic panels : 24/ 48 V. DC
- f) Illumination/ lighting : 240 V, AC

The three phase symmetrical short-circuit ratings of the switch gear at 415 V will be 50 kA for 1 second.

The system/ unit/ equipment will be designed so as to be suitable for the following variations in voltage and frequency :

	Voltage	Frequency
Permissible variations with rated performance, rated current and control effectiveness maintained	$\pm 10\%$ For LT system	+5% & -5%
Permissible variations for	$\pm 10\%$	+3% & -6%



control and regulation
equipment with rated
performance and control
quality maintained

Voltage dip on the starting of largest LT motor will be limited to 15% of the nominal voltage at the motor terminals. Total voltage dips on starting of large motors on crane will be limited to 3% on crane and 6% in DSL system.

Standards

The design, manufacture, assembly and testing as well as performance of the equipment will conform to the relevant IS specifications (latest revision). In case the Contractor is not in a position to comply fully with certain BIS specifications, or in respect of certain items for which there are no IBIS specifications, the Contractor may base his proposals on IEC recommendations or other reputed national or international standards subject to the approval of the Purchaser.

All equipment supplied and all work done including system design and detailed engineering will also comply with the statutory requirements of the Government of India and the Government of Tamilnadu and with the Indian Electricity Rules

Wherever specified, a set of batteries, a battery charger, one annunciation system and other accessories will also be provided along with magnet so that the magnet can hold the full load for atleast half an hour in case of power failure.

Equipment in operator's cabin and on pendant unit

a) Following will be included on the pendant unit:

Push button for	Hoist slow, hoist fast, lower slow, lower fast, left cross traverse, right cross traverse, forward long travel, backward long travel, emergency stop conditions.
Switch for	Lights and bells
Lamps for	Power 'ON' indication and emergency corner switch operation.

The Pendant Push Button station will be supported independently, earthed separately independent of suspension.

b) Cabin operated cranes:



The operator's cabin will contain the following:

- Master controllers for all the motions and magnet (wherever applicable).
- Emergency stop push button.
- Foot switch for alarm or bell.
- Switches for all lighting equipment on crane.
- Switches for exhaust fan and for cabin fan and air conditioner.
- A fire extinguisher.
- Insulating mat and operator's chair.
- Cabin light and fan.
-

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

c) Radio remote control:-

In this mode of control system, all the 3 motions

- Hoist .
 - Main/creep for main hoist &aux hoist separately.
 - Cross travel.
 - Long travel.
- can be controlled .

The system will have capability to provide range of 1.5 times the long travel distance of the crane.

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

The system will have facility of controlling speed in two steps:-

- I) Slow speed on the first step of the breaker contact / pushbutton of the radio remote control representing the first or second notch of the master controller.
- II) Full speed on the second step of the breaker contact / pushbutton of the radio remote control representing the final notch of the master controller.

Transmitter:-

Transmitter will have following features:-



- Constructed with sophisticated microprocessor technology and surface mounted electronics.
- Transmission type: - FM FSK
- Transmission speed: - 9.6 Kbps.
- Built in self test for all functions.
- Transmitter will consist of switching breaker, dial switch and push buttons.
- Switching breaker will be non locking to zero position or maintained function.
- Indications:-
- Operation status
- Battery status
- Indicators that display information from crane.
- PIN -code (Personal Identification Number)
- Internal antenna.
- Rechargeable battery.
- Battery 7.2 V NiCd
- Operating time: - About 8 hours.
- Different operating frequencies (minimum 16 nos.)
- Two hand upstart.
- Stop push button.
- Operating conditions: - Areas having large temperature variations, dusty, more vibrations, oil and humidity.
- Operating temperature range: - Min. 10 deg.C to Max. 60 deg.C
- Protection class: IP - 54.
- Casing material: Polycarbonate / ABS plastic.

Receiver:-

Receiver will have following features:-

- Upto 20 functions exclusive safety relays (for transmitting preset reference values to VFD in the crane).
- 2 safety relays (for control of main contactor)
- Power supply suitable for 240 V AC, 6 A.
- Minimum 16 different operating frequencies.
- Two redundant microprocessors for monitoring each others.
- Cyclically redundancy checks check for high security of transmitted radio messages.
- Frequency scanning in the receiver.
- Memories last 10 users.
- Interlocking of the relays.
- Momentary or latched relay functions.
- Two hand up start (to avoid unintentional start).
- Protection class: IP - 65.



- Casing material: Aluminium profile for fast mounting on DIN rail -
- Operating temperature range :- Min. 10 deg.C to Max. 60 deg.C

Enclosure Class

- a) For indoor operations
 - Resistance boxes : IP : 11
 - Motors : IP : 54
 - All other electric equipment : IP : 54

- b) For outdoor operations
 - Resistance boxes : IP : 33 with canopy
 - Motors & panel : IP : 55 with canopy
 - All other electrical equipment : IP : 65 with canopy

Cables

Power cable suitable for 3 Phase, 4 wire, AC power supply system.

All cables will have stranded copper conductors. Control wiring will be with 2.5 mm² copper; minimum size of power cable will be 6.0 mm². Fixed wiring on cranes will be carried out with PVC insulated. PVC sheathed armoured cable or EPR insulated CSP sheathed cable or better.

All flexible cables (i.e. cables for magnet, trolley, feed, pendant unit etc.) will have copper conductor, EPR insulation and CSP sheathing or better.

All cable will be suitably de-rated for grouping and higher ambient temperature.

All cables will be of 1100 Volts grade.

All accessories like cable glands, clamps, pipes, wire and terminal marks etc. will also be provided.

Cable laying and terminations will be such that the chances of cables getting damaged is remote.

Cable sizes will be selected considering motor rated current.

In all passages and on trolley the cable will be laid in trays and will be covered by similar trays and properly clamped & fixed.

- a) LT Power Cable

1.1 kV, heavy duty power cable, 4/3.5 core with stranded sector shaped (sm) or with compact circular stranded (rm/V) or circular stranded (rm) Copper conductors as applicable, PVC insulated suitable for type – ST2 operation as per IS:5831-1984, core stranded together provided with a common covering of Extruded PVC inner sheath, galvanized round steel wire / strip armoured and Extruded FRLS PVC outer sheathed, multi core conforming to IS:1554 (Part-I – 1988) Type TWY.

- b) Control Cables



1.1 kV, circular stranded (rm), annealed copper conductor, PVC insulated suitable for type ST1 (70°C) operation, as per IS:5831-1984, cores stranded together provided with a common covering of PVC inner sheath, galvanised round steel wire armoured and Extruded FRLS PVC outer sheathed, multi-core similar to IS:1554- (Part-I)-1988, Type YWY.

c) Flexible Trailing Cable

1.1 kV grade, heavy duty type with tinned annealed high conductivity flexible copper conductors, ethylene propylene (EPR) insulated and chlorosulphorated polyethylene (CSP) sheathed conforming to IS:8130-1984, IS:6380-1984 and IS:9968 (Part-I)-1988.

Earthing

A ring earthing system will be provided on the crane. Each and every electrical equipment will be connected to this earthing at least at two points. However the electronic circuit insulated earth wire will run in panel and terminate at main earth connection only at one point. The earthing will be connected to the fourth trolley line in DSL system through 2 nos of current collector. Additionally current collectors will also be provided on crane rails for earthing on crane . All these collectors will be connected to earthing ring.

An earth core will be provided in trolley feed cable and the magnet. The cable reeling drum will have a separate slipring for earthing purpose.

It will conform to general specification for earthing.

Rubber mattings will be provided in front of the protective and control panels.

All bonds between earth conductors and crane parts will be welded if possible, or rivetted and soldered. Where screwed bonds are made, care will be taken that there is satisfactory contact surface and nuts will be locked to prevent their loosening? Earth connections to equipment will be made by means of multi strand flexible conductor to adequate section.

The earth ring on the crane/ machine will be connected to the plant earthing system through to gantry rails. Each end of each gantry rail will be bonded to the plant earthing system.

In addition, intermediate earthing bond will also be provided on the rails at every 60 m in case of longer tracks.

Flexible copper bonds will be provided across any gap in the running gantry rail. For mobile equipment with flexible cables, one separate copper conductor of adequate size will be provided for earthing.

11.6.7. Operation

The crane will be operated either from cabin in the crane bridge and from a pendant control station and through remote control unit as specified in Data Specification Sheet

11.6.8. Operator's Cabin



- a) The operator's cabin will be steel fabricated open type, suitable for indoor service, and air conditioned, fire proof construction and complete with light, fan and seat. The cabin will be located on one end of the crane bridge and on the opposite side of Down Shop Lead (DSL) and under one of the bridge girders, so that it is offset to one side. The cabin will be provided with guarding handrails and the floor will be covered with electric insulating carpet. A clear headroom of 2300 mm will be ensured within the cabin. The cabin will be well braced in order to provide adequate strength and rigidity. The outside surfaces of the cabin and floor beams will present smooth and pleasing appearance.
- b) A foot operated type-warning gong will be provided within the cabin. The cabin will be compact and adequately sized (approximately 2.5x2x2.3 meters dear high) to accommodate controllers, protective panel, distribution board and other accessories required for operating the crane. Arrangement will be such as to provide unrestricted view of load at any position to the operator.
- c) Dead man's Handle/Control for each of the crane motions will be provided in the cabin.
- d) Cabin's platform will be provided with 10 mm thick rubber sheet on the floor to comply with I.E. Rules. No wooden paneling will be permitted. The sides of the cabin will be covered with plate steel to a height of one (1) metre. The floor will be designed for a load of 300 kg per metre square of floor area exclusive of the weight of any equipment mounted on or attached to the cab. An access ladder will be provided from the bridge girder to the Operator's cabin.
- e) In addition to above, accessories not limited to the following will be adequately arranged/ mounted in the cabin:
 - Manually operated master control switches, main line disconnecting switches and other necessary controls and wiring with fittings.
 - A swing way operator's chair.
 - Complete concise instructions covering the crane operation, maintenance and periodical lubrication etc typed in English and neatly framed in a permanent frame for each reference.
 - A non-oscillating-ventilating fan having 350 mm swing (240V AC, single phase) with suitable guard, and separate regulator.
 - Adequate fluorescent illumination with switch inside the cabin.
 - An electric alarm gong and an additional 300 mm dia hand operated metal gong.
 - Portable carbon dioxide fire extinguisher and sand bucket.
- f) Location of the cabin will be on one side of the crane so as to permit maximum visibility of all operations of the crane. Location of cabin and/or access ladder will be such as to prevent personnel from making accidental contact with crane and/or trolley runway conductors.



- g) Enclosure protection class of all Electrical equipment will be at least IP 54 or better except that for motor which will have IP-55 protection & Resistance boxes, which may have IP-23 protection.

11.6.9. Pendent Station

- a) The pendent station will locate the push buttons for controlling the various motions of the crane and will be hung from the crane trolley to a height of approximately 1 metre above the operating floor.
- b) With pendent operation, foot operated travel brake and the drum controllers need not be provided.

11.6.10. Repair Cage

- a) A repair cage will be provided on the inside of the end carriage for attending the main current collectors. In case, the trolley current collectors are located below trolley rail level on the inside webs of the bridge girders, guards will be provided on the trolley to prevent the hoisting ropes from coming in contact with conductors as well as a repair cage will be provided on the trolley to attend to these conductors.
- b) Repair cages will also be provided at the corners of the crane, if required, to facilitate removal and replacement of long travel wheels.
- c) The repair cages will be adequately sized, guarded for safety and correctly located for the intended service. Suitable access to the cages will be provided.

11.6.11. Guarding

- a) Guards of an approved design, which will push forward or off the rail track any object placed across it, such as person's foot or arm, will be attached to each end of the end carriage.
- b) Protection guards to live electrical wirings/conductors will be provided.
- c) Suitable guards to revolving shafts and coupling, long travel cross shafts and gears, will be provided.
- d) The sheaves of the hook block fitted with two sheaves or fewer will be guarded to prevent trapping of a hand between a sheave and the in running rope.
- e) Effective means of guiding the wire ropes over the sheaves will be provided so as to prevent dismounting of rope from the sheave grooves even when a slack rope condition is developed.
- f) All openings in foot walk flooring, for access to bottom chord platform, if any, and to other inspection platforms, will be provided with covers having suitable locking means to avoid any accidental opening.
- g) All electrical panels, resistance boxes and crane trolley wires will have suitable rain/dust hoods over them to prevent water and building construction material



falling on them, as it is apprehended that erection and commissioning of the crane might have to be taken up before the completion of the building roof.

Technical requirement: (DG EOT CRANE)

SL.NO	ITEM DESCRIPTION	DETAILS
1	Crane Model No.	
2	Quantity	2 Nos.
3	Type of Crane	Double Girder Over Head EOT Crane
4	Supplier/ Make	---
5	Capacity (t)	105/25T
6	Span (m)	To suit the layout requirement
7	Bay length	To suit the layout requirement
8	Duty Class	M5 Duty
9	Design fabrication and testing of crane confirm to standard/code no	IS 3177
10	Speeds (normal & Creep -10% of main speed) m/ min	As per specification
	a) Main hoist & creep	
	b) Aux. Hoist & creep	
	c) Cross travel	
	d) Long travel	
11	Height of lift (m)	To suit the layout requirement
	a) Main hook	
	Above floor	
	Below floor	
	b) Aux hook	
	Above floor	
	Below floor	
12	Crane rail height above floor (m)	
13	Max wheel load (t) (without impact)	
14	Type of cabin	
15	l) Type of hook:	
	a) Main hook	
	b) Aux hook	



SL.NO	ITEM DESCRIPTION	DETAILS
	ii) Material confirming to	
	a) Main hook	
	b) Aux hook	
	iii) Standard confirming to	
	a) Main hook	
	b) Aux hook	
16	Location (Indoor/ Outdoor)	Indoor
17	Hook approaches (m) Cabin end	
	a) Main hook	
	b) Aux hook	
	Other end	
	a) Main hook	
	b) Aux hook	
18	No of rope falls, dia, construction, & breaking strength, factor of safety, type of core & standard conforming to for	
	a) Main hoist	
	b) Aux hoist	
19	Sheave material, type of guard	
	a) Main hoist	
	b) Aux hoist	
20	Rope Drum Quantity, Material	
	a) Main hoist	
	b) Aux hoist	
21	Gantry rail size / Hardness	
22	Crab rail size/Hardness	
23	Over buffer dimension (m)	
24	Wheel base	
25	Wheel Type	
26	Material	
27	Hardness	
28	Wheel diameter / Nos provided for	
	a) LT wheel	
	b) CT wheel	



SL.NO	ITEM DESCRIPTION	DETAILS
29	Brake(Hoisting) type & quantity, Braking capacity	
	a) Main hoist	
	b) Aux hoist	
30	Brake(Traveling) type & quantity, Braking capacity	
	a) Cross travel	
	b) Long travel	
31	Handling attachments	
32	Special features (weighing device etc)	
33	Motor:	
	(Type, kW, rpm starts/ hr enclosure etc)	
	a) Main hoist	
	b) Aux hoist	
	c) Cross travel	
	d) Long travel	
34	Type of control for each motion with corresponding characteristic curve	
35	Method of obtaining creep speed	
36	Bearing Type & method of lubrication	
	a) Cross travel b) Long travel	
37	Power supply	
	- Power supply	
	- S.L.D:	
	- Electric equipment specification	
38	Control voltage	
39	Ambient temp/ Environment	
40	Total weight of the crane (t)	
41	Break up of crane weight (t)	
	a) Structural	
	b) Mechanical	
	c) Electrical	
42	Total weight of the crab (t)	
43	Code of design	
44	General arrangement drawing, incorporating the front and side elevations, plan, hook approaches, location of cabin/ pendant, down shop lead, clearance dimension, handling attachments and other relevant characteristics of the crane	



SL.NO	ITEM DESCRIPTION	DETAILS
45	Details of swiveling / rotating arrangement, if any, along with scheme.	
46	Any other information	

11.7. INSPECTION AND TESTING

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

Documents for all electrical and mechanical equipment supplied with the crane will be put up for inspection along with the equipment.

After inspection, an endorsement would be made in the inspection certificate about the availability of the documents.

The crane will be completely assembled and tested in the Supplier's works for full load and 25% over load on hoisting and cross traverse motion, in presence of Purchaser's / Consultant's representative in addition to other tests as specified in the latest revision of IS : 3177 as applicable.

The following test will be carried out at manufacturer's works during inspection.

- High voltage test of panels.
- Contactor sequence test for all motions.

Necessary clearance from statutory authorities (if any) will be obtained by the Contractor on behalf of the purchaser before the cranes are put under operation immediately after the cranes are commissioned. The crane after erection will be tested as follows:

- i. Insulation tests and other tests mentioned will be carried out as per the latest edition of IS: 3177 (as applicable).
- ii. Deflection Test
The deflection test of the bridge girders will be carried out as per latest edition of IS: 3177. After the deflection test with safe working load, there will not be any permanent set after the removal of the load.
- iii. Speed Tests
 - All motion of the crane will be tested with rated load on all notches at the time of commissioning of the crane at site and the speeds will be attained within the tolerance limit.



- All motions of the crane will be tested with 25% over load in which case the specified speeds need not be attained but the crane will show itself capable of dealing with the over load without difficulty.
 - Note for point ii and iii above:
Necessary test loads for testing at both shop floor and site will be arranged by Contractor / sub-contractor.
- iv. Brake Tests
- The hoist brakes will be capable of braking the movement with rated as well as over load. (150% for hoisting and 125% for traveling. However, the braking path with rated load will not exceed hoisting speed/ 150 for class 1 & 2 duty cranes, speed/ 120 for class 3 duty cranes, speed/100 for class 4 duty cranes.
 - The long travel and cross travel brakes will be capable of arresting the motion within a distance in meters equal to 10% of the speed in meter / min and the retardation due to braking will not exceed the values as given in the table below :

Working condition of the crane	Retardation, according to percentage number of driving wheels, in m/sec ²		
	100	50	25
Indoor (When $\mu = 0.2$)	1.5	0.75	0.40

Legend μ = Friction Factor

11.8. PERFORMANCE GUARANTEE OF EOT CRANE

- a) After erection and commissioning of equipment, performance tests will be carried out to prove the performance of the system and equipment.
- b) These tests will be binding on both the parties of the contract determine compliance of the equipment /system with the performance guarantee.
- c) All the equipment, tools and tackles and consumables like oil, grease required for successful completion of the performance tests will be supplied by the successful Contractor.
- d) All the instruments for the performance tests, as required, will be supplied by the successful Contractor and will retained by him till the satisfactory conclusion of all tests at site. All costs associated with the supply, calibration, installation and return of test equipment will be included in the scope of supply. All test instruments will be as per standards approved by the Purchaser.
- e) If the successful Contractor fails to achieve the guarantee and performance parameters, he will investigate the causes and will rectify and/or replace, free



of cost to the Purchaser the defects of the equipment/system within a period of 1 (one) month from the date of commencement of performance and guarantee tests and again prove the guarantees. In such cases, the cost of modifications including labour, materials, and cost of additional testing etc. will be borne by successful Contractor.

- f) If even after necessary alteration and modifications are affected, the performance guarantees are not fulfilled, the Purchaser reserves the right to reject the equipment. In the event of exercising this right, the successful Contractor will replace the defective equipment/ system with the equipment / system that meets the performance guarantee parameters. The cost of replacement inclusive of labour, materials and repeat testing to prove compliance with the performance guarantees will be borne by the successful Contractor. No time extension will be given for this type of replacement of equipment/ components
- g) The following basic performance parameter tests will be concluded:
- All equipment will operate at rated capacity without undue vibration and undue noise etc.
 - Measurement of noise and vibration levels as per relevant IS
 - Measurement of power consumption of various drive motors while operating at performance guarantee levels.
 - Continuous run system performance test.
 - All other parameters of the equipment or system indicated in Inspection and Testing section abide.

11.9. SPECIAL CLEANING, PROTECTION AND PAINTING OF EOT CRANE

The exposed surface of all items of equipment will be thoroughly cleaned and painted. Refer chapter on painting in this volume.

11.10. DRAWINGS, CURVES AND INFORMATION REQUIRED DURING DETAIL ENGINEERING OF EOT CRANE

Besides submitting the enclosed form sheets and schedules after filling in, the proposal will also include the following information:

- a) Crane clearance diagram filling in the various dimensions.
- b) General Arrangement Drawings of the E.O.T. crane assembly.
- c) Detail drawing showing the features of the components of the crane bridge and trolley.
- d) Drawings and data on the crane runway rail, and its method of attachment to runway main girder and general arrangement of runway rail end stops.
- e) Schematic drawings of hoisting mechanism, cross travel mechanism and long travel mechanism indicating all components as well as rope receiving arrangement and relative positions of equalizer sheaves.



- f) A detailed write-up on the crane control system. Drawings and data sheets showing the particulars of the controllers, switches, contactors, relays, other control devices and limit switches will be provided.
- g) A comprehensive write-up and/or Brochure on the details of the manufacturing facilities and the test facilities in the shop of the supplier will be provided.
- h) Other relevant data and particulars.
- i) Drawings showing general arrangement, clearance requirement, assembly, cross sectional data and materials of construction for –
 - EOT Crane Unit
 - Bridge Assembly and Components
 - Bridge End Trucks and Wheel Assembly
 - Trolley
 - Trolley Wheel Assembly
 - Drive and Transmission Unit for Bridge Travel, Trolley Travel, Main Hoist and Auxiliary Hoist.
 - Suspension Unit for Main Hook Block and Auxiliary Hook Block. Main Hook Block
 - Auxiliary Hook Block



FOR ELECTRICALLY TRAVELLING OVERHEAD CRANE

GUARANTEED PERFORMANCE REQUIRED (FOR EACH CRANE)

Capacity (Safe working load (SWL))	: Main hoist - 105 tonnes
	: Aux. Hoist - 25 tonnes
Rated speed (for any load from zero to SWL)	: Main hoist - 1 m/min, Aux. Hoist – 5 m/min Trolley travel – 15 m/min. Bridge trave – 25 m/min
Tolerance	: $\pm 10\%$
Creep speed	: 10% of rated speed for both main and auxiliary hoist
Deflection of main girder	: Max. of 1/900 of crane span with SWL

DESIGN AND CONSTRUCTION

Type	: Double Girder
Duty class: Mechanism class	: M5 as per IS-3177
Electrical service class	: S4
Design ambient temperature for Motors	: 50 Deg C
No. of starts per hour	: 150
No. of Trolleys	: One
Span between runway rail centres	: As per power house building floor drawings
Net runway length	: As per Power House building floor drawings
Runway conductors -	: MS Angle type
a. Material	:
b. Maximum allowable current density at 40 deg. Ambient (suitable derating factor will be considered for design ambient condition)	: 0.35 amps/sq.mm
Permissible tolerance	:
a. Difference in levels of crane rail top measured between two adjacent columns	: 2.0m
b. Crane rail gauge	: ± 3.0 mm
c. Relative shift of ends of	: 1.0 mm



adjacent rails in plan and elevation after welding

d. Deviation of crane rail axis : ± 3.0 mm
from centre line of web of supporting girder

e. Difference in levels of crane rail top (across the bay) :

i) At supports of crane girder : 15 mm

ii) At mid span of crane girder : 20 mm

f. Deflection of main girder : Max. 1/900 of Crane span with SWL

INSPECTION AND TESTING

Deflection test at : required
manufacturer's works

Radiography of structural welds in tension : required

Material testing and identification by : Manufacturer/Employer

Acceptance standard : IS-3177

Gear box assembly, hook test, wire rope test, routine test of electrical items : Certificate from the manufacturer



**VOLUME- IV
SECTION-9,
MOTORS**



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1 GENERAL

This specification is intended to cover the design, Engineering, manufacture, assembly, testing at manufacturer's works, supply in properly packed condition for transport to site and delivery of Electric Motor complete with all accessories for efficient and trouble-free operation of 2 x 500 MW Neyveli New Thermal Power Plant at Neyveli, Tamilnadu for Neyveli Lignite Corporation Limited.

2 CODES & STANDARDS

All equipment and materials will be designed, manufactured and tested in accordance with the latest applicable Indian Standards (IS) / IEC as given below except where modified and/or supplemented by this specification.

- IEC: 60034-1 : Rotating electrical machines.

- NEMA, MG-1 : Motors and Generators

- ISO : 1940-1 : Mechanical vibration – Determination of permissible residual unbalance

- IS : 325 : Specification for three phase induction motor.

- IS : 900 : Code of Practice for installation and maintenance of induction motors

- IS : 996 : Single phase AC motors

- IS : 1231 : Dimensions of three-phase foot-mounted induction motors

- IS : 1271 : Thermal evaluation and classification of electrical insulation.

- IS : 2223 : Dimensions of flange mounted ac induction motors.



- IS : 2254 : Dimensions of vertical shaft motors for pumps
- IS : 3043 : Code of practice for earthing.
- IS : 3177 : Crane duty motors
- IS : 4029 : Guide for testing three phase induction motors.
- IS : 4691 : Degree of protection for enclosures of rotating electrical machinery.
- IS : 4722 : Specification for rotating electrical machinery.
- IS : 4728 : Terminal marking and direction of rotation for rotating electrical machinery.
- IS : 4889 : Methods of determination of efficiency of rotating electrical machines.
- IS : 5571 : Guide for selection of electrical equipment for hazardous areas.
- IS : 6362 : Designation of Method of Cooling of Rotating electrical machines.
- IS : 8223 : Dimensions and output ratings for foot mounted rotating electrical machines with frame numbers 355 to 1000.
- IS : 8789 : Values of performance characteristics for



three phase induction motors.

- IS : 12065 : Noise level of motors.
- IS : 12075 : Measurement and evaluation of vibration of rotating electrical machines.
- IS : 12615 : Induction motors - Energy efficient, three-phase, squirrel cage - Specification
- IS : 12802 : Temperature rise measurement of rotating electrical machines
- IS : 12824 : Type of duty and classes of rating assigned.
- IS : 14222 : Requirements and method of Impulse withstand test
- DIN/IEC/IS : RTD
- BS 5308 part II : RTD triad Cable

Equipment and material conforming to any other standard, which ensures equal or better quality, may be accepted. In such case, copies of the English version of the standard adopted will be submitted along with the bid.

The electrical installation will meet the requirements of Indian Electricity Rules as amended upto date and relevant IS Code of Practice. In addition, other rules and regulations applicable to the work will be followed.

3 DESIGN CRITERIA

All motors will be suitable for an ambient temperature of 50 degree C and relative humidity of 85%. The motors will be suitable for operation in a highly polluted environment.

AC Motors will be of constant speed, squirrel cage, three/ single phase, induction type. Motors will be rated for continuous duty. They will also be suitable for long period of inactivity.



DC motors provided for emergency service will be shunt / compound wound type. Motor will be sized for operation with fixed resistance starter for maximum reliability.

Power supply for AC motors will be as follows:

- Below 0.22 kW : 240V, 1 Phase, 50Hz
- From 0.22 kW upto & including 160 kW : 415V, 3 Phase, 50Hz
- Above 160 kW upto & including 750 kW : 3.3kV, 3 Phase, 50Hz
- Above 750 kW : 11KV, 3 Phase, 50Hz

All AC motors will be suitable for following voltage & frequency variations as follows:

- Voltage Variation : (\pm) 10%
- Frequency Variation : (+) 3% to (-)5%
- Combined Variation of Voltage & Frequency : 10% (absolute sum)

The motor characteristics will match the requirements of the driven equipment so that adequate starting, accelerating, pull up, break down and full load torques are available for the intended service.

Moreover, motors will be so designed that maximum inrush currents and locked rotor and pullout torque developed by them at extreme voltage and frequency variations do not endanger the motor and driven equipment.

For 11kV motors, locked rotor current not to exceed 600% of full load including positive tolerance except BFP & CWP. (For BFP & CWP the starting current will be 450% of FLC). For 3.3 kV and 415 V motors Locked rotor current not to exceed 600% of full load with IS/IEC tolerance.

Maximum continuous motor ratings will be at least 15% above the maximum load demand of the driven equipment under entire operating range including voltage and frequency variations.

Accelerating torque at any speed with the lowest permissible starting voltage will be at least 10% motor full load torque.



The motors will be suitable for bus transfer schemes provided on the 11KV, 3.3kV and 415V systems without any injurious effect on its life. If motors are connected to an automatic bus transfer system, they may be subjected to 150% of the nominal voltage during changeover of buses due to the phase difference between the incoming voltage and motor residual voltage. In such cases, Motors will be capable of restarting under full load after momentary loss of voltage.

Motors will be of energy efficient of type Eff-2 as per IS: 12615/equivalent IEC/ International Standards.

Motor will be designed to keep torsional and rotational natural frequencies of Vibration of the motor and driven equipment atleast 25% above the motor operating speed range.

System Grounding

- (a) 11 kV , 3.3 kV : Low Resistance Grounded to limit the earth fault current to 300 Amps
- (b) 415 V : Solidly Grounded
- (c) 220V DC : Ungrounded

Fault Level

- (a) 11 kV , 3.3 kV : 40 kA for 1 second
- (b) 415 V : 50 kA for 1 second
- (c) 220V DC : 15 kA for 1 second

Degree of Protection

- (a) Indoor Motors : IP 54
- (b) Outdoor Motors : IP 55
- (c) Cable Box located in Indoor Area : IP 54
- (d) Cable Box located in Outdoor Area : IP 55

Winding Insulation

- (a) For 11 kV/3.3 kV AC Motors : Class - F



(b) For 415V AC Motors : Class - F

(c) For 220V DC Motors : Class - F

Winding Conductor Material

(a) For 11 kV/3.3 kV AC Motors : Copper

(b) For 415V AC Motors : Copper

(c) For 220V DC Motors : Copper

Bearing

(a) For Drive End : Roller

(b) For Non Drive End : Roller / Ball

Temperature Rise

(a) For Air Cooled Motors : 70 °C over ambient temperature

(b) For Water Cooled Motors : 80 °C over inlet cooling water
temperature

Motor Earthing

(a) Motors above 90 kW : 50 x 6 mm GI Flat

(b) Motors above 30 kW and upto 90 : 25 x 6 mm GI Flat
kW

(c) Motors above 5 kW and upto 30 : 25 x 3 mm GI Flat
kW

(d) Motors upto 5 kW : 8 SWG GI Wire

(e) Terminal Box : 8 SWG GI Wire

Space Heater



- (a) For Motors and above 30 kW : Space heater suitable for 1Phase, 240V AC, 50 Hz supply
- (b) For Motors below 30 kW : No Space heater provided.

Painting

- (a) Paint Type : Epoxy based with approved class
- (b) Paint Thickness : Within 100 to 150 micron.

4 SPECIFIC REQUIREMENTS

4.1 Locked Rotor Withstand Time

HT Motor

- The locked rotor withstand time for HT motors under hot conditions at 110% rated voltage will be more than the starting time at minimum permissible voltage by at least three seconds or 15% of the accelerating time whichever is greater.
- Provision of speed switches will be avoided to the extent possible. In case speed switch is required to mount on the motor shaft, the same will remain closed for speeds lower than 20% and open for speeds above 20% of the rated speed. The speed switch will be capable of withstanding 120% over speed in either direction of rotation.

LT Motor

- The starting time of the motor will be at the minimum permissible voltage.
- For motors with starting time upto 20 seconds at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit will be at least 2.5 second more than starting time.
- For motors with starting time more than 20 second and upto 45 seconds at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit will be at least 5 second more than starting time.
- For motors with starting time more than 45 seconds at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit will be more than starting time by at least 10% of the starting time.
- Speed switches mounted on the motor shaft will be provided in cases where above requirements are not met.



4.2 Starting Voltage Requirement

- (a) 85% upto 1500 kW
- (b) 80% for above 1500 kW upto 4000 kW
- (c) 75% > 4000 kW

Motor will be designed for direct on line starting at full voltage. Starting current will not exceed 6 times full load current (subject to IS tolerance) for all auxiliaries.

The motor will be capable of withstanding the stresses imposed if started at 110% rated voltage.

H.T Motor will start with rated load and accelerate to full speed with 80% rated voltage at motor terminals except for mill motors for which 90% RV will be the minimum starting voltage. L.T Motor will start with rated load and accelerate to full speed with 85% rated voltage at motor terminals.

Pump motor subject to reverse rotation will be designed to withstand the stresses encountered when starting with non-energized shaft rotating at 125% rated speed in reverse direction.

The motor may be subjected to sudden application of 150% rated voltage during bus transfer, due to the phase difference between the incoming voltage and motor residual voltage.

The motor will be designed to withstand any torsional and/or high current stresses, which may result, without experiencing any deterioration in the normal life and performance characteristics.

4.3 Winding and Insulation

- (a) Type : Non-hygroscopic, oil resistant, flame resistant
- (b) 11 kV and : Winding material will be of copper. Insulation will be
3.3 kV AC of Class F with winding temperature rise limited to
motors Class B. They will withstand 1.2/50 microsecond
switching surges of "4U + 5 KV" (U = Line voltage in
KV). The coil inter-turn insulation will be suitable
for 0.3/3 micro second surge of 32 / 12 KV
followed by 1 min power frequency high voltage



test of appropriate voltage on inter turn insulation.

- (c) 415V AC & : Winding material will be of copper. Insulation will be
220V DC of Class F with temperature rise limited to Class B.
motors
- (d) Conveyor Short circuit rings of conveyor motors will be either
motors joint less or welded type. Brazed joint is not
acceptable.

4.4 Motor Control

(a) For HT Motors

- Motors of rating above 160 kW and up to 750 KW will be suitable for 3.3 KV voltage
- Motors above 750 KW will be suitable for 11 KV voltage.
- Frequent starting motors of rating above 160 kW to 750 kW will be suitable to be controlled by vacuum contactors

(b) For LT Motors

- Motors of rating less than 90 kW will be operated by Contactor Electronic overload relays etc. from respective MCCs.
- Motors of rating up to 18.5 KW will be provided with MPCBs.
- Motors of rating above 18.5 KW and below 45 KW will be provided with MCCBs.
- Motors of rating 45 KW and above but less than 90 KW will be provided with MCCBs with CT operated Electronic over load relays .
- Motors of rating 90 KW and up to 160 KW will be suitable to be



controlled by Air circuit breakers from PCC, PMCCs, and will be provided with comprehensive numerical motor protection relays.

4.5 Starting duty

Motors will be suitable for 3 nos. consecutive Cold starts up and 2 nos. consecutive Hot starts up. Motors will be suitable for three equally spread starts per hour when the motor is under normal service condition. However in case of multiple start motors like conveyor motors three starts will be allowable from hot condition with maximum 20 starts per day and minimum 20,000 starts during life time of motor.

4.6 Bearings

- Anti-friction type radial and thrust bearings (ball, roller) and sleeve bearing will be rated for minimum standard life of 40,000 hours taking bearing and driven equipment loads (in case the drive is not having separate thrust bearing) into account. If bearings are lubricated, loss of grease will be scarce and it will not creep along shaft into motor housing. Facility of removal of excess grease will also be provided for grease lubricated bearings.
- Vertical shaft motors will be provided with thrust and guide bearings. Thrust bearing of tilting pad type is preferred. However, if Anti-friction bearings can take vertical thrust, thrust & guide bearings are not required.
- Bearing will be effectively sealed against dust ingress and will be pressure grease gun lubricated. The bearing and housing will be so designed that greasing will be possible while the motor is running, without removal of covers.
- Where bearing supports are attached to the motor casing, adequate bracing will be provided on these supports to reduce vibrations and ensure life of bearings.
- If the bearings are oil lubricated, a drain plug will be provided for draining residual oil and oil level gauge will be provided to show precisely oil level required under standstill and running conditions.
- Unless otherwise approved, bearing lubricating system will be such that no external forced oil or water is necessary to maintain required oil supply to keep bearing temperature within design limits.
- Lubricants will be selected for prolonged storage and normal use of motors in tropical climate and will contain corrosion and oxidation inhibitors. Greases will have suitable bleeding characteristics to minimize setting. The selected lubricants will be indigenously available.
- Motors rated above 1000 kW will have insulated bearings to prevent flow of shaft currents.

4.7 Temperature Rise

- For Air Cooled Motors, temperature rise of insulation should be limited to 70 Deg C over ambient temperature by resistance method.



- For Water Cooled Motors, temperature rise of insulation should be limited to 80 deg. C over inlet cooling water temperature mentioned elsewhere, by resistance method.

4.8 Cooling

All motors will be either Totally Enclosed Fan Cooled (TEFC) or Totally Enclosed Tube Ventilated (TETV) or Closed Air Circuit Air Cooled (CACCA) type. However, motors rated 3000 kW or above can be Closed Air Circuit Water Cooled (CACW).

4.9 Enclosure

- All motor enclosures will conform to the degree of protection of IP54 for indoor and IP-55 for outdoor installation unless other wise specified. Motor for outdoor or semi outdoor service will be of weather proof construction. Motors of large output rating located indoor could have screen protected drip proof (SPDP) enclosure conforming to IP-23.
- For motors located in outdoor & corrosive locations, FRP canopy will be provided. In case steel canopy is provided, the same will be epoxy painted to meet the surrounding atmosphere. Motors located in hazardous areas will have flame proof enclosures conforming to IS: 2148 as detailed below:

- Fuel oil area : Group – IIB

4.10 Noise Level and Vibration

- Noise level will be limited to 85 dB (A) at 1.5 meters from the motor. However the same will be as per IS: 12065 unless otherwise specified. The peak amplitude of vibration will be within the specified limits laid down in IS: 12075. Motors will withstand vibrations produced by driven equipment. HT motor bearing housings will have flats in both X and Y directions suitable for mounting 80mmX80mm vibration pads. Vibration pads with screwed holes for mounting vibration probes will be provided along with motors at both DE and NDE.

4.11 Temperature Monitoring

In HT motors, atleast four numbers simplex/ two numbers duplex platinum resistance type temperature detectors will be provided for each phase of stator winding. Each bearing will be provided with dial type thermometer with adjustable alarm contact and two numbers duplex Platinum resistance type temperature detector (3 wire 100ohm at zero deg C). In case of CACA and CACW motors dial type temperature indicator will be provided (one each for hot and cold air temperature monitoring for CACA and CACW and one each for inlet and outlet water temperature monitoring for CACW). If alarm and trip



are required for cooling air temperature, temperature switch will be provided. The contact rating will be minimum 0.5A at 220V DC and 5A at 240V AC. Flow switches will be provided for monitoring cooling water flow of CACW motor and oil flow of forced lubrication bearing. The contact rating will be minimum 0.5A at 220V DC and 5A at 240V AC.

4.12 Earthing

Motor body will have two earthing points on opposite sides. Motor terminal boxes will also have separate grounding terminals.

4.13 Termination

- HT motors can be offered with either Elastimold termination or dust tight phase segregated double walled (metallic as well as with insulated barrier) cable boxes. In case Elastimold terminations are offered, then protective cover and trifurcating sleeves will also be provided. Removable gland plates of thickness 3 mm (hot/cold rolled sheet steel) or 4 mm (non magnetic material for single core cables) will be provided in case of cable boxes. The main cable box / terminal box will withstand a fault current upto 40 kA for 0.25 seconds for MV motors and 50 kA for 0.25 seconds for LV motors. Separate terminal boxes will be provided for space heaters and RTDs.
- Terminal box shall be capable of being turned through 360 degrees in step of 90 degrees. However in case of rectangular type, terminal box will be rotatable in steps of 180 degree.
- For HT motors the distance between gland plate and the terminal studs will not be less than 500 mm.
- Minimum inter-phase and phase-earth air clearances for LT motors with lugs installed will be as follows:

Table 4.1

Minimum inter-phase & Phase earth air Clearances

S.No	Motor MCR in kW	Clearance, in mm
1	Up to 110kW	10
2	Above 110 and Up to 150kW	12.5
3	Above 150kW	19

4.14 Differential Protection

- For motors rated 11kV, 1000 KW & above, neutral current transformers of PS class will be provided on each phase in a separate neutral terminal box for differential protection.



4.15 Tropical Protection

- All motors will have fungus protection involving special treatment of insulation and metal against fungus, insects and corrosion.
- All fittings and hardwares will be corrosion resistant.
- Space Heater
- Suitable single phase space heaters operated at 240V, 50Hz, 1Phase AC supply will be provided on motors rated for 30KW and above to maintain windings in dry condition when motor is standstill. Separate terminal box for space heaters & RTDs will be provided.
- The space heater will be sized to maintain the motor internal temperature above dew point when the motor is in idle condition.
- For motor below 30KW, the motor winding will be suitable for continuous heating.

4.16 Rating Plate

Motor will have Stainless steel nameplate(s) showing diagram of connections, all particulars as per IS: 325 / NEMA-MG-1 and following additional information:

- a) Type of bearing and recommended lubricants along with location of insulated bearing.
- b) Temperature rise under normal/abnormal conditions.
- c) In addition to above, an arrow block will be screwed on to the body of motor on the non-driving end to indicate normal direction of rotation of motor.
- d) Year of Manufacture

4.17 Drain Plug

Motor will have drain plugs so located that they will drain the water, resulting from the condensation or other causes from all pockets of the motor casing.

4.18 Dowel Pins

Motor will be designed to permit easy access for drilling holes through motor feet or mounting flange for installation of dowel pins after assembling the motor and driven equipment.

4.19 Painting

The complete motor assembly including fan will be painted with corrosion proof paints of approved class.

4.20 Lifting provision

Motor weighing 25 Kg or more will be provided with eyebolt or other adequate provision of lifting.

5 TESTS

5.1 HT Motors

5.1.1 Routine Test



All equipment will be completely assembled, wired, adjusted and routine tested as per relevant IS / IEC Standards at manufacturer's works in the presence of consultant / purchaser or his representative.

5.1.2 Type Test

For each type & rating of HT motors the Contractor will submit for Owner's approval the reports of all the type tests as per relevant standards and carried out within last five years from the date of bid opening. These reports should be for the tests conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been conducted at an independent laboratory.

In case the Contractor is not able to submit report of the type test(s) conducted within last five years from the date of bid opening, or in case the type test report(s) are not found to be meeting the specification requirements, the Contractor will conduct all such tests under this contract free of cost to the Owner and submit the reports for approval.

5.2 LT Motors

5.2.1 Routine Test

All equipment will be completely assembled, wired, adjusted and routine tested as per relevant IS/IEC Standards at manufacturer's works in the presence of consultant / purchaser or his representative.

5.2.2 Type Test

LT motors will be of type tested quality. For each type & rating of LT motors rated above 50 KW, the Contractor will submit for Owner's approval the reports of all the type tests as per relevant standards and carried out within last five years from the date of bid opening. These reports should be for the tests conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been conducted at an independent laboratory.

In case the Contractor is not able to submit report of the type test(s) conducted within last five years from the date of bid opening, or in case the type test report(s) are not found to be meeting the specification requirements, the Contractor will conduct all such tests under this contract free of cost to the Owner and submit the reports for approval.

5.3 Test Witness

The tests will be carried out in presence of the Owner's representative, for which a minimum 7 days notice will be given by the Contractor. The Contractor will obtain the Owner's approval for the type test procedure before conducting the type test. The test procedure will clearly specify the test set-up, instruments to be used, procedure, acceptance norms, recording of different parameters, interval of recording, precautions to be taken etc. for the type test(s) to be carried out.

5.4 Test Certificates

- Certified copies of all tests carried out at works and at site will be furnished in requisite no. of copies for approval of the Owner.



- The equipment will be dispatched from works only after receipt of Owner's written approval of shop test reports.

6 DRAWINGS, DATA & MANUALS

Drawings, data & manuals for the motors will be submitted as indicated below:

Dimensional General Arrangement drawing

- Motor sizing calculation
- Foundation Plan & Loading
- Cable end box details
- Space requirement for rotor removal
- Thermal withstand curves hot & cold
- Starting and speed torque characteristics at 80% & 100% voltage
- Complete motor data
- Erection & Maintenance Manual
- Test reports
- QAP



**VOLUME- IV
SECTION-16
LV POWER & CONTROL CABLE**



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1 GENERAL

This specification is intended to cover the design, engineering, manufacture, assembly, testing at manufacturer's works, supply & delivery, properly packed for transport to site of LT Power & Control Cable complete with all accessories for efficient and trouble-free operation for 2 x 500 MW Neyveli New Thermal Power Plant at Neyveli, Tamilnadu for Neyveli Lignite Corporation Limited.

2 CODES AND STANDARDS

All equipment and materials will be designed, manufactured and tested in accordance with the latest applicable Indian Standards (IS) / IEC as given below or any international standard acceptable to purchaser.

IS:1554(Part I) : PVC insulated(heavy duty) electric cables for working voltage up to and including 1100V

IS:1554(Part II) : PVC insulated(heavy duty) electric cables for working voltage from 3.3kv up to and including 11Kv

IS: 3961 : Recommended current ratings for cables.

IS: 8130 : Conductors for insulated electric cables and flexible cords

IS:5831 : PVC insulation and sheath of electric cables

IS: 2982 : Copper conductor in insulated cables and cords.

IS: 3975 : Mild steel wires, strips and tapes for armouring cables

IS: 5609 : Specification for low frequency wires and cables with PVC insulation and PVC sheath

IS: 6380 : Specification of elastomeric insulation of sheath of electric cables.

IS: 434(I and II) : Specification for rubber insulation cables.

II)



- IEC: 540 : The methods for insulations and sheath of electric cables and cords(elastomeric and thermoplastic compounds)
- IEC: 230 : Impulse tests on cables and their accessories
- IEC: 60 : High voltage test techniques
- IEC: 287 : Calculation of the continuous current rating of the cables(100% load factor).
- IEC: 288 : Nominal cross sectional area and composition of conductor of insulated cables.
- IEC: 502 : Extruded solid dielectric insulated power cables for rated voltages from 1kV upto 30kV.
- NEMA-WC-5 : Thermoplastic insulated wires and cables for transmission and distribution of electrical energy.
- IEEE: 383 : Standard for type test for class IE electric cables, filled splices and connection for nuclear power generation station.
- IEC: 332-1 : Test on electric cables under fire conditions.
- ASTM-D-2843 : Standard test method for density of smoke from burning/decomposition of plastics.
- ASTM-D-2863 : Test for determination of oxygen index.
- IEC-754-I : Test method for acid gas generation
- IEC-331 : Fire resisting characteristics of electric cables



SVENSK Standard SS-4241475 Class F3

- BICC Hand Book For cables in fire regarding temperature index-chapter-6
- Indian Electricity Rule.

Equipment and material conforming to any other standard, which ensures equal or better quality, may be accepted subject to approval of the Owner. In such case, copies of the English version of the standards adopted will have to be submitted along with the bid.

The electrical installation will meet the requirements of Indian Electricity Rules as amended upto date and relevant IS Codes of Practice. In addition, other rules and regulations applicable to the work will be followed.

3 DESIGN CRITERIA

The cable will be used for connection of power and control circuits of the auxiliary electrical systems.

The cable will be suitable for installation in the required site conditions.

Cables will be sized suitably with proper derating factors as per the installation conditions of the cable.

For continuous operation at specified rating as well as during short circuit condition the maximum conductor temperature will be limited to the permissible value as per relevant standard.

The insulation and sheath materials will be resistant to oil, acid and alkali and will be tough enough to withstand mechanical stresses during handling.

Armouring, wherever provided, will be single round/ flat wire of galvanised steel for multi-core cables and aluminium for single core cable. Cables in buried formation will be armored. Cables laid in duct banks/conduits will be unarmoured.

The outer sheath as well as the inner sheath will have flame retardant low smoke (FRLS) characteristics and will meet the requirements of additional tests specified for this purpose.

Core identification for multi-core cable will be provided by colour coding.

Power cables will be chosen taking into account the following factors:

- a) System Fault level.
- b) Maximum time for fault clearance (i.e, operating time of the back up protection relays plus the time of operation of the circuit breakers).
- c) Full load current of the circuit.
- d) Short circuit current and duration 0.2 sec (for breaker protected cables)
- e) Installation conditions.
- f) Voltage drop under normal running and starting condition
- g) Voltage drop at motor terminals will be within permissible limit during starting & normal running.



- h) The cable should withstand the maximum fault current corresponding to the particular voltage level for the minimum time before the fault is cleared.
- i) Consideration will also be given to limit the cable to the nearest standard sizes instead of using too many types.
- j) The standard cable sizes, ampacities, derating factors, etc. will be as given in IS or relevant standard.
- k) The minimum size of power cables to be used will be as follow :
 - Aluminium conductor : 6 Sq. mm.
 - Copper conductor : 2.5 Sq. mm.

4 SPECIFIC REQUIREMENTS

4.1 Type of Cable

LV power cables will be stranded aluminium conductor, cross linked polyethylene (XLPE) insulated, extruded black FRLS PVC inner sheathed, armoured and overall FRLS extruded black PVC sheathed cables conforming to IS : 7098.

Control Cables will be 1100 V grade with annealed high conductivity stranded copper conductor, PVC insulated, FRLS PVC inner sheathed, armoured and FRLS extruded black PVC outer sheathed cables conforming to IS : 1554.

4.2 Conductor

The cable conductor will be made from standard Aluminum for LT Power cables and Copper for control cables to form compact conductor having a resistance within the limits specified. All the cables of size 25mm² and above will have sector shaped conductors.

4.3 Insulation

The insulation of the LV power cable will be XLPE type & for control the insulation will be PVC type. It will be designed and manufactured for the specified system voltage. The manufacturing process will ensure that insulation will be free from voids. The insulation will withstand mechanical and thermal stresses under steady state and transient operating conditions. The extrusion method should give a very smooth interface between semi conducting screen and insulation. The insulation of the cables will be of high standard quality.

4.4 Inner Sheath

The sheath will be suitable to withstand the site conditions and the desired temperature. It will be of adequate thickness and applied by a continuous process to produce a sheath of consistent quality free from all defects. PVC sheath will be extruded.

4.5 Armour

Hard drawn aluminum wire armouring/ galvanized steel tape/ wire armouring will be used for single core and multi-core cable respectively. Cables should be un-armoured wherever indicated. The hard drawn aluminium wire for armour will be of H4 grade, as per IS-8130 (having tensile strength above 150 N/mm²). The



diameter of the aluminium wire will be as per the table for the dimensions of the galvanized steel wire armour given in the relevant standard.

4.6 Outer sheath

FRLS extruded black PVC serving as per IS: 1554 otherwise will be applied over the armouring with suitable additives to prevent attack by rodent and termites. All serving must be given anti-termite treatment.

4.7 Packing

- Cables will be supplied in non-returnable drums. Drum lengths will be such so that cable joints are totally avoided. The drums will be of heavy construction. All wooden parts will be manufactured from seasoned wood. All ferrous parts used will be treated with suitable rust preventive finish or coating to avoid rusting during transit or storage. Wooden cable drum will be treated by immersing in copper-nitrate solution.
- The ends of each cable length will be sealed before shipment. Heat shrinkable cable cap will be used for this purpose.
- A label will be securely attached to each end of the reel indicating the Purchaser's order number, Owner's identification mark i.e. "NNTPS ", length, type, voltage grade, conductor size and number of cores of the cable. A tag containing the same information will be attached to the leadings end of the cable inside. An arrow and necessary instructions will be marked on the drum indicating the direction in which it should be rolled. Drum numbers are to be indicated on the cable drums.

4.8 Spare Core

Multi-core control cables will have 20% spare core, minimum one spare.

Separate cables for each type of following services / functions as applicable will be used for each feeder. Same multi-core cable using different services will not be acceptable.

- a) Power.
- b) Control, interlock and indication.
- c) Metering and measuring.
- d) Alarm and annunciation.
- e) C.T. Cables.
- f) V.T. Cables.

4.9 Constructional Requirements

- a) Cable will have suitable fillers laid up with the conductors to provide a substantially circular cross section before the sheath is applied. Fillers will be suitable for the operating temperature of the cable and compatible with the insulating material. All materials will be new, unused and of finest quality.
- b) Workmanship will be neat, clean and of the highest grade.
- c) LT Power cables will be 1.1kV grade, heavy duty, stranded aluminium conductor, XLPE Insulated galvanized steel wire/strip armoured, flame retardant low smoke (FRLS) extruded PVC type outer sheathed.



- d) Control cables will be 1.1kV grade, heavy duty, stranded copper conductor, PVC Type-A insulated, galvanized steel wire armoured, flame retardent low smoke (FRLS) extruded PVC of Type - ST1 outer sheathed.
- e) Special Properties:
All the above cables will be conforming to the relevant Indian/IEC standard in general, with the following special properties:
- Oxygen Index of the outer sheath will not be less than 29, when tested as per ASTM-D-2863.
 - Temperature Index of the outer sheath will not be less than 250 °C, when tested as per ASTM-D-2863.
 - Halogen acid contents in outer sheath will not be more than 20%, when tested as per IEC-60754.
 - The maximum smoke density in percent light absorption should not exceed 60% in case of PVC compound and 20% in case of fire survival cables, when tested as per ASTM-D-2843.
 - Swedish chimney test as per SS-4241475 class F3 and ladder test for flammability as per IEEE-383.

4.10 Joints and Terminations

Materials of construction for a joint/termination will perfectly match with the dielectric chemical and physical characteristics of the associated cables. The material and design concepts will incorporate a high degree of operating compatibility between the cable and joints. The protective outer covering (jacket) used on the joints/terminations will have the same qualities as that of the cable outer sheath in terms of ambient/operating temperature withstand capability and resistance to hazardous environments and corrosive elements. No joints will be allowed unless the cable drawn length is exceeded.

4.11 Cable Identification

Cable identification will be provided by embossing the following on the outer sheath:

- a) Manufacturer's name or trade mark
- b) Voltage grade
- c) Year of manufacture
- d) Type of insulation.
- e) Type of outer sheath e.g. "FRLS" etc.
- f) ISI marks
- g) Nominal cross sectional area of the conductor & no of cores
- h) Sequential marking
- i) Owner's identification mark "NNTPS"



5 TESTS

5.1 Type Test

Cables will be type tested quality. For each type and rating of cables reports on all type tests as per relevant standards, and carried out with in last five years from the date of bid opening will be submitted.

These reports will be for the tests conducted on the similar type of cables proposed to be supplied under this contract. These tests should have been conducted at an independent laboratory. If type test certificate are not available the same will be conducted in the presence of the purchaser.

5.2 Shop Tests

The Cables will be tested in accordance with relevant IS/IEC standards at manufacturers' works in the presence of consultant /purchaser or his representative as given below:

- Routine tests on each drum of cables.
- Acceptance tests on drums chosen at random for acceptance of the lot will be conducted in the presence of Consultant / purchaser or his representative.

5.3 Additional Tests

Following additional acceptance tests will also be performed on each type of cables having outer sheath with improved fire performance (Category C1, Type FR/ Category C2, Type FRLS):

- a) Oxygen index test (for both C1 & C2) – The oxygen index test will be carried out as per ASTM D2863. The Oxygen index will not be less than 29. All the additional tests will be conducted in the presence of the purchaser.
- b) Temperature Index Test (for both C1 & C2) - The measured value of temperature index will be 21 at a temperature of 250°C.
- c) Flame retardance test on single cable and on bunched cables (for both C1 & C2) - After the test, there should be no visible damages on the test specimen within 300mm from its upper end. After burning has ceased, the cables should be wiped clean and the charred or affected portion should not have reached a height exceeding 2.5 meter above the bottom edge of the burner, measured at the front and rear of the cable assembly.
- d) Halogen acid gas evolution test (for category C2) – This test will be as per IEC-754-1. The level of HCL evolved will not exceed 20 per cent by weight.
- e) Smoke density test (for category C2) – Smoke generation by outer sheath under fire as per ASTM D 2843. The cables will meet the requirements of light transmission of minimum 40% after the test.
- f) Test for rodent & termite repulsion property.



6 FIRE PROOF SEALING SYSTEM

Fire proof sealing system will consist of Fire-stops/fire-seals for sealing of cable/cable tray and conduit/pipe penetrations, both horizontal and vertical, through brick or RCC walls/floors, to prevent the spread of fire from one area, which is separated from others by fire-resistant barriers.

'Fire-breaks' provided on long runs of cable racks/trays to prevent the propagation of fire along the cable rack, within a single fire-area or fire-zone.

The FPS system will also include all the necessary accessories and equipment required for supporting, holding in position, fixing and installation of the fire-stop/fire-break.

The FPS system will comply in all respects with the requirements of the codes and standards listed below

IEEE-634 ASTM-E-814

ANSI-IEEE-383 IEC-331 IEC-332

Fire stop/ seal

The FPS system adopted for cables or cable trays penetrating through walls and floor constitute a openings, or cables passing through embedded conduits / pipes / pipe- sleeves, fire stop / seal', which is meant to prevent spreading of fire between areas separated by fire-resistant barriers.

Fire Break

The fire proofing system, other than fire-stops, adopted to retard flame propagation long runs of horizontal or vertical cable trays in the same fire zone or area, in an event of a fire, will constitute a 'fire-break' and will be provided by applying a suitable fire –resistance coating on cables and cable trays for the required length, with or without a fire resistant panel, at the point of the fire break to obtain the fire-rating specified.

Application of fire proof sealing system

Fire stops will be provided for cable penetration openings listed below

The passage of cables/cable trays pipe sleeves/embedded conduits through walls / floors.

Vertical raceways, which carry cables between successive floors, through openings provided in the RCC floor slab, will be sealed by fire stops at each floor level.

Cable entry through openings in floor slabs below HT/LT switchgear, MCCs, various Control and relay panels and other bottom entry panels, will be effectively sealed by fire stop

Location of fire breaks

Firebreaks will be provided on both cable rack and trenches at all cable tray Intersections and tee-offs.

On linear runs of cable trays between fire stops or fire breaks, fire breaks will be provided at intervals of 15 metres on horizontal cable runs and 5 m on vertical cable runs.



Fire breaks in linear runs of cable trenches between intersections and tee-offs will be provided at intervals of 30 metres.

Contractor will furnish the test certificates for the fire stops and fire breaks after award of contract for Owner/Owner's Representative review. If the certificates are not satisfactory all the tests will be conducted free of cost. The offered system i.e. fire stops and fire breaks will be identical (or better) with the system which is successfully type tested for the specified rating i.e. the composition density of the material, thickness of coating in case of fire breaks and any other properties of the material / system offered will be identical or better than the tested system and will be subject to Owner / Owner's Representative.

Test on fire stops

The fire stops will be subjected to the following type tests:

Fire Rating Test

Hose Stream Test

Type tests will be conducted on different fire stop test specimens described above as per IEEE-634. The sizes of the fire stop test specimens, will be similar to the largest of the sizes being used in the plant.

Preconditioning of fire stop test specimens before conducting the fire rating and hose stream tests, each test specimen will be preconditioned for thermal ageing, water immersion and vibration.

Test on Fire Stops

During the fire rating test, the transmission of heat through the cable penetration fire stop will not raise the temperature on its unexposed surface above the self ignition temperature of the outer cable covering, the cable penetration fire stop material, or material in contact with the cable penetration fire stop, with a maximum temperature limit on the unexposed surface of 200°C.

Tests on fire breaks

Firebreaks will undergo the following tests as per ANSI-IEEE-383:

Ampacity test

Flame test

7 DRAWINGS, DATA AND MANUALS TO BE FURNISHED FOR APPROVAL

- Cable datasheets
- Cable sizing
- QAPs & Test Reports
- Relevant catalogues



8 RATINGS AND REQUIREMENTS

8.1 L.V. Power cables 1100 V grade

1100 V grade, power cable conforming to following requirement and in line with IS-1554, IS-5831, IS-8130 & IS-3975.

Conductor : Stranded and compacted plain aluminium of grade H2 and class 2/stranded, high conductivity annealed plain copper as per Annexure, generally conforming to IS:8130

Insulation : Extruded cross linked polyethylene (XLPE).

Inner Sheath : Extruded FRLS PVC compound conforming to type ST2 of IS:5831 for multicore cable.

Armour : Galvanised single round/ strip steel wire armour for twin and multicore cables.

Non-magnetic hard drawn aluminium single round wire conforming to H4 grade for single core cables.

Overall Sheath : Extruded FRLS PVC compound conforming to type ST2 of IS:5831.

8.2 Control Cables 1100 V Grade

1100 V grade, 700 C rating, PVC Control cable conforming to following requirement and in line with IS-1554, IS-8130, IS-5831 & IS-3975.

Conductor : Stranded, non-compact & circular, high conductivity annealed plain copper,



generally conforming to IS:8130.

Insulation	:	Extruded PVC compound conforming to type A of IS:5831.
Inner sheath	:	Extruded FRLS PVC compound conforming to type ST1 of IS:5831 for multicore cables. Single core cables will have no inner sheath
Armour	:	Galvanised single round steel wire for twin and multicore cables.
Overall sheath	:	Extruded FRLS PVC compound conforming to type ST1 of IS:5831

8.3 Trailing Cables (Power & Control)

Trailing cable, 1.1kV grade with highly flexible stranded tinned copper conductor, insulation of EPR (Ethylene-propylene Rubber) each individual core protected and covered and overall outer cover of poly-chloroprene rubber cable will conform to IS 9968 part-1.



3. CONTROL PANEL

Control Panel														
ATTRIBUTES / CHARACTERISTICS	ITEMS/ COMPONENTS, SUB SYSTEM ASSEMBLY	Visual	GA, BOM , Lay Out of components	Dimensions	Paint Shade/ Thickness/Adhesion	Component Rating/ Make / Type	Wiring	IR & HV	Review of TC for instruments	Accessibility of TBS/ Devices	Illumination	Functional Check for Control Element , Annunciation	Test as per IEC 1131 *	Routine & acceptance Tests as per IS 8623
	Control Panel													
<p>Note: 1) Detailed procedure of Burn-in and Elevated Temperature test shall be as per Quality Assurance Programme in General Technical Conditions 2) This is an indicative list of test/ checks. The manufacturer is to furnish a detailed quality plan indicating the Practice and Procedure along with relevant supporting documents. *Applicable for PLC</p>														

4. Motors

Attributes / Characteristics	ITEM/ COMPONENTS	Visual	Dimensional	Make/Type/Rating/TC/General Physical Inspection	Mech/Chem. Properties	NDT /DP/MPI/UT	Metallography	Electrical Characteristics	Welding/Brazing(WPS/PQR)	Heat Treatment

Document Number	Rev No.	Description	Page No.	Date of Issue
LII-GEOE11019-G-00155-001	02	TG, VOL.-IV, Sec-20 QAP - NTA2	381	25-Jun-11



Plates for stator frame,end shield, spider etc.									
Shaft									
Magnetic Material									
Rotor Copper/Aluminium									
Stator copper									
SC Ring									
Insulating Material									
Tubes for Cooler									
Sleeve Bearing									
Stator/Rotor, Exciter Coils									
Castings, stator frame,terminal box and bearing housing etc.									
Fabrication & machining of stator, rotor, terminal box									
Wound stator									
Wound Exciter									
Rotor complete									
Exciter, Stator, Rotor, Terminal Box assembly									
Accessories, RTD, BTD,CT, Brushes, Diodes,Space heater, antifriction bearing, cable glands, lugs, gaskets etc.									
Motor (IS 325 / 4722 / 9283)									

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Attributes / Characteristics	Make, Rating, Type & TC	Dimension/surface finish	Mechanical Properties	Chemical Composition	Electrical Properties	Spark Test	Hot set test (XLPE)	Lay length / Sequence	Armour coverage, Cross over, looseness, Gap between two armour wire/strip	Sequential marking/surface finish /cable	Tensile strength, elongation before & after ageing of insulation & sheath	Thermal Stability of insulation and sheath	Anti termite treatment test	Constructional / requirement as per NTPC	Routine and acceptance test as per Relevant Standard specification	FRLS Test
Item / Components / Sub System Assembly																
Aluminum (IS-8130)																
PVC Compound (IS-5831)																
XLPE Compound (IS-7098 Part-I)																
FRLS PVC Compound (IS-5831)/ASTM-D-2843/ASTM-D-2863 IEC-754 Part-I																
Armour wire/ Formed wire (IS-3975)																
Insulated Core																
Laid up core																
PVC Inner sheath																
Armouring																
Outer sheath																
Finish cable (IS-1554 & 7098 Part-1)/ASTM-D-2843/ASTM-D-2863 IEC-754 Part-I Swedish Chimney SEN SS 4241475 for (F3 category)/ Flammability test IEEE-383																
Wooden drum (IS-10418)																
<ul style="list-style-type: none"> Not applicable for XLPE insulation <p>Notes:</p> <ol style="list-style-type: none"> This is an indicative list of tests / checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents. Make of all major bought out Items will be subject to approval. 																

Document Number	Rev No.	Description	Page No.	Date of Issue
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10. Control Cables

Attributes / Characteristics Item / Components / Sub System Assembly	Make, Type, Rating, T.C	Dimension/surface finish	Mechanical Properties	Chemical Composition	Electrical Properties	Spark Test	Lay length/Sequence	Armour coverage, cross over, looseness, gap between two armour	Sequential marking/surface finish/cable length	Tensile strength, elongation before & after ageing of insulation & sheath	Thermal stability of insulation and sheath	Anti termite treatment test	Constructional feature as per Spec.	Routine & Acceptance test as per relevant standard & specification	FRLS Test
Copper Conductor (IS-8130)															
PVC Compound (IS-5831)															
FRLS PVC Compound IS-5831 ASTM-D-2843 ASTM-D-2863 IEC-754 Part-1															
Armour wire/ Formed wire (IS-3975)															
Insulated Core															
Laid up core															
PVC Inner sheath															
Armouring															
Outer sheath															
Finish cable (IS-1554) ASTM-D-2843 ASTM-D-2863 IEC-754 Part-1 Swedish Chimney: SEN SS 424-1475(F3 category)															
Wooden drum(IS:10418)															
<p>Notes: 1.This is an indicative list of tests / checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents</p> <p>2. Make of all major bought out Items will be subject to approval.</p>															

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ANNEXURE – I TO SECTION – C : STANDARD ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR
PACKAGE : EOT CRANES

PROJECT : 2X500 MW NINTPS

<u>S.NO</u>	<u>DETAILS</u>	<u>SCOPE SUPPLY</u>	<u>SCOPE E&C</u>	<u>REMARKS</u>
1	415V Local Starter Panel	Vendor	Vendor	BHEL will provide two/one number 415 V supply feeders up to DSL for cranes / hoist and 415 V & 240 V in Machine Room for elevators.
2	Power cables, control cables, screened control cables and any special cables (if required) between equipment supplied by vendor.	Vendor	Vendor	
3	Cabling material (cable trays, accessories, cable tray supporting system, conduits etc).	Vendor	Vendor	
4	Equipment Earthing	Vendor	Vendor	All equipments metallic enclosures / frames, metal structure etc. shall be grounded at two points each to the nearest grounding points / risers provided by BHEL / customer.
5	Motors	Vendor	Vendor	
6	Cable glands and lugs for equipment supplied by vendor	Vendor	Vendor	1. Double compression Ni-Cr plated brass cable glands 2. Solder less crimping type tinned copper heavy duty lugs for power cables. 3 solderless crimping type heavy duty copper lugs for control cables.
7	a) Input cable schedules (C & I) b) Cable interconnection details for above c) Cable block diagram	Vendor Vendor Vendor	- - -	Cable listing for C & I systems for vendor supplied equipment shall be furnished during detail engineering by vendor in soft copies in the BHEL cable schedule format.
8	Equipment layout drawings	Vendor	-	
9	Electrical Equipment GA drawing	Vendor	-	For necessary interface review.

NOTE :- 1. Above is applicable if motor starters are part of starter cum control panel & control is relay based.
2. If motor starters are provided in main MCC then customer will provide power & control cable including supply, laying & termination



**ELECTRICAL EQUIPMENT SPECIFICATION
FOR
CRANE**

SPECIFICATION NO.
PE-TS-402-501-A001

VOLUME NO. : **II-B**

SECTION : **C**

REV NO. : **00** DATE :

SHEET : **1** OF **1**

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 same shall be provided by the bidder without any extra charge.
- c) Supply of mandatory spares as specified in the specifications of mechanical equipments.
- d) Erection and Commissioning spares.
- e) Erection & Maintenance tools & tackles.
- f) Electrical load requirement for crane
- 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 sheets as per required format, Quality plans, calculations, test reports, test certificates, operation and maintenance manuals etc shall be furnished as specified at contract stage. All documents shall be subject to customer/BHEL approval without any commercial implication to BHEL.

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 two signed and stamped copies of the following shall be furnished by the bidder as technical offer:

- a) A copy of this sheet ”Electrical equipment Specification ” 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 :

- a) Specification AC/DC Motors
- b) Data sheet of AC/DC Motors.
- c) Load data format.

PEM-6666-0



TECHNICAL SPECIFICATION FOR
105/25T TG HALL EOT CRANE
2X500 MW NNTPS (TG)

SPECIFICATION NO. PE-TS-404-501-A002	
VOLUME II - B	
SECTION -D	
REV 00	DATE 24.6.14

VOLUME - IIB
SECTION – D
STANDARD TECHNICAL REQUIREMENTS



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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 | Codes of Practice for Design, Manufacture, Erection and Testing (Structural Portion) of cranes and hoists |
| ii) | IS: 3177 | 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. |
| ix) | IS: 4237 | General requirement of switchgear and Control gear for voltage not exceeding 1000V. |
| 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. |



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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.
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.
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 more stringent of the two as per interpretation of purchaser shall govern.



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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 and any other standard as referred there in and subject to any modification and requirement as specified herein after.

Class of crane mechanism shall correspond to that of the crane requirement and as specified elsewhere.

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

3.1.3 Parts requiring replacement or lubrication shall easily be accessible without dismantling the other equipment or structures. All electrical cables shall be laid to comply with recognized standards and purchaser's requirements.

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

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.

c. 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.

d. Electrode designations and qualifications shall be as per AWS A 5.1.

e. Electrodes should be of radiography quality with heavy covering as per IS: 814 and relevant requirement of ASME Sec IX and IIC.

f. Bare electrodes as per IS: 7280 and flux wire combination as per IS: 3613.

3.1.5 No cast iron part shall be used on the crane and its accessories.

3.1.6 Guard shall be provided on crane to prevent the hoist ropes coming in contact with down shop leads.

Guards/ rail sweep 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.



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- 3.1.7 All cables shall be clamped individually. All trailing cables shall be clamped with PVC or non-metallic clamp.
- 3.1.8 Walkways of CT shall be of chequered plate minimum 6 mm thick O/P at least 800 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.
Ladders provided shall have at least 450mm clear width with 20 mm rungs (rods) spaced 300 mm apart.
- 3.1.9 All wheels, couplings, open gear etc. shall be provided with covers.
- 3.1.10 All bolts except those with locknut shall be provided with grip lock nuts or spring washers.
- 3.1.11 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.
- 3.1.12 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.
- 3.1.13 All parts of the crane shall be thoroughly cleaned of mill scales, rust or foreign matter and then painted as per the specification requirements.
The permissible camber shall be shown in drawing or data sheet submitted for approval.
- 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%.
- 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



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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 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**



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- 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 per latest IS. 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 shall be provided on the side of bridge girders as specified in data sheet - A.
- 3.2.2.7 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 number.
- 3.2.2.9 Maximum Span/ Depth ratio for Girder



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- 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. 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.

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 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..



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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 450 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, 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.

3.2.5.0 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.

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

3.3.0 **MECHANICAL**

3.3.1 **Rope drums**

Rope drums shall be of mild steel plate fabricated/ cast steel/ as per IS 3177. 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 drum 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.



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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 steel core as specified in Data sheet "A" shall be of 6x36 or 6x37 construction of extra flexible plough steel as per IS 2266 having minimum UTS of 1770 kN.

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 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 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 100% 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 suitable 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



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Trolley drive shall be achieved by suitable drives & 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 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 which ever in 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.



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3.3.10 Bearing

3.3.10.1 Ball and roller antifriction bearing of attached sub-vendor list, 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 data sheet-A. 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 a 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.

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: 1030 grade 280-520 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 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



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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

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 a 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% of torque transmitted to the brake drum with full load for hoist motions and 125% of motor rated torque before derating 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 & disc type service brakes shall be provided for each motion of the crane as/or as specified in Data Sheet. The service brakes shall apply automatically when power supply to the drive motor is cut off or fails.

ii) HOIST CONTROL

Hoist motion shall be provided with a self-contained sturdy braking system to control the speed of hoisting as well as lowering motion. The braking system shall be reasonably uniform and effective in all loads at any position.

3.4.0 ELECTRICAL

3.4.1 The scope of supply shall cover all electrical equipments comprising from Main isolating switch, down shop leads, trolley conductors, current collectors etc.

3.4.1.1 Main 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 supply cable to isolating switch fuse unit and further cable from switch to down shop leads shall be included in



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the bidder's scope of work. The switch shall be provided with Power ON Red indication lamp.

- 3.4.1.2 Run way conductors (Down shop leads) shrouded conductor as specified in the data sheet A shall have four conductors. One of the conductors shall be connected to earth grid for earthing connections of all electrical equipments on the crane and shall be connected to suitable collecting gear of earth conductor. Voltage drop across the down shop leads shall be less than 2% or specified in data sheet "A". It shall be supplied with brackets. Maintenance cage for DSL shall be provided on crane.
- 3.4.1.3 The current collectors shall be 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 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 VVVF drive system, the creep speed will be achieved through VVVF drives and the motors for Main hoists, Auxiliary hoist, CT and LT will be Squirrel cage. 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 de-rate the motors. The minimum margin of 10% shall be considered over the calculated rating of the motor. The protection class of the motors shall be as IP-55. 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 or as per the motor spec.
- 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.



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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 **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. Safety Interlocks-Disconnect Switch-The operating handle of the main/ safety disconnect switch shall be mechanically interlocked with enclosure cover such that the same can not be opened unless the switch is in OFF position. Main/ safety disconnect switch shall have provision of pad locking in OFF position

3.4.5. **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.

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. The main contactor shall be electrically interlocked so that it can not close unless all the motor overload relays are RESET and all controllers are in OFF position. The main contactor shall be also opened by means of emergency push buttons and hoist limit switches.

3.4.6 **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.

3.4.7 **Protective Panel**



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3.4.7.1 The electrical protective panel shall be a cubicle fabricated from Cold rolled sheet steel not less than 2.5mm for front & rear & 2mm for side, top & bottom portion with gland plate of 3mm thick 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-52 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.
- 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



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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.

3.4.8 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.

3.4.9 MOTOR CONTROL PANEL

The motor control panels shall be dust and weatherproof to IP-54/55 or as specified in "Data Sheet A" & shall be provided separate 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



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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

Crane lighting and space heating system shall be designed for 240V, 1Phase 50Hz supply and receptacle system with 24V 1Phase 50Hz supply or as specified in the Data sheet A. 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) 60W bulkhead fittings with fluorescent lamp shall be used for lighting bridge platform.
- c) Four (4)no.s - 250 W HPSV 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. 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.

3.4.13 Grounding

3.4.13.1 The crane structure, motor frame and all other electrical equipment/s 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. Pendant push button station shall be earthed



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separately.

3.4.13.3 The crane structures, motor frames & metal of all electrical equipment on EOT crane shall be effectively grounded as per Indian Electricity Rules. Grounding of the crane to the nearest pit shall be in manufacturer's scope.

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) EPR insulated, copper conductor trailing cables, as per IS:9968, on the bridge.
- b) Extruded PVC insulated, copper/Aluminium conductor, 1100 Volt grade power cables. This shall include cable lengths between change over switch & DSL and isolating switch & DSL.
- c) Extruded PVC insulated, copper conductor 1100 volt grade control cables
- d) For selecting the cable rating, cable for power wiring, consideration shall be given to the motor duty, ambient temperature grouping and disposition of the cables voltage drop etc.
- e) 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.
- f) Each motor shall be wired independently. Power and control wiring shall be effectively separated.
- g) Each wire shall be identified at both ends with wire designation in accordance with circuit wiring diagram.
- h) 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.
- i) Multi way terminal blocks complete with screw nut, washer and marking strips shall be furnished for terminating the panel wiring.
- j) 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
- k) Each terminal block shall be marked with designation in accordance with conductors wiring diagram.



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TECHNICAL SPECIFICATION FOR VVVF DRIVE

1.0 General

a) This part of the specification describes the general requirements for the Variable Voltage Variable frequency Drives, herein referred to as AC Drives, for use with standard IEC design AC squirrel cage induction motors. The nominal values, the standard documents and the drive's minimum performance are defined in this part. **To avoid any mismatch between the motor and its control equipment, the AC Drive shall be capable of auto adjustment by automatic measurement of the motor parameters with/without motor rotation.**

- i. Speed control of EOT crane shall be through Variable Voltage Variable Frequency System (VVVF) with minimum 6 (six) pulse design.
- ii. Necessary input & output devices to be provided to reduce harmonics, as per IEE519, at supply side of the drive at the switchgear.
- iii. All necessary protections e.g. Input Phase Loss, Earth Fault, Over Voltage, Output Short Circuit, Load Loss, Input Transient Protection, Overload etc. to be provided.
- iv. VVVF system shall be capable of generating suitable starting torque (upto 400% typical) with / without encoder, however starting current shall not exceed 150% of the rated torque.
- v. VVVF system shall be capable of withstanding upto 50 deg C. ambient temp without derating
- vi. Squirrel cage Induction motor with VPI insulation shall be provided with VVVF system.
- vii. Protective Pane Provided with isolating switch, power contactor control and indication to switch ON/OFF power to starter panels, control and lighting transformer.
- viii. Starter Panel:
Separate VVVF system panels to be provided for CT, LT and hoist motion
 - (a) Contactors: AC 4 duty for reversing application AC 3 duty for non-reversing application
 - (b) Switches: AC 23 for motor application, AC 22 for other application.
 - (c) Fuses: HRC
 - (d) Overload relay: Temperature compensated, bimetallic with single phasing preventor.
- ix. Panel shall be fabricated out of 1.6 mm thick rolled sheet steel. IP 52 degree of protection. Paint shade shall be RAL 9002 for front & rear and RAL 5012 for side covers. Space heaters to be provided.

2.0 User interface

2.1 General

The user interface shall be identical throughout the power range and type to avoid confusion amongst the users and need for training in several different units.

2.2 Inputs and outputs

A. At least, the following standard Inputs and Outputs shall be provided, to be used in



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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
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	Motor current
Summing reference	Motor frequency
	Motor torque
	Motor power
Logic input	Relay or logic outputs (open collector)
Forward	Ready
Reverse	Drive running
Jog	High speed attained
Preset speeds	Drive fault
Reference switching	Frequency threshold attained
Ramp switching	Motor thermal state attained
Parameter sets selection	Torque or current limitation attained
Fast stop	Brake control
Freewheel stop	
+ speed	
- speed	
External fault	

2.3 Programming terminal

- A. The AC drive shall have a keypad /display for programming and controlling purposes. An IP54 or IP65 remote mounting shall be possible at a distance of 10m.
- B. Password protection shall be provided to avoid unauthorized tampering with the set parameters.
- C. The programming terminal shall be able to display the commercial reference of the AC drive and of the options, the software version, the serial number
- D. Direct keypad entry shall be provided to observe the following actual parameters. Any one of the following parameters or actual values shall be selected to be always displayed :-
- i) Input Voltage



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- ii) Input Frequency
- iii) Output Frequency
- iv) Output Power
- v) Output Current
- vi) Motor Speed

The following parameters shall always be displayed during normal operation :-

- i) Drive Status

The following drive control functions at least shall be available from the keypad :-

- i) Run
- ii) Stop
- iii) Local / Remote selection.
- iv) Forward/Reverse (if function enabled)
- v) Accelerate
- vi) Decelerate
- vii) Parameter setting

2.4 Application programming

The AC Drive shall be designed for both simple and the most complicated applications, yet it shall be user friendly. It shall be possible to reset the parameter settings back to the original factory settings through the keypad.

2.5 PC Tools

The AC Drive Supplier shall have a Windows based PC software available for monitoring and controlling the AC Drives, and the software shall be offered as an option. The software shall be supplied with the necessary hardware and a provision for connecting a PC with the AC Drives. It shall be possible to set and modify parameters, control the drive, read actual values and make trend analysis using the software.

3.0 Software features

A. Restart

In the event of a fault trip due to over voltage, over current or loss of analogue signal, the AC DRIVE shall be programmable to attempt an automatic restart. For safety reasons, the maximum number of attempts shall be within a selectable time. If the fault does not clear after the attempts, the drive shall lock out.

B. Brake logic control

The AC Drive shall have a built-in function to control a mechanical brake in order to move the load in a smooth and safe way. The brake logic control shall be adapted to the different movements : hoisting, travel, orientation.

4.0 Preferred makes:

As per attached sub-vendor list.

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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 for 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.



TITLE :
GENERAL TECHNICAL REQUIREMENTS

FOR

LV MOTORS

SPECIFICATION NO.
PE-SS-999-506-E101
VOLUME NO. : **II-B**
SECTION : **D**
REV NO. : **00** DATE : 29/08/2005
SHEET : 3 OF 4

- 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 U 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 bar 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.



TITLE :
GENERAL TECHNICAL REQUIREMENTS
FOR
LV MOTORS

SPECIFICATION NO.
PE-SS-999-506-E101
VOLUME NO. : **II-B**
SECTION : **D**
REV NO. : **00** DATE : 29/08/2005
SHEET : 4 OF 4

- 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.

LV-MOTOR DATA SHEET -A



SPECIFIC ELECTRICAL REQUIREMENT

SL.NO.	PARAMETERS	UNIT	NLC
	MOTOR		
1	DESIGN AMBIENT TEMP	DEG. C	50
2	VOLTAGE SUPPLY AND VARIATION	VOLT	415V, \pm 10%
3	FREQUENCY WITH VARIATION	Hz	50 (+) 5% to (-) 3%
4	COMBINED VOLTAGE & FREQUENCY VARIATION		10%
5	MAX ACCEPTABLE RATING OF MOTOR AT 415 V	KW	160 KW & below
6	SYSTEM FAULT LEVEL AND ITS DURATION	KA	50kA, 1sec
7	SUTABILITY OF TERMINAL BOX FOR FAULT LEVEL AND DURATION		50 KA, 0.25 sec
8	CLASS OF INSULATION & TEMP RISE LIMITED TO		Class-F or better and temp rise limited to Class-B
9	MIN. STARTING VOLTAGE		85%
10	MOTOR RATING FOR SINGLE PHASE SUPPLY		0.22 kW & Below
11	MAXIMUM LOCKED ROTOR CURRENT	% OF FLC	As per IS 12615
12	ACCEPTABLE NOISE LEVEL	DB	Noise level for all motors shall be limited to 85dB(A) at 1.5 m (in line with IS 12065)
13	TYPE OF STARTER PROVIDED IN MCC		DOL
14	DOP OF ENCLOSURE		IP-55 FOR OUTDOOR & IP-54 for indoor resp.
15	SPACE HEATER REQUIREMENT	<30kW	30KW & ABOVE
16	PAINT SHADE		DURING DETAIL ENGINEERING.
17	CRANE DUTY MOTOR AS PER IS3177		S4- Duty with 40% cyclic duration factor shall be considered. Motor operating through VFD shall be suitable for inverteer duty.



QUALITY PLAN		CUSTOMER : NTPC		PROJECT		SPECIFICATION :					
SHEET 2 OF 2		BIDDER/ VENDOR SYSTEM		TITLE		NUMBER : PE-TS-402-501-A001					
COMPONENT/OPERATION CHARACTERISTICS CHECK		CAT.		QUALITY PLAN		SPECIFICATION :					
		TYPE/METHOD OF CHECK		NUMBER PED-506-00-Q-006, REV-01		TITLE :					
		EXTENT OF CHECK		ITEM AC ELECT. MOTORS BELOW 55KW (LV)		SECTION					
		3		7		VOLUME III					
		4		8		REMARKS					
		5		9		AGENCY					
		6		10		P W V					
		7		11							
1	2	3	4	5	6	7	8	9	10	11	
		3.NAMEPLATE DETAILS	MA	VISUAL	100%	IS-325 & DATA SHEET	IS-325 & DATA SHEET	INSPN. REPORT	2 1	-	
<p>NOTES:</p> <ol style="list-style-type: none"> 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. <p><u>Legends for Inspection agency</u></p> <ol style="list-style-type: none"> 1. BHEL/CUSTOMER 2. VENDOR (MOTOR MANUFACTURER) 3. SUB-VENDOR (RAW MATERIAL/COMPONENTS SUPPLIER) <p>P. PERFORM W. WITNESS V. VERIFY</p>											
BHEL		PARTICULARS		BIDDER/VENDOR							
		NAME									
		SIGNATURE									
		DATE									
BIDDER'S/VENDORS COMPANY SEAL											


SL. NO.		COMPONENT/OPERATION		CHARACTERISTIC CHECK		CUSTOMER : NTPC		PROJECT		SPECIFICATION : PE-TS-402-501-A001	
						EXTENT OF CHECK	TYPE/METHOD OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	SECTION AGENCY
QUALITY PLAN		SHEET 1 OF 9		CAT.		BIDDER/ VENDOR SYSTEM		TITLE		SPECIFICATION :	
								2X500 MW NNTPS (TG)		NUMBER :	
								QUALITY PLAN NUMBER PED-506-00-G-007, REV.03		SPECIFICATION :	
								ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)		SECTION AGENCY	
								VOLUME III		REMARKS	
								P		W	
								V		V	
1	2	3	4	5	6	7	8	9	10	11	
1.0	RAW MATERIAL & BOUGHT OUT CONTROL										
1.1	SHEET STEEL, PLATES, SECTION, EYEBOLTS	1.SURFACE CONDITION	MA	VISUAL	100%	-	FREE FROM BLINKS, CRACKS, WA/VINNESS ETC	LOG BOOK	3	-	-
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANFRS DRG./SPEC	MANFRS DRG./SPEC	-DO-	3	-	-
		3.PROOF LOAD TEST (EYE BOLT)	MA	MECH. TEST	-DO-	-DO-	-DO-	INSPEC. REPORT	3	-	2
1.2	HARDWARES	1.SURFACE CONDITION	MA	VISUAL	100%		FREE FROM CRACKS, UN-EVENNESS ETC.	-DO-	3	-	-
		2.PROPERTY CLASS	MA	VISUAL	SAMPLES	MANFRS DRG./SPEC BOOK	RELEVANT IS/SPEC.	SUPPLIERS TC & LOG	3	-	2
1.3	CASTING	1.SURFACE CONDITION	MA	VISUAL	100%		FREE FROM CRACKS, BLOW HOLES ETC.	LOG BOOK	3	-	2
		2.CHEM. & PHY. PROP.	MA	CHEM & MECH TEST	1/HEAT NO.	MANFRS DRG./SPEC	RELEVANT IS/	SUPPLIER'S TC	3	-	2
		3.DIMENSIONS	MA	MEASUREMENT	100%	MANUFRS DRG.	MANUFRS DRG.	LOG BOOK	3	-	2
1.4	PAINT & VARNISH	1.MAKE, SHADE, SHELF LIFE & TYPE	MA	VISUAL	100% CONTINUOUS	MANFRS DRG./SPEC	MANFRS DRG./SPEC	LOG BOOK	3	-	2
		PARTICULARS		BIDDER/VENDOR							
		NAME									
		SIGNATURE									
		DATE									
										BIDDERS/VENDORS COMPANY SEAL	

SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	SYSTEM CAT.	4	5	6	7	8	9	10			11
										P	W	V	
	<div style="display: flex; justify-content: space-between;"> <div style="width: 20%;">  </div> <div style="width: 40%;"> <p>CUSTOMER - NTPC</p> <p>PROJECT TITLE : 2X500 MW NNTPS (TG)</p> <p>BIDDER/ VENDOR SYSTEM : NUMBER PED-506-00-Q-007, REV-03</p> <p>CUSTOMER - NTPC : ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)</p> <p>BIDDER/ VENDOR SYSTEM : 2X500 MW NNTPS (TG)</p> <p>QUALITY PLAN : NUMBER PED-506-00-Q-007, REV-03</p> <p>QUALITY PLAN : ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)</p> </div> <div style="width: 20%;"> <p>QUALITY PLAN</p> <p>QUALITY PLAN</p> </div> </div>												
	<div style="display: flex; justify-content: space-between;"> <div style="width: 20%;">  </div> <div style="width: 40%;"> <p>CUSTOMER - NTPC</p> <p>PROJECT TITLE : 2X500 MW NNTPS (TG)</p> <p>BIDDER/ VENDOR SYSTEM : NUMBER PED-506-00-Q-007, REV-03</p> <p>CUSTOMER - NTPC : ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)</p> <p>BIDDER/ VENDOR SYSTEM : 2X500 MW NNTPS (TG)</p> <p>QUALITY PLAN : NUMBER PED-506-00-Q-007, REV-03</p> <p>QUALITY PLAN : ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)</p> </div> <div style="width: 20%;"> <p>QUALITY PLAN</p> <p>QUALITY PLAN</p> </div> </div>												
1	2	3	4	5	6	7	8	9	10	11			
1.5	SHAFT (FORGED OR ROLLED)	1. SURFACE COND. 2. CHEM. & PHYSICAL PROPERTIES 3. DIMENSIONS 4. INTERNAL FLAWS	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS RELEVANT IS	-DO- SUPPLIER'S TC	3	-	-	VENDOR'S APPROVAL IDENTIFICATION SHALL BE MAINTAINED	
1.6	SPACE HEATERS, CONNECTORS, TERMINAL BLOCKS, CABLES, CABLE LUGS, CARBON BRUSH TEMP DETECTORS, RTD, BTD'S	1. MAKE & RATING 2. PHYSICAL COND. 3. DIMENSIONS (WHEREVER APPLICABLE) 4. PERFORMANCE/ CALIBRATION	MA	VISUAL	-DO-	1/HEAT NO. OR HEAT TREATMENT BATCH NO	MANUFR'S DRG. ASTM-A388	LOG BOOK -DO-	3	2	1	FOR DIA OF 55 MM & ABOVE	
			MA	-DO-	-DO-	-	NO PHYS. DAMAGE, NO ELECTRICAL DISCONTINUITY	-DO-	3	-	2		
			MA	MEASUREMENT	SAMPLE	MANUFR'S DRG./ SPEC.	MANUFR'S DRG. / SPEC.	-DO-	3	-	2		
			MA	TEST	100%	-DO-	-DO-	INSP. REPORT	3	-	2		
BHEL													
PARTICULARS													
BIDDER/VENDOR													
NAME													
SIGNATURE													
DATE													
BIDDER'S/VENDORS COMPANY SEAL													

PROJECT		CUSTOMER : NTPC		PROJECT TITLE		SPECIFICATION : PE-TS-402-501-A001	
QUALITY PLAN		BIDDER/ VENDOR SYSTEM		TITLE		NUMBER :	
SHEET 1 OF 9		CUSTOMER : NTPC		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)		TITLE	
QUALITY PLAN		BIDDER/ VENDOR SYSTEM		TITLE		NUMBER :	
SHEET 3 OF 9		CUSTOMER : NTPC		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)		TITLE	
COMPONENT/OPERATION		CAT.		REFERENCE DOCUMENT		SECTION AGENCY	
CHARACTERISTIC CHECK		TYPE/ METHOD OF CHECK		ACCEPTANCE NORM		P W V	
EXTENT OF CHECK		CHECK		FORMAT OF RECORD		REMARKS	
3		4		5		6	
7		8		9		10	
11		11		11		11	
1	OTHER INSULATING MATERIALS LIKE SLEEVES, BINDINGS CORDS, PAPERS, PRESS BOARDS ETC.	MA	VISUAL	100%	NO VISUAL DEFECTS	INSPT. REPORT	3 - 2
1.7	1. SURFACE COND. ETC. 2. OTHER CHARACTERISTICS	MA	TEST	SAMPLE	MANUF'S SPEC.	LOG BOOK AND OR SUPPLIERS TC	3 - 2
1.8	1. SURFACE COND. 2.DIMENSIONS INCLUDING BURS HEIGHT 3. ACCEPTANCE TESTS	MA	VISUAL	100%	NO VISUAL DEFECTS (FREE FROM BURS)	LOG BOOK	3 - -
1.9	1. SURFACE FINISH 2. ELECT. PROP. & MECH. PROP	MA	MEASUREMENT	SAMPLE	MANUF'S DRG.	-DO-	3 - 2
		MA	ELECT. & MECH TESTS	-DO-	RELEVANT IS	SUPPLIER'S TC	3 - 2
		MA	VISUAL	100%	FREE FROM VISUAL DEFECTS	LOG BOOK	3* - 2*
		MA	ELECT. & MECH. TEST	SAMPLES	RELEVANT IS/ BS OR OTHER STANDARDS	SUPPLIERS TC & VENDORS INSPN. REPORTS	3 - 2
BHEL		PARTICULARS		BIDDER/VENDOR			
		NAME					
		SIGNATURE					
		DATE					
						BIDDER'S/VENDORS COMPANY SEAL	

CUSTOMER : NTPC		PROJECT		SPECIFICATION : PE-TS-402-501-A001						
TITLE		TITLE		NUMBER :						
QUALITY PLAN		QUALITY PLAN		SPECIFICATION :						
BIDDER/ VENDOR SYSTEM		NUMBER PED-506-Q-007, REV-03		TITLE						
SHEET 1 OF 9		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)		SECTION						
CUSTOMER : NTPC		PROJECT		VOLUME III						
TITLE		TITLE		SPECIFICATION :						
QUALITY PLAN		QUALITY PLAN		NUMBER : PE-TS-402-501-A001						
BIDDER/ VENDOR SYSTEM		NUMBER PED-506-Q-007, REV-03		SPECIFICATION :						
SHEET 5 OF 9		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)		TITLE						
COMPONENT/OPERATION		REFERENCE DOCUMENT		SECTION						
CHARACTERISTIC CHECK		ACCEPTANCE NORMI		VOLUME III						
SL. NO.		EXTENT OF CHECK		REMARKS						
2		5		P W V						
3		6		10						
4		7		11						
1	2	3	4	5	6	7	8	9	10	11
2.0	IN PROCESS									
2.1	STATOR FRAME WELDING (IN CASE OF FABRICATED STATOR)	1.WORKMANSHIP & CLEANNESS 2.DIMENSIONS	MA MA	VISUAL MEASUREMENT	100% -DO-	-DO- MANUF'S DRG	GOOD FINISH MANUF'S DRG	LOG BOOK -DO-	3/2 2	- -
2.2	MACHINING	1.FINISH 2.DIMENSIONS 3.SHAFT SURFACE FLOWS	MA MA MA	VISUAL MEASUREMENT PT	100% -DO- -DO-	-DO- MANUF'S DRG RELEVANT SPEC./ ASTM-E165	GOOD FINISH MANUF'S DRG MANUF'S SPEC./ BHEL SPEC./	LOG BOOK -DO- -DO-	2 2 2	- - 1
2.3	PAINTING	1.SURFACE PREPARATION 2.PAINT THICKNESS (BOTH PRIMER & FINISH COAT) 3.SHADE 4.ADHESION	MA MA MA	VISUAL MEASUREMENT BY ELCOMETER VISUAL CROSS CUTTING & TAPE TEST	100% SAMPLE -DO- -DO-	MANFRS SPEC./BHEL SPEC./ RELEVANT STAND -DO- -DO- -DO-	BHEL SPEC. SAME AS COL.7 -DO- -DO- -DO-	LOG BOOK -DO- Log Book Log Book	2 2 2	- - -
BHEL		PARTICULARS		BIDDER/VENDOR						
		NAME								
		SIGNATURE								
		DATE								
										BIDDER'S/VENDORS COMPANY SEAL

SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	4	5	6	7	8	9	SECTION			VOLUME III REMARKS
									P	W	V	
1	TESTS	1. TYPE TESTS INCLUDING SPECIAL TESTS AS PER BHEL SPEC. 2. ROUTINE TESTS INCLUDING SPECIAL TEST AS PER BHEL SPEC. 3. VIBRATION & NOISE LEVEL 4. OVERALL DIMENSIONS AND ORIENTATION 5. DEGREE OF PROTECTION 6. MEASUREMENT OF RESISTANCE OF RTD & BTD 7. MEASUREMENT OF RESISTANCE, IR OF SPACE HEATER 8. NAMEPLATE DETAILS 9. EXPLOSION FLAME PROOFNESS (IF SPECIFIED) 10. PAINT SHADE, THICKNESS & FINISH	MA	ELECT. TEST	1/TYPE/SIZE	IS-325/ BHEL SPEC/ DATA SHEET	IS-325/ BHEL SPEC/ DATA SHEET	TEST REPORT	2	1*	1	* NOTE - 1
3.0			MA	-DO-	100%	-DO-	-DO-	-DO-	2	1\$	1	\$ NOTE - 2
			MA	-DO-	100%	IS-12075 & IS-12065	IS-12075 & IS-12065	-DO-	2	1\$	1	\$ NOTE - 2
			MA	MEASUREMENT & VISUAL	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET & RELEVANT IS	INSPC. REPORT	2	1	-	
			MA	ELECT. & MECH. TEST	1/TYPE/SIZE	RELEVANT IS	BHEL SPEC. AND DATA SHEET	TC	2	-	1	TC FROM AN INDEPENDENT LABORATORY, REFER NOTE-3
			MA	-DO-	100%	-DO-	-DO-	-DO-	2	1\$	1	\$ NOTE - 2
			MA	-DO-	100%	-DO-	-DO-	-DO-	2	1\$	1	\$ NOTE - 2
			MA	VISUAL	100%	IS-325 & DATA SHEET	IS-325 & DATA SHEET	INSPC. REPORT	2	1\$	1	\$ NOTE - 2
			MA	EXPLOSION FLAME PROOF TEST	1/TYPE	IS-3682 IS-8239 IS-8240	IS-3682 IS-8239 IS-8240	TC	2	-	1	TC FROM AN INDEPENDENT LABORATORY, REFER NOTE-3
			MA	VISUAL & MEASUREMENT BY ELKOMETER	SAMPLE	BHEL SPEC. & DATA SHEET	BHEL SPEC. & DATA SHEET	TC	2	1\$	1	SAMPLING PLAN TO BE DECIDED BY INSPECTION AGENCY \$ NOTE - 2
BHEL												
PARTICULARS												
NAME												
SIGNATURE												
DATE												
BIDDER/VENDOR												
BIDDER'S/VENDORS COMPANY SEAL												

	QUALITY PLAN SHEET 1 OF 9	CUSTOMER : NTPC BIDDER/ VENDOR SYSTEM CUSTOMER : NTPC	PROJECT TITLE 2X500 MW NNTPS (TG) QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03 ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV) PROJECT	SPECIFICATION : PE-TS-402-501-A001 NUMBER : SPECIFICATION : TITLE SECTION VOLUME III SPECIFICATION : NUMBER : PE-TS-402-501-A001 SPECIFICATION : TITLE SECTION VOLUME III REMARKS	10 11					
						SL. NO.				
1	2	3	4	5	6	7	8	9	10	11
NOTES: 1 DEPENDING UPON THE SIZE AND CRITICALLY, WITNESSING BY BHEL SHALL BE DECIDED. 2 ROUTINE TESTS ON 100% MOTORS SHALL BE DONE BY THE VENDOR. HOWEVER, BHEL SHALL WITNESS ROUTINE TESTS ON RANDOM SAMPLES. THE SAMPLING PLAN SHALL BE MUTUALLY AGREED UPON. 3 IN CASE TEST CERTIFICATES FOR THESE TESTS ON SIMILAR TYPE, SIZE AND DESIGN OF MOTOR FROM INDEPENDENT LABORATORY ARE AVAILABLE, THESE TEST MAY NOT BE REPEATED. 4 WHEREVER CUSTOMER IS INVOLVED IN INSPECTION, AGENCY (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER.										
Legends for Inspection agency 1. BHEL/CUSTOMER 2. VENDOR (MOTOR MANUFACTURER) 3. SUB-VENDOR (RAW MATERIAL/COMPONENTS SUPPLIER) P. PERFORM W. WITNESS V. VERIFY										
BHEL										
PARTICULARS NAME SIGNATURE DATE										
BIDDER/VENDOR SIGNATURE DATE BIDDERS/VENDORS COMPANY SEAL										



TECHNICAL SPECIFICATION FOR
105/25T TG HALL EOT CRANE
2X500 MW NNTPS (TG)

SPECIFICATION NO. PE-TS-402-501-A001

VOLUME III

REV 00

DATE

ANNEXURE-VI

DRAWINGS / DOCUMENTS TO BE SUBMITTED WITH THE BID

Bidder shall submit the following drawings / documents along with their bid

- a) Copy of Electrical Scope between BHEL & Vendor duly stamped
- b) Electrical Equipment Specification for EOT Crane System duly stamped
- c) Electrical load list
- d) Deviation schedule with reference to specific clauses of the specification along with reason for such deviation in the format given under Vol-III
- e) Un priced copy of price format indicating quoted/ not quoted against each row/column
- f) Copy of pre-bid clarifications, if any, duly signed & stamped
- g) Signed/ Stamped copy of Compliance cum Confirmation Certificate (Vol-III)

OFFER WILL BE CONSIDERED AS INCOMPLETE IN ABSENCE OF ANY OF ABOVE DOCUMENTS. DOCUMENT OTHER THAN ABOVE, IF ANY, SUBMITTED WITH THE OFFER WILL NOT FORM PART OF CONTRACT AND ACCORDINGLY WILL NOT BE CONSIDERED FOR BID EVALUATION.




TITLE: TECHNICAL SPECIFICATION 2X500 MW NNTPS (TG) COMPLIANCE CUM CONFIRMATION CERTIFICATE	SPEC. NO.: PE-TS-402-501-A001
	VOLUME: III
	SECTION:
	REV. NO. 0 DATE
	SHEET 1 OF 1

COMPLIANCE CUM CONFIRMATION CERTIFICATE


The bidder shall confirm compliance with following by signing/ stamping this compliance certificate (every sheet) and furnish same with the offer.

- a) The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusions other than those mentioned under "exclusion" and those resolved as per 'Schedule of Deviations', if applicable, with regard to same.
- b) There are no other deviations w.r.t. specifications other than those furnished in the 'Schedule of Deviations'. Any other deviation, stated or implied, taken elsewhere in the offer stands withdrawn unless specifically brought out in the 'Schedule of Deviations'.
- c) Bidder shall submit QP in the event of order based on the guidelines given in the specification & QP enclosed therein. QP will be subject to BHEL/ CUSTOMER approval & customer hold points for inspection/ testing shall be marked in the QP at the contract stage. Inspection/ testing shall be witnessed as per same apart from review of various test certificates/ Inspection records etc. This shall be within the contracted price with no extra implications to BHEL after award of the contract.
- d) All drawings/ data-sheets/ calculations etc. submitted along with the offer shall be considered for reference only, same shall be subject to BHEL/ CUSTOMER approval in the event of order.
- e) The offered materials shall be either equivalent or superior to those specified in the specification & shall meet the specified/ intended duty requirements. In case the material specified in the specifications is not compatible for intended duty requirements then same shall be resolved by the bidder with BHEL during the pre - bid discussions, otherwise BHEL/ Customer's decision shall be binding on the bidder whenever the deficiency is pointed out.
- f) For components where materials are not specified, same shall be suitable for intended duty, all materials shall be subject to approval in the event of order.
- g) The commissioning spares shall be supplied on 'As Required Basis' & prices for same included in the base price itself.
- h) All sub vendors shall be subject to BHEL/ CUSTOMER approval in the event of order.
- i) The EQUIPMENT'S functional guarantees shall stand valid till at least eighteen (18) months from PERFORMANCE GUARANTEE test of equipment as per technical specification or commercial terms and conditions, whichever is later.
- j) In the event of order, all the material required for completing the job at site shall be supplied by the bidder within the ordered price even if the same are additional to approved billing break up, approved drawing or approved Bill of quantities. This clause will apply in case during site commissioning additional requirements emerges due to customer and/ or consultant's comments. No extra claims shall be put on this account.
- k) Schedule of drawings submissions, comment incorporations & approval shall be as stipulated in the specifications. The successful bidder shall depute his design personnel to BHEL's/ Customer's/ Consultant's office for across the table resolution of issues and to get documents approved in the stipulated time.
- l) As built drawings shall be submitted as and when required during the project execution.
- m) The bidder has not tempered with this compliance cum confirmation certificate and if at any stage any tempering in the signed copy of this document is noticed then same shall be treated as breach of contract and suitable actions shall be taken against the bidder.

	TITLE	SPECIFICATION NO.
	MOTOR DATA SHEET - C	VOLUME II B
		SECTION D
		REV NO. 00 DATE 29/08/2005
		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.
	MOTOR DATA SHEET - C	VOLUME II B
		SECTION D
		REV NO. 00 DATE 29/08/2005
		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		



NAME OF VENDOR:-

SL NO	VOULME/SECTION	PAGE NO.	CLAUSE NO.	TECHNICAL SPECIFICATIO N/ TENDER DOCUMENT	COMPLETE DESCRIPTION OF DEVIATION	COST OF WITHDRAWAL OF DEVIATION	REFERENCE OF PRICE SCHEDULE ON WHICH COST OF WITHDRAWL OF DEVIATION IS APPLICABLE	NATURE OF COST OF WITHDRAWAL OF DEVIATION (POSITIVE/ NEGATIVE)	REASON FOR QUOTING DEVIATION
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TECHNICAL DEVIATIONS

COMMERCIAL DEVIATIONS

PARTICULARS OF BIDDERS/ AUTHORISED REPRESENTATIVE

NAME	DESIGNATIONS	SIGN & DATE

NOTES:

- For self manufactured items of bidder, cost of withdrawal of deviation will be applicable on the basic price (i.e. excluding taxes, duties & freight) only.
- For directly dispatchable items, cost of withdrawal of deviation will be applicable on the basic price including taxes, duties & freight.
- All the bidders have to list out all their Technical & Commercial Deviations (if any) in detail in the above format.
- Any deviation not mentioned above and shown separately or found hidden in offer, will not be taken cognizance of.
- Bidder shall submit duly filled unpriced copy of above format indicating "quoted" in "cost of withdrawal of deviation" column of the schedule above along with their Techno-commercial offer, wherever applicable.
- Bidder shall furnish price copy of above format along with price bid.
- The final decision of acceptance/ rejection of the deviations quoted by the bidder shall be at discretion of the Purchaser.
- Bidders to note that any deviation (technical/commercial) not listed in above and asked after Part-I opening shall not be considered.
- For deviations w.r.t. Payment terms, Liquidated damages, Firm prices and submission of E1/ E2 forms before claiming 10% payment, if a bidder chooses not to give any cost of withdrawal of deviation loading as per Annexure-VIII of GCC. Rev-06 will apply. For any other deviation mentioned in un-priced copy of this format submitted with Part-I bid but not mentioned in priced copy
- Any deviation mentioned in priced copy of this format, but not mentioned in the un-priced copy, shall not be accepted.
- All techno-commercial terms and conditions of NIT shall be deemed to have been accepted by the bidder, other than those listed in unpriced copy of this format.
- Cost of withdrawal is to be given seperately for each deviation. In no event bidder should club cost of withdrawal of more than one deviation else cost of withdrawal of such deviations which have been clubbed together shall be considered as NIL.
- In case nature of cost of withdrawal (positive/negative) is not specified it shall be assumed as positive.
- In case of discrepancy in the nature of impact (positive/ negative), positive will be considered for evaluation and negative for ordering.

