

2X660 MW THDC Khurja STPP

TECHNICAL SPECIFICATION FOR 140/25T TG HALL DOUBLE GIRDER EOT CRANES

SPECIFICATION NO.: PE-TS-475-501-A501



**BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR PROJECT ENGINEERING MANAGEMENT
NOIDA (U.P.)
INDIA**



TITLE

2X660 MW THDC Khurja STPP

DOUBLE GIRDER EOT CRANES ABOVE 100T

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REV 00

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SECTION – I

SPECIFIC TECHNICAL REQUIREMENTS

SUB-SECTION IA – Specific Technical Requirement (Mechanical)

SUB-SECTION IB – Specific Technical Requirement (Electrical)

SUB-SECTION IC – Data Sheet A

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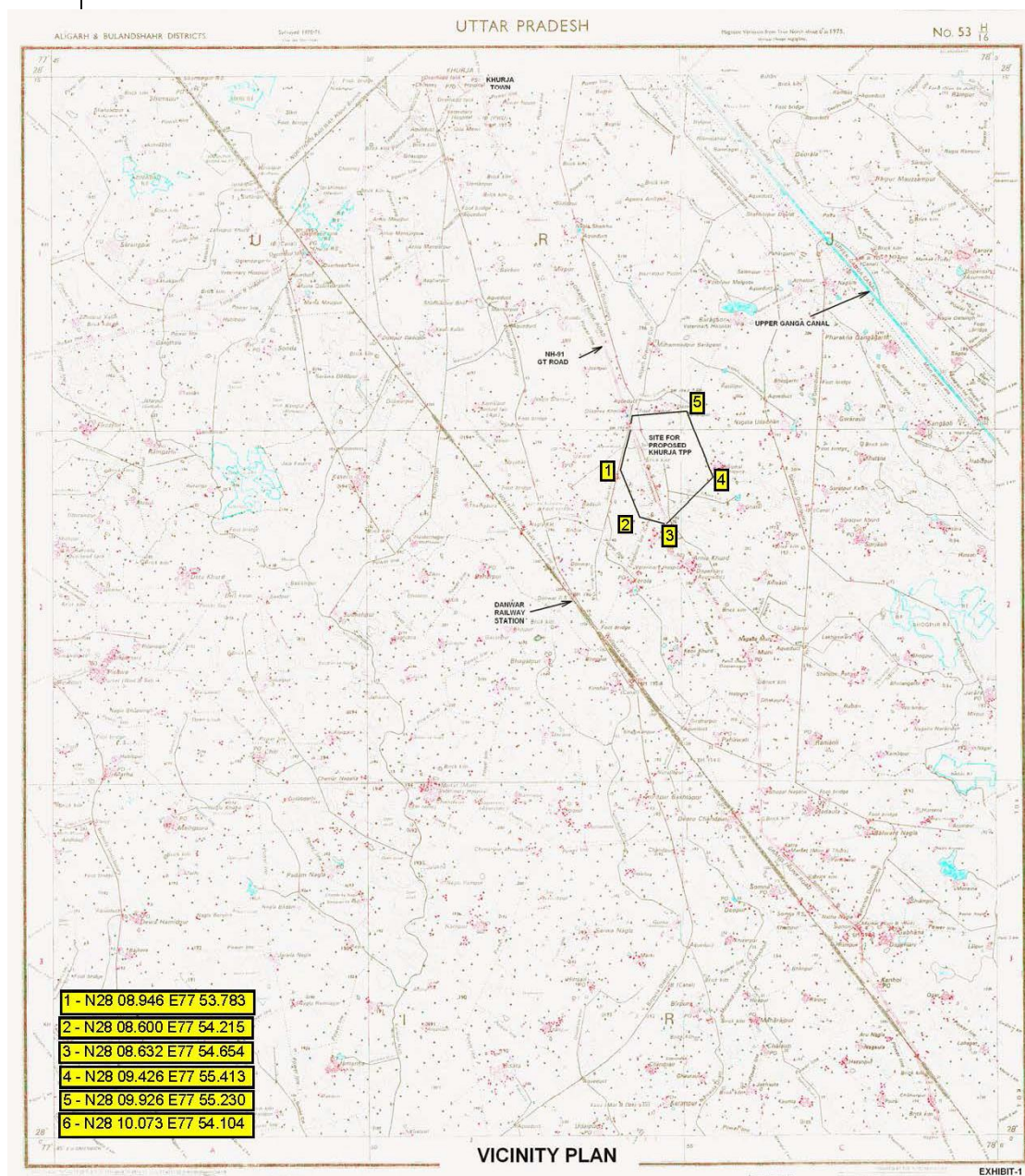
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PROJECT INFORMATION

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CLAUSE NO.	एनटीपीसी NTPC PROJECT INFORMATION 		
4.03.00	AIRPORT The nearest commercial airport at Delhi is located at a distance of approximately 120 kms from the project site.		
5.00.00	LAND The land requirement for the project has been estimated as 1400 Acres for Main Plant, Balance of Plant including Coal Handling Plant, Ash Disposal Area, Ash Disposal Pipeline Corridors, Construction Stores & Offices, Laydown & Fabrication Yard, and Labor Colony etc. Land has already been acquired through UPSIDC. Additional patches of required land shall be acquired.		
6.00.00	WATER The Upper Ganga Canal passes near by the Khurja STPP. The makeup water for the project is proposed to be drawn from Upper Ganga Canal at a distance of about 13 kms. Quantity of make-up water required for 2X660MW would be about 3265 Cum/hr with ash water recirculation system and 4415 Cum/hr with once through ash water system. Make-up water is proposed to be used for condenser cooling, ash sluicing, coal dust suppression and other plant processes. Make up water shall be drawn from the canal by constructing suitable intake structures. A Raw Water Reservoir is envisaged. Govt. of UP has conveyed commitment for supply of required quantity of water for the project.		
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES	TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC NO.: THDC/RKSH/CC-9915-371	SUB-SECTION-A-0 PROJECT INFORMATION	PAGE 2 OF 13

CLAUSE NO.	एनटीपीसी NTPC PROJECT INFORMATION ANNEXURE-I VICINITY PLAN  1 - N28 08.946 E77 53.783 2 - N28 08.600 E77 54.215 3 - N28 08.632 E77 54.654 4 - N28 09.426 E77 55.413 5 - N28 09.926 E77 55.230 6 - N28 10.073 E77 54.104 VICINITY PLAN EXHIBIT-1		
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES	TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC NO.: THDC/RKSH/CC-9915-371	SUB-SECTION-A-0 PROJECT INFORMATION	PAGE 5 OF 13



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SUB-SECTION IA**SPECIFIC TECHNICAL REQUIREMENT (MECHANICAL)**

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SCOPE OF ENQUIRY/INTENT OF SPECIFICATION

- 1.1 This specification includes, but not limited to SUPPLY PART, SERVICE PART & MANDATORY SPARES comprising of design (i.e. preparation and submission of drawing /documents including “As Built” drawings and O&M manuals), engineering, manufacture, fabrication, assembly, inspection / testing at vendor's & sub-vendor's works, painting, maintenance tools & tackles fill of lubricants & consumables along with spares for erection, start up and commissioning as required, forwarding, proper packing, shipment and delivery at site, unloading, handling, transportation & storage at site, in-site transportation, assembly, erection & commissioning, trial run at site and carrying out performance guarantee/Functional/Demonstration tests at site (As applicable), and OPERATION AND MAINTENANCE SERVICE including manpower, supervision, consumables etc. for operation & maintenance of cranes for 24 crane-months for each crane after commissioning & final handing over to end customer (after O & M service) in flawless condition of crane(s) for project and package specified above complete with all accessories for the total scope defined as per BHEL NIT & tender technical specification, amendment & agreements till placement of order.
- 1.2 The contractor shall be responsible for providing all material, equipment & services, which are required to fulfil the intent of ensuring operability, maintainability, reliability and complete safety of the complete work covered under this specification, irrespective of whether it has been specifically listed herein or not. **Omission of specific reference to any component / accessory necessary for proper performance of the equipment shall not relieve the contractor of the responsibility of providing such facilities to complete the supply, erection & commissioning and load testing of the cranes and its accessories.**
- 1.3 It is not the intent to specify herein all the details of design and manufacture. However, the equipment shall conform in all respects to high standards of design, engineering and workmanship and shall be capable of performing the required duties in a manner acceptable to purchaser who will interpret the meaning of drawings and specifications and shall be entitled to reject any work or material which in his judgement is not in full accordance herewith.
- 1.4 The extent of supply under the contract includes all items shown in the drawings, notwithstanding the fact that such items may have been omitted from the specification or schedules. Similarly, the extent of supply also includes all items mentioned in the specification and /or schedules, notwithstanding the fact that such items may have been omitted in the drawing.
- 1.5 The general term and conditions, instructions to tenderer and other attachment referred to elsewhere are made part of the tender specification. The equipment materials and works covered by this specification is subject to compliance to all attachments referred to in the specification. The bidder shall be responsible for and governed by all requirements stipulated herein.
- 1.6 While all efforts have been made to make the specification requirement complete & unambiguous, it shall be bidders' responsibility to ask for missing information, ensure completeness of specification, to bring out any contradictory / conflicting requirement in different sections of the specification and within a section itself to the notice of BHEL and to seek any clarification on specification requirement in the format enclosed under Section-III of the specification **within 10 days of receipt of tender documents**. In absence of any such clarifications, in case of any contradictory requirement, the more stringent requirement as per interpretation of Purchaser/Customer shall prevail and shall be complied by the bidder without any commercial implication on account of the same. Further in case of any missing information in the specification not brought out by the prospective bidders as part of pre-bid clarification, the same shall be furnished by Purchaser/ Customer as and when brought to their notice either by the bidder or by purchaser/ customer themselves. However, such requirements shall be binding on the successful bidder without any commercial & delivery implication.
- 1.7 The bidder's offer shall not carry any sections like clarification, interpretations and /or assumptions.
- 1.8 Deviations, if any, should be very clearly brought out clause by clause in the enclosed deviation schedule along with cost of withdrawal; otherwise, it will be presumed that the vendor's offer is strictly in line with NIT

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specification. If no cost of withdrawal is given against the deviation, it will be presumed that deviation can be withdrawn without any cost to BHEL/its customer.

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

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

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

1.12 Apart from specific design requirement for crane, design of various systems/ Sub-systems and all equipment will also strictly meet the stipulations of Customer's Technical Specification.

Note:

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

- Internet explorer version – Minimum Internet Explorer 7.
- Internet speed – 2 mbps (Minimum preferred).
- Pop ups from our external DMS IP (124.124.36.198) should not be blocked.
- Vendor's internal proxy setting should not block DMS application's link (<https://www.bhelpem.com/wrenchweb>).

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1.0.0. SCOPE OF WORK

1.1.0. SCOPE OF SUPPLY

1.1.1. Equipment and services to be furnished by the bidder for the Two (2) nos. 140T/25T capacity double girder EOT Cranes for TG Hall with accessories as per the details given in the technical specification and data sheet A. Any equipment / accessories not specified in the specification but required to make the EOT crane complete for 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.

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

- a. Bridge girders
- b. End carriages with wheels
- c. Crab (trolley)
- d. Cross Travel & Long Travel drive arrangement
- e. All electrical equipment including cables, junction box, VVVF drive, RRC & pendent and panels etc. as per datasheet A.
- f. PVC insulated shrouded bus bar conductor type DSL
- g. Earthing arrangement
- h. Fill of lubricants till handing over.
- i. Painting of cranes and accessories including touch up painting at site.
- j. Two (2) nos. 3.5 Core Power copper flexible cable (length- Half the bay length + 25m) of suitable size as per load calculation for commissioning, testing & operation of EOT Crane till such time the DSL is charged.
- k. Rail including all accessories and end stopper
- l. Maintenance tools & Tackle
- m. Erection & Commissioning spares
- n. Mandatory Spares
- o. Operator's cabin.
- p. Main Isolating switch/Changeover in enclosure at operating floor for disconnecting supply to DSL. Termination of incoming cable (from BHEL) into isolating switch shall be in Vendor's scope. For maintenance of cranes, 2 nos. isolating switches are to be provided at extreme ends of bay.

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- q. Slings and cradle for load testing on returnable basis
- r. Storm brake (Hydraulic rail clamp) (2 nos. per crane)

1.1.4 Maintenance Tools and Tackles

As per Annexure III, section-IA of this specification

1.1.5 Mandatory Spares

A complete unused and new set of Mandatory Spare parts shall be supplied. Each part shall be stamped so as to be identified, easy for its use. The items supplied shall be of the best quality. The minimum requirement of mandatory spare parts is listed in Annexure –II section-IA 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. Fill of lubricants; oil etc. till commissioning of the cranes shall also be supplied by the bidder.

1.1.7 Any supplies/services mentioned in GCC, SCC as relevant to the package

1.2.0 Services to be provided by the bidder

1.2.1. Packing, forwarding and transportation to site

1.2.2. Development of storage space including ward & watch of the equipment and handling at site.

1.2.3 Unloading, storage and handling at site.

The Bidder shall provide means for all unloading and reloading for all consignments of plant; both during transport to Site and on the Site. Consignments shall be unloaded immediately on arrival at Site. The Bidder is required to take the necessary steps in order to provide the carriage, special supporting structures for heavy loads, etc. The following parts shall be stored inside enclosed warehouses:

Bolts, pins, packing, tools, insulation materials, electrical parts with electrical devices attached, electric motors and excitation equipment, instruments, welding material and

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equipment, all small parts and all parts of the crane which already have been finally painted. If large parts are stored in the open air, they shall be provided with weather resistant and fire & resistant covers. Electrical parts, which are not packed in heavy duty polyethylene foil and those so packed, but whose packing has been damaged shall be kept in suitable places from the moment of storage to the moment of installation. All insulation materials which will be taken from the warehouse for installation and which are stored temporarily in the station shall be protected from weather or humidity. All the equipment shall be stored as per standard storage and preservation instructions etc. of the suppliers.

1.2.4 Arranging test load at site

Collecting the test load at site within a radius of 1-2 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.

1.2.5 Erection and Commissioning & E-Learning Package (Annexure-IX)

1.2.6 Demonstration / Load test at bidder's Works and at site.

1.2.7 Obtaining clearance and acceptance certificate from the concerned competent

Authority after site test and as and when required as per Government Norms /Statutory body till the time of final handling over to Customer. Necessary fees/expenditure as required shall be borne by the supplier.

1.2.8 Operation & maintenance for two years of each crane with details as per Annexure A which may be further extended as per requirement to be intimated by BHEL site. However, bidder to note that warranty period as per relevant clause of GCC shall start after handling over the cranes to BHEL/customer after completion of O&M services.)

1.2.9 Any service mentioned in GCC & SCC as relevant to the package.



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1.3.0. PAINTING & COLOUR SCHEME

As per Annexure IV, section-IA of this specification

2.0.0. Works Excluded

Supply feeder and cable from feeder / MCC to isolating switch.

Gantry girder

Dead load for load/ overload testing at site

Space for storage.

Exclusion, if any, mentioned in GCC, SCC.

3.0.0. Drawing and documents submission schedule along with number of prints.

Drawing and documents submission schedule along with number of prints / copies required for various drawing and documents are listed in Annexure –V, section-IA 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 “Cost of withdrawal of deviation” attached in Section III and 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 mention “**NO DEVIATION**” in cost of withdrawal of deviation format.

5.0.0. Makes of Sub - Vendor items

Makes of bought out items as per Annexure-I, section IA 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.

6.0.0 Parameter and tolerances for structural assembly including rail shall be as per the relevant standards.

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7.0.0. Performance Test requirement

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 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.

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

Performance test of the crane shall include load tests and speeds in various motions at site.

7.1.0 Testing at site

Completely assembled crane at site shall be check for misalignment of gears, shafts and other items. Following minimum tests shall be conducted on the crane at the site

- i. Deflection test of bridge girder at rated load. Crane shall rest on centerline of LT wheels.
- ii. 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. Electrical tests for brakes, panel, electrical equipment etc. as per IS - 3177
- iii. All Other tests as per IS-3177.
- iv. Speed test at rated load for hoisting, CT and LT mechanism.
- v. Brake test.
- vi. Any other test as per IS-3177

Note: The test shall be carried out with actual panel, RRC, Master Controller etc.

8.0 Consumables

The Bidder's scope includes requirements of consumables such as oils, lubricants including grease, servo fluids, gases and essential chemicals etc. till handing over. Consumption of all these consumables till handing over shall also be included in the scope of the Bidder. Bidder shall also supply a quantity of the full charge of each variety

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of lubricants, servo fluids, gases, chemicals etc. used which is expected to be utilized till handing over. This additional quantity shall be supplied in separate Containers.



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ANNEXURE A**OPERATION AND MAINTENANCE SERVICES SHALL INCLUDE BUT NOT LIMITED TO FOLLOWING (FOR TG HALL CRANE ONLY)**

- 1.0 Scope covers operation and maintenance service including manpower, supervision, consumables etc. for complete operation and maintenance of 2 nos. 140T/25T Double Girder Crane for Power House area for two years after successful erection, commissioning & load testing. The O & M period shall be started after successful load testing at site.
- 2.0 For Operation of the Crane, an experienced crane operator or shall be available for each crane as and when required by BHEL for at least 16hrs a day, daily.
- 3.0 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 assembly	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 equipment 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.



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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. Earthing 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 equipment 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



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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 meagre 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.

4.0 Bidders' scope of work shall also include, arranging the statutory clearance from the concerned Government body/Authority as and when required for renewal of license till handing over. It shall be bidder's responsibility to ensure the presence of competent authority at the time of testing and obtaining the clearance and acceptance certificate from the concerned authority. Necessary fees/expenditure as required shall be borne by the supplier.

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QUALITY ASSURANCE AND INSPECTION REQUIREMENT



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1.1.0. Inspection and Testing

Bidder shall submit QAP based on the guidelines given in the specification & QAP enclosed therein.

1.1.1. Inspection and testing at Manufacturer's works

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

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

STAGE INSPECTION

Stage inspection of various components of crane shall be guided by the MQP approved during detail engineering. Indicative MQP is attached in the specification. However, following shall be ensured and read in conjunction with relevant clause of MQP w.r.t. stage inspection:

- i. All test certificates shall be in original and legible. Photocopies certified by Mill/ manufacturer of raw material used, are acceptable.
- ii. 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.**
- iii Radiographs shall be inspected to a sensitivity of 2%.
- iv 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

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2. Defects giving indication larger than ‘4 (four) mm diameter equivalent flaw’ except for wheels for which Defects giving indication larger than ‘6 (six) mm diameter equivalent flaw.’ 3. Group of defects with maximum indication less than that from a 4 mm diameter 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. v. Gear boxes shall be checked at No load for backlash, tooth contact, noise, temperature rise and vibration as per attached Procedure No. PEM (Q)/001. vi. 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). vii. Acceptance and routine tests (HV and insulation) for all electrical and electro-mechanical components and system as per governing specification 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:			

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- 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 equipment etc. as per IS - 3177
- d) All Other tests as per IS-3177.

Procedure for Load/Overload testing of EOT cranes at Manufacturer's Works & Site

Refer Testing requirement as mentioned at ANNEXURE-VII.



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2X660 MW THDC Khurja STPP

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Procedure No. PEM (Q)/001

SHOP TEST PROCEDURE FOR GEAR BOX

1.0.0	Scope: Acceptance Norms for Crane Gear Boxes
1.1.0	This procedure lays down the Acceptance norms for the Gear boxes for EOT crane. This standard also covers vertical gear boxes. 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.
2.0.0	The following dimensions shall be checked:
2.1.0	i. Diameter and keyway dimensions of input and output shafts. ii. Projection of input and output shafts beyond foundation holes and Centre lines of gear box. iii. Centre distance between input and output shafts. iv. Centre Height. v. Distance between foundation holes with respect to center line of the output shaft and distance of foundation holes from center line of the gearbox. vi. Overall dimensions
3.0.0	Backlash
3.1.0	The back lash shall be checked by dial gauge preferably (refer Figure –1). Lead wire may be also be used but final decision in case of dispute shall be taken by using dial gauge. The backlash shall be within the limits specified in the drawing. If the value of the backlash allowed is not specified in the drawing, the allowed backlash shall be a given in Table-1
4.0.0	Area of Contact:
4.1.0	Area of contact shall be taken by applying Prussian blue. The contact area shall be within the limits mentioned below (refer Figure –2) For final stage of Hoist gearing: h / H shall be more than 30% (a – c) / b shall be more than 40% For all other gears: h / H shall be more than 40% (a – c) / b shall be more than 50%
5.0.0	Running Test
5.1.0	The gear boxes shall be run under no-load condition at the rated speed for minimum four hours in each direction and the following are to be checked:

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	i. All bolts at the joints remain tight ii. All gear mesh lines are getting enough lubrication iii. All bearings are getting enough lubrication iv. Bearing temperatures after running for four hours shall not exceed 50 deg. Centigrade or 15 deg. centigrade above ambient whichever is higher. Temperature shall be checked after every hour. v. Vibration : Maximum limit 125 microns (peak to peak) vi. Sound: The gearbox shall not emit unusual sound as obtained under conditions of hard meshing, high spots etc. Maximum sound level shall be 85 dBA at a distance of 1000mm and 91 dBA at a distance of 300 mm. vii. There shall be no Oil leakage at parting lines, bearing housings or inspection covers.
6.0.0	General
6.1.0	In addition to the above specific points, the following general points shall be ensured: 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. Name plate should provide information eg. Ratio, KW rating, Bearing details and manufacturers name.



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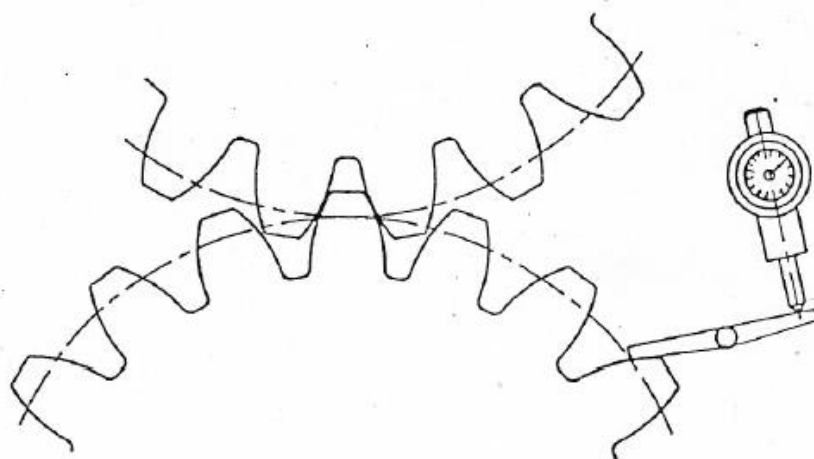


FIG.1 MEASUREMENT OF BACKLASH

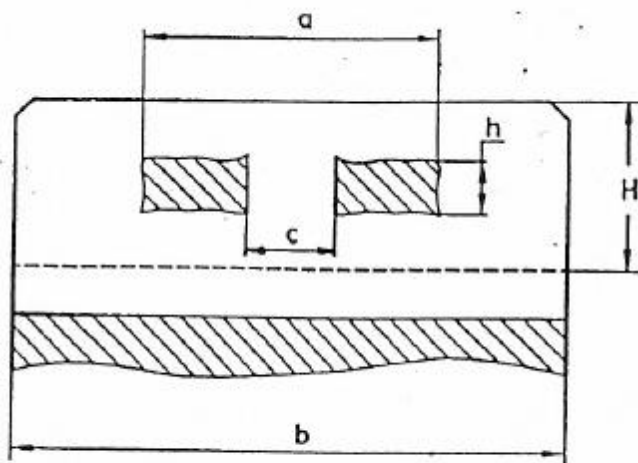


FIG.2 AREA OF CONTACT OF GEAR TEETH



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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

40880/2020/PS-PEM-MAX



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SECTION – IA

CUSTOMER SPECIFICATION

PS-PEM-MAX		TECHNICAL REQUIREMENTS		
CLAUSE NO.				
7.00.00	EOT CRANE:			
7.01.00	TURBINE HALL EOT CRANE			
	(i) RATING			
	(a) Capacity	Two (2) number of Electrically operated overhead travelling cranes with associated auxiliaries, along with electrical equipment, control & instrumentation as required and specified shall be provided in the turbine hall for erection and maintenance of turbo-generators and their auxiliaries.		
		~~For calculating capacity of each crane bidder may opt any one of the following options:~~		
		~~Option # I: - Each crane shall be capable of lifting at least 105% of the weight of single heaviest component/ equipment (except generator stator), including lifting beam and slings etc. (as applicable) to be handled in TG hall for erection as well as maintenance of the equipment provided in AB bay. The auxiliary hook capacity shall not be less than 20 Ton.~~		
		~~In addition it shall also be possible to handle Generator Stator with tandem operation of two Turbine hall EOT cranes for which necessary arrangements shall be provided. In such case, the combined capacity of two EOT cranes shall not be less than 105% of weight of Generator Stator, including the weight of lifting beam with swiveling arrangement and slings.~~		
		~~Option # II:- Each crane shall be capable of lifting at least 105% of the weight of single heaviest component/ equipment/ HP and IP turbine assembly (except generator stator), including lifting beam and slings etc. (as applicable) to be handled in TG hall for erection as well as maintenance of the equipment provided in AB bay. The auxiliary hook capacity shall not be less than 20 Ton. The generator stator shall be handled by the bidder by separate portal cranes / strand jack arrangement.~~		
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371		SUB-SECTION-A-3 TURBINE GENERATOR AND AUXILIARIES
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						Option # III:- Each crane shall be capable of lifting at least 105% of the weight of single heaviest component/ equipment (except generator stator and turbine assemblies), including lifting beam and slings etc. (as applicable) to be handled in TG hall for erection as well as maintenance of the equipment provided in AB bay. The auxiliary hook capacity shall not be less than 20 Ton. In addition it shall be possible to handle HP and IP turbine assemblies with tandem operation of two turbine hall EOT cranes for which necessary arrangements shall be provided. In such case, the combined capacity of two EOT cranes shall not be less than the 105% of weight of the HP/IP turbine assembly, including the weight of lifting beam with swiveling arrangement and slings. The generator stator shall be handled by the bidder by separate portal cranes / strand jack arrangement.			

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MPS-PEM-MAX				
CLAUSE NO.	एनटीपीसी NTPC	TECHNICAL REQUIREMENTS		
		(b) One drive for trolley drive. (viii) Operator's cabin and platform (a) Open type for indoor service to be located at B-row column. Cabin shall be designed as per IS3177 so as to have unrestrictive view of load from operator's cabin. (b) The area of cabin to be 2500/1850 mm with a head room of 2000 mm. (c) A foot operated electric warning horn of double bell type suitable for 240 V AC. of noise level 95 dBA at 3.5 m. (d) One brass gong suspended outside the Cabin and operated from inside. (e) A distinct type alarm with conspicuous warning lights on either side of the crane bridge to indicate overloading of crane. (f) Adequate carbon dioxide gas cylinders of 4.5 Kg. (g) One non oscillating ventilating fan. (h) Suitable inspection cages to accommodate two persons to facilitate inspection of down shop lead. (i) Access walkways of not less than 800 mm (clear) with hand railing of height of 1100 mm along the both side of bridge girder and cross over walkways. (ix) Drums To be in accordance with IS-3177 (latest edition). (x) Wire Rope (a) Wire rope of extra flexible plough steel and of 6/36 or 6/37 construction conforming to IS: 2266 (latest edition). (xi) Bearings and lubrication (a) The type of bearings for various parts as per IS:3177 (latest). (b) Bearing life not less than 10,000 working hours.		
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PPS-PEM-MAX		NTPC		TECHNICAL REQUIREMENTS			
CLAUSE NO.							
		(c) Centralised grease lubrication with hand operated grease pump for all bearings as per bidder's standard proven practice. (xii) Guarding (a) Suitable guard to push forward or off the rail track any object placed across. (b) Suitable guards to live electrical wirings downshop lead. (c) Other guarding as per relevant standard. (xiii) Safety (a) Suitable anti-collision device of two cranes, alongwith stoppers at both the gable ends. (b) To meet the requirements of Factories Act. (xiv) Runway/trolley Rails and rail joints Rails to be as per relevant Indian Standard and joints to be butt welded by thermit welding or fusion welding. (xv) Brakes 2 X 100 % Brake shall be provided for each motion. Each brake for hoisting motion, cross travel, long travel etc., shall be designed as per following: Brakes to be as per IS 3177. The Capacity of hoisting motion brakes to be 150% of torque transmitted to the brake drum with full load and that of cross travel and long travel to be 125% of motor rated torque before deaerating. (xvi) Storm Brakes: 2x50% storm brakes, one each at each end of the bridge, shall be provided for each crane. Storm brakes shall be designed for wind velocity as indicated in "Criteria for wind resistant design for structure and equipment", Sub-section – D-01 / Civil Works/ Part-B/ Section-VI. (xvii) Common lifting beam for generator stator a) Suitable common lifting beam for lifting generator stator by means of two cranes operating in conjunction with suitable swiveling arrangement					
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371		SUB-SECTION-A-3 TURBINE GENERATOR AND AUXILIARIES		PAGE 75 OF 92	

CLAUSE NO.		TECHNICAL REQUIREMENTS	
		b) A suitable indicating device to indicate the difference in the lifts of the two cranes, which shall be limited to 500 mm shall be provided on the lifting beam. The level difference indication shall be visible from ground level. c) A limit switch shall be provided to give alarm at both the cabins to enable the crane operators to control the level difference within 500mm. The bidder shall furnish the GA drawing of the beam showing all the dimensions, constructional details, details of crane hooks connection to the beam, lifting arrangement, level difference indicating devices, etc alongwith the bill.	
7.02.00	EOT CRANES FOR BOILER FEED PUMP(if envisaged)		
7.02.01	If BFPs provided in BC Bay or are not accessible to TG hall EOT crane as per layout requirement, one (1) no of Electrically operated travelling cranes (Double Girder type) for each unit with associated auxiliaries, alongwith electrical equipment, control & instrumentation as required and specified shall be provided in the BC bay for erection and maintenance of Boiler feed pump and their auxiliaries. The capacity of each crane shall be 10% over and above the heaviest component/equipment (including lifting beam and slings etc., if provided) or 25 Tonne whichever is higher.		
7.02.02	The EOT crane shall be pendent operated. The power shall be supplied from a single electrical power supply point at a suitable location on the operation floor of pump house.		
7.02.03	The design code for EOT crane shall be IS: 3177 latest edition.		
7.02.04	However, the speed for the various motions shall be as follows: Main hoist - 1.6 m/min Trolley Travel (Cross Travel) - 4.0 m/min Crane Travel (Long Travel) - 8.0 m/min		
7.02.05	Creep speed drives shall be provided for all the motions viz. bridge motion, trolley motion and hoist motion. This shall be 10% of the rated speeds. (Creep speed to be achieved through pony motor and planetary gear box or through variable voltage variable frequency (VVVF) system. Hoist brake shall not be used for this motion).		
7.02.06	The crane shall be electrically operated, overhead travelling type. Design and duty of crane structure, main hoist, cross travel. Long travel shall be in accordance with class M5 of IS:3177 (latest edition) and shall be suitable for indoor operation.		
7.02.07	The crane shall be complete with trolley and truck, wheels and axles, Drive mechanisms, Hoisting Drums, Brakes, Creep Speed Arrangement, Lifting tackles,		
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MPS-PEM-MAX		CLAUSE NO.		एनटीपीसी NTPC		TECHNICAL REQUIREMENTS					
7.02.08		Buffers Electric Motors, Controls, Switch Board and cabling, horns, warning lights, Limit switches etc. Any item not mentioned herein but required to make the system complete for the satisfactory performance of the crane shall also be included.									
7.02.09		The main hoist, trolley travel and crane travel for each movement shall be motor driven. Proper allowance shall be made for impact and wear in the design of the crane and the factor of safety shall be as per IS: 3177 based on the ultimate strength of the materials used at design duty. The design duty of crane structure, main hoist, cross travel and long travel shall conform to class M5 of the Indian Standard IS: 3177 (latest edition) or superior. The crane as a whole shall comply with the Indian Standard IS: 3177 / IS: 807 or approved equivalent international standard (latest edition).									
7.02.10		Mechanical and Electrical equipment of each crane shall be of simple robust design, easy for correction and adjustment, readily accessible for maintenance and elegant in appearance. All steel used in the crane shall be tested to requirements.									
7.02.11		The hoist motors shall be provided with electro-magnetic brakes / Electro Hydraulic Thrust brakes. Electro - Hydraulic Thrust brakes shall be provided for cross travel & long travel. 2 X 100 % Brake shall be provided for each motion. Each brake for hoisting motion, cross travel, long travel etc., shall be designed as per following: Brakes to be as per IS 3177. The Capacity of hoisting motion brakes to be 150% of torque transmitted to the brake drum with full load and that of cross travel and long travel to be 125% of motor rated torque before deaerating.									
7.02.12		Safe means of access shall be provided and to every place of crane where examination/maintenance of any component is involved. A platform shall extend to full length of the crane bridge on both sides of the bridge girder. The platform shall be made of checkered Steel plate. A double tire hand-rail of height 1100 mm shall be provided along the outer edge of the platform and 75 mm high toe-guards shall be provided all along the platforms and wherever else required from safety consideration. The width of platform shall not be less than 800mm in width and Guard rails shall be provided on the crab side of the bridge platform.									
7.02.13		LADDERS : Necessary access ladders shall be provided for access on to crane bridge platform from the gantry girder level, from crane bridge platform to trolley platform and from operating floor of pump to gantry girder level.									
7.02.13		The lifting tackle shall consist of a safety type lower pulley block, hook, necessary sheave and flexible steel wire ropes. The lower block sheaves and ropes shall be of adequate design and size to handle the specified loads. The hooks shall be of forged steel. The main hook shall be of Ramshorn type conforming to IS: 5749 (latest edition) for 50 T and above capacity and shank type conforming to IS:15560 (latest									
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES				TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371				SUB-SECTION-A-3 TURBINE GENERATOR AND AUXILIARIES		PAGE 77 OF 92	

MPS-PEM-MAX		CLAUSE NO.		एन टी पी सी NTPC		TECHNICAL REQUIREMENTS			

SPEM-MAX		NTPC		TECHNICAL REQUIREMENTS			
CLAUSE NO.							
7.05.00		vii). Squirrel cage Induction motor with VPI insulation shall be provided With VVVF system.					
		viii) Master controller - Desk type having following features.					
		(i) Five speed control points in each direction of hoist motion.					
		(ii) Four speed control points in each direction of bridge and trolley motion.					
		(iii) Release of operator's hand from the controls shall stop motion and set brakes automatically.					
		ix) Protective Panel					
		Provided with isolating switch, power contactor control and indication to switch ON/OFF power to starter panels, control and lighting transformer.					
		x) Starter Panel					
		Separate VVVF system panels to be provided for CT, LT and hoist motion (main and auxiliary drives).					
		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.							
xi) 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.							
		Radio remote Control of EOT Crane:					
		i) The equipment should have facility to control EOT crane by radio frequency based wireless remote unit. The equipment should be supplied with transmitter unit, receiver unit, encoder unit, decoder unit, interface panel, coupling system, battery unit and any other control gear if required.					
		ii) The equipment should be based upon the microprocessor based digital technology with almost nil hard wiring.					
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MPS-PEM-MAX		NTPC		TECHNICAL REQUIREMENTS			
CLAUSE NO.							
		iii) The remote unit should communicate up to the distance of approximately 100 meters. iv) The system has to integrate with the control system of crane, which operates at 110 V AC, Single phase. v) The remote unit should have transmitter which can be mounted on shoulder by suitable belt. Main controls can be of single joystick movement or double joystick movement type stepped control with spring return. The Micro control should be toggle switch type or push control type. vi) Frequency allotment for radio remote unit from Govt. of India, Deptt. of Telecommunication or any other agency shall be the responsibility of supplier. vii) The transmitter and receiver unit should have its own frequency and address code with each system having its own security code so that one particular set becomes unique and there is no interference from any other remote unit device. A microprocessor should check all security codes. The processor should have its own watchdog circuit. The receiver FM band should be sufficiently narrow to allow only passing of desired frequency and valid command. Any error should shut down the system immediately. viii) The remote unit should have safety key to prevent any unauthorized operation. All the crane operations should stop at once the communication break down occurs. ix) On local unit (receiver side), the system should be provided with one selector switch so that EOT crane can be operated either from Operator cabin or radio remote unit. x) ~~In case tandem operation is envisaged, a suitable selector switch shall be provided in the cabin for selection of Tandem/normal operation.~~ xi) The receiver unit along with I/O interface unit should be able to bear the vibrations and shocks encountered in normal usage of EOT crane. xii) The system should have very fast response time.					
7.06.00		Power Supply (a) Incoming numbers: (i) Turbine Hall EOT Crane					
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CLAUSE NO.		एनटीपीसी NTPC		TECHNICAL REQUIREMENTS			
		Contractor shall provide two (2) numbers 415 volts, 3 phase, 4 wire supply at operating floor near A-row column at centre of bay length. with a changeover switch in enclosure. EOT crane for BFP: Contractor shall provide one (1) numbers 415 volts, 3 phase, 3 wire supply for each unit at BFP floor near B-row column					
		(b) Down shop Lead (DSL):					
		(i) Shall conform to IS : 282 and shall be sized to					
		- Cater to all cranes working simultaneously with 40% cyclic duration factor for load. - Limit voltage drop at motor terminals within 2% at extreme positions.					
		(ii) DSL shall be sized with a margin of 10% over load requirement.					
7.07.00		(iii) Protective cover over DSL to be provided.					
		(iv) Two (2) numbers isolating switches in enclosure shall be provided at extreme ends of operating floor for disconnecting supply to DSL while maintaining the crane.					
		(v) DSL shall be located on 'A' -row side for Turbine hall EOT crane.					
		(c) Transformers					
		Dry type, with insulation class B or better. Following transformers shall be provided.					
		(i) Control Transformers : 2x100%, 415V / 110V					
		(ii) Lighting Transformers: One 415V/240V					
		(iii) Hand lamp : One 415V/24V					
		Illumination					
		HPSV lamps under the bridge. Florescent lamp over the bridge and inside the cabin.					
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MPS-PEM-MAX		CLAUSE NO.		एन टी पी सी NTPC		TECHNICAL REQUIREMENTS					
7.08.00		CABLES									
		(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 changeover switch & DSL and isolating switch & DSL.									
		(c) Extruded PVC insulated, copper conductor 1100 volt grade control cables.									
7.09.00		Mechanical overload protection - to be provided for hoist mode.									
7.10.00		MAXIMUM SPAN/DEPTH RATIO FOR GIRDER:									
		(a) Plate girders : 18									
		(b) Lattice girders : 12									
7.11.00		Material									
		(i) Structural steel plates : Mild steel, grade 'B' of IS 2062 in 100% killed, rolled section normalised and ultrasonically tested quality or high strength steel of IS 8500 as appropriate									
		(ii) Nuts & Bolts : As per IS:1363, IS:1364 and IS:1367. High Tension Friction grip bolts as per IS : 3757. High Tension Friction grip nuts as per IS : 6623.									
		(iii) Electrodes : Radiography quality, covered electrodes with heavy covering as per IS : 814 and relevant requirements of ASME Sec. IX and IIC. Bare Electrodes as per IS:7280 and flux wire combination as per IS : 3613.									
		(iv) Chequered plates : IS: 3502 (Minimum 6 mm thick O/P)									
		(v) Hand rail pipes : 32 mm NB Medium class of IS : 1161 having top and bottom rail at height of 1050 mm and 600 mm and vertical post spacing not exceeding 1500 mm with provision of kick plate(100 mm high and 6 mm thick).									
		(vi) Crane Rails : As per IS : 3443									
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MPS-PEM-MAX		CLAUSE NO.		एनटीपीसी NTPC		TECHNICAL REQUIREMENTS					
7.12.00		Minimum thickness of Structure Members:									
		(a) Load Carrying members : 8 mm									
		(b) Tubes with both ends sealed : 4.9 mm (6 SWG)									
		(c) Tubes with unsealed ends : 8 mm									
		(d) Chequered plate : 6 mm O/P									
8.00.00		PRECOMMISSIONING ACTIVITIES									
		The pre-commissioning activities including some of the important checks & tests for certain major equipment/ systems are mentioned under respective equipments, although it is the Contractor's responsibility to draw up a detailed sequential & systematic list of checks / tests and various activities / procedures connected with pre-commissioning of the complete facilities with all systems, sub-systems and equipment supplied and installed by him and get the same approved by the Employer.									
9.00.00		COMMISSIONING OF FACILITIES									
		Upon completion of pre-commissioning activities/test the Contractor shall initiate commissioning of facilities. During commissioning the Contractor shall carryout system checking and reliability trials on various parts of the facilities.									
		Contractor shall carry out these checks/tests at site to prove to the Employer that each equipment of the supply complies with requirements stipulated and is installed in accordance with requirements specified. Before the plant is put into initial operation the Contractor shall be required to conduct test to demonstrate to the Employer that each item of the plant is capable of correctly performing the functions for which it was specified and its performance, parameters etc. are as per the specified/approved values. These tests may be conducted concurrently with those required under commissioning sequence.									
10.00.00		NOISE LEVEL									
		In case the noise level pertaining to equipments covered under the scope exceeds the specified values, as given in relevant clause of General Technical requirement portion of Technical Specification, suitable acoustic enclosures, properly illuminated, having adequate inside space for movement (minimum 500 mm clear space on all sides from last equipment) alongwith all accessories in order to complete the system shall be provided to achieve the specified values. The acoustic enclosures & accessories shall be designed as per internationally accepted standards and shall be subject to Employer's approval.									
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES				TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371				SUB-SECTION-A-3 TURBINE GENERATOR AND AUXILIARIES		PAGE 83 OF 92	

CLAUSE NO.		 TECHNICAL REQUIREMENTS 	
		ANNEXURE- (D) CRITERIA FOR WIND RESISTANT DESIGN OF STRUCTURES AND EQUIPMENT All structures shall be designed for wind forces in accordance with IS: 875 (Part-3) and as specified in this document. See Annexure – B for site specific information. Along wind forces shall generally be computed by the Peak (i.e. 3 second gust) Wind Speed method as defined in the standard. Along wind forces on slender and wind sensitive structures and structural elements shall also be computed, for dynamic effects, using the Gust Factor or Gust Effectiveness Factor Method as defined in the standard. The structures shall be designed for the higher of the forces obtained from Gust Factor method and the Peak Wind Speed method. Analysis for dynamic effects of wind must be undertaken for any structure which has a height to minimum lateral dimension ratio greater than “5” and/or if the fundamental frequency of the structure is less than 1 Hz. Susceptibility of structures to across-wind forces, galloping, flutter, ovaling etc. should be examined and designed/detailed accordingly following the recommendations of IS:875(Part-3) and other relevant Indian standards. It should be estimated if size and relative position of other structures are likely to enhance the wind loading on the structure under consideration. Enhancement factor, if necessary, shall suitably be estimated and applied to the wind loading to account for the interference effects. Damping in Structures The damping factor (as a percentage of critical damping) to be adopted shall not be more than as indicated below for: a) Welded steel structures : 1.0% b) Bolted steel structures : 2.0% c) Reinforced concrete structures : 1.6% d) Steel stacks : As per IS: 6533 & CICIND Model Code whichever is more critical.	
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO. THDC/RKSH/CC-9915-371	SUB-SECTION-D-01 CIVIL WORKS PAGE 135 OF 142

CLAUSE NO.		 TECHNICAL REQUIREMENTS 	
		Appendix-I SITE SPECIFIC DESIGN PARAMETERS The various design parameters, as defined in IS: 875 (Part-3), to be adopted for the project site shall be as follows: a) The basic wind speed “Vb” at ten metre above the mean ground level : 47 metre/second b) The risk coefficient “K1” : 1.07 c) Category of terrain : Category-2	
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO. THDC/RKSH/CC-9915-371	SUB-SECTION-D-01 CIVIL WORKS
			PAGE 136 OF 142

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SECTION – IA

ANNEXURES

	TITLE 2X660 MW THDC Khurja STPP DOUBLE GIRDER EOT CRANES ABOVE 100T SPECIFIC TECHNICAL REQUIREMENTS	SPECIFICATION NO. PE-TS-475-501-A501	
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ANNEXURE-I

MAKES OF SUB-VENDOR ITEMS

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

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SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
10.	HRC FUSES	SIEMENS		
		L&T		
		ENGLISH ELECTRIC		
		GE POWER		
		EATON (BUSSMANN)		
		ABB		
11.	ISOLATING SWITCH	SIEMENS		
		L&T		
		CONTROL & SWITCH GEAR		
		ABB		
12.	SWITCH FUSE UNITS	SIEMENS		
		L&T		
		CONTROL & SWITCH GEAR	-	
		ABB		
13.	TIME DELAY RELAYS	SIEMENS		
		L&T		
		ABB		
		BCH		
		SCHNEIDER (Earlier TELE MACHANIQUE)		
14.	TRANSFORMERS	INDCOIL		
		LOGICSTAT		
		KAPPA		
		AUTOMATIC ELECTRIC		
		PRECISE ELECTRICALS		
		SILKAAN ELECTRIC MFG. CO. LTD.		
		SOUTHERN ELECTRIC		
		NEC		
15.	BULB & FLOURESCENT TUBES/FITTINGS	PHILIPS		
		BAJAJ		
		CROMPTON		
16.	CABLE LUGS (HEAVY DUTY)	DOWELLS		
		UML ENGINEERS	KOLKATA	
		JAINSON		
17.	HOOTERS	BEACON		
		OSC		
		TARGET		
		KHERAJ		
18.	LIGHTING SWITCHES	ANCHOR		
		ELLORA		
		BAJAJ		
		PHILIPS		
19.	PVC POWER CABLES	APAR INDUSTRIES LTD.	MUMBAI	
		CORDS CABLE INDUSTRIES LTD.	NEW DELHI	

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

	TITLE 2X660 MW THDC Khurja STPP DOUBLE GIRDER EOT CRANES ABOVE 100T SPECIFIC TECHNICAL REQUIREMENTS	SPECIFICATION NO. PE-TS-475-501-A501	
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SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		KRISHNA ELECTRICAL INDUSTRIES LTD	GWALIOR	
		KEC INTERNATIONAL LIMITED	MUMBAI	
		MANSFIELD CABLES COMPANY LTD	NOIDA	
		NICCO CORPORATION LTD	KOLKATA	
		PARAMOUNT COMMUNICATIONS LTD	NEW DELHI	
		POLYCAB WIRES PVT. LTD	MUMBAI	
		RAVIN CABLES LIMITED	MUMBAI	
		SUYOG ELECTRICALS LTD	VADODARA	
		SPECIAL CABLES PVT. LTD	NEW DELHI	
		SCOT INNOVATION WIRES AND CABLES PVT. LTD	SOLAN	
		SAM CABLES & CONDUCTORS (P) LTD	UDHAM SINGH NAGAR	
		SPM POWER & TELECOM PVT. LTD	HYDERABAD	
		TORRENT CABLES LTD	AHMEDABAD	
		THERMO CABLES LTD	HYDERABAD	
		TIRUPATI PLASTOMATICS PVT. LTD	JAIPUR	
21.	TRAILING CABLES	UNIVERSAL CABLES LTD	SATNA	
		NICCO	KOLKATA	
		UNIVERSAL	SATNA	
		INCAB		
		ICL	NEW DELHI	
		APAR INDUSTRIES LTD	MUMBAI	
		CMI LTD	FARIDABAD	
		KEI INDUSTRIES LTD	NEW DELHI	
22.	XLPE POWER CABLES	SUYOG ELECTRICALS LTD	VADODARA	
		APAR INDUSTRIES LTD	MUMBAI	
		CORDS CABLE INDUSTRIES LTD	NEW DELHI	
		CRYSTAL CABLE INDUSTRIES LTD	KOLKATA	
		DIAMOND POWER INFRASTRUCTURE LTD	VADODARA	
		GEMSCAB INDUSTRIES LTD	NEW DELHI	
		GOVIND CABLE INDUSTRIES	KOLKATA	
		GUPTA POWER INFRASTRUCTURE LIMITED	BHUBNESWAR	
		HAVELLS INDIA LIMITED	NOIDA	
		KEI INDUSTRIES LTD	NEW DELHI	
		KRISHNA ELECTRICAL INDUSTRIES LTD	GWALIOR	
		KEC INTERNATIONAL LIMITED	MUMBAI	

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SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		MANSFIELD CABLES COMPANY LTD	NOIDA	
		PARAMOUNT COMMUNICATIONS LTD	NEW DELHI	
		POLYCAB WIRES PVT. LTD	MUMBAI	
		RAVIN CABLES LIMITED	MUMBAI	
		SUYOG ELECTRICALS LTD	VADODARA	
		SPECIAL CABLES PVT. LTD	NEW DELHI	
		SCOT INNOVATION WIRES AND CABLES PVT. LTD	SOLAN	
		SRIRAM CABLES PVT. LTD	NEW DELHI	
		TORRENT CABLES LTD	AHMEDABAD	
		THERMO CABLES LTD	HYDERABAD	
		TIRUPATI PLASTOMATICS PVT. LTD	JAIPUR	
23.	XLPE CONTROL CABLES	APAR INDUSTRIES LTD	MUMBAI	
		CABLE CORPORATION OF INDIA LTD	MUMBAI	
		CRYSTAL CABLE INDUSTRIES LTD	KOLKATA	
		DIAMOND POWER INFRASTRUCTURE LTD	VADODARA	
		GEMSCAB INDUSTRIES LTD	NEW DELHI	
		HAVELLS INDIA LIMITED	NOIDA	
		KEI INDUSTRIES LTD	NEW DELHI	
		KRISHNA ELECTRICAL INDUSTRIES LTD	GWALIOR	
		KEC INTERNATIONAL LIMITED	MUMBAI	
		PARAMOUNT COMMUNICATIONS LTD	NEW DELHI	
		POLYCAB WIRES PVT. LTD	MUMBAI	
		RADIANT CORPORATION PRIVATE LIMITED	HYDERABAD	
		RAVIN CABLES LIMITED	MUMBAI	
		SUYOG ELECTRICALS LTD	VADODARA	
		SRIRAM CABLES PVT. LTD	NEW DELHI	
		TORRENT CABLES LTD	AHMEDABAD	
24.	CABLE GLAND	COMMET		
		SUNIL&CO		
		ARUP ENGINEERING		
		JAINSON		
		DOWELL		
25.	PUSH BUTTONS	SIEMENS		
		L&T		
		BCH		
		SCHNEIDER		

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SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
26.	LIMIT SWITCHES	SPEED-O-CONTROL ELECTROMAG		
27.	MASTER CONTROLLER	SPEED-O-CONTROL ELECTROMAG		
28.	SAFETY SWITCHES	ALSTOM L&T SIEMENS		
29.	PENDENT PUSH BUTTON STATION	OEM		
30.	INDICATING LAMPS	TECKNIC BCH SIEMENS		
31.	MCB	STANDARD MDS INDO COPP STANDARD SIEMENS L&T ABB SCHNEIDER		
32.	PANELS	OEM RITTAL PYROTECH		
33.	RESISTANCE BOXES	ENAPROS OEM		
34.	FIRE EXTINGUISHERS	ASKA EQUIPMENTS LTD. ASHOKA ENGINEERING COMPANY KANADIA FYR FYTER PVT. LTD NITIN FIRE PROTECTION INDUSTRIES LTD NEW ENGINEERING CORPORATION SAFEX FIRE SERVICES LTD UNITED FIRE EQUIPMENTS PVT. LTD ZENITH FIRE SERVICES (INDIA) PVT LTD		
35.	VVVF	YASKAWA ABB SIEMENS SCHNIEDER FUJI ELECTRIC MITSUBISHI ELECTRIC		

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SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
36.	SHROUDED DSL	SUSHEEL		
		STROMAG		
37.	ANTI COLLISION DEVICE	ELECTRONIC SWITCHES INDIA		
38.	LOAD CELL	IPA		
		SARTORIUS		
39.	RRC	ACROPOLIS ENGINEERING	-	
		SNT CONTROLS	-	
40.	GEAR BOX	OEM		* = Applicable for Geared Motors only
		ELECON ENGINEERS		
		SHANTI GEARS		
		PBL*		
		NAW*		
		NORD*		
		SEW*		
41.	RAIL	BONGFILIOLI*		
		JSPL		
		SAIL		

NOTE:

1. THE SUB VENDOR LIST ABOVE IS INDICATIVE ONLY AND IS SUBJECT TO BHEL AND NTPC APPROVAL DURING DETAILED ENGINEERING STAGE WITHOUT ANY COMMERCIAL & DELIVERY IMPLICATION TO BHEL.
2. BIDDER TO PROPOSE SUB VENDOR WITHIN 4 WEEKS OF PLACEMENT OF LOI. THEREAFTER NO REQUEST FOR ADDITIONAL SUB-VENDOR SHALL BE ENTERTAINED.
3. THE INSPECTION CATEGORY WILL BE INTIMATED AFTER AWARD OF CONTRACT BY BHEL/CUSTOMER. HOWEVER, THE SAME WILL BE ADHERED BY THE BIDDER WITHOUT ANY COMMERCIAL AND DELIVERY IMPLICATION TO BHEL/ NTPC.



TITLE

2X660 MW THDC Khurja STPP

SPECIFICATION NO. PE-TS-475-501-A501

REV 00

DOUBLE GIRDER EOT CRANES ABOVE 100T
SPECIFIC TECHNICAL REQUIREMENTS

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ANNEXURE-II MANDATORY SPARES

MANDATORY SPARES:

S. NO.	ITEM DESCRIPTION	TOTAL QUANTITY FOR THE PROJECT (2 x 660 MW)
1	Mechanical :	
(a)	Bearings for long travel wheels	1 Set(Requirement for one Crane)
(b)	Bearings for cross travel wheels	1 Set(Requirement for one Crane)
(c)	Bearings for Gear Boxes for each type of Hoist & travel (Main and aux hoist, LT and CT travel))	1 Set(Requirement for one Crane)
(d)	Brake Liner for all the brakes (main and aux hoist ,LT and Ct travel))	2 Sets(Requirement for two Crane)
(e)	Hydraulic thruster for all Brakes (Main and aux hoist, CT and LT travel)	1 Set(Requirement for one Crane)
(f)	Oil Seals (both main and aux hoist , CT and LT)	2 Sets(Requirement for two Crane)
(g)	Brake springs for all brakes (both main and aux hoist, LT and Ct travel)	1 Set(Requirement for one Crane)
(h)	Wire Rope for Aux. Hook	1 No
2	Electrical:	
i)	Solenoid Coils for Brakes	2 sets
ii)	MCBs/MCCBS/Fuse links for the whole crane	1 set
iii)	Contactors and overload Relays for Motors of the EOT	1 set of each type, size & rating
iv)	Timers of each type, size & rating	1 set
v)	Limit Switches for	
a	Main Hoist	1 set
b	Aux. Hoist	1 set
c	Cross Travel	1 set
d	Long Travel	1 set
vi)	Master Controller for Aux. Hoist	1 set each
vii)	Drive for MH,AH,CT&LT	1 no. of each type & rating

Notes:-

- One (1) Set is defined as 100% requirement for one crane for the entire cranes of similar size & capacity.
- All essential spares shall be supplied as per the requirement of the specifications. In case any spare indicated in the specification is not applicable for particular equipment then suitable applicable alternate spare have been offered / shall be supplied without any financial implication.

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3. Unless stated otherwise a 'Set', it will include the total requirement of the item for a unit module or the station as specified. Also, set for the particular equipment e.g. 'set' of bearings for a pump would include the total number of bearings in a pump. Also the 'set' would include all components required to replace the item; for example a set of bearing shall include all hardware normally required while replacing the bearings. It is further, intended that the assembly/sub-assembly which have different orientation (like left hand or right hand, top or bottom), different direction of rotation or mirror image positioning or any other reasons which result in maintaining two different sets of the spares to be used for the subject assembly/sub-assembly, these shall be considered as different types of assembly/sub-assembly.

4. Wherever the quantities have been indicated for each type, size, thickness, material, radius, range etc. these shall cover all the items supplied and installed.

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

6. Any item which is quoted as "not applicable" in the above list and is found to be "applicable" at a later date shall be supplied by the Bidder without any commercial implications. The Bidder shall note that if there is any change/ variation in equipment/ system during detail engineering which causes any change/ variation in the essential spares quantity, the same shall be supplied without any commercial implications. The price indicated for the mandatory spares shall be considered for the purpose of evaluation.

7. Mandatory spares shall not be dispatched before dispatch of corresponding main equipment. The spares shall be treated and packed for a long storage under the climatic condition prevailing at site.

8. Interchangeability and Packings: All spares supplied under this contract shall be strictly interchangeable with parts for which they are intended for replacements. These spares should include all mounted accessories like components, boards, add on items, fitting, connectors etc. and be complete in all respects so that the replacement of the main items by these spares does not require any additional item. The vendors must conform the pair to pair compatibility of each electrical spares modules with the modules should be supplied in the original package. All electronic modules should be pre set and/or preprogrammed for ready use at site. Alternatively, suitable instruction sheet indicating the details of required PCB jumper position, BCD which is setting, EPROM/PROM listing etc should be packed along with each module. Also a caution mark sign should be put on all such module which needs pre setting/pre programming before putting them in to service. The spare shall be treated and properly packed for long term storage.

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

10. Mandatory spares listed above is bare minimum requirement. In case any additional mandatory spares requirement is covered elsewhere in the tender specification, same shall be deemed to have been covered in bidders scope of supply.



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SPECIFIC TECHNICAL REQUIREMENTS

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ANNEXURE III - TOOLS & TACKLES

A complete unused new set of special purpose tools, tackles and accessories along with detailed instructions and maintenance manual for the crane shall be supplied. Each tool and wrench shall be stamped so as to be identified, easy for its use. The tools shall be supplied in steel toolbox and with a copy of instruction manual. The items supplied shall be of the best quality and 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. Further in addition to above mentioned items, if any other items is required for maintenance of cranes, the same shall also be included as a part of maintenance tools by the bidder.



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DOUBLE GIRDER EOT CRANES ABOVE 100T
SPECIFIC TECHNICAL REQUIREMENTS

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ANNEXURE IV PAINTING SPECIFICATION

1. Painting specification for steel structures:-

Surface preparation: De greasing and Mechanical cleaning with wire brush or blasting according to SIS 055900, Grade 2 ½ .

Primer : Epoxy based Zinc Phosphate. - 1 coat, DFT 35 µm per coat.

Intermediate : Epoxy base Tio2 pigmented coat - 1 coat, DFT 35 µm per coat

Finish Coat : Epoxy base paint - 2 coats, DFT 40 µm per coat.

Total DFT : 150µ

2. Painting specification for Indoor components such as motors, electrical parts etc:-

Epoxy based with suitable additives. The thickness of finish coat shall be minimum 50 microns (minimum total DFT shall be 100 microns). However in case electrostatic process of painting is offered for any electrical equipment, minimum paint thickness of 50 microns shall be acceptable for finish coat.

3. Color Shade:

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

S-PEM-MAX		 TECHNICAL REQUIREMENTS 	
CLAUSE NO.			
1.00.00	Specification of surface preparation & painting		
1.01.00	Surface preparation methods and paint/primer materials shall be of the type specified herein. If the contractor desires to use any paint/primer materials other than that specified, specific approval shall be obtained by the contractor in writing from the employer for using the substitute material.		
1.02.00	All paints shall be delivered to job site in manufacturers sealed containers. Each container shall be labeled by the manufacturer with the manufacturer's name, type of paint, batch number and colour.		
1.03.00	Unless specified otherwise, paint shall not be applied to surfaces of insulation, surfaces of stainless steel/nickel/ copper/brass/ monel/ aluminum/ hastelloy/lead/ galvanized steel items, valve stem, pump rods, shafts, gauges, bearing and contact surfaces, lined or clad surfaces.		
1.04.00	All pipelines shall be Colour coded for identification as per the NTPC Colour-coding scheme, which will be furnished to the contractor during detailed engineering.		
1.05.0	SURFACE PREPARATION		
1.05.01	All surfaces to be painted shall be thoroughly cleaned of oil, grease and other foreign matter. Surfaces shall be free of moisture and contamination from chemicals and solvents.		
1.05.02	The following surface schemes are envisaged here. Depending upon requirement any one or a combination of these schemes may be used for surface preparation before application of primer.		
	SP1	Solvent cleaning	
	SP2	Application of rust converter (Ruskil or equivalent grade)	
	SP3	Power tool cleaning	
	SP4	Shot blasting (shot blasting shall be used as surface preparation method for hot worked pipes prior to application of primer)	
	SP4*	Shot blast cleaning/ abrasive blast cleaning to SA21/2 (near white metal) 35-50 microns	
	SP5	Phospating	
	SP6	Emery sheet cleaning/Manual wire brush cleaning.	
1.06.00	APPLICATION OF PRIMER/PAINT		
1.06.01	The paint/primer manufacturer's instructions covering thinning, mixing, method of application, handling and drying time shall be strictly followed and considered as part of this specification. The Dry film thickness (DFT) of primer/paint shall be as specified herein.		
1.06.02	Surfaces prepared as per the surface preparation scheme indicated herein shall be applied with primer paint within 6 hours after preparation of surfaces.		
1.06.03	Where primer coat has been applied in the shop, the primer coat shall be carefully examined, cleaned and spot primed with one coat of the primer before applying intermediate and finish coats. When the primer coat has not been applied in the shop, primer coat shall be applied by brushing, rolling or spraying on the same day as the surface is prepared. Primer coat shall be applied prior to intermediate and finish coats.		
1.06.04	Steel surfaces that will be concealed by building walls shall be primed and finish painted before the floor is erected. Tops of structural steel members that will be covered by grating shall be primed and finish painted before the grating is permanently secured.		
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC NO.: THDC/RKSH/CC-9915-371 Page 54 of 223	SUB-SECTION - A-7 SURFACE PREPARATION & PAINTING
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S-PEM-MAX		CLAUSE NO.		एनटीपीसी NTPC		TECHNICAL REQUIREMENTS					
1.06.05		Following are the Primer/painting schemes envisaged herein:									
		PS3 - Zinc Chrome Primer (Alkyd base) by brush/Spray to IS104.									
		PS3* - Zinc Chrome primer (Alkyd base) by dip coat.									
		PS4 - Synthetic Enamel (long oil alkyd) to IS2932.									
		PS5 - Red Oxide Zinc Phosphate primer (Alkyd base) to IS 12744									
		PS9 - Aluminium paint to IS 2339.									
		PS9* - Heat resistant Aluminum paint to IS-13183 Gr.-I (for temperature 400 degC – 600 degC), IS-13183 Gr.-II (for temperature 200 degC- 400 degC and IS-13183 Gr.-III (for temperature upto 200 degC)									
		PS13 - Rust preventive fluid by spray, dip or brush.									
		PS14 - Weldable primer-Deoxaluminatate or equivalent.									
		PS16 - High Build Epoxy CDC mastic `15'.									
		PS17 - Aliphatic Acrylic Polyurethane CDE134 ,%V=40.0(min.)									
		PS18 - Epoxy based TiO2 pigmented coat									
		PS19 - Epoxy based Zinc phosphate primer (92% zinc in dry film (min.), %VS=35.0(min.).									
		PS-20 - Epoxy based finish paint									
1.06.06		All weld edge preparation for site welding shall be applied with one coat of weldable primer.									
1.06.07		For internal protection of pipes/tubes, VCI pellets shall be used at both ends after sponge testing and ends capped. VCI pellets shall not be used for SS components and composite assemblies.									
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES				TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC NO.: THDC/RKSH/CC-9915-371 Page 55 of 323				SUB-SECTION - A-7 SURFACE PREPARATION & PAINTING		Page 2 of 5	



1.06.08 Primer/Painting Schedule

Sl. No	Description	Surface Preparation	Primer Coat			Intermediate Coat			Finish Coats			Total Min. Painting DFT (Microns)	Colour Shade
			Type of Primer	No. of Coats	Min. DFT / coat (Microns)	Type of coating	No. Coats	Min. DFT/ Coat (Microns)	Type of coating	No. Coats	Min. DFT/ Coat (Microns)		
A) Power Cycle Piping													
1.	All insulated Piping, fittings/ components, Pipe clamps, Vessels/Tanks, Equipments etc.	SP3/SP4	PS 9*	1	20	-	-	-	PS9*	1	20	40	As per NTPC Colour shade/ coding scheme
2.	All un -insulated Piping, fittings/ components, Pipe clamps, Vessels/Tanks, Equipments etc.	SP3/SP4	PS 5	2	25	-	-	-	PS 4	3	35	155	
		SP3/SP4	PS 9*	1	20	-	-	-	PS9*	1	20	40	
		SP3/SP4	PS9*	1	20	-	-	-	PS9*	1	20	40	
3	Constant Load Hanger (CLH), Variable Load Hanger (VLH) .	SP4*	PS19	1	40	-	-	-	PS17	1	30	70	
4.	Piping hangers/ supports (other than (3) above.	SP3/SP5	PS 5	2	25	-	-	-	PS4	2	25	100	
5.	(un-insulated) Valves												

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	Cast/Forged	Design temperature < or equal to 60 degC	SP3/SP5	PS 5	2	35	-	-	-	PS4	2	25	120	
		Design temperature above 60 degC	SP3/SP5	PS 9*	1	20	-	-	-	PS9*	1	20	40	
6.	All auxiliary Structural Steel components for pipe supports	Outside TG building and in SG envelope	SP4*	Inorganic Ethyl Zinc Silicate	1	75	PS18	1	75	a))Epoxy coat	2	35	250	
										b)Final coat of paint PS17	1	30		
		Within TG building	SP4*	-do-	1	35	PS18	1	35	a))Epoxy coat	2	25	150	
										b)Final coat of paint PS17	1	30		
7.	Weld Edges		SP6 (Hand cleaning by wire brushing)	PS13 (Weldable primer)	1	25	-	-	-	-	-	-	25	

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1. \$ The first 2 finished coats (total min.DFT of 70 microns) shall be done at shop and the 3rd finish coat (min.DFT 35 Microns) shall be applied at site.
2. For valves below 65NB and temperature upto and including 540 Deg.C, Parkerizing/zinc phosphate corrosion resistant coating as per ASTM F1137 is also acceptable in lieu of Aluminium paint.
3. For corrosion protection of threaded hanger rods and variable spring cages, electro galvanizing in full compliance to mini mum Corrosion category C3 as per EN ISO12944 is also acceptable.
4. For spring cages, 2 coats of 30 µm(min) zinc-rich epoxy resin primer with zinc content> 80 weight% in dry film followed by 2 coats of 30 µm(min) top coat of Acrylic resin Co-polymerisate with a total combined minimum DFT of 120µm is also acceptable in lieu of above specified paint scheme.
5. For corrosion protection for all inner parts of the hangers shall be atleast in full compliance to Corrosion category C3 as per EN ISO12944.
6. # - For Cast/forged valves upto & including design temperature 60Deg.C, Aluminium painting as per IS-13183 Gr-3 or better with total DFT 40Micron is also acceptable.

B) LOW PRESSURE PIPING

	Surface Preparation	Type of Primer	No. of Coats	Min. DFT / coat (Microns)	Type of coating	No. Coats	Min. DFT/ Coat (Microns)	Type of coating	No. Coats	Min. DFT/ Coat (Microns)	Min. Total DFT (Microns)	
1	All Piping, fittings / components, valves, Equipments etc.	PS3/PS5	2	25	PS 4	1	30	PS 4	2	35	150	As per NTPC Colour shade/ coding scheme
2	Stainless steel surface, Galvanized steel surface and gun metal surface.											
3	On the internal surface for pipes 1000 Nb and above											

No Painting

A coat of primer followed by hot coal -tar enamel or coal tar epoxy painting (cold) shall be applied.

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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.No.	NTPC Drawing No	BHEL drawing No.	Drawing Title	Approval category	Schedule date of submission from date of LOI.
1	9915-371-110-PEM-QVM-Q-443	PE-V0-475-501-A201	MANUFACTURING QUALITY PLAN FOR TG HALL EOT CRANE (with sub vendor list)	A	2
2	9915-371-110-PEM-PVM-U-434	PE-V0-475-501-A204	SIZING CALC FOR ROPES, WHEELS, DRUM, BUFFERS, BRAKES (including storm brake) & MOTORS OF TG HALL EOT CRANE	A	2
3	9915-371-110-PEM-PVM-B-416	PE-V0-475-501-A205	GA OF TG HALL EOT CRANE (with CT DSL details)	A	2
4	9915-371-110-PEM-PVM-B-418	PE-V0-475-501-A209	HOOK, NUT AND HOOK BLOCK ASSEMBLY OF MH & AH OF TG HALL EOT CRANE	I	2
5	9915-371-110-PEM-PVM-B-417	PE-V0-475-501-A206	CRAB ASSEMBLY WITH CT WHEEL ASSEMBLY- TG HALL CRANE	I	3
6	9915-371-110-PEM-PVM-Y-438	PE-V0-475-501-A227	DATA SHEET OF TG HALL EOT CRANE (WITH PAINTING DETAILS)	A	3
7	9915-371-110-PEM-PVM-B-423	PE-V0-475-501-A232	GANTRY RAIL FIXING ARRANGEMENT OF TG HALL EOT CRANE	I	3
8		PE-V0-475-501-A208	General arrangement for PVC shrouded DSL for TG Hall crane	I	3
9		PE-V0-475-501-A212	Structural calculations For TG Hall Crane	A	3
10	9915-371-110-PEM-PVM-B-419	PE-V0-475-501-A210	LT MACHINERY ASSEMBLY WITH WHEEL ASSEMBLY OF TG HALL EOT CRANE	I	4
11	9915-371-110-PEM-PVM-Y-414	PE-V0-475-501-A203	EOT CRANE--DATA SHEET FOR MOTORS OF TG HALL EOT CRANE	I	5
12	9915-371-110-PEM-PVE-F-420	PE-V0-475-501-A216	ELECTRICAL EQUIPEMENT LAYOUT AND VENTILATION ARRANGEMENT IN CABIN FOR TG HALL CRANE	I	5
13	9915-371-110-PEM-PVE-L-421	PE-V0-475-501-A217	SCHEMATIC CIRCUIT DIAGRAM OF A) PROTECTIVE PANEL, MAIN AND LIGHTING CIRCUIT & BOM B) MAIN HOIST PANEL & BOM C) AUX/ HOIST PANEL & BOM D) CROSS TRAVERSE & BOM E) LONG TRAVERSE & BOM , INCLUDING EARTHING DIAGRAM AND CONTROL/OPERATIONAL WRITE UP FOR TG HALL CRANES	A	5
14	9915-371-110-PEM-PVM-B-422	PE-V0-475-501-A218	TG -EOT CRANE GA OF A) PROTECTIVE PANELS B) MAIN HOIST PANEL, C) AUX HOIST PANEL, D) CROSS TRAVEL PANEL, E) LONG TRAVEL PANEL, F) PENDENT, G) RRC	I	5
15	9915-371-110-PEM-QVM-Q-441	PE-V0-475-501-A251	MANUFACTURING QUALITY PLAN OF MOTORS (ABOVE 50 KW) FOR TG HALL EOT CRANE		5
16	9915-371-110-PEM-PVE-U-411	PE-V0-475-501-A220	DSL VOLTAGE DROP & CABLE SIZE CALCULATION & SCHEDULE OF TG HALL EOT CRANE	A	6
17	9915-371-110-PEM-PVM-B-424	PE-V0-475-501-A250	CRANE LUBRICATION ARRANGEMENT OF TG HALL CRANES	I	6



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18	9915-371-110-PEM-PVE-W-413	PE-V0-475-501-A221	TYPE TEST REPORT OF MOTORS ABOVE 50 KW TG HALL DG EOT CRANE	A	8
19		PE-V0-475-501-A215	Detailed BOM/BOQ for TG Hall Crane	I	8
20		PE-V0-475-501-A223	Mandatory spare parts list For TG Hall Crane	A	8
21		PE-V0-475-501-A225	Erection procedure For TG Hall Crane	I	8
22		PE-V0-475-501-A230	Electrical load for TG Hall EOT Crane	I	8
23		PE-V0-475-501-A214	O&M MANUAL OF TG HALL EOT CRANE	I	9

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

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g) 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. h) All drawings shall be prepared as per BHEL's title block and shall bear BHEL's drawing No. i) 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. j) Bidder to follow the following the drawing submission schedule: i. 1st submission of drawings from date of LOI as per the submission schedule. ii. Every revised submission incorporating comments – within 7 days. k) 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.			

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ANNEXURE VI – PACKING PROCEDURE

Packing and Marking

All the equipment shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at site till the time of erection. The Contractor shall be responsible for all loss or damage during transportation, handling and storage due to improper packing.

The identification marking indicating the name and address of the consignee shall be clearly marked in indelible ink on two opposite sides and top of each of the packages. In addition the Contractor shall include in the marking gross and net weight, outer dimension and cubic measurement.

Each package shall be accompanied by a packing note (in weather proof paper) quoting specifically the name of the Contractor, the number and date of contract and names of the office placing the contract, nomenclature of contents and Bill of Material.

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ANNEXURE-VII

Procedure for Load & Overload testing of Double Girder EOT Cranes at Manufacturer's Works

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

Basic Assumptions / Inputs for testing at Works:

- Actual job hook shall be used for load & overload tests for hoisting.
- Actual ropes shall be used for load & 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 / 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.

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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.

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



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ANNEXURE-VIII**Format for Operation & Maintenance Manual**

Project name :

Project number :

Package Name :

PO reference :

Document number :

Revision number :

Sl.no. & Sections	Description	Tick (✓) if included in Manual			Remarks
		Yes	No	Not Applicable	
1.	Cover page				
1.1	Project Name				
1.2	Customer/consultant Name				
1.3	Name of Package				
1.4	Supplier details with phone, FAX ,email address , Emergency Contact number				
1.5	Name and sign of prepared by , checked by & approved by				
1.6	Revision history with approval Details				
2.0	Index				
2.1	showing the sections & related page nos All the pages should be numbered section wise				
3.0	Description of Plant/System				
3.1	Description /write up of operating principle of system equipment/ associated sub-systems & accessories/controls system , operating conditions, performance parameters under normal , start up and special cases				
3.2	Equipment list and basic parameter with Tag numbers				
3.3	Data sheets approved by Customer/for information and catalogues provided by original manufacturer				
3.4	Associated other packages and Interface /terminal points				
3.5	P&ID & Process Diagrams				
3.6	GA Layout drawings, As-built drawings , Actual photograph of items/system (Drawings of A2 & bigger sizes are to be attached in the last)				
3.7	Single line/wiring diagrams				
3.8	Control philosophy /control write-ups				
4.0	Commissioning Activities (if not covered				



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	in separate document i.e. erection manual, commissioning manual)				
4.1	Pre-Commissioning Checks				
4.2	handling of items at site				
4.3	Storage at site				
4.4	Unpacking & Installation procedure				
5.0	Operation Guidelines for plant personal/user/operator				
5.1	Interlock & Protection logic along with the limiting values of protection settings for the equipment along with brief philosophy behind the logic, drawings etc. to be provided.				
5.2	Start up, normal operation and shut down procedure for equipments along with the associated systems in step by step mode. Valve sequence chart, step list, interlocks etc. with Equipment isolating procedures to be mentioned.				
5.3	Do's & Don't of the equipments.				
5.4	Safety precautions to be taken during normal operation. Safety symbols, Emergency instructions on total power failure condition/lubrication failure/any other condition				
5.5	Parameters to be monitored with normal values and limiting values				
5.6	Trouble shooting with causes and remedial measures				
5.7	Routine operational checks, recommended logs & records				
5.8	Changeover schedule if more than one auxiliary for the same purpose is given				
5.9	Painting requirement and schedule				
5.10	Inspection, repair , Testing and calibration procedures				
6.0	Maintenance guidelines for plant personal				
6.1	List of Special Tools and Tackles required for Overhaul/Trouble shooting including special testing equipment required for calibration etc.				
6.2	Stepwise dismantling and re-assembly procedure clearly specifying the tools to be used, checks to be made, records to be maintained, clearances etc. to be mentioned. Tolerances for fitment of various components to be given.				
6.3	Preventive Maintenance & Overhauling schedules linked with running hours/calendar period along with checks to be given				



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6.4	Long term maintenance schedules especially for structural, foundations etc.				
6.5	Consumable list along with the estimated quantity required during commissioning, normal running and during maintenance like Preventive Maintenances and Overhaul. Storage/handling requirement of consumables/self-life.				
6.6	List of lubricants with their Indian equivalent, Lubrication Schedule, Quantity required for each equipment for complete replacement is to be given				
6.7	List of vendors & Sub-vendors with their latest addresses, service centres ,Telephone Nos., Fax Nos., Mobile Nos., e-mail IDs etc.				
6.8	List of mandatory and recommended spare parts list				
6.9	Tentative Lead time required for ordering of spares from the equipment supplier				
6.10	Guarantee and warranty clauses				
7.0	Statutory and other specific requirements considerations.				
8.0	List of reference documents				
9.0	Binding as per requirement				

PS-PEM-MAX		e-Learning Package		
CLAUSE NO.		 GENERAL TECHNICAL REQUIREMENTS		
8.03.05.01	e-learning packages shall be supplied for the equipment / system for the following Steam Turbine Generator & auxiliaries along with associated electrical and C&I system. Steam Turbine Generator & Auxiliaries Steam Turbine including stop valves, control valves, overload valves and cross over piping. Steam Turbine Auxiliary Systems including Quick Closing and Ordinary NRVs, Turbine gland sealing system, Lubricating oil system and its purification system, Centralised oil storage and its purification system, Control fluid and its purification system, governing and protection system, exhaust hood spray cooling system, drainage and vent system, turbine preservation system, HP/LP Bypass system. Generator and Auxiliary System including Generator, complete hydrogen cooling, carbon dioxide and nitrogen gas systems as applicable, complete seal oil system, complete water cooling system where applicable and complete excitation system. Condensing Plant including Condenser, Condenser air evacuation system and Condenser on load tube cleaning system as applicable. Drip Pump along with all accessories as applicable, Condensate Extraction Pumps along with all accessories, Deaerator level Control Station, Feed Water Heating Plant including Drain Cooler, low pressure heaters, deaerator and feed storage tank, high pressure heaters and associated accessories, Boiler Feed Pumps along with all accessories, Drive Turbine for Boiler Feed Pump along with all accessories, Feed regulating station, Make up system to Condenser, Gland Steam Condenser Recirculation System, Turbine Hall EOT Cranes and EOT Crane for Boiler Feed Pump as applicable.			
	8.03.05.02	These packages shall be installed on the Learning Management Server (LMS) of Power Management Institute (PMI) , NTPC located at Noida . The Engineer- In-Charge (EIC) for the e-learning modules shall be from PMI. 1. The objective of the e-Learning package consisting of courses for erection, commissioning, operation and maintenance of equipment / system as specified above is to facilitate the employees to have first hand information /requirement with respect to above activities for the supplied equipment /system. 2. The bidder shall submit e-learning courses each for erection, commissioning, operation and maintenance of each of the equipment / system supplied as above. a. The erection course(s) should include instructions on pre-checks, prerequisites, erection strategy, erection procedure etc. b. The commissioning course(s) should include instructions on recommissioning,commissioning, initial operation etc. c. The operation course(s) should include instructions on the permissive, interlocks, physical check ups, start up , shutdown and protections etc. d. The maintenance course(s) should include instructions on predictive, preventive, breakdown and overhauling. Depth of coverage of above courses shall be as specified for "Instruction Manuals" in above clauses. A literature on caution / safety while handling equipment / system for the above modules shall follow the description of the said equipment /system.		
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO.: THDC/RKSH/CC-9915-371	GENRAL TECHNICAL REQUIREMENTS (GTR)	PAGE 19 OF 89

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CLAUSE NO.	एनडीपीसी NTPC	GENERAL TECHNICAL REQUIREMENTS	
	3. The e-Learning packages on equipment / system shall be installed by the vendor and shall be successfully test run in the presence of EIC or representative before acceptance by NTPC. The vendor will also give the master copy in form of Flash Drive/CD/DVD. The respective module for erection & commissioning shall be delivered and successfully test run at least three months before the scheduled start of the corresponding activity at site. The respective module for operation & maintenance shall be delivered and successfully test run at least three months before scheduled first synchronization of first unit. 4. e-Learning course broad requirements: a. The courses shall be web based and mobile based Application type. It shall run on all possible versions of web browser like Internet Explorer, Google Chrome, Firefox etc. on Laptop/Desktop and shall be Smartphone/Tablet/Mobile responsive. The Mobile responsive courses shall run on Android, Windows Mobile, Blackberry, iOS etc. b. The courses shall support liquid/fluid page layout so that the entire screen gets adjusted to PC, Laptop, Smartphone/Mobile, Tablet and any other display devices. c. Course content text shall be in English language and be associated with a voiceover in English language with Indian accent. d. Courses shall be SCORM (Sharable Content Object Reference Model) compliant, version 1.2 which is compatible with LMS at PMI. e. Each course shall have every physical and functional detail of the equipment / system supplied. f. Each of the e-Learning course shall be based on multiple web pages and mobile pages with multiple modules. g. There shall be option for self-assessment test after every course. In case the user doesn't opt for self assessment test the user shall be able to go to the next course. There shall be no restriction in no. of times for repeating the assessments. All correct answers along with the answers marked by the users shall be displayed at the end of test/quiz. h. If Java and Flash, as applicable are not available in the system to run the package, then there shall be a prompt message for updation of the same. i. Each course shall have a self-running interactive content with navigation buttons containing forward, backward, pause, bookmark and menu options in the course window.		
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO.: THDC/RKSH/CC-9915-371	GENRAL TECHNICAL REQUIREMENTS (GTR)
			PAGE 20 OF 89

PS-PEM-MAX			
CLAUSE NO.	एनडीपीसी NTPC GENERAL TECHNICAL REQUIREMENTS		
	j. The course shall contain chapter titled 'Introduction/overview' that explains the purpose of the course. k. The course content shall contain descriptive text shall be factual, specific, terse, clearly worded, and simply illustrative, so that the user can understand it. l. The system shall provide the user with the ability to select the information with a Cursor. m. The course menu should contain table of content linked to concerned pages. The user shall be given the capability to access all of the functions available on the system through a menu system. This shall consist of active buttons, which shall control a hierarchy of pull down/pop up menus. Menu shall appear quickly and exist only while a selection is being made. The user shall be given the capability to position the cursor or pointer on the menu item and use pointer device such as mouse to activate the function. n. Every course shall contain the 3D design/drawing/exploded view/360° turn around view of the equipment/system, textual description of the equipment/system and its functionality with video (as applicable), animation and audio. o. The users shall be able to control audio sound level associated with the courses. p. Drawings / text in the courses shall be scalable (Zoom In/ Out).' q. The user shall have the capability to record a bookmark to mark displayed information for later recall, whenever he accesses the same course next time. Notes: 1. e-learning Package of an equipment / system shall include e-learning courses for each of erection, commissioning, operation and maintenance of that equipment / system. 2. e-learning courses on erection, commissioning, operation and maintenance of an equipment / system shall include e-learning lessons/chapters/modules (as required) for erection, commissioning, operation and maintenance respectively of that equipment / system. 3. The vendor shall get the approval of one sample course from EIC before proceeding for further courses.		
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO.: THDC/RKSH/CC-9915-371	GENRAL TECHNICAL REQUIREMENTS (GTR) PAGE 21 OF 89

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TITLE

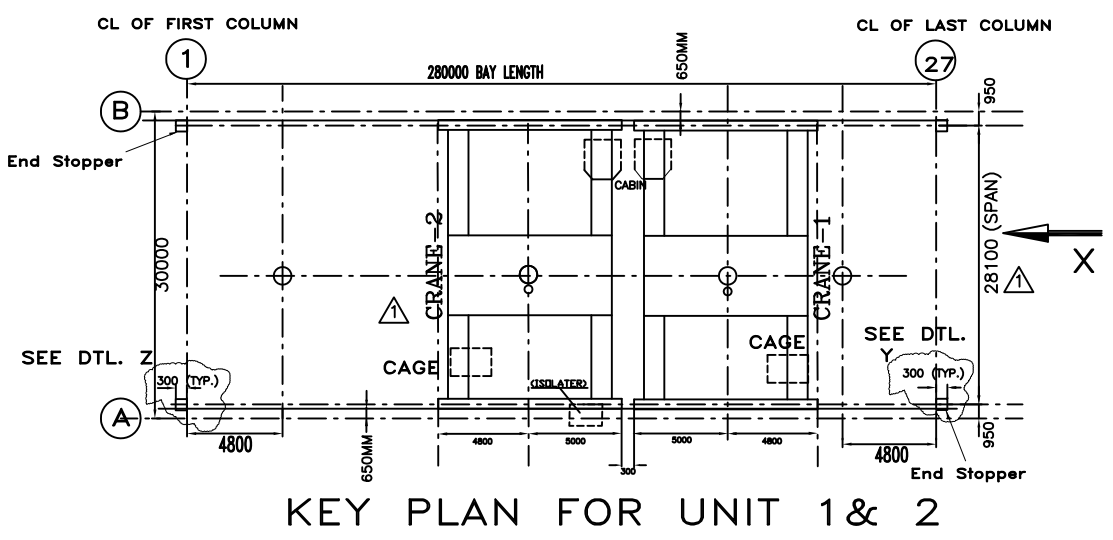
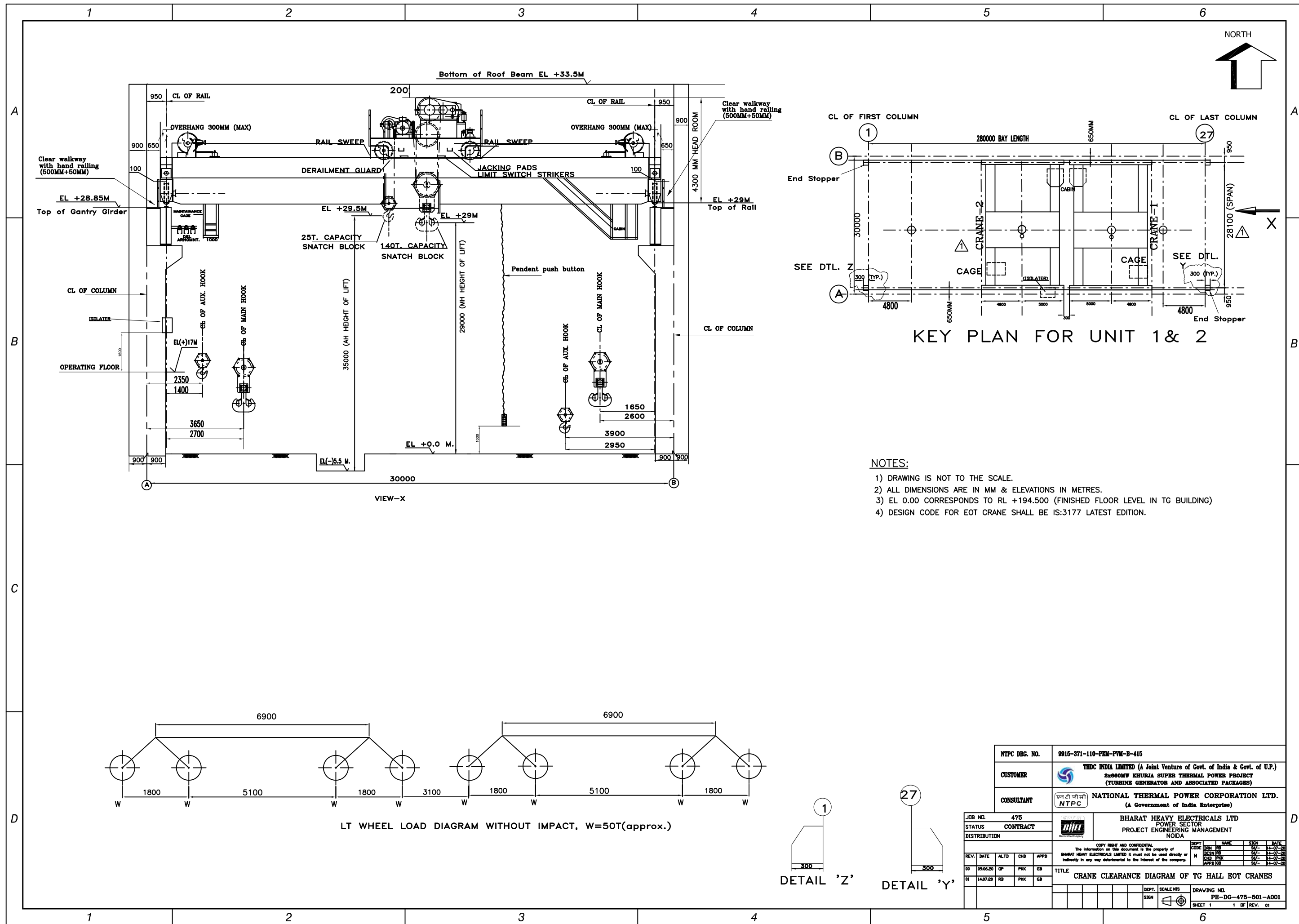
2X660 MW THDC Khurja STPP**DOUBLE GIRDER EOT CRANES ABOVE 100T****SPECIFIC TECHNICAL REQUIREMENTS**

SPECIFICATION NO. PE-TS-475-501-A501

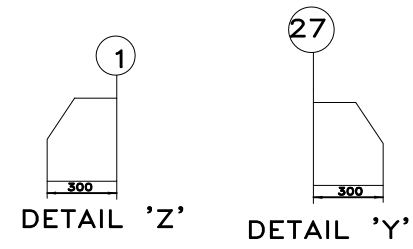
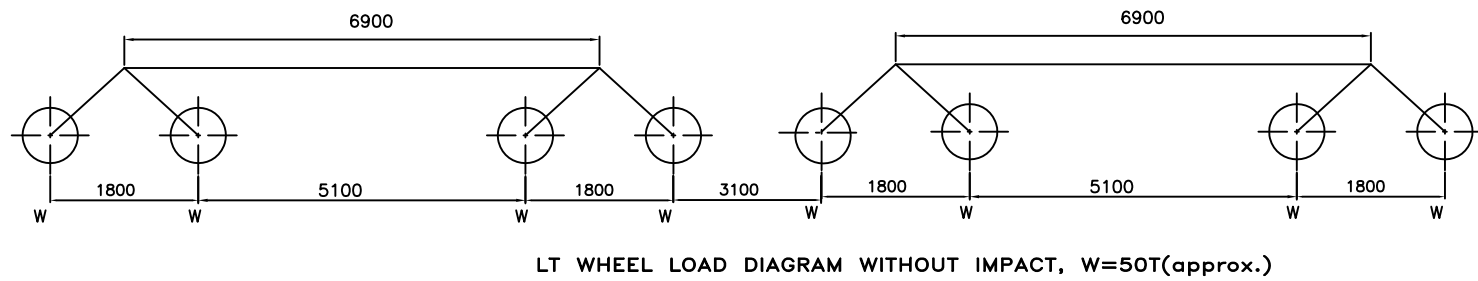
REV 00

Section IA Date JULY'20

SECTION – IA**CRANE CLEARANCE DIAGRAM**



- NOTES:
- 1) DRAWING IS NOT TO THE SCALE.
 - 2) ALL DIMENSIONS ARE IN MM & ELEVATIONS IN METRES.
 - 3) EL 0.00 CORRESPONDS TO RL +194.500 (FINISHED FLOOR LEVEL IN TG BUILDING)
 - 4) DESIGN CODE FOR EOT CRANE SHALL BE IS:3177 LATEST EDITION.



NTPC DRG. NO.		9015-371-110-PEN-PVM-B-415													
CUSTOMER		 THDC INDIA LIMITED (A Joint Venture of Govt. of India & Govt. of U.P.) 2x660MW KHURJA SUPER THERMAL POWER PROJECT (TURBINE GENERATOR AND ASSOCIATED PACKAGES)													
CONSULTANT		 NATIONAL THERMAL POWER CORPORATION LTD. (A Government of India Enterprise)													
JOB NO. 475		 BHARAT HEAVY ELECTRICALS LTD POWER SECTOR PROJECT ENGINEERING MANAGEMENT NOIDA													
STATUS CONTRACT															
DISTRIBUTION															
REV. DATE ALTD CHD APPD		COPY RIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED it must not be used directly or indirectly in any way detrimental to the interest of the company.													
08	09.06.20	GP	PKK	GB	TITLE CRANE CLEARANCE DIAGRAM OF TG HALL EOT CRANES										
01	14.07.20	RB	PKK	GB											
<table><tr><td></td><td></td><td>DEPT.</td><td>SCALE NTS</td><td rowspan="2"></td><td rowspan="2">DRAWING NO. PE-DC-475-501-A001</td></tr><tr><td></td><td></td><td>SIGN</td><td></td></tr></table>							DEPT.	SCALE NTS		DRAWING NO. PE-DC-475-501-A001			SIGN		SHEET 1 1 OF REV. 01
		DEPT.	SCALE NTS		DRAWING NO. PE-DC-475-501-A001										
		SIGN													

40880/2020/PS-PEM-MAX



TITLE

2X660 MW THDC Khurja STPP

DOUBLE GIRDER EOT CRANES ABOVE 100T

SPECIFIC TECHNICAL REQUIREMENTS

SPECIFICATION NO. PE-TS-475-501-A501

REV 00

Section

IA

Date JULY'20

SECTION – IA

STANDARD QUALITY PLAN

MANUFACTURER'S NAME & ADDRESS		STANDARD MANUFACTURING QUALITY PLAN						PROJECT: 2X660 MW THDC Khurja STPP					
								PACKAGE : DOUBLE GIRDER CRANES					
		ITEM:						CONTRACT NO :					
								CONTRACTOR :					
								VENDOR' S QAP No :					
SL.	COMPONENTS & OPERATION	CHARACTERISTICS	CLASS	TYPE PF	QUANTUM	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORDS	AGENCY	REMARKS			
NO.				CHECK	OF CHECK				M	C	N		
1	4	3	4	5	6	7	8	9	D*	**	10	11	
1	Fabricated components												
	Box Girder, End Carriage, Crab Frame, Rope Drum												
a	Material	Chemical & Physical Properties	Major	Corelation with T.C./ Check test in absence of T.C.	1/Heat/Batch	E250 Grade BR IS: 2062	E250 Grade BR IS: 2062	Mfr's T.C/ Check Test Report	√	P	V	V	Refer note: 1
		U.T of plates.		Ultrasonic	100%	ASTM A435	ASTM A435	T.C. / I.R.	√	P	V	V	U.T. ON ABOVE 25MM THICK PLATE
b	weld setup	dimensions	Major	Measurement	100%	Components drawings	Components drawings	Vendor's inspection report		P			
1A	Seamless pipe for rope drum	Chemical & Physical Properties	major	Corelation with T.C./ Check test in absence of T.C.	100%	ASTM A106Gr B	ASTM A106Gr B	Mfr's T.C/ Check Test Report	√	P	V	V	Refer note: 1
		NDT	Major	Macro etching & flattening	100%	ASTM A106Gr B	ASTM A106Gr B	MTC/Lab TC	√	P	V	V	
		NDT	Major	UT	100%	ASTM E-213-2007	Notch depth shall not be more than 12.5% of thickness of pipe	UT Report	√	P	V	V	
2	Welding WPS (Welding procedure specification) in line with ASME sec. IX (QW - 482) - For Box Girder, End Carriage, Crab Frame, Trolley Gear Box Casing & Rope Drum												
a	Check for welding procedure qulification, welder's performance	Welding parameters	Major	Review of documents	100%	ASME Sec-IX	ASME Sec-IX	QW-482,QW-483, QW-484 as per ASME Sec-IX	√	P	V	V	WPS/PQR/WPQ approved/ reviewed by NTPC/ NPCIL/ BVI/ LLOYES/TUV etc. shall be accpetable
b	Back chipping	surface defect	Major	DPT	100%	ASME Sec-VIII, Div-I, Appen - 8	ASME Sec-VIII, Div-I, Appen - 8	DP Report	√	P	V	V	
c	Butt Welds	NDT	Critical	RT	100% in tension, 25% in compression, 100% in rope drum	ASME Sec-V	ASME Sec-VIII, CI UW-51 & 52	RT Report	√	P	V	V	

		MANUFACTURER'S NAME & ADDRESS		STANDARD MANUFACTURING QUALITY PLAN				PROJECT: 2X660 MW THDC Khurja STPP					
								PACKAGE : DOUBLE GIRDER CRANES					
				ITEM:		QP NO :		CONTRACT NO :					
						REV : 0		CONTRACTOR :					
						DATE :		VENDOR'S QAP No :					
SL.	COMPONENTS &	CHARACTERISTICS	CLASS	TYPE PF	QUANTUM	REFERENCE	ACCEPTANCE	FORMAT OF					REMARKS
NO.	OPERATION			CHECK	OF CHECK	DOCUMENT	NORMS	RECORDS		M	C	N	
1	4	3	4	5	6	7	8	9	D*	**	10		11
			Critical	DPT	100%	ASME Sec-V	ASME Sec-VIII, Div-I, Appen - 8	DP Report	√	P	W	V	DP test of fillet weld for rope drum to be conducted. After final machining random witness by BHEL
d	fillet welds	Size and surface defects	Major	Visual	100%	Manufacturing drawing	Manufacturing drawing	Vender inspection Report	√	P	V	V	
		NDT	Major	DPT	10% RANDOM	ASME Sec-V	ASME Sec-VIII, Div-I, Appen - 8	Vender inspection Report	√	P	W	V	
e	final insection of fabricated components listed in Sr.1 above	Dimensions for Girder, end carriage rope drum etc. Camber, Verticality, bend etc	Major	Dimensional Measurement	100%	Vendor Mfg. Drg.	Vendor Mfg. Drg.	vendor inspection report	√	P	V	V	
f	Heat treatment of rope drum	Stress relieving	Major	Review of SR chart	100%	Approved drawing/relevant standard	Approved drawing/relevant standard	SR Chart	√	P	V	V	If fabricated from M.S Plate
3	Gear box casing												
a	Material	Surface condition	Major	Visual	100%	Manufacturing drawing	Manufacturing drawing	Vendor inspection Report	√	P	V	V	Refer note 1
		Chemical & mech	Major	Measurement Correlation with T.C. Check test in absesnce of T.C. Correlation	100%	Manufacturing drawing/ IS: 2062	Manufacturing drawing/ IS: 2062	T.C. & I.R.	√	P	V	V	

		MANUFACTURER'S NAME & ADDRESS		STANDARD MANUFACTURING QUALITY PLAN				PROJECT: 2X660 MW THDC Khurja STPP			
								PACKAGE : DOUBLE GIRDER CRANES			
				ITEM:		QP NO :		CONTRACT NO :			
						REV : 0		CONTRACTOR :			
						DATE :		VENDOR' S QAP No :			
SL.	COMPONENTS & OPERATION	CHARACTERISTICS	CLASS	TYPE PF	QUANTUM	REFERENCE	ACCEPTANCE	FORMAT OF	AGENCY	REMARKS	
NO.				CHECK	OF CHECK	DOCUMENT	NORMS	RECORDS	M	C	N
1	4	3	4	5	6	7	8	9	D*	**	10
b	Dimension	Dimensional conformity	Major	Measurement	100%	Manufacturing drawing	Manufacturing drawing	Vendor inspection Report		P	
c	Heat treatment	stress relieving	Major	Review of SR chart	100%	Approved drawing/relevant standard	Approved drawing/relevant standard	SR Chart	√	P	V V
4	PLATFORMS	Dimensional conformity	Minor	Measurement	100%	Manufacturing drawing	Manufacturing drawing	Vendor inspection Report	√	P	V V Refer note: 1
5	L.T.FRAMES	Dimensional conformity	Minor	Measurement	100%	Manufacturing drawing	Manufacturing drawing	Vendor inspection Report	√	P	V V
6	HAND RAILINGS	Dimensional conformity	Minor	Measurement	100%	Manufacturing drawing	Manufacturing drawing	Vendor inspection Report	√	P	V V
7	CABIN	Dimensional conformity	Minor	Measurement	100%	Manufacturing drawing	Manufacturing drawing	Vendor inspection Report	√	P	V V
8	Current collector arms	Dimensional conformity	Minor	Measurement	100%	Mfr. Catalog	Mfr. Catalog	Vendor inspection Report	√	P	V V
9	DSL Guard	Dimensional conformity	Minor	Measurement	100%	Manufacturing drawing	Manufacturing drawing	Vendor inspection Report	√	P	V V
10	Rails	Dimensional conformity	Minor	Measurement	100%	G.A.drg./IS : 3443 Vendore T.C./Appd.Data Sheet	G.A.drg./IS : 3443 Vendor T.C./Appd.Data Sheet	Vendor inspection Report	√	P	V V
		Chemical , tensile & hardness	Major	Chemical & hardness	100%	IS-3443	IS:3443	Manufacturer TC	√	P	V V
11	MECHANICAL COMPONENTS										
A	a) wheels										

MANUFACTURER'S NAME & ADDRESS		STANDARD MANUFACTURING QUALITY PLAN						PROJECT: 2X660 MW THDC Khurja STPP					
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		ITEM:						CONTRACT NO :					
								CONTRACTOR :					
								VENDOR' S QAP No :					
SL.	COMPONENTS &	CHARACTERISTICS	CLASS	TYPE PF	QUANTUM	REFERENCE	ACCEPTANCE	FORMAT OF	AGENCY			REMARKS	
NO.	OPERATION			CHECK	OF CHECK	DOCUMENT	NORMS	RECORDS	M	C	N		
1	4	3	4	5	6	7	8	9	D*	**	10	11	
	i) raw material	Chemicals composition and Mechanical Properties.	Major	Corelation with Mfr's TC	100%	Mfg.drg./IS:1570 / BS - 970	Mfg.drg./IS:1570 / BS - 970	Test Certificate	√	P	V	V	Refer Note:1
	ii) Machined	a) Dimensions	Major	Measurement	100%	Manufacturing drawing	Manufacturing drawing	Vendor inspection Report		P	V	V	
		b) Hardness		Mechanical	100%	Approved Data Sheet / Mfg. Drg.	Approved Data Sheet / Mfg. Drg.	Vendor inspection Report	√	P	V	V	
		c) UT		NDT	100%	ASTM A 388	ASTM A 388	Vendor inspection Report	√	P	V	V	Refer UT procedure
		d) DPT		NDT	100%	ASME Sec-VIII-App-8	ASME Sec-VIII-App-8	Vendor inspection Report	√	P	W	V	
	b) Raw material for Gears , Pinions, Shafts,Axles etc	i) Chemicals Composition & heat treatment, Physical Properties.	Major	Correlation with Mfr's TC/ Check test in absence of TC	100%	Manufacturing drawing, BS : 970 / IS : 1570 / Approved Data Sheet	Manufacturing drawing, BS : 970 / IS : 1570 / Approved Data Sheet	Mfr's T.C/ Check Test Report	√	P	V	V	
		ii) UT (after machining)	Major	check for UT (above)	100%	ASME Sec-V	Refer UT procedure	Vendor inspection Report	√	P	V	V	
		iii) Hardness	Major	check for Hardness	100%	drg. & Approved Data Sheet	Mfg. drg. & Approved Data Sheet	Vendor inspection Report	√	P	W	V	Hardness witnessing by BHEL before teeth cutting.
		iv) Dimensions	Major	Measurement	100%	Mfg. Drawing	Mfg. Drawing	Vendor inspection Report	√	P	V	V	
		V) D.P.Test on teeth	Major	NDT	100%	ASTME-165	No linear indication	Vendor inspection Report	√	P	V	V	
	c) Casting for Gears and pinions, if applicable	Chemical and Physical	Major	Chemical and Physical	100%	Approved drg/ data sheet	Approved drg/ data sheet	Mfr's T.C	√	P	V	V	
		NDT	Major	U.T.	100%	ASTM A 388	ASTM A 388	Vendor inspection	√	P	V	V	Refer UT procedure
B	Pulleys, Brake drums, coupling & other major steel castings & forging												
	i) Materials	Physical/Chemical/Hardness	Major	Corelation with mfr's TC	100%	Mfg. Drawing	Mfg. Drawing	Mfr's T.C.	√	P	V	V	

MANUFACTURER'S NAME & ADDRESS		STANDARD MANUFACTURING QUALITY PLAN						PROJECT: 2X660 MW THDC Khurja STPP					
								PACKAGE : DOUBLE GIRDER CRANES					
		ITEM:						CONTRACT NO :					
								CONTRACTOR :					
								VENDOR' S QAP No :					
SL.	COMPONENTS &	CHARACTERISTICS	CLASS	TYPE PF	QUANTUM	REFERENCE	ACCEPTANCE	FORMAT OF					
NO.	OPERATION			CHECK	OF CHECK	DOCUMENT	NORMS	RECORDS		M	C	N	
1	4	3	4	5	6	7	8	9	D*	**	10		11
	ii) Machined	a) Dimensions	Major	Measurement	100%	Components Drawing	Components Drawing	Vendor inspection Report		P	V	V	
		b) DPT after machining.	Major	NDT	100%	ASTM E-165	No linear indication	Vendor inspection Report	√	P	V	V	
C	Gear box assy & idle running	Check for oil leakage, Noise level, vibration backlash, rise in temp. after 2 Hrs. of running, reduction ratio, backlash and contact pattern	Major	Visual & Measurement	100%	Vendor standard	Smooth running no oil leakage, Noise 85 db at 1 Mtr. Max. Temp. rise 30°C above amb temp.	Vendor inspection Report	√	P	V	V	
D	a) Top block, bottom block	dimensional conformity	Major	Masurement	100%	Assembly drawing	Assembly drawing	Vendor inspection Report		P	V	V	
	b) Hook	i) Chemical composition, Heat treatment, Mechanical properties on integral test bar	Major	Chemical, heat treatment & Tensile, % elongation	100%	IS:1875		Test Certificate, HT chart & Insp. Report	√	P	V	V	
		ii) UT on raw material of hook	Major	UT	100%	ASME sec--v	Annex-1 (Attached)		√	P	V	V	
		iii) Forging operation of hook	Major	Visual	100%	IS:5749 /IS:15560	IS:5749 /IS:15560		√	P	V	V	
		iv) Proof load test	Major	Mechanical	100%	IS:5749 /IS:15560	IS:5749 /IS:15560		√	P	W	V	
		v) UT & MPI after proof load test	Major	UT & MPI	100%	ASME sec - v & ASTM E709-2007	Annex-1 for UT & No crack & linear indication (For MPI as per ASME Sec VIII Appen 6)		√	P	W	V	
		Identification Punch (By BHEL &/or customer, after proof load & NDT witness)	Major	Visual	100%	-----	-----	-----	-	P			CHP - Customer Hold Point
E	Rope drum assembly	Dimension	Major	Measurement	100%	Mfg. Drawing	Tolerance as per drg	Vendor insp Report		P	V	V	
12	Electrical components												

MANUFACTURER'S NAME & ADDRESS		STANDARD MANUFACTURING QUALITY PLAN					PROJECT: 2X660 MW THDC Khurja STPP						
							PACKAGE : DOUBLE GIRDER CRANES						
		ITEM:					QP NO :		CONTRACT NO :				
							REV : 0		CONTRACTOR :				
							DATE :		VENDOR' S QAP No :				
SL.	COMPONENTS &	CHARACTERISTICS	CLASS	TYPE PF	QUANTUM	REFERENCE	ACCEPTANCE	FORMAT OF	AGENCY				REMARKS
NO.	OPERATION			CHECK	OF CHECK	DOCUMENT	NORMS	RECORDS	M	C	N		
1	4	3	4	5	6	7	8	9	D*	**	10		11
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.	√	P	V	V	Refer Note for motor upto 50 KW.For motor above 50KW separate QP shall be applicable
b)	Brakes	Make , type , rating , dia , Functional test /Routine test	Major	Review mfr's TC	100%	Appd drgs	Appd drgs	Mfr's T.C.	√	P	V	V	
c)	Control panel	Interlocking fuctional, IR, HV, Sheet thickness, cable laying, dressing , ferulling Overall diemsnions , painting shade, Panel surface finish, Paint Thickness, adhesive test, Component fixing, Degree of protection by paper inserting method	CR	Test for HV, IR, functional check	100%	IS : 3177 / App. Panel Drg. & BOM/ Data sheet	IS : 3177 / App. Panel Drg. & BOM/ Data sheet	Vendor insp Report	√	P	W	V	Refer Note No. 4 VVVF Test Certificate to be submitted from app. Vendor for verification.
d)	Radio remote, Master controller	HV, IR,Functional	Major	Verfication	100%	BOM/ Mfr. Catalogue	BOM/ Mfr. Catalogue	Mfr's T.C.	√	P	V	V	Refer Note No. 4
e)	Limit switches	Functional	Major	Verfication	100%	Approved drawings	Approved drawings	Mfr's T.C.	√	P	V	V	
f)	Trailing cable, Power Control Cable & DSL	Make , type , rating ,Routine & acceptance test insulation resistance values	Major	Verfication	100%	IS: 9968, IS 1554-Part-1	IS: 9968, IS 1554-Part-1	Mfr's T.C.	√	P	V	V	
g)	Transformer	make rating , routine test	Major	visual	100%	Appd drg	Appd drg	Mfr's T.C.	√	P	V	V	
h)	SFU, MCCB,MCB, Contactors, DSL, relays, fuses, resitance bank	make, t ype , rating size, functional, continuity check	Major	visual	100%	Appd drg	Appd drg	Mfr's T.C.		P	V	V	
i)	VVVF drives	make , type , rating, routine test	Major	visual	100%	Appd drg	Appd drg	Mfr's T.C.		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	Mfr's T.C.		P	V	V	
13	Bought out items												
a)	Wire rope	Visual , tensile	Major	Type, grade, dia br	100%	IS:2266	IS:2266	Mfr's T.C.	√	P	V	V	
b)	Bearing	Type & Size	Major	Verfication	100%	Appd drg/Mfr's catalogue	Appd drg/Mfr's catalogue	Mfr's T.C.	√	P	V	V	

		MANUFACTURER'S NAME & ADDRESS		STANDARD MANUFACTURING QUALITY PLAN				PROJECT: 2X660 MW THDC Khurja STPP				
								PACKAGE : DOUBLE GIRDER CRANES				
				ITEM:				CONTRACT NO :				
								CONTRACTOR :				
								VENDOR' S QAP No :				
SL. NO.	COMPONENTS & OPERATION	CHARACTERISTICS	CLASS	TYPE PF	QUANTUM	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORDS	AGENCY			REMARKS
1	4	3	4	5	6	7	8	9	D*	**	10	11
14	Assembly of cranes											
a)	Bridge with LT	Dimesions, wheel level alignment	Major	Measurement	100%	GA drg/IS:3177	GA drg/IS:3177	Insp. Report	√	P	W	V
b)	Crab assembly	Dimesions, wheel level alignment	Major	Measurement/ Vis	100%	GA drg/IS:3177	GA drg/IS:3177	Insp. Report	√	P	W	V
c)	Final Inspection (at works) with actual panel and pendent	Overall dimension: Span, Diagonal dimension check, Wheel base & gauge, overhang, LT Stopper, headroom, lift , Eqp. Layout on bridge platform, , elevations /levels etc	Major	Measurement	100%	Approved drgs./IS :3177	Approved drgs./IS: 3177	Insp. Report	√	P	W	W
		No Load & Load Tests										
		a) No load: Hoists,CT & current measurement, No Load running of LT machinery for direction and speed with VVFD	Major	Measurement	100%	Approved drgs	Approved drgs	Insp. Report	√	P	W	W
		b) SWL: Hoists, CT speed, current & Deflection measurement	Major	Operational Check & Measurement	100%	GA drg/ IS:3177/ Approved Drawing	GA drg/ IS:3177/ Approved Drawing	Insp. Report	√	P	W	W
		c) Overload: Hoisting, CT movement & current measurment (at 125% SWL)	Major	Operational Check & Measurement	100%	GA drg/ IS:3177/ Approved Drawing	GA drg/ IS:3177/ Approved Drawing	Insp. Report	√	P	W	W
		d) Operation check of brakes and limit switches .	Major	Operational Check	100%	GA drg/ IS:3177/ Approved Drawing	GA drg/ IS:3177/ Approved Drawing	Insp. Report	√	P	W	W
15	Painting	Surface preparetion & Painting. DFT	Major	Visual	100%	Approved drgs/doc	Approved drgs/doc	Vendor's Report		P	V	
		Note 1 : Original TCs / Photocopies certified in original by mill shall be furnished for review. Test In absence of correlated TCs Check test to be witnessed by BHEL 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.										

		MANUFACTURER'S NAME & ADDRESS		STANDARD MANUFACTURING QUALITY PLAN				PROJECT: 2X660 MW THDC Khurja STPP				
								PACKAGE : DOUBLE GIRDER CRANES				
				ITEM:		QP NO :		CONTRACT NO :				
						REV : 0		CONTRACTOR :				
						DATE :		VENDOR' S QAP No :				
SL.	COMPONENTS &	CHARACTERISTICS	CLASS	TYPE PF	QUANTUM	REFERENCE	ACCEPTANCE	FORMAT OF	AGENCY			REMARKS
NO.	OPERATION			CHECK	OF CHECK	DOCUMENT	NORMS	RECORDS	M	C	N	
1	4	3	4	5	6	7	8	9	D*	**	10	11
Note 3 :	LT motors shall be of type tested quality. For each type & rating of LT motors rated above 30 KW, the bidder shall submit for Owner's approval the reports of all the type tests as per relevant standards and carried out within last ten 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 either conducted at an independent laboratory or should have been witnessed by a client. In case the Bidder is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in case the type test report(s) are not found to be meeting the specification requirements, the Bidder shall conduct all such tests under this contract free of cost to the Owner and submit the reports for approval. LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED The following type test reports shall be submitted for each type and rating of LT motor of above 30 KW only 1. Measurement of resistance of windings of stator and wound rotor. 2. No load test at rated voltage to determine input current power and speed 3. Open circuit voltage ratio of wound rotor motors (in case of Slip ring motors) 4. Full load test to determine efficiency power factor and slip . 5. Temperature rise test . 6. Momentary excess torque test. 7. High voltage test . 8. Test for vibration severity of motor. 9. Test for noise levels of motor 10. Test for degree of protection and 11. Over speed test. <u>LESS THAN 30KW:</u> 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 CUSTOMER 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. <u>30 KW TO BELOW 50 KW:</u>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: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 :	All material of construction shall be as per approved drg. / data sheet / specifications											
LEGEND :												
D: RECORDS IDENTIFIED WITH 'TICK'(v) SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION												
M : MANUFACTURER/SUBCONTRACTOR												
C: BHEL-CQS/THIRD PARTY												
N : CUSTOMER												
INDICATE "P" PERFORM "W" WITNESS AND "V" DOCUMENT REVIEW												

	MANUFACTURER'S NAME & ADDRESS			STANDARDARD MANUFACTURING QUALITY PLAN				PROJECT: 2X660 MW THDC Khurja STPP					
								PACKAGE : DOUBLE GIRDER CRANES					
				ITEM:		QP NO :		CONTRACT NO :					
						REV : 0		CONTRACTOR :					
						DATE :		VENDOR' S QAP No :					
SL.	COMPONENTS &		CHARACTERISTCS	CLASS	TYPE PF	QUANTUM	REFERENCE	ACCEPTANCE	FORMAT OF	AGENCY			REMARKS
NO.	OPERATION				CHECK	OF CHECK	DOCUMENT	NORMS	RECORDS		M	C	N
1	4		3	4	5	6	7	8	9	D*	**	10	11
MANAFACTURER/		CONTRACTOR											
SUBCONTRACTOR													
SIGNATURE								REVIEWED BY	NAME & SIGN OF APPROVING AUTHORITY & SEAL				

ULTRASONIC TEST PROCEDURE

1.	Specification Applicable	:	(I) ASTM A – 388
2.	Test Purpose	:	This test conducted on Round Bar, Forging Blank & Hook material (Before Forming) to detect Internal Defect.
3.	Condition of material	:	As rolled/ Normalized Surface shall be prepared as Necessary for conducting the ultrasonic test.
4.	Method	:	Contact method using with pulse-back echo.
5.	Equipment details	:	Modsonic Instrument/ EEC- PX-10
6.	Scanning Area	:	Scanning shall be done in 100% area direction all Along the length and width scanning shall be done at ± 6 db. Evaluation shall be done at reference level.
7.	Couplant	:	Oil/Water
8.	Calibration block	:	The ultrasonic flow detector shall be calibrated by Using standard calibration block IIW V1, V2.
9.	Probe used Probe	:	Probe dia 24mm, 2MHz, 4MHz (NB) dia 10mm x 4MHz, 24 mm Dia x 2MHz (NB) (For Hook)
10.	Calibration	:	By choosing proper depth range and gain, the back Wall echo from a defect free area shall be brought To 100 % full screen height (FSH). This shall be The reference level.
11.	Acceptance Norms	:	Loss of back echo: More than 20% not acceptable. Defect echo more than 20% not acceptable. Any indication characterized as cracks, lamination, Or any linear defect is not acceptable.
12.	Personnel Qualification	:	The ultrasonic test shall be carried out and results are Evaluated by a person qualified to ISNT/ASNT LEVEL-II.

 PSSR-QUALITY		SUPPLIER'S NAME & ADDRESS		STANDARD FIELD QUALITY PLAN					
		SYSTEM : EOT Crane		QP NO. : QIP/BOP/001 REV. No. : 00 PAGE No. : 1 of 4				REMARKS	
SL.NO.	CHARACTERISTICS / ITEM	TYPE OF CHECK	INSTRUMENT	CLASS	QUANTUM / FREQUENCY OF CHECK	REFERENCE DOCUMENT/ ACCETANCE STANDARD	FORMAT OF RECORD	REMARKS	
1	RECEIPT & STORAGE EOT Crane after arrival at site. a. Check manufacturers dispatch documents at site, MDCC, CHP etc. for completeness, identification. b. Check for coating condition of rust inhibitor check and any transit damage c. Storage condition of parts, rails, crane girders and structural parts shall be placed on the elevated surface. * Gear box, fasteners and wire ropes shall be stored in closed covered shed.	Record Verification	Visual	B	100%	Drawings / Tech. Spec.	Protocol		
2	PRE-ERECTION CHECK a. For Gantry at every 5.0 M i.e. span, level, diagonals before taking over from Client b. Web axes of gantry girders in a raw are aligned. c. Center to center distance of gantry girders.	Visual	Visual	B	100%	Drawings/Tech . Spec/ No. Damage	Protocol		
		Physical	Visual	B	100%	Storage & Preservation Procedure.	Protocol		
		Physical	Visual	B	100%	Storage & Preservation Manual	Protocol		
		Measurement	Tape, Water level	A	100%	Drawings	Protocol		
		Measurement	Water level	B	100%	Drawings/ER Manual	Protocol		
		Measurement	Measuring Tape	B	100%	Drawings/ER Manual	Protocol		

LEGEND : CLASS #:: A = CRITICAL, B = MAJOR, C = MINOR "A" SHALL BE WITNESSED BY BHEL & CUSTOMER/ CLIENT "B" SHALL BE WITNESSED BY BHEL "C" SHALL BE WITNESSED BY ERECTION ENGINEER		FOR BHEL USE		FOR CUSTOMER USE	
TYPE @ : V = VISUAL, R = RECORD VERIFICATION, M= MEASUREMENT, P = PHYSICAL & T-TEST		PREPARED BY	REVIEWED AND APPROVED BY	APPROVED BY	

 PSSR-QUALITY		SUPPLIER'S NAME & ADDRESS		STANDARD FIELD QUALITY PLAN				REMARKS
		SYSTEM : EOT Crane		QP NO. : QIP/BOP/001		REFERENCE DOCUMENT/ ACCETANCE STANDARD	FORMAT OF RECORD	
SL.NO.	CHARACTERISTICS / ITEM	AREA : TG HALL		INSTRUMENT	CLASS			QUANTUM / FREQUENCY OF CHECK
		TYPE OF CHECK						
3	Check for Alignment of Rails a. Straightness of gantry rails b. Level and Elevation of Gantry rails (top level of girder) Distance between rails(every 5 M) including diagonal of gantry rails (Tolerance±. 5 mm) d. Bolting of rails and tightening e. End Stopper Arrangement	Measurement	Piano Wire/ Twine	B	100%	Drawings/Erection Manual	Protocol	Tolerance as per Spec/IS
4	WELDING & RAIL JOINING (FUSION / THERMIT WELDING) a. Scrapping and grinding after weld b. Structural qualification of PQR,WPS & WQT for arc welding c. Typ. Butt joint of rail to be welded by fusion/thermit welding d. Weld joint Soundness	Measurement Physical	Water level/ Measuring Tape Torque wrench -	A C A	100% 100% 100%	Drawings/Erection Manual Drawings Drawing	Protocol Protocol Protocol	
5	ERECTION CHECK FOR	Visual Visual Visual RT/DPT	-	B A A C	100% 100% 100% 100%	Drawing Appd. QAP Drawing AppdDrawing	Report	
	a. Joining of Girders i.e. splice joints	Physical	-	B	100%	Tech. Spec.	Protocol	
	b. Placement of girder assembly on the gantry.	Physical	-	B	100%	Drawings/Tech. Spec.	Protocol	
LEGEND : CLASS #:: A = CRITICAL, B = MAJOR, C = MINOR "A" SHALL BE WITNESSED BY BHEL & CUSTOMER/CLIENT "B" SHALL BE WITNESSED BY BHEL "C" SHALL BE WITNESSED BY ERECTION ENGINEER TYPE @ : V = VISUAL, R = RECORD VERIFICATION, M= MEASUREMENT, P = PHYSICAL & T-TEST		FOR BHEL USE		FOR BHEL USE		FOR CUSTOMER USE		
		PREPARED BY	REVIEWED AND APPROVED BY		APPROVED BY			

SUPPLIER'S NAME & ADDRESS		STANDARD FIELD QUALITY PLAN						
		SYSTEM : EOT Crane		QP NO. : QIP/BOP/001 REV. No. : 00 PAGE No. : 3 of 4				
SL.NO.	CHARACTERISTICS / ITEM	TYPE OF CHECK	INSTRUMENT	CLASS	QUANTUM / FREQUENCY OF CHECK	REFERENCE DOCUMENT/ ACCETANCE STANDARD	FORMAT OF RECORD	REMARKS
	d. Placement and positioning of electrical panel & trolley.	Physical	-	B	100%	Drawings/Tech. Spec.	Protocol	
	e. Movement of crab trolley on the crane girder	Physical	-	B	100%	Drawings/Tech. Spec.	Protocol	
	f. Deviation in the crane rail level at any point from true level tolerance ± 10 mm	Measurement	Piano Wire / Twince	A	100%	Drawings/ Erection Manual	Protocol	
5	D.S.L.							
	a. Fixing arrangement	Visual	-	C	100%	Drawing	Protocol	
	b. Location with respect to gantry rail, spacing & alignment.	Measurement	Measuring Tape	B	100%	Drawing	Protocol	
	c. Continuity check & insulation Resistance	Measurement	Megger	A	100%	Minimum 5 Mega Ohms	Protocol	
6	Cable laying connections	Physical	-	B	100%	Drawing	Protocol	
7	Crab Clearances							
	a. Headroom, end clearance, hook approaches and height of lift and record.	Visual & Measurement	Measuring Tape	B	100%	Drawing	Protocol	
8	Gear Box							
	a. Check oil level	Measurement	Dip stick	B	100%	Drawing	Site log Book	
9	LT Machinery, Platform, cabin, Electrical equipment, other structural components, limit switch & Mechanical stopper.							
	a. Fit up	Visual	-	B	100%		Protocol	
	b. Alignment	Visual	-	B	100%	Drawing	Protocol	
LEGEND : CLASS #: A = CRITICAL, B = MAJOR, C = MINOR "A" SHALL BE WITNESSED BY BHEL & CUSTOMER/ CLIENT "B" SHALL BE WITNESSED BY BHEL "C" SHALL BE WITNESSED BY ERECTION ENGINEER			FOR BHEL USE		FOR CUSTOMER USE			
TYPE @ : V = VISUAL, R = RECORD VERIFICATION, M= MEASUREMENT, P = PHYSICAL & T-TEST			PREPARED BY		REVIEWED AND APPROVED BY		APPROVED BY	

 PSSR-QUALITY		SUPPLIER'S NAME & ADDRESS		STANDARD FIELD QUALITY PLAN				
		SYSTEM : EOT Crane		QP NO. : QIP/BOP/001 REV. No. : 00 PAGE No. : 4 of 4				
SL.NO.	CHARACTERISTICS / ITEM	TYPE OF CHECK	INSTRUMENT	CLASS	QUANTUM / FREQUENCY OF CHECK	REFERENCE DOCUMENT/ ACCETANCE STANDARD	FORMAT OF RECORD	REMARKS
10	Storm braker arrangement	Physical	-	A	100%	Drawing	Protocol	
11	COMMISSIONING CHECKS	Visual	Megger	A	100%	Min 5 Mega Ohms	Protocol	
	a. Power & control cable connections Insulation Resistance	Measurement Physical	Megger	A	100%	Min 5 Mega Ohms	Protocol	
	b. Control panel earthing Insulation resistance Function & sequential operation	Measurement	-	B	100%	Min 5 Mega Ohms	Protocol	
	c. Resistance box earthing IR value	Measurement	-	B	100%	Drawing	Protocol	
	d. Operation of Brakes (Hoist motion, L.T. Motion & C.T. motion)	Physical	-	A	100%	O&M Manual	Protocol	
	e. Operation of limit Switch (Hoist & traveling motion brakes)	Physical	-	A	100%	O&M Manual	Protocol	
	f. Motors. IR value	Measurement	-	B	100%	Min 5 Mega Ohms	Protocol	
	g. At no load check Motor Current Crane Speed (only watching all motion)	Measurement	-	A	100%	As per procedure	Protocol	
	h. At full load check / Load testing of crane (SWL): Motor Current Crane Speed Deflection.	Measurement	-	A	100%	As per procedure	Protocol	
	i. At 25% Overload (only watching all motion)	Visual	-	A	100%	As per procedure	Protocol	
	j. Storm braker arrangement	Physical & operation	-	A	100%	Drawing	Protocol	
	k. Touch Up Painting.	Visual	-	C	100%	As per approved shade	Records	

FOR BHEL USE		FOR BHEL USE		FOR CUSTOMER USE	
LEGEND : CLASS #:: A = CRITICAL, B = MAJOR, C = MINOR "A" SHALL BE WITNESSED BY BHEL & CUSTOMER/ CLIENT "B" SHALL BE WITNESSED BY BHEL "C" SHALL BE WITNESSED BY ERECTION ENGINEER TYPE @ : V = VISUAL, R = RECORD VERIFICATION, M= MEASUREMENT, P = PHYSICAL & T-TEST	PREPARED BY	REVIEWED AND APPROVED BY	APPROVED BY		

CLAUSE NO.		QUALITY ASSURANCE	
Shop Test for T.G.Hall EOT Cranes, Other Cranes & Hoist			
1.0	HOOKS		
1.01	ALL TESTS INCLUDING PROOF LOAD TEST AS PER RELEVANT IS/BS/DIN SHALL BE CARRIED OUT.		
1.02	MPI/DPT SHALL BE CARRIED OUT AFTER PROOF LOAD TEST.		
2.0	STEEL CASTING		
2.01	DPT ON MACHINED SURFACE SHALL BE CARRIED OUT.		
3.0	GIRDERS, END CARRIAGE,CRAB, GEAR BOX AND ROPE DRUM		
3.01	THE PLATES OF THICKNESS 25MM AND ABOVE SHALL BE ULTRASONICALLY TESTED.		
3.02	NDT REQUIREMENTS ON WELDMENTS SHALL BE AS FOLLOWS:		
	a) BUTT WELDS IN TENSION:-	100% RT AND 100% DPT	
	b) BUTT WELDS IN COMPRESSION:-	10% RT AND 100% DPT	
	c) BUTT WELDS IN ROPE DRUM:-	100% RT AND 100% DPT	
	d) FILLET WELDS:-	RANDOM 10% DPT	
4.0	FORGING (WHEEL, GEARS, PINIONS, AXLE, HOOKS & HOOK TRUNION)		
4.01	ALL FORGINGS GREATER THAN OR EQUAL TO 50 MM DIAMETER OR THICKNESS SHALL BE SUBJECTED TO ULTRASONIC TESTING.		
4.02	DPT/MPI SHALL BE DONE AFTER HARDFACING AND MACHINING.		
5.0	WIRE ROPE SHALL BE TESTED AS PER RELEVANT STANDARD.		
6.0	REDUCTION GEARS SHALL BE TESTED FOR REDUCTION RATIO, BACKLASH & CONTACT PATTERN. GEAR BOX SHALL BE SUBJECTED TO NO-LOAD RUN TEST TO CHECK FOR OIL LEAKAGE, TEMPERATURE RISE, NOISE AND VIBRATION.		
7.0	THE CRANES SHALL BE COMPLETELY ASSEMBLED AT SHOP FOR FINAL TESTING. ALL TESTS FOR DIMENSION, DEFLECTION, LOAD, OVERLOAD, HOISTING MOTION, CROSS TRAVEL AS PER IS-3177 SHALL BE CARRIED OUT AT SHOP.		
8.0	ALL ELECTRIC HOISTS SHALL BE TESTED AS PER IS-3938 AND CHAIN PULLEY BLOCKS SHALL BE TESTED AS PER IS-3832.		
~~9.0~~	~~LIFTING BEAM(If applicable):~~		
9.01	THE PLATES OF THICKNESS 25MM AND ABOVE SHALL BE ULTRASONICALLY TESTED.		
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371	SUB-SECTION-E-6 SHOP TEST FOR T.G.HALL EOT CRANES, OTHER CRANES & HOIST
			PAGE 1 OF 2

S-TEMP-MAA					
CLAUSE NO.	 Quality Assurance for Civil Works 				
11.1.7.	SHOP TEST EOT Cranes, Other cranes & Hoist 1.0 HOOKS 1.01 ALL TESTS INCLUDING PROOF LOAD TEST AS PER RELEVANT IS/BS/DIN SHALL BE CARRIED OUT. 1.02 MPI/DPT SHALL BE CARRIED OUT AFTER PROOF LOAD TEST. 2.0 STEEL CASTING 2.01 DPT ON MACHINED SURFACE SHALL BE CARRIED OUT. 3.0 GIRDERS, END CARRIAGE,CRAB, GEAR BOX AND ROPE DRUM 3.01 THE PLATES OF THICKNESS 25MM AND ABOVE SHALL BE ULTRASONICALLY TESTED. 3.02 NDT REQUIREMENTS ON WELDMENTS SHALL BE AS FOLLOWS: a) BUTT WELDS IN TENSION:- 100% RT AND 100% DPT b) BUTT WELDS IN COMPRESSION:- 10% RT AND 100% DPT c) BUTT WELDS IN ROPE DRUM:- 100% RT AND 100% DPT d) FILLET WELDS:- RANDOM 10% DPT 4.0 FORGING (WHEEL, GEARS, PINIONS, AXLE, HOOKS & HOOK TRUNION) 4.01 ALL FORGINGS GREATER THAN OR EQUAL TO 50 MM DIAMETER OR THICKNESS SHALL BE SUBJECTED TO ULTRASONIC TESTING. 4.02 DPT/MPI SHALL BE DONE AFTER HARDFACING AND MACHINING. 5.0 WIRE RPOE SHALL BE TESTED AS PER RELEVANT STANDARD. 6.0 REDUCTION GEARS SHALL BE TESTED FOR REDUCTION RATIO, BACKLASH & CONTACT PATTERN. GEAR BOX SHALL BE SUBJECTED TO NO-LOAD RUN TEST TO CHECK FOR OIL LEAKAGE, TEMPERATURE RISE, NOISE AND VIBRATION. 7.0 THE CRANES SHALL BE COMPLETELY ASSEMBLED AT SHOP FOR FINAL TESTING. ALL TESTS FOR DIMENSION, DEFLECTION, LOAD, OVERLOAD, HOISTING MOTION, CROSS TRAVEL ETC. AS PER IS-3177 SHALL BE CARRIED OUT AT SHOP. 8.0 ALL ELECTRIC HOISTS SHALL BE TESTED AS PER IS-3938 AND CHAIN PULLEY BLOCKS SHALL BE TESTED AS PER IS-3832.				
<table><tr><td>KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES</td><td>TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371</td><td>SUB-SECTION-E-47 STEAM TURBINE GENERATOR</td><td>PAGE 17 OF 23</td></tr></table>		KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES	TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371	SUB-SECTION-E-47 STEAM TURBINE GENERATOR	PAGE 17 OF 23
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES	TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371	SUB-SECTION-E-47 STEAM TURBINE GENERATOR	PAGE 17 OF 23		

40880/2020/PS-PEM-MAX



TITLE

2X660 MW THDC Khurja STPP**DOUBLE GIRDER EOT CRANES ABOVE 100T****SPECIFIC TECHNICAL REQUIREMENTS**

SPECIFICATION NO. PE-TS-475-501-A501

REV 00

Section

I B

Date JULY'20

Page 1 of 1

SUB-SECTION IB

SPECIFIC TECHNICAL REQUIREMENT (ELECTRICAL)

2X660 MW KHURJA TG

**DOUBLE GIRDER CRANE
TECHNICAL SPECIFICATION
(ELECTRICAL PORTION)**



**BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT,
NOIDA, U.P., INDIA**

40880/2020/PS-PEM-MAX



TITLE:

**ELECTRICAL EQUIPMENT SPECIFICATION
FOR
DOUBLE GIRDER CRANE
2X660 MW KHURJA TG**

SPECIFICATION NO.

VOLUME NO. : **II-B**SECTION: **C**REV NO.: **00** DATE: 01.07.20

SHEET: 1 OF 1

CONTENTS

SECTION	TITLE	NO OF SHEETS
C	SPECIFIC TECHNICAL REQUIREMENTS	2
C	ELECTRICAL SCOPE BETWEEN BHEL & VENDOR (ANNEXURE-I)	1
C	ELECTRICAL LOAD DATA FORMAT (ANNEXURE-II)	1
C	CABLE SCHEDULE FORMAT (ANNEXURE-III)	1
C	DATA SHEET A	2
C	SUB VENDOR LIST (ANNEXURE-IV)	1
D	QUALITY PLAN FOR MOTORS	11
D	TECHNICAL SPECIFICATION FOR LT SWITCHGEAR	10
D	TECHNICAL SPECIFICATION FOR MOTORS	10
D	TECHNICAL SPECIFICATION LV CABLES	13
D	TECHNICAL SPECIFICATION CABLING,EARTHING & LIGHTING PROTECTION	35



**ELECTRICAL EQUIPMENT SPECIFICATION
FOR
DOUBLE GIRDER CRANE
2X660MW KHURJA TG**

SPECIFICATION NO.

VOLUME NO. : **II-B**SECTION : **C**REV NO. : **00** DATE : 01.07.2020

SHEET : 1 OF 2

1.0 EQUIPMENT & SERVICES TO BE PROVIDED BY BIDDER:

- a) Services and equipment as per “Electrical Scope between BHEL and Vendor”.
- b) Any item/work either supply of equipment or erection material which have not been specifically mentioned but are necessary to complete the work for trouble free and efficient operation of the plant shall be deemed to be included within the scope of this specification. The same shall be provided by the bidder without any extra charge.
- c) Supply of mandatory spares as specified in the specifications of mechanical equipments.
- d) Electrical load requirement for Double Girder crane in load data format.
- e) All equipment shall be suitable for the power supply fault levels and other climatic conditions mentioned in the enclosed project information.
- f) Bidder to furnish list of makes for each equipment at contract stage, which shall be subject to customer/BHEL approval without any commercial and delivery implications to BHEL.
- g) Various drawings, data sheets as per required format, Quality plans, calculations, test reports, test certificates, operation and maintenance manuals etc shall be furnished as specified at contract stage. All documents shall be subject to customer/BHEL approval without any commercial implication to BHEL.
- h) Motor shall meet minimum requirement of motor specification.
- i) Vendor to clearly indicate equipment locations and local routing lengths in their cable listing furnished to BHEL.
- j) Cable BOQ worked out based on routing of cable listing provided by the vendor for “ both end equipment in vendor’s scope”shall be binding to the vendor with +10 % margin to take care of slight variation in routing length & wastages.

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 The electrical specification without any deviation from the technical/quality assurance requirements stipulated shall be deemed to be complied by the bidder in case bidder furnishes the overall compliance of package technical specification in the form of compliance certificate/No deviation certificate.
- 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.

40880/2020/PS-PEM-MAX :



**ELECTRICAL EQUIPMENT SPECIFICATION
FOR
DOUBLE GIRDER CRANE
2X660MW KHURJA TG**

SPECIFICATION NO.

VOLUME NO. : **II-B**SECTION : **C**REV NO. : **00** DATE : 01.07.2020

SHEET : 2 OF 2

4.0 List of enclosures :

- a) Electrical scope between BHEL & vendor (Annexure –I)
- b) Technical specification for motors.
- c) Datasheets & quality plan for motors.
- d) Electrical Load data format (Annexure –II)
- e) BHEL cable listing format (Annexure –III)
- f) Sub vendor list for motors (Annexure-IV)
- g) Technical specification for LT switchgear
- h) Technical specification for motors
- i) Technical specification cables
- j) Technical specification cabling, earthing & lighting protection

REV: 00 DATE: 11.03.2015

STANDARD ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR (FOR EPC PROJECTS)

PACKAGE: DOUBLE GRIDER EOT CRANES

SCOPE OF VENDOR: SUPPLY, ERECTION & COMMISSIONING OF VENDOR'S EQUIPMENT

PROJECT: 2 X 660 MW KHURJA TPP

ANNEXURE-A

<u>S. NO</u>	<u>DETAILS</u>	<u>SCOPE SUPPLY</u>	<u>SCOPE E&C</u>	<u>REMARKS</u>
1	Isolating Switch (Changeover Provision)	Vendor	Vendor	BHEL will provide Two nos. 415V (3ph, 4W) supply feeder only up to isolating switches for cranes. Any other voltage level (AC/DC) required will be derived by the vendor. Motor starter shall be part of crane control panel.
2	Power cables, control cables, screened control cables and any special cables (if required) between equipment supplied by vendor.	Vendor	Vendor	Cable from supply feeder to isolating switch shall be in BHEL scope.
3	Cabling material (cable trays, accessories, cable tray supporting system, conduits etc).	Vendor	Vendor	
4	Equipment Earthing	Vendor	Vendor	All equipment metallic enclosures / frames, metal structure etc. shall be grounded at two points each to the nearest grounding points / risers provided by BHEL.
5	Motors	Vendor	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 heavy duty tinned copper lugs for power & control cables.
7	a) Input cable schedules (C & I) b) Cable interconnection details for above c) Cable block diagram	Vendor Vendor Vendor	- - -	Cable listing for Control and Instrumentation Cable in enclosed excel format shall be submitted by vendor during detailed engineering stage.
8	Equipment layout drawings	Vendor	-	
9	Electrical Equipment GA drawing	Vendor	-	For necessary interface review.

LOAD TITLE	RATING (KW / A)		UNIT (U)/STN (S)	Nos.		VOLTAGE CODE*	FEEDER CODE**	EMER. LOAD (Y)	CONT.(C)/ INTT.(I)	STARTING TIME >5 SEC (Y)	LOCATION	BOARD NO.	CABLE		BLOCK CABLE DRG. No.	CONTROL CODE	REMARKS	LOAD No.
	NAME PLATE	MAX. CONT. DEMAND (MCR)		RUNNING	STANDBY								SIZE CODE	NOs				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19

NOTES: 1. COLUMN 1 TO 12 & 18 SHALL BE FILLED BY THE REQUISITIONER (ORIGINATING AGENCY); REMAINING COLUMNS ARE TO BE FILLED UP BY PEM (ELECTRICAL)

2. ABBREVIATIONS : * VOLTAGE CODE (7):- (ac) A=11 KV, B=6.6 KV, C=3.3 KV, D=415 V, E=240 V (1 PH), F=110 V (cc): G=220 V, H=110 V, J=48 V, K=+24V, L=-24 V

: ** FEEDER CODE (8):- U=UNIDIRECTIONAL STARTER, B=BI-DIRECTIONAL STARTER, S=SUPPLY FEEDER, D=SUPPLY FEEDER (CONTACTER CONTROLLED)

	LOAD DATA (ELECTRICAL)	JOB NO.	415	ORIGINATING AGENCY		PEM (ELECTRICAL)	
		PROJECT TITLE	2X660MW KHURJA TPS	NAME		DATA FILLED UP ON	
		SYSTEM / S	DG EOT CRANE	SIGN.		DATA ENTERED ON	
		DEPTT. / SECTION	ELECTRICAL	SHEET 1 OF 1	REV. 00	DE'S SIGN. & DATE	

ANNEXURE - B

CABLE SCHEDULE FORMAT

ANNEXURE III



LV MOTORS DATA SHEET-A

2X660 MW KHURJA TG TPP

SPECIFICATION NO.

VOLUME II B

SECTION D

REV NO. 00 DATE 23.01.2019

SHEET 1 OF 1

1.0	Design ambient temperature	:	50 °C
2.0	Maximum acceptable kW rating of LV motor	:	200KW
3.0	Installation (Indoors/ Outdoors)	:	As required
4.0	Details of supply system		
	a) Rated voltage (with variation)	:	415V $\pm$ 10%
	b) Rated frequency (with variation)	:	50 Hz (+3% and -5%)
	c) Combined voltage & freq. variation	:	10% (sum of absolute values)
	d) System fault level at rated voltage	:	50 kA for 1 sec
	e) Short time rating for terminal boxes		
	o 110 kW and upto 200kW	:	50 KA for 1 sec.
	o (Breaker controlled)		
	o Below 110 kW	:	MCCB with inbuilt fixed setting
			magnetic release for Short-circuit
			along-with separate adjustable overload
			relay shall be provided.
	(MPCB)		
	f) LV System grounding	:	Effectively grounded
5.0	Class of insulation	:	Thermal class B or better.
6.0	Minimum voltage for starting (As percentage of rated voltage)	:	85% of rated voltage for rating below 110KW and 80% of rated voltage or rating between 110 and 200KW
7.0	Power cables data	:	Shall be given during Detailed engg
8.0	Earth Conductor Size & Material	:	Shall be given during Detailed engg
9.0	Space heater supply	:	240 V, 1 ϕ , 50 Hz
10.0	Rating up to which Single phase motor	:	Acceptable below 0.20 kW
11.0	Additional tests	:	As per QP and customer motor spec
12.0	Flame-proof motor		
	a) Enclosure suitable (As per IS:2148)	:	As per requirement
	b) Classification of Hazardous area (As per IS: 5572 part-I)	:	As per requirement
13.0	Makes	:	As per ANNEXURE-I
14.0	Paint shade	:	RAL 5012
15.0	Degree of Protection of enclosure (motors):		INDOOR IP-54 OUTDOOR IPW-55
16.0	Energy efficiency	:	IE3 as per IS:12615: 2011

40880/2020/PS-PEM-MAX



TITLE

LV MOTORS DATA SHEET-A

2X660 MW KHURJA TG TPP

SPECIFICATION NO.

VOLUME II B

SECTION D

REV NO. 00 DATE 23.01.2019

SHEET 1 OF 1

❖ Also detail Customer spec. for Motors to be referred as enclosed with spec.

ANNEXURE-IV

SUB-VENDOR LIST

The list of approved make of the LT Motors are as mentioned below:

S.No.	LIST OF LT MOTORS
1.	BHARAT BIJLEE LTD.
2.	CROMPTON GREAVES
3.	ASEA BROWN BOVERI
4.	KIRLOSKAR ELECTRIC CO LTD.
5.	NGEF
6.	SIEMENS
7.	MARATHON
8.	GE-POWER
9.	RAJINDRA ELECT INDUSTRIES
10.	LAXMI HYDRAULICS PVT. LTD

However, the final list of makes for the LT Motors is subjected to BHEL/Customer approval, during contract stage, without any commercial implications.

	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS		STANDARD QUALITY PLAN		SPEC. NO. :	DATE: 27.02.2020
			CUSTOMER :		QP NO. : PED-506-00-Q-006, REV-02	
			PROJECT :		PO NO. :	
			ITEM: AC ELECT. MOTORS UPTO 55KW (LV (415V))		SYSTEM: SECTION: II	
						SHEET 1 OF 2

Sl No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD		AGENCY			
1	2	3	4	5	6		7	8	9	*	**			
					M	C/N					D	M	C	N
1.0	ASSEMBLY	1.WORKMANSHIP	MA	VISUAL	100%	-	MFG. SPEC.	MFG. SPEC.	-DO-	P	-	-	-	
		2.DIMENSIONS	MA	-DO-	-DO-	-	MFG. DRG./ MFG. SPEC.	MFG. DRG./ MFG. SPEC.	-DO-	P	-	-	-	
		3.CORRECTNESS TERMINATIONS/ MARKING/COLOUR CODE	MA	VISUAL	100%	-	MFG.SPEC./	MFG.SPEC.	-DO-	P	-	-	-	
2.0	PAINTING	1.SHADE	MA	VISUAL	SAMPLE	-	MFG. SPEC/ APPROVED DATASHEET	SAME AS COL.7	LOG BOOK	P	-	-	-	
3.0	TESTS	1.ROUTINE TEST INCLUDING SPECIAL TEST	MA	-DO-	100%	100%	IS-325 / IS-12615/ APPROVED DATA SHEET	SAME AS COL.7	TEST/ INSPN. REPORT	P	W	W	W	NOTE -1 & NOTE-2
		2.OVERALL DIMENSIONS & ORIENTATION	MA	MEASUREMENT & VISUAL	100%	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET	TEST/ INSPN. REPORT	P	W	W	W	NOTE -1 & NOTE-2

ENGINEERING		BHEL		QUALITY	
Sign & Date	Name		Sign & Date	Name	
Prepared by: <i>[Signature]</i>	Hema K.		Checked by: <i>[Signature]</i>	Kunt	
Reviewed by: <i>[Signature]</i>	P.Dutta		Reviewed by: <i>[Signature]</i>	Ganbat	

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

FOR CUSTOMER REVIEW & APPROVAL			
Doc No.:	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

		MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS		STANDARD QUALITY PLAN		SPEC. NO.:	
				CUSTOMER :		DATE: 27.02.2020	
PROJECT:		ITEM: AC ELECT. MOTORS UPTO 55KW (LV (415V))		SYSTEM:		SECTION: II	
PO NO.:						SHEET 2 OF 2	

Sl No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD		AGENCY			
1	2	3	4	5	6		7	8	9	*	**			
					M	C/N				D	M	C	N	
		3 NAMEPLATE DETAILS	MA	VISUAL	100%	100%	IS-325 / IS-12815 / APPROVED DATA SHEET	SAME AS COL.7	TEST/ INSPN. REPORT		P	W	W	
4.0	PACKING	SURFACE FINISH & COMPLETENESS	MA	VISUAL	100%	100%	AS PER MFG. STANDARD / APPROVED PACKING DRAWING. (#)	AS PER MFG. STANDARD / APPROVED PACKING DRAWING. (#)	INSPC. REPORT		P	W	-	(#) APPLICABLE FOR EXPORT JOBS

NOTES:

- 1 ROUTINE TESTS ON 100% MOTORS SHALL BE DONE BY THE VENDOR. HOWEVER, BHEL/CUSTOMER SHALL WITNESS ROUTINE TESTS ON RANDOM SAMPLES. THE SAMPLING PLAN SHALL BE MUTUALLY AGREED UPON
- 2 FOR EXHAUST/VENTILATION FAN MOTORS OF RATING UPTO 1.5KW, ONLY ROUTINE TEST CERTIFICATES SHALL BE FURNISHED FOR SCRUTINY.
- 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 BHEL RESERVES THE RIGHT TO PERFORM REPEAT TEST, IF REQUIRED.
- 5 AFTER PACKING AND PRIOR TO ISSUE MDCC, PHOTOGRAPHS OF ITEMS TO BE DESPATCHED SHALL BE SENT TO BHEL FOR REVIEW.
- 6 IN CASE, ANY CHANGES IN CP COMMENTED BY CUSTOMER AT CONTRACT STAGE SHALL BE CARRIED OUT BY BIDDER WITHOUT ANY IMPLICATION TO BHEL/CUSTOMER.

LEGENDS:

* RECORDS, IDENTIFIED WITH 'TICK' (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.
 ** M: SUPPLIER/ MANUFACTURER/ SUB-SUPPLIER, B: MAIN SUPPLIER/ BHEL THIRD PARTY INSPECTION AGENCY, C: CUSTOMER,
 P: PERFORM, W: WITNESS, V: VERIFICATION, AS APPROPRIATE
 MA: MAJOR, MI: MINOR, CR: CRITICAL
 D: DOCUMENT

ENGINEERING				QUALITY			
Sign & Date		Name		Sign & Date		Name	
Prepared by: <i>[Signature]</i>		Hema K.		Checked by: <i>[Signature]</i>		Kunal	
Reviewed by: <i>[Signature]</i>		P. D. H. S.		Reviewed by: <i>[Signature]</i>		G. D. H. S.	

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

 MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS		STANDARD QUALITY PLAN		SPEC. NO.:	
		CUSTOMER:		QP NO.: PED-506-00-Q-007, REV/04	
		PROJECT:		PO NO.:	
		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V))		SYSTEM:	
		SECTION: II		SHEET 1 OF 9	

SI No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD		AGENCY				
					M	C/N			9	D	M	C	N		
1	2	3	4	5		6	7	8							
1.0	RAW MATERIAL & BOUGHT OUT CONTROL														
1.1	SHEET STEEL, PLATES, SECTION, EYEBOLTS	1 SURFACE CONDITION	MA	VISUAL	100%	-	-	FREE FROM BLINKS, CRACKS, WAVERNESS ETC	LOG BOOK		P	-	-		
1.2	HARDWARES	2 DIMENSIONS	MA	MEASUREMENT	SAMPLE	-	MANUFACTURERS DRG./SPEC	MANUFACTURERS DRG./SPEC	-DO-	-DO-	P	-	-		
		3 PROOF LOAD TEST (EYE BOLT)	MA	MECH. TEST	-DO-	-	-DO-	MANUFACTURERS DRG./SPEC	TEST REPORT	PV	-	-			
		1 SURFACE CONDITION	MA	VISUAL	100%	-	FREE FROM CRACKS, UN-EVENNESS ETC.	SUPPLIERS TC & LOG	-DO-	P	-	-	PROPERTY CLASS MARKING SHALL BE CHECKED BY THE VENDOR		
1.3	CASTING	2 PROPERTY CLASS	MA	VISUAL	SAMPLES	-	MANUFACTURERS DRG./SPEC	MANUFACTURERS DRG./SPEC	SUPPLIERS TC & LOG	PV	-	-			
		1 SURFACE CONDITION	MA	VISUAL	100%	-	FREE FROM CRACKS, BLOW HOLES ETC.	LOG BOOK	PV	-	-				
1.4	PAINT & VARNISH	2 CHEM. & PHY. PROP.	MA	CHEM & MECH TEST	1 MEAT NO.	-	MANUFACTURERS DRG./SPEC	MANUFACTURERS DRG./SPEC	SUPPLIERS TC	PV	-	-	HEAT NO SHALL BE VERIFIED		
		3 DIMENSIONS	MA	MEASUREMENT	100%	-	MANUFACTURERS DRG.	MANUFACTURERS DRG.	LOG BOOK	PV	-	-			
		1 MAKE, SHADE, SHELF LIFE & TYPE	MA	VISUAL	100% CONTINUOUS	-	MANUFACTURERS DRG./SPEC	MANUFACTURERS DRG./SPEC	LOG BOOK	PV	-	-			

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ENGINEERING		BHEL		QUALITY	
Prepared by:	Sign & Date	Name	Checked by:	Sign & Date	Name
Reviewed by:	2/13/2020	Hema K.	Reviewed by:	2/13/2020	Hema K.
BIDDER/ SUPPLIER		FOR CUSTOMER REVIEW & APPROVAL			
Sign & Date		Doc No.:			
Seal		Reviewed by:			
		Approved by:			

40880/2020/PS-PEM-MAX

STANDARD QUALITY PLAN										SPEC. NO.:		
CUSTOMER:										QP NO.: PED-506-00-Q-007, REV-04		
PROJECT:										DATE: 27.02.2020		
ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V))										SECTION: II		
SYSTEM:										SHEET 2 OF 9		
SI No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD	AGENCY		
1	2	3	4	5	6	7	8	9	10	11	12	
15	SHAFT (FORGED OR ROLLED)	1. SURFACE COND.	MA	VISUAL	100%	MANUFACTURER'S DRG / SPEC.	FREE FROM VISUAL DEFECTS	MANUFACTURER'S DRG / STD.	SUPPLIERS TC	P	-	VENDOR'S APPROVAL IDENTIFICATION SHALL BE MAINTAINED
16	SPACE HEATERS, CONN- TIONS, TERMINAL BLOCKS, CABLES, CABLE TIES, CARBON BRUSH TEMP DETECTORS, RTD, RTDS	1. MAKE & RATING	MA	VISUAL	100%	ASTM-A388	MANUFACTURER'S DRG / STD.	MANUFACTURER'S DRG / STD.	LOG BOOK	PV	-	FOR DIA OF 55 MM & ABOVE
17	2. CHEM. & PHYSICAL PROPERTIES	MA	CHEM. & PHYSICAL TESTS	100%	1/HEAT NO. OR HEAT TREATMENT BATCH NO	MANUFACTURER'S DRG / SPEC.	MANUFACTURER'S DRG.	MANUFACTURER'S DRG / STD.	NO PHYS. DAMAGE, NO ELECTRICAL DISCONTINUITY	PV	-	
18	3. DIMENSIONS	MA	MEASUREMENT	100%	-	MANUFACTURER'S DRG / STD.	MANUFACTURER'S DRG / STD.	MANUFACTURER'S DRG / STD.	NO PHYS. DAMAGE, NO ELECTRICAL DISCONTINUITY	PV	-	
19	4. INTERNAL FLAWS	CR	ULTRASONIC TEST	100%	-	ASTM-A388	MANUFACTURER'S DRG / STD.	MANUFACTURER'S DRG / STD.	NO PHYS. DAMAGE, NO ELECTRICAL DISCONTINUITY	PV	-	
20	2. PHYSICAL COND.	MA	-DO-	-DO-	-	MANUFACTURER'S DRG / STD.	MANUFACTURER'S DRG / STD.	MANUFACTURER'S DRG / STD.	NO PHYS. DAMAGE, NO ELECTRICAL DISCONTINUITY	PV	-	
21	3. DIMENSIONS (WHEREVER APPLICABLE)	MA	MEASUREMENT	SAMPLE	-	MANUFACTURER'S DRG / STD.	MANUFACTURER'S DRG / STD.	MANUFACTURER'S DRG / STD.	NO PHYS. DAMAGE, NO ELECTRICAL DISCONTINUITY	PV	-	
22	4. PERFORMANCE/ CALIBRATION	MA	TEST	100%	-	MANUFACTURER'S DRG / STD.	MANUFACTURER'S DRG / STD.	MANUFACTURER'S DRG / STD.	NO PHYS. DAMAGE, NO ELECTRICAL DISCONTINUITY	PV	-	

 MANUFACTURER/BIDDER/ SUPPLIER NAME & ADDRESS		STANDARD QUALITY PLAN		SPEC. NO.:		DATE: 27.02.2020 SHEET 3 OF 9
		CUSTOMER :		QP NO.: PED-5005-00-Q-007, REV.04		
		PROJECT:		PO NO.:		
		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V))		SYSTEM:		
		SECTION: II				

Sl No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD		AGENCY				
1	2	3	4	5	6		7	8	9	10		M	C	N	
					M	CN				D					
1.7	OTHER INSULATING MATERIALS LIKE SLEEVES, BINDINGS CORDS, PAPERS, PRESS BOARDS ETC.	1. SURFACE COND. ETC. 2. OTHER CHARACTERISTICS	MA	VISUAL	100%	-	MANUFACTURERS STD.	NO VISUAL DEFECTS	TEST REPORT		PV	-	-		
1.8	SHEET STAMPING (PUNCHED)	1. SURFACE COND.	MA	VISUAL	100%	-	MANUFACTURERS STD.	NO VISUAL DEFECTS (FREE FROM BURS)	LOG BOOK AND OR SUPPLIERS TC		P	-	-		
1.9	CONDUCTORS	2. DIMENSIONS INCLUDING BURS HEIGHT	MA	MEASUREMENT	SAMPLE	-	MANUFACTURERS DRG.	MANUFACTURERS DRG.	-DO-		PV	-	-		
		3. ACCEPTANCE TESTS	MA	ELECT. & MECH TESTS	-DO-	-	MANUFACTURERS DRG/ STD.	MANUFACTURERS DRG/ STD.	SUPPLIERS TC		PV	-	-		
		1. SURFACE FINISH	MA	VISUAL	100%	-	MANUFACTURERS DRG/ STD.	FREE FROM VISUAL DEFECTS	LOG BOOK		TPV	-	-		
		2. ELECT. PROP. & MECH PROP	MA	ELECT. & MECH TEST	SAMPLES	-	MANUFACTURERS DRG/ SPEC.	MANUFACTURERS / SPEC.	SUPPLIERS TC & VENDORS TEST REPORTS		PV	-	-		
															* MOTOR MANUFACTURER TO CONDUCT INSULATION TEST FOR SURFACE FINISH ON RANDOM BASIS (10% SAMPLE) AT HIS WORKS AND MAINTAIN RECORD FOR VERIFICATION BY BHEL/CUSTOMER

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* MOTOR MANUFACTURER TO CONDUCT VISUAL CHECK FOR SURFACE FINISH ON BASIS 10% SAMPLE AT HIS WORKS AND MAINTAIN RECORD FOR VERIFICATION BY BHEL/CUSTOMER.

ENGINEERING		BHEL		QUALITY	
Prepared by:	Sign & Date	Name	Checked by:	Sign & Date	Name
Reviewed by:			Reviewed by:		

BIDDER/ SUPPLIER	
Sign & Date	Seal

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

		STANDARD QUALITY PLAN		SPEC. NO.:	
MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS		CUSTOMER:		GP NO.: PED-506-00-Q-007, REV.04	
PROJECT:		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V))		DATE: 27.02.2020	
SYSTEM:		SECTION: II		SHEET 4 OF 9	

Sl No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD	AGENCY			
					M	CN				D	M	C	N
1													
1.10	BEARINGS	3 DIMENSIONS 1 MAKE & TYPE 2 DIMENSIONS	MA MA MA	MEASUREMENT VISUAL MEASUREMENT	-DO- 100% SAMPLE	-	-DO- MANUFACTURERS DRG./ APPROVED DATASHEET APPROVED DATASHEET	-DO- MANUFACTURERS DRG./ APPROVED DATASHEET APPROVED DATASHEET/ BEARING MANUPS CATALOGUES	-DO- Log Book -DO-		PV PV PV	- - -	- - -
1.11	SUP RING (WHEREVER APPLICABLE)	3 SURFACE FINISH 1 SURFACE COND. 2 DIMENSIONS	MA MA MA	VISUAL VISUAL MEASUREMENT	100% 100% SAMPLE	-	-	-DO- FREE FROM VISUAL DEFECTS -DO- MANUFACTURERS DRG	-DO- -DO- -DO-		PV P P	- - -	- - -
1.12	OIL SEALS & GASKETS	3 TEMP WITH- STAND CAPACITY 4 HW/R 1 MATERIAL OF GASKET 2 SURFACE COND. 3 DIMENSIONS	MA MA MA MA MA	ELECT TEST -DO- VISUAL VISUAL MEASUREMENT	-DO- 100% 100% 100% SAMPLE	-	-DO- MANUFACTURERS DRG/ APPROVED DATASHEET MANUFACTURERS DRG/ APPROVED DATASHEET	-DO- MANUFACTURERS DRG/ APPROVED DATASHEET MANUFACTURERS DRG/ APPROVED DATASHEET	-DO- -DO- -DO- -DO-		PV P P P	- - - -	- - - -

ENGINEERING		BHEL		QUALITY	
Prepared by:	Sign & Date	Name	Checked by:	Sign & Date	Name
Reviewed by:					
BIDDER/ SUPPLIER		FOR CUSTOMER REVIEW & APPROVAL			
Sign & Date		Doc No:			
Seal		Sign & Date			
		Reviewed by:			
		Approved by:			

			
MANUFACTURER/BIDDER/ SUPPLIER NAME & ADDRESS			
STANDARD QUALITY PLAN		SPEC. NO.:	
CUSTOMER :		QP NO. : PED-506-00-Q-007, REV-04	
PROJECT:		PO NO.:	
ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V))	SYSTEM:	SECTION: II	
		DATE: 27.02.2020	
		SHEET 5 OF 9	

Sl No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD	AGENCY			
					6		7	8	9				
					M	CN					M	C	N
2.0	IN PROCESS												
2.1	STATOR FRAME WELDING (IN CASE OF FABRICATED STATOR)	1 WORKMANSHIP & CLEANNESS	MA	VISUAL	100%	-	-DO-	GOOD FINISH	LOG BOOK		PW	-	-
		2 DIMENSIONS	MA	MEASUREMENT	-DO-	-	MANUFACTURERS DRG	MANUFACTURERS DRG	-DO-		P	-	-
2.2	MACHINING	1 FINISH	MA	VISUAL	100%	-	-DO-	GOOD FINISH	LOG BOOK		P	-	-
		2 DIMENSIONS	MA	MEASUREMENT	-DO-	-	MANUFACTURERS DRG	MANUFACTURERS DRG	-DO-		P	-	-
		3 SHAFT SURFACE FLOWS	MA	PT	100%	100%	MANUFACTURERS STD / ASTM E 185	MANUFACTURERS STD / APPROVED DATASHEET.	-DO-	✓	P	V	-
2.3	PAINTING	1 SURFACE PREPARATION	MA	VISUAL	100%	-	MANUFACTURERS STD / APPROVED DATASHEET	SAME AS COL. 7	LOG BOOK		P	-	-
		2 PAINT THICKNESS (BOTH PRIMER & FINISH COAT)	MA	MEASUREMENT BY ELCOMETER	SAMPLE	-	-DO-	-DO-	-DO-		P	-	-
		3 SHADE	MA	VISUAL	-DO-	-	-DO-	-DO-	LOG BOOK		P	-	-
		4 ADHESION	MA	CROSS CUTTING & TAPE TEST	-DO-	-	-DO-	-DO-	LOG BOOK		P	-	-

ENGINEERING

Prepared by: Hema K. Checked by: W. S. S. S. S.

Reviewed by: P. Datta

QUALITY

Sign & Date: Kunal Chandra

Seal: Kunal Chandra

BIDDER/SUPPLIER

Sign & Date: _____

FOR CUSTOMER REVIEW & APPROVAL

Doc No: _____

Sign & Date: _____

Reviewed by: _____

Approved by: _____

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 MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS		STANDARD QUALITY PLAN		SPEC. NO.:	DATE: 27.02.2020 SHEET 6 OF 9
		CUSTOMER:		QP NO.: PED-506-00-Q-007, REV.04	
		PROJECT:		PO NO.:	
		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V))		SYSTEM:	
				SECTION: II	

Sl No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD	AGENCY			
					M	CN				D	M	C	N
1													
2.4	SHEET STACKING	1.COMPLETENESS 2.COMPRESSION & TIGHTENING 1.COMPLETENESS	MA MA CR	MEASUREMENT MEASUREMENT VISUAL	SAMPLE 100% 100%	- - -	MANUFACTURERS STD. -DO- MANUFACTURERS STD/APPROVED DATASHEET	MANUFACTURERS STD. -DO- MANUFACTURERS STD/APPROVED DATASHEET	LOG BOOK LOG BOOK LOG BOOK		P P P	- - -	- - -
2.5	WINDING	2.CLEANLINESS 3.IRHV-IR 4.RESISTANCE 5.INTERTURN INSULATION	CR CR CR CR	-DO- ELECT. TEST -DO- -DO-	-DO- 100% 100% 100%	- - - -	-DO- IS-325/IS-12815/IEC-60034 PART-1 IS-325/IS-12815/IEC-60034 PART-1 -DO-	-DO- IS-325/IS-12815/IEC-60034 PART-1 IS-325/IS-12815/IEC-60034 PART-1 -DO-	LOG BOOK LOG BOOK LOG BOOK LOG BOOK		P P P P	- V - -	- - - -
2.6	IMPERMEATION	1.VISCOSITY 2.TEMP. PRESSURE VACUUM 3.NO. OF DIPS	MA MA MA	PHY. TEST PROCESS CHECK -DO-	AT STARTING CONTINUOUS CONTINUOUS	- - CONTINUOUS	MANUFACTURERS STANDARD MANUFACTURERS STANDARD MANUFACTURERS STANDARD	MANUFERS STANDARD MANUFACTURERS STANDARD MANUFACTURERS STANDARD	LOG BOOK LOG BOOK LOG BOOK		P P P	- - V	- - -
THREE DIPS TO BE GIVEN													

40880/2020/PS-PEM-MAX

		STANDARD QUALITY PLAN		SPEC. NO.:	
MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS		CUSTOMER :		QP NO.: PED-506-00-Q-007, REV-04	
PROJECT:		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V))		DATE: 27.02.2020	
SYSTEM:		SECTION: II		SHEET 7 OF 9	

Sl No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD	AGENCY			
1	2	3	4	5	M	CN	7	8	9	D	M	C	N
2.7	COMPLETE STATOR ASSEMBLY	4 DURATION 1 COMPLETENESS & CLEANLINESS 1 COMPLETENESS	MA MA	-DO- VISUAL	CONTINUOUS 100%	CONTINUOUS	-DO- -DO- -DO-	-DO- -DO- -DO-	LOG BOOK LOG BOOK LOG BOOK	✓	P	V	-
2.8	BRAZING/COMPRESSION JOINT	1 COMPLETENESS 2 SOUNDNESS	CR CR	-DO- MALLETT TEST & UT	-DO- 100%	-DO- 100%	-DO- -DO- -DO-	-DO- -DO- -DO-	LOG BOOK LOG BOOK LOG BOOK	✓	P	V	-
2.9	COMPLETE ROTOR ASSEMBLY	3 HV 1 RESIDUAL UNBALANCE 2 SOUNDNESS CASTING	MA CR	ELECT. TEST DYN. BALANCE	100%	100%	-DO- MANUFACTURER'S SPEC/ ISO 1940 MANUFACTURER'S SPEC.	-DO- MANUFACTURER'S DWG. MANUFACTURER'S SPEC.	LOG BOOK LOG BOOK LOG BOOK	✓	P	V	-
2.10	ASSEMBLY	1 ALIGNMENT 2 WORKMANSHIP 3 AXIAL PLAY 4 DIMENSIONS 5 CORRECTNESS, COMPLETENESS/ TERMINATIONS/ MARKING/ COLOUR CODE 6. RTD, 8TD & SPACE HEATER MOUNTING	MA MA MA MA MA MA	MEAS. VISUAL MEAS. -DO- VISUAL	-DO- -DO- 100% -DO- 100%	-DO- -DO- -DO- -DO- -DO-	-DO- -DO- -DO- -DO- -DO-	-DO- -DO- -DO- -DO- -DO-	LOG BOOK LOG BOOK LOG BOOK LOG BOOK LOG BOOK	✓	P	V	-

ENGINEERING		BHEL		QUALITY	
Prepared by:	Sign & Date	Name	Checked by:	Sign & Date	Name
Reviewed by:	Sign & Date	Name	Reviewed by:	Sign & Date	Name
BIDDER/ SUPPLIER		SEAL		FOR CUSTOMER REVIEW & APPROVAL	
Doc No.:		Sign & Date		Name	
Reviewed by:		Seal		Approved by:	

40880/2020/PS-PEM-MAX

STANDARD QUALITY PLAN										SPEC. NO.			
MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS										CUSTOMER :			
PROJECT:										DATE: 27.02.2020			
ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V))										SYSTEM:			
SECTION: II										SHEET 8 OF 9			
Sl. No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD	AGENCY			
1	2	3	4	5	6	7	8	9	10	11	12		
					M	CN				D	M	C	N
3.0	TESTS	1. TYPE TESTS INCLUDING SPECIAL TESTS 2. ROUTINE TESTS INCLUDING SPECIAL TEST	MA	ELECT. TEST	1/T/TYPE/ SIZE	1/T/TYPE/ SIZE	IS-325/IS-12615/APPROVED DATASHEET	IS-325/IS-12615/APPROVED DATASHEET	TEST REPORT	P	W*	W*	NOTE - 1
		3. VIBRATION & NOISE LEVEL	MA	-DO-	100%	100%	IS-12075 / IEC 60034-14 & IS-12065	IS-12075 / IEC 60034-14 & IS-12065	-DO-	P	V/W*	V/W*	NOTE - 2
		4. OVERALL DIMENSIONS AND ORIENTATION	MA	MEASUREMENT & VISUAL	100%	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET &	TEST/INSPC REPORT	P	W	-	NOTE - 2
		5. DEGREE OF PROTECTION	MA	ELECT. & MECH. TEST	1/T/TYPE/ SIZE	1/T/TYPE/ SIZE	IEC 60034-5/IS-12615	APPROVED DATASHEET	TC	✓	P	V	TC FROM AN INDEPENDENT LABORATORY. REFER NOTE-3
		6. MEASUREMENT OF RESISTANCE OF RTD & RTD	MA	-DO-	100%	100%	IS-325/IS-12615/IEC-60034 PART-1 /IS-12062	IS-325/IS-12615/IEC-60034 PART-1 /IS-12062	-DO-	P	V/W*	V/W*	NOTE - 2
		7. MEASUREMENT OF RESISTANCE IN OF SPACE HEATER	MA	-DO-	100%	100%	IS-325/IS-12615/IEC-60034 PART-1	IS-325/IS-12615/IEC-60034 PART-1	-DO-	P	V/W*	V/W*	NOTE - 2
		8. NAME PLATE DETAILS	MA	VISUAL	100%	100%	IS-325/IS-12615 & DATA SHEET	IS-325/IS-12615 & DATA SHEET	TEST/INSPC REPORT	P	V/W*	V/W*	NOTE - 2
		9. EXPLOSION FLAME PROOF (NESS IF SPECIFIED)	MA	EXPLOSION FLAME PROOF TEST	1/T/TYPE	1/T/TYPE	IS 2148 / IEC 60079-1	IS 2148 / IEC 60079-1	TC	✓	P	V	TC FROM AN INDEPENDENT LABORATORY. REFER NOTE-3
		10. PAINT SHADE, THICKNESS & FINISH	MA	VISUAL & MEASUREMENT BY ELKONETER	SAMPLE	SAMPLE	APPROVED DATASHEET	APPROVED DATASHEET	TC		P	W*	SAMPLING PLAN TO BE DECIDED BY INSPECTION AGENCY
													NOTE - 2

ENGINEERING			QUALITY		
Prepared by:	Sign & Date	Name	Checked by:	Sign & Date	Name
Reviewed by:			Reviewed by:		

BIDDER/SUPPLIER		
Sign & Date	Seal	

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

 MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS		STANDARD QUALITY PLAN		SPEC. NO.		DATE: 27.02.2020 SHEET 9 OF 9
		CUSTOMER :		QP NO.: PED-506-00-Q-007, REV-04		
		PROJECT:		PO NO.:		
		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V))		SYSTEM:		
				SECTION: II		

Sl No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check	Reference Document	Acceptance NORMS	FORMAT OF RECORD	AGENCY	
1	2	3	4	5	6	7	8	9		
					M 100% CN 100%	AS PER MANUFACT STANDARD / APPROVED CROSS SECTION DRAWING.	AS PER MANUFACT STANDARD / APPROVED CROSS SECTION DRAWING.	INSPEC. REPORT	D M P C N	IF APPLICABLE REFER SEAWORTHY PACKING ALSO.
4.0	PACKING	SURFACE FINISH & COMPLETENESS	MA	VISUAL						

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/CUSTOMER SHALL WITNESS ROUTINE TESTS ON RANDOM SAMPLES.
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. BHEL RESERVES THE RIGHT TO PERFORM REPEAT TEST, IF REQUIRED.
5. AFTER PACKING AND PRIOR TO ISSUE MDCC, PHOTOGRAPHS OF ITEMS TO BE DESPATCHED SHALL BE SENT TO BHEL PURCHASE GROUP FOR REVIEW.
6. IN CASE, ANY CHANGES IN QP COMMENTED BY CUSTOMER AT CONTRACT STAGE SHALL BE CARRIED OUT BY BIDDER WITHOUT ANY IMPLICATION TO BHEL/CUSTOMER.

LEGENDS:

* RECORDS, IDENTIFIED WITH TICK(✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.

** M: SUPPLIER/ MANUFACTURER/ SUB-SUPPLIER, B: MAIN SUPPLIER/ BHEL/ THIRD PARTY INSPECTION AGENCY, C: CUSTOMER,

P: PERFORM, W: WITNESS, V: VERIFICATION AS APPROPRIATE

MA: MAJOR, MI: MINOR, CR: CRITICAL

D: DOCUMENT

ENGINEERING		BHEL		QUALITY	
Sign & Date	Name	Sign & Date	Name	Sign & Date	Name
Prepared by: <i>[Signature]</i>	Hema K.	Checked by: <i>[Signature]</i>	Kanet		
Reviewed by: <i>[Signature]</i>	P. Dutt	Reviewed by:			

BIDDER/SUPPLIER	
Sign & Date	Seal

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			



SUB-SECTION – B-6

LT SWITCHGEAR & LT BUSDUCT

**KHURJA SUPER THERMAL POWER PROJECT
(2X660 MW)
TURBINE GENERATOR AND ASSOCIATED PACKAGES
BID DOC. NO.: THDC/RKSH/CC-9915-371**

SEPARATOR

Page 113 of 323

CLAUSE NO.	एनटीपीसी NTPC		TECHNICAL REQUIREMENTS			
1.03.00	Spare capacity and Future Requirements All LV Switchboard shall be provided with spare feeders / modules as specified in relevant clause of Part-A of Technical Specification.					
1.04.00	Standardization It shall be preferred to have all LV Switchboards for the entire plant from a single manufacturer from maintainability and spares management point of view. It shall be preferred to follow a standardization of Terminal Numbers across all LV Modules for ease of Interconnection and maintenance.					
1.05.00	Plant control cable Interconnections Control cable interconnections between switchgears and transformer marshalling boxes, switchgears and motor terminal boxes / push button stations, and between various switchgears shall be in the contractor's scope. (a) Standard control cable sizes shall be 1.5 mm ² (b) Cable size for motor space heater application shall be 2CX2.5 mm ² (c)Interconnections for Current Transformer terminals shall use two cores of 1.5mm ² size per phase (d) Separate control cables shall be used for current transformers (e) Separate control cables shall be laid for EPB (Emergency/Local Push Button) status from EPB to Switchgear for the Switchgear and DCS.					
2.00.00	CODES AND STANDARDS					
2.01.00	All equipment shall, generally, comply with the updated issues of (a.) Applicable Indian Standards (b.) Indian Electricity Act. (c.) Indian electricity rules					
2.02.00	Equipment complying with any other authoritative / internationally recognized standards such as IEC, British, U.S.A., German, etc. will also be considered if it ensures performance equivalent or superior to Indian Standards. In such cases the contractor shall clearly indicate the standard adopted and furnish the copy of latest English version of the same along with the bid and bring out the salient features for comparison.					
2.03.00	All standards, specifications and codes of practice referred to herein shall be the latest editions including all applicable official amendments and revisions as published one month prior to the date of opening of bids. In case of conflict between this specification and those (IS codes, Standards etc.) referred to herein, the former shall prevail. All work shall be carried out as per the following codes and standards.					
	IS: 5	Colours for ready-mixed paints and enamels.				
	IS: 694	PVC insulated cables for working voltages up to and including 1100V.				
	IS: 722	A.C. Electricity Meters				
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371		SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCTS		PAGE 2 OF 62

CLAUSE NO.	एनटीपीसी NTPC TECHNICAL REQUIREMENTS	
	IS: 1248	Electrical Indicating instruments
	IS/IEC: 60947–1	Degree of protection provided by enclosures for low voltage Switchgear and Control gear
	IS/IEC: 60947-2	A.C. circuit Breakers, MCCB, MCB, MPCB
	IS: 2551	Danger Notice Plates
	IS: 2629	Hot dip galvanising
	IS: 2705	Current Transformers
	IS/IEC: IEC-60947-4-1	Contactors and motors starter for voltages not exceeding 1000 V AC or 1200 V DC
	IS: 3043	Code of practice for earthing.
	IS: 3072	Code of practice for installation and maintenance of Switchgear
	IS: 3156	Voltage Transformers
	IS: 3202	Code of practice for climate proofing of electrical equipment.
	IS: 3231	Electrical relays for power system protection.
	IS/IEC 60947	Air-Break Switches, air break disconnectors, air break disconnector and fuse combination units for voltages not exceeding 1000V AC or 1200 V DC.
	IS/IEC 60947-1 / IEC-60947-1	General Requirements for Switchgear and Control gear for voltages not exceeding 1000 V.
	IS: 5082	Wrought Aluminium and Aluminium alloys for electrical purposes.
	IS: 6005	Code of practice of phosphating of iron and steel.
	IS/IEC 60947-5-1 / IEC-60947-5-1	LV switchgear and Control gear Control current devices and switching element.
	IS: 8623 / IEC: 61439-1/2	Low Voltage Switchgear & Control gear assemblies
	IS: 8686	Static Relays
	IS: 13703 / IEC: 60269	HRC Cartridge fuses
IS: 10118 (4 parts)	Code of practice for selection, installation and maintenance of switchgear and control gear.	
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		
TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371		
SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCTS		
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CLAUSE NO.	TECHNICAL REQUIREMENTS		
	IS: 11171	Specification for dry type transformers.	
	IEC: 60255	Electrical Relays	
	IEC: 61850	Communication networks and systems in substations	
	IS: 11353	Guide for uniform system of marking and identification of conductors and apparatus terminals	
	IS: 12021	Specification of control transformers for switchgear and Control gear for voltage not exceeding 1000V AC.	
	IEC: 60947-7-1	Terminal blocks for Copper conductors	
	IS :513 (2008)	Cold Rolled Low Carbon Steel Sheets and Strips	
3.00.00	TECHNICAL PARAMETERS		
3.01.00	Power Supply		
3.01.01	AC SYSTEM		
	1) Voltage	415 V $\pm$ 10%,3 Phase, 4 wire, solidly earthed	
	2) Frequency	50 Hz +/- 5%	
	3) Combined variation (in volts & frequency)	10% absolute sum	
	4) Fault Level	50 kA(RMS)	
3.01.02	DC SYSTEM		
	1) System Voltage	240 V DC 2-Wire, Unearthed	
	2) Fault Level	20 kA	
3.01.03	CONTROL SUPPLY VOLTAGE		
	1) Trip & closing coil of circuit breaker	240 V DC/120 V DC	
	2) Spring charging motor	240 V DC/120 V DC	
	3) MCC control supply	110 V AC Neutral solidly earthed	
	4) Space heater & lighting	240 V AC Neutral solidly earthed	
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371	SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCTS
			PAGE 4 OF 62

CLAUSE NO.	TECHNICAL REQUIREMENTS			
3.02.00	CUBICLE DATA			
	Busbar Rating			
	1) Continuous Current rating	As per requirement		
	2) Short time rating where			
	a) CB is used as incomer	50 kA(RMS) for one sec		
	b)MCCB is used as incomer	Prospective current of 50 kA(RMS) for the MCCB clearing time		
	3) Dynamic Rating where			
	a) CB is used as incomer	105 kA(PEAK)		
	b)MCCB is used as incomer	Prospective current of 105 kA (PEAK) as limited by MCCB		
	4) Busbar insulation			
3.03.00	a) For switchgear /MCC/ACDB/DCDB	PVC Sleeve insulated(UL224)		
	/MCCB Box			
	CIRCUIT BREAKER			
	1) Type	Air break spring charged stored energy type		
	2) Operating duty	O-3 min-CO-3 min-CO		
	3) Symmetrical interrupting	50 kA(RMS)		
	4) Short circuit rating	105 kA(PEAK)		
	5) Short Circuit Breaking current			
	a) AC Component	50 kA(RMS)		
	b) DC Component	As per IS/IEC 60947		
6) Short time withstand	50 kA(RMS) for 1 s			
7) No of aux. contacts	4 NO + 4 NC for DDCMIS interface			
3.04.00	METERS			
	1) Accuracy class	2.0		
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371	SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCTS	PAGE 5 OF 62

CLAUSE NO.	TECHNICAL REQUIREMENTS			
3.05.00	2)	One min. power frequency withstand test 2.0 kV (rms) voltage		
	Current Transformers			
	1)	Type	Cast Resin Bar Primary / Nylon Casing	
	2)	Voltage class and frequency	650 V, 50 HZ	
	3)	Class of insulation	E or better	
	4)	Rated Secondary Current	1 A	
	5)	Accuracy class & burden		
	a)	For protection	5P20, 5VA PS Class for REF	
	b)	For metering	class 1.0, 5VA (min) class 0.2s, 5VA (min) for feeders indicated in SLD ,if any	
	6)	Instrument Security Factor (ISF) for metering CT	5	
3.06.00	7)	Short time withstand		
	a)	For CT Associated with circuit breaker	50 kA(RMS) for 1 sec	
	b)	For CT Associated with MCCB protected feeders	Prospective current of 50 kA(RMS) for the MCCB clearing time	
	8)	Dynamic withstand		
	a)	For CTs Associated with circuit breaker	105 kA(PEAK)	
	b)	For CT Associated with MCCB protected feeders	Prospective current of 105 kA(PEAK) as Limited by MCCB	
	BUSDUCT (NON-SEGREGATED, AIR INSULATED TYPE)			
	1)	Type	Non-Segregated	
	KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371 SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCTS PAGE 6 OF 62			

CLAUSE NO.	एनटीपीसी NTPC		TECHNICAL REQUIREMENTS			
3.07.00	2)	One minute power frequency withstand voltage		2.5 kV		
	3)	One second short ckt withstand current		50 kA(RMS)		
	4)	Momentary dynamic current withstand		105 kA(PEAK)		
	BUSDUCT (SANDWICH TYPE)					
3.08.00	1)	Type		Bus Trunking		
	2)	Rated Insulation voltage		1000V		
	3)	One second short ckt withstand current		50KA(RMS)		
	4)	Momentary dynamic current withstand		105KA(PEAK)		
	5)	Power frequency withstand voltage		3.5kv		
	6)	Impulse withstand voltage		8kV		
	7)	Insulation		Class F		
3.09.00	VOLTAGE TRANSFORMERS					
	1)	Type		Cast Resin		
	2)	Voltage Ratio		415 / 110 V for line PT		
				415/√3 / 110/√3 V for Bus PT		
	3)	Method of Construction		V-V		
	4)	Accuracy Class		0.5		
				0.2 for feeders indicated in SLD ,if any		
	5)	Rated Voltage factor		1.1continuous, 1.5 for 30 sec.		
3.09.00	6)	Class of insulation		E or better		
	7)	One minute power frequency withstand voltage		2.5 KV		
	HRC FUSES					
	1)	Voltage Class		650 Volts		
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371		SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCTS		PAGE 7 OF 62

CLAUSE NO.	TECHNICAL REQUIREMENTS		
3.10.00	2) Rupturing capacity	80 kA (rms) for AC ckt., 20 kA for DC ckt.	
	CONTACTORS		
3.11.00	1) Type	Air break electro magnetic	
	2) Utilising Category	AC3 of IS/IEC 60947 for non reversible AC4 of IS/IEC 60947 for reversible drives	
3.11.00	Relays		
3.12.00	1) Power frequency withstand voltage	2.5 kV for 1 sec. or 2.0 kV for 1 min.	
	CONTROL TRANSFORMERS		
	1) Type	Dry / Cast Resin	
	2) Voltage Ratio	415 / 110 V with taps $\pm$ 5% in steps of 2.5%	
	3) Class of insulation	Class-B or better	
3.13.00	4) One minute power frequency withstand voltage	2.5 kV	
	5) Rating	1.5 X Adequate for application.	
	LIGHTING TRANSFORMER / WELDING TRANSFORMER		
	1) Type & Rating	Dry type / 100 KVA(Welding TRF), 50KVA(Minimum)(Lighting TRF)	
	2) Voltage Ratio	415/415V, +/- 5% taps in steps of 2.5%	
3) Class of insulation	B or better		
3.13.00	4) One minute power frequency withstand voltage	2.5 KV	
	5) Enclosure protection	IP-42	
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371	SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCTS
			PAGE 8 OF 62

CLAUSE NO.	TECHNICAL REQUIREMENTS			
3.14.00	TRANSDUCERS			
	1) Current transducers			
	a) Input	0-1 A (CT secondary)		
	b) Rated frequency	50 Hz		
	c) Output	4-20 mA (2 Nos. decoupled)		
	d) Over current	Transducer for motor current ammeters shall be capable of withstanding min. 6 times CT sec. current of 1A for a min period of 30 seconds		
	e) Accuracy	1.0		
	2) Voltage Transducers			
	a) Input	500 V, 50 Hz (for AC) / 250 V / 125 V DC (for DC)		
	b) Output	4-20 mA (2 Nos. decoupled)		
3.15.00	MCCB			
	1) Rated voltage	415V		
	2) Rated insulation level	690V		
	3) Rated ultimate & Service S.C. breaking capacity	50 kA		
	4) Rated making capacity	105 kA		
	5) Utilization category	A		
3.16.00	MPCB			
	Rated voltage	415V		
	Rated insulation level	690V		
	Rated ultimate & Service S.C. breaking capacity	50 kA		
	Rated making capacity	105 kA		
	Utilization category	A		
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371	SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCTS	PAGE 9 OF 62



SUB-SECTION – B-2

MOTORS

**KHURJA SUPER THERMAL POWER PROJECT
(2X660 MW)
TURBINE GENERATOR AND ASSOCIATED PACKAGES
BID DOC. NO.: THDC/RKSH/CC-9915-371**

SEPARATOR

S-ITEM-MAX		TECHNICAL REQUIREMENTS			
CLAUSE NO.					
		MOTORS			
1.00.00		GENERAL REQUIREMENTS			
1.01.00		For the purpose of design of equipment/systems, an ambient temperature of 50 deg. Centigrade and relative humidity of 95% (at 40 deg C) shall be considered. The equipment shall operate in a highly polluted environment.			
1.02.00		All equipment shall be suitable for rated frequency of 50 Hz with a variation of +3% & -5%, and 10% combined variation of voltage and frequency unless specifically brought out in the specification.			
1.03.00		Contractor shall provide fully compatible electrical system, equipment, accessories and services.			
1.04.00		All the equipment, material and systems shall, in general, conform to the latest edition of relevant National and international Codes & Standards, especially the Indian Statutory Regulations.			
1.05.00		Paint shade shall be as per RAL 5012 (Blue) for indoor and outdoor equipment.			
1.06.00		The responsibility of coordination with electrical agencies and obtaining all necessary clearances for contractors equipment and systems shall be under the contractor scope.			
1.07.00		Degree of Protection			
		Degree of protection for various enclosures as per IEC60034-05 shall be as follows:-			
		i) Indoor motors - IP 54			
		ii) Outdoor motors - IP 55			
		iii) Cable box-indoor area - IP 54			
		iv) Cable box-Outdoor area - IP 55			
2.00.00		CODES AND STANDARDS			
		1) Three phase induction motors : IS/IEC:60034			
		2) Single phase AC motors : IS/IEC:60034			
		3) Crane duty motors : IS:3177, IS/IEC:60034			
		4) DC motors/generators : IS/IEC:60034			
		5) Energy Efficient motors : IS 12615, IEC: 60034-30			
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371		SUB-SECTION B-02 MOTORS	
				PAGE 1 OF 9	

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S-ITEM-MAA		TECHNICAL REQUIREMENTS		
CLAUSE NO.				
6.01.00	Starting Time			
6.01.01	For motors with starting time upto 20 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 2.5 secs. more than starting time.			
6.01.02	For motors with starting time more than 20 secs. and upto 45 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 5 secs. more than starting time.			
6.01.03	For motors with starting time more than 45 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be more than starting time by at least 10% of the starting time.			
6.01.04	Speed switches mounted on the motor shaft shall be provided in cases where above requirements are not met.			
6.02.00	Torque Requirements			
6.02.01	Accelerating torque at any speed with the lowest permissible starting voltage shall be at least 10% motor full load torque.			
6.02.02	Pull out torque at rated voltage shall not be less than 205% of full load torque. It shall be 275% for crane duty motors.			
6.03.00	Starting voltage requirement			
	(a) Up to 85% of rated voltage for ratings below 110 KW			
	(b) Up to 80% of rated voltage for ratings from 110 KW to 200 KW			
	(c) Up to 85% of rated voltage for ratings from 201 KW to 1000 KW			
	(d) Up to 80% of rated voltage for ratings from 1001 KW to 4000 KW			
	(e) Up to 75 % of rated voltage for ratings above 4000KW			
	Except AOP & JOP motors running on D.G emergency supply, starting voltage shall be 80%.			
7.00.00	DESIGN AND CONSTRUCTIONAL FEATURES			
7.01.00	Suitable single phase space heaters shall be provided on motors rated 30KW and above to maintain windings in dry condition when motor is standstill. Separate terminal box for space heaters & RTDs shall be provided. However for flame proof motors, space heater terminals inside the main terminal box may be acceptable.			
7.02.00	All motors shall be either Totally enclosed fan cooled (TEFC) or totally enclosed tube ventilated (TETV) or Closed air circuit air cooled (CACA) type. However, motors rated 3000KW or above can be Closed air circuit water cooled (CACW). The method of movement			
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371	SUB-SECTION B-02 MOTORS	PAGE 3 OF 9

S-ITEM-MAA		CLAUSE NO.		TECHNICAL REQUIREMENTS			
7.03.00		of primary and secondary coolant shall be self-circulated by fan or pump directly mounted on the rotor of the main motor as per IEC 60034-6. However VFD driven motors can be offered with forced cooling type with machine mounted fan or pump driven by separate electric motor. Motors and EPB located in hazardous areas shall have flame proof enclosures conforming to IS: 2148 as detailed below					
		(a) Fuel oil area		: Group – IIB			
		(b) Hydrogen generation		: Group - IIC or (Group-I, Div-II as per plant area NEC) or (Class-1, Group-B, Div-II as per NEMA / IEC60034)			
		Winding and Insulation					
		(a) Type		: Non-hygroscopic, oil resistant, flame resistant			
		(b) Starting duty		: Two hot starts in succession, with motor initially at normal running temperature.			
		(c) 11kV & 3.3 kV AC motors		: Thermal class 155 (F) insulation. The winding insulation process shall be Global Vacuum Pressure Impregnated i.e. resin poor method. The lightning Impulse & interturn insulation surge withstand level shall be as per IEC-60034 part-15. However winding insulation for wet wound Boiler circulation pump motor shall be thermal class 90 (Y) or better.			
		(d) 240VAC, 415V AC & 220V DC motors		: Thermal Class (B) or better			
		7.04.00		Motors rated above 1000KW shall have insulated bearings/housing to prevent flow of shaft currents.			
		7.05.00		Motors with heat exchangers shall have dial type thermometer with adjustable alarm contacts to indicate inlet and outlet primary air temperature.			
7.06.00		Noise level for all the motors shall be limited to 85dB (A) except for BFP motor for which the maximum limit shall be 90 dB(A). Vibration shall be limited within the limits prescribed in IS/IEC 60034-14. Motors shall withstand vibrations produced by driven equipment. HT motor bearing housings shall have flat surfaces, in both X and Y directions, suitable for mounting 80mmX80mm vibration pads.					
7.07.00		In HT motors, at least four numbers simplex / two numbers duplex platinum resistance type temperature detectors shall be provided in each phase stator winding. Each bearing of HT motor shall be provided with dial type thermometer and 2 numbers duplex platinum resistance type temperature detectors.					
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371		SUB-SECTION B-02 MOTORS		PAGE 4 OF 9	

S-ITEM-MAA		TECHNICAL REQUIREMENTS		
CLAUSE NO.				
7.08.00	Motor body shall have two earthing points on opposite sides.			
7.09.00	11 KV motors shall be offered with Separable Insulated Connector (SIC) as per IEEE 386. The offered SIC terminations shall be provided with protective cover and trifurcating sleeves. SIC termination kit shall be suitable for fault level of 25 KA for 0.17 seconds.			
7.10.00	3.3 KV motors shall be offered with dust tight phase separated double walled (metallic as well as insulated barrier) Terminal box. Suitable termination kit shall be provided for the offered Terminal box. The offered Terminal Box shall be suitable for fault level of 250 MVA for 0.12 sec. Removable gland plates of thickness 3 mm (hot/cold rolled sheet steel) or 4 mm (non-magnetic material for single core cables) shall be provided.			
7.11.00	The spacing between gland plate & center of bottom terminal stud shall be as per Table-I.			
7.12.00	All motors shall 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.			
7.13.00	The motors shall be suitable for bus transfer schemes provided on the 11kV, 3.3 kV /415V systems without any injurious effect on its life.			
7.14.00	For motors rated 2000 KW & above, neutral current transformers of PS class shall be provided on each phase in a separate neutral terminal box.			
7.15.00	The size and number of cables (for HT and LT motors) to be intimated to the successful bidder during detailed engineering and the contractor shall provide terminal box suitable for the same.			
8.00.00	The ratio of locked rotor KVA at rated voltage to rated KW shall not exceed the following (without any further tolerance) except for BFP motor.			
	(a)	From 50KW & upto 110KW	:	11.0
	(b)	From 110 KW & upto 200 KW	:	9.0
	(c)	Above 200 KW & upto 1000KW	:	10.0
	(d)	From 1001KW & upto 4000KW	:	9.0
	(e)	Above 4000KW	:	6 to 6.5
9.00.00	CW motor shall be designed with minimum power factor of 0.8 at design duty point.			
10.00.00	TYPE TEST			
10.01.00	HT MOTORS			
10.01.01	The contractor shall carry out the type tests as listed in this specification on the equipment to be supplied under this contract. The bidder shall indicate the charges for each of these type			
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371		SUB-SECTION B-02 MOTORS
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S-TEMP-100A		TECHNICAL REQUIREMENTS		
CLAUSE NO.				
		tests separately in the relevant schedule of Section - VII- (BPS) and the same shall be considered for the evaluation of the bids. The type tests charges shall be paid only for the test(s) actually conducted successfully under this contract and upon certification by the employer's engineer.		
10.01.02		The type tests shall be carried out in presence of the employer's representative, for which minimum 15 days notice shall be given by the contractor. The contractor shall obtain the employer's approval for the type test procedure before conducting the type test. The type test procedure shall clearly specify the test set-up, instruments to be used, procedure, acceptance norms, recording of different parameters, interval of recording, precautions to be taken etc. for the type test(s) to be carried out.		
10.01.03		In case the contractor has conducted such specified type test(s) within last ten years as on the date of bid opening, he may submit during detailed engineering the type test reports to the employer for waiver of conductance of such test(s). These reports should be for the tests conducted on the equipment similar to those proposed to be supplied under this contract and test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. The employer reserves the right to waive conducting of any or all the specified type test(s) under this contract. In case type tests are waived, the type test charges shall not be payable to the contractor.		
10.01.04		Further the Contractor shall only submit the reports of the type tests as listed in "LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED "and carried out within last ten years from the date of bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. However if the contractor is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the contractor shall conduct all such tests under this contract at no additional cost to the employer either at third party lab or in presence of client/ employer's representative and submit the reports for approval.		
10.01.05		LIST OF TYPE TESTS TO BE CONDUCTED The following type tests shall be conducted on each type and rating of HT motor (a) No load saturation and loss curves upto approximately 115% of rated voltage. (b) Measurement of noise at no load. (c) Momentary excess torque test (subject to test bed constraint). (d) Full load test (subject to test bed constraint) (e) Temperature rise test at rated conditions. During heat run test, bearing temp., winding temp., coolant flow and its temp. shall also be measured. In case the temperature rise test is carried at load other than rated load, specific approval for the		
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371	SUB-SECTION B-02 MOTORS	PAGE 6 OF 9

S-TEMP-MAX		TECHNICAL REQUIREMENTS		
CLAUSE NO.				
10.01.06	test method and procedure is required to be obtained. Wherever ETD's are provided, the temperature shall be measured by ETD's also for the record purpose. LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED The following type test reports shall be submitted for each type and rating of HT motor (a) Degree of protection test for the enclosure followed by IR, HV and no load run test. (b) Terminal box-fault level withstand test for each type of terminal box of HT motors only. (c) Lightning Impulse withstand test on the sample coil shall be as per clause no. 4.3 IEC-60034, part-15 (d) Surge-withstand test on interturn insulation shall be as per clause no. 4.2 of IEC 60034, part-15			
10.02.00	LT Motors			
10.02.01	LT Motors supplied shall be of type tested design. During detailed engineering, the contractor shall submit for employer's approval the reports of all the type tests as listed in this specification and carried out within last <i>ten</i> years from the date of bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.			
10.02.02	However if the contractor is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the contractor shall conduct all such tests under this contract at no additional cost to the employer either at third party lab or in presence of client/ employer's representative and submit the reports for approval.			
10.02.03	LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED The following type test reports shall be submitted for each type and rating of LT motor of above 100 KW only 1. Measurement of resistance of windings of stator and wound rotor. 2. No load test at rated voltage to determine input current power and speed 3. Open circuit voltage ratio of wound rotor motors (in case of Slip ring motors) 4. Full load test to determine efficiency power factor and slip. 5. Temperature rise test. 6. Momentary excess torque test.			
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371	SUB-SECTION B-02 MOTORS	PAGE 7 OF 9

S-ITEM-MAX		TECHNICAL REQUIREMENTS																							
CLAUSE NO.																									
		7.	High voltage test.																						
		8.	Test for vibration severity of motor.																						
		9.	Test for noise levels of motor(Shall be limited as per clause no 7.06.00 of this section)																						
		10.	Test for degree of protection and																						
		11.	Over speed test.																						
		12.	Type test reports for motors located in fuel oil area having flame proof enclosures as per IS 2148 / IEC 60079-1																						
10.03.00		All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.																							
10.04.00		The type test reports once approved for any projects shall be treated as reference. For subsequent projects of NTPC, an endorsement sheet will be furnished by the manufacturer confirming similarity and "No design Change". Minor changes if any shall be highlighted on the endorsement sheet.																							
TABLE - I DIMENSIONS OF TERMINAL BOXES FOR LV MOTORS <table><thead><tr><th>Motor MCR in KW</th><th>Minimum distance between centre of bottom terminal stud and gland plate in mm</th></tr></thead><tbody><tr><td>UP to 3 KW</td><td>As per manufacturer's practice.</td></tr><tr><td>Above 3 KW - upto 7 KW</td><td>85</td></tr><tr><td>Above 7 KW - upto 13 KW</td><td>115</td></tr><tr><td>Above 13 KW - upto 24 KW</td><td>167</td></tr><tr><td>Above 24 KW - upto 37 KW</td><td>196</td></tr><tr><td>Above 37 KW - upto 55 KW</td><td>249</td></tr><tr><td>Above 55 KW - upto 90 KW</td><td>277</td></tr><tr><td>Above 90 KW - upto 125 KW</td><td>331</td></tr><tr><td>Above 125 KW-upto 200 KW</td><td>385/203 (For Single core cables only)</td></tr></tbody></table>						Motor MCR in KW	Minimum distance between centre of bottom terminal stud and gland plate in mm	UP to 3 KW	As per manufacturer's practice.	Above 3 KW - upto 7 KW	85	Above 7 KW - upto 13 KW	115	Above 13 KW - upto 24 KW	167	Above 24 KW - upto 37 KW	196	Above 37 KW - upto 55 KW	249	Above 55 KW - upto 90 KW	277	Above 90 KW - upto 125 KW	331	Above 125 KW-upto 200 KW	385/203 (For Single core cables only)
Motor MCR in KW	Minimum distance between centre of bottom terminal stud and gland plate in mm																								
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KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371		SUB-SECTION B-02 MOTORS PAGE 8 OF 9																					

SYSTEM MAX		CLAUSE NO.	एनटीपीसी NTPC	TECHNICAL REQUIREMENTS									
		For HT motors the distance between gland plate and the terminal studs shall not be less than 500 mm. PHASE TO PHASE/ PHASE TO EARTH AIR CLEARANCE: NOTE: Minimum inter-phase and phase-earth air clearances for LT motors with lugs installed shall be as follows: <table><tr><td>Motor MCR in KW</td><td>Clearance</td></tr><tr><td>UP to 110 KW</td><td>10mm</td></tr><tr><td>Above 110 KW and upto 150 KW</td><td>12.5mm</td></tr><tr><td>Above 150 KW</td><td>19mm</td></tr></table>				Motor MCR in KW	Clearance	UP to 110 KW	10mm	Above 110 KW and upto 150 KW	12.5mm	Above 150 KW	19mm
Motor MCR in KW	Clearance												
UP to 110 KW	10mm												
Above 110 KW and upto 150 KW	12.5mm												
Above 150 KW	19mm												
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371		SUB-SECTION B-02 MOTORS	PAGE 9 OF 9								



SUB-SECTION – B-3

LT POWER CABLES

**KHURJA SUPER THERMAL POWER PROJECT
(2X660 MW)
TURBINE GENERATOR AND ASSOCIATED PACKAGES
BID DOC. NO.: THDC/RKSH/CC-9915-371**

SEPARATOR

CLAUSe NO.		TECHNICAL REQUIREMENTS			
1.00.00		CODES & STANDARDS			
1.01.00		All standards, specifications and codes of practice referred to herein shall be the latest editions including all applicable official amendments and revisions as on date of opening of bid. In case of conflict between this specification and those (IS : codes, standards, etc.) referred to herein, the former shall prevail. All the cables shall conform to the requirements of the following standards and codes:			
		IS :1554 - I	PVC insulated (heavy duty) electric cables for working voltages upto and including 1100V.		
		IS : 3961	Recommended current ratings for cables		
		IS : 3975	Low carbon galvanised steel wires, formed wires and tapes for armouring of cables.		
		IS : 5831	PVC insulation and sheath of electrical cables.		
		IS:7098 (Part -I)	Cross linked polyethylene insulated PVC sheathed cables for working voltages upto and including 1100V.		
		IS : 8130	Conductors for insulated electrical cables and flexible cords.		
		IS : 10418	Specification for drums for electric cables.		
		IS : 10810	Methods of tests for cables.		
		ASTM-D -2843	Standard test method for density of smoke from the burning or decomposition of plastics.		
		IEC-754 (Part- I)	Tests on gases evolved during combustion of electric cables.		
		IEC-332	Tests on electric cables under fire conditions. Part-3: Tests on bunched wires or cables (Category-B).		
2.00.00		TECHNICAL REQUIREMENTS			
2.01.00		The cables shall be suitable for laying on racks, in ducts, trenches, conduits and under ground buried installation with chances of flooding by water.			
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371		SUB-SECTION-B-3 LT POWER CABLES	
				PAGE 1 OF 6	

CLAUSe NO.		TECHNICAL REQUIREMENTS	
2.02.00	All cables including EPR cables shall be flame retardant, low smoke (FRLS) type designed to withstand all mechanical, electrical and thermal stresses developed under steady state and transient operating conditions as specified elsewhere in this specification.		
2.03.00	Aluminium conductor used in power cables shall have tensile strength of more than 100 N/ sq.mm. Conductors shall be stranded.		
2.04.00	XLPE insulation shall be suitable for a continuous conductor temperature of 90 deg. C and short circuit conductor temperature of 250 deg C. PVC insulation shall be suitable for continuous conductor temperature of 70 deg C and short circuit conductor temperature of 160 deg. C.		
2.05.00	The cable cores shall be laid up with fillers between the cores wherever necessary. It shall not stick to insulation and inner sheath. All the cables, other than single core unarmoured cables, shall have distinct extruded PVC inner sheath of black colour as per IS : 5831.		
2.06.00	For single core armoured cables, armouring shall be of aluminium wires/ formed wires. For multicore armoured cables, armouring shall be of galvanised steel as follows : Calculated nominal dia. of cable under armour		

CLAUSE NO.			TECHNICAL REQUIREMENTS	
2.08.00	(c.) Smoke density rating shall not be more than 60 % (as per ASTM D-2843). Cores of the cables shall be identified by colouring of insulation. Following colour scheme shall be adopted: 1 core - Red, Black, Yellow or Blue 2 core - Red & Black 3 core - Red, Yellow & Blue 4 core - Red, Yellow, Blue and Black			
2.09.00	For reduced neutral conductors, the core shall be black.			
2.10.00	In addition to manufacturer's identification on cables as per IS, following marking shall also be provided over outer sheath. (a.) Cable size and voltage grade - To be embossed (b.) Word 'FRLS' at every 5 metre - To be embossed (c.) Sequential marking of length of the cable in metres at every one metre -To be embossed / printed The embossing shall be progressive, automatic, in line and marking shall be legible and indelible. For EPR cables identification shall be printed on outer sheath.			
2.11.00	All cables shall meet the fire resistance requirement as per Category-B of IEC 332 Part-3.			
2.12.00	Allowable tolerances on the overall diameter of the cables shall be +\2 mm maximum, over the declared value in the technical data sheets.			
2.13.00	In plant repairs to the cables shall not be accepted. Pimples, fish eye, blow holes etc. are not acceptable.			
2.14.00	Cable selection & sizing			
2.14.01	Cables shall be sized based on the following considerations: (a) Rated current of the equipment (b) The voltage drop in the cable, during motor starting condition, shall be limited to 10% and during full load running condition, shall be limited to 3% of the rated voltage (c) Short circuit withstand capability This will depend on the feeder type. For a fuse protected circuit, cable should be sized to withstand the letout energy of the fuse. For breaker controlled feeder, cable shall be capable of withstanding the system fault current level for total breaker tripping time inclusive of relay pickup time.			
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371		SUB-SECTION-B-3 LT POWER CABLES PAGE 3 OF 6

NTPC		TECHNICAL REQUIREMENTS			
CLAUSE NO.					
2.14.02	Derating Factors Derating factors for various conditions of installations including the following shall be considered while selecting the cable sizes: a) Variation in ambient temperature for cables laid in air b) Grouping of cables c) Variation in ground temperature and soil resistivity for buried cables.				
2.14.03	Cable lengths shall be considered in such a way that straight through cable joints are avoided.				
2.14.04	All Cables shall be armoured type.				
2.14.05	All LT power cables of sizes more than 120 sq.mm. shall be XLPE insulated and sizes shall be 1Cx150, 1Cx300, 1Cx630, 3Cx150 & 3Cx240 sq.mm. However for cable sizes upto 120 sq.mm. both XLPE insulated & PVC insulated LT power cables are acceptable.				
2.14.06	Same cable sizes to be used for same type of application & rating of motor i.e if there are three pumps for one application, all three pumps motor should be provided with same cables sizes.				
3.00.00	CONSTRUCTIONAL FEATURES				
3.01.00	1.1 KV Grade Power Cables				
	(a) 1.1 KV grade XLPE power cables shall have compacted aluminium conductor, XLPE insulated, PVC inner-sheathed (as applicable), armoured, PVC outer-sheathed conforming to IS:7098. (Part-I).				
	(b) 1.1KV grade PVC power cables shall have aluminium conductor(compact type for sizes above 10 sq.mm), PVC Insulated, PVC inner sheathed (as applicable) armoured, PVC outer-sheathed conforming to IS:1554 (Part-I).				
	(c) 1.1 KV grade Trailing cables shall have tinned copper(class 5)conductor, insulated with heat resistant elastomeric compound based on Ethylene Propylene Rubber(EPR) suitable for withstanding 90 deg.C continuous conductor temperature and 250deg C during short circuit, inner-sheathed with heat resistant elastomeric compound, nylon cord reinforced, outer-sheathed with heat resistant, oil resistant and flame retardant heavy duty elastomeric compound conforming to IS 9968.				
4.00.00	CABLE DRUMS				
	(a) Cables shall be supplied in non returnable wooden or steel drums of heavy construction. The surface of the drum and the outer most cable layer shall be covered with water proof cover. Both the ends of the cables shall be properly sealed with heat shrinkable PVC/ rubber caps secured by 'U' nails so as to eliminate ingress of water during transportation, storage and erection. Wood preservative anti-termite treatment shall be applied to the entire drum. Wooden drums shall comply with IS: 10418.				
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371		SUB-SECTION-B-3 LT POWER CABLES PAGE 4 OF 6	

CLAUSE NO.		एनटीपीसी NTPC		TECHNICAL REQUIREMENTS			
5.00.00	(b)	Each drum shall carry manufacturer's name, purchaser's name, address and contract number, item number and type, size and length of cable and net gross weight stencilled on both sides of the drum. A tag containing same information shall be attached to the leading end of the cable. An arrow and suitable accompanying wording shall be marked on one end of the reel indicating the direction in which it should be rolled.					
	(c.)	The standard drum length of LT power cable with a maximum tolerance of +/- 5% may be decided by the bidder subject to condition that there shall not be any joint in cable, where application length of cable is up to & including 1000 meter for single core cable excluding 630 sqmm size, and 750 meter for multicore cable & single core 630 sqmm					
	TESTS						
	1.0	All equipments to be supplied shall be of type tested design. During detailed engineering, the contractor shall submit for Owner's approval the reports of all the type tests as listed in this specification and carried out within last ten years from the date of bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.					
	2.0	However if the contractor is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the contractor shall conduct all such tests under this contract at no additional cost to the owner either at third party lab or in presence of client /owners representative and submit the reports for approval.					
	3.0	All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.					
	4.0	The type test reports once approved for any projects shall be treated as reference. For subsequent projects of NTPC, an endorsement sheet will be furnished by the manufacturer confirming similarity and "No design Change". Minor changes if any shall be highlighted on the endorsement sheet.					
5.01.00	Type Tests						
5.01.01	The reports for the following type tests shall be submitted for one size each of LT XLPE and LT PVC Power cables. Size shall be decided by the employer during detailed engineering:						
	S.No.	Type test			Remarks		
		For Conductor					
	1.	Resistance test					
	2.	Tensile test			For circular non-compacted conductors only		
	3.	Wrapping test			For circular non-compacted only		
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371		SUB-SECTION-B-3 LT POWER CABLES		PAGE 5 OF 6	

CLAUSE NO.		TECHNICAL REQUIREMENTS 
		For Armour Wires/ Formed Wires 4. Measurement of Dimensions 5. Tensile Test 6. Elongation test 7. Torsion test For round wires only 8. Wrapping test For aluminium wires / formed wires only. 9. Resistance test 10(a) Mass of zinc coating test For GS Formed wires/wires only 10(b) Uniformity of zinc coating For GS Formed wires /wires only 11. Adhesion test For GS Formed wires/wires only For PVC/XLPE insulation & PVC Sheath 12. Test for thickness 13. Tensile strength & elongation tests before ageing and after ageing 14. Ageing in air oven 15. Loss of mass test For PVC insulation and sheath only 16. Hot deformation test For PVC insulation and sheath only 17. Heat shock test For PVC insulation and sheath only 18. Shrinkage test 19. Thermal stability test For PVC insulation and sheath only 20. Hot set test For XLPE insulation only 21. Water absorption test For XLPE insulation only 22. Oxygen index test For outer sheath only 23. Smoke density test For outer sheath only 24. Acid gas generation test For outer sheath only For completed cables 25. Insulation resistance test (Volume resistivity method) 26. High voltage test 27. Flammability test as per IEC-332 Part-3 (Category-B) Indicative list of tests/checks, Routine and Acceptance tests shall be as per Quality Assurance & Inspection table of LT power cables enclosed.
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES	TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371	SUB-SECTION-B-3 LT POWER CABLES
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SUB-SECTION – B-4

LT CONTROL CABLES

**KHURJA SUPER THERMAL POWER PROJECT
(2X660 MW)
TURBINE GENERATOR AND ASSOCIATED PACKAGES
BID DOC. NO.: THDC/RKSH/CC-9915-371**

SEPARATOR

CLAUSE NO.	TECHNICAL REQUIREMENTS																							
1.00.00	CODES & STANDARDS																							
1.01.00	All standards, specifications and codes of practice referred to herein shall be the latest editions including all applicable official amendments and revisions as on date of opening of bid. In case of conflict between this specification and those (IS : codes, standards, etc.) referred to herein, the former shall prevail. All the cables shall conform to the requirements of the following standards and codes: <table><tr><td>IS :1554 - I</td><td>PVC insulated (heavy duty) electric cables for working voltages upto and including 1100V.</td></tr><tr><td>IS : 3961</td><td>Recommended current ratings for cables</td></tr><tr><td>IS : 3975</td><td>Low carbon galvanised steel wires, formed wires and tapes for armouring of cables.</td></tr><tr><td>IS : 5831</td><td>PVC insulation and sheath of electrical cables.</td></tr><tr><td>IS : 8130</td><td>Conductors for insulated electrical cables and flexible cords.</td></tr><tr><td>IS : 10418</td><td>Specification for drums for electric cables.</td></tr><tr><td>IS : 10810</td><td>Methods of tests for cables.</td></tr><tr><td>ASTM-D –2843</td><td>Standard test method for density of smoke from the burning or decomposition of plastics.</td></tr><tr><td>IEC-754 (Part-I)</td><td>Tests on gases evolved during combustion of electric cables.</td></tr><tr><td>IEC-332</td><td>Tests on electric cables under fire conditions. Part-3: Tests on bunched wires or cables (Category-B).</td></tr></table>				IS :1554 - I	PVC insulated (heavy duty) electric cables for working voltages upto and including 1100V.	IS : 3961	Recommended current ratings for cables	IS : 3975	Low carbon galvanised steel wires, formed wires and tapes for armouring of cables.	IS : 5831	PVC insulation and sheath of electrical cables.	IS : 8130	Conductors for insulated electrical cables and flexible cords.	IS : 10418	Specification for drums for electric cables.	IS : 10810	Methods of tests for cables.	ASTM-D –2843	Standard test method for density of smoke from the burning or decomposition of plastics.	IEC-754 (Part-I)	Tests on gases evolved during combustion of electric cables.	IEC-332	Tests on electric cables under fire conditions. Part-3: Tests on bunched wires or cables (Category-B).
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IEC-332	Tests on electric cables under fire conditions. Part-3: Tests on bunched wires or cables (Category-B).																							
2.00.00	TECHNICAL REQUIREMENTS																							
2.01.00	The cables shall be suitable for laying on racks, in ducts, trenches, conduits and under ground buried installation with chances of flooding by water.																							
2.02.00	All cables including EPR cables shall be flame retardant, low smoke (FRLS) type designed to withstand all mechanical, electrical and thermal stresses develop under steady state and transient operating conditions as specified elsewhere in this specification.																							
2.03.00	Conductor of control cables shall be made of stranded, plain annealed copper.																							
2.04.00	PVC insulation shall be suitable for continuous conductor temperature of 70 deg C and short circuit conductor temperature of 160 deg. C.																							
2.05.00	The cable cores shall be laid up with fillers between the cores wherever necessary. It shall not stick to insulation and inner sheath. All the cables, other than single core unarmoured cables, shall have distinct extruded PVC inner sheath of black colour as per IS: 5831.																							
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371	SUB-SECTION-B-4 LT CONTROL CABLES	PAGE 1 OF 6																				

CLAUSE NO.	TECHNICAL REQUIREMENTS																	
2.06.00	For multicore armoured cables, the armouring shall be of galvanised steel as follows: <table><thead><tr><th>Calculated nominal dia of cable under armour</th><th>Size and Type of armour</th></tr></thead><tbody><tr><td>Upto 13 mm</td><td>1.4mm dia GS wire</td></tr><tr><td>Above 13 upto 25 mm</td><td>0.8 mm thick GS formed wire / 1.6 mm dia GS wire</td></tr><tr><td>Above 25 upto 40 mm</td><td>0.8mm thick GS formed wire / 2.0mm dia GS wire</td></tr><tr><td>Above 40 upto 55mm</td><td>1.4 mm thick GS formed wire/2.5mm dia GS wire</td></tr><tr><td>Above 55 upto 70 mm</td><td>1.4mm thick GS formed wire / 3.15mm dia GS wire</td></tr><tr><td>Above 70mm</td><td>1.4 mm thick GS formed wire / 4.0 mm dia GS wire</td></tr></tbody></table> The gap between armour wires / formed wires shall not exceed one armour wire / formed wire space and there shall be no cross over / over-riding of armour wire / formed wire. The minimum area of coverage of armouring shall be 90%. The breaking load of armour joint shall not be less than 95% of that of armour wire / formed wire. Zinc rich paint shall be applied on armour joint surface.				Calculated nominal dia of cable under armour	Size and Type of armour	Upto 13 mm	1.4mm dia GS wire	Above 13 upto 25 mm	0.8 mm thick GS formed wire / 1.6 mm dia GS wire	Above 25 upto 40 mm	0.8mm thick GS formed wire / 2.0mm dia GS wire	Above 40 upto 55mm	1.4 mm thick GS formed wire/2.5mm dia GS wire	Above 55 upto 70 mm	1.4mm thick GS formed wire / 3.15mm dia GS wire	Above 70mm	1.4 mm thick GS formed wire / 4.0 mm dia GS wire
Calculated nominal dia of cable under armour	Size and Type of armour																	
Upto 13 mm	1.4mm dia GS wire																	
Above 13 upto 25 mm	0.8 mm thick GS formed wire / 1.6 mm dia GS wire																	
Above 25 upto 40 mm	0.8mm thick GS formed wire / 2.0mm dia GS wire																	
Above 40 upto 55mm	1.4 mm thick GS formed wire/2.5mm dia GS wire																	
Above 55 upto 70 mm	1.4mm thick GS formed wire / 3.15mm dia GS wire																	
Above 70mm	1.4 mm thick GS formed wire / 4.0 mm dia GS wire																	
2.07.00	Outer sheath shall be of PVC as per IS: 5831 and grey in colour. In addition to meeting all the requirements of Indian Standards referred to, outer sheath of all the cables shall have the following FRLS properties. (a.) Oxygen index of min. 29. (As per IS 10810 Part-58) (b.) Acid gas emission of max. 20% (As per IEC-754-I) (c.) Smoke density rating shall not be more than 60% during Smoke Density Test as per ASTM D-2843.																	
2.08.00	Cores of the cables of upto 5 cores shall be identified by colouring of insulation. Following colour scheme shall be adopted. <table><tbody><tr><td>1 core -</td><td>Red, Black, Yellow or Blue</td></tr><tr><td>2 core -</td><td>Red & Black</td></tr><tr><td>3 core -</td><td>Red, Yellow & Blue</td></tr><tr><td>4 core -</td><td>Red, Yellow, Blue and Black</td></tr><tr><td>5 core -</td><td>Red, Yellow, Blue, Black and Grey</td></tr></tbody></table>				1 core -	Red, Black, Yellow or Blue	2 core -	Red & Black	3 core -	Red, Yellow & Blue	4 core -	Red, Yellow, Blue and Black	5 core -	Red, Yellow, Blue, Black and Grey				
1 core -	Red, Black, Yellow or Blue																	
2 core -	Red & Black																	
3 core -	Red, Yellow & Blue																	
4 core -	Red, Yellow, Blue and Black																	
5 core -	Red, Yellow, Blue, Black and Grey																	
2.09.00	For cables having more than 5 cores, core identification shall be done by numbering the insulation of cores sequentially, starting by number 1 in the inner layer (e.g. say for 10 core cable, core numbering shall be from 1 to 10). The number shall be printed in Hindu-Arabic numerals on the outer surfaces of the cores. All the numbers shall be of the same colour, which shall contrast with the colour of insulation. The colour of insulation for all the cores shall be grey only. The numerals shall be legible and indelible. The numbers shall be repeated at regular intervals along the core, consecutive numbers being inverted in relation to each other. When the number is a single numeral, a dash shall be placed																	
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371	SUB-SECTION-B-4 LT CONTROL CABLES	PAGE 2 OF 6														

CLAUSE NO.	TECHNICAL REQUIREMENTS													
	underneath it. If the number consists of two numerals, these shall be disposed one below the other and a dash placed below the lower numeral. The spacing between consecutive numbers shall not exceed 50 mm.													
2.10.00	In addition to manufacturer's identification on cables as per IS, following marking shall also be provided over outer sheath: (a.) Cable size and voltage grade - To be embossed (b.) Word 'FRLS' at every 5 metre - To be embossed (c.) Sequential marking of length of the cable in metres at every one metre - To be embossed / printed. The embossing / printing shall be progressive, automatic, in line and marking shall be legible and indelible. For EPR cables identification shall be printed on outer sheath.													
2.11.00	All cables shall meet the fire resistance requirement as per Category-B of IEC-332 Part-3.													
2.12.00	Allowable tolerances on the overall diameter of the cables shall be +/-2 mm maximum over the declared value in the technical data sheets.													
2.13.00	In plant repairs to the cables shall not be accepted. Pimples, fish eye, blow holes etc. are not acceptable.													
2.14.00	Cable selection & sizing Control cables shall be sized based on the following considerations: (a) The minimum conductor cross-section shall be 1.5 sq.mm. (b) The minimum number of spare cores in control cables shall be as follows: <table><tr><td>No. of cores in cable</td><td>Min. No. of spare cores</td></tr><tr><td>2C, 3C</td><td>NIL</td></tr><tr><td>5C</td><td>1</td></tr><tr><td>7C-12C</td><td>2</td></tr><tr><td>14C & above</td><td>3</td></tr></table>				No. of cores in cable	Min. No. of spare cores	2C, 3C	NIL	5C	1	7C-12C	2	14C & above	3
No. of cores in cable	Min. No. of spare cores													
2C, 3C	NIL													
5C	1													
7C-12C	2													
14C & above	3													
2.14.01	Cable lengths shall be considered in such a way that straight through cable joints are avoided.													
2.14.02	All Cables shall be armoured type.													
3.00.00	CONSTRUCTIONAL FEATURES													
3.01.00	1.1 KV Grade Control Cables shall have stranded copper conductor and shall be multicore PVC insulated, PVC inner sheathed, armoured / unarmoured, FRLS PVC outer sheathed conforming to IS: 1554. (Part-I).													
3.02.00	1.1 KV grade Trailing cables shall have tinned copper(class 5)conductor, insulated with heat resistant elastomeric compound based on Ethylene Propylene Rubber(EPR) suitable for withstanding 90 deg.C continuous conductor temperature and 250deg C during short circuit, inner-sheathed with heat resistant elastomeric compound, nylon cord reinforced, outer-													
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371	SUB-SECTION-B-4 LT CONTROL CABLES	PAGE 3 OF 6										

CLAUSE NO.	TECHNICAL REQUIREMENTS			
4.00.00	sheathed with heat resistant, oil resistant and flame retardant heavy duty elastomeric compound conforming to IS 9968. Minimum conductor size shall be 2.5 sqmm.			
	CABLE DRUMS (a.) Cables shall be supplied in non returnable wooden or steel drums of heavy construction. The surface of the drum and the outer most cable layer shall be covered with water proof cover. Both the ends of the cables shall be properly sealed with heat shrinkable PVC/ rubber caps secured by 'U' nails so as to eliminate ingress of water during transportation, storage and erection. Wood preservative anti-termite treatment shall be applied to the entire drum. Wooden drums shall comply with IS: 10418. (b.) Each drum shall carry manufacturer's name, purchaser's name, address and contract number, item number and type, size and length of cable and net gross weight stenciled on both the sides of the drum. A tag containing same information shall be attached to the leading end of the cable. An arrow and suitable accompanying wording shall be marked on one end of the reel indicating the direction in which it should be rolled. (c.) The standard drum length for control cables with a maximum tolerance of +/- 5% may be decided by the bidder subject to condition that there shall not be any joint in cable, where application length of cable is up to & including 1000 meter.			
5.00.00	TESTS All equipments to be supplied shall be of type tested design. During detailed engineering, the contractor shall submit for Owner's approval the reports of all the type tests as listed in this specification and carried out within last ten years from the date of bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. However if the contractor is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the contractor shall conduct all such tests under this contract at no additional cost to the owner either at third party lab or in presence of client /owners representative and submit the reports for approval. All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price The type test reports once approved for any projects shall be treated as reference. For subsequent projects of NTPC, an endorsement sheet will be furnished by the manufacturer confirming similarity and "No design Change". Minor changes if any shall be highlighted on the endorsement sheet.			
5.01.00	TYPE TESTS			
5.01.01	The reports for the following type tests shall be submitted for one size of control cables. Size shall be decided by the employer during detailed engineering			
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371	SUB-SECTION-B-4 LT CONTROL CABLES	PAGE 4 OF 6

CLAUSE NO.	TECHNICAL REQUIREMENTS		
	S. No.	Type Test	Remarks
		For Conductor	
	1.	Resistance test	
		For Armour Wires / Formed Wires (If applicable)	
	2.	Measurement of Dimensions	
	3.	Tensile Test	
	4.	Elongation test	
	5.	Torsion test	For round wire only
	6.	Wrapping test	For aluminium wires / formed wires only.
	7.	Resistance test	
	8(a).	Mass of zinc Coating test	For GS wires/formed wires only
	8(b).	Uniformity of zinc coating	For GS wires/formed wires only
	9.	Adhesion test	For GS wires/formed wires only
		For PVC insulation & PVC Sheath	
	10.	Test for thickness	
	11.	Tensile strength and elongation test	before ageing and after ageing
	12.	Ageing in air oven	
	13.	Loss of mass test	For PVC insulation and sheath only
	14.	Hot deformation test	For PVC insulation and sheath only
	15.	Heat shock test	For PVC insulation and sheath only
	16.	Shrinkage test	
	17.	Thermal stability test	For PVC insulation and sheath only
	18.	Oxygen index test	For outer sheath only
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371 SUB-SECTION-B-4 LT CONTROL CABLES PAGE 5 OF 6			

CLAUSE NO.	एनटीपीसी NTPC TECHNICAL REQUIREMENTS			
5.02.00	S. No.	Type Test	Remarks	
	19.	Smoke density test	For outer sheath only	
	20.	Acid gas generation test	For outer sheath only	
	For completed cables			
	21.	Insulation resistance test(Volume resistivity method)		
	22.	High voltage test		
	23.	Flammability test as per IEC-332 Part-3 (Category-B)		
	Indicative list of tests/checks, Routine and Acceptance tests shall be as per Quality Assurance & Inspection table of Control Cables enclosed.			
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371	SUB-SECTION-B-4 LT CONTROL CABLES	PAGE 6 OF 6



SUB-SECTION – B-5

CABLING EARTHING LIGHTNING AND PROTECTION

**KHURJA SUPER THERMAL POWER PROJECT
(2X660 MW)
TURBINE GENERATOR AND ASSOCIATED PACKAGES
BID DOC. NO.: THDC/RKSH/CC-9915-371**

SEPARATOR

CL-01-001-001		TECHNICAL REQUIREMENTS			
1.00.00		CODES AND STANDARDS			
1.01.00		All standards, specifications and codes of practice referred to herein shall be the latest editions including all applicable official amendments and revisions as on date of opening of bid. In case of conflict between this specification and those (IS codes, standards, etc.) referred to herein, the former shall prevail. All work shall be carried out as per the following standards/ codes as applicable .			
		IS:513	Cold rolled low carbon steel sheets and strips.		
		IS:802	Code of practice for the use of Structural Steel in Overhead Transmission Line Towers.		
		IS:1079	Hot Rolled carbon steel sheet & strips		
		IS:1239	Mild steel tubes, tubulars and other wrought steel fittings		
		IS:1255	Code of practice for installation and maintenance of power cables upto and including 33 KV rating		
		IS:1367 Part-13	Technical supply conditions for threaded Steel fasteners. (Hot dip galvanized coatings on threaded fasteners).		
		IS:2147	Degree of protection provided by enclosures for low voltage switchgear and control gear		
		IEC:62305	Code of Practice for the protection of building and allied structures against lightning.		
		IS:2309	Code of Practice for the protection of building and allied structures against lightning.		
		IS:2629	Recommended practice for hot dip galvanising of iron & steel		
		IS:2633	Method for testing uniformity of coating on zinc coated articles.		
		IS:3043	Code of practice for Earthing		
		IS:3063	Fasteners single coil rectangular section spring washers.		
		IS:6745	Methods for determination of mass of zinc coating on zinc coated iron & steel articles.		
		IS:8308	Compression type tubular in- line connectors for aluminium conductors of insulated cables		
		IS:8309	Compression type tubular terminal ends for aluminium conductors of insulated cables.		
		IS:9537	Conduits for electrical installation.		
		IS:9595	Metal - arc welding of carbon and carbon manganese steels - recommendations.		
		IS:13573	Joints and terminations for polymeric cables.		
		BS:476	Fire tests on building materials and structures		
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371		SUB-SECTION-B-05 CABLING, EARTHING & LIGHTNING PROTECTION	
				PAGE 1 OF 23	

ES-PLM-MAX		CLAUSE NO.		एनटीपीसी NTPC		TECHNICAL REQUIREMENTS					
		IEEE:80		IEEE guide for safety in AC substation grounding							
		IEEE:142		Grounding of Industrial & commercial power systems							
		DIN 46267 (Part-II)		Non tension proof compression joints for Aluminium conductors.							
		DIN 46329		Cable lugs for compression connections, ring type ,for Aluminium conductors							
		BS:6121		Specification for mechanical Cable glands for elastomers and plastic insulated cables.							
				Indian Electricity Act.							
				Indian Electricity Rules.							
1.02.00		Equipment complying with other internationally accepted standards such as IEC, BS, DIN, USA, VDE, NEMA etc. will also be considered if they ensure performance and constructional features equivalent or superior to standards listed above. In such a case, the Bidder shall clearly indicate the standard(s) adopted, furnish a copy in English of the latest revision of the standards alongwith copies of all official amendments and revisions in force as on date of opening of bid and shall clearly bring out the salient features for comparison.									
2.00.00		DESIGN AND CONSTRUCTIONAL FEATURE									
2.01.00		Inter Plant Cabling									
2.01.01		Interplant cabling for main routes shall be laid along overhead trestles/duct banks. Cables from main plant to switchyard control room shall be laid in overhead trestles or duct bank. In case of Duct banks, pull-pits shall be filled with sand and provided with a PCC covering. Directly buried cables, if essential, shall not have concentration of more than 4 cables in one route. All HT, LT and Control cables shall be armored.									
2.01.02		Transformer yard									
		In transformer yard cables shall be laid in overhead trestle. The main cable routes coming out from Main plant building and crossing the Transformer yard shall be laid in overhead trestles. In transformer yard, trestle height for rail/road crossing shall be suitable for movement of Generator Transformer with bushing.									
2.01.03		Trenches									
		PCC flooring of built up trenches shall be sloped for effective drainage with sump pits and sump pumps.									
2.01.04		No sub zero level cable vault/trenches shall be provided below control building/switchgear rooms in main plant.									
2.01.05		Cable Vault									
		The cable vault/ / cable spreader room space below the HT / LT switchgear room, Control Rooms, unit control equipment room, Programmer room, UPS, Charger & Battery Rooms, Boiler MCC room shall have 800 mm wide and 2.1 m high movement passage all around the cable trays in the cable vault/ cable spreader room for easy laying/maintenance of cables									
		Cable vaults shall be provided with adequate drainage facilities for drainage of fire water.									
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES				TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371				SUB-SECTION-B-05 CABLING, EARTHING & LIGHTNING PROTECTION		PAGE 2 OF 23	

ES-PLM-MAA		CLAUSE NO.		एनटीपीसी NTPC TECHNICAL REQUIREMENTS			
2.01.06	Each cable vault should have at least two doors.						
	Exit signs shall be provided near doors for personnel escape in case of emergency						
	Boiler Area						
	Two separate cable routes one on each side shall be provided for each boiler unit. Cables for on set of auxiliaries such as ID, FD, PA fan & half of the coal mills shall be routed in one route & for other set of auxiliaries through other route.						
	Cable trays in boiler & ESP area shall be supported from the boiler and ESP structures. The same shall be coordinated with SG/ESP contractor.						
	Cable trays in these areas shall be in vertical formation to avoid dust accumulation. No cable trenches shall be provided in boiler/ESP area.						
	2.01.07	Turbine Hall Area					
		a)Two separate cable routes shall be provided for cable routing of working and standby drives or different set/group (say 50% capacity) of auxiliaries.					
	2.01.08	OffSite Area					
		In offsite pumphouses, overhead cable tray arrangement shall be followed. However cable trenches may be considered below switchgear/mcc. Trestle In fuel oil pump house, overhead cable tray arrangement shall be provided. RCC trenches provided in MCC room shall be separated from fuel oil area to avoid oil accumulation.					
	2.01.09	The cable slits to be used for motor/equipment power/control supply shall be sand filled & covered with PCC after cabling.					
2.01.10	Sizing criteria, derating factors for the cables shall be met as per respective chapters. However for the power cables, the minimum conductor size shall be 6 sq.mm. for aluminium conductor and 2.5 sq.mm. for copper conductor cable.						
2.01.11	Conscious exceptions to the above guidelines may be accepted under special conditions but suitable measures should be taken at such location to:						
	Meet all safety requirements Safeguard against fire hazards, mechanical damage, flooding of water, oil accumulation, electrical faults/interferences, etc						
3.00.00		EQUIPMENT DESCRIPTION					
3.01.00		Cable trays, Fittings & Accessories					
3.01.01		Cable trays shall be ladder/perforated type as specified complete with matching fittings (like brackets, elbows, bends, reducers, tees, crosses, etc.) accessories (like side coupler plates, etc. and hardware (like bolts, nuts, washers, G.I. strap, hook etc.) as required. Cable tray shall be ladder type for power & control cables and perforated for instrumentation cables.					
3.01.02		Cable trays, fittings and accessories shall be fabricated out of rolled mild steel sheets free from flaws such as laminations, rolling marks, pitting etc. These (including hardware) shall be hot dip galvanized as per Clause No. 3.13.00 of this chapter.					
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3.01.03		3.01.04		3.01.05		3.02.00		3.02.01		3.02.02	
Cable trays shall have standard width of 150 mm, 300 mm & 600 mm and standard lengths of 2.5 metre. Thickness of mild steel sheets used for fabrication of cable trays and fittings shall be 2 mm. The thickness of side coupler plates shall be 3 mm.		Cable troughs shall be required for branching out few cables from main cable route. These shall be U-shaped, fabricated of mild steel sheets of thickness 2 mm and shall be hot dip galvanised as per Clause No. 3.13.00 of this chapter. Troughs shall be standard width of 50 mm & 75 mm with depth of 25 mm.		The tolerance for cable tray and accessories shall be as per IS 2102 (Part-1). Tolerance Class: - Coarse		Support System for Cable Trays		Cable tray support system shall be pre-fabricated out of single sheet as per enclosed tender drawings.		Support system for cable trays shall essentially comprise of the two components i.e. main support channel and cantilever arms. The main support channel shall be of two types : (i) C1:- having provision of supporting cable trays on one side and (ii) C2:-having provision of supporting cable trays on both sides. The support system shall be the type described hereunder	
a.		b.		c.		d.		e.		f.	
Cable supporting steel work for cable racks/cables shall comprise of various channel sections, cantilever arms, various brackets, clamps, floor plates, all hardwares such as lock washers, hexagon nuts, hexagon head bolt, support hooks, stud nuts, hexagon head screw, channel nut, channel nut with springs, fixing studs, etc.		The system shall be designed such that it allows easy assembly at site by using bolting. All cable supporting steel work, hardwares fittings and accessories shall be prefabricated factory galvanised.		The main support and cantilever arms shall be fixed at site using necessary brackets, clamps, fittings, bolts, nuts and other hardware etc. to form various arrangements required to support the cable trays. Welding of the components shall not be allowed. However, welding of the bracket (to which the main support channel is bolted) to the overhead beams, structural steel, insert plates or reinforcement bars will be permitted. Any cutting or welding of the galvanised surface shall be brushed and red lead primer, oil primer & aluminium paint shall be applied		All steel components, accessories, fittings and hardware shall be hot dip galvanised after completing welding, cutting, drilling and other machining operation.		The typical arrangement of flexible support system is shown in the enclosed drawings and described briefly below: The main support channel and cantilever arms shall be fabricated out of 2.5 thick rolled steel sheet conforming to IS 1079.		Cantilever arms of 320 mm, 620mm and 750 mm in length are required, and shall be as shown in the enclosed drawing. The arm portion shall be suitable for assembling the complete arm assembly on to component constructed of standard channel section. The back plate shall allow sufficient clearance for fixing bolt to be tightened with tray in position.	
g.											
Support system shall be able to withstand											

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3.02.03		- weight of the cable trays - weight of the cables (75 Kg/Metre run of each cable tray) - Concentrated load of 75 Kg between every support span. - Factor of safety of minimum 1.5 shall be considered.				
3.02.04		The size of structural steel members or thickness of sheet steel of main support channel and cantilever arms and other accessories as indicated above or in the enclosed drawings are indicative only. Nevertheless, the support system shall be designed by the bidder to fully meet the requirements of type tests as specified. In case the system fails in the tests, the components design modification shall be done by the Bidder without any additional cost to the Employer. The bidder shall submit the detailed drawings of the system offered by him alongwith the bid.				
3.02.04		Four legged structure shall be provided wherever there is change in elevation and change in direction				
3.03.04		FOR COAL, LIMESTONE AND GYPSUM HANDLING PLANT THE FOLLOWING SHALL ALSO BE APPLICABLE:				
		a) All overhead cable routes shall be along the route of the conveyor gallery on separate supporting structures and cables shall be laid in vertical trays. The bottom of the steel shall be such that the existing facilities, movement of trucks/human beings etc. does not get affected. The cable trestle shall have a minimum 600mm clear walk way and shall have maintenance platforms as required. The bottom of the steel supporting structure shall be generally at 3.0M above the grade level except for rail/road crossings where it shall be at 8.0M above grade level. Tap offs from the overhead cable trestle can be through shallow trenches with prior approval of the Employer. Directly buried cable, if essential, shall not have concentration of more than 4 cables on one route. b) Cable trenches shall be provided only in Switchgear/MCC rooms. c) Cables shall not be routed through the conveyor galleries except for the equipment located in the conveyor galleries for a particular conveyor i.e. protection switches, receptacles etc. d) Cables for PCS and BSS shall be routed along the conveyors through GI conduits.				
3.04.00		Pipes, Fittings & Accessories				
3.03.01		Pipes offered shall be complete with fittings and accessories (like tees, elbows, bends, check nuts, bushings, reducers, enlargers, coupling caps, nipples etc.) The size of the pipe shall be selected on the basis of maximum 40% fill criteria				
3.03.02		GI Pipes shall be of medium duty as per IS: 1239				
3.03.03		Duct banks shall be PVC conduits encased in PCC (10% spare of each size, subject to minimum one) with suitable water-proof manholes and with proper sealing arrangement consisting of fire retardant sealing compound.				
3.03.04		Hume pipes shall be NP3 type as per IS 458.				
3.03.05		TERNE Coated Flexible Steel Conduits shall be water proof and rust proof made of heat resistant lead coated steel. Conduit diameter shall be uniform throughout its length. Internal surface of the conduit shall be free from burrs and sharp edges. Conduits shall be complete				
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	with necessary accessories for proper termination of the conduit with junction boxes and lighting fixtures.			
3.03.06	HDPE pipes and conduits shall be PE-80, PN-10 type as per IS 4984/IS 8008 Part-I.			
3.04.00	Junction Boxes			
3.04.01	Junction box shall be made of Fire retardant material. Material of JB shall be Thermoplastic or thermosetting or FRP type. The box shall be provided with the terminal blocks, mounting bracket and screws etc. The cable entry shall be through galvanized steel conduits of suitable diameter. The JB shall have suitable for installing glands of suitable size on the bottom of the box. The JB shall be suitable for surface mounting on ceiling/structures. The JB shall be of grey color RAL 7035. All the metal parts shall be corrosion protected. Junction box surface should be such that it is free from crazings, blisterings, wrinkling, colour blots/striations. There should not be any mending or repair of surface. JB's will be provided with captive screws so that screws don't fall off when cover is opened. JB's mounting brackets should be of powder coated MS. Type test reports for the following tests shall be furnished:- (a) Impact resistance for impact energy of 2 Joules (IK07)as per BS EN50102 (b) Thermal ageing at 70deg C for 96 hours as per IEC60068-2-2Bb. (c) Class of protection shall be IP 55. (d) HV test.			
3.04.02	Terminal blocks shall be 1100V grade, of suitable current rating, made up of unbreakable polyamide 6.6 grade. The terminals shall be screw type or screw-less (spring loaded) / cage clamp type with lugs. Marking on terminal strips shall correspond to the terminal numbering in wiring diagrams. All metal parts shall be of non-ferrous material. In case of screw type terminals the screw shall be captive, preferably with screw locking design. All terminal blocks shall be suitable for terminating on each side the required cables/wire size. All internal wiring shall be of cu. Conductor PVC wire.			
3.05.00	Terminations & Straight Through Joints			
3.05.01	Termination and jointing kits for 33kV, 11 kV, 6.6 KV and 3.3 kV grade XLPE insulated cables shall be of proven design and make which have already been extensively used and type tested. Termination kits and jointing kits shall be Pre-moulded type or heat shrinkable type. Further Cold shrinkable type termination and jointing kits are also acceptable. The Cold shrinkable type kits shall be type tested as per relevant standards. Calculation to withstand the required fault level shall also be furnished in case of cold shrinkable type kits. 33 kV, 11 kV, 6.6 KV and 3.3kV grade joints and terminations shall be type tested and Type test reports as per IS:13573 Part-II and IEC60502 shall be furnished. Also, heat shrink material shall comply with requirements of ESI 09-13 (external tests). Critical components used in cable accessories shall be of tested and proven quality as per relevant product specification/ESI specification. Cable joints and terminations should be with FRLS properties as per IEC 60754-1&2. Kit contents shall be supplied from the same source as were used for type testing. The kit shall be complete with the tinned copper solderless crimping type cable lugs & ferrule or mechanical connectors (wherein bolts are tightened that shear off at an appropriate torque) as per DIN standard suitable for aluminium compacted conductor cables. (Tender drg. no 0000-211-POE –A-51-RA of cable lug attached at the end of this chapter)..			
3.05.02	Straight through joint and termination shall be capable of withstanding the fault level of 21 KA for 0.12 Sec. with dynamic peak of 52 KA for 33 KV system & of 40 kA for 0.12 sec with a dynamic peak of 100 kA for 11 kV, 6.6 KV & 3.3 KV system. Straight through joints shall			
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		have provisions for shield connection and earthing wherever required and complete with all accessories and consumables suitable for storage without deterioration at a temperature of 50 deg. C with shelf life of more than five years. 1.1 kV grade straight through joints shall also be of proven design			
3.05.03		1.1 KV grade Straight Through Joint shall be of proven design.			
3.06.00		Cable glands			
3.06.01		Cable shall be terminated using double compression type cable glands. Testing requirements of Cable glands shall conform to BS:6121 and gland shall be of robust construction capable of clamping cable and cable armour (for armoured cables) firmly without injury to insulation. Cable glands shall be made of heavy duty brass machine finished and nickel chrome plated. Thickness of plating shall not be less than 10 micron. All washers and hardware shall also be made of brass with nickel chrome plating Rubber components shall be of neoprene or better synthetic material and of tested quality. Cable glands shall be suitable for the sizes of cable supplied/erected.			
3.07.00		Cable lugs/ferrules			
3.07.01		Cable lugs/ferrules for power cables shall be tinned copper solderless crimping type suitable for aluminium compacted conductor cables. Cable lugs and ferrules for control cables shall be tinned copper type. The cable lugs for control cables shall be provided with insulating sleeve and shall suit the type of terminals provided on the equipments. Cable lugs and ferrule shall conform to DIN standards.			
3.08.00		Trefoil clamps			
3.08.01		Trefoil clamps for single core cables shall be pressure die cast aluminum or fibre glass or nylon and shall include necessary fixing accessories like G.I. nuts, bolts, washers, etc. Trefoil clamps shall have adequate mechanical strength, when installed at 1 mtr intervals, to withstand the forces generated by the peak value of maximum system short circuit current.			
3.09.00		Cable Clamps & Ties			
3.09.01		The cable clamps/ties required to clamp multicore cables shall be of SS-316 material, 12mm wide, polyster coated ladder lock type. The clamps/ties shall have self locking arrangement & shall have sufficient strength. The cable clamps/ties shall be supplied in finished individual pieces of suitable length to meet the site requirements.			
3.10.00		Receptacles			
3.10.01		Receptacles boxes shall be fabricated out of MS sheet of 2mm thickness and hot dipped gavanised or of die-cast aluminium alloy of thickness not less than 2.5 mm. The boxes shall be provided with two nos. earthing terminals, gasket to achieve IP55 degree of protection, terminal blocks for loop-in loop-out for cable of specified sizes, mounting brackets suitable for surface mounting on wall/column/structure, gland plate etc. The ON-OFF switch shall be rotary type heavy duty, double break,AC23 category, suitable for AC supply. Plug and Socket shall be shrouded Die-cast aluminium. Socket shall be provided with lid safety cover. Robust mechanical interlock shall be provided such that the switch can be put ON only when the plug is fully engaged and plug can be withdrawn only when the switch is in OFF position. Also cover can be opened only when the switch is in OFF position. Wiring shall be carried out with 1100 V grade PVC insulated stranded aluminium/copper wire of adequate size. The Terminal blocks shall be of 1100 V grade. The Terminal blocks shall be of 1100 V grade made up of unbreakable polyimide 6.6 grade with adequate current rating and size. The welding receptacles shall be provided with RCCB/RCD of 30mA sensitivity having facility for manual testing/checking of operation of RCCB/RCD			
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3.12.00	Cable Drum Lifting Jack The jack for cable drum lifting shall be of screw type with 10 ton capacity. The cable drum jacks shall be manufactured from fabricated steel. The spindles supplied with the cable drum jack shall be manufactured using BSEN-24 grade steel bar with locking collars. Jack nests shall be of SG cast steel. Cable drum jack supplied shall have undergone load testing and reports for the same shall be submitted. At least Two Nos. of jacks shall be supplied for NTPC use. Contractor has to make arrangements for his own jacks for cable reeling/unreeling under his scope of installation.				
3.13.00	Galvanising				
3.13.01	Galvanising of steel components and accessories shall conform to IS:2629 , IS4759 & IS:2633. Additionally galvanising shall be uniform, clean smooth, continuous and free from acid spots.				
3.13.02	The amount of zinc deposit over threaded portion of bolts, nuts, screws and washers shall be as per IS:1367 . The removal of extra zinc on threaded portion of components shall be carefully done to ensure that the threads shall have the required zinc coating on them as specified				
3.14.00	Welding				
3.14.01	The welding shall be carried out in accordance with IS:9595. All welding procedures and welders qualification shall also be followed strictly in line with IS:9595				
4.00.00	INSTALLATION				
4.01.00	Cable tray and Support System Installation				
4.01.01	Cables shall run in cable trays mounted horizontally or vertically on cable tray support system which in turn shall be supported from floor, ceiling, overhead structures, trestles, pipe racks, trenches or other building structures.				
4.01.02	Horizontally running cable trays shall be clamped by bolting to cantilever arms and vertically running cable trays shall be bolted to main support channel by suitable bracket/clamps on both top and bottom side rails at an interval of 2000 mm in general. For vertical cable risers/shafts cable trays shall be supported at an interval of 1000mm in general. Fixing of cable trays to cantilever arms or main support channel by welding shall not be accepted. Cable tray installation shall generally be carried out as per the approved guidelines/ drawings. Vendor shall design the support system along with tray, spacing etc in line with tray loadings/drawings.				
4.01.03	The cantilever arms shall be positioned on the main support channel with a minimum vertical spacing of 300 mm unless otherwise indicated.				
4.01.04	The contractor shall fix the brackets/ clamps/ insert plates using anchor fasteners. Minimum size of anchor fasteners shall be M 8 X 50 and material shall be stainless steel grade 316 or better. Anchor fastener shall be fixed as recommended by manufacturer and as approved by site engineer. For brick wall suitable anchor fasteners shall be used as per the recommendations of manufacturer. Make of anchor fasteners subject to QA approval and the same shall be finalized at pre-award stage.				
4.01.05	All cable way sections shall have identification, designations as per cable way layout drawings and painted/stenciled at each end of cable way and where there is a branch connection to another cable way. Minimum height of letter shall be not less than 75 mm. For long lengths of trays, the identification shall be painted at every 10 meter. Risers shall additionally be painted/stenciled with identification numbers at every floor.				
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4.01.06		In certain cases it may be necessary to site fabricate portions of trays, supports and other non standard bends where the normal prefabricated trays, supports and accessories may not be suitable. Fabricated sections of trays, supports and accessories to make the installation complete at site shall be neat in appearance and shall match with the prefabricated sections in the dimensions. They shall be applied with one coat of red lead primer, one coat of oil primer followed by two finishing coats of aluminium paint.													
4.02.00		Conduits/Pipes/Ducts Installation													
4.02.01		The Contractor shall ensure for properly embedding conduit pipe sleeves wherever necessary for cabling work. All openings in the floor/roof/wall / cable tunnel/cable trenches made for conduit installation shall be sealed and made water proof by the Contractor.													
4.02.02		GI pull wire of adequate size shall be laid in all conduits before installation. Metallic conduit runs at termination shall have two lock nuts wherever required for junction boxes etc.													
4.02.03		Conduit runs/sleeves shall be provided with PVC bushings having round edge at each end. All conduits/pipes shall have their ends closed by caps until cables are pulled. After cables are pulled, the ends of conduits/pipes shall be sealed with Glass wool/Cement Mortar/Putty to prevent entrance of moisture and foreign material													
4.02.04		Exposed conduit/pipe shall be adequately supported by racks, clamps, straps or by other approved means. Conduits /pipe support shall be installed square and true to line and grade with an average spacing between the supports as given below, unless specified otherwise													
		<table><tr><td>Conduit /pipe size (dia).</td><td>Spacing</td></tr><tr><td>Upto 40 mm</td><td>1 M</td></tr><tr><td>50 mm</td><td>2.0 M</td></tr><tr><td>65-85 mm</td><td>2.5 M</td></tr><tr><td>100 mm and above</td><td>3.0 M</td></tr></table>				Conduit /pipe size (dia).	Spacing	Upto 40 mm	1 M	50 mm	2.0 M	65-85 mm	2.5 M	100 mm and above	3.0 M
Conduit /pipe size (dia).	Spacing														
Upto 40 mm	1 M														
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4.02.05		For bending of conduits, bending machine shall be arranged at site by the contractor to facilitate cold bending. The bends formed shall be smooth.													
4.03.00		Junction Boxes Installation													
4.03.01		Junction boxes shall be mounted at a height of 1200mm above floor level or as specified in the drawings and shall be adequately supported/mounted on masonry wall by means of anchor fasteners/ expandable bolts or shall be mounted on an angle, plate or other structural supports fixed to floor, wall, ceiling or equipment foundations.													
4.04.00		Cable Installation													
4.04.01		Cable installation shall be carried out as per IS:1255 and other applicable standards.													
4.04.02		For Cable unloading, pulling etc following guidelines shall be followed in general:													
		a) Cable drums shall be unloaded, handled and stored in an approved manner on hard and well drained surface so that they may not sink. In no case shall be drum be stored flat i.e. with flange horizontal. Rolling of drums shall be avoided as far as possible. For short distances, the drums may be rolled provided they are rolled slowly and in proper direction as marked on the drum. In absence of any indication, the drums may be rolled in the same direction as it was rolled during taking up the cables. For unreeling the cable, the drum shall be mounted on suitable jacks or on													
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				cable wheels and shall be rolled slowly so that cable comes out over the drum and not from below. All possible care shall be taken during unreeling and laying to avoid damage due to twist, kink or sharp bends. Cable ends shall be provided with sealed plastic caps to prevent damage and ingress of moisture. b) While laying cable, ground rollers shall be used at every 2 meter interval to avoid cable touching ground. The cables shall be pushed over the rollers by a gang of people positioned in between the rollers. Cables shall not be pulled from the end without having intermediate pushing arrangements. Pulling tension shall not exceed the values recommended by cable manufacturer. Selection of cable drums for each run shall be so planned so as to avoid using straight through joints. Care should be taken while laying the cables so as to avoid damage to cables. If any particular cable is damaged, the same shall be repaired or changed to the satisfaction of Project Manager.					
4.04.03				Cables shall be laid on cable trays strictly in line with cable schedule . Where specific cable layouts are not shown on drawings, Contractor shall route these as directed by the Project Manager					
4.04.04				Power and control cables shall be laid on separate tiers inline with the approved guidelines/drawings. The laying of different voltage grade cables shall be on different tiers according to the voltage grade of the cables. In horizontal tray stacks, H.T. cables shall be laid on top most tier and cables of subsequent lower voltage grades on lower tiers of trays. Single core cable in trefoil formation shall be laid with a distance of four times the diameter of cable between trefoil center lines and clamped at every-one metre. All multicore cables shall be laid in touching formation. Power and control cables shall be secured fixed to trays/support with cable clamps/ties with self locking arrangement. For horizontal trays arrangements, multicore power cables and control cables shall be secured at every five meter interval. For vertical tray arrangement, individual multicore power cables and control cables shall be secured at every one meter. After completion of cable laying work in the particular vertical tray, all the control cables shall be binded to trays/supports by cable clamps/ties with self locking arrangement at every five meter interval and at every bend. Fibre Optical cable shall be laid in trenches/trays or as decided by Employer.					
4.04.05				Bending radii for cables shall be as per manufacturer's recommendations and IS:1255.					
4.04.06				Where cables cross roads/rail tracks, the cables shall be laid in hume pipe/ HDPE pipe.					
4.04.07				No joints shall be allowed in trip circuits, protection circuits and CT/PT circuits. Also joints in critical equipment in main plant area shall not be permitted. Vendor shall identify and accordingly procure the cable drum length.					
4.04.08				In each cable run some extra length shall be kept at suitable point to enable one LT/two HT straight through joints to made, should the cable develop fault at a later stage. Control cable termination inside equipment enclosure shall have sufficient lengths so that shifting of termination in terminal blocks can be done without requiring any splicing.					
4.04.09				Wherever few cables are branching out from main trunk route troughs shall be used.					
4.04.10				Wind loading shall be considered for designing support as well Cable trays wherever required.					
4.04.11				Where there is a considerable risk of steam, hot oil or mechanical damage cable routes shall be protected by barriers or enclosures.					
4.04.12				The installation work shall be carried out in a neat workman like manner & areas of work shall be cleaned of all scraps, water, etc. after the completion of work in each area every					
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4.04.13	day. Contractor shall replace RCC/Steel trench covers after the Installation work in that particular area is completed or when further work is not likely to be taken up for some time. Separation At least 300mm clearance shall be provided between: - HT power & LT power cables, - LT power & LT control/instrumentation cables,												
4.04.14	Segregation 1) Segregation means physical isolation to prevent fire jumping. 2) All cables associated with the unit shall be segregated from cables of other units. 3) Interplant cables of station auxiliaries and unit critical drives shall be segregated in such a way that not more than half of the drives are lost in case of single incident of fire. Power and control cables for AC drives and corresponding emergency AC or DC drives shall be laid in segregated routes. Cable routes for one set of auxiliaries of same unit shall be segregated from the other set. 4) In switchyard, control cables of each bay shall be laid on separate racks/trays.												
4.04.15	Minimum number of spare cores required to be left for interconnection in control cables shall be as follows: Minimum number of spare cores required to be left for interconnection in control cables shall be as follows: <table><thead><tr><th>No. of cores in cable</th><th>No. of spare cores</th></tr></thead><tbody><tr><td>2C,3C</td><td>NIL</td></tr><tr><td>5C</td><td>1</td></tr><tr><td>7C-10C</td><td>2</td></tr><tr><td>14C and above</td><td>3</td></tr></tbody></table>	No. of cores in cable	No. of spare cores	2C,3C	NIL	5C	1	7C-10C	2	14C and above	3		
No. of cores in cable	No. of spare cores												
2C,3C	NIL												
5C	1												
7C-10C	2												
14C and above	3												
4.04.16	Directly Buried Cables a) Cable trenches shall be constructed for directly buried cables. Construction of cable trench for cables shall include excavation, preparation of sieved sand bedding, riddled soil cover, supply and installation of brick or concrete protective covers, back filling and compacting, supply and installation of route markers and joint markers. Laying of cables and providing protective covering shall be as per IS:1255 and the enclosed drawings showing cabling details. b) RCC cable route and RCC joint markers shall be provided wherever required. The voltage grade of the higher voltage cables in route shall be engraved on the marker. Location of underground cable joints shall be indicated with cable marker with an additional inscription "Cable Joint". The marker shall project 150 mm above ground and shall be spaced at an interval of 30 meters and at every change in direction. They shall be located on both sides of road crossings and drain crossings. Top of cable marker/joint marker shall be sloped to avoid accumulation of water/dust on marker.												
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4.04.17	Cable tags shall be provided on all cables at each end (just before entering the equipment enclosure), on both sides of a wall or floor crossing, on each duct/conduit entry, and at every 20 meters in cable tray/trench runs. Cable tags shall also be provided inside the switchgear, motor control centers, control and relay panels etc. where a number of cables enter together through a gland plate. Cable tag shall be of rectangular shape for power cables and control cables. Cable tag shall be of 2 mm thick aluminum with number punched on it and securely attached to the cable by not less than two turns of 20 SWG GI wire conforming to IS:280. Alternatively, the Contractor may also provide cable tags made of nylon, cable marking ties with cable number heat stamped on the cable tags. The cable tag requirements mentioned above shall prevail over Tag requirements mentioned elsewhere in this document for HT power, LT power & control cables.				
4.04.18	While crossing the floors, unarmoured cables shall be protected in conduits upto a height of 500 mm from floor level if not laid in tray.				
4.05.00	Cable Terminations & Connections				
4.05.01	The termination and connection of cables shall be done strictly in accordance with cable termination kit manufacturer" instructions, drawings and/or as directed by Project Manager. Cable jointer shall be qualified to carryout satisfactory cable jointing/termination. Contractor shall furnish for review documentary evidence/experience reports of the jointers to be deployed at site.				
4.05.02	Work shall include all clamps, fittings etc. and clamping, fitting, fixing, plumbing, soldering, drilling, cutting, taping, preparation of cable end, crimping of lug, insulated sleeving over control cable lugs, heat shrinking (where applicable), connecting to cable terminal, shorting and grounding as required to complete the job to the satisfaction of the Project Manager.				
4.05.03	The equipment will be generally provided with undrilled gland plates for cables/conduit entry. The Contractor shall be responsible for punching of gland plates, painting and touching up. Holes shall not be made by gas cutting. The holes shall be true in shape. All cable entry points shall be sealed and made vermin and dust proof. Unused openings shall be effectively sealed by 2mm thick aluminium sheets.				
4.05.04	Control cable cores entering control panel/switchgear/MCC/miscellaneous panels shall be neatly bunched, clamped and tied with self locking type nylon cable ties with de interlocking facility to keep them in position.				
4.05.05	All the cores of the control cable to be terminated shall have identification by providing ferrules at either end of the core, each ferrule shall be indelible, printed single tube ferrule and shall include the complete wire number and TB number as per the drawings. The ferrule shall fit tightly on the core. Spare cores shall have similar ferrules with suffix sp1, sp2, ---etc along with cable numbers and coiled up after end sealing.				
4.05.06	All cable terminations shall be appropriately tightened to ensure secure and reliable connections.				
5.00.00	EARTHING SYSTEM				
5.01.00	Earthing system shall be in strict accordance with IS:3043 and Indian Electricity Rules/Acts. Earthing system network/earthmat shall be interconnected mesh of mild steel rods buried in ground in the plant. All off-site areas shall be interconnected together by minimum two parallel conductors. The Contractor shall furnish the detailed design and calculations for				
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CLAUSE NO.		TECHNICAL REQUIREMENTS	
5.02.00	Employer's approval. Contractor shall obtain all necessary statutory approvals for the system.		
5.03.00	The earth conductors shall be free from pitting, laminations, rust, scale and other electrical, mechanical defects		
5.04.00	The material of the earthing conductors shall be as follows :		
	1)	Conductors above ground level and in built up trenches.	Galvanized steel
	2)	Conductors buried in earth	Mild steel
	3)	Earth electrodes	Mild steel rod
5.04.00	The sizes of earthing conductors for various electrical equipments shall be as below:		
	Equipment	Earth conductor buried in earth	Earth conductor above ground level & in built-up trenches
	a)	Main earth grid	MS rod -Min 40 mm dia. or as per actual calculation whichever is more
	b)	33kV/11kV/6.6kV/3.3 kV/ switchgear equipment and 415V switchgear	65 x 8mm GS flat
	c)	415 V MCC/ Distribution boards / Transformers	50 x 6mm GS flat
	d)	LT Motors above 125 KW	50 x 6mm GS flat
		25 KW to 125 KW	25 x 6mm GS flat
		1KW to 25 KW	25 x 3mm GS flat
		Fractional House power motor	8 SWG GS wire
	e)	Control panel & control desk	25 x 3 mm GS flat
	f)	Push button station / Junction Box	8 SWG GI wire
	g)	Columns, structures, cable trays and bus ducts enclosures	50 x 6mm GS flat
	h)	Crane, rails, rail tracks & other non-current carrying metal parts	25 x 6mm GS flat
5.05.00	Metallic frame of all electrical equipment shall be earthed by two separate and distinct connections to earthing system, each of 100% capacity, Crane rails, tracks, metal pipes and conduits shall also be effectively earthed at two points. Steel RCC columns, metallic stairs, and rails etc. of the building housing electrical equipment shall be connected to the nearby		
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SPEM-MAA		TECHNICAL REQUIREMENTS		
CLAUSE NO.				
		earthing grid conductor by one earthing ensured by bonding the different sections of hand rails and metallic stairs. Metallic sheaths/screens, and armour of multi-core cables shall be earthed at both ends. Metallic Sheaths and armour of single core cables shall be earthed at switchgear end only unless otherwise approved. Every alternate post of the switchyard fence shall be connected to earthing grid by one GS flat and gates by flexible lead to the earthed post. Railway tracks within the plant area shall be bonded across fish plates and connected to earthing grid at several locations. Portable tools, appliances and welding equipment shall be earthed by flexible insulated cable.		
5.06.00		Each continuous laid lengths of cable tray shall be earthed at minimum two places by G.S. flats to earthing system, the distance between earthing points shall not exceed 30 meter. Wherever earth mat is not available, necessary connections shall be done by driving an earth electrode in the ground		
5.07.00		Neutral points of HT transformer shall be earthed through NG resistors. The Contractor shall connect the NGR earthing point to earth electrodes by suitable earth conductors.		
5.08.00		Neutral connections and metallic conduits/pipes shall not be used for the equipment earthing. Lightning protection system down conductors shall not be connected to other earthing conductors above the ground level.		
5.09.00		Connections between earth leads and equipment shall normally be of bolted type. Contact surfaces shall be thoroughly cleaned before connections. Equipment bolted connections after being tested and checked shall be painted with anti corrosive paint/compound.		
5.10.00		Suitable earth risers as approved shall be provided above finished floor/ground level, if the equipment is not available at the time of laying of main earth conductor.		
5.11.00		Connections between equipment earthing leads and between main earthing conductors shall be of welded type. For rust protection the welds should be treated with red lead compound and afterwards thickly coated with bitumen compound. All welded connections shall be made by electric arc welding.		
5.12.00		Resistance of the joint shall not be more than the resistance of the equivalent length of conductors.		
5.13.00		Earthing conductors buried in ground shall be laid minimum 600 mm below grade level unless otherwise indicated in the drawing. Back filling material to be placed over buried conductors shall be free from stones and harmful mixtures. Back filling shall be placed in layers of 150 mm.		
5.14.00		Earthing conductors embedded in the concrete floor of the building shall have approximately 50 mm concrete cover.		
5.15.00		A minimum earth coverage of 300 mm shall be provided between earth conductor and the bottom of trench/foundation/underground pipes at crossings. Earthing conductors crossings the road can be installed in pipes. Wherever earthing conductor crosses or runs at less than 300 mm distance along metallic structures such as gas, water, steam pipe lines, steel reinforcement in concrete, it shall be bonded to the same.		
5.16.00		Earthing conductors along their run on columns, walls, etc. shall be supported by suitable welding / cleating at interval of 1000mm and 750mm respectively.		
5.17.00		Earth pit shall be of treated type & shall be constructed as per IS:3043. Electrodes shall be embedded below permanent moisture level. Minimum spacing between electrodes shall be 600mm. Earth pits shall be treated with salt and charcoal as per IS:3043. Test links shall be		
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E-07-ELE-MAX		TECHNICAL REQUIREMENTS		
CLAUSE NO.				
	provided with bolted arrangement alongwith each earth pit, in order to facilitate measurement of earth resistance as & when required.			
5.18.00	On completion of installation continuity of earth conductors and efficiency of all bonds and joints shall be checked. Earth resistance at earth terminations shall be measured and recorded. All equipment required for testing shall be furnished by contractor.			
5.19.00	Earthing conductor shall be buried at least 2000mm outside the fence of electrical installations. Every alternate post of the fences and all gates shall be connected to earthing grid by one lead.			
5.20.00	Other Requirements of Earthing System:			
	Standard/Code	IEEE 80, IS 3043		
	Earthing System			
	Life expectancy	40 Years		
	System Fault Level	As per system requirement (B0)		
	Soil resistivity	Actual as per site conditions.		
	Min. Steel corrosion	0.12mm/year		
	Depth of burial of main earth conductor	600mm below grade level; where it crosses trenches, pipes, ducts, tunnels, rail tracks, etc., it shall be at least 300mm below them.		
	Conductor joints	By electric arc welding, with resistance of joint not more than that of the conductor.		
	Welds to be treated with red lead for rust protection and then coated with bitumen compound for corrosion protection.			
	Surface resistivity - Gravel	3000 ohm-meter		
	- Concrete	500 ohm-meter		
6.00.00	LIGHTNING PROTECTION SYSTEM			
6.01.01	Lightning protection system shall be in strict accordance with IEC:62305 .			
6.01.02	Lightning conductor shall be of 25x6mm GS strip when used above ground level and shall be connected through test link with earth electrode/earthing system			
6.01.03	Lightning system shall comprise of air terminations, down conductors, test links, earth electrode etc. as per approved drawings.			
6.02.00	Down Conductors			
	1. Down conductors shall be as short and straight as practicable and shall follow a direct path to earth electrode.			
	2. Each down conductor shall be provided with a test link at 1000 mm above ground level for testing but it shall be in accessible to interference. No connections other than the one direct to an earth electrode shall be made below a test point.			
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SPEM-MAA		CLAUSE NO.		एनटीपीसी NTPC TECHNICAL REQUIREMENTS			
				i) Working load ii) Working load + point load iii) Off load iv) Proof load + point load v) Off load The deflection measured at working loads shall not exceed 16mm. The permanent deflection after removing the combination of working load and point load shall not exceed 10 mm at the arm tips and 6 mm on the channel. No collapse of the structure shall occur with a combination of proof load and point load applied. B) Test 1B: Test 1A shall be repeated with Eight Cantilever arms uniformly loaded and with the same point load on arm 2 Test 2: On Main support channel type -C2 for cantilever arms fixed on both sides a) Test 2A: A 3.5 m length of main support channel C2 for cantilever arms fixing on both sides shall be fixed at each end to rigid structure as per the fixing arrangement as shown in the enclosed drawing. Six (6), 750 mm cantilever arms shall be attached to each sides and each arm uniformly loaded to a working load of 100 kg over the out board 600 mm. A point load of 100 kg shall than be applied to arm 2, followed by a uniform proof load of twice the working load on all the arms; deflection shall be measured at points shown in the enclosed drawings at the following load intervals. i) Working load ii) Working load + Point load iii) Off load iv) Proof load + Point load v) Off load The deflection measured at working loads shall not exceed 16mm. The permanent deflection after removing the combination of working load and point load shall not exceed 10 mm at the arm tips and 6 mm on the channel. No collapse of the structure shall occur with a combination of proof load and point load applied b) Test 2 B: The test 2 A shall be repeated with the assembly but with an asymmetrical load on the C2 column and point load applied to arm 8. The 100 kg and 200 kg uniformly distributed loads shall be applied to the upper three arms on one side and the lower three arms on the opposite side. Test 3 : Tests on Channel Fixed on Beam/Floor A length of main support channel section shall be fixed to steel structure/floor and have loads applied as shown in the drawing enclosed and as detailed below			
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ES-FLM-MAX		TECHNICAL REQUIREMENTS		
CLAUSE NO.				
	a) Test 3A : A length of steel structure shall be rigidly supported. It should be fitted on a meter length of channel section using beam clamps welded/bolted. A point load of 1200 kg shall be applied to the centre point via two brackets. No distortion or pulling of the components shall take place. b) Test 3B: With the components assembled as in Test 3A, two perpendicular point loads of 600 kg shall be simultaneously applied at positions 150 mm either side of the centre line, no distortion or pulling of the components shall take place. c) Test 3C: With the components assembled as in Test 3A, a perpendicular point load shall be applied at a point 150 mm on one side of the centre line. The load shall be gradually increased to the maximum value that can be applied without causing distortion or pulling of the components. This value shall be recorded. Test 4 : Channel Insert Test A 2.5 m length of C1 channel fixed to the concrete wall/ steel structure as per actual site installation conditions. 6 nos. of 750 mm cantilever arms shall be attached to C1 channel as shown in enclosed drawing. Each arm uniformly loaded to a working load of 100 kg over the out board 600 mm. A point load of 100 kg shall than be applied to arm 2, followed by a uniform proof load of twice the working load on all the arms; deflection shall be measured at points shown in the enclosed drawings at the following load intervals. i) Working Load ii) Working Load + Point Load iii) Off Load iv) Proof Load + Point Load v) Off load The deflection measured at working loads shall not exceed 16mm. The permanent deflection after removing the combination of working load and point load shall not exceed 10 mm at the arm tips and 6 mm on the channel. No collapse of the structure shall occur with a combination of proof load and point load applied Test 5 : Channel nut slip characteristics (what ever applicable) Tests 5A1,5A2,5A3 : A length of channel C1 section 200mm long shall have fitted bracket with the two bolt fixing as shown in drawing enclosed. With loads applied at the position shown in drawing enclosed nut slip shall be determined with bolt torque of 30NM, 50 NM and 65 NM No fewer than three measurements shall be made for each torque setting. A minimum loading of 720 kg shall be obtained before nut slip with bolt torque of 65 NM. Tests 5B1,5B2,5B3: The length of channel C1 section 200 mm long shall have fitted bracket with the one bolt fixing as shown in drawing enclosed. With loads applied at the position shown in drawing, nut slip shall be determined with bolt torques of 30 NM, 50 NM and 65 NM. No fewer than three measurements shall be made for each torque setting. A minimum loading of 350 kg shall be obtained before nut slip with a bolt torque of 65 NM.			
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CLAUSE NO.		TECHNICAL REQUIREMENTS			
		Test 6 Weld Integrity Test			
		After deflection test as per test 1A, 1B, 2, 3 & 4 weld integrity shall be checked by magnetic particle inspection to detect sub-surface cracks developed, if any.			
7.02.02		Cable termination kit and straight through joints should have been tested as per IS:13573 for 3.3kV grade & above.			
7.03.00		Routine/ Acceptance Tests			
7.03.01		Routine Tests			
		a) Routine tests as per specification and applicable standards shall be carried out on all requirements/items covered in the specification.			
		b) Physical & dimensional check on all equipments as per approved drawings/standards			
		c) HV/IR as applicable.			
		d) Check/measurement of thickness of paint/zinc coating/nickel-chrome plating as per specification & applicable standard.			
7.03.02		Acceptance Test			
		a) Galvanising Tests as per applicable standards			
		b) Welding checks			
		c) Deflection tests on cable trays:			
		d) One piece each of 2.5m length of cable tray of 300mm & above shall be taken as sample from each offered lot. It shall be supported at both end & loaded with uniform load of 76 kg/meter along the length of cable tray. The maximum deflection at the mid-span of each size shall not exceed 7mm.			
		d) Proof load tests on cable tray support system			
		i) Tests on Main Support Channel shall be done if only C1 Channel are in scope of supply and cantilever arms shall be fitted on one side. This test shall be same as test 4 of type test.			
		ii) Test on Main Support Channel shall be done with C2 channel and cantilever arms fitted on both sides, if C2 channels are in scope of supply. This test shall be same as test 2A of type test. Then test (i) above shall not be done.			
		iii) Nut slip characteristic test (it shall support minimum load of 350kg before nut slips with a bolt torque of 65 NM). This test shall be same as test 5B3 of type test. The procedure for carrying out tests at “d” above shall be as per details given in Type Tests in specification thereafter Die-Penetration test shall be carried out to check weld integrity.			
		d) The above acceptance tests shall be done only on one sample from each offered lot.			
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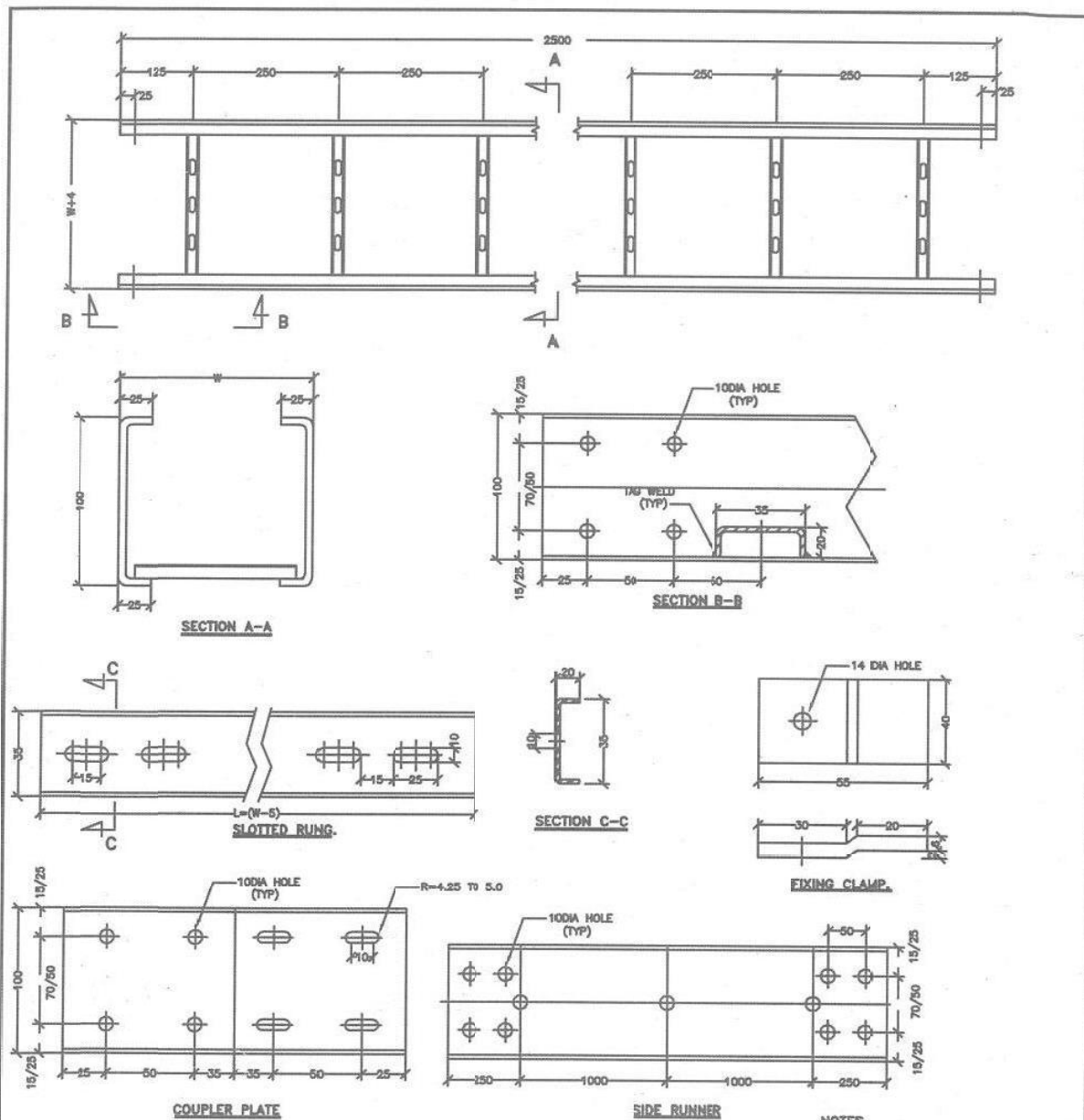
SUPPLEMENTARY		TECHNICAL REQUIREMENTS			
CLAUSE NO.					
8.00.00	COMMISSIONING				
8.01.01	The Contractor shall carry out the following commissioning tests and checks after installation at site. In addition the Contractor shall carry out all other checks and tests as recommended by the Manufacturers or else required for satisfactory performance..				
8.01.02	Cables a) Check for physical damage b) Check for insulation resistance before and after termination/jointing. c) HT cables shall be pressure tested (test voltage as per IS:7098) before commissioning. d) Check of continuity of all cores of the cables. e) Check for correctness of all connections as per relevant wiring diagrams. Any minor modification to the panel wiring like removing/inserting, shorting, change in terminal connections, etc., shall be carried out by the Contractor. f) Check for correct polarity and phasing of cable connections. g) Check for proper earth connections for cable glands, cable boxes, cable armour, screens, etc. h) Check for provision of correct cable tags, core ferrules, tightness of connections.				
8.02.00	Cable trays / supports and accessories 1) Check for proper galvanizing/painting and identification number of the cable trays/supports and accessories. 2) Check for continuity of cable trays over the entire route. 3) Check that all sharp corners, burrs, and waste materials have been removed from the trays supports. 4) Check for earth continuity and earth connection of cable trays.				
8.03.00	Earthing and Lightning protection system 1) Earth continuity checks. 2) Earth resistance of the complete system as well as sub-system.				
8.04.00	Below Ground Earth Mat: The earthing system for plant shall be designed as per Clause No:- 3.07.00 of Sub Section B-0 of Technical Specification Section-VI, Part-B Grounding for TG and other areas or buildings covered in the specification shall be provided in accordance with IS 3043, IEC 62305, IEEE 80. Earthing system network/earthmat shall be interconnected mesh of mild steel rods buried in ground in the plant. All areas under contractor scope of supply shall be interconnected				
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CLAUSE NO.	 TECHNICAL REQUIREMENTS 												
9.00.00	together by minimum two parallel conductors. The Contractor shall furnish the detailed design and calculations for Employer's approval. Contractor shall obtain all necessary statutory approvals for the system. All the columns shall be earthed by nearby risers and earthmat grid spacing shall be maximum 10 X 10 mts.. Minimum two nos of risers shall be provided for each equipment in his scope of area. Separate dedicated riser shall be provided for C&I earthing purpose and also for Lightning down conductor connection purpose. Sufficient nos of risers near the equipment shall be provided as per the system requirement. ELECTRICAL LAYOUT PHILOSOPHY: While developing the layout the bidder must give due consideration to the following requirements: a) Adequate distance shall be maintained between the transformers. As basic guidelines following norms will be adhered to: 1) Transformers shall be separated from the adjacent building/structures and from each other by a minimum distance as defined below or by a fire wall of two hours of fire resisting of height at least 600 mm above bushing / pressure relief vent whichever is higher. <table><tr><th>Oil capacity of individual transformer (in liters)</th><th>Clear separating distance (in meters)</th></tr><tr><td>5,000 to 10,000</td><td>8.0</td></tr><tr><td>10,001 to 20,000</td><td>10.0</td></tr><tr><td>20,001 to 30,000</td><td>12.5</td></tr><tr><td>Over 30,001</td><td>15.0</td></tr></table> 2) In case of auxiliary transformers having an aggregate oil capacity in excess of 2300 liters but individual oil capacity of less than 5000 liters, the maximum separating distance between transformers and surrounding building shall be at least 6M unless they are separated by fire separating walls or are protected by high velocity spray system. 3.) Rail track shall be provided in Transformer yard for movement of each transformer. The rail track in Transformer yard shall be connected with TG area rail track The Foundation top of transformer & rail top shall be at EL +/- 0.0M. Bus duct support or Transformer body shall be at least 8.0M from A-Row of TG building to clear the movement of GT/ Stator/UT/ST/UAT on rail line. Jacking pads shall be provided where the rail track changes the direction. Mooring post shall be provided on rail track for handling the transformers. 4) For each transformer a pit shall be provided all around at a distance of 1.5 m (minimum) from transformer outer edge. A sump pit shall be provided for each pit. A common oil retention pit per unit shall be provided to hold oil quantity of the largest transformer (by volume) & 10 minutes of water quantity of HVW spray system for the largest transformer. Sump pit of individual transformer shall be connected to common oil retention pit of that unit. 5) Rail track shall be provided for all outdoor transformers up to road for movement of each transformer of size more than or equal to 7.5MVA Transformer. Jacking pads shall be provided where the rail track changes the direction. Jacking pad shall also be provided at the location of installation of transformer and mooring post shall be provided on rail track for handling the transformers.	Oil capacity of individual transformer (in liters)	Clear separating distance (in meters)	5,000 to 10,000	8.0	10,001 to 20,000	10.0	20,001 to 30,000	12.5	Over 30,001	15.0		
	Oil capacity of individual transformer (in liters)	Clear separating distance (in meters)											
5,000 to 10,000	8.0												
10,001 to 20,000	10.0												
20,001 to 30,000	12.5												
Over 30,001	15.0												
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	6.) The Transformer fencing shall be at 1.0 M (minimum) distance from the pit wall. The Height of fencing shall be 2.5 M (minimum) and fencing shall have personal entry gate and removable type fencing/gate for transformer withdrawal. 7) The transformer firewall, pit sizing and clearances from adjacent building/structures etc. shall be as per IS 1646/CBIP manual on Transformer 8) However, for all outdoor transformers of oil capacity less than 2000 litre, a trench of suitable size shall be provided all around at a distance of 1.0 m (minimum) from transformer outer edge. A sump pit shall be provided for each trench. b) Layout requirements for Electrical MCC/switchgear rooms 1. Separate Switchgear Rooms shall be provided for each unit. For TG building, all HT boards shall be provided in HT switchgear room at only one floor and all LT boards shall be provided in LT switchgear room only. 2. The following clearances shall be maintained for HT Switchboard. a.) Front Clearance i) For one Row of Swgr. - 2.0 M (Min) ii) For two Rows of Swgr. - 2.5 M (Min) b.) Back Clearance - 1.5 M (Min.) c.) Side Clearance Min. 800 mm, however provision to be made for any additional panel in future at both ends. Therefore end clearance shall be 800+width of panel (including spare panels/dummy panels etc.) 3. The following clearances shall be maintained for LT Switchboard. a.) Front Clearance i) For one Row of Swgr - 1.5M (Min) ii) For two Rows of Swgr - 1.5/1.75M depending upon the depth of panels etc b.) Back Clearance i) For single front - 1.0M (Min) ii) For double front - 1.5M (Min) c.) Side Clearance Min. 800 mm, however provision to be made for any additional panel in future at both ends. Therefore end clearance shall be 800 mm + width of panel. For offsite areas, HT Switchboard clearances shall be followed wherever both LT & HT switch boards are in the same MCC room. 4. Height of HT/LT Switchgear Room and Boiler MCC room i) With Bus Duct - 4.5 m (min) ii) Without Bus Duct - 4.0 m (min)			
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		Further no vertical bracings shall be envisaged in HT/LT switchgear room and associated cable vault area. 5. Cable trench/Cable vault For LT switchgear/MCC room at EL 0.0M, minimum 1400 wide x 1400 deep cable trench shall be provided to route the cables. Horizontal cable trays shall be routed in cable trenches. c) Minimum clear working space 1200mm around the equipment e) In buildings having MCC, minimum 2 fire door along with one rolling shutter of adequate size/capacity shall be provided. f) The cable entry and exit from switchgear room shall be from 1.5 mtr (minimum) above FGL.			
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NOTES.

1. ALL DIMENSIONS ARE IN mm.
2. MATERIAL:-2mm THICK MS SHEET.
3. FINISH :-HOT DIP GALVANISED
4. THICKNESS:-3mm COUPLER PLATE 2mm RING.
5. TOLERANCE:-AS PER RELEVANT I.S.

RD	FOR TENDER PURPOSE	A3	DL	REV	-	N	-	-	-	05.07.10	
RC	FOR TENDER PURPOSE	DL	DL	SS	-	RA	-	-	-	05.07.2000	
RB	FOR TENDER PURPOSE	-	-	-	-	-	-	-	-	07.04.2000	
RA	FOR TENDER PURPOSE	-	-	-	-	-	-	-	-	07.04.2000	
REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD	M	E	C	C&d	ARCH	APPD	DATE
CLEARED BY											
एन टी पी सी NTPC NTPC LTD. (A GOVERNMENT OF INDIA ENTERPRISE) ENGINEERING DIVISION											
PROJECT STANDARD											
TITLE LADDER TYPE CABLE TRAY.											
SIZE A4	SCALE NTS	DRG. NO. 0000-211-PDE-A-001								REV. NO. RD	

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TITLE

2X660 MW THDC Khurja STPP**DOUBLE GIRDER EOT CRANES ABOVE 100T****SPECIFIC TECHNICAL REQUIREMENTS**

SPECIFICATION NO. PE-TS-475-501-A501

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Section

IC

Date JULY '20

SUB-SECTION – IC**DATA SHEET**

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TECHNICAL SPECIFICATION FOR
140/25T TG HALL EOT CRANE
2X660 MW THDC Khurja STPP

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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 crane	Two (2) nos.	
1.5.0		Crane classification	M5 (Mechanical and 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	140/25T	
1.7.1		Main hoist		
	a.	Rated SWC – tonnes	140T	
	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	28.1 m	
1.9.0		Operation from	Cabin + Pendent Push Button+ Radio remote control	
2.00		CRANE PERFORMANCE		
2.1.0		Crane speed with full load	Full speed M/Min	Creep speed M/Min

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	a.	Main hoist	1.6	0.16 (10% of main speed thru' VVVF drives)
	b.	Aux. hoist	7.5	0.75 (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)	30.0	3.0 (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	As per Crane clearance diagram	
	b.	Aux Hoist	As per Crane clearance diagram	
2.4.0		Hook Approaches		
	a.	Main hook (cabin end)	As per Crane clearance diagram	
	b.	Aux. Hook (cabin-end)	As per Crane clearance diagram	
	c.	Main hook (other end)	As per Crane clearance diagram	
	d.	Aux. Hook (other end)	As per Crane clearance diagram	
2.5.0		Hand Rail Pipes	32 mm NB Medium class of IS: 1161 having top and bottom rail at height of 1050 mm and 600 mm and vertical post spacing not exceeding 1500 mm with provision of kick plate (100 mm high and 6mm thick)	
3.0.0		COMPONENT DETAILS		
3.1.0		Trolley	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	Mild Steel (Fe410) Gr-B IS: 2062 100% killed, normalized & Ultrasonically tested	
	d.	Centre to centre distance of wheels (on the same rails)	*	
	e.	Whether jacking pads for lifting trolley provided or not	Yes	
3.2.0		Rope drums	Main hoist	Aux. Hoist

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	a.	Dimensions in mm length and diameter (PCD)	*		*	
	b.	Material (Indicate IS)	Seamless pipe ASTM -106 Gr. B or fabricated rolled section to IS: 2062 Gr. 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	*		*	
3.3.0		Rope details				
	a.	Construction	Extra flexible plough steel , 6 x 36 or 6x37 construction			
	b.	Grade	*			
	c.	Standard conforming to	IS: 2266 (latest edition)			
	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. B / CS Gr. 280-520 IS: 1030 Design as per IS: 3177- 1999			
	b.	Diameter of main sheaves in mm on Root	*		*	
	c.	Diameter of Equalizing sheaves (in mm) on Root	Should not be less 62% of calculated main sheave diameter		Should not be less 62% of calculated main sheave diameter	
	d.	Type of guards provided	Fabricated from 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			
3.5.2		Coupling details (between gear box and wheels)	Cross Travel (CT)		Long Travel (LT)	

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	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	217 to 255 BHN			
	h.	Hardness (BHN) – pinion	266 to 300BHN			
	i.	Difference in Gear and pinion hardness	Min 20 BHN			

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	j.	Materials (gear/pinions)	Main Gears En 9/ 55C8/ IS2707 Gr. 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 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	217 to 255 BHN			
	h.	Hardness (BHN) – pinion	266 to 300BHN			
	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	C55 Mn75			
	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.		8 nos.	
	i.	Specification conforming to	IS: 3177			
	j	Arrangement of lubrication	Grease			
3.8.0		Lifting hooks	MH		AH	

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	a.	Type	Ramshorn shank with safety latch swiveling type as per latest edition of DIN-15402		Plain with safety latch swiveling type as per latest edition of IS: 15560	
	b.	Safe lifting capacity	140 T as per DIN-15402		25 T as per IS: 15560	
	c.	Material	✓ As per DIN-15402 ✓ Class 3 for hook of grades L & M respectively as per IS 1875:1992 for hooks conforming to IS : 15560			
	d.	Standard conforming to	DIN-15402		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 (In calculation crane is considered to be loaded with SWL) to rest from speed of 50% 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			
	b.	Diameter of brake in mm	*	NA	*	NA
	c.	Torque rating Kg. M	*		*	
	d.	Number provided per motor	2		2	
	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
3.10.2		Travel Motions	CT	CT micro	LT	LT micro

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	a.	Type of brake (ac / dc / thruster)	AC Electro-Hydraulic Thruster operated		AC Electro-Hydraulic Thruster operated	
	b.	Dia of brake in mm	*		*	
	c.	Torque rating KgM	*		*	
	d.	Number provided per motor	2	NA	2	NA
	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)	Pony motor NA as creep speed through VVVF drive			
3.12.0		Bearings	Crane hook	Trolley wheels	Rope drum	Gear box
	a.	Type	Antifriction ball / roller bearings			
	b.	Number provided for each	As per assembly requirements			
	c.	Method of lubrication	Centralised grease lubrication with hand operated grease pump for all bearings as per bidder's standard proven practice.			
	d.	Bearing life	10,000 working hours.			
3.13.0		Bridge girder				
	a.	Type & Quantity	Box type – 2 nos. Material: Mild steel, grade '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 or fusion welding/ CR-100
	b.	Standard conforming to	IS: 3443
	c.	Weight per metre	*
	d.	Material	50C12
	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.	Walkways	Access walkways of not less than 800 mm (clear) with hand railing of height of 1100 mm along the both side of bridge girder and cross over walkways.
	c.	Type of access from gantry girder level to crane bridge	Rung ladder at ends from gantry girder level walkway to crane bridges walkway
	d.	Type of access to maintenance cage from crane bridges walkway	Rung ladder
	e.	Type of access to Cabin from crane bridges walkway	By Staircase
	f.	Provided at both ends	Yes
3.16.0		Operators cabin	
	a.	Type of construction	Open type
	b.	Area and minimum clear height	2500x1850 mm with a head room of 2000 mm
	c.	Operator's seat	Revolving type
	d.	Warning gong	A foot operated electric warning horn of double bell type suitable for 240 V AC. of noise level 95 dB at 3.5 m. One brass gong suspended outside the Cabin and operated from inside.

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			A distinct type alarm with conspicuous warning lights on either side of the crane bridge to indicate overloading of crane.			
	e.	Position of controllers	In front/ side of operator's chair			
	f.	Ventilation	One no non oscillating ventilating electric fan in cabin			
	g.	Siren	One (1) heavy duty type industrial siren shall be provided with Each crane. The siren shall be operated from foot-switch in the Operator's cabin.			
3.17.0		End carriage span (wheel base)	As per IS 807 (latest edition)			
3.18.0		Motors				
3.18.1		Hoist Motions	MH	MH micro	AH	AH micro
	a.	Type	Three phase Squirrel Cage Induction motors to be operated from VFD system shall be suitable for speed range and torque without exceeding temperature rise limits as specified elsewhere in this specification. These 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 shall Be suitable for speed range and torque without exceeding temperature rise limits as specified elsewhere in this specification. These 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 $\pm$ 10%, 3 Ph., 4 wire, 50 Hz, +3/-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 50 C shall have Motor rating will be calculated keeping margin of at least 10% 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 70 C			
	j.	Number of starts/ hour	150 starts / hr			
	k.	Contactors for motor	*			

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	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 shall be suitable for speed range and torque without exceeding temperature rise limits as specified elsewhere in this specification. These 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 shall be suitable for speed range and torque without exceeding temperature rise limits as specified elsewhere in this specification. These 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
	d.	Voltage, phase and frequency	415V $\pm$ 10%, 3 Ph., 4 wire, 50 Hz, +3/-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 50 C shall have Motor rating will be calculated keeping margin of at least 10% 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 70C			
	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 pull out torque	Duty S4 and pull out torque 275% of full load torque			

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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 55			
3.20.0		Power conductors (DSL)				
	a.	Type	LT: PVC shrouded Cu/Al conductor bus bar. CT: EPR insulated, copper conductor trailing cables, as per IS: 9968, on the bridge.			
	b.	Size	Shall be sized with a margin of 10% over load requirement. Voltage drop at motor terminal shall be limited to 2% at extreme positions. Protective cover over DSL to be provided.			
	c.	Material	*			
	d.	Numbers	*			
	e.	Length	Suitable for bay length			
	f.	Guard provided	Yes			
3.21.0		Protective Panel				
	a.	Make	OEM			
	b.	Size	*			
	c.	Material	Sheet steel 2 mm size			
	d.	Numbers and location	One number located in cabin			
	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			

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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 up to 50 ° C without derating.
3.25.0		Cable	Power
	a.	Material	Mentioned in Electrical Portion
	b.	Type	
	c.	Size	
	d.	Voltage grade	1100 V
	e.	Voltage drop	Cable from main isolating switch (1.5M above operating floor) to motor terminal shall be so sized that the voltage drop does not exceed 2% of rated voltage at motor terminals.
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 bimetallic with single phasing preventor.
3.28.0		Power supply	Owner shall provide Two (2) nos. 415 V, 3 phase, 4 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	(Dry type, With Insulation Class B or Better)
	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 tube + Bulk head fitting with 60W incandescent lamp – 1 each 2 nos. 24V- 5A-3 pin industrial socket.
	b.	Over Bridge	4 no. 60W Bulk head fittings with Florescent lamp lamps and 4 nos.24V 20A -3 pin Industrial socket
	c.	Under bridge	4 nos. 250 W HPSV lamps
	d.	For inspection of crane components	One (1) portable 40W hand lamp with min. half span length flexible cable for inspection of crane components
3.31.0		Fire Extinguisher	
	a.	Type and size	4.5 kg CO ₂ type
	b.	Location	One in cabin and Three on bridge

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TECHNICAL SPECIFICATION FOR
140/25T TG HALL EOT CRANE
2X660 MW THDC Khurja STPP

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3.32.0		Maintenance cage	Suitable inspection cages to accommodate two persons to facilitate inspection of down shop lead.
3.33.0		Type of control for Hoists/ CT/LT operation	Through VVVF drive
3.34.0		VVVF Drive	Mentioned Elsewhere in the specification
3.35.0		Mechanical overload protection (Load Cell)	To be provided for hoist mode
3.36.0		Painting	As per Annexure- IV
3.37.0		Isolating switch	Two nos. isolating switch shall be provided at extreme ends of the bay length, at a distance of approximately 20 mtrs. From the centre line of first & last column for maintenance of the cranes.
3.38.0		Whether tandem operation envisaged	No

Note: Other requirements for the system.

- Centralized grease lubrication with hand operated grease pump for all bearings.
- 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.
- Additional features in operator's cabin and on pendant push button:
 Emergency Push Button
 Switches for lights and bells
 Lamps for Power 'ON' indication and emergency corner switch operation
- Two nos. 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.
 - The basic wind speed "Vb" at ten metres above the mean ground level: 39 meters /second
 - The risk coefficient "K1" 1.06
 - Category of terrain Category-2
 - Other factors in line with IS 875.

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2X660 MW THDC Khurja STPP**DOUBLE GIRDER EOT CRANES ABOVE 100T****STANDARD TECHNICAL REQUIREMENTS**

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SECTION – II**STANDARD TECHNICAL SPECIFICATION****SUB-SECTION IIA – Standard Technical Requirement (Mechanical)**

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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

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xii)	IS 3043	Code of practice Earthing	
xiii)	IS: 3938	Electric Wire Rope Hoists.	
xiv)	IS: 2147	Degree of protection provided by enclosures for Low voltage switchgear and control gear.	
xv)	IS: 1554 Part I	PVC insulated (Heavy-duty) electric cables for working voltages up to and including 1100 volts.	
xvi)	IS: 691	Flexible trailing cables rubber insulated.	
xvii)	IS: 1653	Steel conduits for general engineering purposes.	
xviii)	IS: 2509	Rigid non-metallic conduit for electric- Installations	
xix)	IS: 2062	Steel for General Engineering purposes.	
xx)	IS: 1030	Carbon Steel castings for general engineering purposes.	
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	



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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.

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: 3613.4e

3.1.5 VOID

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

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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.

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%.

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3.2.1.2 The calculated strength of riveted joint or joints made by friction grip bolts in structure members shall be not less than the calculated net strength of the member.

3.2.1.3 Bolts used in shear shall be fitted in to reamed hole.

3.2.1.4 Nuts and Bolts will be as per IS:1363, IS: 1364 and IS: 1367
High-tension friction grip bolts as per IS: 3757 and High- tension friction grip nuts as per IS: 6623

3.2.1.5 Transverse filled welding on load carrying member shall be avoided.

3.2.1.6 All butt welds on structural members subjected to tensile stress shall be of radiographic quality as ASME Sec VIII Div.1 acceptance norms.

3.2.1.7 Fillet welding on load carrying members shall be avoided.

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

3.2.1.9 The cranes working out door or in corrosive environment, an allowance of 1.5 mm shall be added to the calculated thickness.

3.2.1.10 Minimum thickness of chequered plates for platform shall be over 6 mm over plain. Chequered plates shall not be considered for strength calculations of load carrying members.

3.2.1.11 Splice shall be designed to resist all the forces and moments to which it is subjected to plus 50% thereof.

3.2.1.12 However, in no case the strength developed by the splice shall be less than 50% of the effective strength of the material spliced. Splices shall be proportioned and arranged, so that the gravity axis of the splice in line with the gravity axis of the member joined so as to avoid the eccentricity of the loading.

3.2.1.13 The material of construction of the major components shall be as specified in the specification/data sheet. Manufacturer are however free to use alternate material material which are superior for the intended service. But in all the cases, prior concurrence of the purchaser is must.

3.2.1.14 Splices shall be designed to resist one and half times the forces and moments to which it is subjected, but in no case it shall be less than 2/3rd of the effective strength of the 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

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

3.2.2 Bridge Girder

3.2.2.1 The bridge girder shall consist of a box construction with double Web plate girders or lattice girders and shall be of adequate strength to withstand the rolling loads and other stresses it is subjected to.. The design of the girder shall be in accordance with latest edition of IS- 807.

3.2.2.2 Maximum deflection of the bridge girder, with safe working load, shall not exceed 1/900 of the span or as 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.

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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 Plate Girder shall be 25 or as per IS 807 latest edition.

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 1/6th of the span up to 20m, 3.5m for spans above 21m but less than 24.5m & 1/7th of span above 24.5m (as per IS 807 latest edition). 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**

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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..

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: 1239 having top and bottom rail at height of 1100 mm and 600 mm and vertical post spacing not exceeding 1500 mm with provision of kick plate (100 mm high and 6mm thick) 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.

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The pitch diameter of the drum shall be as per IS - 3177 or as specified elsewhere. The depth of the groove shall not be less than 0.35 times the rope diameter. Each rope shall be clamped to drum with two clamp wedges with at least two numbers of bolts on each clamping arrangement.

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

3.3.2 Hoist ropes

Ropes of 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. 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

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elsewhere. When twin drives are used, these shall be operating in unison to avoid skewing effect. The drives shall be interlocked for simultaneous starting, stopping & speed control.

3.3.7 CT drive

Trolley drive shall be achieved by 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 without disturbing the bottom half. Gear shafts shall be supported on ball/roller bearings mounted in gearbox unless specially agreed otherwise. The gear boxes shall be provided with breather, air vent, oil level indicator, dip stick, drain plug and lugs for lifting.

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

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

3.3.10 **Bearing**

3.3.10.1 Ball and roller antifriction bearing of 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 manufacturer's recommendations.

3.3.10.2 Provision shall be made for service lubrication of all bearings. Lubrication arrangement and clamping shall be done neatly. Bends in pipe shall be done with the help of machine. Bearing enclosures shall be designed as far as practicable to exclude dirt and shall prevent oil leakage. Accessibility should be such that parts may be safely lubricated from the walkway or ladder when the crane is not in motion.

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

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persons. And guarded for safety and correctly located for the intended service. Suitable access to the cage shall be provided. Repair cage shall be provided at the corner of the crane.

3.3.13 Lifting hook

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

3.3.14 LIFTING HOOK BLOCK ASSY

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 de-rating 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.

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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 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 equipment on the crane and shall be connected to suitable collecting gear of earth conductor. Voltage drop across the down shop leads shall be less than 3% or specified in data sheet "A". 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 up on 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 manufacturer's works in accordance with IS-325/as per agreed Quality plan & Reports shall be submitted for approval. Motors shall comply with the requirement of IS-325 or as per the motor spec.

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3.4.2.3

All the motors shall be provided with lifting lugs two earth terminals of adequate size to accept the earthing conductors shall be provided at diametrically opposite points unless specifically designed For higher speeds, motors shall be capable of with-standing 2.5 times the rated speed.

3.4.2.4

Motors shall be painted in line with painting instructions specified in Painting Scheme Annexure IV attached along with the technical specification.

3.4.3

Limit switches
The hoist mechanism of the crane shall be provided with rotary type limit switch to open the control circuit & in order to prevent the crane hook from over hoisting and over lowering, one gravity type back up limit switch of hand reset type shall also be provided. This switch will operate in the event of failure of main limit switch. Lever operated limit switches shall be provided at both ends of longitudinal travel and cross traverse. These limit switches shall be self-reset type. The limit switches shall be as per “Data Sheet A”

3.4.4

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 cannot 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 cannot 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.

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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

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-54 or as specified in data sheet A. All the equipment inside the panel shall have permanent identification. The panels shall be front connected type with front-hinged door for access to wiring and terminals. Engraved nameplate shall be furnished for all panels and also for the equipment and devices mounted there on.

The following minimum equipment 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 equipment as per supplier's standard practice. Air break contactors shall conform to category AC-4 duty. The main contacts shall have the rating for 5 Amps or as specified in the data sheet A. The contactor drop off voltage shall be between 45-50% of rated voltage.

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

3.4.8 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 preventer.

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



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three main contacts and 2 No. & 2 NC auxiliary contacts.

- g) The main contacts shall have the ratings as per duty requirement but auxiliary contact shall be rated for 5 amp 240V AC. The contactor drop off voltage shall be between 45-50% of rated voltage. The contactor coil shall be suitable for 240V AC supply.
- h) The auxiliary contactors shall have 4 No. + 4 NC contacts for control and interlocking purposes. The contacts shall be convertible. The contacts rating shall be suitable for 5 amps at 240 Volts AC.
- i) Adequate protection for overload and short circuit shall be provided for all the three phases of each motor.
- j) Double pole switch fuse unit for control circuit of the contractor 'START (push button and a pilot lamp with the red lens for indicating the contactor "CLOSED" shall be furnished.

3.4.11 Illumination

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) CFL fixtures shall be used for lighting operator's cabin and bridge platform.
- 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

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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 Separately.

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

3.4.15 **Wiring Systems**

- a) All electrical equipment, accessories and wiring shall have tropical protection involving special treatment of insulation and metal against fungus, insects and corrosion. All cabling shall be carried out using XLPE insulated fire resistant (FRLS) cables & wiring by Heat resistance PVC wires with stranded conductor
- b) All wiring shall be done with 1100V grade fire resistance PVC insulated wire in conduits or by 1100V grade PVCA PVC cables with extruded inner sheath.
- c) 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.
- d) Armoured cables or un-armoured running through the flexible conduits may be used for power wiring / control and auxiliary circuit wiring shall run through flexible conduits.
- e) Each motor shall be wired independently. Power and control wiring shall be effectively separated.
- f) Each wire shall be identified at both ends with wire designation in accordance with circuit wiring diagram.
- g) All wire termination to the panels shall be provided with clamp type connections screw. Screw Type terminals with screw directly impinging on conductors are not acceptable.
- h) Multi way terminal blocks complete with screw nut, washer and marking strips shall be furnished for terminating the panel wiring.
- i) Not more than two wires shall be connected to any terminal on either side of terminal block. If necessary number of terminals shall be jumped together to provide the wiring points
- j) Each terminal block shall be marked with designation in accordance with conductors wiring diagram.

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1.0 General

a)

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

b)

Inverter construction and related devices:

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

c)

Programming of VVVF Drives.

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

d)

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

e)

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

1.1 Experience

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

1.2 Local support



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

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

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

2.0 Basic requirements for the AC Drives

2.1 General requirements

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

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

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

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

Rated Input Voltages	380V -15% 480V +10%, three-phase
Rated Input Frequency	50Hz +/- 5%
Output Voltage	0 – Input voltage, three-phase
Output Frequency Range	0 to 400 Hz
Acceleration / Deceleration Time	0.01 – 999s, adjustable, linear, with S, with U or customised shapes
Overload capability (Constant Torque)	150% of nominal current for 1min.
Operating ambient Temperature	-10°C up to 50°C(shall be derated suitably)



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	if not rated at 50°C)
Storage ambient Temperature	-25°C up to 70 °C
Maximum operating altitude	1000 m without de-rating, 1000...3000 (shall be de-rated suitably)
Max. Relative Humidity	95 %, without condensation and dripping water.
Main Protections	Over current, short circuit between phase, short circuit between phase and ground, input phase loss, output phase loss, motor overload, over speed, over voltage, under voltage, drive over temperature

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

The VVVF drives shall have all necessary protections i.e input phase loss, earth fault, over voltage, output short circuit, load loss , input transient protection, overload etc

Suitable encoder shall be provided for all motions.

3.0 User interface

3.1 General

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

3.2 Inputs and outputs

A. At least, the following standard Inputs and Outputs shall be provided, to be used in interface with the control system:

Analogue Inputs	:	1 x Programmable differential voltage input $\pm 10V$, 1 x Programmable current input 0(4) - 20mA 1 x Programmable voltage input 0 – 10V
Analogue Output	:	1 x Programmable analogue outputs 0(4) - 20mA or 0 – 10V
Logic inputs	:	6 x Programmable logic Inputs isolated from the mains

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Relay Outputs : 2 x Programmable Digital outputs with a changeover dry contact

All the control terminals shall be clearly marked.

- B. At least, it shall be possible to assigned the following functions to the I/Os:

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

3.4 Programming terminal

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

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vi) Motor Speed

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

i) Drive Status

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

i) Run

ii) Stop

iii) Local / Remote selection.

iv) Forward/Reverse (if function enabled)

v) Accelerate

vi) Decelerate

vii) Parameter setting

3.5 Application programming

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

3.6 PC Tools

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

4.0 Software features

A. Restart

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

B. Brake logic control

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

5.0 Preferred makes:

As per attached sub-vendor list

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SUB-SECTION – IIA**Site Storage and Preservation Guidelines**

CONTENT

- 1 SCOPE OF THE DOCUMENT
- 2 PURPOSE OF STORAGE & PRESERVATION
- 3 MEASURES TO BE TAKEN FOR STORAGE AND PRESERVATION
 - a) GENERAL STORAGE REQUIREMENTS
 - b) GENERAL PRESERVATION REQUIREMENTS
 - c) GENERAL INSPECTION REQUIREMENTS
- 4 TYPE OF STORAGE FOR VARIOUS EQUIPMENT
5. CONCLUSION
6. STACKING ARRANGEMENT FOR PLATES AND STRUCTURAL STEEL

1. SCOPE OF THE DOCUMENT

This guideline is prepared in intent to provide proper site storage and preservation of the Mechanical, Electrical and C & I items / equipment supplied under various bought out packages/items. This storage procedure shall be followed at different power plant sites by concerned agency for storage and preservation from the date of equipment received at site until the same are erected and handed over to the customer.

2. PURPOSE OF STORAGE & PRESERVATION

Many of the items may be required to be kept in stores for long period. It shall therefore be essential that proper methods of storage and preservation be applied so that items do not deteriorate, loose some of their properties and become unusable due to atmospheric conditions and biological elements.

3. MEASURES TO BE TAKEN FOR STORAGE, HANDLING & PRESERVATION

a) GENERAL STORAGE REQUIREMENTS

1. To the extent feasible, materials should be stored near the point of erection. The storage areas should have adequate unloading and handling facilities with adequate passage space for movement of material handling equipment such as cranes, fork lift trucks, etc. The storage of materials shall be properly planned to minimise time loss during retrieval of items required for erection.
2. The outdoor storage areas as well as semi-closed stores shall be provided with adequate drainage facilities to prevent water logging. Adequacy of these facilities shall be checked prior to monsoon.
3. The storage sheds shall be built in conformity with fire safety requirements. The stores shall be provided with adequate lights and fire extinguishers. 'No smoking' signs shall be placed at strategic locations. Safety precautions shall be strictly enforced.
4. Adequate lighting facility shall be provided in storage areas and storage sheds and security personnel positioned to ensure enforcement of security measures to prevent theft and loss of materials.
5. Adequate number of competent stores personnel and security staff shall be deployed to efficiently store and maintain the equipment / material.
7. The equipment shall be stored in an orderly manner, preserving their identification slips, tags and instruction booklets, etc., required during erection. The storage of materials shall be equipment-wise. Loose parts shall be stored in sheds on racks,

preserving the identification marks and tags in good condition. The group codes shall be displayed on the racks

6. At no time shall any materials be stored directly on ground. All materials shall be stored minimum 200 mm above the ground preferably on wooden sleepers

b) GENERAL PRESERVATION REQUIREMENTS

1. All special measures to prevent corrosion shall be taken like keeping material in dry condition, avoiding the equipment coming in contact with corrosive fluid like water, acid etc.
2. Materials which carry protective coating shall not be wrapped in paper, cloth, etc., as these are liable to absorb and retain moisture. The material shall be inspected and in case of signs of wear or damages to protective coating, that portion shall be cleaned with approved solution and coated with an approved protective paint. Complete record of all such observations and protective measures taken shall be maintained.
3. Generally equipment supplied at site are properly greased or rust protective oil is applied on machined/ fabricated components. However periodic inspection shall be carried out to ensure that protection offered is intact.
4. While handling the equipment, no dragging on the ground is permitted. Avoid using wire rope for lifting coated components. Use polyester slings (if possible) otherwise protective material (e.g. clothes, wood block etc.) should be used while handling the components with rope / slings
5. For Equipment supplied with finished paint, touch paint shall be done in case any surface paint gets peeled off during handling. Otherwise such surfaces shall necessarily be wrapped with polythene to avoid any corrosion. Further for equipment wherein finish coat is to be applied at site, site to ensure that equipment is received with primer coat applied.
6. It shall be ensured by periodic inspection that plastic inserts are intact in tapped holes, wherever applicable.
7. Pipes shall be blown with air periodically and it shall be ensured that there is no obstruction.
8. Silica gel or approved equivalent moisture absorbing material in small cotton bags shall be placed and tied at various points on the equipment, wherever necessary.
9. Heavy rotating parts in assembled conditions shall be periodically rotated to prevent corrosion/jamming due to prolonged storage.

10. All the electrical equipment such as motors, generators, etc. shall be tested for insulation resistance at least once in three months and a record of such measured insulation values shall be maintained.
11. Following preservatives/preservation methods can be used depending upon type of equipment
 - a. Rust preventive fluid (RPF)
 - b. Rust protective paints
 - c. Tarpaulin covers, in case of outdoor storage
 - d. De-oxy aluminate for weld-ments

c) GENERAL INSPECTION REQUIREMENTS

1. Period inspection of materials with specific reference to –
 - Ingress of moisture and corrosion damages.
 - Damage to protective coating.
 - Open ends in pipes, vessels and equipment -
 - In case any open ends are noticed, same shall be capped.
2. Any damages to equipment / materials.
 - In case of any damages, these shall be promptly notified and in all cases, the repairs / rectification shall be carried out.
 - Any items found damaged or not suitable as per project requirements shall be removed from site. If required to store temporarily, they shall be clearly marked and stored separately to prevent any inadvertent use.

4. TYPE OF STORAGE FOR VARIOUS EQUIPMENT

The types of storage are broadly classified under the following heads:

i **Closed storage with dry and dust free atmosphere. (C)**

The closed shed can be constructed by using cold-rolled / tubular components for structure and corrugated asbestos sheets / galvanised iron sheets for roofing. Brick walls / asbestos sheets can be used to cover all the sides. The floor of the shed can be finished with plain cement concrete suitably glazed. The shed shall be provided with proper ventilation and illumination.



ii **Semi-closed storage. (S)**

The semi closed shed can be constructed by using cold-rolled / tubular components for structure and corrugated / asbestos sheets for roofing. The floor shall be brick paved. If required a small portion of sides can be covered to protect components from rainwater splashing onto the components.





iii Open storage (O)

The open yard shall be levelled, well consolidated to achieve raised ground with the provision of feeder roads for crane approach along with access roads running all sides. One part of the open yard shall be stone pitched, levelled and consolidated with raised ground suitable for storing / stacking heavier and critical components with due space to handle them by cranes etc . Adequate number of sleepers, concrete block etc. to be provided to make raised platforms to stack critical materials.

A separate yard to be identified as “scrap yard” slightly away from main open yard to store wooden/steel scraps, which are to be disposed off. This is required to avoid mix up with regular components as well as to avoid fire hazard.

Some of the components, which are having both machined & un-machined surfaces and are bulky, shall be stored in open storage area on a raised ground and suitably covered with water proof / fire retardant tarpaulin.



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The equipment listed below shall be stored and inspected as per requirement mentioned in the table below.

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
Raw material /mechanical items like pipes, plates, structure sections etc.)				
1.	Steel pipes (lined/unlined)	S	Damage , paint, corrosion, rubber lining peeling	Provide end cap
2.	MS Plates	S	Damage, paint, corrosion	
3.	SS Plates	S	Damage	
4.	Non-metallic pipes	S	Damage, cracks	Provide end cap
5.	Stainless steel pipes	S	Damage ,	Provide end cap
6.	MS sections, beams	S	Damage, paint, corrosion	
7.	Cable trays	S	Damage, condition of preservations	
8.	Insulation sheets	S	Damage	
9.	Insulation	C	Damage, packing	
10.	Hangers Rods	S	Damage, paint, packing	
11.	Tubes	S	Damage, paint , packing	Provide end cap
12.	Hume pipes	O	Damage	
13.	Castings	O	Damage, paint, corrosion	
Fabricated mechanical items (pressure vessels, tanks etc.)				
14.	Pressure vessels (unlined)	O	Damage, paint, corrosion,	Covered nozzles
15.	Atmospheric storage tanks (unlined)	O	Damage, paint, corrosion	Covered nozzles

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
16.	Pressure vessels (lined)	S	Damage, paint, corrosion, rubber lining	
17.	Atmospheric storage tanks(lined)	S	Damage, paint, corrosion, rubber lining	
18.	Support structures	O	Damage , paint, corrosion	
19.	Flanges	C	Damage , paint, corrosion	
20.	Fabricated pipes	S	Damage , paint, corrosion	Provide end cap
21.	Vessels internals	C	Damage , paint, corrosion ,packing	
22.	Grills	S	Damage , paint, corrosion	
23.	Angles	S	Damage , paint, corrosion	
24.	Bridge mechanism/clarifier mechanism	O	Damage , paint, corrosion	
25.	Cranes, rails	S	Damage , paint, corrosion	
26.	Stair cases	O	Damage , paint, corrosion	
27.	Ladders/handrails	O	Damage , paint, corrosion	
28.	Fabricated ducts	S	Damage , paint, corrosion	
29.	Isolation Gates	O	Damage , paint, corrosion	
30.	Fabricated boxes/panels	S	Damage , paint, corrosion	
Mechanical components like valves, fittings, cables glands, spares etc.)				
31.	Valves	S	Damage , packing	

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
32.	Fittings	S	Damage , packing	Provide end cap
33.	Cable glands	C	Damage , packing	
34.	Tools & tackles	C	Damage , packing	
35.	Nut , bolts, washers,	C	Damage , packing	
36.	Gasket & Packings	C	Damage , packing	
37.	Copper tubes	C	Damage , packing, corrosion	Provide end cap
38.	SS tubing	C	Damage , packing	Provide end cap
Rotating assemblies (pumps, blowers, stirrers, fans, compressors etc.)				
39.	Pumps	S	Damage , packing, corrosion	Shaft rotation
40.	Blowers/Compressors	S	Damage , packing, corrosion	Shaft rotation
41.	Agitators/stirrers/radial launders	C	Damage , packing, corrosion	Shaft rotation
42.	Rollers for chlorine tonner mounting	C	Damage , packing, corrosion	
43.	Centrifuge	S	Damage , packing,	
44.	Gear box	C	Damage , packing, corrosion	
45.	Bearings	C	Damage , packing, corrosion	
46.	Fans	S	Damage , packing, corrosion	
47.	Dosing skids	S	Damage , packing, corrosion	
48.	Pump assemblies	S	Damage , packing, corrosion	
49.	Air washers(INTERNALS)	S	Damage , packing	
50.	Air conditioners (split)	C	Damage , packing	

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
51.	Elevators(CONTAINERIZED)	O	Damage , packing, corrosion	
52.	Chillers/VA machines	S	Damage , packing	
53.	Air handling Unit/Package unit	S	Damage , packing	
54.	Chlorinators & Evaporators	C	Damage , packing	
55.	Ejectors	C	Damage , packing	
56.	Electrolyser	C	Damage , packing	
Miscellaneous items like chain pulley blocks, hoists etc.				
57.	Chain pulley blocks	S	Damage, Packing	
58.	Electric hoists	S	Damage, Packing	
59.	Fire extinguishers	C	Damage, expiry date	
60.	Fork Lift Truck	S	Damage, Packing	
61.	Hydraulic Mobile Crane	O	Damage, Packing	
62.	Mobile Pick Up & Carry Crane	O	Damage, Packing	
63.	Motor boats	O	Damage, Packing	
64.	Safety showers	S	Damage, Packing	
65.	Diffusers/dampers	S	Damage, Packing	
Chemicals and consumables (acid, alkali, paints, oils, reagents and special chemicals)				
66.	Hydro Chloric Acid (HCl)	Store in canes/ storage tank in dyke area	Date of production/ leakage/fumes	hazardous chemical
67.	Sulphuric acid (H ₂ SO ₄)	Store in canes/ storage tank in dyke area	Date of production/ leakage/fumes	hazardous chemical

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
68.	Sodium hydroxide (NaOH)	Store in canes/ storage tank in dyke area	Date of production/ leakage/ fumes/ breather	hazardous chemical ,breather to be checked for air ingress
69.	Sodium hypo chlorite	To be stored under shed	Date of production/ leakage/ fumes	hazardous chemical ,self-life normally 15-30 days after which strength of chemical decays
70.	Ammonia	S	Date of production/ leakage/ fumes	Store in closed storage tanks, hazardous chemical
71.	CW treatment chemicals	S	Date of production , Self-life	Store in closed canes
72.	RO/UF cleaning chemicals	S	Date of production , Self-life	Store in closed canes
73.	Lime	C	Damage to packing , seepage	Prevent moisture, rain
74.	Alum bricks	C	Damage to packing	Prevent moisture, rain
75.	Poly electrolyte	S		Store in closed storage tanks
76.	Laboratory chemicals(powder)	C	Damage, Packing self-life	
77.	Laboratory chemicals(liquid)	C	Damage, Packing self-life	
78.	Lubrication oils	C	Leakage	
79.	Paints	S	Leakage ,air tightness	
80.	Sand	O	Damage of packing	No hooks
81.	Salt (NaCl)	C	Damage of packing, water ingress	Prevent moisture, rain
82.	Anthracite	S	Damage of packing	
83.	Activated carbon	S	Damage of packing	

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
84.	Thermal insulation	S	Damage of packing	
85.	Cement	C	Damage of packing	Prevent moisture, rain
86.	Gravels	O	Damage of packing	
87.	ION exchange resins	C	Damage , packing	Refer manufacturer guidelines
88.	RO membranes	C	Damage , packing	Refer manufacturer guidelines
89.	UF membranes	C	Damage , packing	Refer manufacturer guidelines
90.	Cleaning chemicals	C	Damage , packing	Refer manufacturer guidelines
91.	Chemicals for analysers/calibration	C	Damage , packing	Refer manufacturer guidelines
Electrical and C & I items (motors, cables etc.)				
92.	Motors	C	Damage , packing	
93.	Cable drums	O	Damage	
94.	Control Panel /control desk, UPS ,JB	S	Damage, Packing	
95.	Instruments(gauges/analysers)	C	Damage	
Special items		As per Manufacturer's item, like Hydrogen cylinders, Ozonator, Analyser, Chlorine dioxide generators etc.		

5. CONCLUSION

Concerned storage agency at site should make sure that loss in equipment performance and wear & tear are minimised through proper storage and preservation. The above are broad guidelines and cover major equipment / materials. However specific storage practices shall be followed as per manufacturer recommendation. All the necessary measures even in addition to the ones mentioned above, if found necessary, should be taken to achieve the objective.

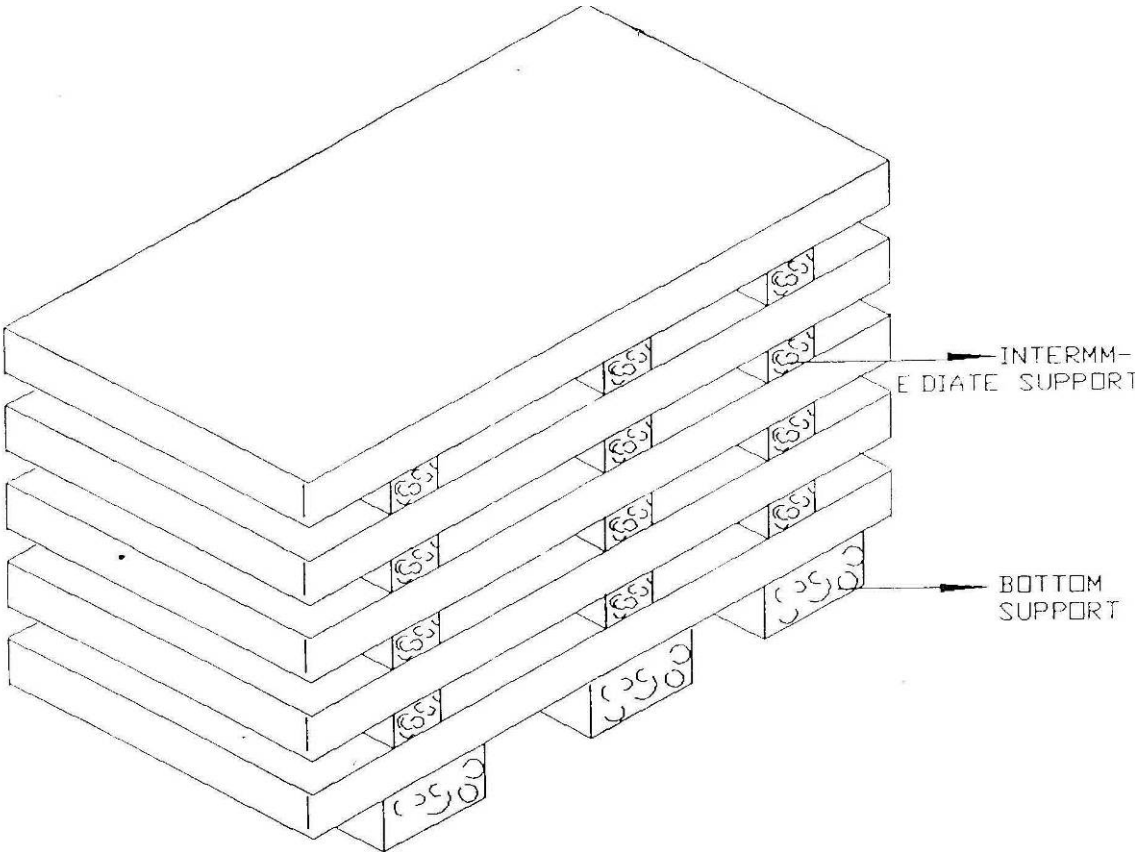


Figure – 1 – PLATE STACKING ARRANGEMENT

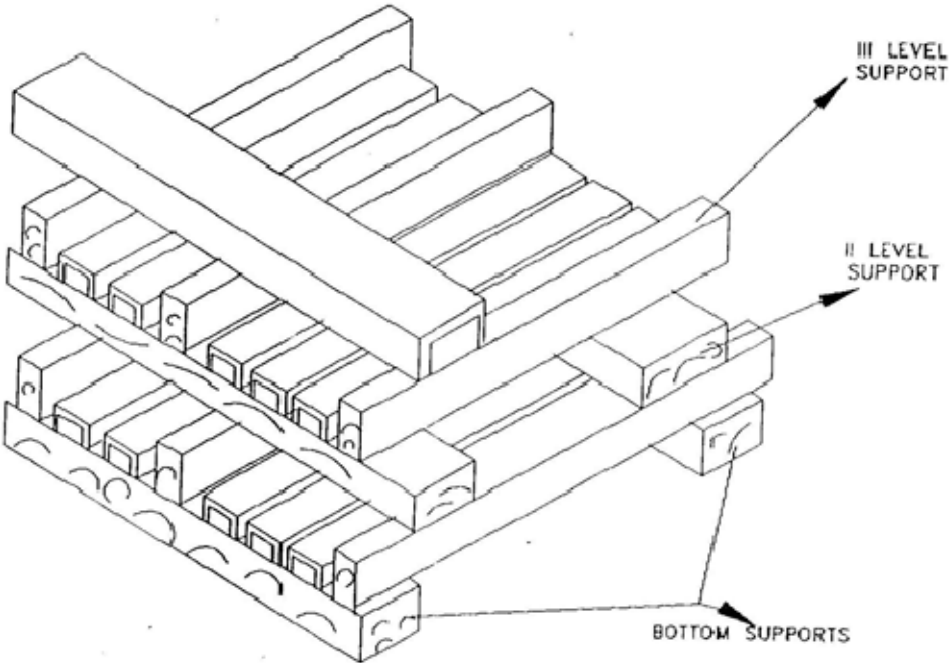


Figure – 2 – STRUCTURAL STEEL STACKING ARRANGEMENT



PART – C

GENERAL TECHNICAL REQUIREMENT (GTR)

KHURJA SUPER THERMAL POWER PROJECT
(2X660 MW)
TURBINE GENERATOR AND ASSOCIATED PACKAGES
BID DOC. NO.: THDC/RKSH/CC-9915-371

SEPARATOR

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5.00.00	Codes & Standards				
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	GENERAL TECHNICAL REQUIREMENTS		
1.00.00	INTRODUCTION		
	This part covers technical requirements which will form an integral part of the Contract. The following provisions shall supplement all the detailed technical requirements brought out in Section-VI, the Technical Specification and the Technical Data Sheets.		
2.00.00	BRAND NAME		
	Whenever a material or article is specified or described by the name of a particular brand, manufacturer or vendor, the specific item mentioned shall be understood to be indicative of the function and quality desired, and not restrictive, other manufacturer's products may be considered provided sufficient information is furnished to enable the Employer to determine that the products proposed are equivalent to those named.		
3.00.00	BASE OFFER & ALTERNATE PROPOSALS		
	The Bidder's proposal shall be based upon the use of equipment and material complying fully with the requirements specified herein. It is recognized that the Contractor may have standardized on the use of certain components, materials, processes or procedures different than those specified herein. Alternate proposals offering similar equipment based on the manufacturer's standard practice will also be considered, provided the base offer is in line with technical specifications and such proposals meet the specified design standards and performance requirement and are acceptable to the Employer. Sufficient amount of information for justifying such proposals shall be furnished to Employer along with the bid to enable the Employer to determine the acceptability of these proposals.		
4.00.00	COMPLETENESS OF FACILITIES		
4.01.00	Bidders may note that this is a contract inclusive of the scope as indicated elsewhere in the specification. Each of the plant shall be engineered and designed in accordance with the specification requirement. All engineering and associated services are required to ensure that a completely engineered plant is provided.		
4.02.00	All equipments furnished by the Contractor shall be complete in every respect, with all mountings, fittings, fixtures and standard accessories normally provided with such equipment and/or those needed for erection, completion and safe operation of the equipment and for the safety of the operating personnel, as required by applicable		
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		codes, though they may not have been specifically detailed in the respective specifications, unless included in the list of exclusions. All same standard components/ parts of same equipment provided, shall be interchangeable with one another.	
4.03.00		For the C&I systems, the Contractor shall be required to provide regular information about future upgrades and migration paths to the Employer.	
5.00.00		CODES & STANDARDS	
5.01.00		In addition to the codes and standards specifically mentioned in the relevant technical specifications for the equipment / plant / system, all equipment parts, systems and works covered under this specification shall comply with all currently applicable statutory regulations and safety codes of the Republic of India, as well as of the locality where they will be installed, including the following: (a.) Indian electricity act (b.) Indian electricity rules (c.) Indian Explosives Act (d.) Indian Factories Act and State Factories Act (e.) Indian Boiler Regulations (IBR) (f.) Regulations of the Central Pollution Control Board, India (g.) Regulations of the Ministry of Environment & Forest (MoEF), Government of India (h.) Pollution Control Regulations of Department of Environment, Government of India (i.) State Pollution Control Board. (j.) Rules for Electrical installation by Tariff Advisory Committee (TAC). (k.) Building and other construction workers (Regulation of Employment and Conditions of services) Act, 1996	
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	(l.) Building and other construction workers (Regulation of Employment and Conditions of services) Central Rules, 1998 (m.) Explosive Rules, 1983 (n.) Petroleum Act, 1984 (o.) Petroleum Rules, 1976, (p.) Gas Cylinder Rules, 1981 (q.) Static and Mobile Pressure Vessels (Unified) Rules, 1981 (r.) Workmen's Compensation Act, 1923 (s.) Workmen's Compensation Rules, 1924 (t.) NTPC Safety Rules for Construction and Erection (u.) NTPC Safety Policy (v.) Any other statutory codes / standards / regulations, as may be applicable.		
5.02.00	Unless covered otherwise in the specifications, the latest editions (as applicable as on date of bid opening), of the codes and standards given below shall also apply: (a) Bureau of Indian Standards (BIS) (b.) Japanese Industrial Standards (JIS) (c.) American National Standards Institute (ANSI) (d.) American Society of Testing and Materials (ASTM) (e.) American Society of Mechanical Engineers (ASME) (f.) American Petroleum Institute (API) (g.) Standards of the Hydraulic Institute, U.S.A. (h.) International Organisation for Standardization (ISO) (i.) Tubular Exchanger Manufacturer's Association (TEMA)		
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	(j.) American Welding Society (AWS)		
	(k.) National Electrical Manufacturers Association (NEMA)		
	(l.) National Fire Protection Association (NFPA)		
	(m.) International Electro-Technical Commission (IEC)/European Norm (EN)		
	(n.) Expansion Joint Manufacturers Association (EJMA)		
	(o.) Heat Exchange Institute (HEI)		
	p) IEEE standard		
	q) JEC standard		
5.03.00	Other International/ National standards such as DIN, VDI, BS, GOST etc. shall also be accepted for only material codes and manufacturing standards, subject to the Employer's approval, for which the Bidder shall furnish, adequate information to justify that these standards are equivalent or superior to the standards mentioned above. In all such cases the Bidder shall furnish specifically the variations and deviations from the standards mentioned else where in the specification together with the complete word to word translation of the standard that is normally not published in English.		
5.04.00	As regards highly standardized equipments such as Steam Turbine and Generator, National /International standards such as JIS, DIN, VDI, ISO, SEL, SEW, VDE, IEC & VGB shall also be considered as far as applicable for Design, Manufacturing and Testing of the respective equipment. However, for those of the above equipment not covered by these National / International standards, established and proven standards of manufacturers shall also be considered.		
5.05.00	In the event of any conflict between the codes and standards referred to in the above clauses and the requirement of this specification, the requirement of Technical Specification shall govern.		
5.06.00	Two (2) English language copies of all-national and international codes and/or standards used in the design of the plant, equipment, and structural works shall be provided by the Contractor to the Employer within two calendar months from the date of the Notification of Award.		
5.07.00	In case of any change in codes, standards & regulations between the date of bid opening and the date when vendors proceed with fabrication, the Employer shall		
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	have the option to incorporate the changed requirements or to retain the original standard. It shall be the responsibility of the Contractor to bring to the notice of the Employer such changes and advise Employer of the resulting effect.		
6.00.00	EQUIPMENT FUNCTIONAL GUARANTEE		
6.01.00	The functional guarantees of the equipment under the scope of the Contract is given in Section-VI Part - A & B of technical specification .These guarantees shall supplement the general functional guarantee provisions covered under General Conditions of Contract.		
6.02.00	Liquidated damages for shortfall in meeting functional guarantee(s) during the performance and guarantee tests shall be assessed and recovered from the Contractor as specified elsewhere in this specification.		
7.00.00	DESIGN OF FACILITIES/ MAINTENANCE & AVAILABILITY CONSIDERATIONS		
7.01.00	Design of Facilities		
	All the design procedures, systems and components proposed shall have already been adequately developed and shall have demonstrated good reliability under similar conditions elsewhere.		
	The Contractor shall be responsible for the selection and design of appropriate equipments to provide the best co-ordinated performance of the entire system. The basic requirements are detailed out in various clauses of the Technical Specifications. The design of various components, assemblies and subassemblies shall be done so that it facilitates easy field assembly and dismantling. All the rotating components shall be so selected that the natural frequency of the complete unit is not critical or close to the operating range of the unit.		
7.02.00	Maintenance and Availability Considerations		
	Equipment/works offered shall be designed for high availability, low maintenance and ease of maintenance. The Bidder shall specifically state the design features incorporated to achieve high degree of reliability/ availability and ease of maintenance. The Bidder shall also furnish details of availability records in the reference plants stated in his experience list.		
	Bidder shall state in his offer the various maintenance intervals, spare parts and man-hour requirement during such operation. The intervals for each type of maintenance namely inspection of the turbine and equipments, inspection of the		
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	steam path and the minor and major overhauls shall be specified in terms of running hours, clearly defining the spare parts and manhour requirement for each stage. Lifting devices i.e. hoists and chain pulley jacks, etc. shall be provided by the contractor for handling of any equipment or any of its part having weight in excess of 500 Kgs during erection and maintenance activities. Lifting devices like lifting tackles, slings, etc. to be connected to hook of the hoist / crane shall be provided by the contractor for lifting the equipment and accessories covered under the specification.		
8.00.00	DOCUMENTS, DATA AND DRAWINGS TO BE FURNISHED BY CONTRACTOR		
8.01.00	Bidders may note that this is a contract inclusive of the scope as indicated elsewhere in the specification. Each of the plant and equipment shall be fully integrated, engineered and designed to perform in accordance with the technical specification. All engineering and technical services required to ensure a completely engineered plant shall be provided in respect of mechanical, electrical, control & instrumentation, civil & structural works as per the scope. Each main and auxiliary equipment/item of the plant including instruments shall be assigned a unique tag number. The assignment of tag numbers shall be in accordance with KKS system. In all drawings/documents/data sheet etc. KKS tag number of the equipment/item/instrument etc. shall be indicated. The Contractor shall furnish engineering data/drawings. in accordance with the schedule of information as specified in Technical Specification and Technical data sheet.		
8.02.00	The number of copies/prints/CD-ROMs/manuals to be furnished for various types of documents is given in Annexure-I to this Part-C, Section-VI of the Technical Specification.		
8.03.00	The documentation that shall be provided by the Contractor is indicated in thvarious sections of specification. This documentation shall include but not be limited to the following :		
8.03.01	(a.) BASIC ENGINEERING DOCUMENTATION		
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		Prior to commencement of the detailed engineering work, the Contractor shall furnish a Plant Definition Manual within 12 weeks from the date of the Notification of Award. This manual shall contain the following as a minimum: i. System description of all the mechanical, electrical, control & instrumentation & civil systems. ii. Technology scan for each system / sub-system & equipment. iii. Selection of appropriate technology / schemes for various systems/ subsystems including techno-economic studies between various options. iv. Optimization studies including thermal cycle optimization. v. Sizing criteria of all the systems, sub-systems including various piping systems/ equipments/ structures/ equipment foundations alongwith all calculations justifying and identifying the sizing and the design margins. vi. Schemes and Process & Instrumentation diagrams for the various systems/ sub-system with functional write-ups. vii. Operation Philosophy and the control philosophy of the equipments / system covered under the scope. viii. General Layout plan of the power station incorporating all facilities in Contractor's as well as those in the Employer's scope. This drawing shall also be furnished in the form of CD-ROMs to the Employer for engineering of areas not included in bidder's scope. ix. Basic layouts and cross sections of the TG building (various floor elevations), and other areas included in the scope of the bidder. x. Documentation in respect of Quality Assurance System as listed out elsewhere in this specification. The successful bidder shall furnish within three (3) weeks from the date of Notification of Award, a list of contents of the Plant Definition Manual (PDMs) including techno-economic studies, which shall then be mutually discussed & finalised with the Employer.	
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	(b) DETAILED ENGINEERING DOCUMENTS i. General layout plan. ii. Layouts, general arrangements, elevations and cross-sections drawings for all the equipment and facilities of the plant. iii. Flow diagrams, Process & Instrumentation Diagrams alongwith write-up and system description. iv. Start-up curves for turbine, for various start-ups, viz. cold, warm and hot start-up. v. Piping isometric, composite layout and fabrication drawings. vi. Piping engineering diagrams, pipe and fittings schedules, valve schedules, hanger and support schedules, insulation schedules. vii. Technical data sheets for all bought out and manufactured items. Contractor shall use the NTPC specifications as a base for placement of orders on their sub-vendors. viii. Detailed design calculations for components, system/sub-system, piping etc., wherever applicable including sizing calculations for all auxiliaries like BFPs, CEPs, Heaters/ Deaerators, Condensers, vacuum pumps etc. ix. Transient, hydraulic and thermal stress analysis of piping and system wherever applicable & input and output data alongwith stress analysis isometrics showing nodes. x. Thermal cycle information (heat balance diagrams, condenser and heat exchanger thermal calculations etc.). xi. Characteristic Curves/ Performance Correction Curves. Hydraulic & Mechanical design calculations for condensers & heaters. xii. Comprehensive list of all terminal points which interface with Employer's facilities giving details of location, terminal pressure, temperature, fluid handled & end connection details, forces, moments etc. xiii. Power supply single line diagram, block logics, control schematics, electrical schematics, etc.		
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		xiv. Protection system diagrams and relay settings. xv. Interconnection diagrams. xvi. Cable routing plan. xvii. Instrument schedule, measuring point list, I/O list, Interconnection & wiring diagram, functional write-ups, installation drawings for field mounted instruments, logic diagrams, control schematics, wiring and tubing diagrams of panels and enclosures etc. Drawings for open loop and close loop controls (both hardware and software). Motor list and valve schedule including type of actuator etc. xviii. Alarm and annunciation list / Sequence of Event (SOE) list and alarms & trip set points. xix. Sequence and protection interlock schemes. xx. Type test reports and power system stability study report. xxi. Control system configuration diagrams. xxii. Detailed DDCMIS system manuals xxiii. Detailed flow chart for digital control system. xxiv. Mimic diagram layout, Assignment for other application engg. xxv. Civil & Structural works drawings and documents for all structures, facilities, foundations, underground and overground works and super-structural works as included in the scope of the Bidder. xxvi. Model study reports wherever applicable. xxvii. Functional & guarantee test procedures and test reports. xxviii. Documentation in respect of Quality Assurance System as listed out elsewhere in this specification. xxix. Documentation in respect of commissioning as listed out elsewhere in this specification.	
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8.03.02	The Contractor while submitting the above documents / drawings for approval / reference as the case may be, shall mark on each copy of submission the reference letter alongwith the date vide which the submissions are made.		
	INSTRUCTION MANUALS The Contractor shall submit to the Employer, draft instruction manuals for all the equipments covered under the Contract by the end of one year from the date of his acceptance of the Letter of Award.The Instruction manuals shall contain full details required for erection, commissioning, operation and maintenance of each equipment. The manual shall be specifically compiled for this project. After finalization and approval of the Employer the Instruction Manuals shall be submitted as indicated in Annexure-I. The Contract shall not be considered to be completed for purposes of taking over until the final Instructions manuals have been supplied to the Employer. The Instruction Manuals shall comprise of the following. (a.) Erection Manuals The erection manuals shall be submitted atleast three (3) months prior to the commencement of erection activities of particular equipment/system. The erection manual should contain the following as a minimum. a) Erection strategy. b) Sequence of erection. c) Erection instructions. d) Critical checks and permissible deviation/tolerances. e) List of tool, tackles, heavy equipments like cranes, dozers, etc. f) Bill of Materials g) Procedure for erection . h) General safety procedures to followed during erection/installation. i) Procedure for initial checking after erection. j) Procedure for testing and acceptance norms.		
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		k) Procedure / Check list for pre-commissioning activities. l) Procedure / Check list for commissioning of the system. m) Safety precautions to be followed in electrical supply distribution during erection (b.) Operation & Maintenance Manuals a) The manual shall be a two rim PVC bound stiff sided binder able to withstand constant usage or where a thicker type is required it shall have locking steel pins, the size of the manual shall not be larger than international size A3. The cover shall be printed with the Project Name, Services covered and Volume / Book number Each section of the manual shall be divided by a stiff divider of the same size as the holder. The dividers shall clearly state the section number and title. All written instructions within the manual not provided by the manufacturers shall be typewritten with a margin on the left hand side. b) The arrangement and contents of O & M manuals shall be as follows : 1) <u>Chapter 1 - Plant Description</u> : To contain the following sections specific to the equipment/system supplied (a) Description of operating principle of equipment / system with schematic drawing / layouts. (b) Functional description of associated accessories / controls. Control interlock protection write up. (c) Integrated operation of the equipment alongwith the intended system. (The is to be given by the supplier of the Main equipment by taking into account the operating instruction given by the associated suppliers). (d) Exploded view of the main equipment, associated accessories and auxiliaries with description. Schematic drawing of the equipment alongwith its accessories and auxiliaries.	
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		(e) Design data against which the plant performance will be compared. (f) Master list of equipments, Technical specification of the equipment/ system and approved data sheets. (g) Identification system adopted for the various components, (it will be of a simple process linked tagging system). (h) Master list of drawings (as built drawing - Drawings to be enclosed in a separate volume). 2) Chapter 2.0 - Plant Operation: To contain the following sections specific to the equipment supplied (a) Protection logics provided for the equipment alongwith brief philosophy behind the logic, Drawings etc. (b) Limiting values of all protection settings. (c) Various settings of annunciation/interlocks provided. (d) Startup and shut down procedure for equipment alongwith the associated systems in step mode. (e) Do's and Don'ts related to operation of the equipment. (f) Safety precautions to be take during normal operation. Emergency instruction on total power failure condition/lubrication failure/any other conditions. (g) Parameters to be monitored with normal value and limiting values. (h) Equipment isolating procedures. (i) Trouble shooting with causes and remedial measures. (j) Routine testing procedure to ascertain healthiness of the safety devices alongwith schedule of testing. (k) Routine Operational Checks, Recommended Logs and Records (l) Change over schedule if more than one auxiliary for the same purpose is given.	
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		(m) Preservation procedure on long shut down. (n) System/plant commissioning procedure. 3) <u>Chapter 3.0 - Plant Maintenance</u>- To contain the following sections specific to the equipment supplied. (a) Exploded view of each of the equipments. Drawings alongwith bill of materials including name, code no. & population. (b) Exploded view of the spare parts and critical components with dimensional drawings (In case of Electronic cards, the circuit diagram to be given) and spare parts catalogue for each equipment. (c) List of Special T/ P required for Overhauling /Trouble shooting including special testing equipment required for calibration etc. (d) Stepwise dismantling and assembly procedure clearly specifying the tools to be used, checks to be made, records to be maintained etc. Clearance to be maintained etc. (e) Preventive Maintenance schedules linked with running hours/calendar period alongwith checks to be carried out. (f) Overhauling schedules linked with running hours/calendar period alongwith checks to be done. (g) Long term maintenance schedules (h) Consumables list alongwith the estimated quantity required during normal running and during maintenance like Preventive Maintenance and Overhauling. (i) List of lubricants with their Indian equivalent, Lubrication Schedule including charts showing lubrication checking, testing and replacement procedure to be carried daily, weekly, monthly & at longer intervals to ensure trouble free operation and quantity required for complete replacement.. (j) Tolerance for fitment of various components. (k) Details of sub vendors with their part no. in case of bought out items.	
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	(l) List of spare parts with their Part No, total population, life expediency & their interchangeability with already supplied spares to NTPC. (m) List of mandatory and recommended spare list along with manufacturing drawings, material specification & quality plan for fast moving consumable spares. (n) Lead time required for ordering of spares from the equipment supplier, instructions for storage and preservation of spares. (o) General information on the equipment such as modification carried out in the equipment from its inception, equipment population in the country / foreign country and list of utilities where similar equipments have been supplied.		
8.03.03	After finalization and approval of the Employer, the O & M Manuals shall be submitted as indicated in Annexure-VI. The Contract shall not be considered to be completed for purposes of taking over until the final Instructions manuals (both erection and O & M manuals have been supplied to the Employer. If after the commissioning and initial operation of the plant, the instruction manuals (Erection and /or O &M manuals) require modifications/additions/ changes, the same shall be incorporated and the updated final instruction manuals shall be submitted by the Contractor to the Employer for records and number of copies shall be as mentioned in Annexure-VI.		
8.03.03	PLANT HANDBOOK AND PROJECT COMPLETION REPORT (a.) PLANT HANDBOOK The Contractor shall submit to the Employer a preliminary plant hand book preferably in A-4 size sheets which shall contain the design and performance data of various plants, equipments and systems covering the complete project including 1. Design and performance data. 2. Process & Instrumentation diagrams. 3. Single line diagrams.		
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8.03.04		4. Sequence & Protection Interlock Schemes. 5. Alarm and trip values. 6. Performance Curves. 7. General layout plan and layout of main plant building and auxiliary buildings 8. Important Do's & Don't's The plant handbook shall be submitted within twelve (12) months from the date of award of contract. After the incorporation of Employer's comments, the final plant handbook complete in all respects shall be submitted three (3) months before start-up and commissioning activities. (b.) Project Completion Report The Contractor shall submit a Project Completion Report at the time of handing over the plant.							
		DRAWINGS (a.) All documents submitted by the Contractor for Employer's review shall be in electronic form (soft copies) along with the desired number of hard copies as per Annexure-I of Part-C. The soft copies shall be uploaded by the vendors in c-folder, a web based system of NTPC ERP, for which a username and password will be allotted to the new vendor by NTPC. Similarly, the vendor can download the drawings / documents, approved / commented by NTPC , through above site. The soft copies of identified drawings / documents shall be in pdf format, whereas the attachments / reply to the submitted document(s) can be in .doc, .xls, .pdf, .dwg or .std formats. (b.) Final copies of the approved drawings alongwith requisite number of hard copies shall be submitted as per Annexure-I of Part-C. (c.) Contractor shall prepare the model of all the facilities located in TG building (including all facilities), and any other facility located in TG building area in an integrated & intelligent 3D software solution using rule-based, data centric 3D Design software with equipment drawings, data sheets, intelligent P&ID correlated with intelligent 3D Model, BOQ, schematics and logic diagrams							
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		etc. attached to the respective equipment / systems in the aforesaid 3D model. All piping layouts, equipment layouts, floor plans, ducting layout (A/C, Ventilation etc.), General Arrangement drawings of major buildings, structural arrangement drawings and RCC layout drawings shall necessarily be extracted from the aforesaid 3D model and submitted for employer's review along with the 3D review model to enable NTPC to review and approve these drawings. Contractor shall prepare and provide 3D design review model (network ready, which shall include visual interference check, walk-through animation, video simulation for major equipment placement and removal, visual effect, photo realism etc.), which is extracted from intelligent 3D model and shall make a presentation of the same every 3 months from LOA to enable NTPC to review the progress of engineering or as and when required by employer.. After the completion of engineering of facilities covered under this package, the corresponding complete 3D review model shall be handed over to the employer for its reference. (d.) All documents/text information shall be in latest version of MS Office/ MS Excel/ PDF Format as applicable. (e.) All drawings submitted by the Contractor including those submitted at the time of bid shall be in sufficient detail indicating the type, size, arrangement, weight of each component for packing and shipment, the external connection, fixing arrangement required, the dimensions required for installation and interconnections with other equipments and materials, clearance and spaces required between various portions of equipment and any other information specifically requested in the drawing schedules. (f.) Each drawing submitted by the Contractor (including those of subvendors) shall bear a title block at the right hand bottom corner with clear mention of the name of the Employer, the system designation, the specifications title, the specification number, the name of the Project, drawing number and revisions. If standard catalogue pages are submitted the applicable items shall be indicated therein. All titles, notings, markings and writings on the drawing shall be in English. All the dimensions should be in metric units. (g.) The drawings submitted by the Contractor (or their subvendors) shall bear Employer's drawing number in addition to contractor's (their sub-vendor's) own drawing number. Employer's drawing numbering system shall be made available to the successful bidder so as to enable him to assign Employer's drawing numbers to the drawings to be submitted by him during the course of execution of the Contract.		
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		Similarly, all the drawings/ documents submitted by the Contractor during detailed engineering stage shall be marked "FOR APPROVAL" or "FOR INFORMATION" prior to submission. Further, space shall be identified on each drawing for approval stamp and electronic signature. (j.) The furnishing of detailed engineering data and drawings by the Contractor shall be in accordance with the time schedule for the project. The review of these documents/ data/ drawings by the Employer will cover only general conformance of the data/ drawings/ documents to the specifications and contract, interfaces with the equipments provided by others and external connections & dimensions which might affect plant layout. The review by the Employer should not be construed to be a thorough review of all dimensions, quantities and details of the equipments, materials, any devices or items indicated or the accuracy of the information submitted. The review and/ or approval by the Employer / Project Manager shall not relieve the Contractor of any of his responsibilities and liabilities under this contract. (k.) After the approval of the drawings, further work by the Contractor shall be in strict accordance with these approved drawings and no deviation shall be permitted without the written approval of the Employer. (l.) All manufacturing, fabrication and execution of work in connection with the equipment / system, prior to the approval of the drawings, shall be at the Contractor's risk. The Contractor is expected not to make any changes in the design of the equipment /system, once they are approved by the Employer. However, if some changes are necessitated in the design of the equipment/system at a later date, the Contractor may do so, but such changes shall promptly be brought to the notice of the Employer indicating the reasons for the change and get the revised drawing approved again in strict conformance to the provisions of the Technical Specification. (m.) Drawings shall include all installations and detailed piping layout drawings. Layout drawings for all piping of 65 mm and larger diameter shall be submitted for review/ approval of Employer prior to erection. Small diameter pipes shall however be routed as per site conditions in consultation with site authority / representative of Employer based on requirements of such piping indicated in approved / finalized Flow Scheme / Process & Instrumentation Diagrams and/or the requirements cropping up for draining & venting of larger diameter piping or otherwise after their erection as per actual physical condition for the entire scope of work of this package.			
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		(n.)	Assessing & anticipating the requirement and supply of all piping and equipment shall be done by the contractor well in advance so as not to hinder the progress of piping & equipment erection, subsequent system charging and its effective draining & venting arrangement as per site suitability.		
		(o.)	As Built Drawings		
			After final acceptance of individual equipment / system by the Employer, the Contractor will update all original drawings and documents for the equipment / system to "as built" conditions and submit number of coppies as per Annexure-I.		
		(p.)	Drawings must be checked by the Contractor in terms of its completeness, data adequacy and relevance with respect to Engineering schedule prior to submission to the Employer. In case drawings are found to be submitted without proper checking by the Contractor, the same shall not be reviewed and returned to the Contractor for re-submission. The contractor shall make a visit to site to see the existing facilities and understand the layout completely and collect all necessary data / drawings at site which are needed as an input to the engineering. The contractor shall do the complete engineering including interfacing and integration of all his equipment, systems & facilities within his scope of work as well as interface engineering & integration of systems, facilities, equipment & works under Employer's scope and submit all necessary drawings/ documents for the same.		
		(q.)	The Contractor shall submit adequate prints of drawing / data / document for Employer's review and approval. The Employer shall review the drawings and return soft copy to the Contractor authorizing either to proceed with manufacture or fabrication, or marked to show changes desired. When changes are required, drawings shall be re-submitted promptly, with revisions clearly marked, for final review. Any delays arising out of the failure of the Contractor to submit/rectify and resubmit in time shall not be accepted as a reason for delay in the contract schedule.		
		(r.)	All engineering data submitted by the Contractor after final process including review and approval by the Project Manager/ Employer shall form part of the contract documents and the entire works covered under these specification shall be performed in strict conformity with technical specifications unless otherwise expressly requested by the Project Manager in writing.		
8.03.05		e-Learning Package:			
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8.03.05.01		e-learning packages shall be supplied for the equipment / system for the following Steam Turbine Generator & auxiliaries along with associated electrical and C&I system. Steam Turbine Generator & Auxiliaries Steam Turbine including stop valves, control valves, overload valves and cross over piping. Steam Turbine Auxiliary Systems including Quick Closing and Ordinary NRVs, Turbine gland sealing system, Lubricating oil system and its purification system, Centralised oil storage and its purification system, Control fluid and its purification system, governing and protection system, exhaust hood spray cooling system, drainage and vent system, turbine preservation system, HP/LP Bypass system. Generator and Auxiliary System including Generator, complete hydrogen cooling, carbon dioxide and nitrogen gas systems as applicable, complete seal oil system, complete water cooling system where applicable and complete excitation system. Condensing Plant including Condenser, Condenser air evacuation system and Condenser on load tube cleaning system as applicable. Drip Pump along with all accessories as applicable, Condensate Extraction Pumps along with all accessories, Deaerator level Control Station, Feed Water Heating Plant including Drain Cooler, low pressure heaters, deaerator and feed storage tank, high pressure heaters and associated accessories, Boiler Feed Pumps along with all accessories, Drive Turbine for Boiler Feed Pump along with all accessories, Feed regulating station, Make up system to Condenser, Gland Steam Condenser Recirculation System, Turbine Hall EOT Cranes and EOT Crane for Boiler Feed Pump as applicable.							
8.03.05.02		These packages shall be installed on the Learning Management Server (LMS) of Power Management Institute (PMI) , NTPC located at Noida . The Engineer- In-Charge (EIC) for the e-learning modules shall be from PMI. - The objective of the e-Learning package consisting of courses for erection, commissioning, operation and maintenance of equipment / system as specified above is to facilitate the employees to have first hand information /requirement with respect to above activities for the supplied equipment /system. - The bidder shall submit e-learning courses each for erection, commissioning, operation and maintenance of each of the equipment / system supplied as above. - The erection course(s) should include instructions on pre-checks, prerequisites, erection strategy, erection procedure etc. - The commissioning course(s) should include instructions on recommissioning,commissioning, initial operation etc. - The operation course(s) should include instructions on the permissive, interlocks, physical check ups, start up , shutdown and protections etc. - The maintenance course(s) should include instructions on predictive, preventive, breakdown and overhauling. Depth of coverage of above courses shall be as specified for “Instruction Manuals” in above clauses. A literature on caution / safety while handling equipment / system for the above modules shall follow the description of the said equipment /system.							
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	3. The e-Learning packages on equipment / system shall be installed by the vendor and shall be successfully test run in the presence of EIC or representative before acceptance by NTPC. The vendor will also give the master copy in form of Flash Drive/CD/DVD. The respective module for erection & commissioning shall be delivered and successfully test run at least three months before the scheduled start of the corresponding activity at site. The respective module for operation & maintenance shall be delivered and successfully test run at least three months before scheduled first synchronization of first unit. 4. e-Learning course broad requirements: a. The courses shall be web based and mobile based Application type. It shall run on all possible versions of web browser like Internet Explorer, Google Chrome, Firefox etc. on Laptop/Desktop and shall be Smartphone/Tablet/Mobile responsive. The Mobile responsive courses shall run on Android, Windows Mobile, Blackberry, iOS etc. b. The courses shall support liquid/fluid page layout so that the entire screen gets adjusted to PC, Laptop, Smartphone/Mobile, Tablet and any other display devices. c. Course content text shall be in English language and be associated with a voiceover in English language with Indian accent. d. Courses shall be SCORM (Sharable Content Object Reference Model) compliant, version 1.2 which is compatible with LMS at PMI. e. Each course shall have every physical and functional detail of the equipment / system supplied. f. Each of the e-Learning course shall be based on multiple web pages and mobile pages with multiple modules. g. There shall be option for self-assessment test after every course. In case the user doesn't opt for self assessment test the user shall be able to go to the next course. There shall be no restriction in no. of times for repeating the assessments. All correct answers along with the answers marked by the users shall be displayed at the end of test/quiz. h. If Java and Flash, as applicable are not available in the system to run the package, then there shall be a prompt message for updation of the same. i. Each course shall have a self-running interactive content with navigation buttons containing forward, backward, pause, bookmark and menu options in the course window.		
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8.04.00	j. The course shall contain chapter titled 'Introduction/overview' that explains the purpose of the course. k. The course content shall contain descriptive text shall be factual, specific, terse, clearly worded, and simply illustrative, so that the user can understand it. l. The system shall provide the user with the ability to select the information with a Cursor. m. The course menu should contain table of content linked to concerned pages. The user shall be given the capability to access all of the functions available on the system through a menu system. This shall consist of active buttons, which shall control a hierarchy of pull down/pop up menus. Menu shall appear quickly and exist only while a selection is being made. The user shall be given the capability to position the cursor or pointer on the menu item and use pointer device such as mouse to activate the function. n. Every course shall contain the 3D design/drawing/exploded view/360° turn around view of the equipment/system, textual description of the equipment/system and its functionality with video (as applicable), animation and audio. o. The users shall be able to control audio sound level associated with the courses. p. Drawings / text in the courses shall be scalable (Zoom In/ Out).' q. The user shall have the capability to record a bookmark to mark displayed information for later recall, whenever he accesses the same course next time. Notes: 1. e-learning Package of an equipment / system shall include e-learning courses for each of erection, commissioning, operation and maintenance of that equipment / system. 2. e-learning courses on erection, commissioning, operation and maintenance of an equipment / system shall include e-learning lessons/chapters/modules (as required) for erection, commissioning, operation and maintenance respectively of that equipment / system. 3. The vendor shall get the approval of one sample course from EIC before proceeding for further courses.		
	Engineering Co-ordination Procedure		
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		h) Contractor shall resubmit the drawings approved under Category II, III & IV within three (3) weeks of receipt of comments on the drawings, incorporating all comments. Every revision of the drawing shall bear a revision index wherein such revisions shall be highlighted in the form of description or marked up in the drawing identifying the same with relevant revision Number enclosed in a triangle (eg. 1, 2, 3 etc). Contractor shall not make any changes in the portions of the drawing other than those commented. If changes are required to be made in the portions already approved, the Contractor shall resubmit the drawing identifying the changes for Employer's review and approval. Drawings resubmitted shall show clearly the portions where the same are revised marking the relevant revision numbers and Employer shall review only such revised portion of documents. i) In case, the Contractor/ Vendor does not agree with any specific comment, he shall furnish the explanation for the same to NTPC for consideration. In all such cases the Contractor shall necessarily enclose explanations along with the revised drawing (taking care of balance comments) to avoid any delay and/or duplication in review work. j) It is responsibility of the Contractor/ Vendor to get all the drawings approved in the Category I & IV (as the case may be) and complete engineering activities within the agreed schedule. Any delay arising out of submission and modification of drawings shall not alter the contract completion schedule. k) If Contractor/ Vendor fails to resubmit the drawings as per the schedule, construction work at site will not be held up and work will be carried out on the basis of comments furnished on previous issues of the drawing. l) These comments will be taken care by the contractor while submitting the revised drawing. The contractor shall use a single transmittal for drawings. Submission. This shall include transmittal numbers and date, number of copies being sent, names of the agencies to whom copies being sent, drawing number and titles, remarks or special notes if any etc.			
8.05.00	ENGINEERING PROGRESS AND EXCEPTION REPORT				
8.05.01	The Contractor shall submit every month an Engineering progress and Exception Report giving the status of each engineering information including				
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	(a.) A list of drawings/engineering information which remains unapproved for more than four (4) weeks after the date of first submission. (b.) Drawings which were not submitted as per agreed schedule.		
8.05.02	The draft format for this report shall be furnished to the Employer within four (4) weeks of the award of the contract, which shall then be discussed and finalised with the Employer.		
8.06.00	TECHNICAL CO-ORDINATION MEETING		
8.06.01	The Contractor shall be called upon to organise and attend monthly Design/ Technical Co-ordination Meetings (TCMs) with the Employer/Employer's representatives and other Contractors of the Employer during the period of contract. The Contractor shall attend such meetings at his own cost at NEW DELHI / NOIDA or at mutually agreed venue as and when required and fully co-operate with such persons and agencies involved during the discussions.		
8.06.02	The Contractor should note that Time is the essence of the contract. In order to expedite the early completion of engineering activities, the Contractor shall submit all drawings as per the agreed Engineering Information Submission Schedule. The drawings submitted by the Contractor will be reviewed by the Employer as far as practicable within three (3) weeks from the date of receipt of the drawing. The comments of the Employer shall then be discussed across the table during the above Technical Co-ordination Meeting (s) wherein best efforts shall be made by both sides to ensure the approval of the drawing.		
8.06.03	The Contractor shall ensure availability of the concerned experts / consultants/ personnel who are empowered to take necessary decisions during these meetings. The Contractor shall be equipped with necessary tools and facilities so that the drawings/documents can be resubmitted after incorporating necessary changes and approved during the meeting itself.		
8.06.04	Should any drawing remain unapproved for more than six (6) weeks after it's first submission, this shall be brought out in the monthly Engineering Progress and Exception Report with reasons thereof.		
8.06.05	Any delays arising out of failure by the Contractor to incorporate Employer's comments and resubmit the same during the TCM shall be considered as a default and in no case shall entitle the Contractor to alter the Contract completion date.		
8.07.00	DESIGN IMPROVEMENTS		
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8.07.01		The Employer or the Contractor may propose changes in the specification of the equipment or quality thereof and if the parties agree upon any such changes the specification shall be modified accordingly. If any such agreed upon change is such that it affects the price and schedule of completion, the parties shall agree in writing as to the extent of any changing the price and/or schedule of completion before the Contractor proceeds with the change. Following such agreement, the provision thereof, shall be deemed to have been amended accordingly. Testing of major design features: The major design features of the system shall be conducted by the Contractor at the Contractor's works or any other place mutually agreed within six months from the date of LOA. These are the system function tests, which have a major impact on the detailed system design & finalization of important engineering documents like configuration, functional grouping, BOM etc., but do not require a fully engineered system for conductance. Bidder shall identify these features & include detailed test procedures in the bid, which shall be finalized during discussions with the bidder before award. The developments and any augmentation of standard features undertaken by the Bidder to fulfill the various specification requirements, shall be also be tested during these major design tests. This shall include but not be limited to the following. a) System accuracy tests of DDCMIS for the various type of inputs identified in Part-B. b) Loop reaction time for sample loops/ logics. c) N/A. d) Server changeover. e) Various response times, having serious implication on operation & maintenance philosophy. f) Duty cycle of controller/ HMIPIS with simulated load, representative of the final engineered load. g) Unified HMI for DDCMIS as indicated in IIC-01, Scope of supply & services chapter of Part-A, Section-VI. The results of the above tests, after its acceptance by the Employer, shall be properly documented and submitted to Employer. If any of the envisaged tests have			
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8.07.02	been carried out by Bidder in a previous NTPC project, then the same need not be specifically conducted by the Bidder for this project, provided it is clearly established by the Bidder & accepted by the Employer that there is no difference between the system offered for this project & the previous NTPC project w.r.t. the test. However, even in such a case, test report of the previous project shall be submitted by the Bidder as a part of MDFT (Major Design Feature Test) report. Demonstration of Application Engineering A) The Contractor shall prepare and submit typical implemented scheme in their system (Control system & HMI) on sample basis. The typical cases to be covered shall include but not be limited to the following. (i) Logics/Loops: a) Drive logics implementation for each type of binary drive along with its display in HMI. b) Sequence implementation along with its display in HMI. c) Single non-cascade controller implementation. d) Cascade loop implementation. e) Master slave implementation with different slave combination. f) Temperature & pressure compensation for flow signals & pressure compensation for level signals as applicable. (ii) HMI Functions: a) LVS Annunciation. b) Graphics. c) HSR d) Logs/Reports. e) N/A. B) The above typical cases shall be finalized with the Employer through Technical Co-ordination meetings. After review and finalization of the typical cases, the implementation of each logic & control loop shall be carried out by the Contractor. After implementation of these			
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	logics & loops, the Contractor shall test each logic/loop and record the observations in a format to be provided by the Employer and demonstrate to Employer at Employer premises during engineering finalization. Any modifications as a result of the demonstration shall be done and documented as part of the test report along with the final scheme. Similarly, HMI functions shall also be demonstrated by the Contractor at Employer premises & the results shall be documented as part of test report. C) During the integrated testing at the Contractor's works, only sample checks shall be done by the Employer for the items covered in above application engineering demonstration.		
8.08.00	EQUIPMENT BASES A cast iron or welded steel base plate shall be provided for all rotating equipment which is to be installed on a concrete base, unless otherwise specifically agreed to by the Employer. Each base plate which support the unit and its drive assembly, shall be of a neat design with pads for anchoring the units, shall have a raised lip all around, and shall have threaded drain connections.		
8.09.00	PROTECTIVE GUARDS Suitable guards shall be provided for protection of personnel on all exposed rotating and/or moving machine parts. All such guards shall be designed for easy installation and removal for maintenance purpose.		
8.10.00	LUBRICANTS, SERVO FLUIDS AND CHEMICALS		
8.10.01	All the first fill and one year's topping requirements of consumables such as greases, oil, lubricants, servo fluids / control fluids, gases (excluding H₂, CO₂ and N₂ for Generator) and essential chemicals etc. which will be required to put the equipment covered under the scope of specifications, into successful commissioning / initial operation and to establish completion of facilities shall be supplied by the Contractor. Suitable standard lubricants as available in India are desired. Efforts should be made to limit the variety of lubricants to minimum. Bidder scope shall also include supply of H₂ , CO₂ and N₂ as applicable for the Generator till successful commissioning of the Generator. Bidder shall also supply a quantity not less than 10% of the full charge of each variety of lubricants, servo fluids, gases, chemicals etc (as detailed above) which is expected to be utilised during the first year of operation. This additional quantity shall be supplied in separate Containers.		
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8.10.02	As far as possible lubricants marketed by the Indian Oil Corporation shall be used. The variety of lubricants shall be kept to a minimum possible. Detailed specifications for the lubricating oil, grease, gases, servo fluids, control fluids, chemicals etc. required for the complete plant covered herein shall be furnished. On completion of erection, a complete list of bearings/ equipment giving their location and identification marks shall be furnished to the Employer alongwith lubrication requirements.		
8.11.00	Lubrication		
8.11.01	Equipment shall be lubricated by systems designed for continuous operation. Lubricant level indicators shall be furnished and marked to indicate proper levels under both standstill and operating conditions.		
8.12.00	Material of Construction		
8.12.01	All materials used for the construction of the equipment shall be new and shall be in accordance with the requirements of this specification. Materials utilised for various components shall be those which have established themselves for use in such applications.		
8.13.00	RATING PLATES, NAME PLATES & LABELS		
8.13.01	Each main and auxiliary item of plant including instruments shall have permanently attached to it in a conspicuous position, a rating plate of non-corrosive material upon which shall be engraved manufacturer's name, equipment, type or serial number together with details of the ratings, service conditions under which the item of plant in question has been designed to operate, and such diagram plates as may be required by the Employer.		
8.13.02	Each item of plant shall be provided with nameplate or label designating the service of the particular equipment. The inscriptions shall be approved by the Employer or as detailed in appropriate section of the technical specifications.		
8.13.03	Such nameplates or labels shall be of white nonhygroscopic material with engraved black lettering or alternately, in the case of indoor circuit breakers, starters, etc. of transparent plastic material with suitably coloured lettering engraved on the back. The name plates shall be suitably fixed on both front and rear sides.		
8.13.04	Items of plant such as valves, which are subject to handling, shall be provided with an engraved chromium plated nameplate or label with engraving filled with enamel.		
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		The name plates for valves shall be marked in accordance with MSS standard SP-25 and ANSI B 16.34 as a minimum.	
8.13.05		Hanger/ support numbers shall be marked on all pipe supports, anchors, hangers, snubbers and restraint assemblies. Each constant and variable spring support shall also have stamped upon it the designed hot and cold load which it is intended to support. Suitable scale shall also be provided to indicate load on support/hanger.	
8.13.06		Valves, steam traps and strainers shall be identified by Employer's tag number of a metal tap permanently attached to non pressure parts such as the yoke by a stainless steel wire. The direction of flow shall also be marked on the body.	
8.13.07		Safety and relief valves shall be provided with the following : (a.) Manufacturer's identification. (b.) Nominal inlet and outlet sizes in mm. (c.) Set pressure in Kg/cm² (abs). (d.) Blowdown and accumulation as percentage of set pressure. (e.) Certified capacity in Kg of saturated steam per hour or in case of liquid certified capacity in litres of water per minute.	
8.13.08		All such plates, instruction plates, etc. shall be bilingual with Hindi inscription first, followed by English. Alternatively, two separate plates one with Hindi and the other with English inscriptions may be provided.	
8.13.09		All segregated phases of conductors or bus ducts, indoor or outdoor, shall be provided with coloured phase plates to clearly identify the phase of the system	
8.14.00		TOOLS AND TACKLES The Contractor shall supply with the equipment one complete set of all special tools and tackles and other instruments required for the erection, assembly, disassembly and proper maintenance of the plant and equipment and systems (including software). These special tools will also include special material handling equipment, jigs and fixtures for maintenance and calibration / readjustment, checking and measurement aids etc. A list of such tools and tackles shall be submitted by the Bidder alongwith the offer.	
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	The price of each tool / tackle shall be deemed to have been included in the total bid price. These tools and tackles shall be separately packed and sent to site. The Contractor shall also ensure that these tools and tackles are not used by him during erection, commissioning and initial operation. For this period the Contractor should bring his own tools and tackles. All the tools and tackles shall be of reputed make acceptable to the Employer.		
8.15.00	WELDING		
8.15.01	If the manufacturer has special requirements relating to the welding procedures for welds at the terminals of the equipments to be performed by others the requirements shall be submitted to the Employer in advance of commencement of erection work.		
8.16.00	COLOUR CODE FOR ALL EQUIPMENTS/ PIPINGS/ PIPE SERVICES		
8.16.01	All equipment/ piping/ pipe services are to be painted by the Contractor in accordance with Employer's standard colour coding scheme, which will be furnished to the Contractor during detailed engineering stage.		
8.17.00	PROTECTION AND PRESERVATIVE SHOP COATING		
8.18.00	PROTECTION		
	All coated surfaces shall be protected against abrasion, impact, discoloration and any other damages. All exposed threaded portions shall be suitably protected with either metallic or a nonmetallic protection device. All ends of all valves and pipings and conduit equipment connections shall be properly sealed with suitable devices to protect them from damage. The parts which are likely to get rusted, due to exposure to weather, should also be properly treated and protected in a suitable manner. All primers/paints/coatings shall take into account the hot humid, corrosive & alkaline, subsoil or overground environment as the case may be. The requirements for painting specification shall be complied with as detailed out in Part-A & B of the Technical Specification.		
8.19.00	PRESERVATIVE SHOP COATING		
	All exposed metallic surfaces subject to corrosion shall be protected by shop application of suitable coatings. All surfaces which will not be easily accessible after the shop assembly, shall be treated beforehand and protected for the life of the equipment. All surfaces shall be thoroughly cleaned of all mill scales, oxides and other coatings and prepared in the shop. The surfaces that are to be finish-painted		
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		after installation or require corrosion protection until installation, shall be shop painted as per the requirement covered in the relevant part of the Technical Specification. Transformers and other electrical equipments if included shall be shop finished with one or more coats of primer and two coats of high grade resistance enamel. The finished colors shall be as per manufacturer's standards, to be selected and specified by the Employer at a later date.	
8.19.01		Shop primer for all steel surfaces which will be exposed to operating temperature below 95 degrees Celsius shall be selected by the Contractor after obtaining specific approval of the Employer regarding the quality of primer proposed to be applied. Special high temperature primer shall be used on surfaces exposed to temperature higher than 95 degrees Celsius and such primer shall also be subject to the approval of the Employer.	
8.19.02		All other steel surfaces which are not to be painted shall be coated with suitable rust preventive compound subject to the approval of the Employer.	
8.19.03		All piping shall be cleaned after shop assembly by shot blasting or other means approved by the Employer. Lube oil piping or carbon steel shall be pickled.	
8.19.04		Painting for Civil structures shall be done as specified under technical requirements on civil works in relevant part of this specifications.	
9.00.00		QUALITY ASSURANCE PROGRAMME	
9.01.00		The Contractor shall adopt suitable quality assurance programme to ensure that the equipment and services under the scope of contract whether manufactured or performed within the Contractor's works or at his sub-contractor's premises or at the Employer's site or at any other place of work are in accordance with the specifications. Such programmes shall be outlined by the Contractor and shall be finally accepted by the Employer/authorised representative after discussions before the award of the contract. The QA programme shall be generally in line with ISO-9001.A quality assurance programme of the contractor shall generally cover the following: (a.) His organisation structure for the management and implementation of the proposed quality assurance programme (b.) Quality System Manual (c.) Design Control System	
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		(d.) Documentation and Data Control System (e.) Qualification data for bidder's key personnel. (f.) The procedure for purchase of materials, parts, components and selection of sub-contractor's services including vendor analysis, source inspection, incoming raw-material inspection, verification of materials purchased etc. (g.) System for shop manufacturing and site erection controls including process, fabrication and assembly. (h.) Control of non-conforming items and system for corrective actions and resolution of deviations. (i.) Inspection and test procedure both for manufacture and field activities. (j.) Control of calibration and testing of measuring testing equipment. (k.) System for Quality Audits. (l.) System for identification and appraisal of inspection status. (m.) System for authorising release of manufactured product to the Employer. (n.) System for handling, storage and delivery. (o.) System for maintenance of records, and (p.) Quality plans for manufacturing and field activities detailing out the specific quality control procedure adopted for controlling the quality characteristics relevant to each item of equipment/component.	
9.02.00	GENERAL REQUIREMENTS - QUALITY ASSURANCE		
9.02.01	All materials, components and equipment covered under this specification shall be procured, manufactured, erected, commissioned and tested at all the stages, as per a comprehensive Quality Assurance Programme. An indicative programme of inspection/tests to be carried out by the contractor for some of the major items is given in the respective technical specification which shall be finalised giving due consideration to the manufacturer's standard and proven practices being followed. This is, however, not intended to form a comprehensive programme as it is the contractor's responsibility to draw up and implement such programme duly approved by the Employer. The detailed Quality Plans for manufacturing and field activities		
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	shall be drawn up by the Bidder and will be submitted to Employer for approval. Schedule of finalisation of such quality plans will be finalised before award. Monthly progress reports on MQP/FQP submission/approval shall be furnished on enclosed format No. QS-01-QAI-P-02/F1.		
9.02.02	Manufacturing Quality Plan will detail out for all the components and equipment, various tests/inspection, to be carried out as per the requirements of this specification and standards mentioned therein and quality practices and procedures followed by Contractor's/ Sub-contractor's/ sub-supplier's Quality Control Organisation, the relevant reference documents and standards, acceptance norms, inspection documents raised etc., during all stages of materials procurement, manufacture, assembly and final testing/performance testing. The Quality Plan shall be submitted on electronic media through c-folders, a web based system of NTPC ERP in addition to hard copy, for review and approval. After approval the same shall be submitted in compiled form on CD-ROM.		
9.02.03	Field Quality Plans will detail out for all the equipment, the quality practices and procedures etc. to be followed by the Contractor's "Site Quality Control Organisation", during various stages of site activities starting from receipt of materials/equipment at site.		
9.02.04	The Bidder shall also furnish copies of the reference documents/plant standards/acceptance norms/tests and inspection procedure etc., as referred in Quality Plans along with Quality Plans. These Quality Plans and reference documents/standards etc. will be subject to Employer's approval without which manufacturer shall not proceed. These approved documents shall form a part of the contract. In these approved Quality Plans, Employer shall identify customer hold points (CHP), i.e. test/checks which shall be carried out in presence of the Employer's Project Manager or his authorised representative and beyond which the work will not proceed without consent of Employer in writing. All deviations to this specification, approved quality plans and applicable standards must be documented and referred to Employer along with technical justification for approval and dispositioning.		
9.02.05	No material shall be despatched from the manufacturer's works before the same is accepted, subsequent to predespatch final inspection including verification of records of all previous tests/inspections by Employer's Project Manager/Authorised representative and duly authorised for despatch by issuance of Material Despatch Clearance Certificate (MDCC).		
9.02.06	All material used for equipment manufacture including casting and forging etc. shall be of tested quality as per relevant codes/standards. Details of results of the tests conducted to determine the mechanical properties; chemical analysis and details of		
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9.02.07		heat treatment procedure recommended and actually followed shall be recorded on certificates and time temperature chart. Tests shall be carried out as per applicable material standards and/or agreed details. The contractor shall submit to the Employer Field Welding Schedule for field welding activities in the enclosed format No.: QS-01-QAI-P-02/F2. The field welding schedule shall be submitted to the Employer along with all supporting documents, like welding procedures, heat treatment procedures, NDT procedures etc. at least ninety days before schedule start of erection work at site.									
9.02.08		All welding and brazing shall be carried out as per procedure drawn and qualified in accordance with requirements of ASME Section IX/BS-4870 or other International equivalent standard acceptable to the Employer. All welding/brazing procedures shall be submitted to the Employer or its authorised representative for approval prior to carrying out the welding/brazing.									
9.02.09		All brazers, welders and welding operators employed on any part of the contract either in Contractor's/sub-contractor's works or at site or elsewhere shall be qualified as per ASME Section-IX or BS-4871 or other equivalent International Standards acceptable to the Employer.									
9.02.10		Welding procedure qualification & Welder qualification test results shall be furnished to the Employer for approval. However, where required by the Employer, tests shall be conducted in presence of Employer/authorised representative.									
9.02.11		For all IBR pressure parts and high pressure piping welding, the latest applicable requirements of the IBR (Indian Boiler Regulations) shall also be essentially complied with. However, for other piping system ASME B31.1 or other relevant code as applicable shall be followed. Similarly, any other statutory requirements for the equipment/systems shall also be complied with. On all back-gauged welds MPI/LPI shall be carried before seal welding.									
9.02.12		Unless otherwise proven and specifically agreed with the Employer, welding of dissimilar materials and high alloy materials shall be carried out at shop only.									
9.02.13		No welding shall be carried out on cast iron components for repair.									
9.02.14		All the heat treatment results shall be recorded on time temperature charts and verified with recommended regimes.									
9.02.15		All non-destructive examination shall be performed in accordance with written procedures as per International Standards, The NDT operator shall be qualified as per SNT-TC-IA (of the American Society of non-destructive examination) / EN /									
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9.02.16		Equivalent. NDT shall be recorded in a report, which includes details of methods and equipment used, result/evaluation, job data and identification of personnel employed and details of co-relation of the test report with the job. All plates of thickness above 40mm & all bar stock/Forging above 40mm dia shall be ultrasonically tested. For pressure parts, plate of thickness equal to or above 25mm shall be ultrasonically tested.					
		The Contractor shall list out all major items/ equipment/ components to be manufactured in house as well as procured from sub-contractors (BOI). All the sub-contractor proposed by the Contractor for procurement of major bought out items including castings, forging, semi-finished and finished components/equipment etc., list of which shall be drawn up by the Contractor and finalised with the Employer, shall be subject to Employer's approval. The contractor's proposal shall include vendor's facilities established at the respective works, the process capability, process stabilization, QC systems followed, experience list, etc. along with his own technical evaluation for identified sub-contractors enclosed and shall be submitted to the Employer for approval within the period agreed at the time of pre-awards discussion and identified in "DR" category prior to any procurement. Monthly progress reports on sub-contractor detail submission / approval shall be furnished on enclosed on format no. QS-01-QAI-P-02/F1. Such vendor approval shall not relieve the contractor from any obligation, duty or responsibility under the contract.					
9.02.17		For components/equipment procured by the contractors for the purpose of the contract, after obtaining the written approval of the Employer, the contractor's purchase specifications and inquiries shall call for quality plans to be submitted by the suppliers. The quality plans called for from the sub-contractor shall set out, during the various stages of manufacture and installation, the quality practices and procedures followed by the vendor's quality control organisation, the relevant reference documents/standards used, acceptance level, inspection of documentation raised, etc. Such quality plans of the successful vendors shall be finalised with the Employer and such approved Quality Plans shall form a part of the purchase order/contract between the Contractor and sub-contractor. With in three weeks of the release of the purchase orders /contracts for such bought out items /components, a copy of the same without price details but together with the detailed purchase specifications, quality plans and delivery conditions shall be furnished to the Employer on the monthly basis by the Contractor along with a report of the Purchase Order placed so far for the contract.					
9.02.18		Employer reserves the right to carry out quality audit and quality surveillance of the systems and procedures of the Contractor's or their sub-contractor's quality management and control activities. The contractor shall provide all necessary assistance to enable the Employer carry out such audit and surveillance.					
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9.02.19	The contractor shall carry out an inspection and testing programme during manufacture in his work and that of his sub-contractor's and at site to ensure the mechanical accuracy of components, compliance with drawings, conformance to functional and performance requirements, identity and acceptability of all materials parts and equipment. Contractor shall carry out all tests/inspection required to establish that the items/equipment conform to requirements of the specification and the relevant codes/standards specified in the specification, in addition to carrying out tests as per the approved quality plan.		
9.02.20	Quality audit/surveillance/approval of the results of the tests and inspection will not, however, prejudice the right of the Employer to reject the equipment if it does not comply with the specification when erected or does not give complete satisfaction in service and the above shall in no way limit the liabilities and responsibilities of the Contractor in ensuring complete conformance of the materials/equipment supplied to relevant specification, standard, data sheets, drawings, etc.		
9.02.21	For all spares and replacement items, the quality requirements as agreed for the main equipment supply shall be applicable.		
9.02.22	Repair/rectification procedures to be adopted to make the job acceptable shall be subject to the approval of the Employer/ authorised representative.		
9.02.23	Environmental Stress Screening All solid state electronic system / equipment / sub assembly shall be free from infant mortile components. For establishing the compliance to this requirement, the contractor / sub - contractor should meet the following. 1) The Contractor / Sub - contractor shall furnish the established procedure being followed for eliminating infant mortile components. The procedure followed by the Contractor / Sub - contractor should be substantiated along with the statistical figures to validate the procedure being followed. The necessary details as required under this clause shall be furnished at the stage of QP finalization. OR In case the Contractor / Sub - contractor do not have any established procedure to eliminate infant mortile components then two or 10% which ever is less, most densely populated Panels shall be tested for Elevated Temperature Cycle Test as per the following procedure.		
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		Elevated Temperature Test Cycle During the elevated temperature test which shall be for 48 hours, the ambient temperature shall be maintained at 50° C. The equipment shall be interconnected with devices and kept under energized conditions so as to repeatedly perform all operations it is expected to perform in actual service with load on various components being equal to those which will be experienced in actual service. During the elevated temperature test the cubicle doors shall be closed (or shall be in the position same as they are supposed to be in the field) and inside temperature in the zone of highest heat dissipating components / modules shall be monitored. The temperature rise inside the cubicle should not exceed 10° C above the ambient temperature at 50° C. In case of any failure during the test cycle, the further course of action should be mutually discussed for demonstrating the intent of the above requirement.			
2)		Burn in Test Cycle The test shall be conducted on all the panels fully assembled and wired including the panels having undergone the above mentioned elevated temperature test. The period of Burn in Test Cycle shall be 120 hrs and process shall be similar to the elevated temperature test as above except that the temperature shall be reduced to the ambient temperature prevalent at that time. During the above tests, the process I/O and other load on the system shall be simulated by simulated inputs and in the case of control systems; the process which is to be controlled shall also be simulated. Testing of individual components or modules shall not be acceptable. During the Burn in Test the cubicle doors shall be closed (or shall be in the position same as they are supposed to be in the field) and inside temperature in the zone of highest heat dissipating components / modules shall be monitored. The temperature rise inside the cubicle should not exceed 10° C above the ambient temperature. The Contractor / Sub-contractor shall carry out routine test on 100% item at contractor / sub-contractor's works. The quantum of check / test for routine & acceptance test by employer shall be generally as per criteria / sampling plan defined in referred standards. Wherever standards have not been mentioned			
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	quantum of check / test for routine / acceptance test shall be as agreed during detailed engineering stage.		
9.03.00	QA DOCUMENTATION PACKAGE The Contractor shall be required to submit the QA Documentation in two hard copies and two CD ROMs, as identified in respective quality plan with tick (✓) mark.		
9.03.01	Each QA Documentation shall have a project specific Cover Sheet bearing name & identification number of equipment and including an index of its contents with page control on each document. The QA Documentation file shall be progressively completed by the Supplier's sub-supplier to allow regular reviews by all parties during the manufacturing. The final quality document will be compiled and issued at the final assembly place of equipment before despatch. However CD-Rom may be issued not later than three weeks.		
9.03.02	Typical contents of QA Documentation is as below:- (a.) Quality Plan (b.) Material mill test reports on components as specified by the specification and approved Quality Plans. (c.) Manufacturer / works test reports/results for testing required as per applicable codes and standard referred in the specification and approved Quality Plans. (d.) Non-destructive examination results /reports including radiography interpretation reports. Sketches/drawings used for indicating the method of traceability of the radiographs to the location on the equipment. (e.) Heat Treatment Certificate/Record (Time- temperature Chart) (f.) All the accepted Non-conformance Reports (Major/Minor) / deviation, including complete technical details / repair procedure). (g.) CHP / Inspection reports duly signed by the Inspector of the Employer and Contractor for the agreed Customer Hold Points. (h.) Certificate of Conformance (COC) wherever applicable.		
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	(i.) MDCC		
9.03.03	NOT USED.		
9.03.04	NOT USED.		
9.03.05	Similarly, the contractor shall be required to submit two sets (two hard copies and two CD ROMs), containing QA Documentation pertaining to field activities as per Approved Field Quality Plans and other agreed manuals/ procedures, prior to commissioning of individual system.		
9.03.06	Before despatch / commissioning of any equipment, the Supplier shall make sure that the corresponding quality document or in the case of protracted phased deliveries, the applicable section of the quality document file is completed. The supplier will then notify the Inspector regarding the readiness of the quality document (or applicable section) for review.		
	(a.) If the result of the review carried out by the Inspector is satisfactory, the Inspector shall stamp the quality document (or applicable section) for release.		
	(b.) If the quality document is unsatisfactory, the Supplier shall endeavor to correct the incompleteness, thus allowing to finalize the quality document (or applicable section) by time compatible with the requirements as per contract documents. When it is done, the quality document (or applicable section) is stamped by the Inspector.		
	(c.) If a decision is made for despatch, whereas all outstanding actions cannot be readily cleared for the release of the quality document by that time, the supplier shall immediately, upon shipment of the equipment, send a copy of the quality document Review Status signed by the Supplier Representative to the Inspector and notify of the committed date for the completion of all outstanding actions & submission. The Inspector shall stamp the quality document for applicable section when it is effectively completed. The submission of QA documentation package shall not be later than 3 weeks after the despatch of equipment.		
9.03.07	TRANSMISSION OF QA DOCUMENTATION		
	On release of QA Documentation by Inspector, one set of quality document shall be forwarded to Corporate Quality Assurance Department and other set to respective Project Site of Employer.		
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		For the particular case of phased/part derivatives of equipment, the complete quality document of that particular equipment to the Employer shall be issued not later than 3 weeks after the date of the last delivery of equipment.	
9.04.00		Project Manager's Supervision	
9.04.01		To eliminate delays and avoid disputes and litigation, it is agreed between the parties to the Contract that all matters and questions shall be referred to the Project Manager and without prejudice to the provisions of 'Arbitration' clause in Section GCC of Vol.I, the Contractor shall proceed to comply with the Project Manager's decision.	
9.04.02		The work shall be performed under the supervision of the Project Manager. The scope of the duties of the Project Manager pursuant to the Contract, will include but not be limited to the following:	
		(a.) Interpretation of all the terms and conditions of these documents and specifications:	
		(b.) Review and interpretation of all the Contractor's drawing, engineering data, etc:	
		(c.) Witness or his authorised representative to witness tests and trials either at the manufacturer's works or at site, or at any place where work is performed under the contract :	
		(d.) Inspect, accept or reject any equipment, material and work under the contract:	
		(e.) Issue certificate of acceptance and/or progressive payment and final payment certificates	
		(f.) Review and suggest modifications and improvement in completion schedules from time to time, and	
		(g.) Supervise Quality Assurance Programme implementation at all stages of the works.	
9.05.00		INSPECTION, TESTING AND INSPECTION CERTIFICATES	
9.05.01		The word 'Inspector' shall mean the Project Manager and/or his authorised representative and/or an outside inspection agency acting on behalf of the Employer	
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		to inspect and examine the materials and workmanship of the works during its manufacture or erection.	
9.05.02		The Project Manager or his duly authorised representative and/or an outside inspection agency acting on behalf of the Employer shall have access at all reasonable times to inspect and examine the materials and workmanship of the works during its manufacture or erection and if part of the works is being manufactured or assembled on other premises or works, the Contractor shall obtain for the Project Manager and for his duly authorised representative permission to inspect as if the works were manufactured or assembled on the Contractor's own premises or works.	
9.05.03		The Contractor shall give the Project Manager/Inspector ten (10) working days written notice of any material being ready for testing. Such tests shall be to the Contractor's account except for the expenses of the Inspector's. The Project Manager/Inspector, unless the witnessing of the tests is virtually waived and confirmed in writing, will attend such tests within ten (10) working days of the date on which the equipment is noticed as being ready for test/inspection failing which the contractor may proceed with test which shall be deemed to have been made in the inspector's presence and he shall forthwith forward to the inspector duly certified copies of test reports in two (2) copies.	
9.05.04		The Project Manager or Inspector shall within ten (10) working days from the date of inspection as defined herein give notice in writing to the Contractor, or any objection to any drawings and all or any equipment and workmanship which is in his opinion not in accordance with the contract. The Contractor shall give due consideration to such objections and shall either make modifications that may be necessary to meet the said objections or shall inform in writing to the Project Manager/Inspector giving reasons therein, that no modifications are necessary to comply with the contract.	
9.05.05		When the factory tests have been completed at the Contractor's or sub-contractor's works, the Project Manager /Inspector shall issue a certificate to this effect ten (10) working days after completion of tests but if the tests are not witnessed by the Project Manager /Inspectors, the certificate shall be issued within ten (10) working days of the receipt of the Contractor's test certificate by the Project Manager /Inspector. Project Manager /Inspector to issue such a certificate shall not prevent the Contractor from proceeding with the works. The completion of these tests or the issue of the certificates shall not bind the Employer to accept the equipment should it, on further tests after erection be found not to comply with the contract.	
9.05.06		In all cases where the contract provides for tests whether at the premises or works of the Contractor or any sub-contractor, the Contractor, except where otherwise specified shall provide free of charge such items as labour, material, electricity, fuel,	
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		water, stores, apparatus and instruments as may be reasonably demanded by the Project Manager /Inspector or his authorised representatives to carry out effectively such tests on the equipment in accordance with the Contractor and shall give facilities to the Project Manager/Inspector or to his authorised representative to accomplish testing.		
9.05.07		The inspection by Project Manager / Inspector and issue of Inspection Certificate thereon shall in no way limit the liabilities and responsibilities of the Contractor in respect of the agreed Quality Assurance Programme forming a part of the contract.		
9.05.08		To facilitate advance planning of inspection in addition to giving inspection notice as specified at clause no 9.05.03- of this chapter, the Contractor shall furnish quarterly inspection programme indicating schedule dates of inspection at Customer Hold Point and final inspection stages. Updated quarterly inspection plans will be made for each three consecutive months and shall be furnished before beginning of each calendar month.		
9.05.09		All inspection, measuring and test equipment used by contractor shall be calibrated periodically depending on its use and criticality of the test/measurement to be done. The Contractor shall maintain all the relevant records of periodic calibration and instrument identification, and shall produce the same for inspection by NTPC. Wherever asked specifically, the contractor shall re-calibrate the measuring/test equipment in the presence of Project Manager / Inspector.		
9.06.00		ASSOCIATED DOCUMENT FOR QUALITY ASSURANCE PROGRAMME:		
9.06.01		List of items requiring Quality Plan & Sub-supplier approval. Format No. QS-01-QAI-P-01/F3-R0		
9.06.02		Status of Quality Plan and Sub-supplier approval Format No. QS-01-QAI-P-02/F1-R0		
9.06.03		Field Welding Schedule Format No.: QS-01-QAI-P-02/F2-R0		
9.06.04		Manufacturing Quality Plan Format No.: QS-01-QAI-P-09/F1-R0		
9.06.05		Field Quality Plan Format No.: QS-01-QAI-P-09/F2-R0 The above formats are enclosed as Annexure-III to VII		
10.00.00		PRE-COMMISSIONING AND COMMISSIONING FACILITIES (a.) As soon as the facilities or part thereof has been completed operationally and structurally and before start-up, each item of the equipment and systems		
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		forming part of facilities shall be thoroughly cleaned and then inspected jointly by the Employer and the Contractor for correctness of and completeness of facility or part thereof and acceptability for initial pre-commissioning tests, commissioning and start-up at Site. The list of pre-commissioning tests to be performed shall be as mutually agreed and included in the Contractor's quality assurance programme as well as those included in Part-D, Section-VI and elsewhere in the Technical Specifications. (b.) The Contractor's pre-commissioning/ commissioning/start-up engineers, specially identified as far as possible, shall be responsible for carrying out all the pre-commissioning tests at Site. On completion of inspection, checking and after the pre-commissioning tests are satisfactorily over, the commissioning of the complete facilities shall be commenced during which period the complete facilities, equipments shall be operated integral with sub-systems and supporting equipment as a complete plant. (c.) All piping system shall be flushed, steam blown, air blown as required and cleanliness demonstrated using acceptable industry standards. Procedures to accomplish this work shall be submitted for approval to the Employer six months prior to the respective implementations. The Employer will approve final verification of cleanliness. (d.) The time consumed in the inspection and checking of the units shall be considered as a part of the erection and installation period. (e.) The check outs during the pre - commissioning period should be programmed to follow the construction completion schedule. Each equipment/system, as it is completed in construction and turned over to Employer's commissioning (start-up) Engineer(s), should be checked out and cleaned. The checking and inspection of individual systems should then follow a prescribed schedule to be agreed by the Employer. (f.) The Contractor during initial operation and performance testing shall conduct vibration testing to determine the 'base line' of performance of all plant rotating equipment. These tests shall be conducted when the equipment is running at the base load, peak load as well as lowest sustained operating condition as far as practicable. (g.) Contractor shall furnish the commissioning organization chart for review & acceptance of employer at least eighteen months prior to the schedule date of synchronization of 1st unit. The chart should contain: (1.) Biodata including experience of the Commissioning Engineers.	
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10.02.00	(2.) Role and responsibilities of the Commissioning Organisation members. (3.) Expected duration of posting of the above Commissioning Engineers at site.		
	Initial Operation a) On completion of all pre-commissioning activities / tests and as a part of commissioning the complete facilities shall be put on 'Initial Operation' during which period all necessary adjustments shall be made while operating over the full load range enabling the facilities to be made ready for the Guarantee Tests. b) The 'Initial Operation' of the complete facility as an integral unit shall be conducted for 720 continuous hours. During the period of initial operation of 720 hours, the unit shall operate continuously at full rated load for a period not less than 72 hours. The Initial Operation shall be considered successful, provided that each item/ part of the facility can operate continuously at the specified operating characteristics, for the period of Initial Operation with all operating parameters within the specified limits and at or near the predicted performance of the equipment/ facility. The Contractor shall intimate the Employer about the commencement of initial operation and shall furnish adequate notice to the Employer in this respect. c) Any loss of generation due to constraints attributable to the Employer shall be construed as Deemed Generation. In the event of test interruptions as a result of Force Majeure or Employer-Caused-Delay during Initial Operation test, where. (i) The total cumulative interrupted time during the test is more than twenty-four (24) hours. (ii) The total number of interruptions during the test is more than four (4). The test shall not be deemed a successful Initial Operation Test.		
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	The interrupted test resulting from Force Majeure or Employer-Caused-Delay shall be extended by an amount of time equal to the cumulative length of the interruptions, including time to return to steady-state operation; the test data for the period of interruptions shall be excluded from analysis; and the test data that were collected both before and after the interruptions shall be included in the analysis. d) An Initial Operation report comprising of observations and recordings of various parameters to be measured in respect of the above Initial Operation shall be prepared by the Contractor. This report, besides recording the details of the various observations during initial operation shall also include the dates of start and finish of the Initial Operation and shall be signed by the representatives of both the parties. The report shall have sheets, recording all the details of interruptions occurred, adjustments made and any minor repairs done during the Initial Operation. Based on the observations, necessary modifications/repairs to the plant shall be carried out by the Contractor to the full satisfaction of the Employer to enable the latter to accord permission to carry out the Guarantee tests on the facilities. However, minor defects which do not endanger the safe operation of the equipment, shall not be considered as reasons for with holding the aforesaid permission. (g) Grid Restriction Any loss in generation in terms of power (KW) or energy (KWH) during Initial operation Test due to grid restrictions shall be treated as deemed generation. however, the total cumulative deemed generation shall not exceed 5% of the total generation during the test period failing which the test shall be extended to limit the deemed generation to 5% of the total generation.		
11.00.00	GUARANTEE TESTS		
	a) The final test as to prove the Functional Guarantees shall be conducted at Site by the Contractor in presence of the Employer. The contractor's Commissioning, Start-up Engineer shall make the unit ready to conduct such test before start of initial operation. Such test shall be conducted along with Initial Operations. b) These tests shall be binding on both the parties of the Contract to determine compliance of the equipment with the functional guarantee. c) For performance/ demonstration tests instrumentations, accuracy class shall be as per specified test codes. The numbers and location of the instruments shall be as per the specified test codes. In addition the values of parameters		
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		shall be logged from the information system provided under Employer's Distributed Digital Control Monitoring and Information system. Test will be conducted at specified load points. d) Any special equipment, tools and tackles required for the successful completion of the Guarantee Tests shall be provided by the Contractor, free of cost. e) The Guarantee tests and specific tests to be conducted on equipments have been brought out in detail elsewhere in the specification.		
12.00.00	TAKING OVER Upon successful completion of Initial Operations and all the tests conducted to the Employer's satisfaction, the Employer shall issue to the Contractor a Taking over Certificate as a proof of the final acceptance of the equipment. Such certificate shall not unreasonably be with held nor will the Employer delay the issuance thereof, on account of minor omissions or defects which do not affect the commercial operation and/or cause any serious risk to the equipment. Such certificate shall not relieve the Contractor of any of his obligations which otherwise survive, by the terms and conditions of the Contract after issuance of such certificate.			
13.00.00	TRAINING OF EMPLOYER'S PERSONNEL			
13.01.00	The scope of service under training of Employer's engineers shall include a training module in the areas of Operation & Maintenance. Such training should cover the following areas as a minimum in order to enable these personnel to individually take the responsibility of operating and maintaining the power station in a manner acceptable to the Employer: (a.) Training for TG and related equipments. (b.) TG related C&I system like turbine supervisory system (TSS) etc. (c.) DDCMIS as detailed in Part-B (d.) Training for Electric Power Supply systems (e.) Training for power cycle piping / critical piping			
13.02.00	The scope of services under training shall also necessarily include training of Employer's Engineering personnel covering entire scope for the package This shall			
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		cover all disciplines viz, Mechanical, Electrical, C&I, & QA etcand shall include all the related areas like Design familiarization, training on product design features and product design softwares of major equipment and systems, engineering, manufacturing, erection, commissioning, training on operating features of equipment, quality assurance and testing, plant visits and visits to manufacturer's works, exposure to various kinds of problems which may be encountered in fabrication, manufacturing, erection, welding etc.			
13.03.00		Contractor shall also arrange for training of Employer's personnel in respect of fire detection and protection systems and other Balance of Plant equipments.			
13.04.00		Exact details, extent of training and the training schedule shall be finalised based on the Bidder's proposal within two (2) months from placement of award.			
13.05.00		In all the above cases, the lodging and boarding of the Employer's personnel shall be at the cost of Bidder. The Bidder shall make all necessary arrangements towards the same.			
13.06.00		Take off prices (product wise) should be indicated by the Bidder in the Bid Proposal Sheets. Employer reserves the right to include or exclude these item(s) during placement of Award.			
		Note:			
		1. For training purposes, one (1) man month implies 30 working days (excluding all intervening holidays) per person.			
		2. The total man months in each area shall be divided into suitable number of modules which shall be discussed and finalized during post award stage.			
		3. Duration of each module shall not be less than 10 (ten) working days out of which 20 % shall be for plant/manufacturers' works visits and 80% shall be class room training.			
		4. A) Location of class room training for engineering shall be at Design/Engineering office.			
		B) Class room training for erection/O&M shall be at location of Manufacturers' works.			
		TRAINING REQUIRED IN MAN MONTH			
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Steam Turbine Generator and its Auxiliaries including electricals	6.5	9.0	23
Station C&I (Control and Instrumentation)	3.5	5.5	10
Total			

Area	Topics	MANDAYS
Condensate Polishing Plant (CPU)	System/Product Design - Basic design features including Pre-filters - Theory & principle of operation - Latest technological trends in CPU & Pre-filters and design aspects & Selection criteria.	3
	Plant Visit - Operational feedback - O&M history / problems related to CPU plant	
	Visit to Manufacturer's Work -Manufacturing process of pre-filters and major equipment -Testing facilities	
	Operation & Maintenance of Plant -Trouble shooting and fault analysis -Familiarization of special maintenance techniques -Special tool and tackles familiarization	

14.00.00

SAFETY ASPECTS DURING CONSTRUCTION AND ERECTION

In addition to the requirements given in Erection Conditions of Contract (ECC) the following shall also cover:

(a.) Working platforms should be fenced and shall have means of access.

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15.00.00	(b.) Ladders in accordance with Employer's safety rules for construction and erection shall be used. Rungs shall not be welded on columns. All the stairs shall be provided with handrails immediately after its erection. NOISE LEVEL The equivalent 'A' weighted sound pressure level measured at a height of 1.5 m above floor level in elevation and at a distance of one (1) metre horizontally from the nearest surface of any equipment / machine, furnished and installed under these specifications, expressed in decibels to a reference of 0.0002 microbar, shall not exceed 85 dBA except for (a.) Safety valves and associated vent pipes for which it shall not exceed 105 dBA-115 dBA. (b.) Regulating drain valves in which case it shall be limited to 90 dBA-115dBA. (c.) TG unit in which case it shall not exceed 90 dBA. (d.) For HP-LP bypass valves and other intermittantly operating control valves, the noise level shall be within the limit of 90 dBA. (e) For BFP motor, the noise level shall be within the limit of 90 dBA		
16.00.00	PACKAGING AND TRANSPORTATION All the equipments shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at Site till the time of erection. While packing all the materials, the limitation from the point of view of the sizes of railway wagons available in India should be taken account of. The Contractor shall be responsible for any loss or damage during transportation, handling and storage due to improper packing. The Contractor shall ascertain the availability of Railway wagon sizes from the Indian Railways or any other agency concerned in India well before effecting despatch of equipment. Before despatch it shall be ensured that complete processing and manufacturing of the components is carried out at shop, only restricted by transport limitation, in order to ensure that site works like grinding, welding, cutting & preassembly to bare minimum. The Employer's Inspector shall have right to insist for completion of works in shops before despatch of materials for transportation.		
17.00.00	ELECTRICAL ENCLOSURE		
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		All electrical equipments and devices, including insulation, heating and ventilation devices shall be designed for ambient temperature and a maximum relative humidity as specified elsewhere in the specification,	
18.00.00	INSTRUMENTATION AND CONTROL	All instrumentation and control systems/ equipment/ devices/ components, furnished under this contract shall be in accordance with the requirements stated herein, unless otherwise specified in the detailed specifications.	
18.01.00	All instrument scales and charts shall be calibrated and printed in metric units and shall have linear graduation. The ranges shall be selected to have the normal reading at 75% of full scale. All scales and charts shall be calibrated and printed in Metric Units as follows: a) Temperature - Degree centigrade (deg C) b) Pressure - Kilograms per square centimetre (Kg/cm2). Pressure instrument shall have the unit suffixed with 'a' to indicate absolute pressure. If nothing is there, that will mean that the indicated pressure is gauge pressure. c) Draught - Millimetres of water column (mm wc). d) Vacuum - Millimeters of mercury column (mm Hg) or water column (mm Wcl). e) Flow (Gas) - Tonnes/ hour f) Flow (Steam) - Tonnes/ hour g) Flow (Liquid) - Tonnes / hour h) Flow base - 760 mm Hg. 15 deg.C i) Density - Grams per cubic centimetre.		
18.02.00		All instruments and control devices provided on panels shall be of miniaturized design, suitable for modular flush mounting on panels with front draw out facility and flexible plug-in connection at rear.	
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18.03.00	NOT USED.		
19.00.00	ELECTRICAL NOISE CONTROL The equipment furnished by the Contractor shall incorporate necessary techniques to eliminate measurement and control problems caused by electrical noise. Areas in Contractor's equipment which are vulnerable to electrical noise shall be hardened to eliminate possible problems. Any additional equipment, services required for effectively eliminating the noise problems shall be included in the proposal.		
20.00.00	INSTRUMENT AIR SYSTEM The instrument air supply system as supplied by the Contractor for various pneumatic control & instrumentation devices like pneumatic actuators, power cylinders, E/P converters, piping / tubing etc. shall be as per the details furnished elsewhere. Each pneumatic instrument shall have an individual air shut - off valve. The pressure regulating valve shall be equipped with an internal filter, a 50 mm pressure gauge and a built-in filter housing blow down valve.		
21.00.00	TAPPING POINTS FOR MEASUREMENTS Tapping points shall include probes, wherever applicable, for analytical measurements and sampling. For direct temperature measurement of all working media, one stub with internal threading of approved pattern shall be provided along with suitable plug and washer. The Contractor will be intimated about thread standard to be adopted. The following shall be provided on equipment by the Contractor. The standard which is to be adopted, will be intimated to the Contractor. (a.) Temperature test pockets with stub and thermowell (b.) Pressure test pockets		
22.00.00	SYSTEM DOCUMENTATION The Bidder shall provide drawings, system overview & description, hardware/ software details, technical literature, functional & hardware schemes, bill of material, parts list, interconnection diagrams, data sheets, erection/ installation/		
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		commissioning procedures, instruction/ operating manuals, etc. for each of the C& I system / sub-systems/ equipment supplied under this package. The documentation shall include complete details of the C&I systems/ sub-systems/ equipment to enable review by Employer during detailed engineering stage and to provide information to plant personnel for operation & Maintenance (including quick diagnostics & trouble shooting) of these C&I systems/ sub-systems/ equipment at site. The minimum documentation requirements for C&I systems shall be as stipulated under C&I "Technical Data Sheets" Part of specifications. In addition to this, system documentation for DDCMIS shall include as a minimum to that specified elsewhere in the Technical Specification. The exact format, submission schedule and contents of various documents shall be as finalised during detailed engineering stage.			
22.01.00		Bill of material (instrument list) for all C&I equipment/ devices shall be furnished by the bidder in standard formats as approved by the Employer.			
23.00.00		MAINTENANCE MANUALS OF ELECTRONIC MODULES The Contractor shall have to furnish two (2) sets of all maintenance manual of each and every electronic card/module as employed on the various systems and equipment including peripherals etc., offered by him. The Contractor will also have to furnish the data regarding the expected failure rate of various modules and other system components. Further, the contractor shall furnish a set of operating manuals which should include block diagrams, make, model/type, details wiring and external connection drawings etc as required to do the testing and maintenance of the electronic modules.			
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO.: THDC/RKSH/CC-9915-371		GENRAL TECHNICAL REQUIREMENTS (GTR)	
				PAGE 53 OF 89	

CLAUSE NO.		GENERAL TECHNICAL REQUIREMENTS		
		ANNEXURE-I		
S.NO.		DESCRIPTION OF DOCUMENTS	NO OF PRINTS	NO. OF CD-ROMs
1.		PLANT DEFINITION MANUAL-	2 sets	4 CD-ROMs
2.		Drawings "FOR APPROVAL"		
	i)	Layout drawings / P&IDs	6	2 CD - ROMs
	ii)	Other drawings	2	2 CD - ROMs
3.		Drawings "FOR INFORMATION"	2	2 CD - ROMs
4.		Drawings "FINAL DRAWING"	15	4 CD-ROMs
5.		Drawings "AS BUILT "	15	4 CD-ROMs
6.		DATASHEETS, DESIGN CALCULATIONS, PURCHASE SPECIFICATIONS, etc. and Other type of documents		
	i)	For Approval	2	2 CD - ROMs
	ii)	FINAL	15	4 CD-ROMs -
	iii)	Analysis reports of equipments/ piping/ structures components/ systems employing software packages as detailed in the specifications	2	2 CD - ROMs
7.		Erection manual "1st Submission"	4 Sets	2 CD - ROMs
8.		Erection manual "FINAL "	4 Sets	4 CD ROMs
9.		Operation & Maintenance manual "1st submission"	4	2 CD - ROMs
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO.: THDC/RKSH/CC-9915-371	GENRAL TECHNICAL REQUIREMENTS (GTR)	PAGE 54 OF 89

PS-PEM-MAX			
CLAUSE NO.			
GENERAL TECHNICAL REQUIREMENTS			
S.NO.	DESCRIPTION OF DOCUMENTS	NO OF PRINTS	NO. OF CD-ROMs
10	Operation & Maintenance manual "FINAL"	4 Sets	4 CD-ROMs
11	Plant Hand Book "1st Submission"	4 Sets	2 CD ROMs
12	Plant Hand Book "FINAL"	4 Sets	4 CD ROMs
13	Commissioning and Performance Procedure manual "1st Submission"	4 Sets	2 CD-ROMs
14	Commissioning and Performance Procedure manual "FINAL"	4 Sets	4 CD ROMs
15	Performance and Functional GURANTEES TEST REPORT	4 Sets	4 CD ROMs
16	Project completion report	15	4 CD ROMs
17	QA programme including Organi- sation for implement-ation and QA systemmanual (with revision- servicing)	1	1 CD ROM
18	Vendor details in respect of pro- posed vendors including contractor's evaluation report.	1	1 CD ROM
19	Manufacturing QPs, Field QPs, Field welding schedules and their reference documents like test procedures, WPS, PQR etc.		
(i)	For review/comment	2	2 CD-ROMs
(ii)	For final approval	2	2 CD ROMs
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO.: THDC/RKSH/CC-9915-371	GENRAL TECHNICAL REQUIREMENTS (GTR) PAGE 55 OF 89

PS-PEM-MAX		GENERAL TECHNICAL REQUIREMENTS	
CLAUSE NO.			

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PS-PEM-MAX	
CLAUSE NO.	एनटीपीसी NTPC GENERAL TECHNICAL REQUIREMENTS

PS-PEM-MAX																					
CLAUSE NO.	एनडीपीसी NTPC GENERAL TECHNICAL REQUIREMENTS 																				
	ANNEXURE-II LIST OF CODES AND STANDARDS <table><tr><th>Indian Standards</th><th>Title</th><th>International and Internationally recognised standards</th></tr><tr><td>IS:277</td><td>Galvanised steel sheets (plain or corrugated)</td><td></td></tr><tr><td>IS:655</td><td>Specification for metal air duct</td><td></td></tr><tr><td>IS:800</td><td>Code of practice for use of structural steel in general building construction</td><td>BS 449:1969 BS 5950 ASA A57, 1-1952</td></tr><tr><td>IS:807</td><td>Code of practice for design, manufacture, erection and testing (Structural portion) of cranes and hoists 6588 (Issued by Standards Association of Australia). DIN 120:1936 (Sheet 1) DIN 120:1936 (Sheet 2) 327 part-I, 1951 BS 466 part-II, 1960 BS 644:1960 BS 1757:1951 BS 2573:part-I:1960</td><td>Draft Revision of A.S. NO. CS.2 SAA Crane and Hoist code Doc:No. BU/4 Rev</td></tr><tr><td>IS:875</td><td>Code of practice for design loads (other than earthquake) for buildings and structures Leading standards (issued by Canadian Standard) DIN-1055-1955 (Issued by ASA)</td><td>National Building code of Canada (1953)-Part-IV Design section 4.1</td></tr></table>			Indian Standards	Title	International and Internationally recognised standards	IS:277	Galvanised steel sheets (plain or corrugated)		IS:655	Specification for metal air duct		IS:800	Code of practice for use of structural steel in general building construction	BS 449:1969 BS 5950 ASA A57, 1-1952	IS:807	Code of practice for design, manufacture, erection and testing (Structural portion) of cranes and hoists 6588 (Issued by Standards Association of Australia). DIN 120:1936 (Sheet 1) DIN 120:1936 (Sheet 2) 327 part-I, 1951 BS 466 part-II, 1960 BS 644:1960 BS 1757:1951 BS 2573:part-I:1960	Draft Revision of A.S. NO. CS.2 SAA Crane and Hoist code Doc:No. BU/4 Rev	IS:875	Code of practice for design loads (other than earthquake) for buildings and structures Leading standards (issued by Canadian Standard) DIN-1055-1955 (Issued by ASA)	National Building code of Canada (1953)-Part-IV Design section 4.1
Indian Standards	Title	International and Internationally recognised standards																			
IS:277	Galvanised steel sheets (plain or corrugated)																				
IS:655	Specification for metal air duct																				
IS:800	Code of practice for use of structural steel in general building construction	BS 449:1969 BS 5950 ASA A57, 1-1952																			
IS:807	Code of practice for design, manufacture, erection and testing (Structural portion) of cranes and hoists 6588 (Issued by Standards Association of Australia). DIN 120:1936 (Sheet 1) DIN 120:1936 (Sheet 2) 327 part-I, 1951 BS 466 part-II, 1960 BS 644:1960 BS 1757:1951 BS 2573:part-I:1960	Draft Revision of A.S. NO. CS.2 SAA Crane and Hoist code Doc:No. BU/4 Rev																			
IS:875	Code of practice for design loads (other than earthquake) for buildings and structures Leading standards (issued by Canadian Standard) DIN-1055-1955 (Issued by ASA)	National Building code of Canada (1953)-Part-IV Design section 4.1																			
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO.: THDC/RKSH/CC-9915-371	GENRAL TECHNICAL REQUIREMENTS (GTR) PAGE 58 OF 89																		

PS-PEM-MAX			
CLAUSE NO.	एनडीपीसी NTPC GENERAL TECHNICAL REQUIREMENTS		
	IS:1239 Part-I	Mild steel tubes	(ISO/R 65-1957) (ISO/R-64-1958) (ISO/R-65-1958) (BS 1387 : 1957)
	IS:1239 Part-II	Mild steel tubulars and other wrought steel pipe fittings	BS 1387 : 1967 BS 1387 :1967 BS 1740 :1965
	IS:2825	Code for unfired vessels	
	IS:1520	Horizontal centrifugal pumps for clear cold and fresh water	
	IS:1600	Code for practice for performance of constant speed IC Engines for general purpose	
	IS:1601	Specification for perform- ance of constant speed IC Engines for general Purpose	
	IS:1893	Criteria for earthquake resistant design of structures	
	IS1978-1971	Line Pipe April 1969.	API Standards 5L
	IS:2254-1970	Dimensions of vertical shaft motor for pumps	IEC Pub 72-1 part I NEMA Pub MG 1 1954
	IS:2266	Steel wire ropes for general engineering purposes	BS :302 : 1968
	IS:2312	Propellant type Ventilation fans	
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO.: THDC/RKSH/CC-9915-371	GENRAL TECHNICAL REQUIREMENTS (GTR)
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PS-PEM-MAX			
CLAUSE NO.	एनडीपीसी NTPC GENERAL TECHNICAL REQUIREMENTS 		
	IS:2365	Steel wire suspension ropes for lifts and hoists	BS : 1957
	IS:3346	Method for the determination of thermal conductivity of thermal insulation materials (two slab guarded hot plate method)	DIN 52612 (Deutscher Normenausschuss) ASTM C 163-1964 (American Society of Testing and materials) ASTM C 167-1974 ASTM C 177-1963
	IS:3354	Outline dimensions for electric lifts.	
	IS:3401	Silica gel	
	IS:3588	Specification for electrical axial flow fans	
	IS:3589	Electrically welded steel pipes for water, gas and sewage (200mm to 2000 mm Nominal Diametre)	
	IS:3677	Unbonded rock and slag wool for thermal insulation	
	IS:3815	Point hook with shank for general engineering purposes	BS 482 - 1968 Doc.:67/3 1284 (Revision of BS 2903) (Issued BS)
	IS:3895	Specification for monocrystalline semiconductor rectifier cells and stacks	
	IS:3963	Roof extractor unit	
	IS:3975	Mild steel wires, strips and tapes for armouring cables	
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO.: THDC/RKSH/CC-9915-371	GENRAL TECHNICAL REQUIREMENTS (GTR)
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PS-PEM-MAX			
CLAUSE NO.	एनडीपीसी NTPC GENERAL TECHNICAL REQUIREMENTS 		
	IS:4503	Shell and tube type heat Exchanger	
	IS:4540	Specification for monory-stallines rectifire assembly equipment	
	IS:4671	Expanded polystyrene for thermal insulation purpose	
	IS:4736	Hot dip zinc coating on steel tubes	
	IS:4894	Centrifugal fans	
	IS:5456	Code of practice for testing of positive displacement type air compressors and exhauster (For Test Tolerance Only)	
	IS:5749	Forged ramshorn hooks	Entwurf DIN 15402 Blett 1 Entwurf DIN 15402 BS 3017-1958
	IS:6392	Steel pipe flanges	BS 4504 : 1969
	IS:6524 Part-I	Code of practice for design of tower cranes Static and rail mounted	BS 2799 : 1956
	IS:7098	Cross linked Polyethylene insulated PVC sheathed cables	Standard No. 1 to IPCEA (USA) Pub. No. 5-66-524
	IS:7373	Specification for wrought aluminium and aluminium sheet and strips	
	IS:7938	Air receivers for compressed air installation	
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO.: THDC/RKSH/CC-9915-371	GENRAL TECHNICAL REQUIREMENTS (GTR)
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PS-PEM-MAX		CLAUSE NO.		एनडीपीसी NTPC				GENERAL TECHNICAL REQUIREMENTS			
				ISO:1217		Displacement compressor-Acceptance test					
				ASHRAE-33 and air heating coils.		Methods of testing for rating of forced circulation air cooling					
				ASHRAE-52-76 particle matter.		Air cleaning device used in general ventilation for removing					
				ASHRAE-22-72 condensers.		Method of testing for rating of water cooled refrigerant					
				ASHRAE 23-67		Methods of testing for rating of positive displacement					
						refrigerant compressors.					
				ARI-450-6		Standard for water cooled refrigerant condensers.					
				ARI-550		Standard for centrifugal water chilling packages.					
				ARI-410		Standard for forced circulation air cooling and air heating coils					
				ARI-430/435 BS:848 (Part-1,2)		Central station AHU/Application of Central Station AHU Fans					
				BS:400		Low carbon steel cylinders for the storage & transport of permanent gases.					
				BS:401		Low carbon steel cylinders for the storage & transport of liquified gases.					
				CTI Code ACT-105		Acceptance test code for Water Cooling Tower.					
				ANSI-31.5		Refrigerant piping					
				ASME-PTC- 23-1958		Atmospheric Water Cooling Equipment					
				AMCA A-21C		Test Code for air moving devices					
				API:618		Reciprocating Compressor for general refinery services.					
				HYDRAULIC INSTITUTE STANDARDS.							
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES				TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO.: THDC/RKSH/CC-9915-371				GENRAL TECHNICAL REQUIREMENTS (GTR)		PAGE 62 OF 89	

PS-PEM-MAX		CLAUSE NO.					
GENERAL TECHNICAL REQUIREMENTS							
HYDRANT SYSTEM MANUALS OF TAC. TAC MANUALS OF SPRAY SYSTEM NFPA USA/ NSC UK/ UL USA/ FM USA STANDARDS. INDIAN EXPLOSIVES ACT. INDIAN FACTORIES ACT. STANDARD OF TUBULAR EXCHANGER MANUFACTURER'S ASSOCIATION. CODE AND STANDARD FOR CIVIL WORKS Some of the applicable Standards, Codes and references are as follows: Excavation & Filling IS: 2720 (Part-II, IV TO VIII, XIV, XXI, XXIII, XXIV, XXVII TO XXIX, XL) Methods of test for soils-determination for water content etc. IS: 4701 Code of practice for earth work on canals. IS: 9758 Guide lines for Dewatering during construction. IS: 10379 Code of practice for field control of moisture and compaction of soils for embankment and sub-grade. Properties, Storage and Handling of Common Building Materials IS: 269 Specification for ordinary Portland cement, 33 grade. IS: 383 Specification for coarse and fine aggregates from natural sources for concrete. IS: 432 Specification for mild steel and (Parts 1&2) medium tensile steel bars and hard-drawn steel wires for concrete reinforcement. IS: 455 Specification for Portland slag cement. IS: 702 Specification for Industrial bitumen. IS: 712 Specification for building limes.							
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PS-PEM-MAX		NTPC		GENERAL TECHNICAL REQUIREMENTS	
CLAUSE NO.					
		IS: 808	Rolled steel Beam channel and angle sections.		
		IS: 1077	Specification for common burnt clay building bricks.		
		IS: 1161	Specification of steel tubes for structural purposes.		
		IS: 1363	Hexagon head Bolts, Screws and nuts of production grade C.		
		IS: 1364	Hexagon head Bolts, Screws and Nuts of Production grade A & B.		
		IS: 1367	Technical supply conditions for Threaded fasteners.		
		IS: 1489	Specification for Portland-pozzolana cement:		
		(Part-I)	Fly ash based.		
		(Part-II)	Calcined clay based.		
		IS: 1542	Specification for sand for plaster.		
		IS: 1566	Specification for hard-drawn steel wire fabric for concrete reinforcement.		
		IS: 1786	Specification for high strength deformed bars for concrete reinforcement.		
		IS: 2062	Specification for steel for general structural purposes.		
		IS: 2116	Specification for sand for masonry mortars.		
		IS: 2386	Testing of aggregates for concrete.		
		(Parts-I to VIII)			
		IS: 3150	Hexagonal wire netting for general purpose.		
		IS: 3495	Methods of tests of burnt clay building bricks.		
		(Parts-I to IV)			
		IS: 3812	Specification for fly ash, for use as pozzolana and admixture.		
		IS: 4031	Methods of physical tests for hydraulic cement.		
		IS: 4032	Methods of chemical analysis of hydraulic cement.		
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PS-PEM-MAX		GENERAL TECHNICAL REQUIREMENTS	
CLAUSE NO.			

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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
	एनटीपीसी NTPC		
	IS: 4995 (Parts I & II)	Criteria for design of reinforced concrete bins for the storage of granular and powdery materials.	
	IS: 5256	Code or practice for sealing joints in concrete lining on canals.	
	IS: 5525 concrete work.	Recommendations for detailing of reinforcement in reinforced concrete work.	
	IS: 5624	Specification for foundation bolts.	
	IS: 6461	Glossary of terms relating to cement concrete.	
	IS: 6494	Code of practice for water proofing of underground water reservoirs and swimming pools.	
	IS: 6509	Code of practice for installation of joints in concrete pavements.	
	IS: 7861	Code of practice for extreme weather concreting. (Parts I & II)	
	IS: 9012	Recommended practice for shot concreting.	
	IS: 9103	Specification for admixtures for concrete.	
	IS: 9417	Recommendations for welding cold worked steel bars for reinforced concrete construction.	
	IS: 10262	Recommended guidelines for concrete mix design.	
	IS: 11384	Code of practice for composite construction in structural steel and concrete.	
	IS: 11504	Criteria for structural design of reinforced concrete natural draught cooling towers.	
	IS: 12118	Specification for two-parts poly sulphide.	
	IS: 12200	Code of practice for provision of water stops at transverse contraction joints in masonry and concrete dams.	
	IS: 13311	Method of non-destructive testing of concrete.	
	Part-1	Ultrasonic pulse velocity.	
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO.: THDC/RKSH/CC-9915-371	GENRAL TECHNICAL REQUIREMENTS (GTR) PAGE 67 OF 89

PS-PEM-MAX		CLAUSE NO.					
		GENERAL TECHNICAL REQUIREMENTS					
	Part-2	Rebound hammer.					
	SP:23	Handbook of concrete mixes					
	SP: 24	Explanatory Handbook on IS: 456-1978					
	SP: 34	Handbook on concrete reinforcement and detailing.					
	Precast Concrete Works						
	SP: 7(PartVI/	National Building Code- Structural design of prefabrication and Sec.7) systems building.					
	IS: 10297	Code of practice for design and construction of floors and roofs using precast reinforced/prestressed concrete ribbed or cored slab units.					
	IS: 10505	Code of practice for construction of floors and roofs using pre-cast reinforced concrete units.					
	Masonry and Allied Works						
	IS: 1905	Code of Practice for Structural Safety of Buildings-Masonry walls.					
	IS: 2212	Code of Practice for Brickwork.					
	IS: 2250	Code of Practice for Preparation and use of Masonry Mortar.					
	SP: 20	Explanatory hand book on masonry code.					
	Sheeting Works						
	IS:277	Galvanised steel sheets (plain or corrugated).					
	IS: 459	Unreinforced corrugated and semi-corrugated asbestos cement sheets.					
	IS: 513	Cold-rolled carbon steel sheets.					
IS: 730	Specification for fixing accessories for corrugated sheet roofing.						
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO.: THDC/RKSH/CC-9915-371		GENRAL TECHNICAL REQUIREMENTS (GTR)		PAGE 68 OF 89	

PS-PEM-MAX		CLAUSE NO.					
		GENERAL TECHNICAL REQUIREMENTS					
	IS: 1626	Specification for Asbestos cement building pipes and pipe fittings, gutters and gutter fittings and roofing fittings.					
	IS: 2527	Code of practice for fixing rain water gutters and down pipe for roof drainage.					
	IS: 3007	Code of practice for laying of asbestos cement sheets.					
	IS: 5913	Methods of test for asbestos cement products.					
	IS: 7178	Technical supply conditions for tapping screw.					
	IS: 8183	Bonded mineral wool.					
	IS: 8869	Washers for corrugated sheet roofing.					
	IS: 12093	Code of practice for laying and fixing of sloped roof covering using plain and corrugated galvanised steel sheets.					
	IS: 12866	Plastic translucent sheets made from thermosetting polyster resin (glass fibre reinforced).					
	IS: 14246	Specification for continuously pre-painted galvanised steel sheets and coils.					
	Fabrication and Erection of Structural Steel Work						
	IS: 2016	Specification for plain washers.					
	IS: 814	Specification for covered Electrodes for Metal Arc Welding for weld steel.					
	IS: 1852	Specification for Rolling and Cutting Tolerances for Hot rolled steel products.					
	IS: 3502	Specifications for chequered plate.					
	IS: 6911	Specification for stainless steel plate, sheet and strip.					
	IS: 3757	Specification for high strength structural bolts					
	IS: 6623	Specification for high strength structural nuts.					
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO.: THDC/RKSH/CC-9915-371		GENRAL TECHNICAL REQUIREMENTS (GTR)		PAGE 69 OF 89	

PS-PEM-MAX		GENERAL TECHNICAL REQUIREMENTS	
CLAUSE NO.			

PS-PEM-MAX		CLAUSE NO.		एनडीपीसी NTPC		GENERAL TECHNICAL REQUIREMENTS							
		IS : 1182		Recommended practice for Radiographic Examination of fusion welded butt joints in steel plates.									
		IS : 3664		Code of practice for Ultra sonic Testing by pulse echo method.									
		IS : 3613		Acceptance tests for wire flux combination for submerged Arc Welding.									
		IS : 3658		Code of practice for Liquid penetrant Flaw Detection.									
		IS : 5334		Code of practice for Magnetic Particle Flaw Detection of Welds.									
		Plastering and Allied Works											
		IS : 1635		Code of practice for field slaking of Building lime and preparation of putty.									
		IS : 1661		Application of cement and cement lime plaster finishes.									
		IS : 2333		Plaster-of-paris.									
		IS : 2402		Code of practice for external rendered finishes.									
		IS : 2547		Gypsum building plaster.									
		IS : 3150		Hexagonal wire netting for general purpose.									
		Acid and Alkali Resistant Lining											
		IS : 158		Ready mixed paint, brushing, bituminous, black, lead free, acid, alkali & heat resisting.									
		IS : 412		Specification for expanded metal steel sheets for general purpose.									
		IS : 4441		Code of practice for use of silicate type chemical resistant mortars.									
		IS : 4443		Code of practice for use of resin type chemical resistant mortars.									
		IS : 4456		Method of test for chemical resistant tiles. (Part I & II)									
		KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES				TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO.: THDC/RKSH/CC-9915-371				GENRAL TECHNICAL REQUIREMENTS (GTR)		PAGE 71 OF 89	

PS-PEM-MAX		GENERAL TECHNICAL REQUIREMENTS	
CLAUSE NO.			

PS-PEM-MAX			
CLAUSE NO.		 GENERAL TECHNICAL REQUIREMENTS	
IS : 3311	Waste plug and its accessories for sinks and wash basins.		
IS : 3438	Silvered glass mirrors for general purposes.		
IS : 3486	Cast iron spigot and socket drain pipes.		
IS : 3589	Electrically welded steel pipes for water, gas and sewage (200mm to 2000mm nominal diameter).		
IS : 3989	Centrifugally cast (Spun) iron spigot and socket soil, waste and ventilating pipes, fittings and accessories.		
IS : 4111 (Part I to IV)	Code of practice for ancillary structure in sewerage system.		
IS : 4127	Code of practice for laying of glazed stone-ware pipes.		
IS : 4764	Tolerance limits for sewage effluents discharged into inland-surface waters.		
IS : 4827	Electro plated coating of nickel and chromium on copper and copper alloys.		
IS : 5329	Code of practice for sanitary pipe work above ground for buildings.		
IS : 5382	Rubber sealing rings for gas mains, water mains and sewers.		
IS : 5822	Code of practice for laying of welded steel pipes for water supply.		
IS : 5961	Cast iron grating for drainage purpose.		
IS : 7740	Code of practice for road gullies.		
IS : 8931	Cast copper alloy fancy bib taps and stop valves for water services.		
IS : 8934	Cast copper alloy fancy pillar taps for water services.		
IS : 9762	Polyethylene floats for ball valves.		
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PS-PEM-MAX		CLAUSE NO.					
		GENERAL TECHNICAL REQUIREMENTS					
	IS : 10446	Glossary of terms for water supply and sanitation.					
	IS : 10592	Industrial emergency showers, eye and face fountains and combination units.					
	IS : 12592	Specification for precast concrete manhole covers and frames.					
	IS : 12701	Rotational moulded polyethylene water storage tanks.					
	SP: 35	Hand book on water supply and drainage.					
	-	Manual on Sewerage and sewage treatment (Published by CPH & EEO) As updated.					
	Doors, Windows and Allied Works						
	IS : 204	Tower Bolts					
	Part-I	Ferrous metals.					
	Part-II	Nonferrous metals.					
	IS : 208	Door Handles.					
	IS : 281	Mild steel sliding door bolts for use with padlocks.					
	IS : 362	Parliament Hinges.					
	IS : 420	Specification for putty, for use on metal frames.					
	IS : 1003	Specification for timber panelled and glazed shutters-					
	Part-I door	(Part-I) shutters.					
	IS : 1038	Steel doors, windows and ventilators.					
	IS : 1081	Code of practice for fixing and glazing of metal (steel and aluminium) doors, windows and ventilators.					
	IS : 1341	Steel butt hinges.					
	IS : 1361	Steel windows for industrial buildings.					
IS : 1823	Floor door stoppers.						
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO.: THDC/RKSH/CC-9915-371		GENRAL TECHNICAL REQUIREMENTS (GTR)		PAGE 75 OF 89	

PS-PEM-MAX		GENERAL TECHNICAL REQUIREMENTS	
CLAUSE NO.			
			
	IS : 1868	Anodic coatings on Aluminium and its alloys.	
	IS : 2202 (Part-II)	Specification for wooden flush door shutters (solid core type); particle board face panels and hard board face panels	
	IS:2209	Mortice locks (vertical type).	
	IS:2553	Safety glass	
	IS:2835	Flat transparent sheet glass.	
	IS:3548	Code of practice for glazing in buildings.	
	IS:3564	Door closers (Hydraulically regulated).	
	IS : 3614	Fire check doors; plate, metal covered and rolling type.	
	IS:4351	Steel door frames.	
	IS:5187	Flush bolts.	
	IS:5437	Wired and figured glass	
	IS:6248	Metal rolling shutters and rolling grills.	
	IS:6315	Floor springs (hydraulically regulated) for heavy doors.	
	IS:7196	Hold fasts.	
	IS:7452	Hot rolled steel sections for doors, windows and ventilators.	
	IS:10019	Mild steel stays and fasteners.	
	IS:10451	Steel sliding shutters (top hung type).	
	IS:10521	Collapsible gates.	
	Roof Water Proofing and Allied Works		
	IS:1203	Methods of testing tar and bitumen.	
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO.: THDC/RKSH/CC-9915-371	GENRAL TECHNICAL REQUIREMENTS (GTR) PAGE 76 OF 89

PS-PEM-MAX		GENERAL TECHNICAL REQUIREMENTS	
CLAUSE NO.			
			
IS:1322	Specification for bitumen felts for water proofing and damp proofing.		
IS:1346	Code of practice for water proofing of roofs with bitumen felts.		
IS:1580	Specification for bituminous compound for water proofing and caulking purposes.		
IS:3067	Code of practice for general design details and preparatory work for damp proofing and water proofing of buildings.		
IS:3384	Specification for bitumen primer for use in water proofing and damp proofing.		
Floor Finishes and Allied Works			
IS:1237	Specification for cement concrete flooring tiles.		
IS:1443	Code of practice for laying and finishing of cement concrete flooring tiles.		
IS:2114	Code of practice for laying in-situ terrazzo floor finish.		
IS:2571	Code of practice for laying in-situ cement concrete flooring.		
IS:3462	Specification for unbacked flexible PVC flooring.		
IS:4971	Recommendations for selection of industrial floor finishes.		
IS:5318	Code of practice for laying of flexible PVC sheet and tile flooring.		
IS:8042	Specification for white portland cement.		
IS:13801	Specification for chequered cement concrete flooring tiles.		
Painting and Allied Works			
IS:162	Specification for fire resisting silicate type, brushing, for use on wood, colour as required.		
IS:1477	Code of practice for painting of ferrous metals in buildings.		
Part-I	Pretreatment.		
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO.: THDC/RKSH/CC-9915-371	GENRAL TECHNICAL REQUIREMENTS (GTR) PAGE 77 OF 89

PS-PEM-MAX		CLAUSE NO.		एनडीपीसी NTPC		GENERAL TECHNICAL REQUIREMENTS			
	Part-II	Painting.							
	IS:1650	Specification for colours for building and decorative finishes.							
	IS:2074	Specification for red oxide-zinc chrome, priming, ready mixed paint air drying.							
	IS:2338	Code of practice for finishing of wood and wood based materials.							
	Part-I	Operations and workmanship							
	Part-II	Schedules							
	IS:2395	Code of practice for painting concrete, masonry and plaster surfaces.							
	Part-I	Operations and workmanship.							
	Part-II	Schedule.							
	IS:2524	Code of practice for painting of nonferrous metals in buildings.							
	Part-I	Pretreatment.							
	Part-II	Painting.							
	IS:2932	Specification of synthetic enamel paint, exterior, under-coating and finishing.							
	IS:2933	Specification enamel paint, under coating and finishing.							
	IS:4759	Code of practice for hot dip zinc coating on structural steel and other allied products.							
	IS:5410	Specification for cement paint							
	IS:5411 (Part-I)	Specification for plastic emulsion paint-for exterior use							
	IS:6278	Code of practices for white washing and colour washing.							
	IS:10403	Glossary of terms relating to building finishes.							
	Piling and Foundation								
IS:1080	Code of practice for design and construction of simple spread foundations.								
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES			TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO.: THDC/RKSH/CC-9915-371			GENRAL TECHNICAL REQUIREMENTS (GTR)		PAGE 78 OF 89	

PS-PEM-MAX		CLAUSE NO.					
		GENERAL TECHNICAL REQUIREMENTS					
	IS:1904	Code of practice for design and construction of foundations in Soils; General Requirements.					
	IS:2911	Code of practice for designs and construction of Pile foundations (Relevant Parts).					
	IS:2950	Code of practice for designs and construction of Raft (Part-I) foundation.					
	IS:2974	Code of practice for design and construction of machine (Part-I TO V) foundations.					
	IS:6403	Code of practice for determination of Allowable Bearing pressure on Shallow foundation.					
	IS:8009	Code of practice for calculation of settlement of foundation subjected to symmetrical vertical loads.					
	Part-I	Shallow foundations.					
	Part-II	Deep foundations.					
	IS:12070	Code of practice for design and construction of shallow foundations on rocks.					
	DIN:4024	Flexible supporting structures for machines with rotating machines.					
	VDI:2056	Criteria for assessing mechanical vibrations of machines.					
	VDI:2060	Criteria for assessing rotating imbalances in machines.					
	Stop Log and Trash Rack						
	IS:4622	Recommendations for fixed - wheel gates structural design.					
	IS:5620	Recommendations for structural design criteria for low head slide gates.					
	IS:11388	Recommendations for design of trash rack for intakes.					
	IS:11855	General requirements for rubber seals for hydraulic gates.					
	Roads						
IRC:5	Standard specifications and Code of practice for road bridges, section-I general Features of Design.						
IRC:14	Recommended practice of 2cm thick bitumen and tar carpets.						
IRC:16	Specification for priming of base course with bituminous primers.						
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO.: THDC/RKSH/CC-9915-371		GENRAL TECHNICAL REQUIREMENTS (GTR)		PAGE 79 OF 89	

PS-PEM-MAX		NTPC		GENERAL TECHNICAL REQUIREMENTS	
CLAUSE NO.					
		IRC:19	Standard specifications and code of practice for water bound macadam.		
		IRC:21	Standard specifications and Code of practice for road bridges, section-III - Cement concrete (plain and reinforced).		
		IRC:34	Recommendations for road construction in waterlogged areas.		
		IRC:36	Recommended practice for the construction of earth embankments for road works.		
		IRC:37	Guidelines for the Design of flexible pavements.		
		IRC:56	Recommended practice for treatment of embankment slopes for erosion control.		
		IRC:73	Geometric design standards for rural (non-urban) highways.		
		IRC:86	Geometric Design standards for urban roads in plains.		
		IRC:SP:13	Guidelines for the design of small bridges & culverts.		
		IRC - Publication	Ministry of Surface Transport (Roads Wing), Specifications for road and bridge works.		
		IS:73	Specification for paving bitumen		
		Loadings			
		IS:875 (Pt. I to V)	Code of practice for design loads other than earthquake) for buildings and structures.		
		IS:1893	Criteria for earthquake resistant design of structures.		
		IS:4091	Code of Practice for design and construction of foundation for transmission line towers & poles.		
		IRC:6	Standard specifications & code of practice for road bridges, Section-II Loads and stresses.		
		M.O.T.	Deptt. of railways Bridge Rules.		
		Safety			
		IS:3696 (Part I & II)	Safety code for scaffolds and ladders.		
		IS:3764	Safety code for excavation work.		
		IS:4081	Safety code for blasting and related drilling operations.		
		IS:4130	Safety code for demolition of buildings.		
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO.: THDC/RKSH/CC-9915-371		GENRAL TECHNICAL REQUIREMENTS (GTR)	PAGE 80 OF 89

PS-PEM-MAX				
CLAUSE NO.	एनडीपीसी NTPC	GENERAL TECHNICAL REQUIREMENTS		
	IS:5121 Safety code for piling and other deep foundations. IS:5916 Safety code for construction involving use of hot bituminous materials. IS:7205 Safety code for erection on structural steelwork. IS:7293 Safety code for working with construction machinery. IS:7969 Safety code for handling and storage of building materials IS:11769 Guidelines for safe use of products containing asbestos. - Indian Explosives Act. 1940 as updated. Architectural design of buildings SP:7 National Building Code of India SP:41 Hand book on functional requirements of buildings (other than industrial buildings) Miscellaneous IS:802 Code of practice for use of structural steel in (Relevant parts) overhead transmission line towers. IS:803 Code of practice for design, fabrication and erection of vertical mild steel cylindrically welded in storage tanks. IS:10430 Creteria for design of lined canals and liner for selection of type of lining. IS:11592 Code of practice for selection and design of belt conveyors. IS:12867 PVC handrails covers. CIRIA Design and construction of buried thin-wall pipes. Publication REFERENCE CODES AND STANDARDS FOR CONTROL AND INSTRUMENTATION The design, manufacture, inspection, testing & installation of all equipment and system covered under this specification shall conform to the latest editions of codes and standards mentioned below and all other applicable VDE, IEEE, ANSI, ASME, NEC, NEMA, ISA AND Indian Standards and their equivalents.			
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO.: THDC/RKSH/CC-9915-371	GENRAL TECHNICAL REQUIREMENTS (GTR)	PAGE 81 OF 89

PS-PEM-MAX		CLAUSE NO.		एनडीपीसी NTPC				GENERAL TECHNICAL REQUIREMENTS	
		Temperature Measurements 1. Instrument and apparatus for temperature measurement - ASME PTC 19.3 (1974). 2. Temperature measurement - Thermocouples ANSI MC 96.1 - 1982. 3. Temperature measurement by electrical Resistance thermometers - IS:2806. 4. Thermometer - element - Platinum resistance - IS:2848. Pressure Measurements 1. a) Instruments and apparatus for pressure measurement - ASME PTC 19.2 (1964). b) Electronic transmitters BS:6447. 2. Bourdon tube pressure and vacuum gauges - IS:3624 - 1966. 3. Process operated switch devices (Pr. Switch) BS-6134. Flow Measurements Instruments and apparatus for flow measurements - ASME PTC 19.5 (1972) Interim supplement, Part-II. Measurement of fluid flow in closed conduits - BS-1042. Electronic Measuring Instrument & Control Hardware/ Software 1. Automatic null balancing electrical measuring instruments - ANSI C 39.4 (Rev. 1973): IS:9319. 2. Safety requirements for electrical and electronic measuring and controlling instrument - ANSI C 39.5 - 1974. 3. Compatibility of analog signals for electronic industrial process instruments - ISA - S 50.1 (1982) ANSI MC 12.1 - 1975. 4. Dynamic response testing of process control instrumentation ISA - S 26 (1968). 5. Surge Withstand Capability (SWC) tests - ANSI C 37.90 a/IEEE-472 or suitable class of IEC-255-4 equivalent to ANSI C37.90a/IEEE-472. 6. Printed circuit boards - IPC TM - 650, IEC 326 C.							
KHURJA SUPER THERMAL POWER PROJECT		TECHNICAL SPECIFICATION		GENERAL TECHNICAL		PAGE			
(2X660 MW)		SECTION – VI, PART-C		REQUIREMENTS (GTR)		82 OF 89			
TURBINE GENERATOR AND ASSOCIATED		BID DOC. NO.:							
PACKAGES		THDC/RKSH/CC-9915-371							

PS-PEM-MAX				
CLAUSE NO.	एनडीपीसी NTPC	GENERAL TECHNICAL REQUIREMENTS		
	7. General requirement and tests for printed wiring boards - IS 7405 (Part-I) 1973. 8. Edge socket connectors - IEC 130-11. 9. Requirements and methods of testing of wire wrap terminations DIN 41611 Part-2. 10. Dimensions of attachment plugs & receptacles - ANSI C 73 - 1973 (Supplement ANSI C 73 a - 1980). 11. Direct acting electrical indicating instrument - IS:1248 - 1968 (R). 12. Standard Digital Interface for Programmable Instrumentation - IEEE-488.2 - 1990. 13. Information Processing Systems - Local Area Networks - Part 2 : Logical Link Control - IEEE-802.2 - 1989. 14. Standard for Local Area Networks : Carrier Sense Multiple Access with Collision Detection - IEEE-802.3 - 1985. 15. Supplements A, B, C and E to Carrier Sense Multiple Access with Collision Detection - IEEE-802.3 - 1988. 16. Standard for Local Area Networks : Token - Passing Bus Access Method - IEEE-802.4 - 1985. 17. Standard for Local Area Networks : Token - Ring Access Method and Physical Layer Specification - IEEE-802.5 - 1985. 18. IEEE Guide to Software Requirements Specifications - IEEE-830 - 1984. 19. Hardware Testing of Digital Process Computers - ISA RP55.1 - 1983. 20. Electromagnetic Susceptibility of Process Control Instrumentation - SAMA PMC 33.1 - 1978. 21. Interface Between the Data Terminal Equipment and Data Circuit - Terminating Equipment Employing Serial Binary Data Interchange - EIA-232-D-1987. 22. Electromagnetic Compatibility for Industrial Process Measurement and Control Equipment, Part 3 : Radiated Electromagnetic Field Requirements - IEC 801-3-1984. Instrument Switches and Contact			
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO.: THDC/RKSH/CC-9915-371	GENRAL TECHNICAL REQUIREMENTS (GTR)	PAGE 83 OF 89

PS-PEM-MAX			
CLAUSE NO.	एनडीपीसी NTPC	GENERAL TECHNICAL REQUIREMENTS	
	1. Contact rating - AC services NEMA ICS 2 - 1978 (with revision through May 1983), Part - 2-125, A6000. 2. Contact rating - DC services NEMA ICS 2-1978 Part-2 125, N600. Enclosures 1. Type of Enclosures - NEMA ICS Part - 6 - 1978 (with Rev. 1 4/80) through 110.22 (Type 4 to 13). 2. Racks, panels and associated equipment - EIA : RS - 310 C- 1983 (ANSI C 83.9 - 1972). 3. Protection class for Enclosures, cabinets, control panels & desks - IS:2147 - 1962. Apparatus, enclosures and installation practices in hazardous area 1. Classification of hazardous area - NFPA 70 - 1984, Article 500. 2. Electrical Instruments in hazardous dust location - ISA - 512.11, 1973. 3. Intrinsically safe apparatus - NFPA 493 1978. 4. Purged and pressurised enclosure for electrical equipment in hazardous location - NFPA 496-1982. 5. Enclosures for Industrial Controls and Systems - NEMA IS 1.1 - 1977. Sampling System 1. Stainless steel material of tubing and valves for sampling system - ASTMA 296-82, Grade 7 P 316. 2. Submerged helical coil heat exchangers for sample coolers ASTM D11 92-1977. 3. Water and steam in power cycle - ASME PTC 19.11. 4. Standard methods of sampling system - ASTM D 1066-99. Annunciators 1. Specifications and guides for the use of general purpose annunciators - ISA S 19.1, 1979. 2. Surge withstand capability tests - ANSI C 37.90a - 1989/IEEE-472 or suitable class of IEC 255-4 equivalent to ANSI C37.90a 1989/IEEE-472		
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO.: THDC/RKSH/CC-9915-371	GENRAL TECHNICAL REQUIREMENTS (GTR)
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PS-PEM-MAX			
CLAUSE NO.		 GENERAL TECHNICAL REQUIREMENTS	
	3. Damp heat cycling test - IS:2106 4. Specification for Electromagnetic Susceptibility - SAMA DMC 33, 1/78 Protections 1. Relays and relay system associated with electric power apparatus. ANSI C 37.90, 1 - 1989. 2. General requirements & tests for switching devices for control and auxiliary circuits including contactor relays - IS:6875 (Part-I) - 1973. 3. Turbine water damage prevention - ASME TDP-1-1980. 4. Boiler safety interlocks - NFPA Section 85 B - 1984, 85 C - 1991. UPS System 1. Practices and requirements for semi-conductor power rectifiers - ANSI C 34.2, 1973. 2. Relays and relays system associated with electrical power apparatus - ANSI C 3.90 - 1983. 3. Surge withstand capability test - ANSI C 37.90 1 -1989. 4. Performance testing of UPS - IEC 146. 5. Stationary cells & Batteries Lead Acid type (with tubular positive plates) specification IS-1651-1991. 6. Recommended practice for sizing large lead storage batteries for generating stations & sub-stations - IEEE-485-1985. 7. Printed Circuit Board - IPC TM 650, IEC 326C. 8. General Requirements & tests for printed wiring boards, IS:7405 (Part-I) 1973. Control Valves 1. Control valve sizing - Compressible & Incompressible fluids - ISA S 75.01-1985. 2. Face to face dimensions of control valves - ANSI B 16.00 - 1973.		
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO.: THDC/RKSH/CC-9915-371	GENRAL TECHNICAL REQUIREMENTS (GTR) PAGE 85 OF 89

PS-PEM-MAX		CLAUSE NO.		एनडीपीसी NTPC		GENERAL TECHNICAL REQUIREMENTS			
						3. Colour coding of single or multi-pair cables - ICEA - S - 61-402 (third edition) NEMA WCS - 1979 with revisions thorough 2/83. 4. Insulation & Sheathing compounds for cables : VDE 0207 (Part-4, 5 & 6). 5. Guide design and installation of cable systems in power generating stations (insulation, jacket materials) - IEEE Std. 422-1977. 6. Rules for Testing insulated cables and flexible cables : VVDE - 0472 7. Requirements of vertical flame propagation test - IEEE 383 - 1974 (R 1980) 8. Standard specification for tinned soft or annealed copper wire for electrical purpose - ASTM B-33-81. 9. Oxygen index and temperature index test - ASTM D - 2863. 10. Smoke density measurement test - ASTMD - 2843. 11. Acid gas generation test - IEC - 754 - 1. 12. Swedish Chimney test - SEN - 4241475 (F3). 13. Teflon (FEP) insulation & sheath test - ASTMD - 2116. 14. Thermocouple compensating cables - Testing requirements & sampling plan IS:8784. 15. PVC insulated electric cables for working voltage upto and including 1100 V - IS:1554 (Part-I). Cable Trays, Conduits 1. Guide for design and installation of cable systems in power generating staiton (Cable trays, support systems, conduits) - IEEE Std. 422, 1977, NEMA VE-1 1979, NFPA 70-1984. 2. -do- Test Standards. NEMA VE-1-1979. 3. Zinc coating "hot dip" on assembled products for galvanising of carbon steel cable trays - ASTMA - 386-78. Public Address System 1. Specifications for lod speakers - IS:7741 (Part-I, II and III) 2. Code of safety requirement for electric mains operated audio amplifiers - IS:1301			
						KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO.: THDC/RKSH/CC-9915-371	

PS-PEM-MAX			
CLAUSE NO.	एनडीपीसी NTPC GENERAL TECHNICAL REQUIREMENTS		
	3. Specification for Public Address Amplifiers - IS:10426. 4. Code of practice for outdoor installation of PA system - IS:1982. 5. Code of practice for installation for indoor amplifying and sound distribution system - IS:1881. 6. Basic environmental testing procedures for electronic and electrical items - IS:9000. 7. Characteristics and methods of measurements for sound system equipment - IS:9302 8. Code of practice of electrical wiring installations (System voltage not exceeding 650 volts) - IS:732 9. Rigid steel conduits for electric wiring - IS:9537 (Part-I and II) 10. Fittings for rigid steel conduits for electrical wiring - IS:2667 11. Degree of protection provided by enclosure for low voltage switchgear and control gear - IS:2147. Vibration Monitoring System 1. API 670 - 1994 2. BS : 4675 Part-2		
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO.: THDC/RKSH/CC-9915-371	PAGE 88 OF 89



ANNEXURE - III

[illegible]

KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES	TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO.: THDC/BJKSH/CC 0015 371	GENERAL TECHNICAL REQUIREMENTS (GTR)	PAGE 85 OF 89



ANNEXURE - IV

[illegible]

FORMAT NO. : QS-01-QAI-P-02/F1-R0

1 / 1

Engg. Div./QA&I

KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES	TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO.: THDC/RKSH/CC-9915-371	GENRAL TECHNICAL REQUIREMENTS (GTR)	PAGE 86 OF 89



ANNEXURE - V

		Project : Contractor : Contractor No. : System :		Stage :		FIELD WELDING SCHEDULE (To be raised by the contractor) Welding Code						DOC. NO. :			
												REV. NO. :			
												DATE :			
												PAGE : OF			
Sl. No.	DRG No. for Weld Location and Identification mark	Description of parts to be welded	Matl. Spec.	Dimensions	Process of welding	Type of weld	Electrode filler spec.	WPS. No.	Min. pre-heat	Heat treatment Temp.	Holding time	NDT method/ Quantum	Spec. No.	RFF ACC Norm Ref.	Remarks
NOTES:															
SIGNATURE															
FORMAT NO.: QS-01-QAI-P-02/F2-R0										1/1		Engg. Div./QA&I			

KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES	TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO.: THDC/RKSHICC-9915-371	GENRAL TECHNICAL REQUIREMENTS (GTR)	PAGE 87 OF 89



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Supplier's Name & Address		FIELD QUALITY PLAN						PROJECT : PACKAGE : CONTRACT NO. : MAIN-SUPPLIER :	
		ITEM		SUB-SYSTEM				QF	
		QF NO. : REV.NO. : DATE : PAGE :	QF	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	REMARKS		
SL. NO	ACTIVITY AND OPERATION	CHARACTERISTICS/INSTRUMENTS	CLASS# OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK	7	8	9	10.
1	2	3	4	5	6	7	8	9	10.
LEGEND : * RECORDS, IDENTIFIED WITH "TICK" () SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION LEGEND TO BE USED : CLASS # : A - CRITICAL, B = MAJOR, C = MINOR; 'A' SHALL BE WITNESSED BY NTPC FQA, 'B' SHALL BE WITNESSED BY NTPC ERECTION / CONSTRUCTION DEPTT. AND 'C' SHALL BE WITNESSED BY ERECTION SUPPLIER (A & B CHECK SHALL BE NTPC CHP STAGE)									
MANUFACTURER / SUB-SUPPLIER		SIGNATURE		 FOR NTPC USE				DOC. NO. : REV.....CAT.....	
		MAIN-SUPPLIER						REVIEWED BY	

FORMAT - Q3-01-QAI-P-09/F2-R0

1/1

ENGINEERING DIV. / QA&I

KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES	TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO.: TUDC/IKSJ/CC 0015-371	GENERAL TECHNICAL REQUIREMENTS (GTR)	PAGE 89 OF 89

40880/2020/PS-PEM-MAX

	TITLE 2X660 MW THDC Khurja STPP DOUBLE GIRDER EOT CRANES ABOVE 100T DOCUMENTS TO BE SUBMITTED ALONG WITH BID	SPECIFICATION NO. PE-TS-475-501-A501	
		REV 00	
		Section	III Date JULY'20

SECTION-III

DOCUMENTS TO BE SUBMITTED ALONG WITH BID

	TITLE 2X660 MW THDC Khurja STPP DOUBLE GIRDER EOT CRANES ABOVE 100T DOCUMENTS TO BE SUBMITTED ALONG WITH BID	SPECIFICATION NO. PE-TS-475-501-A501	
		REV 00	
		Section	III Date JULY'20

DRAWINGS / DOCUMENTS TO BE SUBMITTED WITH THE BID

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

- a) Signed and Stamped copy of Compliance cum Confirmation Certificate.
- b) Electrical load list, duly signed and stamped.
- c) Deviation schedule with reference to specific clauses of the specification along with reason for such deviation in the 'cost-of-withdrawal' format attached in GCC Rev07.
- d) Un-priced copy of price format indicating quoted/ not applicable against each row/column.
- e) Signed and stamped copy of Supply price percentage break-up (enclosed with section-IA).

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 WILL NOT BE CONSIDERED FOR BID EVALUATION.



TITLE

2X660 MW THDC Khurja STPP**DOUBLE GIRDER EOT CRANES ABOVE 100T****COMPLIANCE CUM CONFIRMATION CERTIFICATE**

SPECIFICATION NO. PE-TS-475-501-A501

REV 00

Section III Date JULY'20

Page 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.

For components where materials are not specified, same shall be suitable for intended duty, all materials shall be subject to approval in the event of order.

- f) The commissioning spares shall be supplied on 'As Required Basis' & prices for same included in the base price itself.
- g) All sub vendors shall be subject to BHEL/ CUSTOMER approval in the event of order.
- h) 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.
- i) In the event of order, all the material required for completing the job at site shall be supplied by the bidder within the ordered price even if the same are additional to approved billing break up, approved drawing or approved Bill of quantities. This clause will apply in case during site commissioning additional requirements emerges due to customer and/ or consultant's comments. No extra claims shall be put on this account.
- j) Schedule of drawings submissions, comment incorporations & approval shall be as stipulated in the specifications. The successful bidder shall depute his design personnel to BHEL's/ Customer's/ Consultant's office for across the table resolution of issues and to get documents approved in the stipulated time.
- k) As built drawings shall be submitted as and when required during the project execution.
- l) The bidder has not tempered with this compliance cum confirmation certificate and if at any stage any tempering in the signed copy of this document is noticed then same shall be treated as breach of contract and suitable actions shall be taken against the bidder.



TITLE

2X660 MW THDC Khurja STPP

DOUBLE GIRDER EOT CRANES ABOVE 100T

PRE BID CLARIFICATION SCHEDULE

SPECIFICATION NO. PE-TS-475-501-A501

REV 00

Section III Date JULY'20

Page 1 of 1

PRE-BID CLARIFICATION SCHEDULE

S. No.	Section/Clause /Page No.	Statement of the referred clause	Clarification Required

The bidder hereby certifies that above mentioned are the only clarifications required on the technical specification for the subject package.

SIGNATURE: _____

NAME: _____

DESIGNATION: _____

COMPANY: _____

DATE: _____

COMPANY SEAL

	TITLE 2X660 MW THDC Khurja STPP DOUBLE GIRDER EOT CRANES ABOVE 100T DOCUMENTS TO BE SUBMITTED ALONG WITH BID	SPECIFICATION NO. PE-TS-475-501-A501	
		REV 00	
		Section III	Date JULY'20

SUPPLY PRICE PERCENTAGE BREAKUP

S. N.	Details of Works or Equipment/System	Qty. (LOT / Nos.)	Percentage (%) Break up proposed for billing purpose during contract for Supply
1.	Total lump sum firm price for design, engineering, manufacturing, inspection and testing, painting, supply/delivery duly packed at project site including freight, unloading, storage and handling at site in line with drawings/ documents/ test procedures approved by BHEL / Customer for Two (2) nos. of 140/25 T capacity, Double girder EOT cranes with 29 M lift of main hook, 35 m lift of auxiliary hook, 28.1 M span, complete with all accessories, isolating switch and power cable from isolating switch to DSL, Erection and commissioning spares for the total scope defined as per technical specification PE-TS-475-501-A501.	2 set.	85%
2.	Total lump sum firm price for design, engineering, manufacturing, inspection and testing, painting, supply/delivery duly packed at project site including freight, unloading, storage and handling at site in line with drawings/ documents/ test procedures approved by BHEL / Customer for PVC shrouded bus bar type DSL for 280 M bay length complete with all accessories for the total scope defined as per technical specification PE-TS-475-501-A501.	1 set	4%
3.	Total lump sum firm price for design, engineering, manufacturing, inspection and testing, painting, supply/delivery duly packed at project site including freight, unloading, storage and handling at site in line with drawings/ documents/ test procedures approved by BHEL / Customer for 280 M bay length Gantry rail complete with all accessories for the total scope defined as per technical specification PE-TS-475-501-A501.	1 set	8%
4.	Lump sum price of temporary cable for operation of crane during erection stage of the plant (equal to half the bay length plus 25 M) for the total scope defined as per technical PE-TS-475-501-A501.	1 set	0.25%
5.	Lump sum price of STORM BRAKE (LT hydraulic rail clamps/parking brakes) as per technical specification PE-TS-475-501-A501.	2 set	0.50%
6.	Lump sum price of MAIN HOOK AND AUXILLIARY HOOK ASSEMBLY as per technical specification PE-TS-475-501-A501.	2 set	2%
7.	Total lump sum price for Maintenance tools and Tackles as per technical specification PE-TS-475-501-A501.	1 set	0.25%

NOTE: -These prices shall be used for billing purpose during contract stage.

Note:

1. The supply price percentage breakup is for progressive payment purpose only. This breakup does not relieve vendor from any contractual obligations and responsibilities with respect to condition of technical and commercial scope of contract.
2. Any item/quantity not specifically indicated in this break up but required as per system requirement, shall be supplied by vendor without any additional financial implication to BHEL.
3. The unit rates derived for PVC shrouded DSL, Gantry rail and temporary cable from sl no 2,3 & 4 respectively shall be used for adjustment purpose in case of change in baylength during detail engineering stage.