2X800 MW SINGRAULI STPP STAGE III
1 X 800 MW SIPAT STPP STAGE-III

TECHNICAL SPECIFICATION
FOR

DOUBLE GIRDER EOT CRANES
FOR UPTO 100T CAPACITY

SPECIFICATION No. **PE-TS-512/520-501-A001**

REV NO. 0

BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA, INDIA

INDEX

PROJECT INFORMATION

SL.NO	DESCRIPTION	2X800 MW SINGRAULI STPP STAGE III	1 X 800 MW SIPAT STPP STAGE-III
1	**CUSTOMER**	**NTPC Ltd.**	**NTPC Ltd.**
2	**CUSTOMER CONSULTANT**	**NA**	**NA**
3	**LOCATION**	The project is located in Sonebhadra District of Uttar Pradesh	The project is located in Bilaspur district of Chhattisgarhe.
4	**DATA**		
4.1	THE BASIC WIND SPEED “Vb” AT TEN METERS ABOVE THE MEAN GROUND LEVEL.	47 METERS PER SECOND	39 METERS PER SECOND
4.2	THE RISK COEFFICIENT “K1”	1.07	1.07
4.3	CATEGORY OF TERRAIN	CATEGORY 2	CATEGORY 2
4.4	OTHER FACTORS	IN LINE WITH IS 875	IN LINE WITH IS 875
4.5	SEISMIC ZONE	ZONE-II AS PER IS:1893	ZONE-III AS PER IS:1893
4.6	DESIGN AMBIENT TEMPERATURE	50 DEG. CELCIUS	50 DEG. CELCIUS
5	**ELECTRICAL DATA**		
5.1	RATED VOLTAGE	415 V	415 V
5.2	FREQUENCY	50 Hz	50 Hz
5.3	PERMISSIBLE VARIATIONS FOR		
a.	VOLTAGE	+/-10 %	+/-10 %
b.	FREQUENCY	(-)5 to (+)3 %	(-)5 to (+)3 %
c.	COMBINED VOLTAGE & FREQUENCY	10 %	10 %
5.4	SYSTEM FAULT LEVEL AT RATED VOLTAGE FOR 1 SEC	50 kA	50 kA
5.5	SHORT TIME RATING FOR TERMINAL BOXES FOR 0.25 SEC	50 kA	50 kA

SCOPE

SCOPE OF THIS PACKAGE COVERS THE FOLLOWING:

SL.NO	PARAMETERS	REQUIREMENT
1	Supply Including Design, Engineering, Manufacturing Of	
a)	Main Supply	YES
b)	Commissioning Spares	YES
2	Painting	YES
3	Inspection & Testing	YES
4	Packing	YES
5	Transportation & Delivery To Site	YES
6	Erection & Commissioning	YES
7	Supervision of Erection & Commissioning	NO
8	Performance Guarantee (PG) Test	YES
9	Mandatory Spares	YES FOR SINGRAULI PROJECT; NO FOR SIPAT PROJECT
10	O & M Service	NO
11	O & M Spares	NO
12	Storage	YES

	EXCLUSIONS	
1	Supply feeder and cable from feeder to isolating switch.	
2	Steel Gantry girder	
3	Dead load for load/ overload testing at site	
	Note	
1	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.	

	GENERAL TECHNICAL REQUIREMENT
1.0	It is not the intent to specify herein all the details of design and manufacturing. Bidder shall ensure that the offered equipment confirms in all respects to high standards of design, engineering and workmanship.
2.0	The equipment shall comply with all applicable safety codes and statutory regulations of India as well as of the locality where the equipment is to be installed.
3.0	In the event of any conflict between the codes and standards referred to in the above clauses and the requirement of this specification, the requirement of Technical Specification shall govern.
4.0	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.
5.0	Drawing/document submission shall be through web based Document Management System. Bidder would be provided access to the DMS for drg/doc approval and training for the same. Bidder to ensure proper internet connectivity at
6.0	The first revision drawings/ documents submitted by vendor shall be complete in all respects.Any incomplete drawing submitted shall be treated as non- submission with delays attributable to vendor's account. For any clarification/ discussion required to complete the drawings, the bidder shall himself depute his personal to BHEL / Customer's place as per the requirement for across the table discussions/ finalizations/ submissions of drawings.
7.0	In case of any change in codes, standards & regulations between the date of bid opening (23.12.2023 for Singrauli project and 10.07.2024 for Sipat project) and the date when vendors proceed with fabrication, the Employer shall have the option to incorporate the changed requirements or to retain the original standard. It shall be the responsibility of the Contractor to bring to the notice of the Employer such changes and advise Employer of the resulting effect.
8.0	Other International/ National standards such as DIN, VDI, BS, GOST etc. shall also be accepted for only material codes and manufacturing standards, subject to the Employer's approval, for which the Bidder shall furnish, adequate information to justify that these standards are equivalent or superior to the standards mentioned above. In all such cases the Bidder shall furnish specifically the variations and deviations from the standards mentioned elsewhere in the specification together with the complete word to word translation of the standard that is normally not published in English.

9.0	In the event of any conflict between the codes and standards referred to in the above clauses and the requirement of this specification, the requirement of Technical Specification shall govern.
10.0	Bidder shall carry out the type tests as listed in the Quality Plan. OR Bidder shall furnish Type Test Certificate of specified Type Test as per quality plan for applicable equipment which has been carried out within last ten years from 23.12.2023 for Singrauli project and 10.07.2024 for Sipat project. These reports should be for the tests conducted on the equipment same (model / type / size / rating) 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 absence of valid Type Test report vendor to conduct the same without any commercial & delivery implication to BHEL.
11.0	Manufacturing Quality Plan is included for reference in this specification to enable the bidder to understand the extent of inspection and testing requirements to execute this job. The successful bidder has to follow the quality plan's minimum requirement during manufacturing and testing. Further all checks and tests indicated in Quality Assurance Requirement as detailed in Customer's specification etc have to be followed.
12.0	Sub vendor list is attached. Any additional sub - vendors proposed by biddder during contract stage shall be subject to BHEL/ Customer/Customer's Consultant
13.0	Document approval by BHEL / Customer shall not absolve the supplier of their contractual obligations of completing the work as per specification requirement without any commercial and delivery impact.
14.0	**Mandatory Spares (if applicable)**
14.1	One (1) Set is defined as 100% requirement for one crane for the entire cranes of similar size & capacity.
14.2	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.
14.3	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.

14.4	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.
14.5	Interchangeability and Packings: All spares supplied under this contract shall be strictly interchangeable with the parts for which they are intended for replacements. The spares shall be treated and packed for long storage under the climatic conditions prevailing at the site e.g. small items shall be packed in sealed transparent plastic with desecrator packs as necessary.
14.6	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.
14.7	Bidder shall not indicate “Not Applicable” against any of the spare (except for those items for which “if applicable” is specified). In case of not applicability, functionally equivalent spare shall be offered.
15.0	SHOP TEST PROCEDURE FOR GEAR BOX
15.1	Gear Box Running Test: The gear boxes shall be run under no-load condition at the rated speed for minimum four hours in each direction and the following are to be checked:
a	All bolts at the joints remain tight.
b	All gear mesh lines are getting enough lubrication.
c	All bearings are getting enough lubrication.
d	Bearing temperatures after running for four hours shall not exceed 50 deg. Centigrade or 15 deg. centigrade above ambient whichever is higher. Temperature shall be checked after every hour.
e	Vibration : Maximum limit 125 microns (peak to peak)
f	Sound: The gearbox shall not emit unusual sound as obtained under conditions of hard meshing, high spots etc. Maximum sound level shall be 85 dBA at a distance of 1000mm and 91 dBA at a distance of 300 mm.
g	There shall be no Oil leakage at parting lines, bearing housings or inspection covers.
15.2	**In addition to the above specific points, the following general points shall be ensured**:
a	Inspection pockets are provided as required.
b	Gear box casings are provided with at least two fit bolts/dowels at the parting line.

c	Dip sticks with minimum / maximum level markings are provided.
d	Drain plugs are provided at convenient locations preferably at vertical wall of the housing.
e	Breathers are provided.
f	Lifting lugs or eye bolts ar provided as required.
g	Wherever bearings have splash lubrication, oil retainers are provided.
h	Gear boxes are painted as per specification outside and inside. Inside surfaces shall be painted with Oil proof paint.
i	In case of vertical gear boxes having more than two stage reduction, forced lubrication is also provided.
j	Name plate should provide information eg. Ratio, KW rating, Bearing details and manufacturers name.
16.0	**STAGE INSPECTION OF EOT CRANES AT WORKS**: Stage inspection of various components of crane shall be guided by the MQP attached with this specification. However, following shall be ensured and read in conjunction with relevant clause of MQP wrt stage inspection:
a	For tensile testing of hooks/ forgings, samples shall be drawn from the full cross section of the shank diameter of hooks/ forgings Samples forged to reduced cross section for testing purposes is not acceptable. Hooks shall be manufactured from Blooms, billets, rounds by forging with forging ratio of at least 3:1. Hooks manufactured from plates are not acceptable.
b	Radiographs shall be inspected to a sensitivity of 2%.
c	Gear boxes shall be checked at No load for backlash, tooth contact, noise, temperature rise and vibration.
d	Acceptance and routine tests (HV and insulation) for all electrical and electro-mechanical components and system as per governing specification.
17.0	**Testing at site**: Completely assembled crane at site shall be check for misalignment of gears, shafts and other items. The test shall be carried out with actual panel, RRC, Master Controller etc. Following minimum tests shall be conducted on the crane at the site
a	Deflection test of bridge girder at rated load. Crane shall rest on centerline of LT wheels.
b	Load test and Overload test
c	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
d	All Other tests as per IS-3177.
e	Speed test at rated load for hoisting, CT and LT mechanism.
f	Brake test.
18	**Services to be provided by the bidder**
a	Packing, forwarding and transportation to site.

b	Development of storage space including ward & watch of the equipment and handling
c	**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:
d	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.
e	**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.
f	Erection and Commissioning
g	Demonstration / Load test at bidder's Works and at site.
h	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.
i	Any service mentioned in GCC & SCC as relevant to the package.

TECHNICAL DATA SHEET A

Sr. No.		DESCRIPTION	TECHNICAL PARTICULARS				
1.0.0		**General**					
1.1.0		**Basic Details**	**For Singrauli Project**			**For Sipat Project**	
	a.	Crane type	EOT	EOT	EOT	EOT	EOT
	b.	Location	BC Bay BFP Handling	CW Pump House	Heavy Material Store	BC Bay BFP Handling	CW Pump House
	c.	Numbers of cranes	2 nos.	1 no.	1 no.	1 no.	1 no.
	d.	Outdoor or indoor duty	Indoor	Indoor	Indoor	Indoor	Indoor
	e.	Rated SWL – tonnes	75T	70T	30T	75T	70T
	f.	Test load SWL – tonnes	125% of SWL (Safe Working Load)				
	g.	Lift	13.3m	18.7 m	8.6m	13.3m	18.7 m
	h.	Span	10.1m	13.4m	13m	10.1m	13.4m
	i.	Mode of operation	Pendant Push Button + Radio Remote Control	Pendant Push Button + Radio Remote Control	Pendant Push Button + Radio Remote Control	Pendant Push Button + Radio Remote Control	Pendant Push Button + Radio Remote
1.2.0	a.	**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 or approved equivalent International Standard (latest edition).				
	b.	**Minimum thickness of Structural members**	a) Load carrying members: 8 mm b) Tubes with both ends sealed: 4.9 mm (6 SWG) c) Tubes with unsealed ends: 8mm d) Chequered plates: 6 mm O/P				
	c.	**MAXIMUM SPAN/DEPTH RATIO FOR GIRDER:**	Plate girders : 18				
1.3.0		**Crane classification**	M5 (Mechanical, Structural and Electrical) as per IS: 3177-2020, IS: 807-2006 and 13834 (part-5)-1993				
2.0		**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'	
	b.	Aux. hoist	Not applicable			Not applicable	
	c.	Trolley travel (CT)	4			0.4 (10% of main speed thru' VVVF drives)	
	d.	Longitudinal bridge travel (LT)	8			0.8 (10% of main speed thru' VVVF drives)	
2.2.0		**Acceleration values for LT motion (bridge travel) and CT motion (trolley travel)**	As per IS: 3177 (2020)				
2.3.0		**Hook Approaches from centreline of rails**					
	a.	Main hook (non DSL side)	As per Crane clearance diagram (Refer Compliance Drawings)				
	b.	Aux. Hook (non DSL side)	Not applicable				
	c.	Main hook (DSL side)	As per Crane clearance diagram (Refer Compliance Drawings)				
	d.	Aux. Hook (DSL side)	As per Crane clearance diagram (Refer Compliance Drawings)				
2.4.0		**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		**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.	Stress consideration	Following to be consider as per IS 807: Static load (dead load), loads due to working load multiplied by dynamic coefficient, two most unfavourable horizontal effects excluding buffer forces.All these loads must then be multiplied by amplifying coefficient.				

	c.	Maximum Limit for Vertical Deflection	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.	
	d.	Type of connection to end carriage	By fitted bolts.	
3.2.0		**Type of platform required on the bridge**	Chequered plate platform 6mm thick over plain as per IS : 3502	
	a.	Length	Full span length	
	b.	Walkways	Access walkways of not less than 800 mm (clear) with hand railing of height of 1100 mm along the both side of bridge girder and cross over walkways.	
	c.	Type of access from gantry girder level to crane bridge	Rung ladder at ends from gantry girder level walkway to crane bridges walkway	
	d	Type of access to maintenance cage from crane bridges walkway	Rung ladder	
	e	Type of access to Cabin from crane bridges walkway	NOT APPLICABLE	
	f	Provided at both ends	Yes	
3.3.0		**End carriage span (wheel base)**	As per IS 807 (latest edition)	
3.4.0		**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.	
			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, grade 'B' of IS 2062 in 100% killed, normalised and ultrasonically tested quality.	
	d.	Other requirements	Upper pulley block shall be approachable for maintenance.	
	e.	Whether jacking pads for lifting trolley provided or not	Yes	
3.5.0		**Rope drums**	**Main hoist**	**Aux hoist (if applicable)**
	a.	Material (Indicate IS)	Seamless pipe ASTM A -106 Gr. B or fabricated rolled section to IS: 2062 Gr. 'B' & stress relieved, 100% killed, normalised and ultrasonically tested quality.	
	b.	Flange / flangeless	Flanged	
	c.	Numbers provided	One for each hoist	
	d.	Type of grooves	Identical Right hand and Left hand & other details shall be as per IS 3177:2020	
3.6.0		**Rope details**	**Main hoist**	**Aux hoist (if applicable)**
	a.	Construction	Extra flexible plough steel , 6 x 36 or 6x37 construction	
	b.	Standard conforming to	IS: 2266 (latest edition)	
	c.	Factor of safety	As per IS-3177 : 2020	
	d.	Type of core	Steel	Steel
3.7.0		**Sheaves details**	**Main hoist**	**Aux hoist (if applicable)**
	a.	Material	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.	
3.8.0		**COUPLINGS & SHAFTING**		
3.8.1		**Coupling details (between motor and gear box)**	**for Main hoist, Aux hoist (if applicable), Cross Travel and Long Travel**	
	a.	Type	Flexible shock absorbing coupling	
	b.	Guards and enclosures	Provided	
	c.	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	
3.8.2		**Coupling details (between gear box and wheels)**	**Cross Travel (CT)**	**Long Travel (LT)**
	a.	Type	Flexible geared type	
	b.	Guards and enclosures provided	Yes	
3.8.3		**Coupling details (between gear box and rope drum)**	**Main hoist**	**Aux hoist (if applicable)**

	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.	Guards and enclosures provided	Yes	
3.8.4		**Shafting (Output)**	**Cross Travel**	**Long Travel**
	a.	Factor of Safety	As per IS: 3177-2020	
	b.	Arrangement of lubrication	Grease cups / Nipple	
	c.	Type of lubricant	Grease	
3.9.0		**Gear box details**		
3.9.1		**Hoist Motions**	**Main hoist and Main hoist Micro**	**Aux hoist and Aux hoist**
	a.	Type of mounting of gear box	Horizontal / Vertical	
	b.	Classification	Suitable for M5 duty	
	c.	Type of gears	For Main hoist and Aux hoist: Helical / Spur For Main hoist Micro and Aux hoist Micro: Through VVVF Drives	
	d.	Type of lubrication (grease / splash / pump lubrication)	Splash Lubrication	
	e.	Hardness (BHN) – gear	220 BHN (minimum)	
	f.	Hardness (BHN) – pinion	270 BHN (minimum)	
	g.	Difference in Gear and pinion hardness	Min 20 BHN	
	h.	Materials (gear/pinions)	Main Gears En 9/ 55C8/ IS2707. Pinions En 19/EN 24. Hardness conforming to IS: 3177-2020 Gears to be hardened, tempered & heat treated as per IS 4460	
	i.	Casings	Material of the gear box housing shall be cast or fabricated. The fabricated gear boxes shall be stress relieved before machining.	
	j.	Noise level	85 db	
	k.	Standard conforming to	IS: 4460 / AGMA	
3.9.2		**Travel Motions**	**Cross Travel and Cross Travel Micro**	**Long travel and Long travel Micro**
	a.	Type of mounting gear box	Vertical/ Horizontal	
	b.	Classification	M5 duty	
	c.	Type of gears	For Cross Travel and Long Travel: Helical / Spur For Cross Travel Micro and Long Travel Micro: Through VVVF drive	
	d.	Type of lubrication (grease / splash / pump lubrication)	Splash Lubrication	
	e.	Hardness (BHN) – gear	220 BHN (minimum)	
	f.	Hardness (BHN) – pinion	270 BHN (minimum)	
	g.	Difference in Gear and pinion hardness	Min 20 BHN	
	h.	Materials (gear / pinions)	Main Gears En 9/ 55C8/ IS 2707 Gr. 1or 2. Pinions En 19/EN 24. Hardness conforming to IS: 3177-2020 Gears to be hardened, tempered & heat treated as per IS 4460	
	i.	Casings	Material of the gear box housing shall be cast or fabricated. The fabricated gear boxes shall be stress relieved before machining.	
	j.	Noise level	85 db	
	k.	Standard conforming to	IS: 4460 / AGMA	
3.10.0		**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.	
	b.	Hardness	300 – 350 BHN	
	c.	Depth of hardness	10 mm (min)	
	d.	Process of hardening	Volume hardening	
	e.	Type	Double flanged	
	f.	Min.Numbers provided	4 nos.	8 nos.
	g.	Specification conforming to	IS: 3177-2020	
	h.	Arrangement of lubrication	Grease	
3.11.0		**Lifting hooks**	**Main hoist**	**Aux hoist (if applicable)**
	a.	Type	For 50T and above: Ramshorn type conforming to IS:5749 For less than 50T: shank type conforming to IS:15560	
	b.	Safe lifting capacity	As per SWL capacity of Crane	
	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	
3.12.0		**Buffers**	**Cross Travel**	**Long Travel**
	a.	Type	Spring loaded type. To be designed to bring the loaded crane (In calculation crane is considered to be loaded with SWL) to rest from speed of 50% of the rated speed.	
	b.	Numbers provided	4	4
	c.	Details of end stop	Mild steel, grade 'B' of IS 2062 (E250) in 100% killed, normalised and ultrasonically tested quality.	
3.13.0		**Brakes**		
3.13.1		**Hoist Motions**	**Main hoist**	**Aux hoist (if applicable)**
	a.	Type of brake	AC Electro-Hydraulic Thruster operated + DCEM	
	b.	Number provided per motor	1+1	1+1
	c.	Braking capacity of each (% of torque transmitted to the brake drum with full load.)	150%	150%
	d.	Material		
		· Brake liners	Ferrodo liners	
		· Drum	CS IS : 1030 / CL 4 IS : 1875	
		· Springs	As per manufacturers standard	
3.13.2		**Travel Motions**	**Cross Travel**	**Long Travel**
	a.	Type of brake (ac / dc / thrustor)	AC Electro-Hydraulic Thruster operated + DCEM	
	b.	Number provided per motor	1+1	1+1
	c.	Braking capacity of each (% of motor rated torque before derating)	125%	125%
	d.	Material		
		· Brake liners	Ferrodo liners	
		· Drum	CS IS : 1030 / CL 4 IS : 1875	
		· Springs	As per manufacturers standard	
3.14.0		**Motors**		
	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. 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 IS 3177 and motor subsection of this specification.	
	b.	Design Codes & Standards	1.Three phase induction motors : IS15999, IEC:60034, IS: 12615, IS: 325 2.Single phase AC motors : IS:996, IEC:60034 3.Energy Efficient motors : IS 12615, IEC:60034-30 4.Crane duty motors : IS:3177, IS/IEC:60034 5.Designation of Methods of Cooling of Rotating Electrical Machines: IS 6362 6.Designation for types of construction and mounting arrangement of rotating electrical machines: IS 2253	
	c	Enclosure	TEFC	
	d	Numbers furnished	For Main hoist: 1 no.	
			For Aux hoist: Not applicable	
			For Cross travel: As per bidder's design.	
			For Long travel: 2 nos minimum.	
	e.	Voltage, phase and frequency	415V ± 10%, 3 Ph., 4 wire, 50 Hz, +3/-5 % Combined voltage & frequency variation = 10% absolute	
	f	Class of protection for motor including terminal box	IP – 55	
	g	Rated capacity (KW)	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.	
	h.	Duration factor/duty	40 % CDF / S-4	

	i.	Bearings (Motors)	Grease lubricated ball or roller bearings for Horizontal motors Grease lubricated ball or roller bearings or combined trust and guide beaing for Vertical motors. These motors shall be provided with insulated bearing on at least one side for motor frame size above 250 frame. However, supplier's proven practice with respect to use of insulated bearing in VFD driven motor may be accepted subject to End customer's approval.
	j	Class of insulation	Temp rise 70 deg. C by resistance method for both thermal class 130(B) & 155(F) insulation
	k	Number of starts/ hour	Starts / hr as per IS 3177-2020
	l	Overload protection for motors provided	Yes
	m	Space heater requirements	For motors of rating 30 KW and above. Separate terminal box for space heaters & RTDs shall be provided.
	n	Motor pull out torque	275% of full load torque
	o	Terminal box of motor	-Motor terminal box shall be detachable type and located in accordance with Indian Standards clearing the motor base- plate/ foundation. DOP of terminal box shall be same as motor.
			-Terminals shall be stud or lead wire type, substantially constructed and thoroughly insulated.
			The terminals shall be clearly identified by phase markings, with corresponding direction of rotation marked on the non-driving end of the motor.
			- Rotation at 90 deg
	p	Cable glands and lugs	-Motor terminal box shall be furnished with suitable cable lugs and double compression brass glands to match with cable used.
			-Gland plates of thickness 3 mm (hot/cold rolled sheet steel) or 4 mm (non magnetic material for single core cables) shall be provided in case of cable boxes.
	q	Earthing points suitable for conenction	Motor body shall be grounded at two earthing points on opposite sides with two separate and distinct grounding pads complete with tapped holes, GI bolts and washers. LT Motors above 125 KW --- 50 x 6mm GS flat 25 KW to 125 KW --- 25 x 6mm GS flat 1KW to 25 KW --- 25 x 3mm GS flat.
	r	Minimum spacing between gland plate & centre of bottom terminal stud	UP to 3 KW As per manufacturer's practice. Above 3 KW - upto 7 KW 85 mm Above 7 KW - upto 13 KW 115 mm Above 13 KW - upto 24 KW 167 mm Above 24 KW - upto 37 KW 196 mm Above 37 KW - upto 55 KW 249 mm Above 55 KW - upto 90 KW 277 mm Above 90 KW - upto 125 KW 331 mm Above 125 KW-upto 200 KW 385/203 (For Single core cables only) mm
	s	Minimum inter-phase and phase-earth air clearances with lugs installed	UP to 110 KW 10mm Above 110 KW and upto 150 KW 12.5mm Above 150 KW 19mm
	t	Inspection Testing (for motor)	
	t.1	List of Test for which reports have to be submitted. 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.	
	t.2	The type test listed above should have been conducted within 10 yrs prior to supply under this contract. 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.	
	t.3	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.	

	t.4	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.	
	q	Other requirement	
	q.1	Squirrel cage Induction motor with VPI insulation shall be provided With VVVF system. Motor shall be energy efficient as per IS:12615, IEC 60034 and shall be Crane duty as per IS:3177. Winding & insulation shall be Electrolytic grade Copper conductor, Non-hygroscopic, oil resistant, flame resistant Insulation. Vibration shall be limited within the limits IS:12075.	
	q.2	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. Permissible starting voltage for motor shall be as follows:Up to 85% of rated voltage for ratings below 110 KW & upto 80% of rated voltage for ratings from 110 kW to 200 kW. Starting Duty : Two hot starts, with motor initially at normal running temperature Maximum Locked Rotor Current : as per IS 12615	
	q.3	The ratio of locked rotor KVA at rated voltage to rated KW shall not exceed 11 for motors above 50 KW upto 110 KW	
	q.4	Starting Time: a) 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. b) 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. c) 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. d) Speed switches mounted on the motor shaft shall be provided in cases where above requirements are not met.	
	q.5	PAINT SHADE FOR MOTOR (CORROSSION PROOF PAINTS OF COLOUR SHADE): - RAL 5012 (Blue). 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. minimum paint thickness of 50 microns shall be acceptable for finish coat. Epoxy based paint with suitable additives shall be used.	
3.15.3		**Storm brake**	Not applicable
3.16.0		**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)	Creep speed through VVVF drive.
3.17.0		**Bearings (for crane hook, Trolley wheels, rope drum, gear box or 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	not less than 10,000 working hours
3.18.0		**Rails**	
	a.	Type / section	Rails sections as per IS: 3443. Joint to be butt-welded by thermit welding or fusion welding.
3.19.0		**Power conductors (DSL) & Cables**	
	a.	Design Criteria	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 at extreme positions. DSL shall be sized with a margin of 10% overload requirement.
	b.	Type	LT: PVC shrouded Cu/Al conductor bus bar. CT: EPR insulated, copper conductor trailing cables, as per IS: 9968, on the bridge/ energy chain trailing system
	c.	LT POWER CABLES	All LT power cables of sizes more than 120 sq.mm. shall be XLPE insulated, and sizes shall be of 1Cx150, 1Cx300, 1Cx630, 3Cx150, 3Cx185, 3Cx240 & 3Cx300 Sq.mm. However for cable sizes upto 120 sq.mm. both XLPE insulated & PVC insulated LT power cables are acceptable.

	c.1	1.1 KV grade XLPE power cables	1.1 KV grade XLPE power cables shall have multi stranded compacted aluminum conductor (tensile strength of more than 100 N/ sq.mm), XLPE insulated, PVC inner-sheathed (black color as per IS:5831), Armoured (For single core Armoured cables, armoring shall be of aluminum wires H4 grade. For multicore Armoured cables armouring shall be of galvanized steel round wire/strip), PVC FRLS outer-sheathed (black colour) conforming to IS: 7098. (Part-I).
	c.2	1.1KV grade PVC power cables	1.1KV grade PVC power cables shall have multi stranded aluminum conductor (compacted type for sizes above 10 sq.mm), PVC Insulated, PVC inner sheathed ((black color as per IS:5831)) Armoured (For single core Armoured cables, armoring shall be of aluminum wires H4 grade. For multicore Armoured cables armouring shall be of galvanized steel round wire/strip), PVC FRLS outer-sheathed (black colour) conforming to IS:1554 (Part-I).
	c.3	LT Control Cables	LT Control Cables are Cu conductor 1.5 sq mm, PVC insulated, PVC inner sheath, GS wire/strip armoured and FRLS PVC outer sheath confirming to IS 1554 Part-1. Standard control cable sizes shall preferably be 3CX1.5, 5CX1.5, 7CX1.5 & 10CX1.5mm2, 14CX1.5 mm2.
	c.4	1.1 kV grade trailing cables	1.1 kV grade trailing cables shall have tinned copper (class 5) conductor, insulated with heat resistant elastomeric compound based on Ethylene Propylene Rubber (EPR) suitable for withstanding 90 deg.C continuous conductor temperature and 250deg C during short circuit, inner sheathed with heat resistant elastomeric compound, nylon cord reinforced, outer-sheathed with heat resistant, oil resistant and flame retardant heavy duty elastomeric compound conforming to IS 9968.
	d.	Size	Cables shall be sized based on the following considerations: a) Rated current of the equipment b) Short circuit withstand capability c) Derating factors for various conditions of installations (variation in ambient temperature, grouping of cables).
	e.	Guard provided for DSL	Yes
3.19.1		**CABLE TRAYS**	Cable trays shall be ladder/perforated type complete with matching fittings (like brackets, elbows, bends, reducers, tees, crosses, etc.) accessories (like side coupler plates, etc. and hardware (like bolts, nuts, washers, G.I. strap, hook etc.) as required. Cable tray shall be ladder type for power & control cables and perforated for instrumentation cables. Cable trays, fittings and accessories shall be fabricated out of rolled mild steel sheets free from flaws such as laminations, rolling marks, pitting etc. These (including hardware) shall be hot dip galvanized. Cable trays shall have standard width of 150 mm, 300 mm & 600 mm and standard lengths of 2.5 metre. Thickness of mild steel sheets used for fabrication of cable trays and fittings shall be 2 mm. The thickness of side coupler plates shall be 3 mm. Cable troughs shall be required for branching out few cables from main cable route. These shall be U-shaped, fabricated of mild steel sheets of thickness 2 mm and shall be hot dip galvanised. Troughs shall be standard width of 50mm & 75 mm with depth of 25 mm. The tolerance for cable tray and accessories shall be as per IS 2102 (Part-1). Tolerance Class: - Coarse
3.19.2		**SUPPORT SYSTEM FOR CABLE TRAYS**	Cable supporting steel work for cable racks/cables shall comprise of various channel sections, cantilever arms, various brackets, clamps, floor plates, all hardwares such as lock washers, hexagon nuts, hexagon head bolt, support hooks, stud nuts, hexagon head screw, channel nut, channel nut with springs, fixing studs, etc. All steel components, accessories, fittings and hardware shall be hot dip galvanized. Cable tray support system shall be pre-fabricated out of single sheet. Support system for cable trays shall essentially comprise of the two components i.e. main support channel and cantilever arms. The main support channel shall be of two types : (i) C1:- having provision of supporting cable trays on one side and (ii) C2:-having provision of supporting cable trays on both sides. The main support channel and cantilever arms shall be fabricated out of 2.5 thick rolled steel sheet conforming to IS 1079. Cantilever arms of 320 mm, 620mm and 750 mm in length are required.

3.20.0		**Operators cabin**	Not applicable.
	a.	Type of construction	
	b.	Area and minimum clear height	
	c.	Operator's seat	
	d.	Warning gong	
	e.	Alarm	
	f	Position of controllers	
	g	Ventilation	
3.21.0		**Limit switches**	
	a.	Type	For Main hoist: Rotary gear + Gravity
			For Aux hoist: Not applicable
			For Cross Travel: Lever type (one way/ two way)
			For Long travel: Lever type (one way/ two way)
	b.	Number provided	For Main hoist: 1+1
			For Aux hoist: Not applicable
			For Cross Travel: 2/1
			For Long travel: 2
	c.	Material of contacts	Double break Silver Cadmium
	d.	Control voltage / Enclosure	110 V/ IP 55
3.22.0		**Isolating switch**	
	a.	Main isolating cum changeover switch (01 no.), mushroom type emergency STOP push buttons : At center of bay length(to be decided during detail engineering).	
	b.	BHEL will provide one number 415 V AC (3 PHASE 4 WIRE) supply feeder only up to isolating switch for each crane. Any other voltage level (AC/DC) required will be derived by the vendor.	
	c.	Motor starter shall be part of crane control panel.	
3.23.0		**Protective Panel**	Shall be Provided with isolating switch, power contactor control and indication to switch ON/OFF power to starter panels, control and lighting transformer.
	a.	Material	Cold Rolled Sheet steel 2 mm size,3mm for Gland Plates (CRCA/HR),1.6mm: Doors, covers etc
	b.	Numbers and location	One number
	c.	DOP	IP 54
3.24.0		**Control panel**	
	a.	Material	Cold Rolled 2 mm size,3mm for Gland Plates (CRCA/HR),1.6mm: Doors, covers etc: sheet steel 2mm size
	b.	Numbers and location	One each for Main hoist, Aux hoist (if applicable), Cross travel and Long travel located on bridge platform with space heaters.
	c.	Degree of protection	IP 54
3.25.0		**Master Controllers (Desk Type)**	Not applicable
	a.	Number of steps	
	b.	Voltage & current rating	
	c.	Type	
	d.	Location	
3.26.0		**Control for Hoists /Cross travel/Long travel operations**	Through Variable Voltage Variable frequency drive
	a.	Speed control	Thru' VVVF with minimum 6 pulse design
	b.	Starting torque of VVVF	Up to 400 % typical with/ without encoder
	c.	Starting current	Less than 150 % of rated torque.
	d.	Temperature	VVVF system shall be capable of withstanding up to 50 degree C without derating.
	e	Other requirements for VFD	Necessary input & output devices to be provided to reduce harmonics, as per IEEE519, at supply side of the drive at the switchgear.
	f	Other requirements for 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 frontend harmonic filter. For drives less than 100 KW Six (6) pulse can be offered meeting all other requirements.

	g	Other requirements for VFD	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.
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**	Purchaser 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		**Cable glands**	Cable shall be terminated using double compression type cable glands. 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 glands shall be suitable for the sizes of cable supplied/erected.
3.30.0		**Lugs**	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
3.31.0		**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
3.32.0		**Illumination**	
	a.	In cabin	Not applicable.
	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. 150 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 compon-ents.
3.33.0		**Fire Extinguisher**	
	a.	Type and size	4.5 kg CO2 type
	b.	Location	One no. on bridge per Crane
3.34.0		**Maintenance cage**	Suitable inspection cages to accommodate two persons to facilitate inspection of down shop lead.
3.35.0		**Mechanical overload protection (Load Cell with digital display)**	To be provided for hoist mode. Digital display of load should be clearly visible from operation floor.
3.36.0		**RRC details**	
	a.	RRC should be supplied with transmitter unit, receiver unit, encoder unit, decoder unit, interface panel, coupling system, battery unit and any other control gear if required.	
	b.	The equipment should be based upon the microprocessor based digital technology with almost nil hard wiring.	
	c.	The remote unit should communicate up to the distance of approximately 100 meters.	
	d.	The system has to integrate with the control system of crane, which operates at 110 V AC, Single phase.	
	e.	The remote unit should have transmitter which can be mounted on shoulder by suitable belt. Main controls can be of single joystick movement or double joystick movement type stepped control with spring return. The Micro control should be toggle switch type or push control type.	
	f.	Frequency allotment for radio remote unit from Govt. of India, Dept. of Telecommunication or any other agency shall be the responsibility of supplier.	
	g.	The transmitter and receiver unit should have its own frequency and address code with each system having its own security code so that one particular set becomes unique and there is no interference from any other remote unit device. A microprocessor should check all security codes. The processor should have its own watchdog circuit. The receiver FM band should be sufficiently narrow to allow only passing of desired frequency and valid command. Any error should shut down the system immediately.	
	h.	The remote unit should have safety key to prevent any unauthorized operation. All the crane operations should stop at once the communication breakdown occurs.	
	i.	On local unit (receiver side), the system should be provided with one selector switch so that EOT crane can be operated either from pendent push button or radio remote unit.	

	k.	The receiver unit along with I/O interface unit should be able to bear the vibrations and shocks encountered in normal usage of EOT crane.	
	l.	The system should have very fast response time.	
3.37.0		**Pendent Push buttons station**	Movable and retractable type. Emergency stop, start, lights, main and creep speed for up & down, forward & reverse for Cross travel and long travel, alarm, selector switch (for mode of operation), glow type push buttons to be provided. Indicative marking for easy operation shall be provided. 1.Suitable for IP 55 protection 2.Ambient temp (-25 to 60 deg C) 3.Pendant cable shall be multicore EPR flexible. 4.PVC coated steel wire rope for pendant shall be 2 mm.
3.38.0		**Sweep**	Sweep shall be attached to the end carriages and to the trolley to remove foreign materials from the rails.
3.39.0		**Whether tandem operation envisaged**	No
3.40.0		**Lifting Beam & its capacity**	Not applicable
3.41.0		**Anti Collision device**	Not applicable
3.42.0		**Lubrication**	
	a.	Provisions shall be made for proper lubrication of all parts.	
	b.	Bearings shall be provided with means of pressure lubrication.	
	c	The crane shall be provided with all necessary lubrication fittings.	
	d	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.	
	e	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. .	
	f	Metering valves with indicators shall be provided for all points of grease application and shall be mounted at readily visible and accessible locations.	
	g	All piping shall be made of suitable metal tubing with flexible hoses where required.	
3.43.0		**DSL phase indicating lamps**	To be provided on both end of bay length.
3.44.0		**Consumables**	Consumables such as oils, lubricants including grease, servo fluids, gases and essential chemicals etc. till one year after commissioning. 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.
3.45.0		**E-Learning Package**	**(Applicable for BC Bay BFP handlng crane only)**
	a.	The courses shall be web based and mobile based Application type. It shall run on all possible versions of web browser like Internet Explorer, Google Chrome, Firefox etc. on Laptop/Desktop and shall be Smartphone/Tablet/ Mobile responsive. The Mobile responsive courses shall run on Android, Windows Mobile, Blackberry, iOS etc.	
	b.	The courses shall support liquid/fluid page layout so that the entire screen gets adjusted to PC, Laptop, Smartphone/ Mobile, Tablet and any other display devices.	
	c	Course content text shall be in English language and be associated with a voiceover in English language with Indian accent.	
	d	Courses shall be SCORM (Sharable Content Object Reference Model) compliant, version 1.2 which is compatible with LMS at PMI.	
	e	Each course shall have every physical and functional detail of the equipment / system supplied.	
	f	Each of the e-Learning course shall be based on multiple web pages and mobile pages with multiple modules.	
	g	There shall be option for self-assessment test after every course. In case the user doesn't opt for self-assessment test the user shall be able to go to the next course. There shall be no restriction in no. of times for repeating the assessments. All correct answers along with the answers marked by the users shall be displayed at the end of test/ quiz.	
	h.	If Java and Flash, as applicable are not available in the system to run the package, then there shall be a prompt message for updation of the same.	
	i.	Each course shall have a self-running interactive content with navigation buttons containing forward, backward, pause, bookmark and menu options in the course window.	
	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/3600 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.	
	r	e-learning Package of an equipment / system shall include e-learning courses for each of erection, commissioning, operation and maintenance of that equipment / system.	
	s	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.	
	t	The vendor shall get the approval of one sample course from EIC before proceeding for further courses.	
3.46.00		**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.
3.47.00		**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.
	Note:-		
1	Material of all Structural steel plates and rolled section shall be Mild steel, grade 'B' of IS 2062 in 100% killed,normalised and ultrasonically tested quality or high strength steel of IS 8500 as appropriate.		
2	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.		
3	Trolley stops of spring type to be mounted independently on bridge rails to prevent trolley from running off.		
4	Buffers to be designed to bring the loaded crane to rest from a speed of 50% of the rated speed.		
5	Suitable guard to push forward or off the rail track any object placed across to be provided. Suitable guards to live electrical wirings downshop lead.		
6	Necessary access ladders shall be provided for access on to crane bridge platform from the gantry girder level, from crane bridge platform to trolley platform and from operating floor of pump to gantry girder level.		
7	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.		
8	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.		

TECHNICAL DATA SHEET B

(SUCCESSFUL BIDDER TO FILL AFTER PLACEMENT OF ORDER)

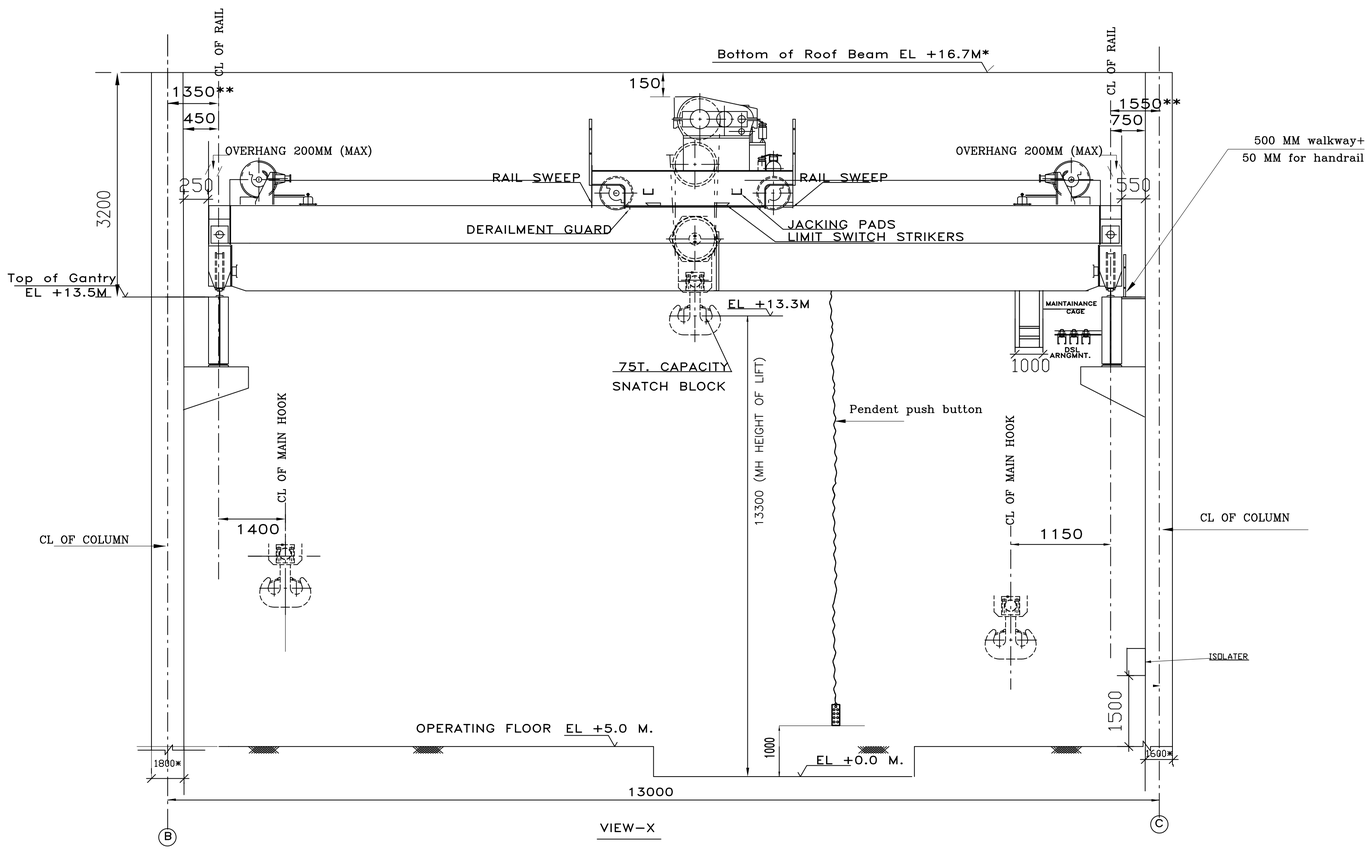
Sr. No.		DESCRIPTION	TECHNICAL PARTICULARS	
1.0.0		**COMPONENT DETAILS**		
		Bridge girder		
	a.	Size		
	b.	Width		
	c.	Length		
2.0.0		**Trolley**		
	a.	Centre to centre distance of wheels (on the same rails)		
3.0.0		**Rope drums**	**Main hoist**	**Aux hoist (if applicable)**
	a.	Dimensions in mm length and diameter (PCD)		
	b.	Number of grooves		
	c.	Diameter on bottom of grooves		
4.0.0		**Rope details**	**Main hoist**	**Aux hoist (if applicable)**
	a.	Grade		
	b.	Diameter in mm		
	c.	Breaking strength		
	d.	Tensile designation		
	e.	Number of falls		
	f	Length of rope		
3.4.0		**Sheaves details**	**Main hoist**	**Aux hoist (if applicable)**
	a.	Diameter of main sheaves in mm on Root		
	b.	Diameter of Equalizing sheaves (in mm) on Root		
3.5.0		**COUPLINGS & SHAFTING**		
3.5.1		**Coupling details (between motor and gear box)**	**(for Main hoist, Aux hoist (if applicable), Cross Travel and long travel)**	
	a.	Size & Torque rating		
3.5.2		**Coupling details (between gear box and wheels)**	**Cross Travel (CT)**	**Long Travel (LT)**
	a.	Size & Torque rating		
3.5.3		**Coupling details (between gear box and rope drum)**	**Main hoist**	**Aux hoist (if applicable)**
	a.	Size		
3.5.4		**Shafting (Output)**	**Cross Travel**	**Long Travel**
	a.	Diameter in mm		
	b.	Number of support bearings		
	c.	Type of support bearing		
	d.	Max unsupported length of shaft in mm		
3.6.0		**Gear box details**		
3.6.1		**Hoist Motions**	**MH and MH Micro**	**AH and AH Micro (if applicable)**
	a.	Total number of reductions		
	b.	Type of gears for MH and AH		
	c.	Reduction ratio		
	d.	Hardness (BHN) – gear		
	e.	Hardness (BHN) – pinion		
	f.	Difference in Gear and pinion hardness		
	g.	Materials (gear/pinions)		
3.6.2		**Travel Motions**	**CT and CT Micro**	**LT and LT Micro**
	a.	Total number of reduction		

	b.	Type of gears		
	c.	Reduction ratio		
	d.	Hardness (BHN) – gear		
	e.	Hardness (BHN) – pinion		
	f.	Difference in Gear and pinion hardness		
	g.	Materials (gear / pinions)		
3.7.0		**Wheels details**	**Cross Travel**	**Long Travel**
	a.	Material		
	b.	Hardness		
	c.	Depth of hardness		
	d.	Tread diameter in mm		
	e.	Tread width in mm		
	f.	Numbers provided		
3.8.0		**Lifting hooks**	**Main hoist**	**Aux hoist (if applicable)**
	a.	Material		
3.9.0		**Brakes**		
3.9.1		**Hoist Motions**	**Main hoist**	**Aux hoist (if applicable)**
	a.	Diameter of brake in mm		
	b.	Torque rating Kg. M		
	c.	Braking torque actually required		
	d.	Braking distance in mm		
	e.	Thruster material		
3.9.2		**Travel Motions**	**Cross Travel**	**Long Travel**
	a	Dia of brake in mm		
	b.	Torque rating KgM		
	c.	Braking torque actually required		
	d.	Thruster material		
	e.	Braking distance in mm		
3.10.0		**Rails**	**Cross Travel**	**Long Travel**
	a.	Weight per metre		
	b.	Top width in mm		
	c.	Height in mm		
3.11.0		**Motors**		
	a.	rating	For Main hoist: For aux hoist (if applicable): For Cross travel: For long travel:	
	b.	Speed (rpm)		
	c.	Contactors for motor		
	d.	Spacing between gland plate & centre of bottom terminal stud		
	e.	Minimum inter-phase and phase-earth air clearances with lugs installed		
	f.	Space heater requirements details		
	g.	Overload protection details		
3.12.0		**Limit switches**		
	a.	Rating of contacts		
3.13.0		**Protective Panel**		
	a.	Dimension		
3.14.0		**Control panel for MH, AH (if applicable), CT and LT**		
	a.	Dimension		

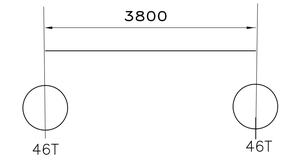
3.15.0		**Slings, suitable for load & overload test of EOT Crane (to be supplied alongwith load test certificate for joint at 2 X rated capacity)**	
	a	Length	
	b.	Size	

COMPLIANCE DRAWINGS

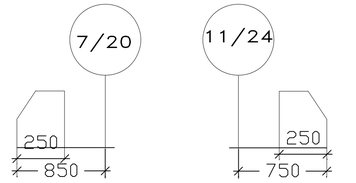
COMPUTER FILE NAME : TAL5



WEIGHT OF SINGLE HEAVIEST ASSEMBLED COMPONENT	65T
CRANE CAPACITY AFTER 10% MARGIN AS PER CONTRACT REQUIREMENT ON HEAVIEST WEIGHT	71.5T
CRANE CAPACITY CONSIDERED	75T (ONE NO. FOR EACH UNIT)



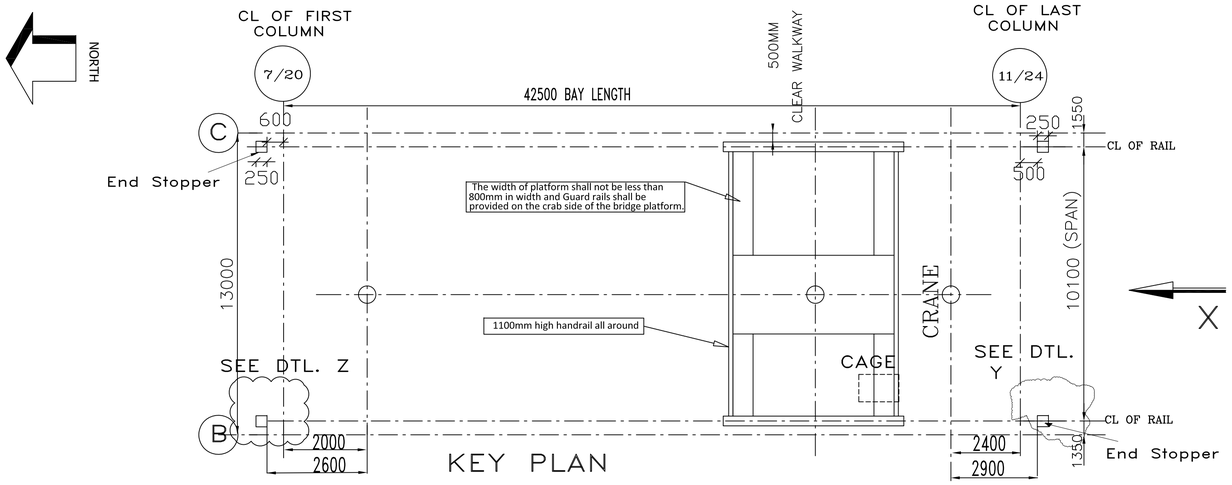
TENTATIVE LT WHEEL LOAD
WITHOUT IMPACT



DETAIL 'Z' DETAIL 'Y'

NOTES:

1) DRAWING IS NOT TO THE SCALE.
2) ALL DIMENSIONS ARE IN MM & ELEVATIONS IN METRES.
3) EL 0.00 CORRESPONDS TO RL +209.500 (FINISHED FLOOR LEVEL IN TG BUILDING)
4) DESIGN CODE FOR EOT CRANE SHALL BE IS3177:2020.



NO. OF CRANES: 2

NTPC DRG NO	
OWNER	NTPC LTD
CONTRACT	2X800 MW SINGRAULI STPP STAGE III EPC

PRINT SCALE 0 2 4 6 8 10 20 30 40 50

BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NEW DELHI

DEPT CODE		NAME	SIGN	DATE
	DRN	RG		07.05.25
	DESN	RG		07.05.25
	CHD	PK		07.05.25
	APPD	PK		07.05.25

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

SUB-CONTRACTOR

TITLE

CRANE CLEARANCE DIAGRAM OF BFP HANDLING EOT CRANE

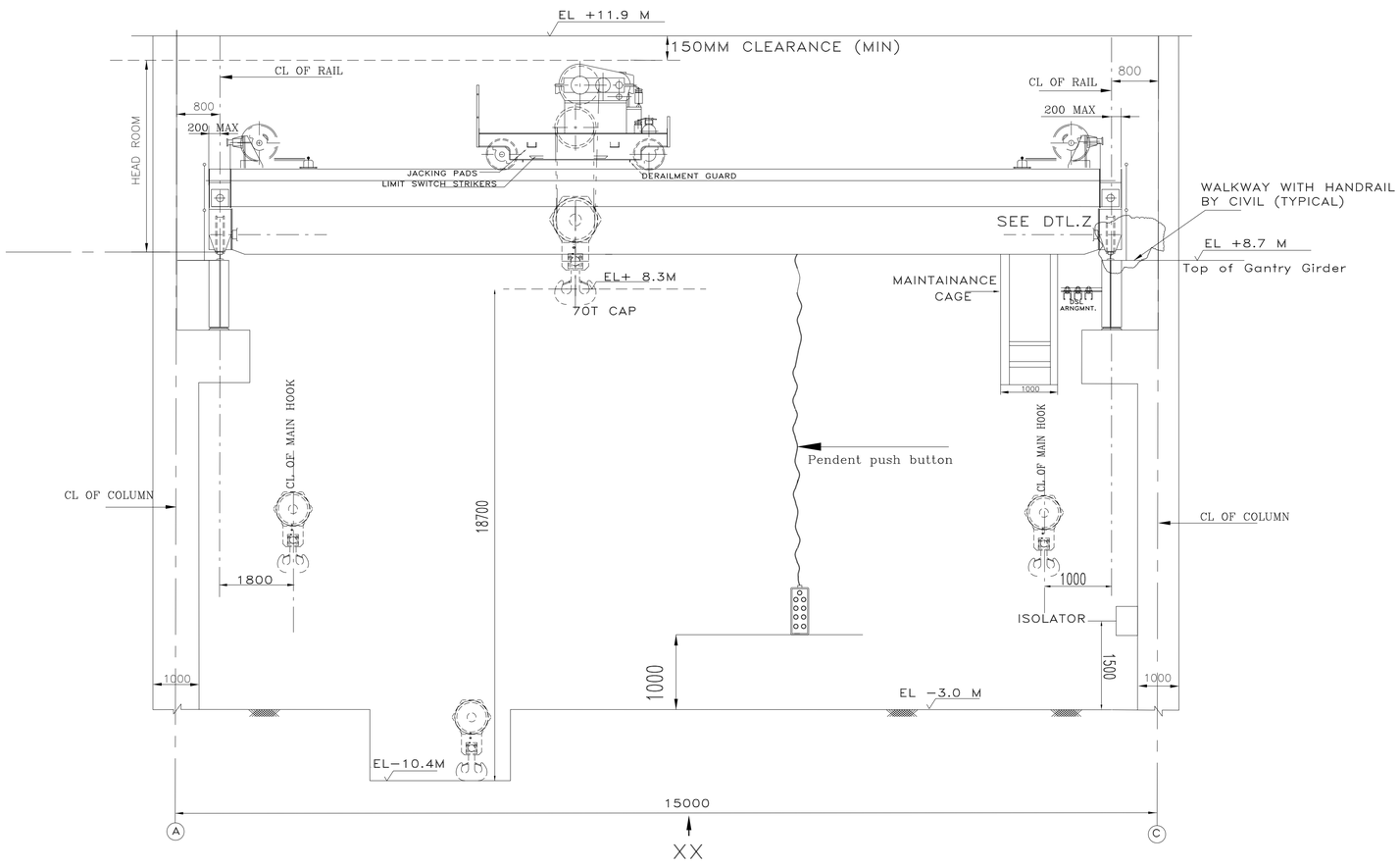
DEPT. SCALE
SIGN
DATE

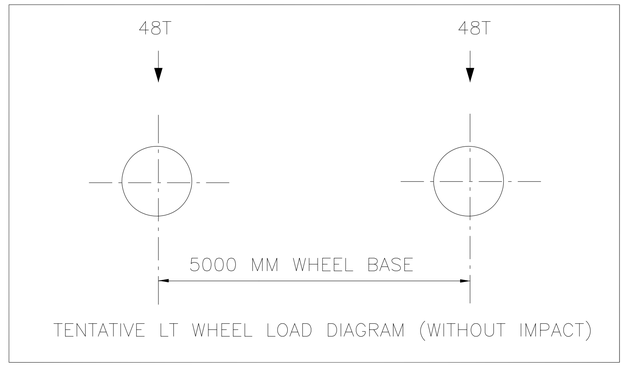
BHEL DRG NO : PE-DG-512-501-A001

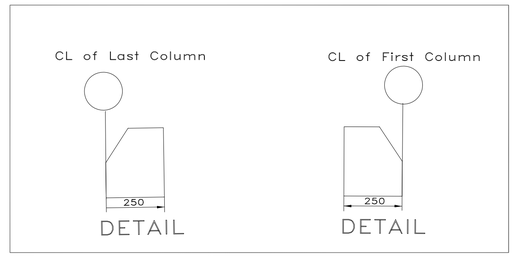
SHEET 1 OF 1 REV 0

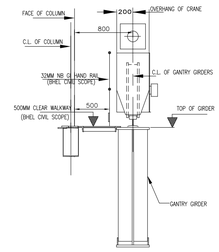
SIZE-A2

THIS IS PART OF TECHNICAL SPECIFICATION PE-TS-512/520-501-A001 REV 0

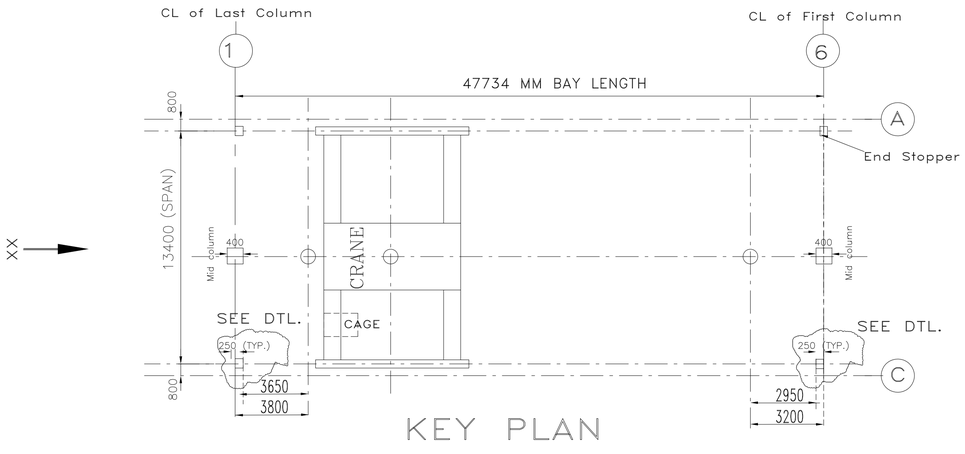








DETAIL 'Z'



KEY PLAN

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.
6) QTY OF CRANE: 1

REFERENCE DRAWING:−

1. MECHANICAL GA OF CW WATER PUMP HOUSE: 1150−001−133−PVM−B−046

THIS IS PART OF TECHNICAL SPECIFICATION PE-TS-512/520-501-A001 REV 0

REV.	DATE	ALTD	CHD	APPD	DESCRIPTION
A	08.11.2022	RG	VKH	PK	REVISED AS PER NTPC COMMENTS.

ELECTRONIC FILE NAME :

ग्राहक ड्राइंग संख्या/ CUSTOMER DRAWING NO.

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

जॉब संख्या/ JOB NO.

स्थिति/ STATUS: CONTRACT

मुद्रण स्केल मीटर में/ PRINT SCALE IN METRE: 0.5 0.0 0.5 1.0 1.5 2.0

परियोजना/ PROJECT: 2X800 MW SINGRAULI STPP STAGE III EPC

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

	नाम NAME	हस्ताक्षर SIGNATURE	दिनांक DATE
तैयारकर्ता/DSN	RG		19.08.2023
डिजाइनकर्ता/DESN	RG		19.08.2023
जांचकर्ता/CHD	VKH		19.08.2023
अनुमोदनकर्ता/APPD	PK		19.08.2023

शीर्षक/TITLE: CRANE CLEARANCE DIAGRAM OF 70T CWPH EOT CRANE

एमपीएल MPL	सिविल CIVIL	इलेक्ट्रिकल ELEC	सी&आई C&I	एमएसई MSE	मैक्स MAX

विभाग DEPT. | स्केल SCALE – NTS | हस्ताक्षर SIGN | दिनांक DATE

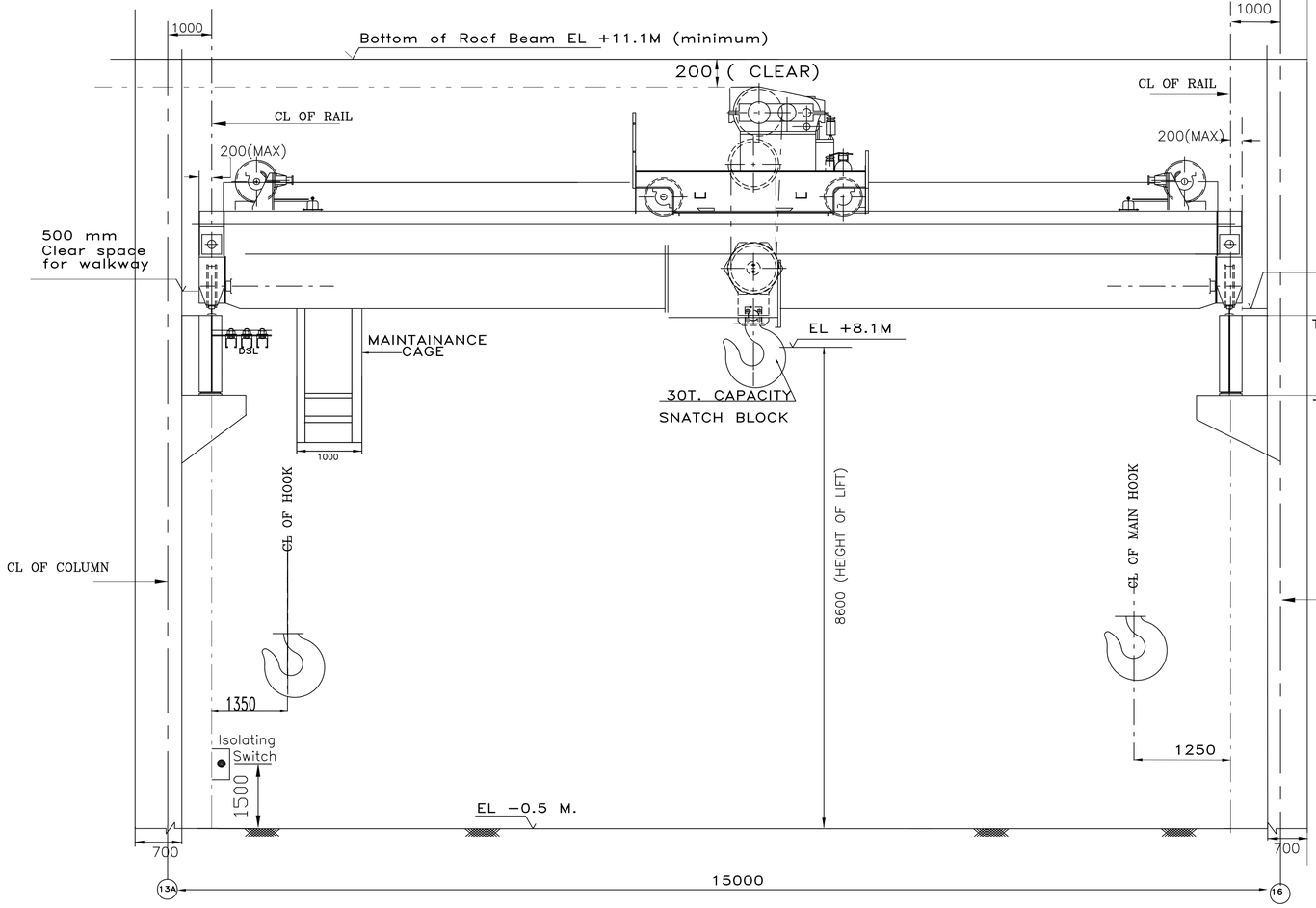
ड्राइंग संख्या/ DRAWING NO.: PE-DG-512-501-A003

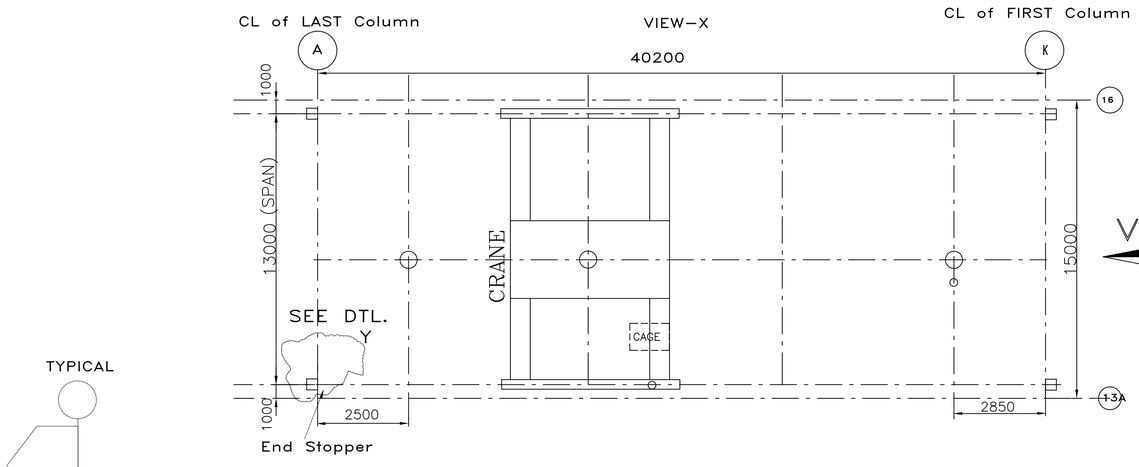
शीट/ SHEET 1 OF 1 | पुनरीक्षण/ REV. 0

फॉर्मेट साइज़ A0 / FORMAT SIZE A0

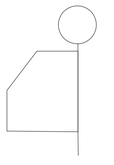
Fold-2 | ALL DIMENSIONS ARE IN MM | FIRST ANGLE PROJECTION | Fold-1

COMPUTER FILE NAME : TAL5





TYPICAL



DETAIL 'Y'

KEY PLAN

NOTE
1. THE DESIGN CODE FOR EOT CRANE SHALL BE IS:3177 (latest edition).
2. DRAWING IS NOT TO SCALE.
3. QTY OF CRANE: 1 NO.

NTPC DRG NO	
OWNER	NTPC LTD
CONTRACT	2X800 MW SINGRAULI STPP STAGE III EPC
PRINT SCALE 0 2 4 6 8 10 20 30 40 50	BHARAT HEAVY ELECTRICALS LTD POWER SECTOR PROJECT ENGINEERING MANAGEMENT NEW DELHI

DEPT CODE		NAME	SIGN	DATE
	DRN	RG		07.05.25
	DESN	RG		07.05.25
	CHD	PK		07.05.25
	APPD	PK		07.05.25

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

SUB−CONTRACTOR

TITLE
CRANE CLEARANCE DIAGRAM OF STORE EOT CRANE

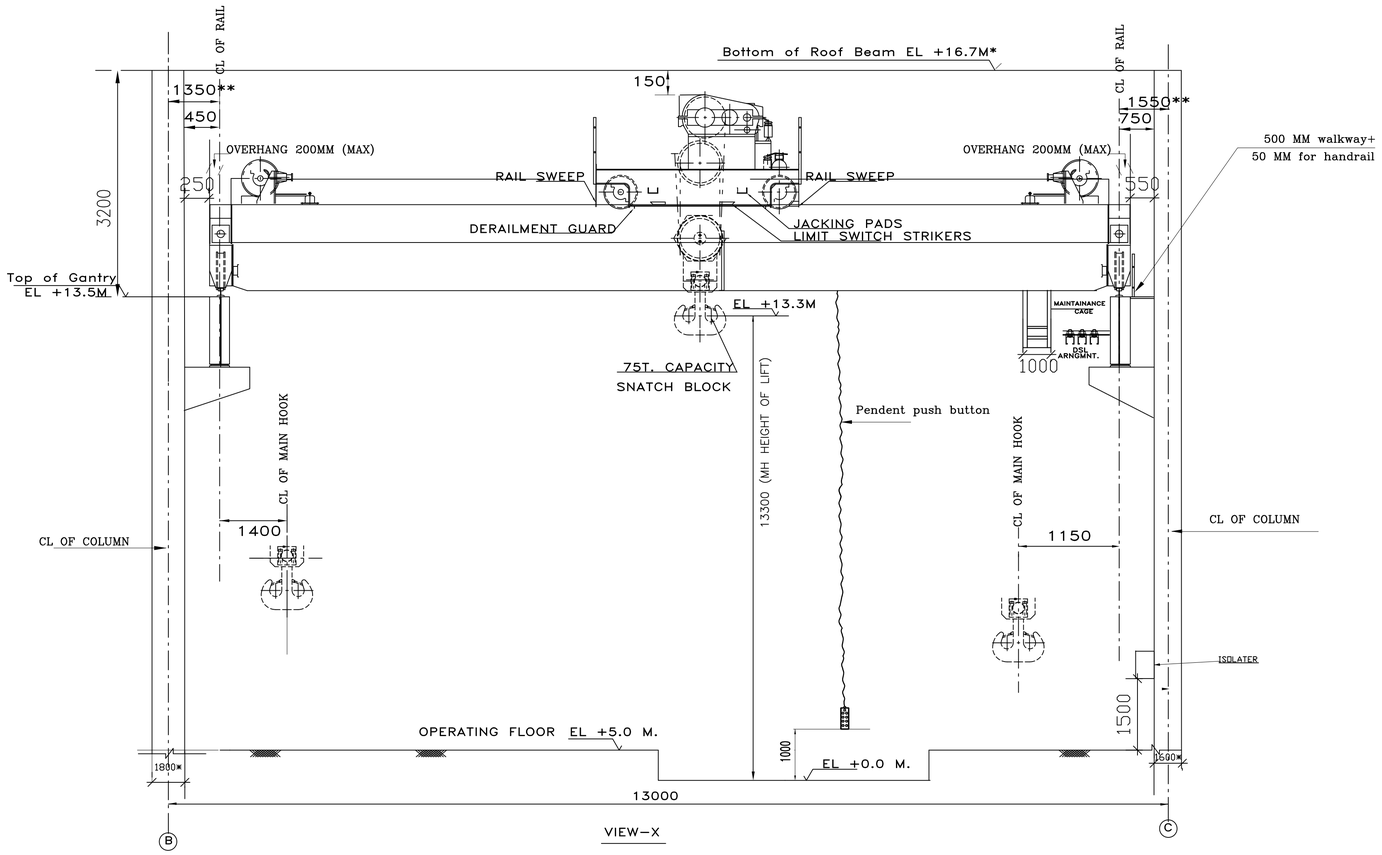
DEPT.	SCALE	BHEL DRG NO : PE−DG−520−501−A001
SIGN		
DATE		SHEET 1 OF 1 REV 0

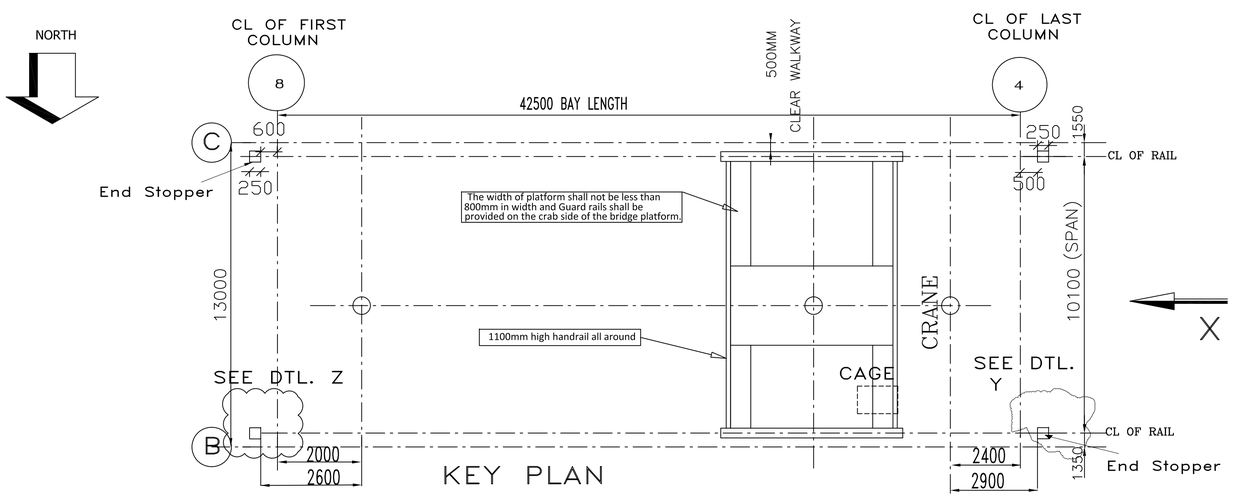
SIZE−A2

THIS IS PART OF TECHNICAL SPECIFICATION PE-TS-512/520-501-A001 REV 0

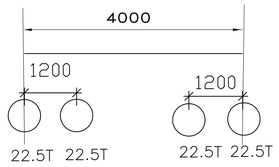
Fold-2

ALL DIMENSIONS ARE IN MM FIRST ANGLE PROJECTION

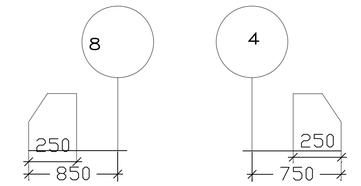




WEIGHT OF SINGLE HEAVIEST ASSEMBLED COMPONENT	65T
CRANE CAPACITY AFTER 10% MARGIN AS PER CONTRACT REQUIREMENT ON HEAVIEST WEIGHT	71.5T
CRANE CAPACITY CONSIDERED	75T (ONE NO. FOR EACH UNIT)



TENTATIVE LT WHEEL LOAD WITHOUT IMPACT



DETAIL 'Z' DETAIL 'Y'

NOTES:

1) DRAWING IS NOT TO THE SCALE.
2) ALL DIMENSIONS ARE IN MM & ELEVATIONS IN METRES.
3) EL 0.00 CORRESPONDS TO RL +209.500 (FINISHED FLOOR LEVEL IN TG BUILDING)
4) DESIGN CODE FOR EOT CRANE SHALL BE IS3177:2020.

NO. OF CRANES: 1

NTPC DRG NO	
OWNER	NTPC LTD
CONTRACT	1 X 800 MW SIPAT STPP STAGE–III
PRINT SCALE 0 2 4 6 8 10 20 30 40 50	BHARAT HEAVY ELECTRICALS LTD POWER SECTOR PROJECT ENGINEERING MANAGEMENT NEW DELHI

DEPT CODE		NAME	SIGN	DATE
	DRN	RG		07.05.25
	DESN	RG		07.05.25
	CHD	PK		07.05.25
	APPD	PK		07.05.25

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

SUB–CONTRACTOR

TITLE

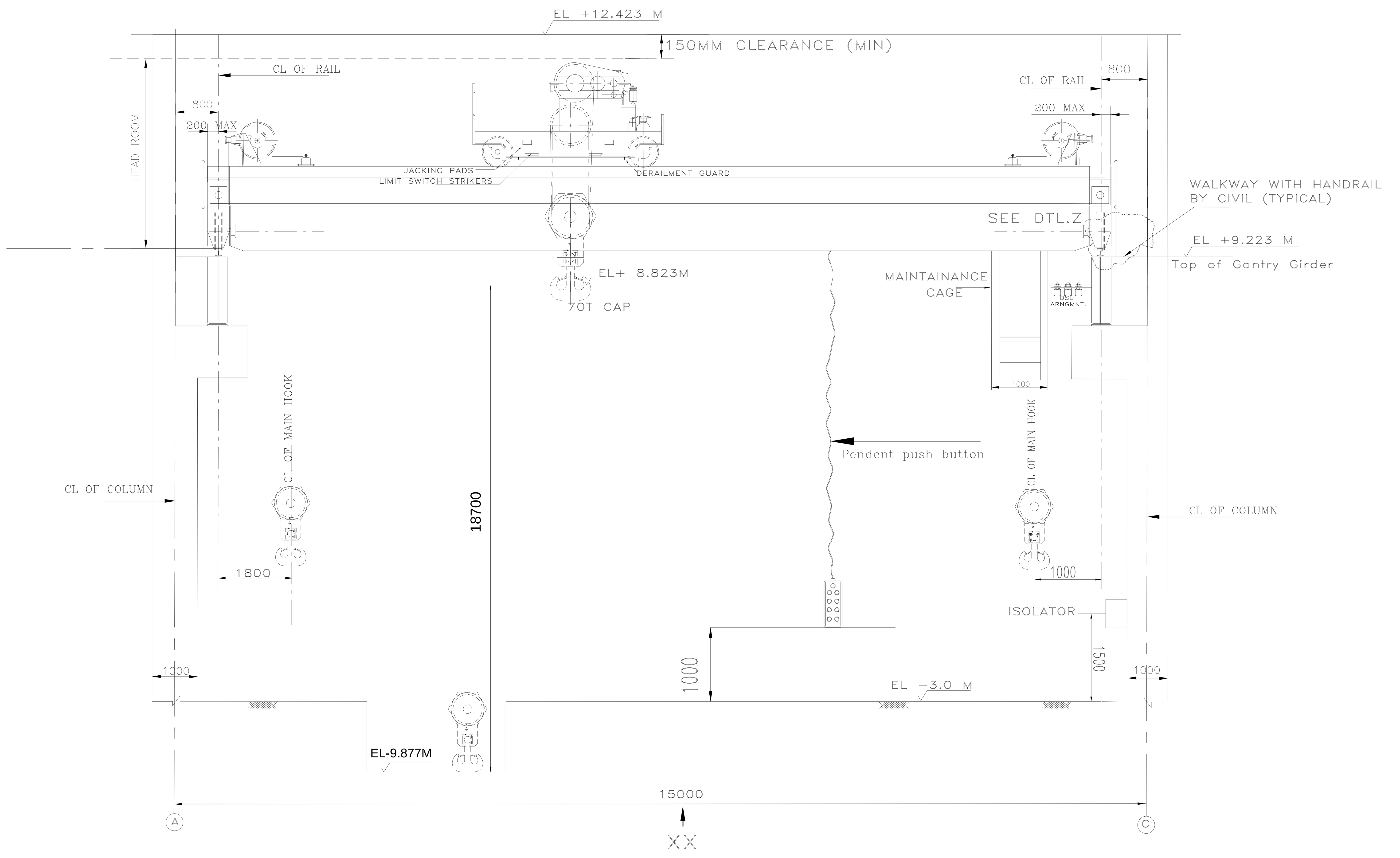
CRANE CLEARANCE DIAGRAM OF BFP HANDLING EOT CRANE

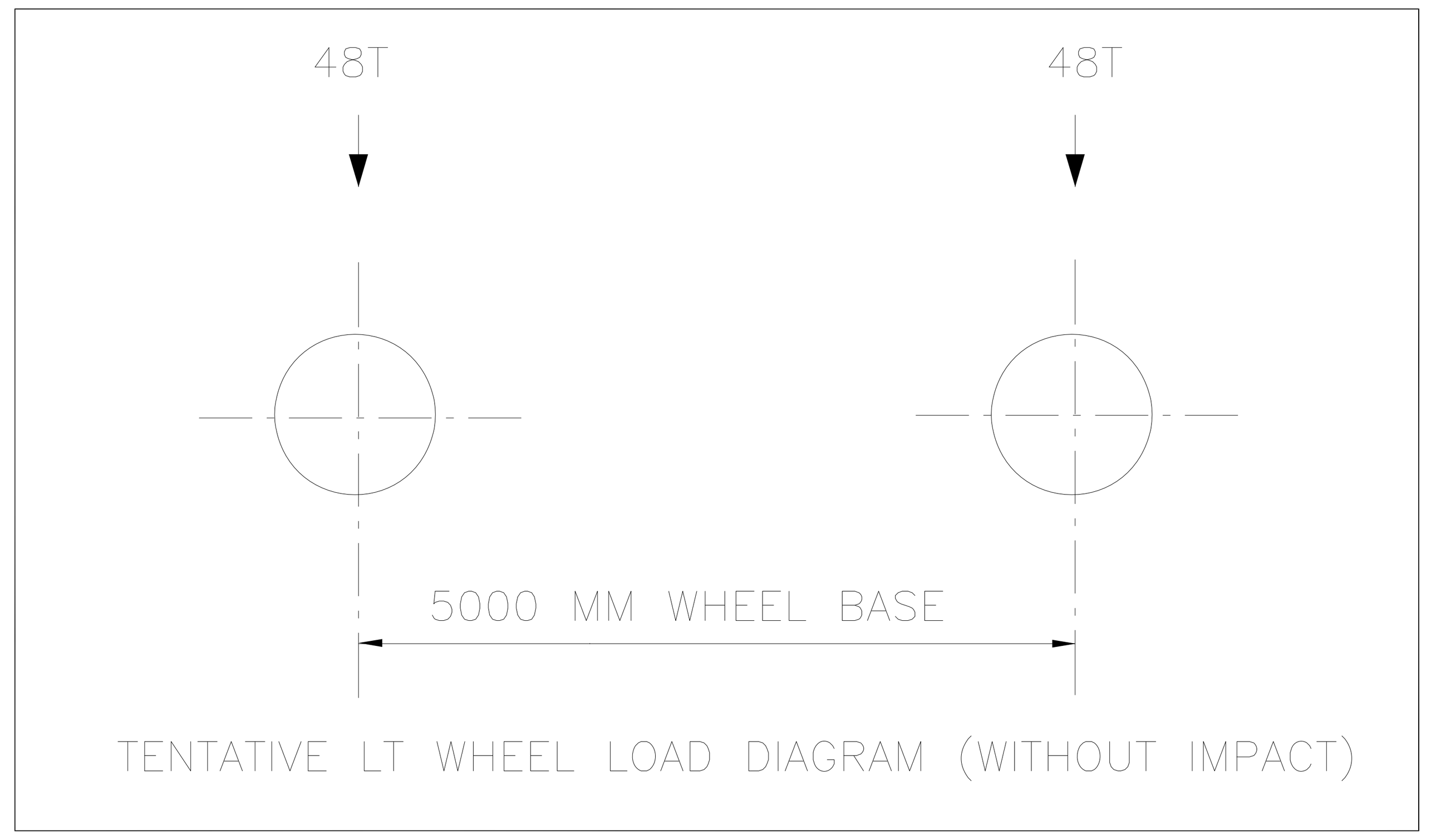
DEPT.	SCALE	BHEL DRG NO : PE–DG–520–501–A001
SIGN		
DATE		SHEET 1 OF 1 REV 0

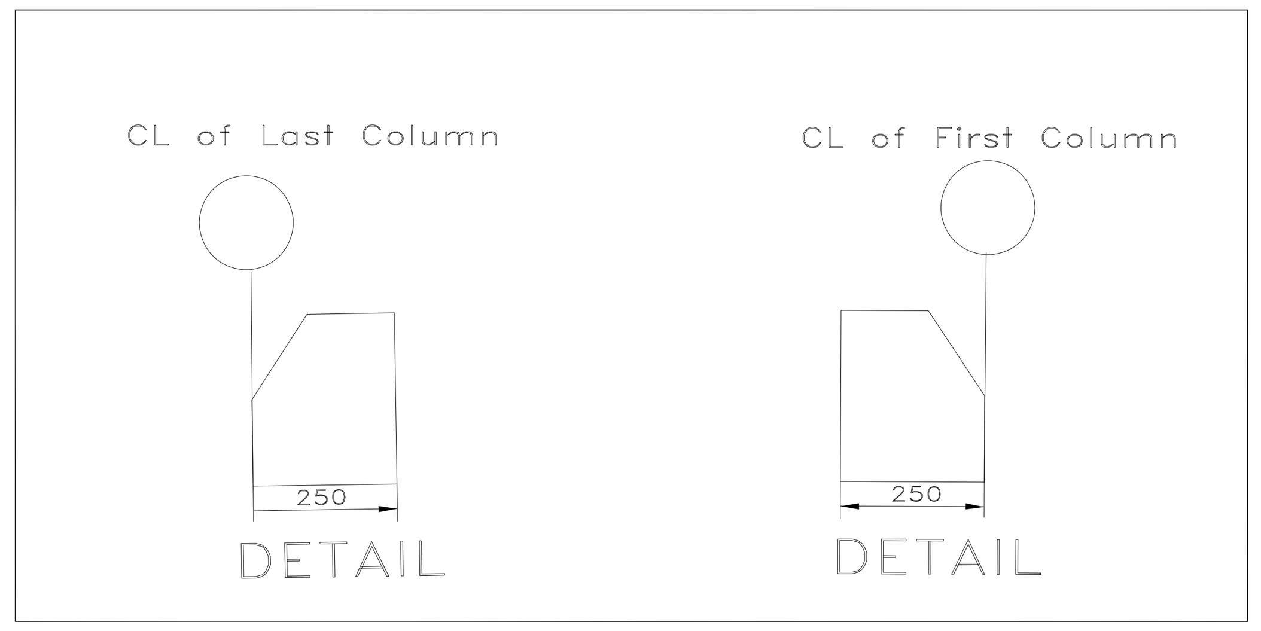
SIZE–A2

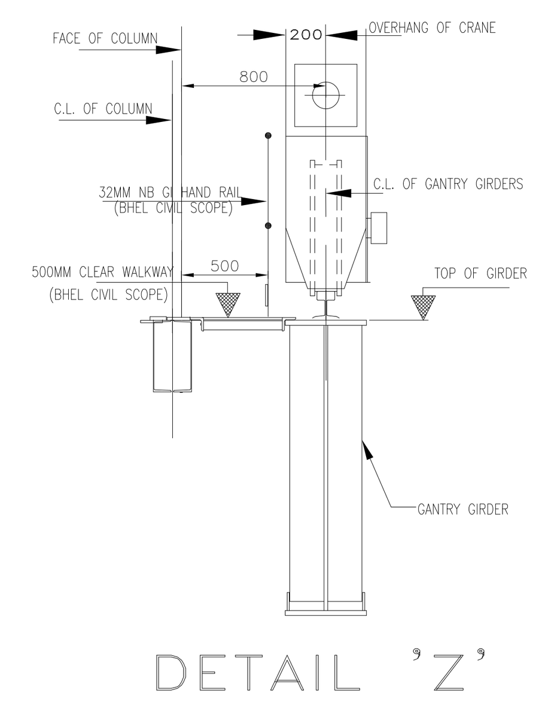
COMPUTER FILE NAME : TAL5

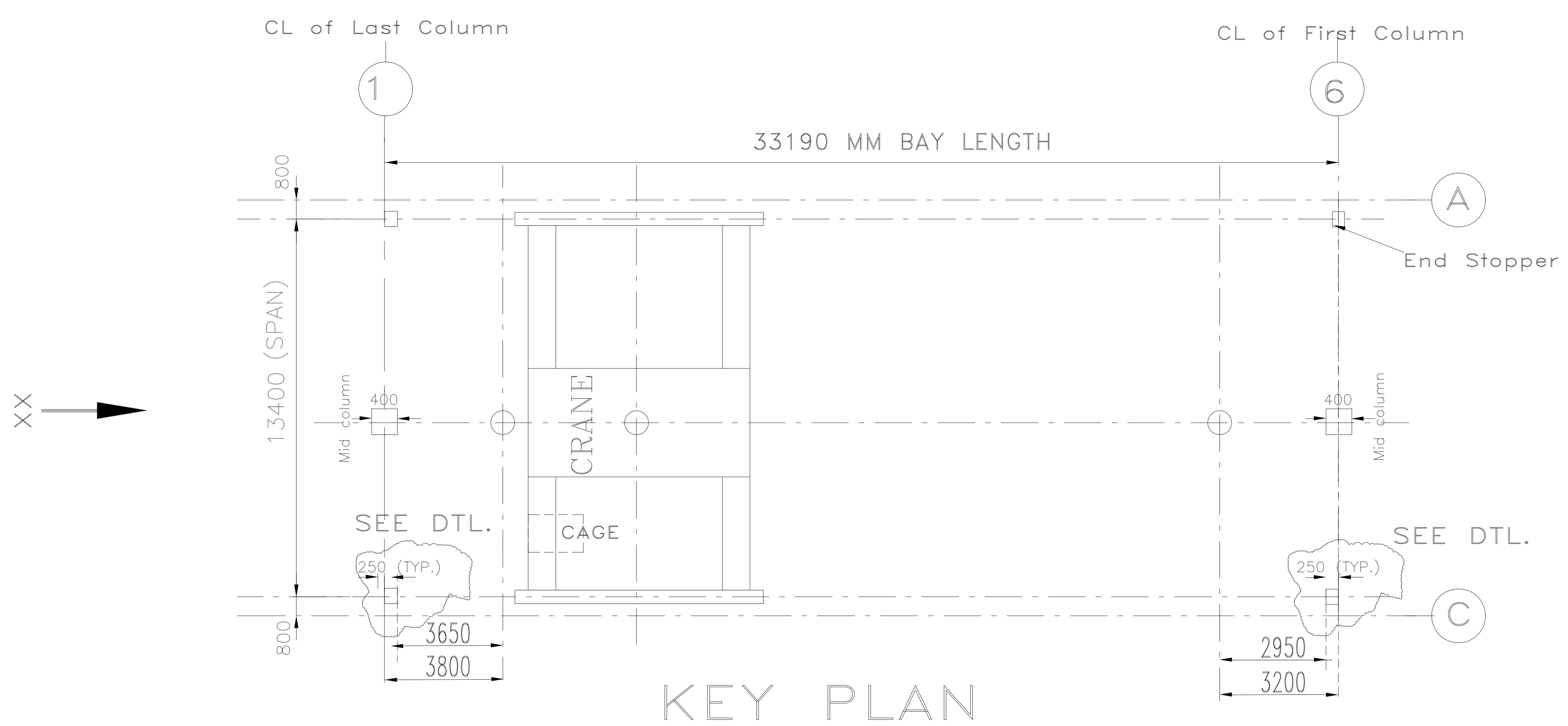
THIS IS PART OF TECHNICAL SPECIFICATION PE-TS-512/520-501-A001 REV 0











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.
6) QTY OF CRANE: 1

REFERENCE DRAWING:-

1. MECHANICAL GA OF CW & ACW PUMP HOUSE: 8003-001-133-PVM-B-046

पुनरीक्षण REV.	दिनांक DATE	परिवर्तितकर्ता ALTD	जांचकर्ता CHD	अनुमोदनकर्ता APPD
Rev 01	28.11.2022	RG	WH	PK
REVISED AS PER NTPC COMMENTS.				

ग्राहक ड्राइंग संख्या / CUSTOMER DRAWING NO.

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

कार्य संख्या- JOB NO.

स्थिति STATUS: CONTRACT

मुद्रण स्केल मीटर में / PRINT SCALE IN METRE: 0 2 4 6 8 10 20 30 40 50

परियोजना PROJECT: 1 X 800 MW SIPAT STPP STAGE-III

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

	नाम NAME	हस्ताक्षर SIGNATURE	दिनांक DATE
तैयारकर्ता/DRN	RG		19.08.2023
डिजाइनकर्ता/DESN	RG		19.08.2023
जांचकर्ता/CHD	WH		19.08.2023
अनुमोदनकर्ता/APPD	PK		19.08.2023

शीर्षक/TITLE: CRANE CLEARANCE DIAGRAM OF 70T CWPH EOT CRANE

एमपीएल MPL	सिविल CIVIL	इलेक्ट्रिकल ELEC	सीएण्डआई C&I	एमएसई MSE	मैक्स MAX	विभाग DEPT.	स्केल - SCALE- NTS
						हस्ताक्षर SIGN / दिनांक DATE	

ड्राइंग संख्या / DRAWING NO. PE-DG-497-501-A003

शीट SHEET 1 OF 1 — पुनरीक्षण REV. 0

फार्मेट साइज A0 / FORMAT SIZE A0

PERFORMANCE GUARANTEES TO BE DEMOSTRATED AT SITE

PERFORMANCE GUARANTEES TO BE DEMOSTRATED AT SITE AS PER IS-3177.	
S.N.	**DESCRIPTION OF TESTS TO BE PERFORMED**
1	Speed test at rated load for hoisting, CT and LT mechanism.
2	Brakes test
3	Deflection test of bridge girder at rated load. Crane shall rest on centerline of LT wheels.
4	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.

STANDARD MANUFACTURING QUALITY PLAN FOR DOUBLE GIRDER EOT CRANE

	MANUFACTURER/BIDDER/VENDOR NAME & ADDRESS	MANUFACTURING QUALITY PLAN							SPEC. NO: PE-TS-512/520-501-A001					DATE: May 2025
		CUSTOMER: NTPC LTD.							QP NO.: PE-V0-512/520-501-A001					DATE:
		PROJECT: 2X800 MW SINGRAULI STPP STAGE III & 1 X 800 MW SIPAT STPP STAGE-III							PO NO.:					DATE:
		ITEM: DOUBLE GIRDER EOT CRANES FOR TG HALL 265/25T			SYSTEM: EOT CRANES				SECTION:					SHEET 1 OF 8

SL NO.	COMPONENT & OPERATIONS	CHARACTERIST-ICS	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		**			10
					M	C/N				D	M	C	N	
1.0 MATERIAL:														
1.1	Steel Plates (Box Girder, End Carriage, Trolley & Gear Casing ,Fabricated Rope Drum)	1.Chemical & Physical	Major	Chemical & Physical	100%	1/Heat	APPD. DRG / DATA SHEET	APPD. DRG / DATA SHEET	TC	√	P	V/ W	V	Refer Note 12
		2. NDT	Major	UT (25mm & above thickness)	100%	100%	ASTM A435 / A578 LEVEL B	ASTM A435 / A578 LEVEL B	TC/ NDT Report	√	P	V/ W	V	Refer Note 13
1.2	Round Bars (For Pinion ,Gear ,Axles & Shafts)	1. Chemical & Physical	Major	Chemical & Physical	100%	-	APPD. DRG. / DATA SHEET	APPD. DRG. / DATA SHEET	TC	√	P	V	V	Refer Note 14
		2. NDT	Major	U.T	100%	-	ASTM A 388-2007	UT PROCEDURE	NDT Report	√	P	V	V	For UT procedure refer Note 4
1.3	Forgings (For Gears, Wheels)	1. Chemical & Physical	Major	Chemical & Physical	100%	1/Heat	APPD. DRG. / DATA SHEET	APPD. DRG. / DATA SHEET	TC	√	P	V/ W	V	Refer Note 12 & 14
		2. NDT	Major	U.T	100%	-	ASTM A 388-2007	UT PROCEDURE	NDT Report	√	P	W	V	For UT procedure refer Note 4
1.4	Casting for Gear	1. Chemical & Physical	Major	Chemical & Physical	100%	-	APPD. DRG. / DATA SHEET	APPD. DRG. / DATA SHEET	TC	√	P	V	V	
		2.NDT	Major	U.T	100%	-	ASME Sec.V,article-23,SA-609	SA - 609 , Level - II	NDT Report	√	P	V	V	For UT procedure refer Note 4
1.5	Pulley & Brake Drums	1. Chemical & Physical	Major	Chemical & Physical	100%	-	APPD. DRG. / DATA SHEET	APPD. DRG. / DATA SHEET	TC	√	P	V	V	
		2.NDT	Major	U.T (only boss area)	100%	-	ASME Sec.V,article-23,SA-609	SA - 609 , Level - II	NDT Report	√	P	V	V	For UT procedure refer Note 4
1.6	Seamless Pipe for Rope Drum	1. Chemical & Physical	Major	Chemical & Physical	100%	-	APPD. DRG. / DATA SHEET	APPD. DRG. / DATA SHEET	TC	√	P	V	V	
		2.NDT	Major	U.T	100%	-	ASTM E 213	ASTM E 213	NDT Report	√	P	V	V	For UT procedure refer Note 4
			Major	Macro Etching, Flattening for Seamless Pipe	100%	-	APPD. DRG. / DATA SHEET	APPD. DRG. / DATA SHEET	TC	√	P	V	V	
2.0	BOUGHT OUT ITEMS													
2.1	Hook	Forging Raw material	Major	Visual Check	100%	100%	APPD. DRG. / DATA SHEET	No Visual defect	I.R	√	P	W	V	
			Major	UT after forging	100%	100%	ASTM A 388-2007	UT PROCEDURE	NDT Report	√	P	W	V	Refer Note 15
		Heat treatment	Major	Heat treatment after forging	100%	-	Mfg. Std. / Drg	Mfg. Std. / Drg	HT Chart	√	P	V	V	Refer Note 16

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

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	MANUFACTURER/BIDDER/VENDOR NAME & ADDRESS	MANUFACTURING QUALITY PLAN							SPEC. NO: PE-TS-512/520-501-A001					DATE: May 2025
		CUSTOMER: NTPC LTD.							QP NO.: PE-V0-512/520-501-A001					DATE:
		PROJECT: 2X800 MW SINGRAULI STPP STAGE III & 1 X 800 MW SIPAT STPP STAGE-III							PO NO.:					DATE:
		ITEM: DOUBLE GIRDER EOT CRANES FOR TG HALL 265/25T				SYSTEM: EOT CRANES			SECTION:					SHEET 2 OF 8

SL NO.	COMPONENT & OPERATIONS	CHARACTERIST-ICS	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	*	**			10
					M	C/N				D	M	C	N	
		Chemical test	Major	Chemical integral test piece.	1 Per Heat/Batch	-	APPD. DRG. / DATA SHEET	APPD. DRG. / DATA SHEET	TC	√	P	V	V	
		Physical test	Major	Tensile test on integral test piece after heat treatment	1 Per Heat/Batch	1 Per Heat/Batch	APPD. DRG. / DATA SHEET	APPD. DRG. / DATA SHEET	I.R	√	P	W	V	Refer Note 17
		Macro etching	Major	Grain Size	100%	-	ASTM E 112	Grain size 6 or final	TC	√	P	V	V	
		NDT before Proof Load	Major	UT	100%	-	ASTM A 388-2007	UT PROCEDURE	NDT Report	√	P	V	V	For UT procedure refer Note 4
			Major	DPT	100%	-	ASME Sec V	ASME SEC. VIII, Div-1, Append. - 8	NDT Report	√	P	V	V	
		Proof Load Test	Major	Proof Load Test	100%	100%	APPD. DRG. / DATA SHEET	APPD. DRG. / DATA SHEET	I.R	√	P	W	V	Refer Note 18
		NDT after Proof Load (UT only shank portion)	Major	U.T & MPI after Proof Load Test	100%	100%	ASTM A 388-2007 / ASTM E 709-2007	ASTM A 388-2007 / ASTM E 709-2007	NDT Report	√	P	W	V	
		Identification Punch	Major	Visual	100%	100%	—	—	I.R	√	P	H	V	Refer Note 20
2.2	Wire Rope & slings	Visual & Breaking Strength	Major	Type, grade, breaking strength &visual , Diameter	100%	-	APPD DRG / DATA SHEET	APPD DRG / DATA SHEET	Mill T.C.	√	P	V	V	
2.3	Rails	Chemical & Tensile , Cross section , Hardness , Dimension	Major	Chemical & Tensile, Hardness, Dimension	100%	-	APPD DRG / DATA SHEET	APPD DRG / DATA SHEET	TC	√	P	V	V	
3.0	**ELECTRICAL ITEMS**													
3.1	Transformer (Control transformer, Light transformer etc.)	Make , Rating	Major	Visual	100%	-	APPD DRG / DATA SHEET	APPD DRG / DATA SHEET	IR	√	P	V	V	
		Routine Test	Major	Doc. Review	100%	-	Mfg. Catalogue	Mfg. Standard	TC	√	P	V	V	

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	MANUFACTURER/BIDDER/VENDOR NAME & ADDRESS	MANUFACTURING QUALITY PLAN			SPEC. NO: PE-TS-512/520-501-A001	DATE: May 2025
		CUSTOMER: NTPC LTD.			QP NO.: PE-V0-512/520-501-A001	DATE:
		PROJECT: 2X800 MW SINGRAULI STPP STAGE III & 1 X 800 MW SIPAT STPP STAGE-III			PO NO.:	DATE:
		ITEM: DOUBLE GIRDER EOT CRANES FOR TG HALL 265/25T		SYSTEM: EOT CRANES	SECTION:	SHEET 3 OF 8

SL NO.	COMPONENT & OPERATIONS	CHARACTERIST-ICS	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	*	**			10
					M	C/N				D	M	C	N	
3.2	SFU , MCCB , MCB , CONTRACTORS , DSL, RELAYS , FUSES , RESISTENCE BANK,HOOTER, PUSH BUTTONS, indicating instruments , junction box, Limit Switches	Make / Rating / Type / Size	Major	Visual	100%	-	APPD DRG / DATA SHEET	APPD DRG / DATA SHEET	IR	√	P	V	V	
		Functional / Continuity Check	Major	Operational	100%	-	APPD DRG / DATA SHEET	APPD DRG / DATA SHEET	IR / COC	√	P	V	V	
3.3	Motor	Type, Rating, Make, Size	Major	Visual	100%	-	CUSTOMER approved BOI list & ADS / DRG		Mfg. TC	√	P	V	V	Refer Note 19
		Routine Test / Clearance of QP for Motor above 50 KW	Major	Measurement	100%		IS: 325 / App. Data sheet/CUSTOMER ADS	IS: 325 / App. Data sheet/CUSTOMER ADS	COC / Mfg T.C. (As per Note-3)	√	P	V	V	
3.4	Brakes	Make,Type,Rating	Major	Measurement	100%	-	APPD DRG / DATA SHEET	APPD DRG / DATA SHEET	TC		P	V	V	
		IR, HV, Functional Test	Major	Measurement	100%	-	MFG. STD.	MFG. STD.	TC	√	P	V	V	
3.5	VVVF Drive	Type, Rating, Make,	Major	Visual	100%	-	APPD DRG / DATA SHEET	APPD DRG / DATA SHEET	TC/ COC	√	P	V	V	
		Routine Test	Major	Measurement	100%	-	APPD DRG / DATA SHEET	APPD DRG / DATA SHEET	TC	√	P	V	V	
3.6	Cables (Power / Control / Trialing / Flexible)	Make, Type, Size	Major	Visual	100%	-	APPD DRG / DATA SHEET	APPD DRG / DATA SHEET	TC	√	P	V	V	
		Routine Test	Major	Measurement	100%	-	APPD DRG / DATA SHEET	APPD DRG / DATA SHEET	TC	√	P	V	V	
3.7	Radio Remote, Master Controller, Pendent Station, Switches	Make / Rating / Type / Functional	Major	Visual	100%	-	APPD DRG / DATA SHEET	APPD DRG / DATA SHEET	TC / COC	√	P	V	V	
3.8	Anti - Collision Device , Cable Gland & lugs , Rectifier ,Lamps, Load cell, Illumination and Earthing material	Make / Type	Major	Visual	100%	-	APPD DRG / DATA SHEET	APPD DRG / DATA SHEET	TC/ COC		P	V	V	
4.0	OTHER BOUGHT OUR ITEMS													

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			CUSTOMER: NTPC LTD.						QP NO.: PE-V0-512/520-501-A001					DATE:
			PROJECT: 2X800 MW SINGRAULI STPP STAGE III & 1 X 800 MW SIPAT STPP STAGE-III						PO NO.:					DATE:
			ITEM: DOUBLE GIRDER EOT CRANES FOR TG HALL 265/25T				SYSTEM: EOT CRANES		SECTION:					SHEET 4 OF 8

SL NO.	COMPONENT & OPERATIONS	CHARACTERIST-ICS	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		**			10
					M	C/N				D	M	C	N	
4.1	Bearings	Type & Size	Major	Verification	100%	-	Appd.drg./ Mfr's catalogue	Appd.drg./ Mfr's catalogue	TC / IR / COC	√	P	V	V	
4.2	Tools and tackles	Verification of type size / rating	Major	Verification	100%	-	As per PO / BBU	APPD DRG / DATA SHEET	TC / COC	√	P	V	V	
4.3	Spares (Mandatory / recommended spare / commissioning spares)	Verification of make, type, size , rating	Major	Review Of Internal Inspection Reports / Mfr's TC / COC	100%	-	Approved Spare List	APPD DRG / DATA SHEET	IR / COC	√	P	V/W	V/W	Refer Note 21
5.0	**IN PROCESS : FABRICATED COMPONENTS : GIRDER, END CARRIAGE, TROLLEY, GEAR BOX CASING , FABRICATED ROPE DRUM**													
5.1	Welding	WPS, PQR & WPQ	Major	Review of Document	100%	-	ASME SEC IX	ASME SEC IX	As ASME Format	√	P	V	V	Refer Note 22
5.2	Weld Fit Up & Edge Preparation	Dimension	Major	Dimension	100%	-	Mfg. Drg.	Mfg. Drg.	I.R	√	P	V	V	
5.3	Fillet Weld	NDT	Major	DPT on Fillet Weld	100%	-	ASME - Sec. V	ASME SEC. VIII , Div-1 , Append. - 8	NDT Report	√	P	V	V	Refer Note 23
5.4	Butt Weld (Girder ,End-carriage, Trolley & Fabricated Rope drum, if applicable)	NDT	Major	Radiography Test / Gamma Ray	Refer Note 24	-	ASME - Sec. V	ASME - Sec. VIII,Div-1, Cl.- UW-51 & 52	NDT Report	√	P	V	V	
				DPT on Butt Weld	100%	10%	ASTM E165	No Relevant Indications	I.R	√	P	W	V	10% random witness by BHEL
5.5	Heat Treatment (SR) of Rope drum and Gear Box Casing	Mechanical	Major	Review of SR chart/Test Report	100%	-	Appd Drg./ Relevant Std.	Appd Drg./ Relevant Std.	SR Chart	√	P	V	V	
5.6	Cabin (as applicable), Platform, Hand railing	Dimension	Major	Dimension	100%	-	APPD DRG / DATA SHEET	APPD DRG / DATA SHEET	I.R	√	P	V	V	
5.7	Fabricated Components (Girders, End Carriages & Trolley, end stopper)	Visual & dimensional	Major	Dimensional & Visual Check	100%	-	APPD DRG / DATA SHEET	APPD DRG / DATA SHEET	I.R.	√	P	V	V	At the Time of Final Insp. Of Crane
6.0	**IN PROCESS INSPECTION OF MACHINED COMPONENTS**													
6.1	Pinions, Gear & Wheel	1.Dimensional Check	Major	Measurement	100%	-	Mfg Drg / Data sheet	Mfg Drg / Data sheet	I.R	√	P	V	V	
		2. Heat Treatment	Major	Heat Treatment chart	100%	-	Material specification/ Mfg drg	Material specification/ Mfg drg	HT Chart	√	P	V	V	Refer Note 25
		3. Hardness	Major	Measurement	100%	100%	Mfg Drg / APPD DRG / DATA SHEET	Mfg Drg / APPD DRG / DATA SHEET	I.R	√	P	W	V	
		4. NDT	Major	DPT on teeth	100%	-	IS:3658-1981 / ASME - Sec. V	NO CRACKS & LINEAR INDICATION	NDT Report	√	P	V	V	

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	MANUFACTURER/BIDDER/VENDOR NAME & ADDRESS	MANUFACTURING QUALITY PLAN			SPEC. NO: PE-TS-512/520-501-A001	DATE: May 2025
		CUSTOMER: NTPC LTD.			QP NO.: PE-V0-512/520-501-A001	DATE:
		PROJECT: 2X800 MW SINGRAULI STPP STAGE III & 1 X 800 MW SIPAT STPP STAGE-III			PO NO.:	DATE:
		ITEM: DOUBLE GIRDER EOT CRANES FOR TG HALL 265/25T		SYSTEM: EOT CRANES	SECTION:	SHEET 5 OF 8

SL NO.	COMPONENT & OPERATIONS	CHARACTERIST-ICS	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	*	**			10
					M	C/N				D	M	C	N	
6.2	Hardness Difference (Pinion & Gear)	Hardness	Major	Mechanical	100%	-	APPD DRG / DATA SHEET	APPD DRG / DATA SHEET	TC	√	P	V	V	
6.3	Rope Drum	1.NDT & Dimensional Check	Major	DP test on fillet weld & Dimension	100%	-	ASME SEC VIII Div -1 / Mfg. Drg.	NO RELEVANT INDICATION	NDT Report	√	P	V	V	
		2.NDT	Major	DP test on Groove after machining	100%	-	IS: 3658-1981 / ASME - Sec. V	NO RELEVANT INDICATION	NDT Report	√	P	V	V	
6.4	Pulley & Brake Drums	1.Visual & dimension	Major	verification	100%	-	Mfg. Drg	Mfg. Drg	I.R.	√	P	V	V	
		2. NDT	Major	DPT after machining	100%	-	ASME - Sec. V	NO RELEVANT INDICATION	NDT Report	√	P	V	V	
6.5	Assembled Gear Box	1. Visual & Dimensional	Major	Visual & dimensional	100%	-	Mfg. Standard	Mfg. Standard	I.R.	√	P	V	V	
		2. NDT	Major	DPT on Fillet Weld	100%	-	ASME - Sec. V	NO RELEVANT INDICATION	NDT Report	√	P	V	V	
		3.Mechanical	Major	Backlash ,Contact Pattern	100%	-	APPD DRG / DATA SHEET /Mfg. Std.	APPD DRG / DATA SHEET /Mfg. Std.	I.R	√	P	V	V	
			Major	Reduction Ratio , No Load Run Test For Check of Oil Leakage / Temp. Rise, Vibration & Noise	100%	100%	Approved Drawing /Data Sheet/Mfg. Std	Approved Drawing /Data Sheet/Mfg. Std	I.R.	√	P	V/W	V	Refer Note 26
6.6	DSL Guard	Dimensional	Major	Dimension	100%	-	Mfg. Drg.	Mfg. Drg.	I.R.	√	P	V	V	
7.0	**FINAL INSPECTION**													
7.1	CONTROL PANEL With VVVF Drive	Identification of all Elect. Components, Cable laying / Dressing/ Feruling /Terminations Dimensional, Functional , HV, IR, interlocks, Protection DOP	Major	Visual, dimensional, Operational & Functional Check , HV,IR, Painting	100%	100%	IS:3177 / APPD DRG / DATA SHEET	IS:3177 / APPD DRG / DATA SHEET	I.R	√	P	W	W	Refer Note 27
		Paint Shade/ Thk/ Adhesion	Major	Visual / DFT Check	100%		APPD DRG / DATA SHEET	APPD DRG / DATA SHEET	TC	√	P	V	V	Refer Note 28

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		CUSTOMER: NTPC LTD.			QP NO.: PE-V0-512/520-501-A001	DATE:
		PROJECT: 2X800 MW SINGRAULI STPP STAGE III & 1 X 800 MW SIPAT STPP STAGE-III			PO NO.:	DATE:
		ITEM: DOUBLE GIRDER EOT CRANES FOR TG HALL 265/25T		SYSTEM: EOT CRANES	SECTION:	SHEET 6 OF 8

SL NO.	COMPONENT & OPERATIONS	CHARACTERIST-ICS	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	*	**		10
					M	C/N				D	M	C	N
7.2	EOT crane assembly with control panel, Master Controller / Remote Controller Pendent Station (At Works)	Visual & dimensional	Major	Dimensional ,Span, Diagonal & Wheel Base Dimension, LT Stopper Dimension	100%	100%	IS 3177 / APPD DRG / DATA SHEET	IS 3177 / APPD DRG / DATA SHEET	I.R.	√	P	W	W	Refer Note 29
		Operational	Major	(1) Speed & Current Measurement at No Load for Hoist & CT/LT motion (2) Speed & Current measurement at SWL of Hoist & CT motion (3) Over load test (125%) of SWL for Hoist motion (4) Deflection test at SWL (5) Operation Check of Brake at SWL (6) Interlock & Functional test (7) Verification of breaking path (calculated), under bridge Clearance (difference Of lt wheel bottom to Girder bottom)	100%	100%	APPD DRG / DATA SHEET / IS 3177	APPD DRG / DATA SHEET / IS 3177	I.R.	√	P	W	W	Refer Note 30
8.0	Lifting beam (if applicable for tandem operation) - at works	Measurement	Major	Dimension, Visual and load /overload test	100%	100%	APPD DRG / DATA SHEET / IS 3177	APPD DRG / DATA SHEET / IS 3177	IR	√	P	W	W	
9.0	Cleaning & painting	Paint Shade / DFT	Major	Visual , DFT Check	100%		APPD DRG / DATA SHEET	APPD DRG / DATA SHEET	IR	√	P	V	V	
10.0	Review of QA documentation						As per approved QAP			V	V	V	V	
11.0	Packing of components	Packing Soundness	Major	Visual	100%	100%	APPD DRG / DATA SHEET /Packing specification	APPD DRG / DATA SHEET /Packing specification	IR	√	P	W	V	Refer Note 6

NOTES:

1) Original TCs / Photocopies certified in original by mill shall be furnished for review. Test In absence of correlated TCs Check test shall be carried out from each plate/ bar for above 10 mm thk., certificates shall be offered for review at the time of stage inspection of components / assembly. Supplier shall ensure that pitted material is not used.
2) X-Ray to be taken for thickness upto 19 mm and Gamma Ray for thickness above 19 mm. If Gamma Ray is used for lower thickness slow speed film like D2 or equivalent which gives enough readable and interpretable film quality to be used for clarity. All NDT shall be carried out by Qualified Level II personnel.

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		CUSTOMER: NTPC LTD.			QP NO.: PE-V0-512/520-501-A001	DATE:
		PROJECT: 2X800 MW SINGRAULI STPP STAGE III & 1 X 800 MW SIPAT STPP STAGE-III			PO NO.:	DATE:
		ITEM: DOUBLE GIRDER EOT CRANES FOR TG HALL 265/25T		SYSTEM: EOT CRANES	SECTION:	SHEET 7 OF 8

SL NO.	COMPONENT & OPERATIONS	CHARACTERIST-ICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
					M	C/N				D	M	C	N	
1	2	3	4	5	6		7	8	9	*	**			10

3) Performance of electrical & control devices along with the interlocks, protection & sequence to be checked after crane assembly at works.
4) Vendor's UT Procedure from NDT Level II to be submitted to BHEL for approval.
5) Following to be noted for packing:
   a) Packing shall be suitable for storage at site in tropical climate conditions.
   b) For export job, packing shall be as per BHEL seaworthy packing specification.
   c) Photographs of items duly placed inside the box just before the final packing and photographs of the box just before dispatch to be sent to BHEL purchase group for review before issuing MDCC.
6) In case of foreign supplier, all test certificates shall be furnished by the supplier, duly witnessed/verified by supplier's TPI.
7) The latest revisions/year of issue of all the standard indicated in the QP shall be referred.
8) Blank.
9) Blank.
10) The heat no. /plate identification no. shall be transferred on all major cut pieces of the MS plate for proper correlation, cutting plan of each plate shall be maintained for proper traceability.
11) Welder no. shall be punched near butt weld joints, the welding plan of each fabricated item shall be maintained.
12) In absence of co-related TC, check testing shall be witnessed on samples selected by Main contractor.
13) Co-related Mill TC inclusive of UT will be reviewed by BHEL/CUSTOMER, In absence of UT conformance in Mill TC, then UT will be witnessed by BHEL. For UT procedure refer Note 4.
14) Mech. Properties against H.T condition if applicable against respective Material standard/Grade. Hardness test report review after applicable Q & T condition.
15) For MH Hook, UT in proof machined condition and AH Hook in grinding condition. For UT procedure refer Note 4
16) HT chart review for Main Hook & AH Hook.
17) Test Piece will be drawn from top of shank portion to be identified by BHEL and CUSTOMER.
18) W - FOR MAIN HOOK, & AH Hook (Cap. >15T). For UT procedure refer Note 4.
18.1) In case of Indian Manufactured Hook : Proof Load test and NDT test (UT & MPI/PT) shall be witnessed by BHEL-CQS/Third Party/NTPC.
18.2) In case of imported Hooks:
   a) Proof load test & NDT of hooks before EOT crane load test may be jointly witnessed by a customer/ third party / IDLR approved Laboratory in India OR
   b) TPIA viz. M/S Lloyds Inspection Agency, M/S Bureau Veritas, M/s DNV, M/s TPL etc. (duly approved by NTPC) shall be appointed for proof load test & NDT at the country of origin. NTPC shall witness proof load test and NDT remotely
18.3) Bidder has to include scope of inspection of main hook by reputed third party inspector in case of inspection being done at foreign location. Charges of Third party inspection at foreign location shall be borne by bidder.
19) For Motors of 50kW rating and above Routine Test will be witnessed by BHEL and Type test Certificate for identical frame size will be reviewed for validity and conformance. For below 50kW rating routine tests to be witnessed by supplier of crane and type test Certificate for identical frame size will be reviewed for validity and conformance. Photocopies of Type Test Certificates are acceptable but shall be authenticated by Manufacturer. SQP of Motor: PE-QP-999-Q-007, REV-04 Dated 17.04.2021 (MOTORS 55 KW & ABOVE) & PE-QP-999-Q-006, REV-02 Dated 17.04.2021 (MOTORS UPTO 55 KW)
20) Identification by BHEL/Customer
21) V/W for items as per the Quality Plan
22) Welder/procedure qualification will be witnessed by Customer/ BHEL as per appd. WPS. In case the BHEL/NTPC/Lloyds /any other renowned approving agency already available, and doing the job, requalification is not required.
23) DP test of fillet weld for rope drum to be conducted after final machining.

BHEL					
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Reviewed by:			Reviewed by:		

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		PROJECT: 2X800 MW SINGRAULI STPP STAGE III & 1 X 800 MW SIPAT STPP STAGE-III			PO NO.:	DATE:
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SL NO.	COMPONENT & OPERATIONS	CHARACTERIST-ICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
					M	C/N			* D	** M	C	N	
1	2	3	4	5	6		7	8	9				10

24) 100% in Tension Zone, 25% in Compression Zone & 100% for rope drum Seam weld. RT before Stress relieving. RT Film shall be reviewed by BHEL/Customer
25) Heat treatment Chart to be reviewed by BHEL/CUSTOMER.
26) Noise Max.85 db at 1 mtr. & 30^0 C temp. rise at ambient. Witness for Noise & vibration measurement during the final inspection
27) HV at 2.5 KV AC for power ckt at 2 KV for control ckt, DOP by paper insertion method. BOI as per CUSTOMER Approved Makes. Will be Checked at the time of Final Inspection.
28) 7 Tank Pretreatment before Painting.
29) Crane Should be Operable by RRC & PPB (Radio Remote Controller, Pendent) meant for that Crane only.
30) Functional & Interlock test to be checked as per approved Electrical Schematic drawing.
31) 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, 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 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, 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.
32) Safe working load test & 125% over load test shall be conducted at shop with actual hooks, vvfd panels, shop wire ropes & temporary cables. Load test at site shall be offered with all actual components including radio remote control tests and covered in field quality assurance plan.
33) All raw material shall confirm to BHEL approved drg. / datasheet / specification. i.e 100 % killed, normalized and ultrasonially tested quality (UT of plate thickness _ 25 mm).

LEGENDS:
*RECORDS, INDENTIFIED WITH "TICK"(√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION,
** **M**: SUPPLIER/ MANUFACTURER/ SUB-SUPPLIER, **C**: BHEL/ THIRD PARTY INSPECTION AGENCY, **N**: NTPC,
P: PERFORM, **W**: WITNESS, **V:** VERIFICATION, AS APPROPRIATE
MA: MAJOR, **MI**: MINOR, **CR:** CRITICAL. **H** - Hold point

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

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

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

SUB VENDOR LIST

SR. NO.	ITEM	SUPPLIERS	REMARKS
1.	STEEL	SAIL	
		TISCO	
		JINDAL	
		RINL	
		ESSAR (AMNS)	
2.	HOOKS	STEEL FORGING & ENGG. CO.,	
		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	
		B OMBAY WIRE ROPES	
		BHARAT WIRE ROPES	
5.	BEARINGS	SKF	
		FAG	
		TATA	
		NBC	
		ZKL	
		NORMA	
		NRB	
		NTN	
		KOYO	
		URB	
6.	MOTORS	JYOTI LTD.	
		NGEF	(up to 15KW)
		CROMPTON	
		KEC	(UPTO 90KW)
		BHARAT BIJLI	
		MARATHON	
		ABB	
		HAVELLS	UPTO 90 KW
		LHP	
		BHARAT BIJLEE	
7.	BRAKES	ELECTROMAG	
		SPEED-O- CONTROL	
		BCH	FOR DCEM BRAKES ONLY
		KAKKU	
		PATHE	

8.	CONTACTOR	SIEMENS	
		L&T	
		SCHNEIDER (Earlier TELE MECHANIQUE)	
		ABB	
		GE-POWER	
		BCH	
9.	OVER LOAD RELAYS	SIEMENS	
		L&T	
		ABB	
		SCHNEIDER (Earlier TELE MACHANIQUE)	
10.	HRC FUSES	SIEMENS	
		L&T	
		ENGLISH ELECTRIC	
		GE POWER	
		EATON (BUSSMANN)	
		INDO ASIAN	
		C&S ELECTRIC LTD.	
		SPACEAGE SWITCHGEARS LTD.	
		ALSTOM LTD	
		ESSEN DEINKI	
		SCHNEIDER ELECTRIC INDIA PVT. LTD.	
		ABB	
11.	ISOLATING SWITCH	SIEMENS	
		L&T	
		CONTROL & SWITCH GEAR	
		ABB	
12.	SWITCH FUSE UNITS	SIEMENS	
		L&T	
		SCHNEIDER	
		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	
		UNILEC ENGINEERS PVT. LTD.	
		NEC	

15.	BULB & FLOURESCENT TUBES/FITTINGS	ANCHOR	
		PHILIPS	
		BAJAJ	
		Orient	
		CROMPTON	
16.	CABLE LUGS (HEAVY DUTY)	DOWELLS	
		UML ENGINEERS	
		CHETNA	
		BILLET	
		BRACO	
		JAINSON	
17.	HOOTERS	BEACON	
		OSC	
		TARGET	
		KHERAJ	
18.	LIGHTING SWITCHES	ANCHOR	
		ELLORA	
		GE	
		CROPMTON	
		BAJAJ	
		PHILIPS	
19.	PVC POWER CABLES	APAR INDUSTRIES LTD.	
		CORDS CABLE INDUSTRIES LTD.	
		DIAMOND POWER INFRASTRUCTURE LTD	
		GOYOLENE FIBRES (INDIA) PVT.LTD	
		GOVIND CABLE INDUSTRIES	
		GUPTA POWER INFRASTRUCTURE LIMITED	
		HAVELLS INDIA LIMITED	
		KEI INDUSTRIES LTD.	
		KRISHNA ELECTRICAL INDUSTRIES LTD	
		KEC INTERNATIONAL LIMITED	
		MANSFIELD CABLES COMPANY LTD.	
		NICCO CORPORATION LTD.	
		PARAMOUNT COMMUNICATIONS LTD.	
		POLYCAB WIRES PVT. LTD.	
		RADIANT CORPORATION PRIVATE LIMITED	
		RAVIN CABLES LIMITED	
		SUYOG ELECTRICALS LTD.	
		SRIRAM CABLES PVT. LTD.	
		SCOT INNOVATION WIRES AND CABLES PVT. LTD.	
		SAM CABLES & CONDUCTORS (P) LTD	
		THERMO CABLES LTD	

20.	PVC CONTROL CABLES	GEMSCAB INDUSTRIES LTD	
		GOVIND CABLE INDUSTRIES	
		GUPTA POWER INFRASTRUCTURE LIMITED	
		HAVELLS INDIA LIMITED	
		INCOM CABLES (P) LTD	
		KEI INDUSTRIES LTD	
		KRISHNA ELECTRICAL INDUSTRIES LTD	
		KEC INTERNATIONAL LIMITED	
		MANSFIELD CABLES COMPANY LTD	
		NICCO CORPORATION LTD	
		PARAMOUNT COMMUNICATIONS LTD	
		POLYCAB WIRES PVT. LTD	
		RAVIN CABLES LIMITED	
		SUYOG ELECTRICALS LTD	
		SPECIAL CABLES PVT. LTD	
		SCOT INNOVATION WIRES AND CABLES PVT. LTD	
		SAM CABLES & CONDUCTORS (P) LTD	
		SPM POWER & TELECOM PVT. LTD	
		TORRENT CABLES LTD	
		THERMO CABLES LTD	
		TIRUPATI PLASTOMATICS PVT. LTD	
		UNIVERSAL CABLES LTD	
21.	TRAILING CABLES	NICCO	
		UNIVERSAL	
		INCAB	
		ICL	
		APAR INDUSTRIES LTD	
		CMI LTD	
		KEI INDUSTRIES LTD	
		SUYOG ELECTRICALS LTD	
22.	XLPE POWER CABLES	APAR INDUSTRIES LTD	
		CORDS CABLE INDUSTRIES LTD	
		CRYSTAL CABLE INDUSTRIES LTD	
		DIAMOND POWER INFRASTRUCTURE LTD	
		GEMSCAB INDUSTRIES LTD	
		GOVIND CABLE INDUSTRIES	
		GUPTA POWER INFRASTRUCTURE LIMITED	
		HAVELLS INDIA LIMITED	
		KEI INDUSTRIES LTD	
		KRISHNA ELECTRICAL INDUSTRIES LTD	
		KEC INTERNATIONAL LIMITED	
		MANSFIELD CABLES COMPANY LTD	
		PARAMOUNT COMMUNICATIONS LTD	
		POLYCAB WIRES PVT. LTD	
		RAVIN CABLES LIMITED	
		SUYOG ELECTRICALS LTD	
		SPECIAL CABLES PVT. LTD	
		SCOT INNOVATION WIRES AND CABLES PVT. LTD	
		SRIRAM CABLES PVT. LTD	
		TORRENT CABLES LTD	
		THERMO CABLES LTD	
		TIRUPATI PLASTOMATICS PVT. LTD	

23.	XLPE CONTROL CABLES	APAR INDUSTRIES LTD	
		CABLE CORPORATION OF INDIA LTD	
		CRYSTAL CABLE INDUSTRIES LTD	
		DIAMOND POWER INFRASTRUCTURE LTD	
		GEMSCAB INDUSTRIES LTD	
		HAVELLS INDIA LIMITED	
		KEI INDUSTRIES LTD	
		KRISHNA ELECTRICAL INDUSTRIES LTD	
		KEC INTERNATIONAL LIMITED	
		PARAMOUNT COMMUNICATIONS LTD	
		POLYCAB WIRES PVT. LTD	
		RADIANT CORPORATION PRIVATE LIMITED	
		RAVIN CABLES LIMITED	
		SUYOG ELECTRICALS LTD	
		SRIRAM CABLES PVT. LTD	
		TORRENT CABLES LTD	
		UNIVERSAL CABLES LTD	
24.	CABLE GLAND	COMMET	
		SUNIL&CO	
		ARUP ENGINEERING	
		JAINSON	
		ELECTROMAC INDUSTRIES	
		INCAB	
		BALIGA LIGHTING EQPT.PVT.LTD	
		DOWELL	
25.	PUSH BUTTONS	SIEMENS	
		L&T	
		BCH	
		SCHNEIDER	
26.	LIMIT SWITCHES	SPEED-O-CONTROL	
		OMEGA	
		ELECTROMAG	
27.	MASTER CONTROLLER	SPEED-O-CONTROL	
		ELECTROMAG	
28.	SAFETY SWITCHES	ALSTOM	
		L&T	
		SCHNEIDER	
		ABB	
		SIEMENS	
29.	PENDENT PUSH BUTTON STATION	OEM	
30.	INDICATING LAMPS	TECKNIC	
		BCH	
		SIEMENS	
		STANDARD	

31.	MCB	MDS	
		INDO COPP	
		STANDARD	
		SIEMENS	
		L&T	
		ABB	
		S&S POWER SWITCHGEAR LTD,	
		SCHNEIDER	
32.	PANELS	OEM	
		RITTAL	
		BCH	
		PYROTECH	
33.	RESISTANCE BOXES	ENAPROS	
		SOC	
		EMM	
		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	
		BIS APPROVED SOURCE WITH VALID LICENSE	
35.	VVVF	L&T -YASKAWA	
		ABB	
		SIEMENS	
		SCHNIEDER	
		FUJI ELECTRIC	
		ROCKWELL	
		VACON	
		MITSUBISHI ELECTRIC	
36.	SHROUDED DSL	SUSHEEL	
		STROMAG	
37.	ANTI COLLISION DEVICE	SICK	
		IFM	
		ELECTRONIC SWITCHES INDIA	

38.	LOAD CELL	IPA	
		METTLER TOLEDO	
		SARTORIUS	
39.	RRC	ACROPOLIS ENGINEERING	
		HBC	
		SOC	
		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	CRANE OEM MAKE POWERPACK IS NOT ALLOWED.
		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	
43	MCCB/MPCB	L&T	
		ABB	
		SIEMENS	
		SCHNIEDER	
44	SINGLE PHASE PREVENTOR	MINILEC	
		L&T	
		SIEMENS	
45	Drag Chain	IGUS/Reputed make	
46	CONTROL SWITCHES/ SELECTOR SWITCH	KAYCEE	
		GE-POWER	
		ALSTOM LTD	
		SCHNEIDER ELECTRICINDIA PVT. LTD.	
		M/s Shrenik & Co.	
		RECOM PVT. LTD.	
47	AUXILIARY RELAYS	ABB	
		ALSTOM LTD	
		JYOTI LTD.	
		OEN INDIA LTD	
		SIEMENS	

48	BIMETAL RELAYS	L&T	
		GE-POWER	
		SIEMENS	
		TELEMECHANIQUE/ SCHNEIDER ELECTRIC INDIA PVT. LTD.	
49	CABLE CLAMPS & CABLE TIES	ELECTROMAC IND.CORPN.	
		INCAB	
		NOVOFLEX MARKETING PVT. LTD.	
50	GI CONDUITS	BIS APPROVED MAKE	
51	GI CONDUIT (EPOXY PAINTED)	BIS APPROVED MAKE	
52	FLEXIBLE CONDUITS (LEAD COATED)	PLICA INDIA PVT. LTD.	
53	FLEXIBLE CONDUIT (PVC COATED)	REPUTED MAKE	
54	CONTROL SWITCHES/ SELECTOR SWITCH	KAYCEE	
		GE-POWER	
		ALSTOM LTD	
		SCHNEIDER ELECTRIC INDIA PVT. LTD.	
		M/s Shrenik & Co.	
		RECOM PVT. LTD.	
55	FUSE BASE	INDO ASIAN	
		GE-POWER	
		L&T	
		C&S ELECTRIC LTD.	
		SIEMENS	
		ABB	
		SPACEAGE SWITCHGEARS LTD.	
		SCHNEIDER ELECTRIC INDIA PVT. LTD.	
		ALSTOM LTD	
		ESSEN DEINKI	
56	MODULAR SWITCH BOARD	ANCHOR	
		ELEXPRO ELECTRICALS PVT/ LTD.	
		HAVELLS INDIA LIMITED	
57	SWITCH BOX	ANCHOR	
		ELEXPRO ELECTRICALS PVT/ LTD.	
		BAJAJ ELECTRICALS	
		AJMERA INDUSTRIES & ENGG. WORKS	
		S.B. ELECTRICAL ENGINEERING CORPORATION	

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.

PAINTING REQUIREMENT

Crane	Condition	Surface Preparation	Primer Coat	No. of Coats	DFT (in Microns)	Intermediate Coat (in Microns)	No. of Coats	DFT (in Microns)	Final Coat	No. of Coats	DFT (in Microns)	Total DFT
BC BAY BFP HANDLING DOUBLE GIRDER EOT CRANE	STEEL STRUCTURE	Surface preparation: Shot blast cleaning/ abrasive blast cleaning to SA21/2 (near white metal) 35-50 microns.	Inorganic Zinc Phosphate. (epoxy based)	1	40 µm per coat.	Epoxy base Tio2 pigmented coat	1 coat	40 µm per coat	Epoxy based finish coat/Two pack polyurethane coat	2 coat	35 µm. per coat	150µ
CWPH DOUBLE GIRDER EOT CRANE AND HEAVY MATERIAL STORE CRANE	STEEL STRUCTURE	Surface preparation: Shot blast cleaning/ abrasive blast cleaning to SA21/2 (near white metal) 35-50 microns.	Inorganic Zinc Phosphate. (epoxy based)	1	75 µm per coat.	Epoxy base Tio2 pigmented coat	1 coat	75 µm per 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, DFT 30 µm. per coat	2 +1 coat	2 x 35 + 1 x 30 µm = 100µm	250µ
DOUBLE GIRDER EOT CRANE	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.										

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	RAL 5012 (Blue)		
4	Control Panels	RAL 9002 for front & rear and RAL 5012 for side		

PACKING REQUIREMENT

	COMMON GUIDELINES FOR PACKING
1	**GENERAL:**
1.1	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.
1.2	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.
1.3	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.
1.4	Each package shall be accompanied by a packing note 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.
a	**OP'** - Open Type.
b	**PP'** - Partially Packed.
c	**CP'** – Crate/Box Packing - Components/Equipment requiring physical protection.
d	'**CQ**' - Case Packing – Machined components-Small & Medium Components/ Assemblies/ Equipment which require corrosion & physical protection.
e	**'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**
3.2.1	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
3.2.2	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
3.4.1	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.
3.4.2	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.

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	**MULTI LAYER CROSS LAMINATED POLY FILM WHILE PACKING OF CUBICLES/CASING**
5.1	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.
5.2	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.
5.3	The cubicles shall be covered with Multi-layer cross laminated poly film.

6	**PACKING OF LOOSE ITEMS/SPARES**
6.1	Inner surfaces of all 6 sides shall be lined with Multi Layered Cross Laminated Polythelene Film (as per clause 5.4) using blue nails.
6.2	Rubberized coir of minimum 25mm thickness and 100 mm width shall be nailed to inner surfaces of bottom and 4 sides of box.
6.3	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.
6.4	Certain items like transformers, reactors, breakers, etc., shall be bolted to the bottom of the box using bolts, nuts and washers.
6.5	Silica gel held in cotton bags shall be kept at proper places in the box.
6.6	Packing slip kept in polyethylene bag shall be placed in the box.
6.7	Two numbers of hoop iron strips shall be strapped tightly on the case using clips.
6.8	Stencil marking of various details and marking of various symbols shall be done as per BHEL instructions using indelible/non-washable marking ink.
6.9	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.

7	**TYPICAL PATTERN OF WOODEN BOX**

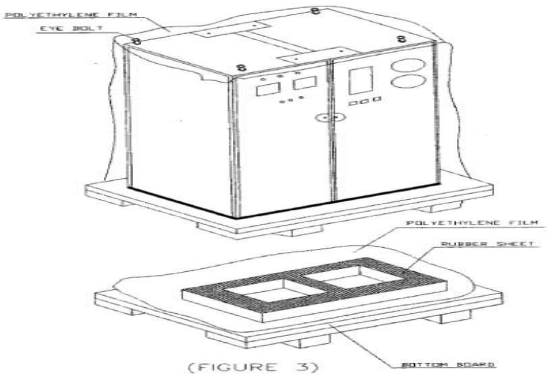

Figure 2

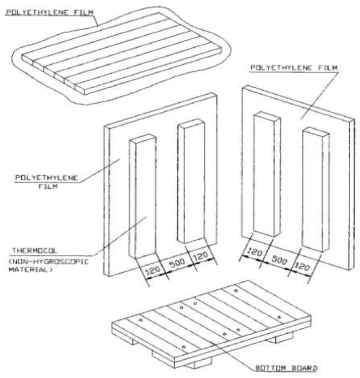

Figure 1

8	**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.

9	**MARKINGS/STENCILINGS**
9.1	**"HANDLE WITH CARE", "FRAGILE DO NOT TURN OVER".**
9.2	Besides the caution signs the product information's shall be stencilled of letters with 13mm to 50mm height.
9.3	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.
9.4	Caution signs & other markings shall be stencilled on both the end shooks & the side shooks.
9.5	Caution sign (for slinging) shall be stencilled only on side shooks at the appropriate place.
9.6	In case the size of package is small for using the stencils, then hand written letters/figures shall be allowed.

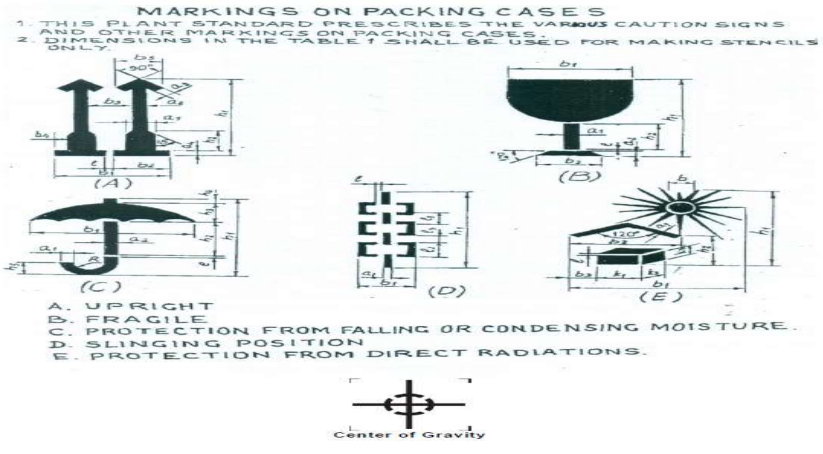

Figure 3

	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:

10 STANDARD METHOD OF PACKING

Table 1 - Standard Method of Packing

S. No.	DESCRIPTION	CASE	CRATE	BUNDLE	BARE	DRUM
1	FAB STRUCTURALS, GIRDER				O	
2	FAB STRUCTURALS, GIRDER				O	
3	SUPPORTING STRUCTURALS				O	
4	STRUCTURE SUB ASSEMBLY, CRAB, END CARRIAGE, END STOPPERS, ROPE DRUM				O	
5	RAIL				O	
6	STAIR CASES				O	
7	HANDRAILS/ PLATFORMS/ LADDERS/ CAGE				O	
8	FASTENERS, RAIL CLAMPS AND FIXING ACCESSORIES	O				
9	BEARING BLOCKS	O				
10	FANS	O				
11	GASKETS	O	O			
12	FLANGES	O	O			
13	PAINT TINS		O			
14	PAINT DRUMS					O
15	MOTORS, TRANSMFORMERS, VVVFD, LIMIT SWITCHES, ELECTRIC HOIST ASSEMBLY, RELAYS, FUSES, LIGHTING FIXTURES, PENDANT, ISOLATING SWITCH, RRC, TRANSMITTERS AND OTHER ELECTRICAL ACCESORIES	O				
16	SWITCH BOARDS, DISTRIBUTION BOARDS, STARTERS, JUNCTION BOXES, PANELS,		O			
17	INDICATORS, VIBRATOR SWITCHES	O				
18	CABLE TRAYS, CABLE RACKS, EARTHING MATERIAL,		O			
19	OPERATIONAL SPARES , MAINTENANCE TOOLS AND TACKLES	O				
20	ALL OTHER LOOSE ITEMS	O				

Note

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.

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.

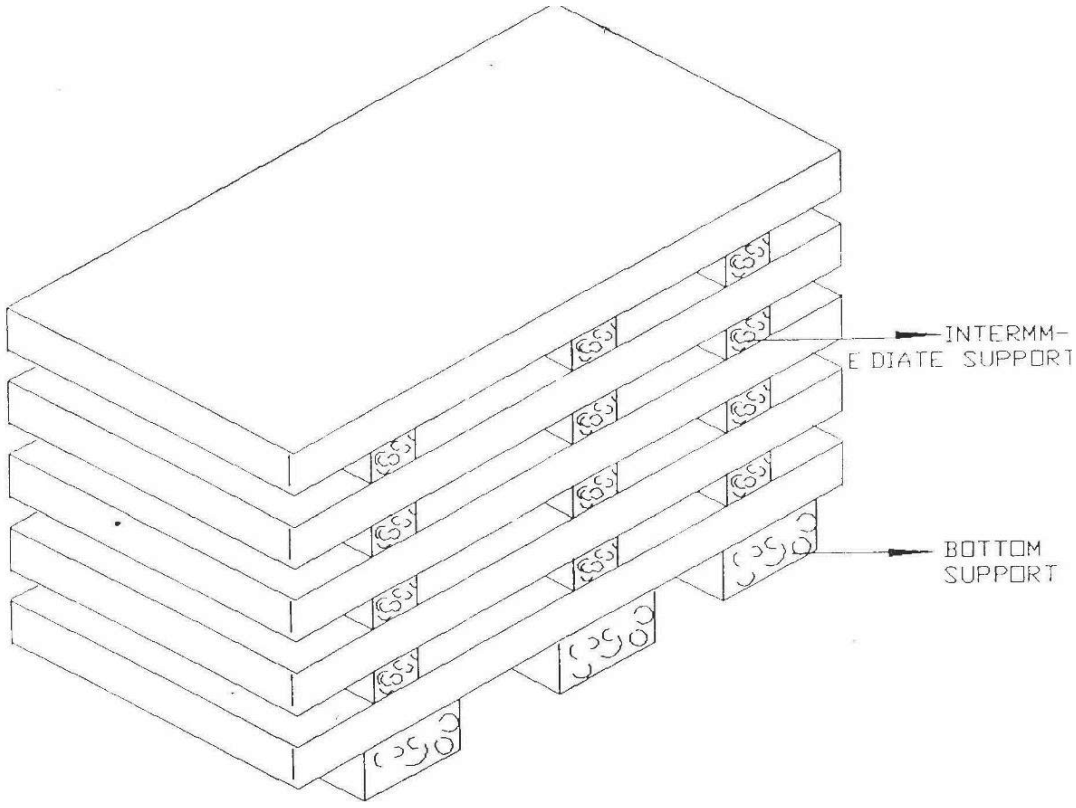

Figure – 1 – PLATE STACKING ARRANGEMENT

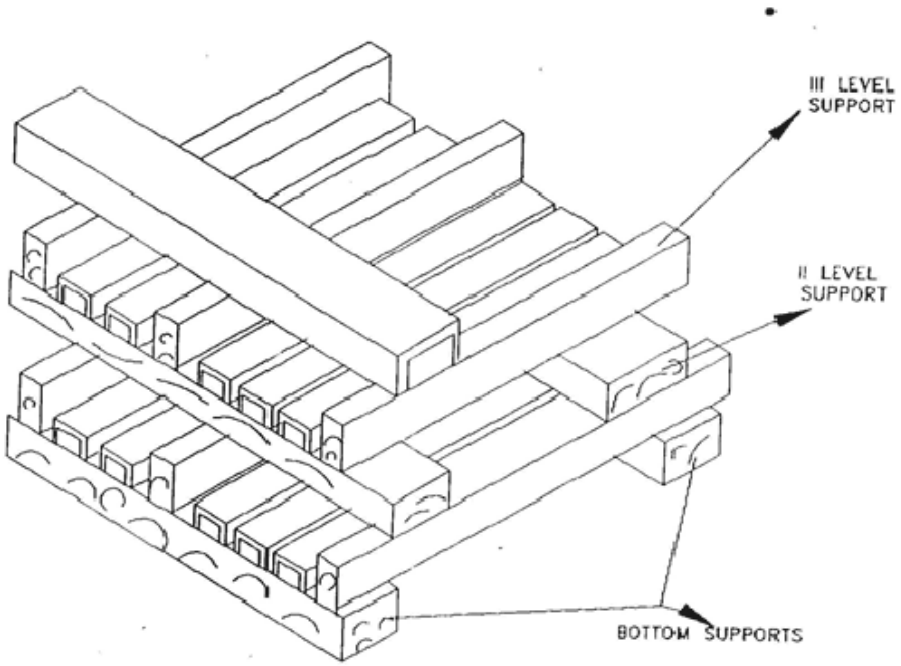

Figure – 2 – STRUCTURAL STEEL STACKING ARRANGEMENT

BILL OF QUANTITY

A	SUPPLY:		2X800 MW SINGRAULI STPP STAGE III										1 X 800 MW SIPAT STPP STAGE-III					
	S. No.	Description	75T BC Bay BFP handling Double Girder crane 1		75T BC Bay BFP handling Double Girder crane 2		70T CWPH Double Girder crane		30T Heavy Material store Double Girder crane		Common for all Double Girder cranes		75T BC Bay BFP handling Double Girder crane		70T CWPH Double Girder crane		Common for all Double Girder cranes	
			Qty	UOM	Qty	UOM	Qty	UOM	Qty	UOM	Qty	UOM	Qty	UOM	Qty	UOM	Qty	UOM
	1	Bridge girders along with walkway, platform, handrails, CT stoppers etc.	2	Nos.	2	Nos.	2	Nos.	2	Nos.	----	----	2	Nos.	2	Nos.	----	----
	2	End carriages																
	a	End carriages structure with walkway, platform, handrails, LT buffers etc.	1	set	1	set	1	set	1	set	----	----	1	set	1	set	----	----
	b	Long Travel Mechanism (Motor, gear box, shaft couling, wheels, brakes, bearings etc.)	1	set	1	set	1	set	1	set	----	----	1	set	1	set	----	----
	3	Crab (trolley)																
	a.	Crab (trolley) structure with CT rails, platform, handrails, CT buffers etc.	1	set	1	set	1	set	1	set	----	----	1	set	1	set	----	----
	b	Main Hoist Mechanism (Motor, Gear box, Rope drum, Rope Upper block, Lower block, hook, couplings, shaft, brakes, bearings etc.)	1	set	1	set	1	set	1	set	----	----	1	set	1	set	----	----
	c.	Aux Hoist Mechanism (Motor, Gear box, Rope drum, Rope Upper block, Lower block, hook, couplings, shaft, bearings, brakes etc.)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	d.	Cross Travel Mechanism (Motor, gear box, shaft couling, wheels, brakes, bearings etc.)	1	set	1	set	1	set	1	set	----	----	1	set	1	set	----	----
	4	LT End stopper	4	Nos.	4	Nos.	4	Nos.	4	Nos.	----	----	4	Nos.	4	Nos.	----	----
	5	Storm Brake	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6	LT rail along with accessories	2x42.5	m	2x42.5	m	2x48.73	m	2x40.2	m	----	----	2x42.5	m	2x33.19	m	----	----
	7	LT PVC insulated shrouded bus bar conductor type DSL with accessories and junction boxes as required	42.5	m	42.5	m	48.73	m	40.2	m	----	----	42.5	m	33.19	m	----	----
	8	Operator's cabin along with operator's seat, gong, fan and other accesories	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	9	Main hoist limit switch (Rotory gar + Gravity)	1+1	Nos.	1+1	Nos.	1+1	Nos.	1+1	Nos.	----	----	1+1	Nos.	1+1	Nos.	----	----
	10	Aux hoist limit switch (Rotory gar + Gravity)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	11	CT lever type limit switch (one way/two way)	2/1	Nos./No.	2/1	Nos./No.	2/1	Nos./No.	2/1	Nos./No.	----	----	2/1	Nos./No.	2/1	Nos./No.	----	----
	12	LT lever type limit switch (one way/two way)	2/1	Nos./No.	2/1	Nos./No.	2/1	Nos./No.	2/1	Nos./No.	----	----	2/1	Nos./No.	2/1	Nos./No.	----	----
	13	Power cables, control cables etc. along with cable tray/conduits etc.	1	set	1	set	1	set	1	set	----	----	1	set	1	set	----	----
	14	Temprory cable: 3.5 Core Power copper flexible cable of suitable size as per load calculation for commissioning, testing & operation of EOT Crane till such time the DSL is charged.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	15	Main Isolating switch	1	No.	1	No.	1	No.	1	No.	----	----	1	No.	1	No.	----	----
	16	Protective Panel along with Control tansformers, lighting transformers, 415/24 V (DC) transformer, contactors, switches, fuses relays and other	1	No.	1	No.	1	No.	1	No.	----	----	1	No.	1	No.	----	----
	17	Main Hoist Panel along with VVVFD, contactors, switches, fuses relays and other accessories	1	No.	1	No.	1	No.	1	No.	----	----	1	No.	1	No.	----	----
	18	Aux Hoist Panel along with VVVFD, contactors, switches, fuses relays and other accessories	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

	19	Cross Travel Panel along with VVVFD, contactors, switches, fuses relays and other accessories	1	No.	1	No.	1	No.	1	No.	----	----	1	No.	1	No.	----	----
	20	Long Travel Panel along with VVVFD, contactors, switches, fuses relays and other accessories	1	No.	1	No.	1	No.	1	No.	----	----	1	No.	1	No.	----	----
	21	Master Controller	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	22	Lighting for cranes (including illumination in cabin (if applicable), over bridge and under bridge) along with	1	set	1	set	1	set	1	set	----	----	1	set	1	set	----	----
	23	Portable 40 W hand lamp with minimum half of baylengh lengh flexible cable for inspection	1	set	1	set	1	set	1	set	----	----	1	set	1	set	----	----
	24	Fire extinguisher	1	No.	1	No.	1	No.	1	No.	----	----	1	No.	1	No.	----	----
	25	Maintenance cage	1	No.	1	No.	1	No.	1	No.	----	----	1	No.	1	No.	----	----
	26	Mechanical overload protection (Load cell) for hoist mode with digital display	1	No.	1	No.	1	No.	1	No.	----	----	1	No.	1	No.	----	----
	27	Radio Remote control with transmitter unit, receiver unit, batterg etc.	1	set	1	set	1	set	1	set	----	----	1	set	1	set	----	----
	28	Additional isolating switches for maintenance of cranes	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	29	Lifting beam & its slings	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	30	Anti collission device	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	31	Centralized grease lubrication system to be provided with hand pumps located at crab and both end carriages for all grease lubricated bearings of crane.	1	set	1	set	1	set	1	set	----	----	1	set	1	set	----	----
	32	DSL Phase indicating lamps (RYB)	2	Sets	2	Sets	2	Sets	2	Sets	----	----	2	Sets	2	Sets	----	----
	33	Earthing strips	1	set	1	set	1	set	1	set	----	----	1	set	1	set	----	----
	34	First fill of lubricants i.e. oils, grease, servo fluids, cadmium compounds etc. till one year after commissioning	1	set	1	set	1	set	1	set	----	----	1	set	1	set	----	----
	35	E-Learning Package	1 set common for both BC Bay handling crane				----	----	----	----	----	----	1	set	----	----	----	----
	36	Load testing sling, cradles and any other item required by the vendor during the load testing at site on returnable basis	----	----	----	----	----	----	----	----	1	set	----	----	----	----	1	set
	37	**Maintenance tools & tackles**																
a.		Complete set of ring spanners	1	set	1	set	1	set	1	set	----	----	1	set	1	set	----	----
b.		Complete set of screwdrivers (Min. 6 Nos., Indicate the sizes)	1	set	1	set	1	set	1	set	----	----	1	set	1	set	----	----
c.		Adjustable Spanner	1	no.	1	no.	1	no.	1	no.	----	----	1	no.	1	no.	----	----
d.		Insulated plier	1	no.	1	no.	1	no.	1	no.	----	----	1	no.	1	no.	----	----
e.		Wrench spanner	1	no.	1	no.	1	no.	1	no.	----	----	1	no.	1	no.	----	----
f.		Grease Gun	1	no.	1	no.	1	no.	1	no.	----	----	1	no.	1	no.	----	----
g.		Oil Gun.	1	no.	1	no.	1	no.	1	no.	----	----	1	no.	1	no.	----	----
h.		Hand Lamp.	1	no.	1	no.	1	no.	1	no.	----	----	1	no.	1	no.	----	----
i.		Line tester	1	no.	1	no.	1	no.	1	no.	----	----	1	no.	1	no.	----	----
j.		O&M Manual	1	no.	1	no.	1	no.	1	no.	----	----	1	no.	1	no.	----	----
k.		Steel box to place above tools & manual	1	no.	1	no.	1	no.	1	no.	----	----	1	no.	1	no.	----	----
	41	**Erection & Commissioning Spares (to be supllied as per requirement)**	1	set	1	set	1	set	1	set	----	----	1	set	1	set	----	----
	42	**Any other item/s for completion of scope of work**	1	set	1	set	1	set	1	set	----	----	1	set	1	set	----	----

B	MANDATORY SPARES:		Qty for both 75T BC Bay BFP handling Double Girder cranes		70T CWPH Double Girder crane		30T Heavy Material store Double Girder crane			75T BC Bay BFP handling Double Girder cranes	70T CWPH Double Girder crane	
	S. NO.	ITEM DESCRIPTION	Qty	UOM	Qty	UOM	Qty	UOM		Qty	Qty	UOM
	1.1	**Mechanical:**										
	(a)	Bearings for long travel wheels	1 Set (Requirement for one Crane)									
	(b)	Bearings for cross travel wheels	1 Set (Requirement for one Crane)									
	(c)	Bearings for Gear Boxes for each type of Hoist & travel (Main and aux hoist(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))	2 Sets (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)	2 Sets (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 Main Hook	1	No.								
	1.2	**Electrical:**										
	i)	Solenoid Coils for Brakes	2	sets								
	ii)	MCBs/MCCBS/Fuse links for the whole crane	1	set		----		----		----	----	
	iii)	Contactors and overload Relays of each type, size & rating for Motors of the EOT	1	set								
	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 of each tpe and rating	1	No.								

	1.3	MECHANICAL																
	i)	Bearings for long travel wheels	----	----	----	----	1	set										
	ii)	Bearings for cross travel wheels	----	----	----	----	1	set										
	iii)	Brake liners for all the Brakes	----	----	----	----	1	set										
	iv)	Hydraulic thrusters for Brakes	----	----	----	----	1	set										
	v)	Wire rope for Crane	----	----	----	----	1	length										
	vi)	Bearings for hoisting	----	----	----	----	1	set										
	vii)	Electrical Items of Crane	----	----	----	----												
	a	Carbon brushes and brush holders for motors	----	----	----	----	1 set of each rating/Size											
	b	Solenoid coils for all brakes	----	----	----	----	1 set of each rating/Size											
	c	Contactors and Overload relays for motors	----	----	----	----	1 set of each rating/Size											
	d	Set of MCB/MCCB/fuses/Fuse links for the whole crane	----	----	----	----	1	set			----		----		----			
	e.	Limit switches for main hoist, long travel & Cross travel	----	----	----	----	1	set										
	f.	Motors of the EOT	----	----	----	----	1no. of each type, size & rating											
	g.	Timers of each type, size & rating	----	----	----	----	1	set										
	h.	Master Controller for Aux. Hoist,	----	----	----	----	1	set										
	i.	Resistance Box	----	----	----	----	1 No of each type											
	j.	Overload relays for motors	----	----	----	----	1	set										
C	**SERVICES**		**75T BC Bay BFP handling Double Girder crane 1**		**75T BC Bay BFP handling Double Girder crane 2**		**70T CWPH Double Girder crane**		**30T Heavy Material store Double Girder crane**				**75T BC Bay BFP handling Double Girder crane**		**70T CWPH Double Girder crane**			
	i)	Unloading, handling, transportation to site.	1	set	1	set	1	set	1	set			1	Set	1	Set		
	ii)	Assembly, erection & commissioning including Performance guarantee tests at site.	1	set	1	set	1	set	1	set			1	Set	1	Set		
	iii)	Final handing over to Customer	1	set	1	set	1	set	1	set			1	Set	1	Set		

DOCUMENTATION REQUIREMENT

DRAWINGS & DOCUMENTS TO BE SUBMITTED BY ALL THE BIDDERS ALONG WITH THE BID	
Sl. No.	**DOCUMENT TITLE**
1	PQR CREDENTIALS
2	COMPLIANCE SHEET
3	"NO DEVIATION" CERTIFICATE DULY STAMPED AND SIGNED.

DRAWINGS & DOCUMENTS TO BE SUBMITTED BY SUCCESSFUL BIDDER AFTER AWARD OF CONTRACT ALONG WITH SUBMISSION SCHEDULE

S.N.	BHEL drawing No. (for Singrauli Project)	BHEL drawing No. (for Sipat Project)	Title	Approval category	Schedule date of submission (in weeks from date of LOA)
1	PE-V0-512-501-A401	PE-V0-520-501-A401	Manufacturing Quality Plan with sub vendor list For Double Girder EOT cranes upto 100T	A	3
2	PE-V0-512-501-A403	PE-V0-520-501-A403	Data sheet of motors for Double Girder EOT cranes upto 100T	I	6
3	PE-V0-512-501-A404	PE-V0-520-501-A404	Mechanism Sizing Calculation Including storm brake calculation for Double Girder EOT cranes upto 100T	A	3
4	PE-V0-512-501-A405	PE-V0-520-501-A405	General arrangement for Double Girder EOT cranes upto 100T with CT DSL details	A	3
5	PE-V0-512-501-A406	PE-V0-520-501-A406	Crab sub assembly for Double Girder EOT cranes upto 100T with CT wheel assembly	A	3
6	PE-V0-512-501-A408	PE-V0-520-501-A408	General arrangement for PVC shrouded DSL for Double Girder EOT cranes upto 100T	I	6
7	PE-V0-512-501-A409	PE-V0-520-501-A409	Main and Auxiliary hook block assembly with details of hook, nut and check plate Double Girder EOT cranes upto 100T	I	3
8	PE-V0-512-501-A410	PE-V0-520-501-A410	Long travel Machinery Assembly with LT wheel assembly For Double Girder EOT cranes upto 100T	I	4
9	PE-V0-512-501-A412	PE-V0-520-501-A412	Structural calculations For Double Girder EOT cranes upto 100T (including structual calculation for crab structure)	I	4
10	PE-V0-512-501-A414	PE-V0-520-501-A414	O & M Manual For Double Girder EOT cranes upto 100T	A	12
11	PE-V0-512-501-A417	PE-V0-520-501-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-V0-512-501-A418	PE-V0-520-501-A418	"General Arrangement of a) Protective panel b) Main hoist panel c) Aux. hoist panel d) Cross Travel panel e) Long Traverse travel panel.	A	5

			f) Pendent g) Remote Radio Control For Double Girder EOT cranes upto 100T"		
13	PE-V0-512-501-A419	PE-V0-520-501-A419	Cable Sizing and cable schedule For Double Girder EOT cranes upto 100T	A	6
14	PE-V0-512-501-A420	PE-V0-520-501-A420	Crane Operational write up For Double Girder EOT cranes upto 100T	I	5
15	PE-V0-512-501-A421	PE-V0-520-501-A421	Type test certificate (for motors) For Double Girder EOT cranes upto 100T (Applicable for above 100 KW rating motors)	A	10
16	PE-V0-512-501-A423	PE-V0-520-501-A423	Mandatory spare parts list For Double Girder EOT cranes upto 100T	A	16
17	PE-V0-512-501-A425	PE-V0-520-501-A425	Erection procedure For Double Girder EOT cranes upto 100T	I	8
18	PE-V0-512-501-A427	PE-V0-520-501-A427	Data sheet of Double Girder EOT cranes upto 100T with painting details	A	8
19	PE-V0-512-501-A430	PE-V0-520-501-A430	Electrical load for Double Girder EOT cranes upto 100T	I	8
20	PE-V0-512-501-A432	PE-V0-520-501-A432	Gantry Rail installation for Double Girder EOT cranes upto 100T	A	4
21	PE-V0-512-501-A450	PE-V0-520-501-A450	Crane lubrication drawing For Double Girder EOT cranes upto 100T	I	6

	LEGENDS
	A= Approval category
	I= Information category

Notes:-

1	Bidder to follow the following the drawing submission schedule: i.1st submission of drawings from date of LOA as per the submission schedule. ii.Every revised submission incorporating comments – within 10 days. iii. BHEL & Customer Comment/ Approval -18 days
2	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.

DRAWINGS & DOCUMENTS TO BE SUBMITTED AS FINAL/AS-BUILT DOCUMENT

Sl. No.	DOCUMENT TITLE	No. of prints (Sets)	No. of portable hard disk
1	APPROVED DOCUMENTS	3	2
2	AS BUILT DRAWINGS/ DOCUMENTS	3	2
3	ERECTION MANUAL	3	2
4	O&M MANUAL	3	2
5	PERFORMANCE AND FURNTIONAL GUARANTEE TEST REPORTS	3	0

COMPLIANCE CERTIFICATE

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

1	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.
2	Bidder shall submit Manufacturing Quality Plan(MQP) in the event of order based on the guidelines given in the specification & reference MQP enclosed therein. MQP will be subject to BHEL / CUSTOMER approval & customer hold points for inspection / testing and additional inspection requirement, if any shall be marked in the MQP 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.
3	All drawings/ data-sheets / calculations etc. submitted along with the offer shall not be taken cognizance off.
4	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.
5	All sub vendors shall be subject to BHEL / CUSTOMER approval in the event of order.
6	Guarantee for plant/ equipment shall be as per relevant clause of GCC / SCC / Other Commercial Terms & Conditions.
7	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.
8	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.
9	As built drawings shall be submitted as and when required during the project execution.

10	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.
11	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.
12	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.

Signature of authorised Representative

Name and Designation :

Name & Address of the Bidder

Date

PRE QUALIFICATION REQUIREMENT (TECHNICAL)	
1	The Bidder should have designed, manufactured, erected and commissioned Double Girder EOT/Gantry/Semi-Gantry crane of minimum 30T capacity with span of 10 Metres or more and having/ability to have in house facility for testing of Double girder EOT crane with actual capacity required for the tender.
2	The Bidder has to submit following supporting documents meeting above mentioned prequalifying requirement Copy of minimum one (1) performance certificate (in English) from end user along with copy of related Purchase Order (PO) or Letter of intent (LOI) or Letter of Award (LOA) or Work Order (WO) specifying that the product/equipment is running successfully for one (1) year from date of commissioning meeting the minimum pre-qualifying requirement.
3	Bidder shall submit design documents to substantiate technical parameters specified in clause 1 & 2 above, if the same is not mentioned in performance certificate/purchase order.
Note	
a	Bidder to submit all supporting documents in English. If documents submitted by bidder are in language other than English, a self-attested English translated document should also be submitted.
b	Minimum one (1) no. Purchase order shall be submitted which should not be more than seven (7) years old as on date of bid submission, for establishing continuity in business.
c	Notwithstanding anything stated above, BHEL/CUSTOMER reserves the right for physical assessment of the capabilities and capacity of the bidder to perform the contract, should the circumstances warrant such assessment in the overall interest of BHEL/CUSTOMER. Bidder to furnish details as per Annexure A- "Sub-Vendor Questionnaire".
d	BHEL shall evaluate and qualify the bidders based on their performance in awarded contracts in current projects under execution as per attached Annexure C-Performance Feedback.
e	Consideration of offer shall be subject to Customer's approval of bidders, if applicable.
f	After satisfactory fulfilment of all the above criteria/ requirement, offer shall be considered for further evaluation as per NIT and all the other terms of the tender.

CORPORATE QUALITY ASSURANCE

SUB-VENDOR QUESTIONNAIRE

i.	***Item/Scope of Sub-contracting***	
ii.	***Address of the registered office***	***Details of Contact Person (Name, Designation, Mobile, Email)***
iii.	***Name and Address of the proposed Sub-vendor's works where item is being manufactured***	***Details of Contact Person: (Name, Designation, Mobile, Email)***
iv.	***Annual Production Capacity for proposed item/scope of sub-contracting***	
v.	***Annual production for last 3 years for proposed item/scope of sub-contracting***	
vi.	***Details of proposed works***	
1.	***Year of establishment of present works***	
2.	***Year of commencement of manufacturing at above works***	
3.	***Details of change in Works address in past (if any)***	
4.	***Total Area***	
	Covered Area	
5.	***Factory Registration Certificate***	***Details attached at Annexure – F2.1***
6.	***Design/ Research & development set-up (No. of manpower, their qualification, machines & tools employed etc.)***	***Applicable / Not applicable if manufacturing is as per Main Contractor/purchaser design) Details attached at Annexure – F2.2 (if applicable)***
7.	***Overall organization Chart with Manpower Details (Design/Manufacturing/Quality etc)-***	***Details attached at Annexure – F2.3***
8.	***After sales service set up in India, in case of foreign sub-vendor (Location, Contact Person, Contact details etc.)***	***Applicable / Not applicable Details attached at Annexure – F2.4***
9.	***Manufacturing process execution plan with flow chart indicating various stages of manufacturing from raw material to finished product including outsourced process, if any***	***Details attached at Annexure – F2.5***
10.	***Sources of Raw Material/Major Bought Out Item***	***Details attached at Annexure – F2.6***
11.	***Quality Control exercised during receipt of raw material/BOI, in-process , Final Testing, packing***	***Details attached at Annexure – F2.7***
12.	***Manufacturing facilities***	***Details attached at Annexure – F2.8***

CORPORATE QUALITY ASSURANCE

SUB-VENDOR QUESTIONNAIRE

	(List of machines, special process facilities, material handling etc.)	
13.	*Testing facilities* *(List of testing equipment)*	*Details attached at Annexure – F2.9* *& Details of load testing facility of Work/s to be submitted in Annexure B*
14.	*If manufacturing process involves fabrication then-* *List of qualified Welders* *List of qualified NDT personnel with area of specialization*	*Applicable / Not applicable* *Details attached at Annexure – F2.10* *(if applicable)*
15.	*List of out-sourced manufacturing processes with Sub-Vendors' names & addresses*	*Applicable / Not applicable* *Details attached at Annexure. –F2.11* *(if applicable)*
16.	*Supply reference list including recent supplies*	*Details attached at Annexure – F2.12* *(as per format given below)*

Project/ package	*Customer Name*	*Supplied Item (Type/Rating/Model /Capacity/Size etc)*	*PO ref no/date*	*Supplied Quantity*	*Date of Supply*

17.	*Product satisfactory performance feedback letter/certificates/End User Feedback*	*Attached at annexure - F2.13*
18.	*Summary of Type Test Report (Type Test Details, Report No, Agency, Date of testing) for the proposed product (similar or higher rating)* *Note:- Reports need not to be submitted*	*Applicable / Not applicable* *Details attached at Annexure – F2.14* *(if applicable)*
19.	*Statutory / mandatory certification for the proposed product*	*Applicable / Not applicable* *Details attached at Annexure – F2.15* *(if applicable)*
20.	*Copy of ISO 9001 certificate* *(if available)*	*Attached at Annexure – F2.16*
21.	*Product technical catalogues for proposed item (if available)*	*Details attached at Annexure – F2.17*

Name:		*Desig:*		*Sign:*		*Date:*	

Company's Seal/Stamp:-

Details of Testing facility of Work/s **Annexure -B**

PACKAGE	DOUBLE GIRDER EOT CRANES UPTO 100T			
Bidder name				
Bidder works address				
S. NO.	**FACILITY**	**DETAILS REQUIRED**	**DATA TO BE FURNISHED**	**REMARKS**
1 a)	Handling facilities in the test bay/ shop	Number & capacity of cranes available		
1 b)		Maximum capacity of load that can be handled with shed/testing bay cranes handle (individually or in tandem)		Layout drawing of the testing / bay shed to be furnished.
1 c)		Clear height from floor level to the Hook level of the crane of testing bay/ shed		
2 a)	Stand/frame for supporting the crane bridge girders during load/ overload testing of crane at works	Number of stands available		
2 b)		Load bearing capacity of each stand		Documentary proof i.e previous load testing report of similar capacity and span or structural calculations for justifying the load bearing capacity of the crane.
2 c)		Height of stand		
3 a)	Load Pit	Dimensions		Pit drawing/photograph to be furnished.
3 b)		Maximum capacity of the load that can be accomodated in load pit		Calculations / drawing to be furnished for justification of maximum load claimed to be accomodated in the avaiable test pit dimensions.
4 a)	Calibrated Dead Load	Maximum dead load (calibrated) along with cradle available		In case of unavailability of sufficient dead load, whether supplier makes any alternate arrangement i.e type of dead load, availabilty of suitable capacity load cells with display etc.
4 b)		Dimensions		Dimensions of individual load block, as available, to be furnished.
Note: Details of testing facility shall be submitted for justification of capability of testing.				

Annexure-C

Assessment of Bidder/ Supplier wrt Performance Feedback from current projects by PS- Regions

Name of Bidder/ Supplier:
Package quoted for:
Reference Project for Performance Assessment:
Date:

Sl. No.	Area of Assessment	Particulars for Evaluation	Maximum marks	Marks awarded
1	**Material supply**		**50**	
1a	Package Name	Whether agency has supplied the material within given contractual period with extension. Supply 100% - 40 marks 75% - 30 marks 50% - 25 marks Marks may be given on pro-rate supply basis.	40	
1b		Assessment of Qualitative ability of agency to follow the approved documents/ BHEL procedures / guidelines for material inspections/ inspection call/ MDCC request / Dispatch documentation.	10	
2	**Execution Capabilities**		**50**	
2a	Package Name	Whether agency has engaged competent person as site in charge and other supervisors/ manpower to handle site execution.	10	
2b		Vendor involvement/ behaviour/ engagement during E&C at site and initiative to resolve of interface issues.	10	
2c		Quality of erection drawings and BOQ availability.	10	
2d		Agency efforts & inclination on implementation of HSE, Safety and quality during execution of system	10	
2e		Whether agency has made the system ready/ commissioned before corresponding project milestone requirement.	10	
	Grand Total		**100**	

Note: 1. The feedback to be provided by PS-Regions against the bidder's performance.
2. The average qualifying marks will be 60.

PS-Region Representative

PS-Region (Head/Projects)

PRE QUALIFICATION REQUIREMENT (FINANCIAL)