NTPC LIMITED

2X660 MW TALCHER TPP STAGE-III

TECHNICAL SPECIFICATION FOR DOUBLE GIRDER EOT CRANES UPTO 100T

SPECIFICATION NO.: PE-TS-497-501-A502

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

SUB-SECTION IA
SPECIFIC TECHNICAL REQUIREMENT

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) & handing over 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 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://pem.bhel.com/wrenchweb

SUB-SECTION IA
SPECIFIC TECHNICAL REQUIREMENT (MECHANICAL)

TITLE	SPECIFICATION NO. PE-TS-497-501-A502
2x660MW TALCHER TPP STAGE-III	REV 00
DOUBLE GIRDER EOT CRANES UPTO 100T SPECIFIC TECHNICAL REQUIREMENTS	Section IA Date AUG 2023

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) numbers 35T Double Girder Crane for TG hall-BC Bay, One (1) number 60T Double Girder Crane for CWPH, , One (1) number 45T Double Girder Crane for Electrical Workshop and One (1) number 10T Double Girder Crane for Mechanical Workshop** with accessories as per the details given in the technical specification and data sheet A. Any equipment / accessories not specified but required to make the EOT crane complete for efficient & reliable operation shall also be under the bidder's scope of work. 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. Rail (suitable for steel gantry girder) complete including all accessories and end stoppers.
h. Earthing arrangement
i. Centralized grease lubrication system to be provided with hand pumps located at crab and both end carriages for all grease lubricated bearings of crane. Tubing/connectors shall be of SS/CS/MS material.
j. Fill of lubricants till one year after commissioning
k. Painting of cranes and accessories including touch up painting at site.
l. 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 : For each 35T TG Hall BC Bay crane and 60T CWPH EOT crane.
m. Maintenance tools & Tackle
n. Erection & Commissioning spares
o. Mandatory Spares
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.

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

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.

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. Load & overload test along with deflection test of lifting beam in line with BHEL approved MQP for lifting beam (if applicable).
v. Speed test at rated load for hoisting, CT and LT mechanism.
vi. Brake test.
vii. 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 one year after commissioning. Consumption of all these consumables till one year after commissioning shall also be included in the scope of the Bidder. Bidder shall also supply a quantity of the full charge of each variety of lubricants, servo fluids, gases, chemicals etc. used which is expected to be utilized till one year after commissioning. This additional quantity shall be supplied in separate Containers.

SECTION – IA

CUSTOMER SPECIFICATION

CLAUSE NO.	TECHNICAL REQUIREMENTS

~~(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.~~

~~(xvi) 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.~~

~~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 bid.~~

7.02.00	**EOT CRANES FOR BOILER FEED PUMP (if envisaged)**
7.02.01	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 to be handled (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).

CLAUSE NO.	TECHNICAL REQUIREMENTS
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, 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.
7.02.08	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).
7.02.09	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.
7.02.10	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 75mm 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.
7.02.11	LADDERS : Necessary access ladders shall be provided for access on to crane bridge platform form the gantry girder level, from crane bridge platform to trolley platform and from operating floor of pump to gantry girder level.
7.02.12	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 edition) for capacity lower than 50 T. The factor of safety for the rope shall be as per IS:3177. The sheaves shall be of heavy duty with deep flanges made of cast steel and shall be properly grooved to fit the rope and adequately guarded.
7.02.13	Each crane shall be controlled individually for all its motions from the control pendent panel.
7.02.14	Each crane shall have a permanent inscription of English on each side, readily visible from the ground level, stating the safe working loads in tonnes for both the hooks, year of manufacture, crane serial number and manufacturer's name.
7.02.15	The vertical deflection of crane girder shall not exceed 1/800 of the span. The girder shall be of box type and construction shall ensure non-accumulation of water/oil inside the box.
7.03.00	**MAXIMUM SPAN/DEPTH RATIO FOR GIRDER:** (a) Plate girders : 18 (b) Lattice girders : 12

CLAUSE NO.	TECHNICAL REQUIREMENTS

7.04.00 Material

(i)	Structural steel plates rolled section	:	Mild steel, grade 'B' of IS 2062 in 100% killed, 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.

7.05.00 **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.~~

CLAUSE NO.	TECHNICAL REQUIREMENTS

c. Contractor shall provide electronic door detector (Infra red curtain type).

d. Digital hall position indicator at all floors, tell lights at all floors shall also be provided by the Contractor.

e. For facilitating the movement of visually & hearing impaired persons, hall lantern and car arrival chimes shall be provided

f. All fixtures shall be in stainless steel face plates.

g. Push buttons shall be fixed in the car for holding the doors open for any length of the time required.

h. All other safety/protection/operation interlocks as required by IS:14665 (latest edition).

4.00.00 **POWER SUPPLY**

Each elevator shall be provided with a separate three phase, three wire 415V feeder of adequate rating

5.00.00 **Controls:**

The controls shall be Variable Voltage and Variable frequency type and shall provide smooth and constant acceleration and retardation under all conditions of operation . Suitable control panel shall be provided in the machine room.

6.00.00 **Cables and wiring:**

All the cables except trailing cables shall be as per IS:1554-1 or IS-7098-I. the PVC outer sheath of these cables shall be flame retardant, low smoke (FRLS) type with 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% (as per ASTMD-2843).

The circular trailing cables shall be either in accordance with IS-4289 Part-I (Elastomer insulated) or IS-4289 Part-II (PVC insulated). The flat type trailing cables if offered shall be in accordance with IEC-60227-6.

All wiring / cabling between the equipment's in the lift machine room and that between the machine room and equipment's in the lift well and at the landings shall be wired in HDP conduits/ galvanized steel conduits to be supplied by the contractor. Alternatively armored cables may be used.

7.00.00 **Earthing:**

The elevator, EOT and crane structures and all Electrical equipment, including metal conduits shall be effectively earthed with the earth conductors provided in the machine room as per IS: 3043.

8.00.00 EOT/ Hoist and Crane **Motors**

8.01.01 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. VFD shall be used to drive three (3) phase squirrel cage inverter duty Induction motor with VPI insulation (Resin poor) suitable for VFD application. These motors shall be provided with insulated bearing on at least one side for motor frame size above 250 frame. However, contractor's proven practice with respect to use of insulated bearing in VFD driven motor may be accepted subject to Employer's approval. Motors shall conform to latest revision of IS 325, IS 3177 and motor subsection of this specification.

8.02.00 **Controls**

i) Speed control of EOT crane shall be through Variable Voltage Variable Frequency System (VVVF) with minimum 6 (six) pulse design.

CLAUSE NO.	TECHNICAL REQUIREMENTS

ii) Necessary input & output devices to be provided to reduce harmonics, as per IEE519, at supply side of the drive at the switchgear.

iii) All necessary protections e.g. Input Phase Loss, Earth Fault, Over Voltage, Output Short Circuit, Load Loss, Input Transient Protection, Overload etc to be provided.

iv) VVVF system shall be capable of generating suitable starting torque (upto 400% typical) with / without encoder, however starting current shall not exceed 150% at rated torque.

v) VVVF system shall be capable of withstanding upto 50 deg C ambient temp without derating

vi) Provision for controlling the motion from operator cabin (in case of Turbine hall EOT crane) as well as remote control shall be available.

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.

8.03.00 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.

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.

CLAUSE NO.	TECHNICAL REQUIREMENTS

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.

7.06.0 **Power Supply**

(a) Incoming numbers:

~~(i)Turbine hall EOT crane: Contractor shall provide two (2) numbers 415 volts, 3 phase, 3 wire supply at operating floor near A-row column at centre of bay length with a changeover switch in enclosure.~~

(ii) 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.

(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

CLAUSE NO.	TECHNICAL REQUIREMENTS

MOTORS

1.00.00 GENERAL REQUIREMENTS

1.01.00 This chapter has to be read in conjunction with sub-section B-0 "General electrical specification" of Technical specification Section- VI, Part-B and Sub-Section-IIB Electrical system/Equipment of Technical Specifications Section-VI, Part-A"

Degree of Protection

Degree of protection for various enclosures as per IEC60034-05 shall be as follows :-

i)	Indoor motors	-	IP 55
ii)	Outdoor motors	-	IP 55 (Additional Canopy to be provided)
iii)	Cable box-indoor area	-	IP 55
iv)	Cable box-Outdoor area	-	IP 55

2.00.00 CODES AND STANDARDS

1)	Three phase induction motors	:	IS15999/IEC:60034
2)	Single phase AC motors	:	IS 996/ IEC:60034
3)	Crane duty motors	:	IS:3177, IEC:60034
4)	DC motors/generators	:	IS:4722, IEC:60034
5)	Energy Efficient motors	:	IS 12615, IEC:60034-30

3.00.00 TYPE

3.01.00 **AC Motors:**

a) Squirrel cage induction motor suitable for direct-on-line starting.

b) Continuous duty LT motors upto 200 KW Output rating (at 50 deg.C ambient temperature), shall be **Premium Efficiency class-IE3**, conforming to IS 12615, or IEC:60034-30. HT motors shall have minimum design efficiency of 95 %. However, tolerance on this efficiency value shall be applicable as per IEC 60034

c) Motor operating through variable frequency drives shall be suitable for inverter duty with VPI insulation. Also these motors shall comply the requirements stipulated in IEC: 60034-18-41 and IEC: 60034-18-42 as applicable.

3.02.00 DC Motors: Shunt wound.

4.00.00 RATING

(a) Continuously rated (S1). However, crane motors shall be rated for S4 duty, 40% cyclic duration factor.

(b) Whenever the basis for motor or driven equipment ratings are not specified in the corresponding mechanical specification sub-sections, maximum continuous motor ratings shall be at least 10% above the maximum load demand of the driven equipment under entire operating range including voltage and frequency variations.

5.00.00 TEMPERATURE RISE

Air cooled motors

70 deg. C by resistance method for both thermal class 130(B) & 155(F) insulation.

Water cooled

80 deg. C over inlet cooling water temperature mentioned elsewhere, by resistance method for both thermal class 130(B) & 155(F) insulation.

CLAUSE NO.	TECHNICAL REQUIREMENTS
6.00.00	**OPERATIONAL REQUIREMENTS**
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 rated torque.
6.02.02	Pull out torque at rated voltage shall not be less than 205% of rated torque. It shall be 275% for crane duty motors.
6.03.00	**NOT USED.**
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 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)
7.03.00	Winding and Insulation Type : Electrolytic grade Copper conductor, Non-hygroscopic, oil resistant, flame resistant Insulation. Starting duty : Two hot starts in succession, with motor initially at normal running temperature. However, conveyor motors shall be suitable for 3 consecutive hot starts 11kV, 6.6 KV & 3.3 kV AC motors : Thermal class 155 (F) insulation. The winding insulation process shall be total Vacuum Presure Impregnated i.e resin poor method. The lightning Impulse & interturn insulation surge withstand level shall be as per IEC-60034 part-15.

CLAUSE NO.	TECHNICAL REQUIREMENTS
	240VAC, 415V AC & 220V DC motors : Thermal Class (F) 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 85 dB(A) except for BFP motor for which the maximum limit shall be 90dB(A). Vibration shall be limited within the limits prescribed in IS:12075 / 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 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 three numbers duplex RTDs connected to three numbers dual input transmitters with display. However for air compressor, being high speed drive, each motor bearing shall be provided with minimum two numbers of duplex RTDs connected to two numbers dual input transmitters with display unit.7.08.00 Motor body shall have two earthing points on diagonally 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~~	~~3.3/6.6 KV motors shall be offered with dust tight phase segregated double walled (metallic as well as insulated barrier) Terminal box. Contractor shall provide termination kit 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 & centre 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, 6.6 KV, 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	NOT USED
8.00.00	NOT USED
10.00.00	**TYPE TEST**
10.01.00	~~**HT MOTORS**~~ ~~**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)~~

CLAUSE NO.	TECHNICAL REQUIREMENTS
	(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 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 inter turn insulation shall be as per clause no. 4.2 of IEC 60034, part 15~~
10.02.00	**LT Motors**
	~~**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.~~ ~~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. Overspeed 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.

SUB-SECTION-B – 03

VFD

CLAUSE NO.	TECHNICAL REQUIREMENTS

VFD

as applicable for LT motors

1.00.0 **GENERAL**

This chapter has to be read in conjunction with sub-section B-0 "General electrical specification" of Technical specification Section- VI, Part-B and Sub-Section-IIB Electrical system/Equipment of Technical Specifications Section-VI, Part-A.

2.00.00 **CODES AND STANDARDS**

HT breaker	IEC:60056
DC reactor	IEC 60289
Transformers	IS:2026, IEC:60076, IEC 61378
Bushing	IS: 2099, IEC 60137
Adjustable Speed Electrical Power Drive Systems	IEC 61800
Semiconductor converters–General requirements	IEC 60146
IEEE Recommended practices and requirements for harmonic control in electrical power systems	- IEEE 519
Degrees of protection provided by enclosures (IP Code)	IEC 60529
Electrostatic immunity test	IEC1000-4-2
Fast transient immunity test	IEC1000-4-4
Surge immunity test	IEC1000-4-5
High-voltage switchgear and controlgear; Pt.102: Alternating current disconnectors and earthing switches	IEC 62271-102

CLAUSE NO.	TECHNICAL REQUIREMENTS

High-voltage switchgear and controlgear; Pt.200: AC metal-enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 52 KV	IS/IEC: 62271-200
AC electricity meters	IS: 722
Metal oxide surge arrestor without gap for AC system	IEC: 60099-4
Terminal blocks for copper conductors	IEC: 60947-7-1
Dry transformer	IS: 11171
Motor	IS:15999, IEC-60034, IEC60034 / NEMA 30 & 31
Contactor/Switches/Fuses etc.	IEC:60947, IS: 13947
Harmonics & EM compatibility	IEEE:519/IEC: 61000
VFD	IEC: 60034/ IEC: 61800

3.00.00 **OPERATING CONDITIONS**

3.01.00 For the purpose of design of equipment/systems, an ambient temperature of 50 deg. Centigrade and also relative humidity of 95% at 40 deg. Celsius shall be considered.

3.02.00 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.

3.03.00 The voltage level for the VFD output to be fed to motor shall be as follows:-

1. Upto 400 kW : 415V/690V, Low Voltage, Three Phase AC
2. Above 400kW and upto 700 KW : 690V, Low Voltage, Three Phase AC
3. Above 700KW : Medium Voltage

From here onwards in the specifications all the VFD Systems consisting of either 415 V or 690 V may be termed as LV VFD while the higher rated VFD System shall be termed as MV VFD. If nothing is mentioned than the Clause is applicable for both the LV and the MV VFD until deliberated otherwise.

CLAUSE NO.	TECHNICAL REQUIREMENTS
4.00.00	**SYSTEM DESCRIPTION**
	Type of drive: 3-Phase Diode / Thyristor / Multi Stage IGBT / IGCT / SGCT/ IEGT
	Type of Cooling of VFD: Naturally air cooled/forced air cooled/Liquid cooled
	Converter Type: Full wave diode rectifier/active front end type
	Inverter Type: Thyristor/IGBT/IGCT/SGCT/IEGT
5.00.00	**GENERAL REQUIREMENTS**
5.01.00	**Medium Voltage VFD**: The Variable frequency drive (VFD) system shall be of a modern proven design for similar applications in power plants/industry. The system shall be either Current Source Inverter (CSI) or Voltage Source Inverter (VSI) type with minimum eighteen (18) pulse design.
5.02.00	**415 V/690 V LV VFD:** The Variable frequency drive (VFD) system shall be of a modern proven design for similar applications in power plants/industry. The system shall be either Current Source Inverter (CSI) or Voltage Source Inverter (VSI) type with minimum Twelve (12) pulse design / 6 pulse with active front end harmonic filter. For drives less than 100 KW Six (6) pulse can be offered meeting all other requirements.
5.04.00	The offered equipment shall be with state of art technology and proven field track record. No prototype equipment shall be offered.
5.05.00	The VFD manufacturer shall ensure the proper coordination of their VFD with the Driven Motor and the supply system. The VFD operation shall have no inherent detrimental impact on the Motors/ cables & supply system.
6.00.00	**TECHNICAL AND OPERATIONAL REQUIREMENTS**
6.01.00	The system shall be designed to deliver the motor input current and torque for the complete speed torque characteristics of the driven equipment, with worst input supply voltage and frequency variation. The system shall be suitable for the load characteristics and the operational duty of the driven equipment.
6.02.00	The overload capacity of the controller shall be 150% of the rated current of the motor for one minute for constant torque applications and 110% of rated current for one minute for variable torque applications at rated voltage. If the motor load exceeds the limit, the drive shall automatically reduce the frequency and voltage to the motor to guard against overload.
6.03.00	The drive system shall be designed to operate in one or more of the following operating modes as to suit characteristics of the driven equipment or specified by the load: a. Variable torque changing as a function of speed. b. Constant torque over a specific speed range. c. Constant power over a specific speed range.

CLAUSE NO.	TECHNICAL REQUIREMENTS
	d. Any other as specified in data-sheet
6.04.00	VFDs shall comply with the latest edition of IEEE 519 & IEC 61000 for both individual as well as total harmonic voltage and current distortion limits. The Voltage and Current limits shall be applicable at the Point of Common Coupling (PCC), which shall be the MCC/ Switchgear/ from which the VFD system is fed.
6.05.00	The above compliance shall be verified by the field measurements of harmonics at the PCC with and without VFDs operation.
6.06.00	VFD shall be capable of withstanding the thermal and dynamic stresses and the transient mechanical torque, resulting from short circuit. Any damage resulting from such a short circuit or internal fault shall be limited to the component concerned.
6.07.00	The system shall be suitable to maintain speed variation within range 10-110% or as per the requirement of driven equipment with speed set accuracy of +1% of rated maximum speed and steady state regulation of +0.5% of rated speed as per system requirement.
6.08.00	The VFD System shall maintain a power factor of 0.95 (minimum) (for LV VFD system) and 0.9 (minimum) (for MV VFD system) in the entire operating range.
6.09.00	Maximum allowable audible noise from the VFD system will be 85 dB (A) at a distance of one meter under rated loaded with all cooling fan operating conditions.
6.10.00	All the circuit components shall be suitably protected against over voltages, surges, lightning etc.
6.11.00	The panels shall be designed to provide easy access to hardware, to facilitate replacement of cards in case of any failure.
6.12.00	All the VFDs for particular application shall be of same design so as to ensure 100 % interchangeability of components.
6.13.00	For each programmed warning and fault protection function, the VFD shall display a message in complete English words or Standard English abbreviations. At least 30 time tagged fault messages shall be stored in the drive's fault history.
6.14.00	The VFD cubicles shall be placed in air conditioned environment. However if VFDs of less than 100 kW are designed to operate in non-air condition environment the same shall also be acceptable.
6.15.00	The 3-Phase Thyristor/IGCT/SGCT/ multistage IGBT/IEGT based VFD system shall have minimum number of components to ensure very high reliability. The input side converter shall have 3-Phase Diode/Thyristor bridge configuration modular type and inverter shall be of 3-Phase Thyristor/IGCT/SGCT/multi stage IGBT/IEGT type, using Pulse Width Modulation or better technique for generating near sine wave output to motor.
6.16.00	Fiber optic cable connection shall be provided preferably to ensure high network reliability.
7.00.00	**VFD COMPATIBILITY WITH THE MOTOR**
7.01.00	MV VFD output current waveform, as measured at the motor, shall be inherently sinusoidal at nominal loads, with a total harmonic current and voltage distortion within acceptable/standard limits. VFD with transformers on output side are not acceptable.

CLAUSE NO.	TECHNICAL REQUIREMENTS
7.02.00	The system design shall not have any inherent output harmonic resonance in the operating speed range.
7.03.00	VFD shall provide stable operation of motor from high-voltage dv/dt stress, regardless of cable length to motor. The vendor shall clearly state the limitations in the motor cable distance in his proposal. However, due to system requirements & constraints if the cable length becomes critical, filters/ chokes etc. shall be provided by the VFD manufacturers as an integral part of the VFD to mitigate the reflected wave effect of harmonics.
8.00.00	**BYPASS ARRANGEMENT (OPTIONAL, IF SPECIFIED)**
8.01.00	The VFD System shall have an optional feature to run the motor under bypass arrangement for operation of Motor with VFD bypassed. During starting (under rated conditions) the motor will be switched on in VFD Mode to limit the starting current and after gaining speed, the load would be switched over to bypass mode.
8.02.00	Comprehensive motor protection scheme for protection and control for operation VFD during bypass mode shall be finalized during detailed engineering.
9.00.00	**STANDBY VFD ARRANGEMENT (OPTIONAL, IF SPECIFIED)**
9.01.00	A Common standby arrangement with auto/manual switchover shall be provided in case of failure of any VFD in a group of drives. Complete protection, interlocks & control required shall be provided in the changeover module.
10.00.00	**EFFICIENCY**
10.01.00	Efficiency (Drive only) shall be minimum 98% for both MV VFD and LV VFD. Overall efficiency (Includes the transformer if applicable) shall be minimum 96.5% for LV VFD and minimum 95 % for MV VFD at rated load and speed. Overall Efficiency evaluation shall include input transformer, harmonic filters and power factor correction (if applicable), VFD converters, cooling fans and output filter, as applicable in the system. Auxiliary controls, such as internal VFD control boards, cooling fans/pumps.
10.02.00	In absence of valid test report, a factory test shall be performed at the VFD manufacturer's facility verifying the efficiencies. Manufactures who are supplying Drive and transformer from different locations, efficiency test will be conducted separately for Drive and transformer.
11.00.00	**COOLING SYSTEM**
11.01.00	VFD manufacturer to primarily offer Air cooled Design. However in case of large ratings, liquid cooled drives may be accepted subject to employer's approval. In case of liquid cooled system, there shall be no necessity of continuous water supply system (Closed Loop System).
11.2.00	In case of Air cooled design, the VFD Cooling system shall be such that it puts minimum heat load inside the room and preferably throw the hot air outside the room with ventilation ducts. The Cooling system shall be designed in such a way that the Air Conditioning & Ventilation Air requirements are kept to minimum. The VFD Manufacturer shall furnish the data regarding heat load, air flow requirements during the detailed engineering.
11.03.00	Air cooled VFDs shall be provided with cooling fans mounted integral to the VFD/ enclosure. The VFD shall include air-flow pressure switches and temperature detectors to monitor proper operation of the air cooling system. If the fan fails, the system must generate the alarm/trip for the fan failure.

CLAUSE NO.	TECHNICAL REQUIREMENTS	
12.00.00	**TRANSFORMER:**	
12.01.00	Type: Outdoor Mineral oil filled ONAN type or Indoor air-cooled Dry type, Three phase unit, rectifier/converter duty type transformer.	
12.02.00	All other components, technical parameters shall be as per applicable IEC/IS.	
12.03.00	Enclosure for Dry Type Transformer (as applicable)	
	Enclosure shall be of a tested quality sheet steel of minimum thickness 2 mm & shall also accommodate cable terminations. The housing door shall be interlocked such that it should be possible to open the door only when transformer is off. The enclosure shall be provided with lifting lugs and other hardware for floor mounting.	
12.04.00	Core	Shall be High grade non-ageing cold rolled grain oriented silicon steel Laminations.
12.05.00	Winding conductor	Shall be electrolytic grade copper. Windings shall be of class F insulation or better.
.		
12.06.00	Winding temperature Indicator (WTI)	Shall be Platinum resistance type temperature detector in each limb.
12.07.00	Thermistors	Shall be embedded in each limb with alarm and trip contacts for remote annunciation.
12.08.00	Temperature rise:	For dry type transformer the winding temperature rise shall be 95 Deg. C for Class-H insulation or 70 Deg.C for Claas – F Insulation.
13.00.00	**POWER CONVERTER:**	
13.01.00	The static power converter shall consist of a line side converter for operation as a rectifier and a load side power converter for operation as a fully controller inverter. Power converter shall be fast switching, most efficient and low loss type.	
13.02.00	The converter shall be coordinated with the transformers. The converter shall be able to withstand a three phase short circuit current until interrupted by normal breaker operation.	
13.03.00	Adequate short circuit and over voltage protection shall be provided for the converter and inverter system.	
13.04.00	All power converter devices shall include protective devices, snubber networks and dv/dt networks as required.	
13.05.00	The current rating of the converter's semi-conductor components shall not be less than 120% of the nominal current flowing through the elements at full load of the VFD through the whole speed range. If the parallel connection of semiconductor is applied, the above current rating shall not be less than 140% of the above values.	
13.06.00	All power diodes shall be of silicon type with minimum VBO rating at 2.5 times the rated operating voltage.	
13.07.00	The power converter circuit shall be designed so that motor can be powered at its full nameplate rating continuously without exceeding its rated temperature rise nor reducing its service factor due to harmonic currents generated by the inverter operation. The conversion	

CLAUSE NO.	TECHNICAL REQUIREMENTS
	devices and associated heat sinks shall be assembled such that individual devices can be replaced without requiring the use of any special precautions / tools.
13.08.00	The cooling system of the electronic components, if provided, shall be monitored and necessary alarms shall be provided to prevent any consequential damage to the power control devices.
14.00.00	**OUTPUT FILTER (AS APPLICABLE):**
14.01.00	Output/ dv/dt filter shall be provided, if required. It shall be an integral part of the VFD system and included within the VFD enclosure. It shall inherently protect motor from high voltage dv/dt stress.
15.00.00	**DC LINK CAPACITOR (AS APPLICABLE):**
15.01.00	Capacitor shall be of self-healing film or electrolytic type having high life time. The capacitor shall be an integral part of VFD system. DC link Capacitors shall have discharge resistors which shall be capable of reducing the residual charges to zero just after the capacitor is disconnected from the supply source. The capacitor shall be suitable for high ripple currents.
16.00.00	AC/**DC Reactor (As applicable)** 1) Type: Dry type, air cored, self cooled, indoor type. Suitable for withstanding earth fault continuously. 2) Insulation: Thermal Class 155(F), temperature rise is limited to thermal class 130 (B). 3) Noise level shall not exceed value specified in NEMA TR-1.
17.00.00	**VFD PANEL REQUIREMENTS**
17.01.00	Enclosure frames and load bearing members shall be as per the Chapter B-05 and B06
17.02.00	The cable entry shall be from the bottom of the panel and a removable bolted un-drilled gland plate.
17.03.00	All Panels shall be of dust-proof and vermin-proof construction and shall be provided with a degree of protection of IP: 3X or better for MV VFD and IP: 4X or better for LV VFD as per IS/IEC 60947
17.04.00	Enclosures must be designed to avoid harmonic and inductive heating effects and to shield any outside equipment from interference, enclosing and shielding the complete to eliminate any radio frequency interference. The construction of the panel shall provide effective protection against electromagnetic emissions.
17.05.00	Each panel shall be provided with illuminating lamp, space heater with switch fuse and variable setting thermostat.
17.06.00	Proper ventilation using air filters and fans/pumps shall be provided in the panels to ensure that maximum temperature inside the cubicle is within permissible limits for reliable and continuous operation of the system.
18.00.00	**NOT USED**
19.00.00	**HT SWITCHGEAR**
19.01.00	The technical requirements of HT switchgear shall be as per chapter of HT switchgear in Part-B of Technical specifications.

CLAUSE NO.	TECHNICAL REQUIREMENTS
20.00.00	**MOTORS**
20.01.00	VFD shall be used to drive three (3) phase squirrel cage inverter duty Induction motor with VPI insulation (Resin poor) suitable for VFD application. These motors shall be provided with insulated bearing on at least one side for motor frame size above 250 frame. However, contractor's proven practice with respect to use of insulated bearing in VFD driven motor may be accepted subject to Employer's approval.
20.02.00	Motors shall also meet the requirements mentioned in subsection for motors, relevant portions of the specifications for driven equipment and relevant IS/IEC.
20.03.00	Motor shall be suitable for operation with a solid state power supply consisting of an adjustable frequency inverter for speed control & shall be suitable for the current waveforms produced by the power supply including the harmonics generated by the drive.
20.04.00	Motor insulation shall be designed to accept the applied voltage waveform, within the Vpeak and dv/dt limits as per IEC-61800.
20.05.00	Drive manufacturer shall coordinate with the motor manufacturer for proper selection of the motor for the given load application and the output characteristics of the drive.
20.06.00	Other requirements of motor shall be as stipulated in technical chapter of Motors and driven equipment in Part-B of technical specifications.
21.00.00 .	**LT & HT CABLES**
21.01.00	Contractor's scope shall also include LT and HT cables suitable for VFD system and Motors.
22.00.00	**CONTROL AND PERFORMANCE REQUIREMENTS**
22.01.00	The VFD to provide an automatic current limiting feature to control motor currents during startup and provide a "soft start" torque profile for the motor load combination. Current and torque limit adjustments shall be provided to limit the maximum VFD output current and the maximum torque produced by the motor.
22.02.00	It shall be possible to vary the speed of the drive and control it in either Local or Remote mode. Local / Remote selection shall be done from VFD panel unless otherwise specified.
22.03.00	Provision shall be kept for exchange of information between different VFD control system parameters thru PLC/DDCMIS. Man machine interface for (MV) VFD shall have one flat TFT monitor with keyboard (password protected) in the VFD room and a color laser printer for system alarm and monitoring located in control room. Parameter Monitoring: -Input and output voltage of Drive - Input and output current of Drive - Motor speed - Input and output power frequency of Drive - Torque -Input and Output power of Drive system (covering transformer if applicable) - Output kWhr of Drive - Transformer (if applicable) temperature for alarm & trip. - Ambient temperature - Run/stop and local/remote status displayed

CLAUSE NO.	TECHNICAL REQUIREMENTS
22.04.00	Drive shall be equipped with a front mounted operator console panel consisting of a backlit alphanumeric display and a keypad with keys for parameterization and adjusting parameter. Control panel shall be operable with password for changing the protection setting, safety interlock etc.
22.05.00	Operator console/Main Control Card shall have facility / port to connect external hardware such as Lap-Top etc. Console shall have facility for upload and download of all parameter settings from one drive to another drive for start up and operation.
22.06.00	User-friendly licensed software for operation and fault diagnostic shall be loaded in the drive system panel before commissioning.
23.00.00	**PROTECTION FEATURES**
23.01.00	The system offered shall incorporate adequate protection features as per IEC 61800-4: 2002 Table-8, properly coordinated for the drive control and for motor including following: i) Converter transformer: short circuit, over current, earth fault & winding temperature high protection. ii) Incoming and outgoing line surge protection. iii) Under / over voltage protection iv) Phase loss, phase reversal, overload, negative phase sequence, locked rotor protection. v) Instantaneous Over current & Earth fault protection vi) Converter/Inverter module failure indication. vii) Over frequency/speed protection. viii) Ventilation failure indication & alarm. ix) Over temperature of VFD x) Bearing temperature protection. xi) System earth fault protection. xii) Speed reference loss protection.
23.02.00	Under VFD Bypass Mode (if applicable) all the electrical protections related to the Motor shall remain applicable.
24.00.00	**CONTROL FEATURES**
24.01.00	Following controls shall be provided as a part of the Operator Control Panel or through separate switches on the front panel door. i) Start / stop (in local/remote mode) ii) Speed control (Raise / lower)

CLAUSE NO.	TECHNICAL REQUIREMENTS
	iii) Acknowledge/Accept/ Test Push Button for annunciation iv) Auto / Manual / Test Mode select v) Emergency stop vi) Trip-Remote Breaker
25.00.00	**DIAGNOSTIC FEATURES**
25.01.00	The VFD shall include a microprocessor/PLC based digital diagnostic system which monitors its own control functions and displays faults and operating conditions.
25.02.00	Fault diagnostic shall be built into the system to supervise the operation and failure of the system. The information regarding failure of any of the system including shut down of the system shall be available. It shall be possible to retrieve the record of events prior to tripping of the system or de-energization. Auxiliary supply to the system components or to the electronics (firmware) for the diagnostics / display shall be taken care of by the manufacturer for this purpose.
26.00.00	**SERVICEABILITY / MAINTAINABILITY**
26.01.00	Power Component Accessibility: All power components in the converter sections shall be designed for rack-out accessibility for ease of maintenance and to minimize repair downtime.
26.02.00	Marking / Labeling: Sleeve type wire marker tags or other acceptable means of permanent identification shall be applied to power and control wiring. Individual labels shall be provided for all major components of the VFD system.
27.00.00	**NOT USED**
28.00.00	**TESTS**
28.01.00	**ROUTINE TESTS** All acceptance and routine tests as envisaged in QA section shall be carried out. Charges for these shall be deemed to be included in the equipment price.
28.02.00	**TYPE TESTS** **LIST OF TYPE TESTS TO BE CONDUCTED** The following type tests shall be conducted under this contract for MV VFD i) Overall efficiency determination of VFD system including transformer/ Harmonic filters etc at motor full load ii) Temperature rise test iii) Noise level iv) Harmonics of No load current.(Input/Output) **LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED** The following type test reports shall be submitted for VFD Panels'

CLAUSE NO.	TECHNICAL REQUIREMENTS

1) VFD panels (For LV VFD used with load >= 50 KW)

i. Rated Current/ Output

ii. Temperature rise test

iii. Noise level test

iv. Power Loss Determination Test

v. Power factor measurement.

vi. Degree of Protection Test

vii. EMC Test

viii. The Fast transient SWC tests as per ANSI / IEEE C37.901-2002 / IEC 60255-22-04-2008 / IEC 61800

2) VFD panels (For MV VFD)

i. Rated Current/ Output

ii. Current Sharing

iii. Voltage Division

iv. Power Loss Determination Test

v. Power factor measurement.

vi. Degree of Protection Test

vii. The Fast transient SWC tests as per ANSI / IEEE C37.901-2002 / IEC 60255-22-04-2008 / IEC 61800

3) AC/DC Reactor

i. Lightning impulse test(If applicable)

ii. Heat run test

iii. Short time current test(If applicable)

iv. Noise level test

4) Transformers (for Non Integrated type)

i. As per requirements mentioned in subsection for Transformer chapter in technical specifications.

(c) Butt welds in the tube/ separator /body casing of the mill shall be tested by UT / RT and MPI. All other welds in main tube/separator shall be tested by MPI/LPI for acceptance. The tube shall be statically balanced.

(d) All gearboxes shall be run tested for adequate duration to check rise in oil temperature, noise level and vibration. Check for leak tightness of gear case also shall be performed.

(e) Trail assembly (stacking) of at least one Mill complete with all major components needs to be carried out at shop.

(f) Fabricated pipe welds should be examined by MPI.

(g Ceramic/basalt lined piping/bends shall be checked for proper layout.

(h) Weldments on burner components shall be checked with suitable NDT. The burner assembles shall be tested for operation at shop.

1.02.05 Coal Feeders

(a) Any welds in the casing/ pulley fabrication shall be checked with MPI.

(b) Type tests including degree of protection and routine tests shall be done as per relevant Indian Standards or equivalent International Standards.

(c) All major items like plates for casings, head pulley, tail pulley, Pulley shaft and major castings shall be procured with respective material test certificates.

(d) Leak tightness test shall be done on individual feeder casing. Functional test for load cell shall be carried out.

(e) Test for weighing accuracy, calibration and repeatability shall be carried out at various speeds by a coal flow on one feeder.

(f) Calibration check shall be carried out on all feeder cabinet/ assemblies prior to dispatch.

1.02.06 Fuel Oil Pumps

(a) Bar stock/forging above 40 mm diameter shall be subjected to UT. Impeller and rotor shall be dynamically balanced.

(b) Pump assemblies shall be subjected to hydraulic test.

(c) All pumps including spare cartridges shall be subjected to performance test at the manufacturer's works under as near site conditions as possible and strip down examination after the test.

1.02.07 EOT CRANES

1.0 HOOKS

1.01 All Tests including Proof Load Test as per relevant IS 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 FORGINGS (wheel, gears, pinions, axle, hooks & hook trunnion)

4.01 All forgings greater than or equal to 50 mm diameter or thickness shall be subjected to Ultrasonic test.

4.02 DPT/MPI shall be done after hard-facing 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 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.

~~**1.02.08**~~ ~~**Lube Oil systems/ Hydraulic Power Pack**~~

~~Lube Oil system/ hydraulic power packs shall be tested for performance.~~

~~**1.02.09**~~ ~~Fans & pumps which are not mentioned in other clauses above shall be dynamically balanced and functionally tested at Manufacturer's works. Complete performance tests shall be carried out on first pump/fan of each type and capacity to verify its output against total head, power input, efficiency, vibration and noise level. Head/volume, efficiency and power input curves corrected for site conditions shall be furnished.~~

~~**1.02.10**~~ ~~**Dampers**~~

~~(a)~~ ~~All the dampers shall be subjected to operational test/checks.~~

~~(b)~~ ~~Leak tightness of test of Dampers / Gates shall be carried out as given in respective subsection of Technical Requirements of Steam Generator & Auxiliaries.~~

~~(c)~~ ~~All dampers shall be checked for sealing dimensions to establish guaranteed tightness.~~

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 20MM 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 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.
9.0	~~**LIFTING BEAM**~~:
~~9.01~~	~~THE PLATES OF THICKNESS 20MM AND ABOVE SHALL BE ULTRASONICALLY TESTED.~~

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS (Annexure-VI)

S. No.	Description of Drgs./Docs.	No. of Prints	No. of Portable Hard Disk
1	Drawings, Data sheets, Design calculations, Purchase specifications and other documents		
	First submission and submission with major changes		
	▪ Layout (A0&A1 sizes)	4	-
	▪ Other Drawings/Documents (A0 & A1 sizes)	2	-
	▪ P&ID (All sizes)	4	-
	a) Final drawings/documents (Directly to site)	6	2
	b) "As Built" Drawing/Documents (Directly to site)	6	2
	c) Analysis reports of Equipments / piping / structures components/system employing software packages as detailed in the specifications.	2	2
2	Erection Manual (Directly to site)	4 sets	2
3	Operation & Maintenance manual i) First Submission	1 set	--
	ii) Final Submission (Directly to site)	4 sets	2
4	Plant Hand Book i) First Submission	1	1
5	Commissioning and Performance Test Procedure manual i) First Submission	1 set	--
	ii) Final Submission (Directly to site)	4 sets	2

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS (Annexure-VI)

S. No.	Description of Drgs./Docs.	No. of Prints	No. of Portable Hard Disk
6	Performance and Functional Guarantee Test Report i) First Submission	2 sets	--
	ii) Approved Copies (Direct to Site)	4 sets	2
7	Project Completion Report (Directly to site)	6 sets	2

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS
	~~Address :~~ ~~a) Postal :~~ ~~b) Telegraphic / e-Mail :~~ ~~c) FAX : TELEPHONE :~~
~~8.05.02~~	~~All engineering correspondence shall be in the name of above coordinators on behalf of the respective organizations.~~
8.05.03	Contractor's/Vendor's Drawing Submission and Approval Procedure: a) All data/information furnished by Vendor in the form of drawings/ documents/catalogues or in any other form for NTPC's information/ interface and or review and approval are referred by the general term "drawings". b) Not used c) All drawings (including those of subvendor's) shall bear at the right hand bottom corner the 'title plate' with all relevant information duly filled in. The Contractor shall furnish this format to his sub-vendor along with his purchase order for sub-vendor's compliance. d) Not used e) 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. f) **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 endorsement for checking by the Contractor, the same shall not be reviewed and returned to the Contractor for re-submission.** g) The Contractor shall submit drawing / data / document for Employer's review and approval. The drawings submitted by the Contractor/vendor shall be reviewed by NTPC and their comments shall be forwarded within three (3) weeks of receipt of drawings. Upon review of each drawing, depending on

the correctness and completeness of the drawing, the same will be categorized and approval accorded in one of the following categories:

CATEGORY- I: Approved

CATEGORY- II Approved, subject to incorporation of comments/ modification as noted. Resubmit revised drawing incorporating the comments.

CATEGORY –III Not approved. Resubmit revised drawings for approval after incorporating comments/ modification as noted.

CATEGORY -IV For information and records.

h) Contractor shall resubmit the drawings approved under Category II, III & IVR within two (2) 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.

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS
	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.
~~8.06.00~~	~~**ENGINEERING PROGRESS AND EXCEPTION REPORT**~~
~~8.06.01~~	~~The Contractor shall submit every month an Engineering progress and Exception Report giving the status of each engineering information including~~ ~~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.~~
~~8.06.02~~	~~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.~~
~~9.00.00~~	~~**TECHNICAL CO-ORDINATION MEETING**~~
~~9.01.00~~	~~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.~~
~~9.02.00~~	~~The Contractor should note that Time is the essence of the contract. In order to expedite the early completion of engineering activities, the comments of the Employer shall 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.~~
~~9.02.01~~	~~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.~~
~~9.02.02~~	~~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.~~

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS
9.03.0	~~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.~~
~~10.00.00~~	~~**DESIGN IMPROVEMENTS**~~ ~~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.~~
~~11.00.00~~	~~**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 shall 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.~~
~~12.00.00~~	~~**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.~~
13.00.00	**LUBRICANTS, SERVO FLUIDS AND CHEMICALS**
13.01.00	All the first fill and one year's topping requirement of consumables such as greases, oils, lubricants, servo fluids / control fluids, gases (excluding H_2, CO_2 and N_2 for Generator) 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 include supply of H_2, CO_2 and N_2 as applicable for the Generator till successful commissioning of Generator. Bidder shall supply a quantity not less than 10% of the full charge or one (1) year topping requirement mentioned above (Whichever is higher) of each variety of lubricants, servo fluids, gases etc. (as detailed above) used which is expected to be

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS
	utilized during the first year of operation. This additional quantity shall be supplied in separate containers.
13.02.00	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.
14.00.00	**LUBRICATION**
14.01.00	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.
15.00.00	**MATERIAL OF CONSTRUCTION**
15.01.00	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.
16.00.00	**RATING PLATES, NAME PLATES & LABELS**
16.01.00	Each main and auxiliary item of plant 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.
16.02.00	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.
16.03.00	Such nameplates or labels shall be of white non-hygroscopic 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.
16.04.00	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. The name plates for valves shall be marked in accordance with MSS standard SP-25 and ANSI B 16.34 as a minimum.

SECTION – IA

ANNEXURES

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)		
10.	HRC FUSES	SIEMENS		

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		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	

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	

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	
		UNIVERSAL CABLES LTD	SATNA	
21.	TRAILING CABLES	NICCO	KOLKATA	
		UNIVERSAL	SATNA	
		INCAB		
		ICL	NEW DELHI	
		APAR INDUSTRIES LTD	MUMBAI	
		CMI LTD	FARIDABAD	
		KEI INDUSTRIES LTD	NEW DELHI	
		SUYOG ELECTRICALS LTD	VADODARA	
22.	XLPE POWER CABLES	APAR INDUSTRIES LTD	MUMBAI	
		CORDS CABLE INDUSTRIES LTD	NEW DELHI	
		CRYSTAL CABLE INDUSTRIES LTD	KOLKATA	
		DIAMOND POWER INFRASTRUCTURE LTD	VADODARA	
		GEMSCAB INDUSTRIES LTD	NEW DELHI	
		GOVIND CABLE INDUSTRIES	KOLKATA	
		GUPTA POWER INFRASTRUCTURE LIMITED	BHUBNESWAR	
		HAVELLS INDIA LIMITED	NOIDA	
		KEI INDUSTRIES LTD	NEW DELHI	
		KRISHNA ELECTRICAL INDUSTRIES LTD	GWALIOR	
		KEC INTERNATIONAL LIMITED	MUMBAI	

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	
		UNIVERSAL CABLES LTD	SATNA	
24.	CABLE GLAND	COMMET		
		SUNIL&CO		
		ARUP ENGINEERING		
		JAINSON		
		DOWELL		
25.	PUSH BUTTONS	SIEMENS		
		L&T		
		BCH		
		SCHNEIDER		

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		
		STANDARD		
31.	MCB	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		

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*		
		BONGFILIOLI*		
41.	RAIL	JSPL		
		SAIL		
42.	CENTRALIZED LUBRICATION / HYDRAULIC POWER PACK	LUBCON, PUNE PRAKASH LUBRICANT, KOLKATA AFMC, KOLKATA SKF ENGG AND LUBRICATION (LINCOLN HELIOS) VIJAY ENGINEERS INDO HYDRAULIC BOMBAY PVT LTD MEHATA HYDRAULIC EQUIPMENT CLAYSYS VEDNAT ENGINEERING SERVICES ELECTROPNEUMATICS AND HYDRAULIC PVT LTD SN HYDRAULIC		CRANE OEM MAKE POWERPACK IS NOT ALLOWED.

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.

ANNEXURE-II MANDATORY SPARES

MANDATORY SPARES:

	BFP EOT CRANES	Qty for both cranes
1	**Mechanical:**	
(a)	Bearings for long travel wheels	1Set (Requirement for one Crane)
(b)	Bearings for cross travel wheels	1Set (Requirement for one Crane)
(c)	Bearings for Gear Boxes for each type of Hoist & travel (Main and aux Hoist (if applicable), LT and CT travel))	1 Set (Requirement for one Crane)
(d)	Brake Liner for all the brakes (main and aux hoist (if applicable) ,LT and Ct travel))	2Sets (Requirement for two Crane)
(e)	Hydraulic thruster for all Brakes (Main and aux hoist (if applicable), CT and LT travel)	1 Set (Requirement for one Crane)
(f)	Oil Seals (both main and aux hoist (if applicable), CT and LT)	2Sets (Requirement for two Crane)
(g)	Brake springs for all brakes (both main and aux hoist (if applicable), LT and CT travel)	1 Set (Requirement for one Crane)
(h)	Wire Rope for Aux. Hook (if applicable)	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

For CWPH Crane

I	MECHANICAL	
a)	Bearings for long travel wheels	1 set
b)	Bearings for cross travel wheels	1 set
c)	Brake liners for all the Brakes	1 set
d)	Hydraulic thrusters for Brakes	1 set
e)	Wire rope for Crane	1 length
f)	Electrical Items of Crane	
i)	Carbon brushes and brush holders for motors	1 set of each rating/Size
ii)	Solenoid coils for all brakes	1 set of each rating/Size
iii)	Overload relays for motors	1 set of each rating/Size
iv)	Set of fuses	1 set
v)	Limit switches for main hoist, long travel & Cross travel	1 set
II	ELECTRICAL	

a)	Solenoid Coils for Brakes	2 sets
b)	MCBs/MCCBS/Fuse links for the whole crane	1 set
c)	Contactors and overload Relays	1 set of each type, size & rating
d)	Motors of the EOT	1 set of each type, size & rating
e)	Timers of each type, size & rating	1 set
f)	Limit Switches for	
f.1	Main Hoist	1 set
f.2	Aux. Hoist	NA
f.3	Cross Traverse	1 set
f.4	Long Travel	1 set
g	Carbon brushes & brush holders	1 set
h	Master Controller for Aux. Hoist,	NA
i	Resistance Box	1 No of each type.

For Electrical Workshop Crane and Mechanical Workshop Crane: Mandatory spares are not applicable.

Notes:-
1. One (1) Set is defined as 100% requirement for one crane for the entire cranes of similar size & capacity.
2. 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.
3. Any variation in quantity of items during detail engineering shall be adjusted based on prices quoted against each item.
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 in any change/ variation in equipment/ system during detail engineering which causes any change/ variation in the essential spares quantity, the same shall be supplied without any commercial implications. The price indicated for the mandatory spares shall be considered for the
purpose of evaluation.
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 or 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.

ANNEXURE III - TOOLS & TACKLES

One set of tools and tackles to be provided with each crane.

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.

One set of tools and tackles comprised of following items:-

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.

ANNEXURE IV PAINTING SPECIFICATION

1. Painting specification for **BC BAY Cranes**:-

Surface preparation: De greasing and Mechanical cleaning by Shot blast cleaning/ abrasive blast cleaning to SA 2 ½ (near white metal) 35-50 microns

Primer : Inorganic Ethyl Zinc Silicate. - 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 25 µm per coat. Final coat of paint Aliphatic Acrylic Polyurethane CDE134, %V=40.0(min.) – 1 coat 30 µm.

Total DFT : 150µ

2. Painting specification for **CWPH Crane and Workshop cranes**:-

Surface preparation: De greasing and Mechanical cleaning by Shot blast cleaning/ abrasive blast cleaning to SA 2 ½ (near white metal) 35-50 microns

Primer : Inorganic Ethyl Zinc Silicate. - 1 coat, DFT 75 µm per coat.

Intermediate : Epoxy base Tio2 pigmented coat - 1 coat, DFT 75 µm per coat

Finish Coat : Epoxy base paint - 2 coats, DFT 35 µm per coat. Final coat of paint Aliphatic Acrylic Polyurethane CDE134, %V=40.0(min.) – 1 coat 30 µm.

Total DFT : 250µ

3. 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.

4. 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	

ANNEXURE-V

DRAWINGS/ DOCUMENTS TO BE SUBMITTED AFTER AWARD OF CONTRACT

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

S.N.	BHEL drawing No.	Title	Approval category	Schedule date of submission from date of LOI (in weeks).
1	PE-V0-497-501-A401*	Manufacturing Quality Plan with sub vendor list For Double Girder EOT Cranes (upto 100T)	A	2
2	PE-V0-497-501-A403	Data sheet of motors for Double Girder EOT Cranes (upto 100T)	I	5
3	PE-V0-497-501-A404*	Mechanism Sizing Calculation for Double Girder EOT Cranes (upto 100T)	A	2
4	PE-V0-497-501-A405*	General arrangement Double Girder EOT Cranes (upto 100T) with CT DSL details	A	2
5	PE-V0-497-501-A406	Crab sub assembly Double Girder EOT Cranes (upto 100T)with CT wheel assembly	I	3
6	PE-V0-497-501-A408	General arrangement for PVC shrouded DSL for Double Girder EOT Cranes (upto 100T)	I	3
7	PE-V0-497-501-A409	Main and Auxiliary hook block assembly with details of hook, nut and check plate For Double Girder EOT Cranes (upto 100T)	I	2
8	PE-V0-497-501-A410	Long travel Machinery Assembly with LT wheel assembly For Double Girder EOT Cranes (upto 100T)	I	4
9	PE-V0-497-501-A412*	Structural calculations For Double Girder EOT Cranes (upto 100T)	A	3
10	PE-V0-497-501-A414	O & M Manual For Double Girder EOT Cranes (upto 100T)	I	9
11	PE-V0-497-501-A417*	"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 For Double Girder EOT Cranes (upto 100T)"	A	5
12	PE-V0-497-501-A418	"General Arrangement of a) Protective panel b) Main hoist panel c) Aux. hoist panel d) Cross Travel panel e) Long Traverse travel panel f) Pendent g) Remote Radio Control for Double Girder EOT Cranes (upto 100T)	I	5
13	PE-V0-497-501-A419	Cable Sizing and cable schedule for Double Girder EOT Cranes (upto 100T)	A	6
14	PE-V0-497-501-A420	Crane Operational write up for Double Girder EOT Cranes (upto 100T)	I	5

15	PE-V0-497-501-A421	Type test certificate (for motors) for Double Girder EOT Cranes (upto 100T)	A	8
16	PE-V0-497-501-A423	Mandatory spare parts list for Double Girder EOT Cranes (upto 100T)	A	8
17	PE-V0-497-501-A425	Erection procedure for Double Girder EOT Cranes (upto 100T)	I	8
18	PE-V0-497-501-A427	Data sheet for Double Girder EOT Cranes (upto 100T) with painting details	A	3
19	PE-V0-497-501-A430	Electrical load for Double Girder EOT Cranes (upto 100T)	I	8
20	PE-V0-497-501-A432	Gantry Rail installation for Double Girder EOT Cranes (upto 100T)	I	3
21	PE-V0-497-501-A450	Crane lubrication drawing for Double Girder EOT Cranes (upto 100T)	I	6
	LEGENDS			
	A= Approval category			
	I= Information category			
	*Marked drawing/documents are Basing engineering drawing/documents.			

Notes:

1. 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.
2. 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.
3. 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.
4. 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.
5. 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.:-

    a) All drawings and documents shall indicate the list of all reference drawings including general arrangement.

    b) 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.

    c) Painting schedule shall also be made as a part of general arrangement drawing of each equipment / items indicating at least 3 trade names.

    d) 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.

    e) Drawings/ documents to be submitted for purchasers review/ approval shall be under Revision A, B, C… etc. while drawings /documents to be submitted thereafter for customer's approval after purchaser's approval shall be under R-0, 1, 2, 3 ….etc.

f) 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.

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.

ANNEXURE VI – PACKING PROCEDURE

COMMON GUIDELINES FOR PACKING

1. GENERAL:

The Components/Assemblies need to be packed suitably to avoid physical damage & corrosion during transit & storage. This packing shall be suitable for different handling operations and for the adverse conditions during transportation and during indoor / outdoor storage of materials.

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.

2. TYPES OF PACKING:

The following 5 types of packing have been standardized for packing of General Components/ Assemblies.

1) '**OP**' - Open Type.

2) '**PP**' - Partially Packed.

3) '**CP**' – Crate/Box Packing - Components/Equipment requiring physical protection.

4) '**CQ**' - Case Packing – Machined components-Small & Medium Components/ Assemblies/ Equipment which require corrosion & physical protection.

5) **'CR'** - Case Packing – Electrical/Electronic Components/ Assemblies, which require special packing viz. Water Proof, Shock Proof etc…

3. DESCRIPTION OF TYPES OF PACKING:

The various types of packing, as standardized above, are described below.

3.1 'OP' - Open Type

In case, of components which are not affected by water & dust and do not require special protection, are generally not machined, shall be sent as open packages. However, these components may be sent in crates, wherever necessary.

3.2 'PP' - Partially Packed

Components which need special protection at selected portions only shall be despatched partially packed. Machined surfaces should not be allowed to come directly in contact with the wood. Such surfaces should be protected with 100GSM(Colourless) Multi Layered Cross Laminated Polyethylene Film. All sharp corners and edges shall be protected by rubber mats to prevent damage to the polyethylene film.

3.3 'CP' - Crate Packing

Assemblies/Components which need only physical protection from the point of view of handling shall be despatched duly packed in crates.

3.4 'CQ' - Case Packing - Machined Components/Assemblies/Equipment

Small and medium sized components/assemblies/equipment due to size/weight and to avoid handling and pilferage problems shall be packed in Case/Containers. Wherever required adequate quantity of silica gel or VCI Powder/Tablets, packed in thin muslin cloth cotton bags shall be suitably placed. Small machines/components of less weight shall be provided with suitable cushioning by Rubberised coir. The components inside the case shall

be entirely covered with100GSM(Colourless) Multi Layered Cross Laminated Polyethylene Film, wherever required. This may be prescribed for electronic parts/critical machined components/surfaces.
For mechanical product like valves where motors are separately securely wrapped in polyethylene, the requirement of individual component wrapping shall be exempted.

3.5 'CR' - Case Packing - Electrical & Electronic Components/Assemblies

Delicate components likely to be damaged e.g. Gauges, Instruments etc. are to be wrapped in waxed paper or polyethylene air bubble film and packed in cartons. Adequate quantity of Silica gel packed in cotton bags of 100grams each are to be suitably placed in the cartons. The cartons shall be entirely covered with 100GSM(Colourless) Multi Layered Cross Laminated Polyethylene Film before being packed in the cases. VCI Powder/Tablets can be used as an alternative to Silica Gel.
Empty space in the cartons shall be filled with rubberized coir to get proper cushioning effect. The cartons shall be manufactured from corrugated Fiber Board.

4 PREPARATION OF PACKING CASES

4.1 DIMENSIONS:

a) Thickness of planks for Front, rear, top and bottom sides and binding, jointing battens shall be 25/20mm +2/- 3 mm as per applicable drawings of the respective units/manufacturers.

b) Width of all planks including the tongue shall be more than 125mm and after plaining it shall be minimum 100mm.

c) Minimum number of planks shall be used for a shook.

d) Horizontal, vertical, diagonal planks shall be given for binding (number of such planks depend on the dimension of panel.

e) Width of binding planks shall be minimum 100mm.

f) Distance between any 2 binding planks shall be less than 750mm.

g) diagonal planks shall be used in between vertical binding planks when distance between inner to inner of vertical planks is more than 750mm

h) Distance of the outer edges of these planks from the edge of case shall be less than 250mm.

i) Diagonal planks are not required for top planks and width side, if the width of pallet is less than 750mm.

4.2 HOOP IRON STRIPS

These are used for strapping the boxes. The width of the strips shall be 19+1mm and thickness 0.6+0.01mm. The material shall be free from rust. If sufficient nailing is done for bigger boxes, strapping need not be done.

4.3 BRACKETS

These brackets are used for nailing to the corners of cubicle boxes. The brackets shall be of mild steel of thickness min 2mm and width 25+1mm. The brackets shall be of "L" shape, the length of each side being 100+2mm. Two holes shall be provided towards the end of each side for screwing /nailing.

4.4 MULTI LAYERED CROSS LAMINATED POLYTHELENE FILM

100GSM (Colourless) Multi Layered Cross Laminated Polythelene Film are used to make covers to the jobs individually. The cross lamination gives qualities of extra toughness, together with flexibility and lightness coupled with good weather resistance to ultra violet rays.

4.5 RUBBERISED COIR:

The rubberized coir is used as cushioning material. For the packing of loose items, items are to be arrested by using rubberized coir. For the packing of cubicles rubberized coir of thickness 25mm and width 75mm shall be used.

5.4 MULTI LAYER CROSS LAMINATED POLY FILM WHILE PACKING OF CUBICLES/CASING

The inner surface of 4 sides of shook's shall be nailed with Multi-layer cross laminated poly film (as per 4.4) using blue nails wherever 2 pieces of Cross laminated poly film are used, the joint shall have an overlap of minimum 20mm.

The inner surface of top cover shall be nailed with Multi-layer cross laminated poly film. This sheet shall project outside on 4 sides by at least 100mm and shall be nailed properly on sides. Joining of sheets should have overlap of minimum 20mm.

The cubicles shall be covered with Multi-layer cross laminated poly film.

6 PACKING OF LOOSE ITEMS/SPARES

1) Inner surfaces of all 6 sides shall be lined with Multi Layered Cross Laminated Polythelene Film (as per clause 5.4) using blue nails.

2) Rubberized coir of minimum 25mm thickness and 100 mm width shall be nailed to inner surfaces of bottom and 4 sides of box.

3) Internal packing: Items that go into the box shall be packed using 100GSM, (Colourless) Multi Layered Cross Laminated Polyethylene Film. Any space left between the job and the sides and the top of the box shall be filled with rubberized coir to get proper cushioning effect.

4) Certain items like transformers, reactors, breakers, etc., shall be bolted to the bottom of the box using bolts, nuts and washers.

5) Silica gel held in cotton bags shall be kept at proper places in the box.

6) Packing slip kept in polyethylene bag shall be placed in the box.

7) Two numbers of hoop iron strips shall be strapped tightly on the case using clips.

8) Stencil marking of various details and marking of various symbols shall be done as per BHEL instructions using indelible/non-washable marking ink.

9) Loose items to be kept inside the cubicle/casing

- Other items which are given loose in addition to cubicle shall be packed in separate boxes.

TYPICAL PATTERN OF WOODEN BOX

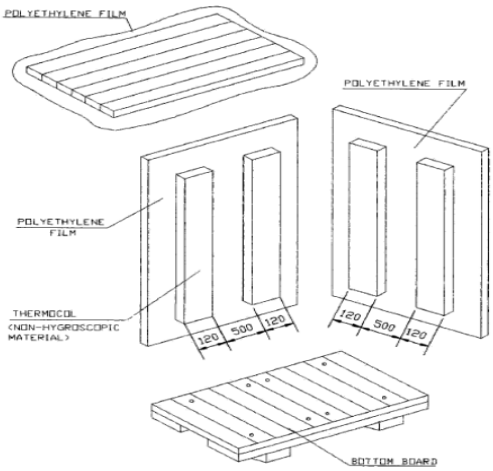
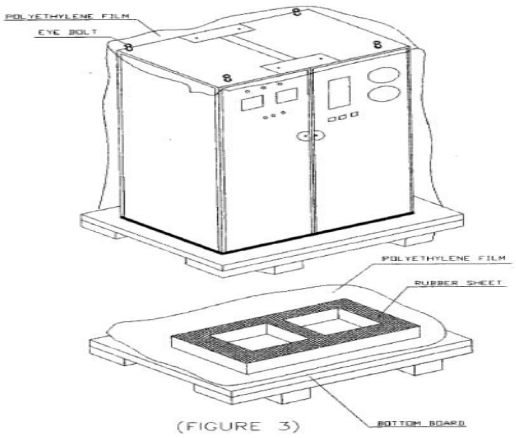


Figure 1



(FIGURE 3)

Figure 2

7.3 SEALED PACKING:

Components sub-assemblies and assemblies sensitive to climatic conditions shall be packed seal tight. All the openings of the sensitive components, sub-assemblies and assemblies shall be blanketed to prevent the ingress of dust and moisture. The components sub-assemblies and assemblies are completely covered with 2 layers of polyethylene sheet. All sharp corners and edges are to be protected by rubber mats to prevent the polyethylene sheet from damage. Top surface of the case shall be free from dents to prevent rain water pockets.

8 MARKINGS/STENCILINGS

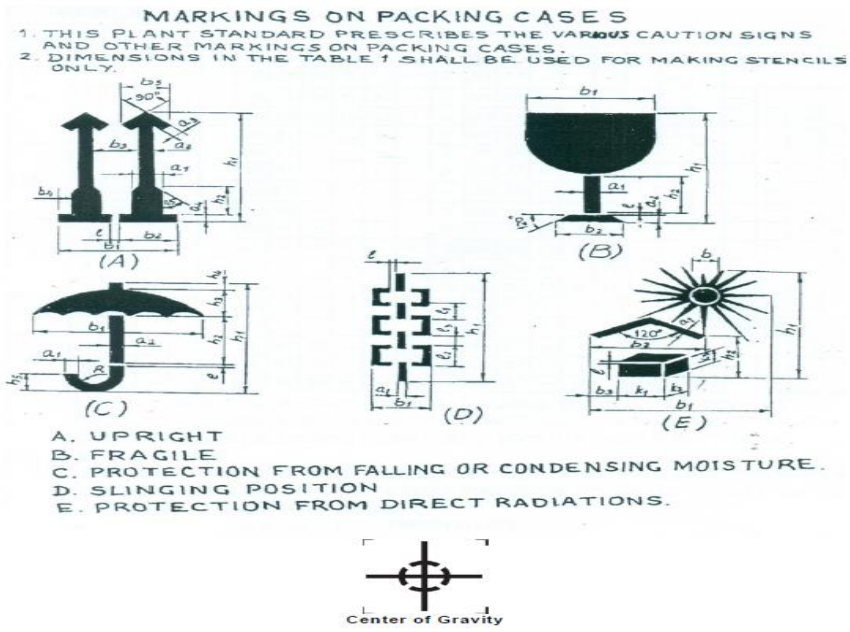


Figure 3

"HANDLE WITH CARE", "FRAGILE DO NOT TURN OVER".

Besides the caution signs the product information's shall be stencilled of letters with 13mm to 50mm height.
In case of consignment consists of more than one package, each package shall carry its package no as given in shipping list. All caution signs shall be stencilled in high quality full glossy out door finishing paint red in colour (AA56126). All other markings shall be carried out in black enamel.
Caution signs & other markings shall be stencilled on both the end shooks & the side shooks.
Caution sign (for slinging) shall be stencilled only on side shooks at the appropriate place.
Note: In case the size of package is small for using the stencils, then hand written letters/figures shall be allowed.

	BHEL – <unit> - <location> - <pin>			
CONSIGNEE				
MATERIAL				
CUSTOMER REF.		MO. NO.		
DESPATCH ADVICE NOTE NO		CASE NO		
DIMENSIONS(MM) L x B x H			NET WT –KGS	GROSS WT –KGS
SPECIAL INSTRUCTIONS	HANDLE WITH CARE - KEEP DRY DO NOT DROP - DO NOT TILT			

Figure 4 – TYPICAL MARKING PLATE (225 X 170)

Figure 5

* Easy spares [Initial and O&M] Traceability and Identification at units and as well as at sites:

9 STANDARD METHOD OF PACKING

Table 5 - Standard Method of Packing

DESCRIPTION	CASE	CRATE	BUNDLE	BARE (COVERED FROM MINIMUM 100 GSM TARPAULIN SUITABLY)	DRUM
FAB STRUCTURALS, GIRDER				O	
FAB STRUCTURALS, GIRDER				O	
SUPPORTING STRUCTURALS				O	
STRUCTURE SUB ASSEMBLY, CRAB, END CARRIAGE, END STOPPERS, ROPE DRUM				O	
RAIL				O	
STAIR CASES				O	
HANDRAILS/ PLATFORMS/ LADDERS/ CAGE				O	
FASTENERS, RAIL CLAMPS AND FIXING ACCESSORIES	O				
BEARING BLOCKS	O				
FANS	O				
GASKETS	O	O			
FLANGES	O	O			
PAINT TINS		O			
PAINT DRUMS					O
MOTORS, TRANSMFORMERS, VVVFD, LIMIT SWITCHES, ELECTRIC HOIST ASSEMBLY, RELAYS, FUSES, LIGHTING FIXTURES, PENDANT, ISOLATING SWITCH, RRC, TRANSMITTERS AND OTHER ELECTRICAL ACCESORIES	O				
SWITCH BOARDS, DISTRIBUTION BOARDS, STARTERS, JUNCTION BOXES, PANELS,		O			
INDICATORS, VIBRATOR SWITCHES	O				
CABLE TRAYS, CABLE RACKS, EARTHING MATERIAL,		O			
OPERATIONAL SPARES , MAINTENANCE TOOLS AND TACKLES	O				
ALL OTHER LOOSE ITEMS	O				

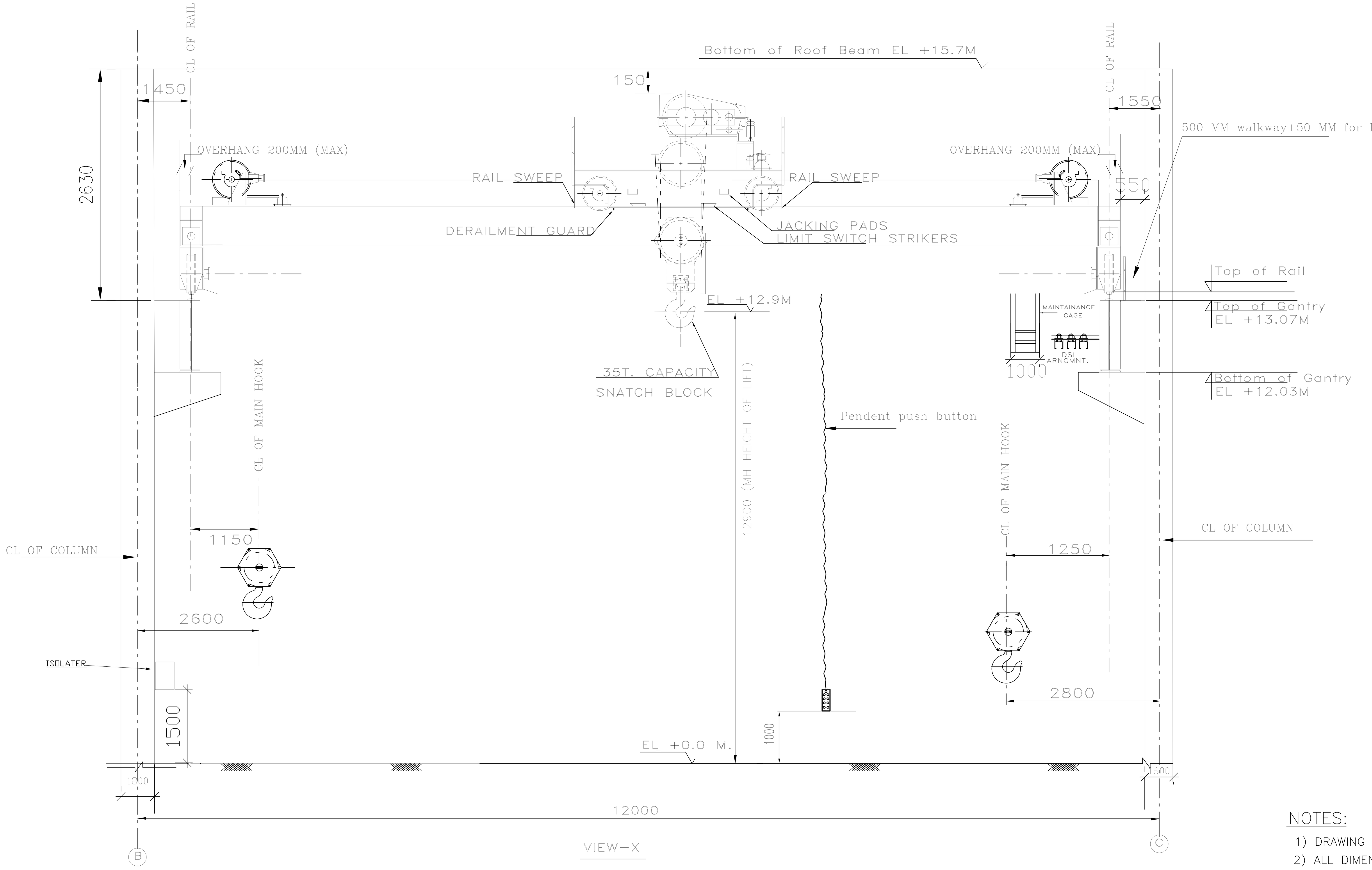
- Protective coating applied on machined surfaces should not be disturbed. The plastic covering should be put back carefully so that it prevents ingress of dust and moisture. Some packing may have vapour phase inhibitor (VPI) paper enclosed inside the packing cases. This should be restored to its original place as far as possible.

ANNEXURE VII

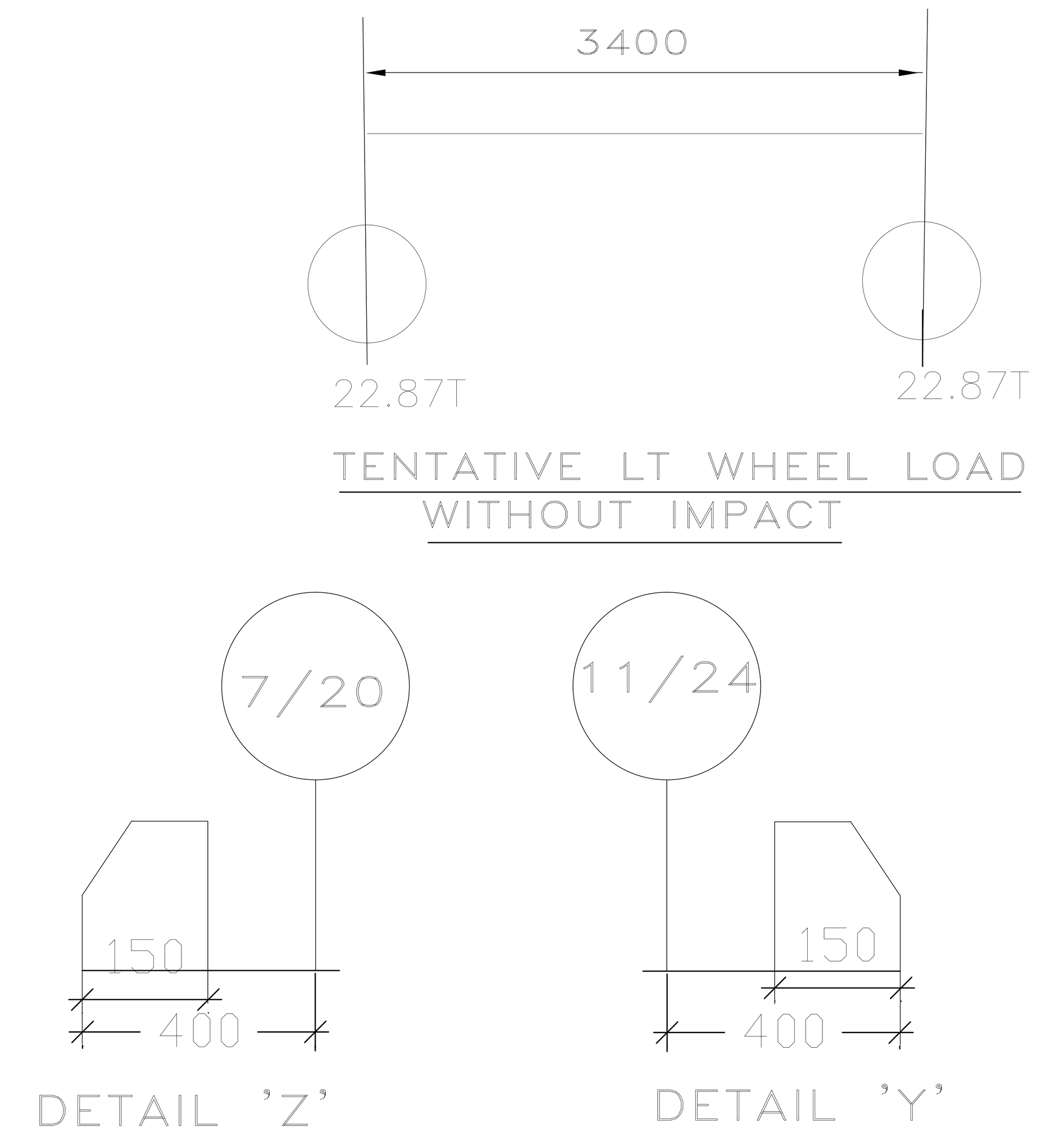
CRANE CLEARANCE DIAGRAM

फर्स्ट एंगल प्रोजेक्शन/FIRST ANGLE PROJECTION

सभी माप मि मी में है/ALL DIMENSIONS ARE IN MM

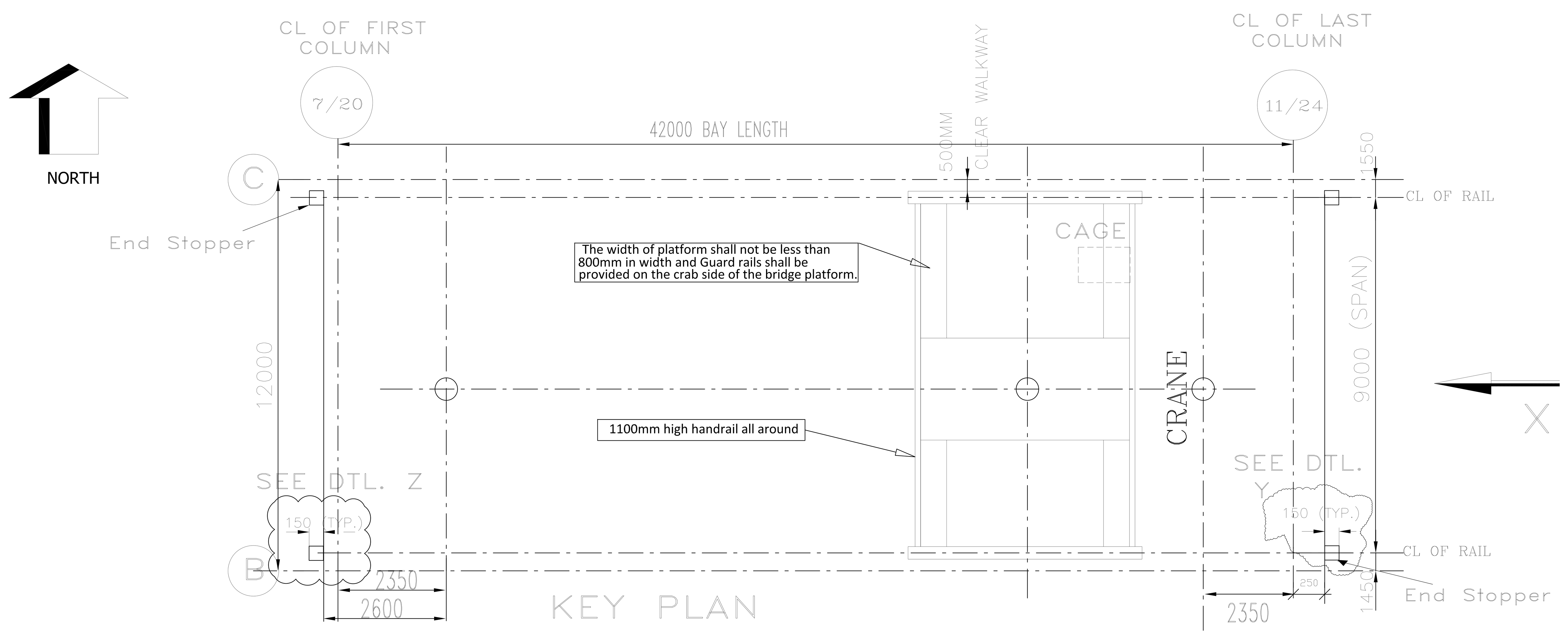


WEIGHT OF SINGLE HEAVIEST ASSEMBLED COMPONENT	25T (Refer drawing no. 4540-110-110-PVM-B-044 GENERAL ARRANGEMENT OF TDBFP SET)
CRANE CAPACITY AFTER 10% MARGIN AS PER CONTRACT REQUIREMENT ON HEAVIEST WEIGHT	27.5T
CRANE CAPACITY CONSIDERED	35T (ONE NO. FOR EACH UNIT)



NOTES:

1) DRAWING IS NOT TO THE SCALE.
2) ALL DIMENSIONS ARE IN MM & ELEVATIONS IN METRES.
3) EL 0.00 CORRESPONDS TO RL +71.500 (FINISHED FLOOR LEVEL IN TG BUILDING)
4) DESIGN CODE FOR EOT CRANE SHALL BE IS3177:2020.



REFERNCE DRAWINGS

1) 4540-001-110-PVM-F-053 (MAIN PLANT TG HALL CROSS SECTION)
2) 4540-001-110-PVM-F-050 (TG EQUIPMENT PLAN AT MEZENINE FLOOR)
3) 4540-110-110-PVM-B-044 (GENERAL ARRANGEMENT OF TDBFP SET)

THIS IS PART OF TECHNICAL SPECIFICATION PE-TS-497-501-A502 Rev 0

ग्राहक ड्राइंग संख्या / CUSTOMER DRAWING NO.: 4540-001-110-PVM-B-416

ग्राहक/CUSTOMER: एन टी पी सी लिमिटेड / N T P C LIMITED

कार्य संख्या / JOB NO.: 497

स्थिति / STATUS: CONTRACT

परियोजना / PROJECT: तालचर थर्मल पावर परियोजना चरण-III (2X660मेगावाट) ईपीसी पैकेज / TALCHER THERMAL POWER PROJECT STAGE-III (2X660MW)EPC PACKAGE

भारत हेवी इलेक्ट्रिकल्स लिमिटेड / BHARAT HEAVY ELECTRICALS LTD
पावर सेक्टर/POWER SECTOR
परियोजना अभियांत्रिकी प्रबंधन / PROJECT ENGINEERING MANAGEMENT
नोएडा (उ.प्र.)/NOIDA (U.P.)

DEPT CODE: M

REVISED AS PER COMMENTS

शीर्षक/TITLE: CRANE CLEARANCE DIAGRAM OF BFP HANDLING EOT CRANES

ड्राइंग संख्या / DRAWING NO.: PE-DG-497-501-A002

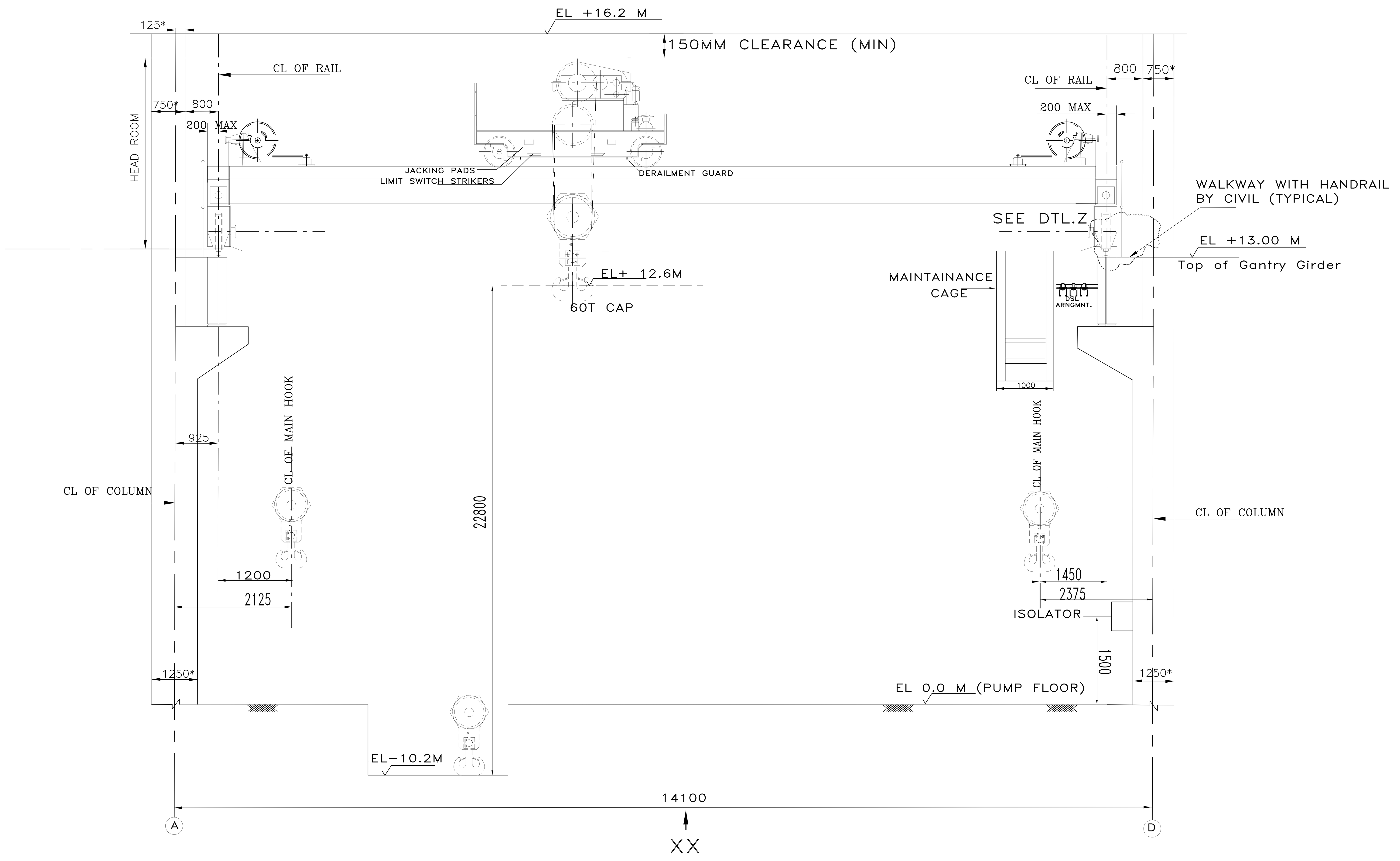
शीट / SHEET 1 OF 1 — पुनरीक्षण / REV. 0

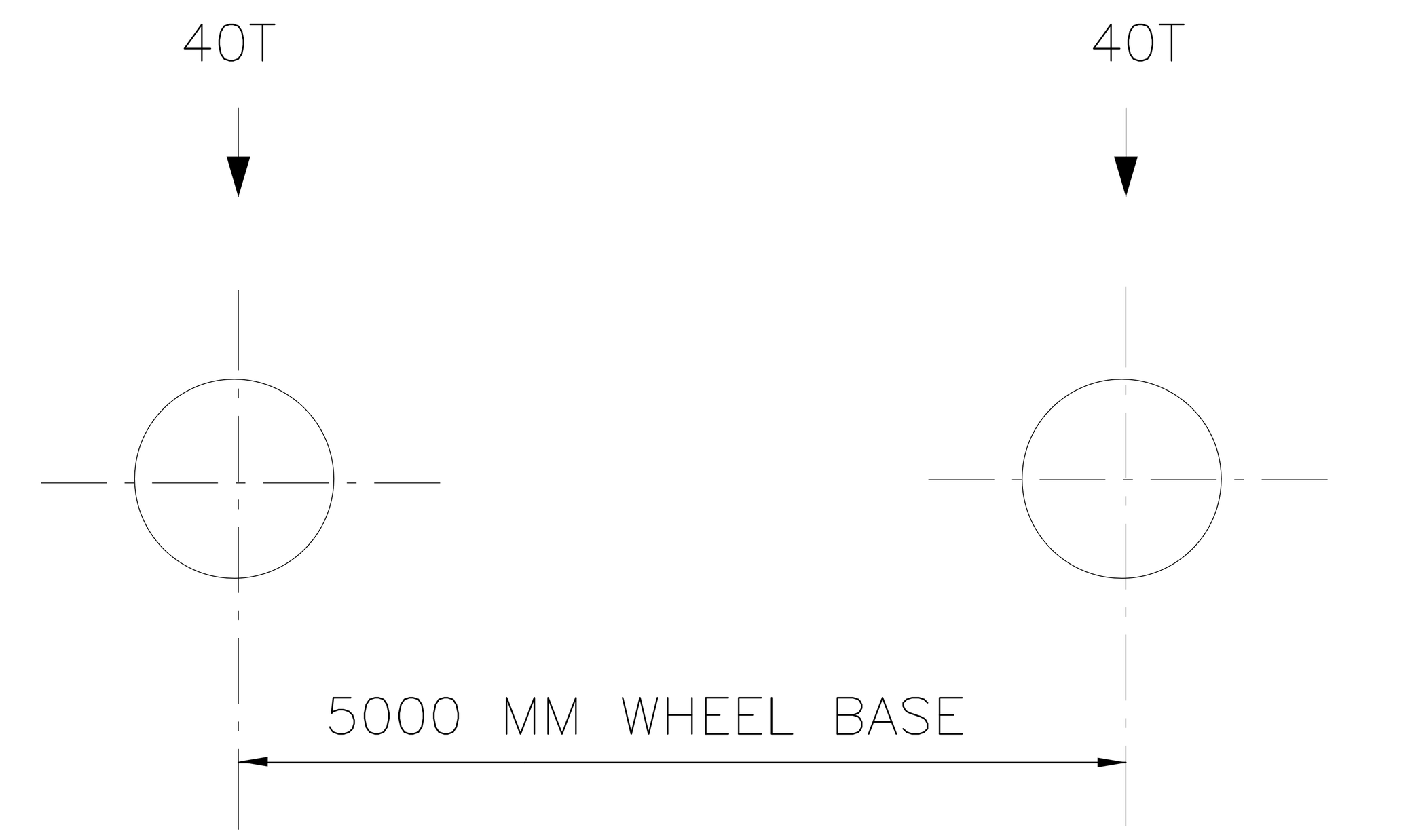
फार्मेट साइज़ A0 / FORMAT SIZE A0

फस्ट एंगल प्रोजेक्शन/FIRST ANGLE PROJECTION

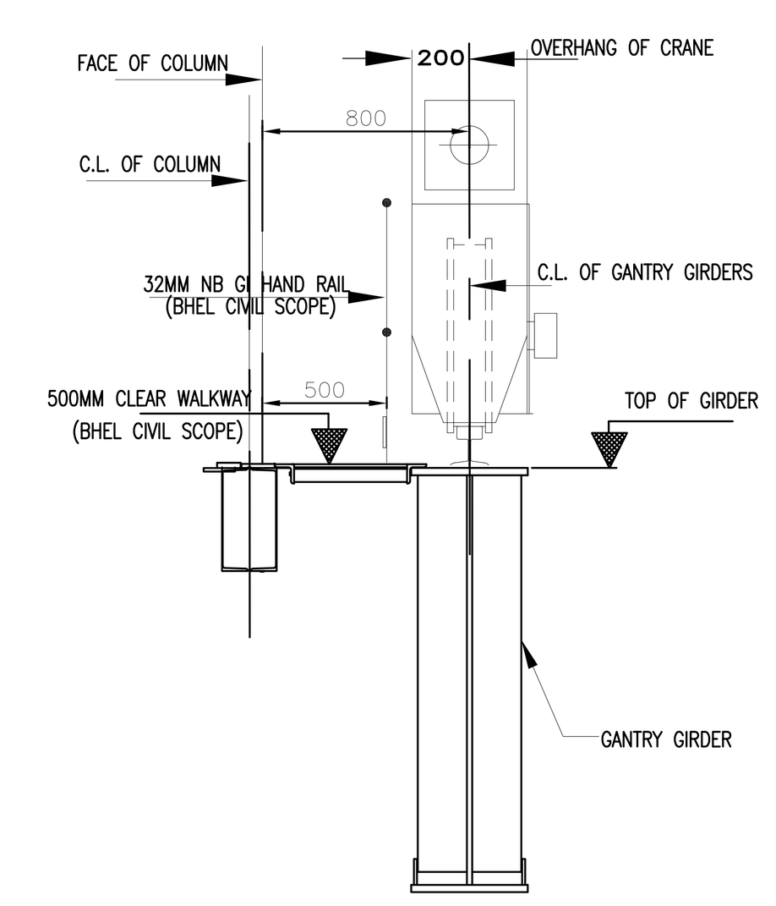
सभी माप मि॰ मी॰ में हैं/ALL DIMENSIONS ARE IN MM

ड्राइंग संख्या/DRAWING NO. PE-DG-497-501-A001





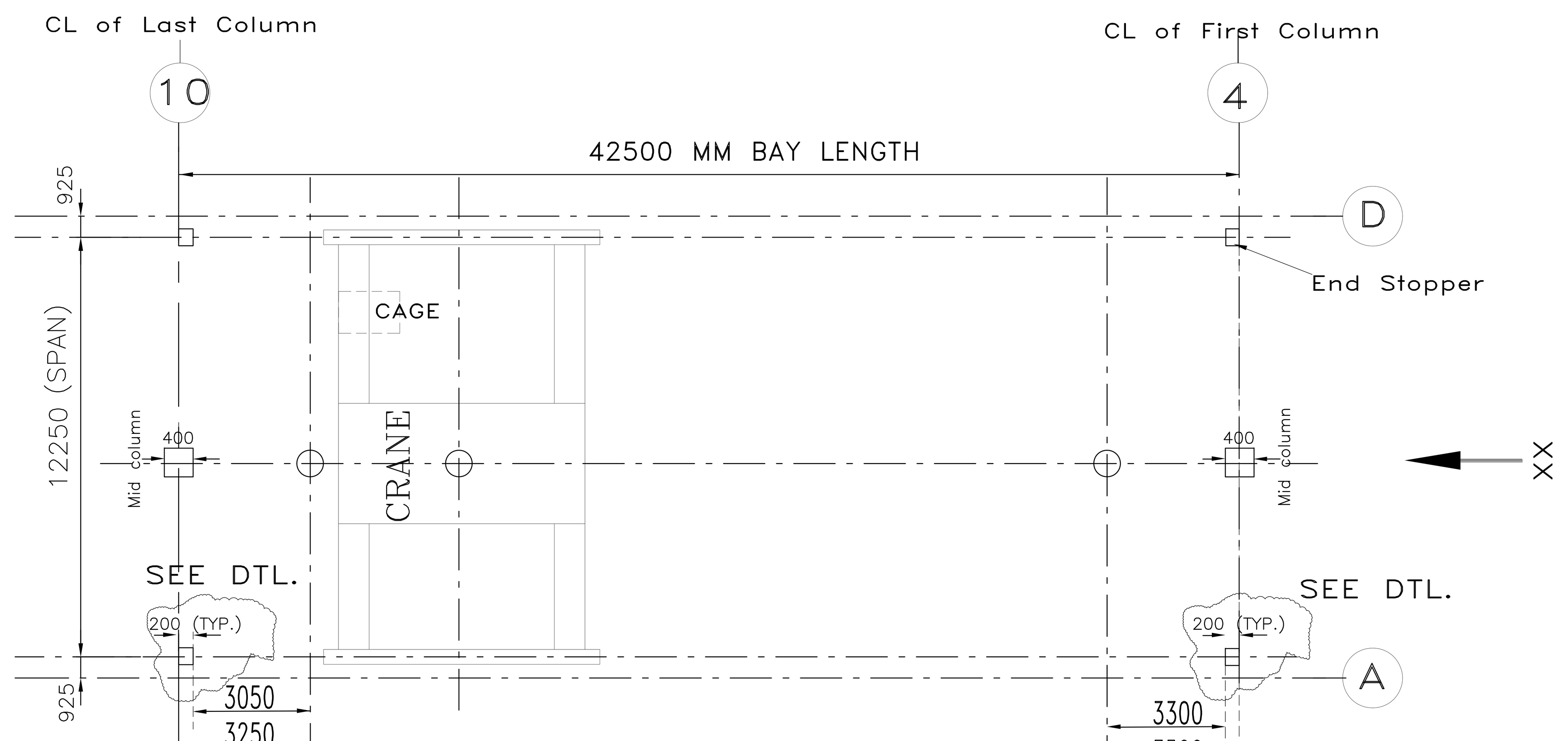
LONG TRAVEL WHEEL LOAD DIAGRAM (WITHOUT IMPACT)



DETAIL 'Z'

NOTE:

1) DRAWING IS NOT TO THE SCALE.
2) ALL DIMENSIONS ARE IN MM & ELEVATIONS IN METRES.
3) THE WEIGHTS AND DIMENSIONS INDICATED ARE PRELIMINARY AND SUBJECT TO CHANGE DURING DETAIL ENGINEERING AFTER AWARD OF CONTRACT TO BHEL'S SUB CONTRACTOR.
4) TOP OF RAIL IS SUBJECT TO CHANGE DURING DETAIL ENGINEERING.
5) (*) MARKED DIMENSIONS ARE TO BE CONFIRMED BY CIVIL.



KEY PLAN

DESIGN CRITERIA (CRANE)

HEAVIEST WEIGHT (CW PUMP MOTOR) TO BE LIFTED = 35 T
(Reference drg.4540-001-133-PVM-B-35)
CONSIDERING 25 % MARGIN = 8.75 T
TOTAL DESIGN LOAD = 44.75 T
MINIMUM CRANE CAPACITY AS PER TENDER = 60T
CRANE CAPACITY SELECTED = 60 T

REFERENCE DRAWING:-

1. MECHANICAL GA OF CW & ACW PUMP HOUSE: PE-DG-497-165-N004
2. GA & DATASHEET OF CW PUMP: 4540-001-133-PVM-B-035

ग्राहक/CUSTOMER: एन टी पी सी लिमिटेड / N T P C LIMITED

परियोजना / PROJECT: तालचेर थर्मल पावर परियोजना चरण-III (2X660मेगावाट) ई पी सी पैके... / TALCHER THERMAL POWER PROJECT STAGE-III (2X660MW)EPC PACK...

कार्य संख्या / JOB NO. 497
स्थिति / STATUS CONTRACT

भारत हेवी इलेक्ट्रिकल्स लिमिटेड / BHARAT HEAVY ELECTRICALS LTD
पावर सेक्टर/POWER SECTOR
परियोजना अभियांत्रिकी प्रबंधन / PROJECT ENGINEERING MANAGEMENT
नोएडा (उ॰प्र॰)/NOIDA (U.P.)

Rev 01 28.11.2022 RG WH PK — REVISED AS PER NTPC COMMENTS.

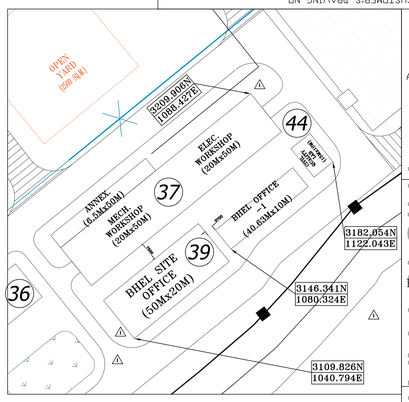
शीर्षक/TITLE: CRANE CLEARANCE DIAGRAM OF 60T CWPH EOT CR...

ड्राइंग संख्या / DRAWING NO. PE-DG-497-501-A0...
शीट / SHEET 1 OF 1 — संशोधन / REV. 0

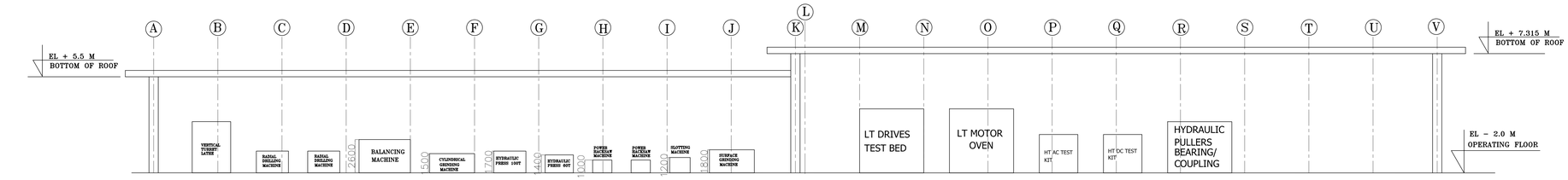
COMPUTER FILE NAME: WORKPAT1

THIS IS PART OF TECHNICAL SPECIFICATION PE-TS-497-501-A502 Rev 0

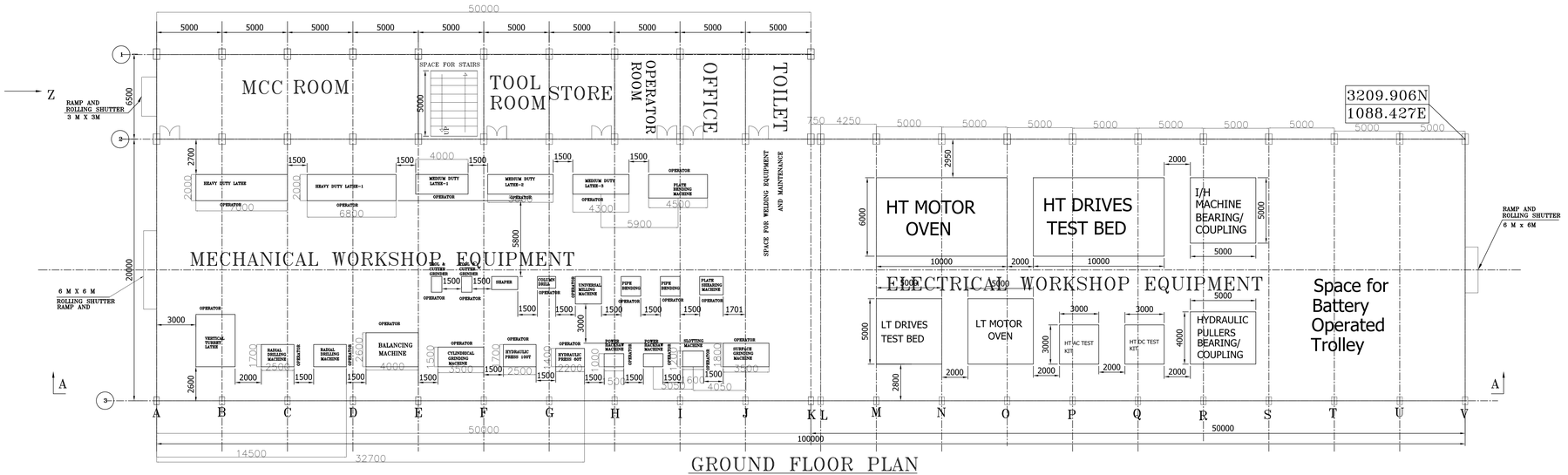
NORTH



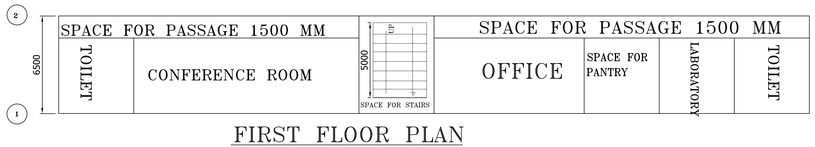
KEY PLAN



SECTION A–A



GROUND FLOOR PLAN

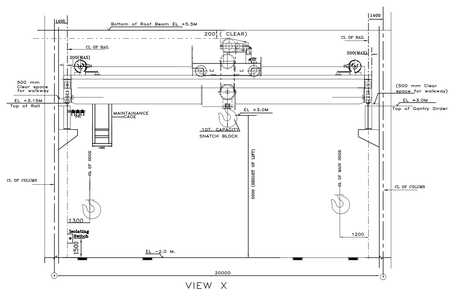


FIRST FLOOR PLAN

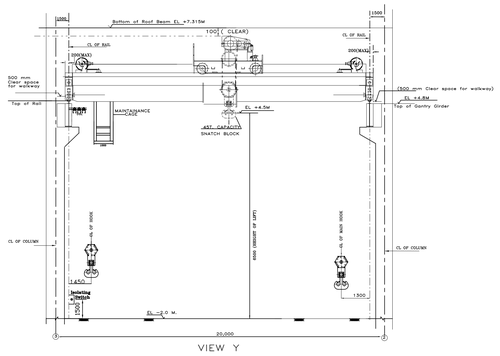
DIMENSION DETAIL OF MACHINE		
MACHINE	QUANTITY	SPACE REQUIRED (LXB IN MM)
VERTICAL TURRET LATHE	1 NO.	4000 x 3000
HEAVY DUTY LATHE	1 NO.	7000 X 2000
HEAVY DUTY LATHE–1	1 NO.	6800 X 2000
MEDIUM DUTY LATHE–1	1 NO.	4000 X 1500
MEDIUM DUTY LATHE–2	1 NO.	5000 X 1500
MEDIUM DUTY LATHE–3	1 NO.	4300 X 1500
UNIVERSAL MILLING MACHINE	1 NO.	2000 X 2100
SURFACE GRINDING MACHINE	1 NO.	3500 X 1800
CYLINDRICAL GRINDING M/C	1 NO.	3500 X 1500
SLOTTING MACHINE	1 NO.	1600 X 1200
RADIAL DRILL	2 NO.	2500 X 1700
COLUMN DRILL	1 NO.	1400 X 900
HYDRAULIC PRESS 60 T	1 NO.	2200 X 1400
PLATE BENDING MACHINE	1 NO.	4500 X 1800
PLATE SHEARING MACHINE	1 NO.	1800 X 1400
DYNAMIC BALANCING MACHINE	1 NO.	4000 X 2600
SHAPER	1 NO.	2000 X 1000
PIPE BENDING MACHINE	2 NO.	1500 X 1500
TOOL & CUTTER GRINDER	2 NOS.	800 X 1200
POWER HACKSAW	2 NOS.	1500 X 1000
HYDRAULIC PRESS 100 T	1 NO.	2500 X 1700

NOTE

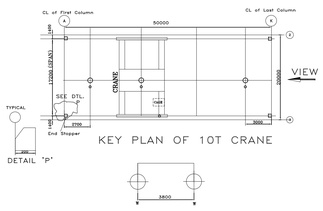
01. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
02. M/C s ARE TO BE PLACED ABOVE 200 mm F.F. LEVEL.
03. CABLING DETAILS SHALL BE SHOWN IN CIVIL / ELECTRICAL DRAWING.
04. CAPACITY OF CRANE FOR MECHNICAL WORKSHOP IS 10 TONNES. TRAVEL FROM A TO K
05. CAPACITY OF CRANE FOR ELECTRICAL WORKSHOP IS 45 TONNES. TRAVEL FROM K TO U
06. BATTERY OPERATED TROLLEY WILL BE KEPT IN ELECTRCIAL WORKSHOP.

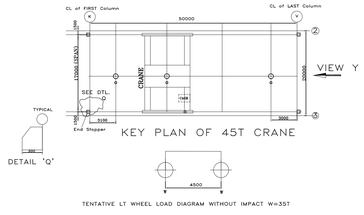


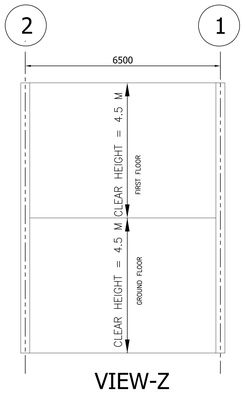
VIEW X



VIEW Y







VIEW-Z

WEIGHT OF SINGLE HEAVIEST ASSEMBLED COMPONENT	35T (HT motor of CW Pump)
CRANE CAPACITY AFTER 25% MARGIN AS PER CONTRACT REQUIREMENT ON HEAVIEST WEIGHT	43.75T
CRANE CAPACITY CONSIDERED	45T

CRANE CAPACITY SELECTION FOR ELECTRICAL WORKSHOP

WEIGHT OF SINGLE HEAVIEST ASSEMBLED COMPONENT	8T
CRANE CAPACITY AFTER 25% MARGIN AS PER CONTRACT REQUIREMENT ON HEAVIEST WEIGHT	10T
CRANE CAPACITY CONSIDERED	10T

CRANE CAPACITY SELECTION FOR MECHANICAL WORKSHOP

REV	DATE	ALTD	CHD	APPD	REV	DATE	ALTD	CHD	APPD	REV	DATE	ALTD	CHD	APPD	REV	DATE	ALTD	CHD	APPD

NTPC No.	9585-001-100-PVM-F-001
CUSTOMER	NTPC LIMITED
JOB NO. 497	TALCHER THERMAL POWER PLANT STAGE-III (2X660 MW)
STATUS CONTRACT	
DISTRIBUTION	
TO	
No.OFF	

BHARAT HEAVY ELECTRICALS LTD
POWER GROUP
PROJECTS ENGINEERING MANAGEMENT
NOIDA

DEPT CODE		NAME	SIGN	DATE
A	DRN	AKM	SD/	
	DESN	AKM	SD/	
	CHD	PKK	SD/	
	APPD	SKB	SD/	

TITLE: LAYOUT OF WORKSHOP BUILDING

DEPT. | SCALE: NTS | BHEL DRAWING NO. PE-DG-497-568-A001
SIGN
DATE
SHEET 1 OF 1 | REV. 00

SIZE-A1

ANNEXURE VIII

STANDARD QUALITY PLAN

		MANUFACTURER'S NAME & ADDRESS			STANDARD MANUFACTURING QUALITY PLAN				PROJECT: 2X660 MW TALCHER TPP					
									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
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.		Ultransonic	100%	ASTM A435	ASTM A435	T.C. / I.R.	√	P	V	V	U.T. ON ABOVE 20MM 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/ reviewd 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, Cl UW-51 & 52	RT Report	√	P	V	V	

		MANUFACTURER'S NAME & ADDRESS			**STANDARD MANUFACTURING QUALITY PLAN**				PROJECT: 2X660 MW TALCHER TPP					
									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
			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 TALCHER TPP					
									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
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 TALCHER TPP					
									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
	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/ W#	V	Refer Note:1. # UTS required for selection of PL value as indicated in Table 6 of IS 3177 shall be witnessed by BHEL.
	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 (abov	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													

		MANUFACTURER'S NAME & ADDRESS			STANDARD MANUFACTURING QUALITY PLAN				PROJECT: 2X660 MW TALCHER TPP					
									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
	i) Materials		Physical/Chemical/Hardness	Major	Corelation with mfr's TC	100%	Mfg. Drawing	Mfg. Drawing	Mfr's T.C.	√	P	V	V	
	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 integeral test bar	Major	Chemical, heat treatment & Tensile , % elongation	100%	IS:1875		Test Certifacte , 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		Diemnsion	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 TALCHER TPP					
									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
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 thikness, cable laying, dressing , ferulling Overall diemsnions , painting shade, Panel surface finish, Paint Thickness, adhesive test, Component fixing, Degree of protection by paper inserting	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 VVVFD Test Cerificate 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 & aceptance 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	
14	Assembly of cranes													

		MANUFACTURER'S NAME & ADDRESS			STANDARD MANUFACTURING QUALITY PLAN				PROJECT: 2X660 MW TALCHER TPP					
									PACKAGE : DOUBLE GIRDER CRANES					
					ITEM:		QP NO :		CONTRACT NO :					
							REV : 0		CONTRACTOR :					
							DATE :		VENDOR' S QAP No :					
SL. NO.	COMPONENTS & OPERATION		CHARACTERISTCS	CLASS	TYPE PF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORDS		AGENCY M	AGENCY C	AGENCY N	REMARKS
1	4		3	4	5	6	7	8	9	D* **		10		11
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 VVVFD	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 equvalent 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 TALCHER TPP					
									PACKAGE : DOUBLE GIRDER CRANES					
					ITEM:		QP NO :		CONTRACT NO :					
							REV : 0		CONTRACTOR :					
							DATE :		VENDOR' S QAP No :					
SL. NO.	COMPONENTS & OPERATION		CHARACTERISTCS	CLASS	TYPE PF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORDS	D*	M **	C	N	REMARKS
1	4		3	4	5	6	7	8	9			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 yearsfrom 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 INDETIFIED WITH 'TICK'(√) 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			**STANDARD MANUFACTURING QUALITY PLAN**				PROJECT: 2X660 MW TALCHER TPP					
									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					

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS
8.03.05	**e-Learning Package:** e-learning packages shall be supplied for the equipment / system for the following Steam Turbine Generator & auxiliaries and Steam Generator & auxiliaries along with associated electrical and C&I system.
8.03.05.01	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, Centralized 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 etc. 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~~	~~**Steam Generator & Auxiliaries**~~ ~~Furnace/evaporator, separator & drain collection vessel, superheater, reheater, economiser, startup recirculation & drain system, desuperheating spray system, safety valves, soot blowing system, draft plant including FD & ID fans, PA fan, air preheaters, SCAPH, coal preparation and firing system including raw coal feeder and pulverisers, coal burners, fuel oil system and oil burners, Electrostatic precipitator, NOx control system and Flue gas desulphurisation system, Aux. PRDS system.~~
8.03.05.03	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 pre-commissioning, 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.

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.

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS

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.

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/360^0 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.

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS
	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.
~~**8.04.00**~~	~~**Provision for Fail Safe operation of vital Equipments**~~ ~~All the Plant and equipments / Systems supplied under the contract shall be designed following "Fail Safe" concept. In case of failure of Power supply like Electric power, Hydraulic pressure, Pneumatic pressure, Vacuum etc. the system should be designed in such a way that the equipment/Valves/dampers etc. shall always move/remains (as applicable) to safest position as per system requirement to ensure safety of Man and Machinery.~~
~~**8.05.00**~~	~~**Engineering Co-ordination Procedure**~~
~~8.05.01~~	~~The following principal coordinators will be identified by respective organizations at time of award of contract:~~ ~~NTPC Engineering Coordinator (NTPC EC):~~ ~~Name :~~ ~~Designation :~~ ~~Address :~~ ~~a) Postal :~~ ~~b) Telegraphic / e-Mail :~~ ~~c) FAX : TELEPHONE :~~ ~~Contractor's/ Vendor's Engineering Coordinator (VENDOR EC):~~ ~~Name :~~ ~~Designation :~~

SUB-SECTION IB
SPECIFIC TECHNICAL REQUIREMENT (ELECTRICAL)

BHEL	TECHNICAL SPECIFICATION FOR DG EOT CRANE UPTO 100T (ELECTRICAL PORTION)	SPECIFICATION NO. PE-TS-XXX-XXX-A001 VOLUME II B REV 0 DATE 23.08.2023 PAGE 1 OF 1

SPECIFIC TECHNICAL REQUIREMENTS: ELECTRICAL

1.0 **EQUIPMENT & SERVICES TO BE PROVIDED BY BIDDER/ PURCHASER**

1.1 Scope for supply, and erection & commissioning of various equipment forming part of electrical system for this package shall be as per Annexure–I [Scope of Work (Electrical)].

1.2 Bidder shall furnish all AC as well as DC loads required for the system at different voltage levels (eg. 415V AC, 240 V AC, 220 V DC etc.) of all types, such as motor feeders, supply feeders in PEM format along with the offer.

2.0 **DOCUMENTS TO BE SUBMITTED ALONG WITH BID**

2.1 Bidder shall confirm total compliance to the electrical specification without any deviation from the technical/ quality assurance requirements stipulated.

2.2 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.

3.0 **LIST OF ENCLOSURES**

3.1 Electrical scope between BHEL & vendor (Annexure-I).
3.2 Technical specification - Motors
3.3 Datasheets –
3.4 Quality Plan for motors.
3.5 Load data format (Annexure-II).
3.6 Explanatory note for Cable routing & Cable schedule format.

REV: 00 DATE: 23.08.2023

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

PACKAGE: DOUBLE GRIDER EOT CRANE UPTO 100T

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

PROJECT : **2 X 660 MW TALCHER TPP STAGE-III (EPC)**

S. NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
1	Isolating Switch	Vendor	Vendor	BHEL will provide one number 415 V (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.

TECHNICAL DATASHEET

S.No.	Parameters	Requirement
1	Applicable Standards	1) Three phase induction motors : IS:325, IEC:60034, IS:12615, IS: 15999 2) Single phase AC motors : IS:996, IEC:60034 3) Energy Efficient motors : IS 12615, IEC:60034-30
2	Rated voltage	415V, 3 Phase
3	Frequency (Hz)	50Hz
4	Permissible variations for	
	a) Voltage	+/-10%
	b) Frequency	+3% & -5%
	c) Combined	10% (Sum of absolute values)
	System fault level at rated voltage	50KA for 1 sec
	Short time rating for terminal boxes	50KA for .25 sec
5	Type of motors	Continuous duty squirrel cage induction motor suitable for direct-on-line starting
6	Efficiency class	IE3 Class confirming to IS 12615 or IEC:60034-30
7	Design margin over continous max. demand of the driven equipment (min)	10%
8	Starting requirement	
	a) Minimum permissible voltage as a percentage of rated voltage, at start to bring the driven equipment upto the driven equipment upto rated speed	(a) Below 110KW : Up to 85% of rated voltage (b) From 110 KW & upto 200 KW : Up to 80% of rated voltage
	b) Maxmum locked rotor current	as per IS 12615
	c) Starting duty	Two hot starts in succession, with motor initially at normal running temperature.
	d) the locked rotor withstand time under hot condition at highest voltage limit	a) atleast 2.5 secs. more than starting time(for motors with starting time upto 20 secs. at minimum permissible voltage during starting b)atleast 5 secs. more than starting time(for motors with starting time more than 20 secs. and upto 45 secs. at minimum permissible voltage during starting c) more than starting time by at least 10% of the starting time(For motors with starting time more than 45 secs.at minimum permissible voltage during starting d) Speed switches mounted on the motor shaft shall be provided in cases where above requirements are not met.
	e)The ratio of locked rotor KVA at rated voltage to rated KW	(a) Below 110KW : 11.0 (b) From 110 KW & upto 200 KW : 9.0
9	Torque (percent of full load torque)	1] Accelerating torque at any speed with the lowest permissible starting voltage shall be at least 10% motor full load torque. 2]Pull out torque at rated voltage shall not be less than 205% of full load torque. It shall be 275% for crane duty motors.
10	Noise level (max.)	85dB(A)
11	Vibration shall be limited within the limits	as per IS:12075 / IEC 60034-14
12	Construction Features	
(i)	Enclosure Details	
	a) Degree of protection	i) Indoor motors - IP 55 ii) Outdoor motors - IP 55 (Additional Canopy to be provided)
	b) Method of ventilation	Totally enclosed fan cooled (TEFC) or totally enclosed tube or ventilated (TETV) or Closed air circuit air cooled (CACA) type.
(ii)	Insulation	Class F temperature rise limited to class -B
(iii)	Bearings	Grease lubricated ball or roller bearings for Horizontal motors Grease lubricated ball or roller bearings or combined trust and guide beaing for Vertical motors
(iv)	Winding Type	Electrolytic grade Copper conductor, Non hygroscopic, oil resistant, flame resistant Insulation.
13	Main terminal box	
(i)	Type	-Motor terminal box shall be detachable type and located in accordance with Indian Standards clearing the motor base- plate/ foundation. -Terminals shall be stud or lead wire type, substantially constructed and thoroughly insulated from the frame. - The terminals shall be clearly identified by phase markings, with corresponding direction of rotation marked on the non-driving end of the motor.
(ii)	DOP	same as motor
(iii)	Position when veiwed from the non driving end	- Left hand side
(iv)	Rotation	90 Deg.
(v)	Space heater	Motors rated 30KW and above sapce heater required.Separate terminal box for space heaters & RTDs shall be provided.

(vi)	Cable glands and lugs	-Motor terminal box shall be furnished with suitable cable lugs and double compression brass glands to match with cable used. Cable glands shall conform to BS:6121. 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 lugs/ferrules shall be solderless crimping type suitable for power and control cables as per the DIN 46239. Aluminium solderless crimping lugs/ ferrules shall be used for Aluminium cables and Copper lugs/ferrules shall be used for Copper cables. Bimetallic washers or bimetallic type lugs shall be used for bimetallic connections.
(vii)	DIMENSIONS OF TERMINAL BOXES FOR LV MOTORS:	
	Motor MCR in KW	**Minimum distance between centre of stud and gland plate in mm**
	a) UP to 3 KW	As per manufacturer's practice.
	b) Above 3 KW - upto 7 KW	85
	c) Above 7 KW - upto 13 KW	115
	d) Above 13 KW - upto 24 KW	167
	e) Above 24 KW - upto 37 KW	196
	f) Above 37 KW - upto 55 KW	249
	g) Above 55 KW - upto 90 KW	277
	h) Above 90 KW - upto 125 KW	331
	i) Above 125 KW-upto 200 KW	203
	j) For HT motors the distance between gland plate and the terminal studs shall not be less than 500 mm.	
(viii)	**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:	
	Motor MCR in KW	**Clearance**
	a) UP to 110 KW	10mm
	b) Above 110 KW and upto 150 KW	12.5mm
	c) Above 150 KW	19mm
14	Earthing points (2 nos. on diagonally opposite sides) suitable for connection	GS Flat- 50 x 6 OR 25 X 6 OR 25 X 3
15	Paint shade	RAL 5012 (Blue)/Light grey finish No. 631 as per IS: 5 (subject to customer approval)
16	**LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED**	
	a) 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.	
	7. High voltage test	
	8. Test for vibration severity of motor.	
	9. Test for noise levels of motor(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.)	
	10. Test for degree of protection and	
	11. Overspeed test.	
	12. Type test reports for motors located in fuel oil area having flame proof enclosures as per IS 2148 / IEC 60079-1	
	13. The type test listed above should have been conducted within 10 yrs from 06.06.2022. In absence of type tests reports or in case reports are not found to be meeting the specification/standards requirements, vendor shall conduct all such type tests without any commercial/delivery implication to BHEL according to the relevant standards and reports shall be submitted to the owner for approval.	
	14. For Motor rating upto 50KW, BHEL QP No.PE-QP-999-Q-006, REV -02 is to be followed	
	b) 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.	
	c) 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.	

DATA TO BE FURNISHED BY SUCCESSFUL BIDDER AFTER ORDERING

1. GENERAL		
i)	Manufacturer & Country of origin.	
ii)	Equipment driven by motor)	
iii)	Motor type	
iv)	Country of origin	
v)	Quantity	
2. DESIGN AND PERFORMANCE DATA		
i)	Frame size	
ii)	Type of duty	
iii)	Type of enclosure and method of cooling	
vi)	Type of mounting	
vii)	Direction of rotation as viewed from DE END	
viii)	Standard continuous rating at 40 deg.C. ambient temp. as per Indian Standard (KW)	
ix)	(A) Derated rating for specified normal condition i.e. 50 deg. C ambient temperature (KW)	
	(B) Rating as specified in load list/Maximum continuous load demand of driven equipment	
xi)	Rated speed at rated voltage and frequency	
xii)	At rated Voltage and frequency	
	a) Full load current (Amps)	
	b) No load current (Amps)	
xiii)	Power Factor at	
	a) 100% load	
	b) At duty point	
	c) 75% load	
	d) 50% load	
	e) NO load	
	f) Starting.	
xiv)	Efficiency at rated voltage and frequrecy	
	a) 100% load	
	b) At duty point	
	c) 75% load	
	d) 50% load	
xv)	Starting current (amps) at	
	a. 100 % voltage	
	b. 85% voltage	
	c. 80% voltage	
xvi)	Starting time with minimum permissible voltage	
	a. Without driven equipment coupled	
	b. With driven equipment coupled	
xvii)	Safe stall time with 110% of rated voltage	
	a. From hot condition	
	b. From cold condition	
xviii)	**Torques :**	
	a. Starting torque at min. permissible voltage(kg-mtr.)	
	b. Pull up torque at rated voltage.	
	c. Pull out torque	
	d. Min accelerating torque (kg.m) available	
	e. Rated torque (kg.m)	
xix)	Stator winding resistance per phase (ohms at 20 Deg.C.)	
xx)	GD^2 value of motors	
xxi)	Locked rotor KVA input (at rated voltage)	
xxii)	Locked rotor KVA/KW.	
xxiii)	**Bearings**	
	a. Type	
	b. Manufacturer	
	c. Self Lubricated or forced Lubricated	
	d. Recommended Lubricants	
	e. Guaranteed Life in Hours	
	f. Whether Dial Type thermometer provided	
	g. Oil pressure Gauge/switch	
	i. Range	
	ii. Contact Nos. & ratings	
	iii. Accuracy	
xxiv)	**Vibration**	
	a) Velocity (mm/s)	
	b) Displacement (microns)	
xxv)	Noise level (DB)	
3. CONSTRUCTIONAL FEATURES		

i)	Stator winding insulation	
	a. Class & Type	
	b. Tropicalised (Yes/No)	
	c. Temperature rise over specified max.	
	i. Cold water temperature of 38 DEG. C.	
	ii. Ambient Air 50 DEG. C.	
	d. Method of temperature measurement	
	e. Stator winding connection	
	f. Number of terminals brought out	
ii)	Type of terminal box for	
	a. stator leads	
	b. space heater	
	c. Temperature detectors	
	d. Instrument switch etc.	
iii)	For main terminal box	
	a. Location	
	b. Entry of cables	
	c. Recommended cable size	
	d. Fault level (MVA)	
	e. No. of Eathing Pads	
iv)	Temperature detector for stator winding	
	a Type	
	b. Nos. provided	
	c . Location	
	d. Make	
	e. Resistance value at 0 deg. C. (ohms)	
vi)	Paint shade	
vii)	Weight of(approx)	
	a. Motor stator (KG)	
	b. Motor Rotor (KG)	
	c. Total weight (KG)	
4. LIST OF CURVES		
i)	Torque speed characteristic of the motor	
ii)	Thermal withstand characteristic	
iii)	Starting. current Vs. Time	
iv)	Starting. current Vs speed	
v)	P.F. and Effi. Vs Load	

NOTE :

1. THESE DETAILS ARE IN ADDITION TO THE DETAILS MENTIONED IN SHEET- I & 2 OF DATASHEET. SHEET - 3 & 4 SHOULD BE READ IN CONJUCTION TO SHEET - I & 2
2. DURING CONTRACT STAGE : SUCCESSFUL BIDDER TO STAMP & SIGN SHEET - I & 2 OF DATASHEET, AND APPEND DULY FILLED UP STAMPED & SIGNED SHEET -3 & 4 OF DATASHEET FOR BHEL/CUSTOMER'S APPROVAL.

CLAUSE NO.	TECHNICAL REQUIREMENTS

HT & LT POWER CABLES & control cables

~~This chapter has to be read in conjunction with sub-section B-0 "General electrical specification" of Technical specification Section- VI, Part-B and Sub-Section-IIB Electrical system/Equipment of Technical Specifications Section-VI, Part-A".~~

1.00.00 CODES AND STANDARDS

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:7098 (Part -II)	Specification for Cross linked polyethylene insulated PVC sheathed cables. Part-II: For working voltages from 3.3 KV upto and including 33 KV.
IS : 3975	Low Carbon Galvanized steel wires, formed wires and tapes for armouring of cables.
IS :4905	Methods for random sampling.
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.
IS :1554 - I	PVC insulated (heavy duty) electric cables for working voltages upto and including 1100V.
IS : 3961	Recommended current ratings for cables
IEC- 332	Tests on electric cables under fire conditions. Part-3: Tests on bunched wires or cables (Category-B).
IS:7098 (Part -I)	Cross linked polyethylene insulated PVC sheathed cables for working voltages upto and including 1100V.

2.00.00 TECHNICAL REQUIREMENTS

2.01.00 All cables (HT Power, LT power and control cables) shall be armoured type only irrespective of anything contrary mentioned elsewhere in the specification. All cables including EPR cables

CLAUSE NO.	TECHNICAL REQUIREMENTS

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.

2.02.00 Aluminium conductor used in power cables shall have tensile strength of more than 100 N/ sq.mm. Conductors shall be multi stranded.

2.03.00 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.

2.04.00 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.

2.05.00 For single core armoured cables, armouring shall be of aluminium wires. For multicore armoured cables armouring shall be of galvanised steel as follows : -

	Calculated nominal dia of cable under armour	**Size and Type of armour**
i)	Upto 13 mm	1.4mm dia GS wire
ii)	Above 13 & upto 25mm	0.8 mm thick GS formed wire / 1.6 mm dia GS wire
iii)	Above 25 & upto 40 mm	0.8mm thick GS formed wire / 2.0mm dia GS wire
iv)	Above 40 & upto 55mm	1.4 mm thick GS formed wire/2.5mm dia GS wire
v)	Above 55 & upto 70mm	1.4 mm thick GS formed wire/3.15mm dia GS wire
vi)	Above 70mm	1.4 mm thick GS formed wire / 4.0 mm dia GS wire

2.05.01 The aluminium used for armouring shall be of H4 grade as per IS: 8130 with maximum resistivity of 0.028264 ohm-sq.mm/mtr at 20 deg.C. The types and sizes of aluminium armouring shall be same as mentioned for galvanised steel at 2.05.00 above.

2.05.02 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 of G.S.wire/ formed wire.

2.06.00 Distinct extruded PVC inner sheath of black colour as per IS:5831 shall be provided for the cables as follows:

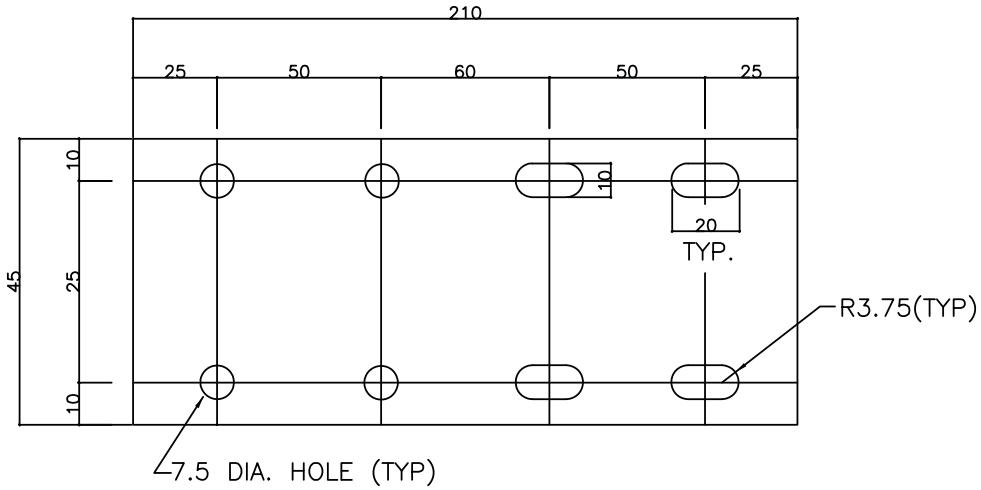
a). For all multicore cables.

b). For single core armoured cables, where armouring is not being used as metallic screen.

CLAUSE NO.	TECHNICAL REQUIREMENTS
2.07.00	Outer sheath shall be of PVC black 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 (Test method as per IS 10810 Part-58) (b.) Acid gas emission of max. 20% as per IEC-754 (Part-I) (c.) Smoke density rating shall not be more than 60% during Smoke Density Test as per ASTMD-2843.
2.08.00	Allowable tolerances on the overall diameter of the cables shall be +\-2 mm maximum over the declared value in the technical data sheets.
2.09.00	Cable lengths shall be considered in such a way that straight through cable joints is avoided.
2.10.00	All Cables shall be armoured type only.
2.11.00	All LT power cables of sizes more than 120 sq.mm. shall be XLPE insulated and **sizes shall be of 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. For LT cables, Same cable sizes to be used for same type & rating of motor i.e if there are three pumps for one application, all three pumps motor should be provided with same cables sizes
2.12.00	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
2.13.00	For reduced neutral conductors, the core shall be black.2.14.00 In plant repairs to the cables shall not be accepted. Pimples, fish eye, blow holes etc. are not acceptable.
2.15.00	The cross-sectional area of the metallic screen strip/tape/wires shall be considered in sizing calculations.
2.16.00	The eccentricity of the core shall not exceed 10% and ovality not to exceed 2%.
3.00.00	**CABLE SELECTION & SIZING**
3.00.01	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
3.00.02	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

CLAUSE NO.	TECHNICAL REQUIREMENTS
	c) Variation in ground temperature and soil resistivity for buried cables. The bidder shall furnish detailed cable selection/sizing criteria for Employer's approval.
4.00.00	**CONSTRUCTIONAL FEATURES**
4.00.01	~~**19/33, 11/11 KV Grade Power Cables:**~~ ~~Cables shall conform to IS 7098 Part-II. These cables shall be multi-stranded, compacted circular aluminium conductor, XLPE-insulated, metallic screened PVC outer sheathed. The conductor screen and insulation screen shall both be of extruded semiconducting compound and shall be applied along with the XLPE insulation in a single operation of triple extrusion process so as to obtain continuously smooth interfaces. Method of curing for 33/33 KV Cables shall be "dry curing / gas curing ". The metallic screen for each core shall be capable of carrying the system earth fault current and shall consist of copper wires or tape with minimum overlap of 20%. However, for single core armoured cables, the armouring shall constitute the metallic part of the screening.~~
~~4.00.02~~	~~**3.3/3.3kV Grade Power Cables:**~~ ~~Cables shall conform to IS: 7098 Part - II. These cables shall be multi- stranded, compacted circular aluminium conductor, XLPE insulated, metallic screened, PVC outer sheathed. The metallic screen of each core shall consist of copper wires or tape with minimum overlap of 20%. However, for single core armoured cables, the armouring shall constitute the metallic part of the screening. The metallic screen of each core shall be capable of carrying the system earth fault current Method of curing for cables shall be "dry curing / gas curing / steam curing".~~
~~4.00.03~~	~~Trailing cables shall have tinned copper (class 5) conductor, insulated with heat resistant elastomeric compound based on Ethylene Propyline 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~~
4.00.03	**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 (compacted 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 Propyline 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.
~~**4.00.04**~~	~~**CABLE DRUMS**~~
~~4.00.04.01~~	~~Cables shall be supplied in steel drums of heavy construction. The drum shall be designed on the basis of weight, diameter, bending radius and length of cable. The surface of the drum and the outer most cable layer shall be covered with water proof cover. Both the ends of the~~

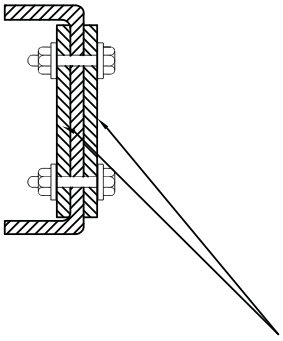
1648456/2023/PS-PEM-MAX



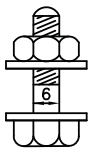
SIDE COUPLER PLATE FOR PERFORATED TYPE TRAYS

(100/50W TRAYS)

QTY. REQUIRED/TRAY SECTION : 4 NOS.

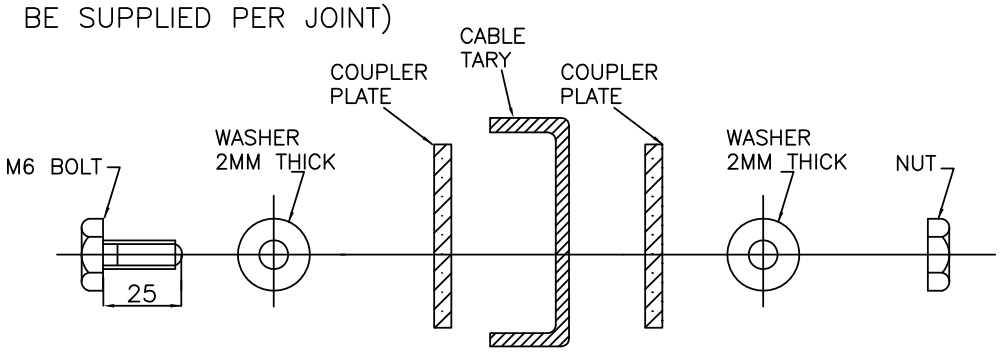


(2 NOS. COUPLER PLATES OF 3 MM THICKNESS TO BE SUPPLIED PER JOINT)



QTY. REQD/TRAY SECTION

A) 16 NOS. M6 BOLTS
B) 16 NOS. NUTS
C) 32 NOS. WASHERS



SEQUENCE OF M6 BOLT, WASHER, NUT, COUPLER PLATE & CABLE TRAY

FOR TYPICAL CABLE TRAY JOINT

FOR GENERAL NOTES REFER SHEET 14 OF 14

TYPICAL DETAILS OF CABLE TRAYS AND ACCESSORIES	NTPC DOCUMENT NO: 4540-001-215-PVE-B-045
	BHEL DWG. NO. PE-DG-497-507-E041
	SHT. 04 OF 14 REV.01

1648456/2023/PS-PEM-MAX

NOTES:–

1. THE CABLE TRAYS AND ACCESSORIES SHALL BE MADE OF 2mm HOT ROLLED M.S.SHEET CONFIRMING TO IS:1079. ALL THE COUPLER PLATE SHALL BE OF 3 MM THICK.
2. THE CABLE TRAYS AND ACCESSORIES SHALL BE HOT DIP GALVANISED AS PER IS 2629. THE MASS OF ZINC COATING SHALL BE 610 gm/sqm FOR 2MM THICK PRODUCT AND 460 gm/sqm FOR 1.7 MM THICK PRODUCT. THICKNESS SHALL BE 75 MICRONS (MINIMUM), 86 MICRONS (AVERAGE) FOR 2.0 MM THICK PRODUCT AND 55 MICRONS (MINIMUM), 65 MICRONS (AVERAGE) FOR 1.7 MM THICK PRODUCT .
3. FOR LADDER TYPE CABLE TRAYS AND ACCESSORIES, ALL RUNGS SHALL BE SLOTTED.
4. PERFORATED TRAYS SHALL BE FABRICATED OUT OF A SINGLE M.S. SHEET.
5. THE DIMENSIONS OF ALL BENDS, TEES, CROSSES, ETC. FOR PERFORATED CABLE TRAYS SHALL BE THE SAME AS FOR LADDER TYPE TRAY FITTINGS.
6. SIDE CHANNELS OF PERFORATED TRAY ACCESSORIES SHALL BE WELDED WITH THE PERFORATED SHEET AT INTERVALS OF 100mm.
7. LENGTH OF WELDING SHALL NOT BE LESS THAN 25mm. WELDING SHALL BE AS PER IS 9595.
8. PREFERABALY SINGLE MS PERFORATED SHEET SHALL BE USED AS BASE OF ALL PERFORATED TYPE TRAY ACCESSORIES. HOWEVER, IF USE OF PIECES OF PERFORATED SHEET IS UNAVIODABLE FOR BASE, PIECES SHALL BE WELDED WITH EACH OTHER IN LINE WITH THE ABOVE.
9. ALL TRAY CORNERS SHALL BE FREE OF SHARP EDGES & SMOOTH.
10. THE DEPTH, WIDTH AND LENGTH OF TRAYS AND ACCESSORIES SHALL BE WITHIN A TOLERANCE AS PER RELEVANT IS
11. TO FACILITATE ASSEMBLY, ALL ACCESSORIES AT ENDS SHALL HAVE 100mm STRAIGHT PORTION.
12. ALL NUTS, BOLTS, WASHERS ETC., SHALL BE HOT DIP GALVANISED AS PER IS 1367 FOR SIZES ABOVE 12MM AND ELECTROPLATED/ELECTROGALVANISED FROM SIZE BELOW 12MM.
13. ALL DIMENSIONS ARE IN mm UNLESS NOTED OTHERWISE.
14. TRAY ACCESSORIES SHOWN IN THIS DRAWING SHALL BE FACTORY FABRICATED FOR USE AT SITE AS PER APPROVED LAYOUT DRAWINGS. FOR SPECIFIC SITE REQUIREMENTS (E.G. IRREGULAR ANGLE BENDS SUCH AS 30°/60° BENDS, ETC) AS PER SITE LAYOUT CONDITIONS, TRAY ACCESSORIES SHALL BE FABRICATED AT SITE FROM THE STRAIGHT LENGHT OF RESPECTIVE SIZES AS REQUIRED. GALVANISATION DAMAGED DURING CUTTING/WELDING OPEARTIONS SHALL BE BRUSHED AND RED LEAD PRIMER, OIL PRIMER AND ALUMINIUM PAINT SHALL BE APPLIED BEFORE INSTALLATION OF THE ACCESSORIES.
15. WIDTH OF CABLE TRAYS PROPOSED TO BE USED FOR PROJECT ARE AS UNDER :
    LADDER TYPE CABLE TRAY (MM) : 600, 300 & 150.
    PERFORATED TYPE CABLE TRAY (MM) : 600, 300, 150, 100 & 50.
16. 600MM WIDE CABLE TRAY SHALL BE SUITABLE FOR WEIGHT OF 100KG/M INCLUDING LIVE LOAD OF RUNNING LENGTH OF CABLE TRAY.
17. CABLE TROUGHS OR 50/100MM WIDE PERFORATED TYPE TRAY SHALL BE USED FOR LOCAL CABLING/BRANCHING OUT FEW CABLES FROM MAIN ROUTE.

भेल BHEL	TYPICAL DETAILS OF CABLE TRAYS AND ACCESSORIES	NTPC DOCUMENT NO: 4540–001–215–PVE–B–045 BHEL DWG. NO. PE–DG–497–507–E041 SHT. 14 OF 14 REV.01

MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :	DATE:
	CUSTOMER :		QP NO.: PE-QP-999-Q-006, REV-02	DATE: 17.04.2020
	PROJECT:		PO NO.:	DATE:
	ITEM: AC ELECT. MOTORS UPTO 55KW (LV (415V))	SYSTEM:	SECTION: II	SHEET 1 of 2

S. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	*	AGENCY			REMARKS
1	2	3	4	5	6		7	8	9	D	**			
					M	C/ N					M	C	N	
1.0	ASSEMBLY	1.WORKMANSHIP	MA	VISUAL	100%	-	MFG. SPEC.	MFG. SPEC.	LOG BOOK		P	-	-	
		2.DIMENSIONS	MA	VISUAL	100%	-	MFG. DRG./ MFG. SPEC.	MFG. DRG./ MFG. SPEC.	LOG BOOK		P	-	-	
		3.CORRECTNESS COMPLETENESS TERMINATIONS/ MARKING/ COLOUR CODE	MA	VISUAL	100%	-	MFG.SPEC./	MFG.SPEC.	LOG BOOK		P	-	-	
2.0	PAINTING	1.SHADE	MA	VISUAL	SAMPLE	-	MFG. SPEC/ APPROVED DATASHEET	MFG. SPEC/ APPROVED DATASHEET	LOG BOOK	✓	P	V	-	
3.0	TESTS	1.ROUTINE TEST INCLUDING SPECIAL TEST	MA	VISUAL	100%	-	IS-325 / IS-12615/ APPROVED DATA SHEET	IS-325 / IS-12615/ APPROVED DATA SHEET	TEST/ INSPN. REPORT	✓	P	V *	-	* NOTE -1
		2.OVERALL DIMENSIONS & ORIENTATION	MA	MEASUREMENT & VISUAL	100%	-	APPROVED DRG/ DATA SHEET	APPROVED DRG/ DATA SHEET	TEST/ INSPN. REPORT	✓	P	V *	-	* NOTE -1 & NOTE-2

BHEL						BIDDER/ SUPPLIER	
ENGINEERING			QUALITY			Sign & Date	
	Sign & Date	Name		Sign & Date	Name	Seal	
Prepared by:	HEMA KUSHWAHA	HEMA KUSHWAHA	Checked by:		KUNAL GANDHI		
Reviewed by:	PRAVEEN DUTTA	PRAVEEN DUTTA	Reviewed by:	RITESH KUMAR JAISWAL	RITESH KUMAR JAISWAL		

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:
	CUSTOMER :		QP NO.: PE-QP-999-Q-006, REV-02	DATE: 17.04.2020
	PROJECT:		PO NO.:	DATE:
	ITEM: AC ELECT. MOTORS UPTO 55KW (LV (415V))	SYSTEM:	SECTION: II	SHEET 2 of 2

		3.NAMEPLATE DETAILS	MA	VISUAL	100%	-	IS-325 / IS-12615 / APPROVED DATA SHEET	SAME AS COL. 7	TEST/ INSPN. REPORT	✓	P	V	-	
4.0	PACKING	SURFACE FINISH & COMPLETENESS	MA	VISUAL	100%	100%	AS PER MFG. STANDARD / (#)	AS PER MFG. STANDARD / (#).	INSPC. REPORT	✓	P	W	-	(#) REFER NOTE-8

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 up to 1.5 KW, 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, the same is valid for 5 years.
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 of any changes in QP commented by customer at contract stage, same shall be carried out by bidder without any implication to BHEL/ Customer.
7. Project specific QP to be developed based on customer requirement.
8. For export job, BHEL technical specification for seaworthy packing to be followed.
9. Packing shall be suitable for storage at site in tropical climate conditions.
10. Latest revision/ year of issue of all the standards (IS/ ASME/ IEC etc.) indicated in QP shall be referred.

LEGENDS:

*RECORDS, INDENTIFIED 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: DOCUMENTATION

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:	HEMA KUSHWAHA	HEMA KUSHWAHA	Checked by:		KUNAL GANDHI
Reviewed by:	PRAVEEN DUTTA	PRAVEEN DUTTA	Reviewed by:	RITESH KUMAR JAISWAL	RITESH KUMAR JAISWAL

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

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

CLAUSE NO.

QUALITY ASSURANCE

MOTOR

TESTS/CHECKS / TEMS/COMPONENTS	Visual	Dimensional	Make/Type/Rating /General Physical Inspection	Mech/Chem. Properties	NDT /DP/MPI/UT	Metallography	Electrical Characteristics	Welding/Brazing(WPS/PQR)	Heat Treatment	Magnetic Characteristics	Hydraulic/Leak/Pressure Test	Thermal Characteristics	Run out	Dynamic Balancing	Routine & Acceptance tests as per IS-4722 /IS- 9283/IS 2148/IEC60034\IEC 60079-I/ IS-12615	Vibration	Over speed	Tan delta, shaft voltage & polarization index test	Paint shade, thickness & adhesion
Plates for stator frame, end shield, spider etc.	Y	Y	Y	Y	Y				Y										
Shaft	Y	Y	Y	Y	Y	Y			Y										
Magnetic Material	Y	Y	Y	Y			Y			Y		Y							
Rotor Copper/Aluminium	Y	Y	Y	Y			Y		Y										
Stator copper	Y	Y	Y	Y			Y		Y			Y							
SC Ring	Y	Y	Y	Y	Y		Y	Y	Y										
Insulating Material	Y		Y	Y			Y					Y							
Tubes, for Cooler	Y	Y	Y	Y	Y				Y		Y								
Sleeve Bearing	Y	Y	Y	Y	Y				Y		Y								
Stator/Rotor, Exciter Coils	Y	Y	Y				Y	Y											
Castings, stator frame, terminal box and bearing housing etc.	Y	Y	Y	Y	Y			Y											
Fabrication & machining of stator, rotor, terminal box	Y	Y			Y			Y	Y										
Wound stator	Y	Y					Y	Y											
Wound Exciter	Y	Y					Y	Y											
Rotor complete	Y	Y					Y						Y	Y					
Exciter, Stator, Rotor, Terminal Box assembly	Y	Y					Y												
Accessories, RTD, BTD, CT, Space heater, antifriction bearing, gaskets etc.	Y	Y	Y																

CLAUSE NO.	QUALITY ASSURANCE	

Complete Motor	Y	Y	Y											Y	Y	Y	Y1	Y

Note:

1. The manufacture is to furnish a detailed Quality Plan indicating the practices & Procedure followed along with relevant supporting documents during QP finalization. However, following methodology to be followed for Inspection Categorization:

Note for LT Motor:

i) Motor rating up to 50 KW: Inspection CAT- III : Acceptance of Motor up to 50 KW is based on COC of the Manufacturer and Main 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, temperature rise, distance between center of stud gland plate and tested in accordance with approved drawing /data sheets."

ii) Motor rating above 50 KW & less than 75 KW: Inspection CAT- II as per NTPC approved MQP: Acceptance of Motor rating above 50 KW & less than 75 KW is based on NTPC review of Routine Test inspection report as per IS:12615 - 2018 (including latest revision) duly witnessed by main contractor along with COC of the Manufacturer and Main 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, temperature rise, distance between center of stud gland plate, space heater and tested in accordance with approved drawing /data sheets."

iii) Motor rating 75 KW & above: Inspection CAT-I: As per NTPC approved MQP.

2. Additional routine tests for Flame proof motors shall be applicable as per relevant standard
3. Makes of major bought out items for HT motors will be subject to NTPC approval.
4. Y1 = for HT Motor / Machines only.
5. For LT Motors, stator core stack length & grade, no load loss and winding resistance w.r.t. type tested motor for IE2/IE3 shall be checked/verified in addition to

Compliance of relevant standard IS:12615/IEC requirement. In case actual results are not within the tolerance limit as declared by manufacturer during QP submission,

the motor shall be subjected to efficiency test.

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
BFP CRANE 1																		
BFP CRANE 2																		
CWPH CRANE																		
ELECTRICAL WORKSHOP CRANE																		
MECHANICAL WORKSHOP CRANE																		

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.	497	ORIGINATING AGENCY		PEM (ELECTRICAL)
		PROJECT TITLE	2X660 MW TALCHER TPP	NAME		DATA FILLED UP ON
		SYSTEM	DG EOT Crane (UPTO 100 T)	SIGN.		DATA ENTERED ON
		DEPTT. / SECTION	MH	SHEET 1 OF 1	REV. 00	DE'S SIGN. & DATE

CABLE SCHEDULE FORMAT **ANNEXURE III**

UNITCABLENO	FROM	TO	PURPOSE	CABLE SCOPE (BHEL PEM/ VENDOR)	REMARKS	CABLESIZE	PATHCABLENO	TENTATIVE CABLE LENGTH

Explanatory notes for filling up cable list for routing through WinPath, the cable routing program (developed by Corporate R&D) being used in PEM.

1. For the purpose of clarity, it may please be noted that the information given in regard to the cables to be routed through WinPath as per the system elaborated below is called "Cable List", while the term "Cable Schedule" applies to the cable list with routing information added after routing has been carried out.
2. The cable list shall be entered as an MS Excel file in the format as per enclosed template EXT_CAB_SCH_FORMAT.XLS. No blank lines, special characters, header, footer, lines, etc. shall be introduced in the file. No changes shall be made in the title line (first line) of the template.
3. The field properties shall be as under:
    a. UNITCABLENO: A/N, up to sixteen (16) characters; each cable shall have its own unique, unduplicated cable number. In case this rule is violated, the cable cannot be taken up for routing.
    b. FROM: A/N, up to sixty (60) characters; the "From" end equipment/ device description and location to be specified here. Information in excess of 60 characters will be truncated after 60 characters.
    c. TO: A/N, up to sixty (60) characters; the "To" end equipment/ device description and location to be specified here. Information in excess of 60 characters will be truncated after 60 characters.
    d. PURPOSE: A/N, up to sixty (60) characters; the purpose (i.e. power cable/ indication/ measurement, etc.) to be specified here. Information in excess of 60 characters will be truncated after 60 characters.
    e. REMARKS: A/N, up to forty (40) characters; Any information pertinent to routing to be specified here (e.g., cable number of the cable redundant to the cable number being entered). Information in excess of 40 characters will be truncated after 40 characters.
    f. CABLESIZE: A/N, 7 characters exactly as per the codes indicated below shall be specified here. The program cannot route cables described in any other way/ format.
    g. PATHCABLENO: Field reserved for utilization by the program. User shall not enter any information here.
4. One list shall be prepared for each system/ equipment (i.e., separate and unique cable lists shall be prepared for each system).
5. The cables shall be described as per the scheme listed below:

A	NN	A	NNN
|	|	|	|
Cable Voltage Code (see B below)	No. of cores (e.g. 01,03,3H, 07)	Cable code (See C below)	Cable size (e.g. 035,185,2.5, 0.5)

(A) SYSTEM VOLTAGE CODES:
(ac) A = 11KV, B = 6.6KV, C = 3.3KV, D = 415V, E = 240V, F = 110V
(dc) G = 220V, H = 110V, J = 48V, K = +24V, L = -24V

(B) CABLE VOLTAGE CODES:
A = 11KV (Power cables)

Explanatory notes for filling up cable list for routing through WinPath, the cable routing program (developed by Corporate R&D) being used in PEM.

B = 6.6KV (Power cables)
C = 3.3KV (Power cables)
D = 1.1KV (LV & DC system power & control cables)
E = 0.6KV (0.5 sq. mm. Control cables)

(C) CABLE CODES

PVC Copper

A = Armoured FRLS	B = Armoured Non-FRLS
C = unarmoured FRLS	D = Unarmoured Non-FRLS

PVC Aluminium

E = Armoured FRLS	F = Armoured Non-FRLS
G = unarmoured FRLS	H = Unarmoured Non-FRLS

XLPE Copper

J = Armoured FRLS	K = Armoured Non-FRLS
L = unarmoured FRLS	M = Unarmoured Non-FRLS

XLPE Aluminium

N = Armoured FRLS	P = Armoured Non-FRLS
Q = unarmoured FRLS	R = Unarmoured Non-FRLS

S = FIRE SURVIVAL CABLES
T = TOUGH RUBBER SHEATH
U = OVERALL SCREENED
V = PAIRED OVERALL SCREENED
W = PAIRED INDIVIDUAL SCREENED
Y = COMPENSATING CABLES
I = PRE-FABRICATED CABLES
Z = JELLY FILLED CABLES

	TITLE	SPECIFICATION NO. PE-TS-497-501-A502
	2x660MW TALCHER TPP STAGE-III	REV 00
	DOUBLE GIRDER EOT CRANES UPTO 100T	Section IC Date AUG 2023
	SPECIFIC TECHNICAL REQUIREMENTS	

SUB-SECTION – IC

DATA SHEET

BHEL	**TECHNICAL SPECIFICATION FOR DOUBLE GIRDER EOT CRANE UPTO 100T 2x660MW TALCHER TPP STAGE-III**	SPECIFICATION NO. PE-TS-497-501-A502
		SECTION - I / SECTION - I C
		REV 00 / DATE AUG 2023

DATA SHEET FOR DOUBLE GIRDER EOT CRANES 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: 3177-2020 & Structure design in accordance to IS 807:2006 / IS 800:1984. Minimum web thickness - 8mm. Minimum diaphragm/stiffner thickness - 8mm.			
1.4.0		**Number of crane**	**2 nos. for BC Bay BFP Handling**	**1 no. for CWPH**	**1 no. for Electrical Workshop**	**1 no. for Mechanical Workshop**
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**	35T each	60T	45T	10T
1.7.1		**Main hoist**	For BC Bay BFP Handling	For CWPH	For Electrical Workshop	For Mechanical Workshop
	a.	Rated SWC – tonnes	35T each	60T	45T	10T
	b.	Test load SWC – tonnes	Rated SWC and over load test : 125% of SWC			
1.7.2		**Aux. hoists**				
	a.	Rated SWC – tonnes	NA			
	b.	Test load SWC – tonnes	Rated SWC and over load test : 125% of SWC			
1.8.0		**Span**	As per attached Crane Clearance diagrams			
1.9.0		**Operation from**	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**	
	a.	Main hoist	**1.6**		0.16 (10% of main speed thru' VVVF drives)	
	b.	Aux. hoist	**NA**		NA	
	c.	Trolley travel (CT)	**4.0**		0.4	

	TECHNICAL SPECIFICATION FOR **DOUBLE GIRDER EOT CRANE UPTO 100T** **2x660MW TALCHER TPP STAGE-III**	SPECIFICATION NO. PE-TS-497-501-A502
		SECTION - I / SECTION - I C
		REV 00 / DATE AUG 2023

				(10% of main speed thru' VVVF drives)
	d.	Longitudinal bridge travel (LT)	**8.0**	0.8 (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 diagrams**	
	b.	Aux Hoist	**NA**	
2.4.0		Hook Approaches	**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. 800 mm (clear) with hand railing of height of 1100 mm along the cross over walkways on trolley.	
	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**
	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	*	*

TECHNICAL SPECIFICATION FOR

DOUBLE GIRDER EOT CRANE UPTO 100T

2x660MW TALCHER TPP STAGE-III

SPECIFICATION NO. PE-TS-497-501-A502	
SECTION - I	SECTION - I C
REV 00	DATE AUG 2023

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)	
	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: 3177-2020			
	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	minimum 220 BHN			

	h.	Hardness (BHN) – pinion	minimum 270 BHN			
	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 OR Hardened and ground gears & pinions. Material (gear/pinions) - 815M17 / En353. The hardness of gears & pinions shall be in the range of 560 - 580BHN.			
	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	minimum 220 BHN			
	h.	Hardness (BHN) – pinion	minimum 270 BHN			
	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 OR Hardened and ground gears & pinions. Material (gear/pinions) - 815M17 / En353. The hardness of gears & pinions shall be in the range of 560 - 580BHN.			
	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	Grade C55Mn75 of IS 1570 (Part 1 and Part 2/Sec 2) or 42CrMo4 or equivalent as per IS 3177-2020. UTS required for selection of P_L value as indicated in Table 6 of IS 3177 shall be witnessed by BHEL.			
	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**	For BC Bay BFP Handling	For CWPH	For Electrical Workshop	For Mechanical Workshop

	TECHNICAL SPECIFICATION FOR **DOUBLE GIRDER EOT CRANE UPTO 100T** **2x660MW TALCHER TPP STAGE-III**	SPECIFICATION NO. PE-TS-497-501-A502
		SECTION - I / SECTION - I C
		REV 00 / DATE AUG 2023

	a.	Type	shank type conforming to IS:15560	Ramshorn type conforming to IS:5749	Ramshorn type conforming to IS:5749	shank type conforming to IS:15560
	b.	Safe lifting capacity	35T	60T	45T	10T
	c.	Material	✓ Class 2 as per IS 1875:1992 (re affirmed 2004) for hooks conforming to IS : 5749 ✓ Class 3 for hook of grades L & M respectively as per IS 1875:1992 for hooks conforming to IS : 15560			
	d.	Standard conforming to	IS-5749/ IS: 15560			
	e.	Hook can rotate	Yes			
	f.	Safety latch on hook provided	Yes			
	g.	Locking device on swivelling hook required or not	Provided			
3.9.0		**Buffers**	**Cross travel**		**Long travel**	
	a.	Type	Spring loaded type. To be designed to bring the loaded crane (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 stopper	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**			
	a	Type of brake	Electro-magnetic brakes / Electro Hydraulic Thrust brakes			
	b.	Diameter of brake in mm	*			
	c.	Torque rating Kg. M	*			
	d.	Number provided per motor	2 X 100 %			
	e.	Braking capacity (% of torque transmitted to the brake drum with full load.)	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	*			
3.10.2		**Travel Motions**	**CT**		**LT**	
	a.	Type of brake (ac / dc / thrustor)	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 X 100 %		2 X 100 %	
	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	*	*			
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**	**Any other assembly**
	a.	Type	Antifriction ball / roller bearings				
	b.	Number provided for each	As per assembly requirements				
	c.	Method of lubrication	Centralised grease lubrication with hand operated grease pump for all bearings 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	*				
		Limiting value of stress	The following shall be taken into consideration, The static loads due to the dead weight, the loads due to working load multiplied by dynamic coefficient and the two most unfavorable horizontal effects, excluding buffer forces. All these loads must then be multiplied by the amplifying coefficient.'				
	c.	Vertical Deflection	Span / 900				
	d.	Type of connection to end carriage	By fitted bolts				
	e.	Width	*				
	f.	Length	*				
3.14.0		**Rails**					
	a.	Type / section	Rails sections as per IS: 3443 Grade 50 C 12. Joint to be butt-welded by thermit welding or fusion welding/ CR-100 with 45 degrees angle.				
	b.	Standard conforming to	IS: 3443				
	c.	Weight per metre	*				
	d.	Material	50C12 / 55C11				
	e.	Top width in mm	*				
	f.	Height in mm	*				
3.15.0		**Type of platform required on the bridge**	Chequered plate platform 6mm thick over plain as per IS : 3502				
	a.	Length	Full span length				
	b.	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	.Platform Provided at both ends	Yes			
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**	
	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 insulated bearing on at least one side for motor frame size above 250 frame. However, contractor's proven practice with respect to use of insulated bearing in VFD driven motor may be accepted subject to Employer's approval.		Thru VVVF drive	
	b.	Enclosure	TEFC		NA	
	c.	Numbers furnished	One per motion			
	d.	Voltage, phase and frequency	415V ± 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 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	70 deg. C by resistance method for both thermal class 130(B) & 155(F) insulation.			
	j.	Number of starts/ hour	Starts / hr as per IS 3177-2020			
	k.	Contactors for motor	*			
	l.	Overload protection for motors provided	Yes			
	m	Space heater requirements	For motors of rating 30 KW and above			
3.18.2		**Travel Motions**	**CT**	**CT micro**	**LT**	**LT micro**
	a.	Type	Three phase Squirrel Cage Induction motors to be operated from VFD system 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 insulated bearing on at least one side for motor frame size above 250 frame. However, contractor's proven practice with respect to use of insulated bearing in VFD driven motor may be accepted subject to Employer's approval.	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 insulated bearing on at least one side for motor frame size above 250 frame. However, contractor's proven practice with respect to use of insulated bearing in VFD driven motor may be accepted subject to Employer's approval.	Thru VVVF drives

	b.	Enclosure	TEFC	NA	TEFC	NA
	c.	Numbers furnished	1	NA	2	NA
	d.	Voltage, phase and frequency	415V ± 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 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	70 deg. C by resistance method for both thermal class 130(B) & 155(F) insulation.			
	j.	Number of starts/ hour	Starts / hr as per IS 3177-2020.			
	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			
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		**Control panel**				
	a.	Make	OEM			
	b.	Size	*			
	c.	Material	Cold Rolled sheet steel 2mm size			
	d.	Numbers and location	One number protective panel & One each for MH, AH, CT and LT located on bridge platform			
	e.	Degree of protection	IP 54			
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**	**Control**
	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.	cabin	NA	
	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 LED 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	
	e	Hand lamp socket and hand tool sockets	Hand lamp socket outlets (2 pin, 10A, 24V) and power socket outlets (3 pin, 20A, 240V) shall be provided for use of hand tools along with switches.	
3.31.0		**Fire Extinguisher**		
	a.	Type and size	4.5 kg CO_2 type	
	b.	Location	One no. on bridge per Crane	
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		**RRC details**	Mentioned Elsewhere in the specification	
3.37.0		**Painting**	As per Annexure- IV	
3.38.0		**Main isolating switch**	At center of bay length(to be decided during detail engineering)	

3.39.0		**Sweep**	Sweep shall be attached to the end carriages and to the trolley to remove foreign materials from the rails.
3.40.0		**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

Note: Other requirements for the system.

- Crane Lubrication: Provisions shall be made for proper lubrication of all parts. Bearings shall be provided with means of pressure lubrication. The crane shall be provided with all necessary lubrication fittings. Lubricating points shall be located for easy and safe access without the necessity of removing guards or other parts. Lubrication lines shall be securely fastened to the cranes structure and shall be located to provide the maximum protection and so that ordinary repairs can be made without removing the lines. The crane shall be provided with a centralized lubrication system of reputed make. This system shall be manually operated, complete with a manual pump, reservoir, supply lines, connectors, valves, and discharge lines to all bearings. System shall be centralized lubrication type with at least, one pump mounted on the trolley and one on each of the crane bridge with supply line for connection to all lubrication points. Metering valves with indicators shall be provided for all points of grease application and shall be mounted at readily visible and accessible locations. All piping shall be made of suitable metal tubing with flexible hoses where required. Upper pulley block to be placed above crab platform level for ease in approach during maintenance.

- The crane electrical shall be designed for ambient air temperature of 50 Deg. C relative humidity of 100%. The equipment shall operate in highly polluted environment.

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

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

- DSL phase indicating lamps to be provided on both side of bay length.

- Additional features on pendant push button:

  Emergency Push Button
  Switches for lights and bells
  Lamps for Power 'ON' indication and emergency corner switch operation

SECTION – II

Site Storage and Preservation Guidelines

CONTENT

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.

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_2SO_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.

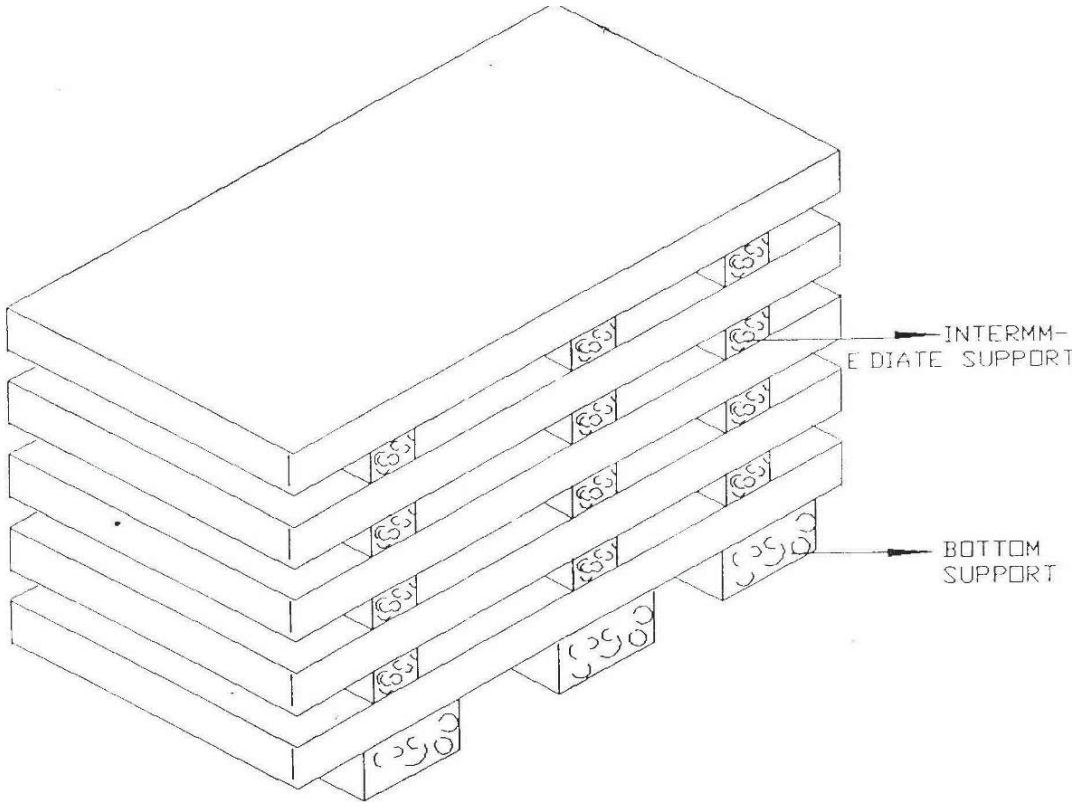


Figure – 1 – PLATE STACKING ARRANGEMENT

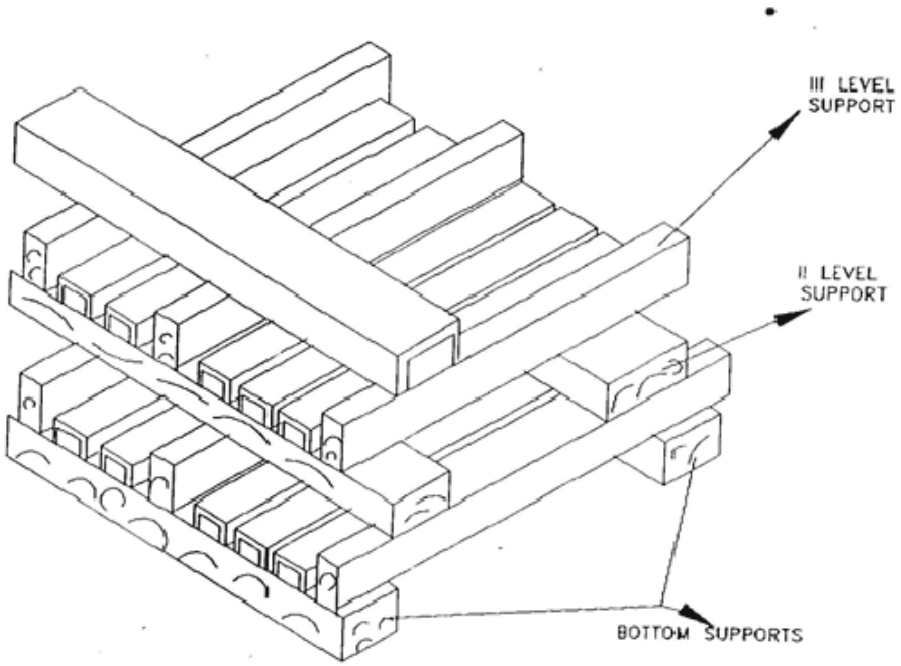


Figure – 2 – STRUCTURAL STEEL STACKING ARRANGEMENT

DRAWINGS / DOCUMENTS TO BE SUBMITTED WITH THE BID

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

a) Deviation schedule with reference to specific clauses of the specification along with reason for such deviation in the 'Deviation Schedule' (Cost of withdrawal) format as attached in GCC.
b) Un-priced copy of price format indicating quoted/ not quoted against each row/column
c) Copy of pre-bid clarifications/ amendment/ corrigendum issued by BHEL, if any, duly signed & stamped
d) Signed/ Stamped copy of Compliance cum Confirmation Certificate

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 WILLNOT BE CONSIDERED FOR BID EVALUATION.

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', 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 is within the contracted price without any extra implications to BHEL after award of the contract.

d) All drawings/ data-sheets / calculations etc. submitted along with the offer shall not be taken cognizance off.

e) The offered materials shall be either equivalent or superior to those specified in the specification & shall meet the specified / intended duty requirements. In case the material specified in the specifications is not compatible for intended duty requirements then same shall be resolved by the bidder with BHEL during the pre-bid discussions, otherwise BHEL / Customer's decision shall be binding on the bidder whenever the deficiency is pointed out.

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

f) The commissioning spares shall be supplied on 'As Required Basis' & prices for same included in the base price itself.

g) All sub vendors shall be subject to BHEL / CUSTOMER approval in the event of order.

h) Guarantee for plant/equipment shall be as per relevant clause of GCC / SCC / Other Commercial Terms & Conditions

i) In the event of order, all the material required for completing the job at site shall be supplied by the bidder within the ordered price even if the same are additional to approved billing break up, approved drawing or approved Bill of quantities within the scope of work as tender specification. This clause will apply in case during site commissioning, additional requirements emerges due to customer and / or consultant's comments. No extra claims shall be put on this account

j) Schedule of drawings submissions, comment incorporations & approval shall be as stipulated in the specifications. The successful bidder shall depute his design personnel to BHEL's / Customer's / Consultant's office for across the table resolution of issues and to get documents approved in the stipulated time.

k) As built drawings shall be submitted as and when required during the project execution.

l) The bidder has not tempered with this compliance cum confirmation certificate and if at any stage any tempering in the signed copy of this document is noticed then same shall be treated as breach of contract and suitable actions shall be taken against the bidder.

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

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

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

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

ANNEXURE-II DEVIATION SHEET (COST OF WITHDRAWAL)									
PROJECT:- 2X660 MW TALCHER TPP STAGE III									
PACKAGE :- DOUBLE GIRDER EOT CRANES UPTO 100T CAPACITY									
TENDER ENQUIRY :-									
Sl. No.	Volume/ Section	Page No.	Clause No.	Technical Specification/Tender Document No	Complete Description of Deviation	Cost of withdrawal of deviation to be entered by the bidder in	Reference of price Schedule of which Cost of Withdrawal of Deviation is applicable	Nature of cost of withdrawal of deviation (Positive /Negative)	Reasons for quoting deviation
1	TECHNICAL DEVIATION								
1.01									
1.02									
1.03									
1.04									
1.05									
1.06									
1.07									
1.08									
2	COMMERCIAL DEVIATION								
2.01									
2.02									
2.03									
2.04									
2.05									
2.06									
2.07									
2.08									

NOTES:

1. Cost of Withdrawal of deviation will be applicable on the basic price (i.e. excluding taxes, duties & freight) only.
2. All the bidders have to list out all their technical & commercial deviations (if any) in details in the above format.
3. Any deviation not mentioned above and shown separately or found hidden in offer, will not be taken cognizance of.
4. Bidder shall submit duly filled unpriced copy of above format indicating "quoted" in "cost of withdrawl of deviation" column of the schedule above along with their Techno-commercial offer, wherever applicable. In absence of same, such deviation(s) shall not be considered and offer shall be considered in total compliance to NIT.
5. Bidder shall furnish price copy of above format along with price bid.
6. The final decision of acceptance/ rejection of the deviations quoted by the bidder shall be at discretion of the Purchaser.
7. Bidders to note that any deviation (technical/commercial) not listed in above and asked after Part-I opening shall not be considered.
8. For deviations w.r.t. Credit Period, Liquidated damages, Firm prices if a bidder chooses not to give any cost of withdrawl of deviation loading as per Annexure-VII of BOP-GCC will apply. For any other deviation mentioned in un-priced copy of this format submitted with Part-I bid but not mentioned in priced copy of this format submitted with Priced bid, the cost of withdrawl of deviation shall be taken as NIL.
9. Any deviation mentioned in priced copy of this format, but not mentioned in the un-priced copy, shall not be accepted.
10. All techno-commercial terms and conditions of NIT shall be deemed to have been accepted by the bidder, other than those listed in unpriced copy of this format.
11. Cost of withdrawl is to be given seperately for each deviation. In no event bidder should club cost of withdrawl of more than one deviation else cost of withdrawl of such deviations which have been clubbed together shall be considered as NIL.
12. In case nature of cost of withdrawl (positive/negative) is not specified it shall be assumed as positive.
13. In case of descrepancy in the nature of impact (positive/ negative), positive will be considered for evaluation and negative for ordering.