



BHARAT HEAVY ELECTRICALS LIMITED
TRANSMISSION BUSINESS ENGINEERING MANAGEMENT
TRANSMISSION BUSINESS GROUP
SEC – 142, NOIDA

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CUSTOMER	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD.							
CONSULTANT	TATA CONSULTING ENGINEERS LIMITED BENGALURU							
PROJECT	2X660MW UDANGUDI STPP (STATE-1)							
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TECHNICAL PRE-QUALIFICATION REQUIREMENT

QUALIFYING CONDITIONS FOR EOT CRANE

DESCRIPTION OF BHEL REQUIREMENT	TO BE SUPPLIED/ CONFIRMED/ SUBMITTED BY	OFFERED	DEVIATION	REMARKS
The bidder should have designed, manufactured, supplied, erected, tested and commissioned EOT cranes (atleast one number) of capacity 3T or more with minimum crane span of 16 m. Above crane should have been in #successful operation for at least two (2) years during last 10 years prior to date of techno-commercial bid opening of this tender. (#) Successful operation means certificate issued by the Customer/ end user certifying the operation without any adverse remark. The following information should be submitted by the vendor about the facilities where EOT cranes have been supplied. This is required from all the vendors for qualification of their offer.	Vendor to accept & confirm.			
1. Name of the customer / company alongwith complete postal address where referred crane is commissioned.	Vendor to inform			
2. Month & Year of Commissioning.	Vendor to inform			
3. Details of Crane (e.g. Type, Span, Capacity etc.) supplied.	Vendor to inform			
4. Name & designation, Phone, FAX no. and email address of the contact person of the customer	Vendor to inform			
5. Copy of purchase order and supporting acceptance papers or MOM of commissioning of Crane from the customers (clearly indicating type, capacity & span of crane) will be required	Vendor to submit			
6. Letter/ Certificate/ MOM from customer/ end user for satisfactory operation	Vendor to submit			
7. BHEL reserves the right to verify the information provided by vendor. In case the information provided by vendor is found to be false/ incorrect, the offer shall be rejected.	Vendor to accept & confirm			



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SECTION-1 INTENT, SYSTEM REQUIREMENT, DESIGN CRITERIA & SCOPE

1.0 INTENT OF SPECIFICATION

1.0.0 This specification is intended to cover following activities and services in respect of all the equipment of the One Set Single Girder EOT Crane of 3T capacity to be provided for 400 kV Gas Insulated Substation Building of 2X660MW UDANGUDI STPP (STAGE-1)

- i) Detailed design of all the equipment and equipment system(s).
- ii) Complete manufacturing including shop testing.
- iii) Providing engineering data, drawings, and O & M manuals as per specified format etc. for owners/purchaser's review, approval and records.
- iv) Packing and transportation from the manufacturer's works to the site including any clearance, if required.
- v) Fabrication, pre-assembly, if any, erection testing and putting into satisfactory operation all the equipment including successful completion of trial operation.
- vi) Performance and Guarantee tests after successful completion of trial operation.

Note: Receipt of material and safe storage of all components shall be excluded from bidder's scope.

1.0.1 The requirements specified under SECTION 2, SECTION 3 & SECTION 4 of the specification shall be considered as part of this section. In the event of any conflict between the various sections/sub-sections of this specification, SECTION 1 shall prevail.

1.0.2 It is not the intent to specify herein all the details of design and manufacture. However, the equipment and the system 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/ Owner, who will interpret the meaning of drawings and specifications and shall be entitled to reject any work or material, which in his judgment is not in full accordance herewith.

1.0.3 Contract shall be on lumpsum basis for the scope defined in the specification. Variations in quantities during contract stage without any change in input from BHEL side shall not have any commercial implications. The Bidder shall be responsible for providing all material, equipment and services, specified or otherwise which are required to fulfill the intent of ensuring operability, maintainability and the reliability of the complete work covered under this specification.

1.0.4 The Bidder shall deem to have understood completely all the tender drawings and documents and quoted accordingly.

1.0.5 **Deviation:** There shall preferably be no deviation on technical specification. The bidder shall sign and stamp the "Certificate for No Deviation" enclosed in Schedule-2, Section-4 towards confirmation. Except for these deviations/ variations covered under Deviation Schedules which are accepted by the Purchaser before the award of the Contract, it will be the responsibility of the Bidder to fully meet the intent and the requirements of the specification within the quoted price. *Deviations in any other form including clarifications / assumptions / etc will not be considered and it will be construed that the bid conforms strictly to the specification.*



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- 1.0.6 The Bidder to note carefully that the parameters, estimated capacities of equipment indicated and the tender drawings in the specification are only for the guidance of the Bidder. The system shall be designed as per relevant standards/ codes and exact capacities and quantities are to be estimated by the Bidder. All such estimations and design calculations shall be submitted for Purchaser's approval.
- 1.0.7 It is the responsibility of the successful Bidder to obtain necessary approval/ clearance from statutory organizations wherever applicable for the equipment/ systems under the scope specified.
- 1.0.8 **The term 'Owner/Client' appearing in this specification shall refer to TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD. (TANGEDCO), the term 'Consultant' shall refer to TATA CONSULTING ENGINEERS LTD., the term 'Purchaser' shall refer to BHEL and the term 'Contractor' shall refer to the successful Bidder.**

This system shall be designed to provide one no. 3T capacity Single Girder EOT Crane for GIS Hall Building of **2X660MW UDANGUDI SUPER THERMAL POWER PROJECTS STAGE-I -400 KV GIS.**

2.0 Scope

One number (1) Single Girder Electrically Operated Travelling Crane or EOT Crane (**having 3 tones capacity**) with Variable Voltage Variable Frequency i.e. VVVF Drive in all three controls of Hoisting, CT & LT suitable for erection of various equipment at 400 kV GIS Hall Buildings shall be required.

Crane shall be designed on the following main technical parameters:

S.N.	Description	Technical Particulars
1.	GENERAL	Single Girder EOT Crane at 400KV GIS Hall Building
2.	Type of Crane	Single Girder Over Head EOT
3.	Capacity (SWC)	3 Tones
4.	Span*	16 m (Approx.)
5.1	Lift	9.5 m
5.2	Bay Length*	86 m (Approx.)
6.	Crane structure	Single Girder
7.	PAINTING	As per Annexure-I
8.	Control for Hoisting, CT and LT operations	Thru' VVVF drives
9.	Speed Control	Thru' VVVF drive
10.	Design Temperature	50 degC

***Please refer architecture drawing of GIS hall Building attached to this specification for exact dimension. Minimum margin of +/-10% should be considered for bidding purpose.**

Reference: ARCHITECTURAL DRAWING GIS BUILDING (PLAN, SECTION, ELEVATION) (TB-1-400-607-640-1 Rev.01)

Scope shall include design, engineering, manufacture, assembly/pre-assembly, tests at manufacturer's works, shop painting & packing and transportation to site of the equipment complete with all the auxiliaries as specified hereunder for trouble free and satisfactory operation.



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2.1 SCOPE OF SUPPLY AND SERVICES

The scope of the work under the contract shall be deemed to include all such items, which although not specifically mentioned in the bid documents and/or in the bidder's proposal, but are required to make the equipment/system complete for its safe, efficient, reliable and trouble free operation, unless the same is specifically excluded from the bidder's scope of work under clause 6.2.0 of this section. The scope covers broadly the following:

A. SUPPLIES

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

Each EOT crane shall include all necessary items but shall not be limited to the following:

- i. Bridge girder.
- ii. Maintenance platform
- iii. End carriages complete with wheels
- iv. Electric Hoist (For EOT Crane)
- v. CT / L T drive arrangement
- vi. Electrical equipment
- vii. PVC Shrouded Conductor Bus Bar Type DSL with accessories for entire bay length.
- viii. Earthing arrangement.
- ix. First fill of lubricant.
- x. Main isolating switch and power cable from 1.5 m above ground / operating floor to down shop lead.

B. Services to be provided by the bidder

1. Packing, loading, transportation to site.
2. Erection, testing and commissioning at site.

C. Inspection and Testing

Inspection and testing at Manufacturer's works

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

- i. Identification, co-relation and verification of material test certificates for the important components like girders, major load carrying components, hooks, gears, shafts, wheels, wire, rope drum, wire rope etc. For other components supporting test certificates or random check tests shall be conducted.
- ii. Qualification of welder and welding procedure as per ASME section 1X of ASTM -7.1.
- iii. 100% radiography of tension zone & 25% radiography of compression butt welds of load bearing members shall be carried over and all butt welds as per ASME- 165/ASTME 109 and acceptance norm as per ASME Section viii Div.1.
- iv. For fillet welds visual inspection on all welds. Die penetration test (DPT) for fillet welds in the load bearing members as per ASME-165/ASTME 109 and acceptance norm as per ASME section VIII Div. 1.
- v. Ultrasonic test on forgings and casting of critical components like hook, shafts, axles, gears, wheels, pulleys, etc. Ultrasonic test for casting as per ASME Section III NB 2572 & for forging as per ASTM A388.
- vi. Unacceptable defects in forgings are as given below: -
 - a. Cracks, flaws, seams and laps.
 - b. Defects giving indication larger than 4mm diameter equivalent flaw.



- c. Groups of defects with maximum indication less than that from a 4mm dia, equivalent flaw, which cannot be separated at testing sensitivity if the back echo is reduced by 50%.
- d. Defects giving indication of 2 to 4 mm diameter equivalent flaw separated by a distance less than 4 the size of the larger of the adjacent flaws.
- vii. PT/ MT on component with surface hardening as per ASTM E -165 and ASTM E 138 respectively with no surface defects.
- viii. Gearbox trial run test as per AGMA standards.
- ix. Verification of type test certificates and enclosure for electrical and electro mechanical items. If type test certificates of the similar items are not available, arrangement shall be made to conduct the same in the presence of BHEL/ Customers representative.
- x. Acceptance and routine tests (HV and insulation) for all electrical and electromechanical components and system as per governing specification
- xi. Functional and simulated operation test, sequencing, interlocks, safety, protection and alarm system. Test on CRANE/ CRAB motors and other mechanical, electrical, electro-mechanical as per BHEL technical specification and or as per applicable code
- xii. Cranes shall be completely assembled at manufacturer's works to check the misalignment of gears, shafts and other items. Gears shall have the idle run for minimum two (2) hours.

Testing At Works

- i. Deflection test of bridge girder at rated load
- ii. No load / load (EWL) / Over load test (running of CT & Hoisting mechanism at 125% of rated load.)
- iii. Electrical tests for brakes, panel, electrical equipment etc. as per IS - 3177
- iv. No load run test of LT mechanism
- v. Measurement of speed of CT & Hoisting (lowering & raising) at rated load
- vi. All Other tests as per IS - 3177.
- vii. All Tests including Proof Load Test as per relevant IS shall be carried out for Hooks
- viii. MPI/DPT shall be carried out after proof load test.
- ix. DPT on machined surface shall be carried out for steel casting
- x. The plates of thickness 25mm and above shall be ultrasonically tested for Girders, End Carriage, Crab, Gear Box, and Rope
- xi. NDT requirements on weldments shall be as follows:

a)	Butt Welds in Tension	100% RT and 100% DPT
b)	Butt Welds in Compression	10% RT and 100% DPT
c)	Butt Welds in Rope	100% RT and 100% DPT
d)	Fillet Welds	Random 10% DPT

FORGINGS (wheel, gears, pinions, axle, hooks & hook trunion).

All forgings greater than or equal to 50 mm diameter or thickness shall be subjected to Ultrasonic test. PT/MPI shall be done after hard facing and machining.

- xii. Wire rope shall be tested as per relevant standard.
- xiii. Reduction gears shall be tested for reduction ratio, backlash & contact pattern. Gear box shall be subjected to no load run test to check for oil leakage, temperature rise, noise and vibration.

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- xiv. The cranes shall be completely assembled at shop for final testing. All tests for dimension, deflection, load, overload, hoisting motion, cross travel etc. as per IS-3177 shall be carried out at shop.

Testing at site

Following tests shall be carried out at site as a part of ETC scope:

- All the tests as mentioned above, with actual hook and wire rope
- Speed test at rated load for hoisting / CT and LT mechanism
- Brake test and working of both electric hoist
- Any other test as per IS-3177-1999.

The successful bidder shall furnish their recommended procedure for carrying out the Erection and Commissioning, to be done by the customer.

3.0 Design Features & requirements

CODES AND STANDARDS.

IS 3177: Code of Practice for Electric overhead travelling cranes and gantry cranes other than steel works cranes.

IS 800: Code of practice for use of structural steel in general building construction.

IS 807: Code of practice for design, manufacture, erection and testing (structural portion) of cranes and hoists.

IS 2266: Steel wire ropes for general engineering purposes.

IS 3443: Crane rail sections.

IS 15560: Point hooks with shank up to 160 tonne specification

IS 4029: Guide for testing three phase induction motors

IS 5749: Forged ramshorn hooks.

IS 4164: Specification for lifting 'C' Hooks with eye - capacity up to 25 tonnes

IS 12162: Specification for lifting hook

IS 3832: Specification for hand-operated chain pulley blocks

IS 3938: Specification for electric wire rope hoists

IS 1835: Specification for Round steel wire for ropes

IS 7847: General Characteristic of Lifting hook.

IS 3815: Specification for point hook with shank

3.0.0 DESIGN REQUIREMENT

EOT cranes conforming to M5 for Mechanical, Structural and M7 for Electrical of IS:3177 – 1999 and Class II of IS 3938 shall be designed, manufactured, inspected, shop tested, erection, site testing and commissioning to well established engineering practices, safety codes and other relevant codes and standards. However, Work shop single girder overhead crane conforming to Group M7 for mechanical, structural and electrical of IS 3177.

3.1.0 Ambient Temperature

Crane and its components shall be designed /selected for ambient temperature of 50° C.

3.2.0 All materials / components will be new and of tested quality and will conform to the specification requirements and standards mentioned.

3.3.0 Crane control shall be from Variable Voltage and Variable Frequency (VVVF) drive. Creep speed shall be achieved through VVVF drive for cranes.

3.4.0 For guidance purposes the following crane speeds shall be considered:-



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Single Girder Crane:

- **Main Hoist -2.5 to 5m/min**
- **Trolley Travel -10 to 15 m/min & Bridge Travel- 15 m/min**
- **Creep speeds-10% of operating speeds for all motion**

VVVF control: The VVF drive control shall be used for control of each motion. The VVF drive shall be equipped at least with 1024 pulse incard, droop control for synchronization and crane software. The rating of VVF shall be decided considering 250% of full load current of respective drive motor based on in panel rating with derated at 50 Deg C ambient temperature. VVVF system shall be rated for continuous duty as per IEC 146 (clause II). Output frequency range shall be minimum 0 to 50 Hz at constant torque and 0 to 100 Hz at constant power. Efficiency of VVVF shall be minimum 97%. Individual converters shall be provided for each vector drive. The harmonic content reflected on incoming line is to be limited to 5% THD and 3% for individual harmonics. Harmonics filters preferably along with 12 pulse converter/IGBT based converter shall be used to achieve this.

3.5.0 The cranes and hoist shall be designed to operate at 100% safe working load and subjected to over load test at 125% of rated load.

3.6.0 Design will be provided for easy maintenance of all the parts.

4.0 CONSTRUCTION FEATURES

The crane will be furnished with required components comprising the following.

4.1.0 Rolled steel sections shall be used for the crane main girders having adequate strength. Crane shall be designed for easy maintenance of all the parts, particularly the wheel bearings on end carriage.

4.2.0 The cranes shall have only main hoisting motion and no auxiliary hoisting is applicable in this crane. Hooks shall be as per IS 15560. Hooks shall have swivels and safety latch

4.3.0 All materials / components will be new and of tested quality and will conform to the specification requirements and standards mentioned.

4.4.0 *a) Electrical equipment shall be adequately rated to permit simultaneous operation of may combination of motions of the crane for it duty service. b) Motor ratings shall be 25% (at least) over the maximum power requirement. The hoist motors shall be rated to lift 125% of the design load at rated speed. c) Motors shall suit the duty class S4, cyclic duration factor 60% and 300 starts per hour and shall be suitable for VVF operation. Motor pull out torque shall not be less than 2.75 times/ rated torque. Motor shall have class F insulation temperature rise limited to class B and enclosures shall conform to the degree of protection IP-55.*

4.5.0 *All motors shall be capable of the following:*

- **Operating satisfactorily at full load for 5 minutes without injurious heating with 75% rated voltage at motor terminals.**
- **Withstand 120% of rated speed for two minutes.**
- **Current shall not exceed 6 times full load current for creep speed motor.**
- **Withstanding the stresses imposed if started at 110% rated voltage.**
- **Start with rated load and accelerate to full speed with 80% rated voltage at motor terminals.**
- **The locked rotor motor withstand time under hot condition at 110% rated voltage shall be more than motor starting time at minimum**



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permissible voltage by at least 3 seconds for motors upto 20 seconds starting time. • Maximum torque shall not be below 200% of full load torque.

Each motor more than 30 KW rating shall be provided with space heater. All electrical equipment accessories and wiring shall have tropical protection.

The crane(s) shall be furnished complete with all electrical equipment, accessories, like drive motors with VVF drives, conductors, insulators, protective & operating devices, cables, current collectors, all protective devices, anti-collision limit switches, mechanical overload and protection for electrical faults etc.

The limit switches shall be totally enclosed type IP-55.

Each hoist shall be furnished with two (2) limit switches meeting the following requirements:

- A screw type limit switch with self-resetting features which will act in case of over hoisting.
- A gravity operated hand reset type limit switch as a backup protection against over hoisting.

Track type limit switches shall be provided on the bridge and trolley to prevent over travelling in either direction.

Trailing cable shall be 1100 V grade, tinned copper, heat resistant, with EPR insulation and as per Class – 5 of IS-8130. Also should have inner PCP sheath and outer CSP sheath with nylon chord reinforcement & heat resistant, oil resistant and flame retardant heavy duty FRLS type.

Necessary start/stop and emergency controls shall be provided. Automatic reset type limit switches shall be provided to prevent over-travel for:

- Over hoisting and lowering motions of the hook.
- Long travel motion
- Cross travel motion

4.6.0 Down Shop Leads (DSL) One (1) set of shrouded type down shop leads (DSL) with copper conductor for the crane runway length shall be provided. Conductor shall be colour coded for R, Y, B phases and ground. Current carrying capacity of Runway conductors shall be designed for simultaneous operation of the two cranes as applicable. The shrouded copper bus bar conductor system shall comprise of 4 wire suitable for single power feed to mid-point. The material of shroud shall be PVC suitable for 70 deg. C. The continuous current rating of the conductors shall be so chosen that the voltage drop from load break switch to the motor terminal is restricted to 3 % based on maximum derated current and 10% based on peak current. Minimum 20% allowance for wear and tear shall be provided over the calculated size. Wheel bases for end carriage shall not be less than 1/5 of the span or as per IS.3177.

4.7.0 The crane shall be a complete unit with bridge girder, end carriages for long travel, travelling for cross travel, rope drums, wire ropes, sheaves, drive units, brakes, rails and fixtures, rail clamps (if applicable), end stops, buffers, conductors, all electrical etc. to make the equipment complete in all respects. The steel used for the crane construction shall be of standard quality. All materials used shall be of recent manufacture, free from defects, mill scales, laminations, pitting, flakes, rust etc. All welds shall be free from defects like blowholes, lack of penetration, slag intrusions etc.

4.8.0 Bridge Girder: The crane bridge shall consist of single girder. In case of overhead crane, bridge girder shall be mounted on runway rails. The trolley shall move on the bottom flange of the girder. The bridge girder shall have enough strength to carry the rated load without causing undue stress or deflection.



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- 4.9.0 Wheel: The LT wheel arrangement for overhead crane shall have double flanged wheel and CT wheel arrangement shall have single flanged wheel. The wheels shall be machined on their tread to match the runway rail section for overhead crane.
- 4.10.0 The ratio between wheelbase and crane span shall be as stipulated in IS 807.
- 4.11.0 Trolley frames shall be fabricated from rolled structural steel section and not from re-rolled structural steel section.
- 4.12.0 Design shall provide for easy maintenance of all parts, particularly the wheel bearings on end carriage.
- 4.13.0 Platforms/walkways shall be provided by BHEL (Civil) for maintenance of crane components with access ladder to access the platforms from operating floor/maintenance area.
- 4.14.0 Suitable brake shall be provided for each motion. The capacity of hoisting motion brake shall be 150% of rated torque or greater than the torque transmitted to the brake drum from the suspended load up-to the test load and that of cross travel and long travel to be 150% of motor rated torque before de-rating. Electromagnetic brakes will be provided as per the details given in data sheet for each motion.
- 4.15.0 Cranes shall be operated through fixed type pendent push button station and through Radio remote control (RRC) also.

Radio remote Control of EOT Crane:

The equipment should have facility to control EOT crane by radio frequency based wireless remote unit. The equipment should be supplied with transmitter unit, receiver unit, encoder unit, decoder unit, interface panel, coupling system, battery unit and any other control gear if required.

The equipment should be based upon the microprocessor based digital technology with almost nil hard wiring.

The remote unit should communicate up to the distance of approximately 100 meters.

The system has to integrate with the control system of crane, which operates at 110 V AC, Single phase.

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.

Frequency allotment for radio remote unit from Govt. of India, Deptt. of Telecommunication or any other agency shall be the responsibility of supplier.

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.

The remote unit should have safety key to prevent any unauthorized operation. All the crane operations should stop at once the communication breakdown occurs.

On local unit (receiver side), the system should be provided with one selector switch so that EOT crane can be operated either from push button or radio remote unit.



In case tandem operation is envisaged, a suitable selector switch shall be provided for selection of Tandem/normal operation.

- 4.16.0 No cast iron part shall be used on the crane except for electrical equipment. However, in case of gear boxes casing only, use of cast iron of grade not less than 25, IS: 210 -1962 is recommended. Similarly, no wood or other combustible material shall be used in any part of the crane.
- 4.17.0 ***Crane shall be complete with trolley, tracks, wheels, axles, drive mechanism, hoisting drum brakes, horns, warning lights limit switches etc.***
- 4.18.0 ***Short maintenance platform for LT mechanism to be provided.***
- 4.19.0 Bridge and trolley frames shall be of fabricated structural steel sections. Mountings shall be designed to facilitate easy removal of the wheels, bearings and journals.
- 4.20.0 Buffers shall be provided on trolley and bridge frames to absorb shock of impact without transferring to the frame. Crane Bridge shall be driven by two independent end drives
- 4.21.0 **DEFLECTION AND CAMBER:**
i. The total maximum vertical deflections of the girders for the safe weight of working load plus the weight of the crab in central position (without taking into consideration the impact factor) shall not exceed limit of span/900 as specified by the relevant IS 807 or any other code whichever is having higher deflection shall be taken for limit.
ii. The girder shall be cambered by an amount equal to the maximum deflection due to dead load plus one half the live load and trolley.
- 4.22.0 Guard shall be provided on crane to prevent the hoist ropes coming in contact with down shop leads. Guards of an approved design, which will push forward or off the track any object such as a person, foot or arm placed across it. Guards shall be attached to each end of the end carriage Suitable guards shall be provided to revolving shafts, coupling etc.
- 4.23.0 The complete electrical equipment basically including:
Load break changeover switch mounted on the building structure. Cabling between the load break switch and the down shop leads. Down shop leads and current collector for crane. Load break switch on the crane bridge walkway (if applicable). Protective and control switch gear, Motors, Festoon cable system for crab, Master controllers, Pendant controller, Wireless remote control, Indicating lamps, push buttons, Lighting panel, lighting fixtures, light, alarm/bell, socket outlets etc. All power and control cables, Cable trays & supports, Conduits, Cable glands, lugs & clamps etc. Crane earthing system, Variable Voltage and Variable Frequency (VVVF) control for speed control of crane motors, Electronic Anti-collision device.
- 4.24.0 **Temperature Effects**
Where any portion of the structure is not free to expand or contract under variation of temperature, allowance shall be kept for stress resulting from these conditions. IS: 800- (latest edition) Code of practice for use of structural steel in General Building construction - shall also apply.

5.0 Inspection and testing

All material, castings and forgings will be of tested quality & certificates shall be made available as per approved QAP.

Final inspection and load testing of cranes shall be carried out at manufacturer's works. Further the cranes shall also be successfully erected and load testing at site.



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Functional Guarantee (at site)

- Load test as per IS 3177(Latest edition)
- Overload test as per IS 3177(Latest edition)
- Operating Speed demonstration.
- Limiting deflection check of bridge girder as per IS 3177 (latest edition)

6.0 Technical Data Sheet of Single Girder EOT Crane

Sr. No.		DESCRIPTION	TECHNICAL PARTICULARS	
1.0.0		Design, fabrication and testing of the crane confirm to standard / code number	Mechanical and Electrical as per IS: 3177-1999 (Reaffirmed 2006) & Structure design in accordance to IS 807:2006.	
		* Make * Model * Gantry Rail/Monorail Size * Weight of complete crane (unladen). * Maximum crab weight (unladen). * Maximum wheel load (without impact) * Drum diameter & length * Make of motor * Rated current * Rated torque (starting/Braking) * 15% margin for motor ratings considered	*(to be furnished by manufacturer)	
1.1.0		Number of cranes and capacity	01 / 3Tonnes	
1.2.0		Crane classification	M5 for Mechanical, Structural & M7 for Electrical.	
1.3.0		Suitable for outdoor or indoor duty	Indoor	
1.4.0		Capacity and lift		
1.4.1		Main hoist	SWL = Safe working load	
	a.	Rated SWL – tonnes	*(to be furnished by manufacturer)	
	b.	Test load SWL – tonnes	Rated SWL and over load test : 125% of SWL	
1.4.2		Deflection test of crane	Shall be carried out at SWL	
1.5.0		Span	16 m (Approx.)	
1.6.0		Operation from	Fixed type pendent push button station and through Radio remote control (RRC) also	
2.00		CRANE PERFORMANCE		
2.1.0		Crane speed with full load	Full speed M/Min	Creep speed M/Min
	a.	Main hoist	2.5 to 5	10% of operating speed (thru' VVVF drives)
	b.	Trolley travel (CT)	10 to 15	10% of operating speed (thru' VVVF drives)
	c.	Longitudinal bridge travel (LT)	15	10% of operating speed (thru' VVVF drives)



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2.2.0		Acceleration values	LT motion (bridge travel)		CT motion (trolley travel)	
			As per IS: 3177		As per IS: 3177	
2.3.0		Lift in Metres	The lifting rope shall be of sufficient length to permit the main hook to reach the zero level.			
	a.	Main Hoist	9.5 m			
2.4.0		Hook Approaches				
	a.	Main hook (DSL end)	To suit the layout requirement.			
	b.	Main hook (Other end)				
3.0.0		COMPONENT DETAILS				
3.1.0		Trolley				
	a.	Type	Fabricated/ Fusion welded			
	b.	Material	MS. IS: 2062 Gr. A or B			
	c.	Number of Trolleys	One (1)			
	d.	Number of hoists on trolley	One (1) Main			
3.2.0		Rope drums	Hoist drum length shall be such that each lead of wire rope has a minimum of two full turns on the drum when the hook is at its lowest position not taking into consideration turns covered by wire rope anchorage and one spare groove for each lead of wire rope on the drum when the hook is at its highest position.			
	a.	Type	Rope drums shall be spur / helical gear type and should be fabricated from M.S. as per IS 2062 and should be stress relieved.			
	b.	Material	Seamless pipe ASTM-106 or fabricated Fe410w IS: 2062 Gr. A/B & stress relieved.			
	c.	Flange / flangeless	Flanged			
	d.	Numbers provided	One			
	e.	Type of grooves	Machined grooved identical Right hand and Left hand			
3.3.0		Rope details	Extra flexible plough steel conforming to IS:2266, Rope grade 1770			
	a.	Rope Details	Extra flexible plough steel conforming to IS:2266, Rope grade 1770, 6 x 36 construction			
	b.	Construction	6 x 36			
	d.	Factor of safety	Not less than 5.25 as per IS 3177			
	e.	Type of core	Fibre			
3.4.0		Sheaves details				
	a.	Material	Fabricated from cast steel / steel plate IS 2062 Gr A or B / CS Gr 280-520 IS 1030			
	b.	Diameter of Equivalent sheaves in mm on Root	Should not be less than 62% of calculated main sheave diameter.			
	c.	Type of guards provided	Fabricated from sheet steel			
3.5.0		Coupling & Shafting				
3.5.1	A.	Coupling details (between motor and gear box)	Main Hoist	Cross Travel	Long Travel	
	a.	Type	Flexible geared type			
	b.	Guards and Enclosures	Provided			
	B.	Coupling details (gear box and wheels)	Cross Travel	Long Travel		
	a.	Type	Flexible geared type			
	b.	Guards and Enclosures	Provided			



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	C.	Coupling details (gear box and rope drum)	Main Hoist	
	a.	Type	Flexible geared type	
	b.	Guards and Enclosures	Provided	
3.5.2	A.	Shafting (Output)		
	a.	Factor of Safety	As per IS : 3177 - 1999	
	b.	Arrangement of Lubrication	Grease cups/ Nipples	
	c.	Type of Lubricant	Grease	
3.6.0		Gear box details		
3.6.1		Hoist Motions		
	a.	Type of mounting of gear box	Horizontal / Vertical	
	b.	Classification	Suitable for M5 duty	
	c.	Type of gears	Helical / Spur for MH & through VVVF drive for MH micro	
	d.	Type of lubrication	Splash lubrication	
	e.	Difference in Gear and pinion hardness	Min 20 BHN	
	f.	Materials (gear/pinions)	Main Gears En 9/ 55C8 Pinions En 19/ EN 24. Hardness conforming to IS: 3177	
	g.	Casings	Fabricated Fe 410w IS: 2062 Gr A/B & stress relieved	
	h.	Type of Bearing	Antifriction Ball/ roller	
3.6.2		Travel Motions	CT	LT
	a.	Type of mounting gear box	Vertical	Vertical / Horizontal
	b.	Classification	M5 duty	
	c.	Type of gears	Helical / spur for CT & LT and through VVVF drive for CT micro & LT micro	
	d.	Type of lubrication	Splash lubrication	
	e.	Materials (gear / pinions)	Main Gears En 9/ 55C8Pinions En 19/ EN 24. Hardness conforming to IS: 3177	
	f.	Type of Bearing	Antifriction Ball/ roller	
	g.	Casings	Fabricated Fe 410w IS: 2062 Gr A/B & stress relieved	
3.7.0		Wheels details	Cross travel	Long travel
	a.	Material	Forged Steel	C55 Mn 75 & Steel used for wheel shall not contain more than 0.06% of Sulphur or Phosphorous.
	c.	Type	Single flanged	Double flanged
	d.	Numbers provided	As per manufacturer's standard.	
	e.	Hardness	Not more than 200BHN	300 to 350 BHN
	f.	Arrangement of lubrication	Grease	
	g.	Specification conforming to	IS: 3177-1999	
	h.	Bearing life	10,000 working hours	
3.8.0		Lifting hooks	Main Hoist (MH)	
	a.	Type	Swivel "C" type single shank of suitable grade of either circular or standard trapezoidal section, point hook suitably heat treated with adequate lifting capacity. Swivel lock pin shall be provided.	
	b.	Safe lifting capacity	*(to be furnished by manufacturer)	
	c.	Material	Forged steel	



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	d.	Standard conforming to	Single hook (or) “C” hook: IS 15560				
	e.	Hook suspension	Thrust Bearing				
	f.	Hook can swivel	Yes				
	g.	Safety latch on hook provided	Yes				
3.9.0		Buffers	Cross travel		Long travel		
	a.	Type	Spring or rubber buffer. To be designed to bring the loaded crane to rest from speed of 50 % of the rated speed.				
	b.	Numbers provided	4		4		
3.10.0		Brakes					
3.10.1		Hoist Motions					
	a	Type of brake	DCEM “fail to safe”				
	b.	Number provided per motor	1+1 (per motor)				
	c.	Braking capacity (% of full load torque)	150% of rated torque or greater than the torque transmitted to the brake drum from the suspended load up-to the test load.				
3.10.2		Travel Motions	CT		LT		
	a.	Type of brake	DCEM “fail to safe”				
	b.	Number provided per motor	1+1 (per motor)		1+1 (per motor)		
	c.	Braking capacity (% of full load torque)	150%		150%		
3.11.0		Drive system for hoisting					
	a.	Arrangement of drive from motor to rope drum (main)	Through geared steel coupling and gear box				
3.12.0		Bearings	Crane hook	Trolley wheels	Rope drum	Gear box	Any other assembly
	a.	Type	Antifriction ball / roller bearings				
	b.	Lubrication	Grease lubrication				
	c.	Bearing life	10,000 working hours.				
3.13.0		Bridge girder					
	a.	Type & Quantity	Box type – 2 nos., Material: IS 2062 Gr. A / B				
	b.	Vertical Deflection	Span / 900 (maximum)				
	c.	Type of connection to end carriage	By fitted bolts				
		Rails-Bridge girder					
	a.	Type / section	Rails sections as per IS: 3443 Grade 50 C 12. Joint to be butt-welded by thermit welding & fusion welding or by end clamping welded by thermit welding & Fusion welding or by end clamping arrangement.				
	b.	Standard conforming to	IS: 3443				
	c.	Material	Rail Steel				
3.14.0		Motors	Suitable for ambient temperature of 50 deg C				
3.14.1		Hoist Motions	MH				
	a.	Type	Three phase squirrel cage induction motors operated from VVVF Drive system and suitable for inverter duty				
	b.	Enclosure	TEFC				



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	c.	Numbers furnished	One
	d.	Voltage, phase and frequency	3 Ph., 4 wire, 415V + 10%, 50 Hz (+3 & -5%) Combined voltage & frequency variation = 10% absolute
	e.	Class of protection	IP – 55
	f.	Rated capacity (KW)	Motor nameplate rating at 50 degC shall have Motor rating will be calculated keeping margin of at least 25% over the maximum power requirement in the duty condition specified. Further, the hoist motors will be rated to lift 125% of the design load on the hook at the rated speed.
	g.	Duration factor/duty	60 % CDF / S-4
	h.	Class of insulation	Class 'F' for sq. cage motors with temp rise limited class B
	i.	Number of starts/ hour	300 starts / hr.
	j.	Pull out torque	The pull out torque of the motor will not be less than 275 % of the full load torque.
3.14.2		Travel Motions	CT & LT
	a.	Type	Three phase squirrel cage induction motors and suitable for inverter duty
	b.	Enclosure	TEFC
	c.	Numbers furnished	Two
	d.	Voltage, phase and frequency	3 Ph., 4 wire, 415V + 10%, 50 Hz + 5% Combined voltage & frequency variation = 10% absolute
	e.	Class of protection	IP – 55
	f.	Rated capacity (KW)	Motor nameplate rating at 50 degC shall have Motor rating will be calculated keeping margin of at least 25% over the maximum power requirement in the duty condition specified.
	g.	Duration factor/duty	60 % CDF / S-4
	h.	Class of insulation	Class 'F' for sq. cage motors with temp rise limited class B.
	i.	Number of starts/ hour	300 starts / hr.
	j.	Pull out torque	The pull out torque of the motor will not be less than 275 % of the full load torque.
	k.	Space heater requirement	For motors above 30 KW rating
3.15.0		Limit switches	Main hoist Cross Travel Long Travel
	a.	Type	Rotary gear (screw type) + Gravity Two way lever type/ One way lever type
	b.	Number provided	1+1 1/2 1/2
	c.	Material of contacts	Double break Silver Cadmium
	d.	Control voltage / Enclosure	110V / IP-55
3.16.0		Power conductors (DSL)	
	a.	Type	As specified in the specification
	b.	Size	
	c.	Length	



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3.17.0		Control Panel	
	a.	Material & size	Fabricated from sheet steel, minimum 2 mm thick.
	b.	Degree of protection	IP 54
	c.	Illumination	Internal illumination with florescent lamp
3.18.0		Control for Hoisting operations	
	a.	Speed control	Thru' VVVF
	b.	Temperature	VVVF system shall be capable of withstanding up to 50 ° C without derating.
3.19.0		Cable	Power Control
	a.	Material	Copper Copper
	b.	Type	XLPE insulated FRLS
	c.	Size	Min 2.5 mm ² Min 2.5 mm ²
	d.	Voltage grade	1100 V
	e.	Voltage drop deration	Cable from main isolating switch (1.5M above operating floor) to motor terminal shall be so sized that the voltage drop does not exceed 3% of rated voltage with cranes at extreme position.
3.20.0		Earthing	
	a.	Material of earthing	G.I / Copper
3.21.0		Power supply	415 V, 3 phase, 4 wire supply at 1.5m above operating floor at centre of bay length
3.22.0		Contactors	AC 4 duty for reversing application. AC 3 duty for non-reversing application
3.23.0		Switches	AC 23 for motor application, AC 22 for other application.
3.24.0	a.	Type of control for Hoists/ CT/LT operation	Through VVVF drive
	b.	Sweep	Sweep shall be attached to the end carriages and to the trolley to remove foreign materials from the rails.
3.25.0		Main Isolating switch	Main isolating switch at Middle of the bay length (1.5M above operating floor)
3.26.0		Painting & Color Coding	As per <i>Annexure I</i> below
3.27.0		Runway rail	Minimum 50mm Square Bar or of suitable size (whichever is higher) and material as per relevant IS shall be supplied by crane manufacturer. This runway rail shall be fixed (welded) over gantry girder throughout the bay length and crane girder's wheel shall match this runway rail for smooth travelling.

Note: Supply and fixing of runway rail over gantry girder and suitable wheel alignment shall be under contractor scope.



7.0 Works Excluded

1. Receipt of material, Unloading and safe storage of all material/components of EOT crane.
2. Supply of steel gantry girders for LT.
3. For EOT crane, the purchaser shall provide single point 415V, 3 phase, and 50Hz power feeder at any point of the bay or in the middle of the bay as specified in the Data sheet (clause 6.0). Vendor shall provide main isolating switch at 1.5 M above the ground / operating floor level and cable required from isolating switch to DSL.
4. Any other supply required by the bidder shall be arranged by the bidder himself by using suitable transformer as per the specification.
5. Supply of earthing flats.

8.0 Make of Sub - Vendor items

The makes of bought out items will be as per Annexure-II, of the specification. No other make will be acceptable, until and unless specifically got it approved by the purchaser/customer.

9.0 Various Heads to be quoted

Sl. No.	Item Description	Unit	Quantity	Total Ex-works	Total ETC
1.	3 T Single Girder EOT Crane for 400 kV GIS Building as per technical specification	Set	01		
2.	Mandatory Spares as per Annexure-M of technical specification	Set	01		Not Applicable

10.0 Drawing / design document for submission

All applicable documents, drawings and datasheets as per below list to be submitted during detailed engineering.

A. For Approval

1. Completely filled in Technical data sheets.
2. Crane clearance diagrams showing various dimensions.
3. Drawings showing general arrangement, clearance requirement, assembly, cross sectional data and material of construction for:
 - a. E.O.T. Crane Unit
 - b. Bridge Assembly and Components
 - c. Bridge and long travel and Wheel Assembly
 - d. Trolley
 - e. Trolley Wheel Assembly
 - f. Drive and Transmission Unit for Bridge Travel, Trolley Travel, and Hoist
 - g. Suspension Unit for Hook Block
 - h. Main Hook Block
 - i. Protection, control and lighting panels.



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- j. Electric hoist
- k. Manual hoist
- 4. Drawings on runway rails, fixtures to fix runway rails with the runway main girder and stops etc.
- 5. Design and sizing calculations of the following: DSL, Bridge girder, Rope drum, Machinery Shafts, Gearbox excluding proprietary items, Cables, Motor rating, Brake capacity, Bearing life, Wheel loading and current collector, angle iron conductor sizing.
- 6. Catalogues of all items such as motors, brakes, cables, limit switches, relays, meters, gear box, coupling etc.
- 7. Dimensional General arrangement drawing for Panels, Main Switch, Master controller etc.
- 8. Schematic wiring diagram for Panels.
- 9. Dimensional General arrangement drawing for Motors, Brakes etc
- 10. Lighting arrangement
- 11. Earthing layout drawing.
- 12. Cable routing drawing
- 13. Characteristic curves for Motors.
- 14. Load requirement for each crane / hoist
- 15. VVVF Control Features.
- 16. Control write-up for tandem operation.
- 17. Quality plans/ Inspection test plan and Field Quality Plan
- 18. Type test certificates.

B. For Reference

- 1. Erection Manual
- 2. Operation and Maintenance Manuals
- 3. Material test certificates, including those for the Hooks and wire rope.
- 4. Report on various tests at shop and at site and certificates of approval by authorized authority for all flame proof components and test reports for the same if required.

Any other drawings required for review during the detailed engineering stage, same shall also be submitted by contractor.



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ANNEXURE-M

List of Mandatory spares for EOT crane in Gas Insulated Switchyard as per contract:

Sl. No.	Description	Quantity
1.0	SPARES FOR LONG TRAVEL UNIT	
A	SET OF AXLE BEARINGS	1 SET
B	SET OF GEARBOX BEARINGS WITH SLEEVES	1 SET
C	LONG TRAVEL END SHAFT BEARINGS	1 SET
D	COUPLING	1 SET
E	SEALS FOR TRAVEL GEAR BOX	1 SET
F	LONG TRAVEL BRAKE SHOES	1 SET
G	LONG TRAVEL BRAKE SPRINGS	1 SET
H	LONG TRAVEL BRAKE SHOE LINERS	1 SET
2.0	SPARES FOR CROSS TRAVEL UNIT	
A	AXLE BEARINGS	1 SET
B	SET OF GEARBOX BEARINGS WITH SLEEVES	1 SET
C	SET OF SEALS FOR GEARBOX	1 SET
D	CROSS TRAVEL END SHAFT BEARING	1 SET
E	COUPLING	1 SET
F	CROSS TRAVEL BRAKE SHOES	1 SET
G	CROSS TRAVEL BRAKE SPRINGS	1 SET
H	CROSS TRAVEL BRAKE SHOE LINERS	1 SET
3.0	SPARES FOR MAIN HOIST	
A	MAIN HOIST PULLEY BEARINGS	1 SET
B	SET OF BEARINGS FOR RODE DRUM	1 SET
C	SET OF BEARINGS FOR GEAR BOX	1 SET
D	SET OF SEALS FOR MAIN HOIST	1 SET
E	MAIN HOIST BRAKE SHOES	1 SET
F	MAIN HOIST BRAKE SPRINGS	1 SET
G	MAIN HOIST BRAKE SHOE LINERS	1 SET
H	DISC PAD	1 SET
4.0	SPARES FOR AUXILIARY HOIST (IF APPLICABLE)	Not Applicable
5.0	ELECTRICAL: CONTROL PANELS/MOTORS	
A	POWER CONTACTOR OF EACH RATING	02 NOS.
B	OVER LOAD RELAYS OF EACH RATING	02 NOS.
C	MCCB/MPCB OF EACH RATING	02 NOS.
D	PUSH BUTTON OF EACH TYPE	02 NOS.
E	SPARES FOR VVVF DRIVE OF EACH RATING	As required
F	SET OF BEARINGS FOR MAIN HOIST MOTOR	1 SET
G	SET OF BEARINGS FOR AUX HOIST MOTOR	Not Applicable
H	SET OF BEARINGS FOR CROSS TRAVEL MOTOR	1 SET
I	SET OF BEARINGS FOR LONG TRAVEL MOTOR	1 SET
6.0	ELECTRICAL: MOTORS	
A	DRIVING END BEARING	1 SET
B	NON DRIVING END BEARING	1 SET
C	TERMINAL BLOCK FOR MOTORS UP TO 30KW EACH RATING	10 NOS.



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D	TERMINAL BLOCK FOR MOTORS ABOVE 30KW EACH RATING	5 NOS.
E	MOTORS OF EACH TYPE AND RATING	10% OF INSTALLED CAPACITY OR 1 NO. WHICHEVER IS HIGHER

Annexure I

PAINING SPECIFICATION

A) Steel structure: -

Surface preparation : Blasting according to SIS 055900 grade Sa 2½

Primer : One (1) layers of Primer paint shall be Solvent based IZS - VS of 60%. Zn Dust - 1.77 kg/ltr minimum. Zn dust by weight -minimum 85%. Pot life 12 hrs/ 21 Deg.- Paint to meet compositional & performance specifications for SSPC Paint 20, Level 1, DFT 75 µm.

Touch up : One (1), Two component Zinc rich Primer meeting performance and compositional specifications of SSPC Paint 20 Level2, DFT 75 µm.

Mid Coat : One (1), 2 pack High build High Solid Lamellar MIO based Epoxy Mid coat., DFT 200 µm.

Finish Coat : One (1) finishing coats of 2 pack Acrylic Aliphatic Polyurethane top coat with Gloss retention of at least 90% on QUVB exposure of minimum 1000 hrs. DFT 75 µm.

Total DFT : 350µm

B) Mechanical Components and Motor: –

Surface preparation : Blasting according to SIS 055900 grade Sa 2½

Primer : One (1) catalysed Zn rich Primer with a VS of 60% min, complying to SSPC Paint 20 level 2. DFT 75 µm.

Finish Coat : Two (2) finishing coat of two component High Build high Solid Aliphatic Amine Cured Epoxy coating. - Min VS 85%. DFT 200 µm.

Total DFT : 275 µm

C) Control Panel: –

Surface preparation : Seven tank process

Primer : Two coats of zinc rich primer paint, total dry film thickness 75µm.

Finish Coat : Two coats of finishing epoxy paint shall be applied, 30-40 microns DFT each coat.

Total DFT : 135-155µm Or powder coating – 75 micron (total DFT)

COLOR SHADE

Sl. No.	Item Description	Color Shade	Remarks
1	Crane Structure	Golden yellow, shade 356 as per IS-5	Color band black
2	Trolley & Hook	Crimson shade, shade 540 as per IS-5	
3	Motors	Smoke grey	RAL 7032
4	Control Panels	Pebble Grey	RAL 7032



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ANNEXURE II
MAKES OF IMPORTANT ITEMS / COMPONENTS OF EQUIPMENTS AND THEIR DETAILS
MAKES OF SUB VENDORS ITEMS

Bidder shall choose make of materials strictly from list enclosed in Annexure-II to this section only. However final applicable make is subject to ultimate customer approval. Bidder can provide any other make that is not included in the list below under special circumstances only if it is acceptable to ultimate customer without any cost implication to BHEL.

S.N.	ITEM	MAKES
1	STEEL	SAIL/IISCO/TISCO/ JINDAL
2	HOOKS	MOOZUMDAR / KARACHIWALA/ SIMRITI FORGING / HARMAN MOHTA / Steel Forging & Engg. Co., Kolkata
3	GEAR COUPLINGS	ALLIANCE / HICLIFF / OEM
4	WIRE ROPE	USHA MARTIN BLACK / BOMBAY WIRE ROPES / UNITED WIRE ROPE / Bharat wire rope
5	BEARINGS	SKF/ FAG/ TATA/ NORMA / NBC
6	MOTORS	SIEMENS /NGEF /KIRLOSKAR / BHARAT BIJI / ALSTHOM / ABB
7	BRAKES	ELECTROMAG /SPEED-O- CONTROL / EMCO LENZE
8	CONTACTOR	SIEMENS / L&T /TELE MECHANIQUE / BCH
9	OVER LOAD RELAYS	SIEMENS / L&T / TELE MACHANIQUE / ABB
10	HRC FUSES	SIEMENS / L&T/ GEPC/ L&T
11	ISOLATING SWITCH	SIEMENS/ L&T / GEC A / CONTROL & SWITCH GEAR
12	SWITCH FUSE UNITS	SIEMENS/ L&T/ CONTROL/ & SWITCH GEAR/ GEC A
13	TIME DELAY RELAYS	SIEMENS/ L&T/ ABB/ BCH/ GEC A / TELEMCHANIQUE
14	TRANSFORMERS	INDCOIL/LOGICSTAT/PRAGATI/PRAYOG KAPPA/SOTHERN ELECTRIC/ AUTOMATIC ELECTRIC / PRECISE ELECTRICALS / SILKAAN
15	BULB & FLOURESCENT TUBES/FITTINGS	PHILIPS/ BAJAJ/ CROMPTON
16	CABLE LUGS (HEAVY DUTY)	DOWELLS / UML ENGINEERING
17	HOOTERS	BEACON / OSC/TARGET / KHERAJ
18	LIGHTING SWITCHES	ANCHOR / ELLORA
19	CABLES	
a)	POWER CABLES	NICCO / UNIVERSAL / INCAB / FORT GLOSTER TORRENT / CCI / ICL / RADIANT
b)	CONTROL CABLES	NICCO / UNIVERSAL / INCAB / FORT GLOSTER / DELTON / FINOLEX / TORRENT / CCI / ICL / RADIANT
c)	TRAILING CABLES	NICCO / UNIVERSAL / INCAB / ICL
20	CABLE GLAND	COMMET / SUNIL&CO. / ALLIED TRADERS / ARUP ENGINEERING / ELECTROMAC INDUSTRIES



CLIENT – TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD.
CONSULTANT- TATA CONSULTING ENGINEERS LIMITED BENGALURU
PROJECT: 2X660MW UDANGUDI STPP (STATE-1)
TECHNICAL SPECIFICATION FOR EOT CRANE FOR 400KV GIS

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21	PUSH BUTTONS	SIEMENS / L&T / BCH
22	LIMIT SWITCHES	SPEED-O-CONTROL / ELECTROMAG
23	MASTER CONTROLER	SPEED-O-CONTROL / ELECTROMAG
24	SAFETY SWITCHES	ALSTOM / L&T / SIEMENS
25	PENDENT PUSH BUTTON STATION	OEM
26	INDICATING LAMPS	TECKNIC / BCH / SIEMENS / STANDARD
27	MCB	MDS / INDO COPP / STANDARD
28	PANELS	OEM
29	RESISTANCE BOXES	OEM
31	INSULATORS & COPPER CONDUCTORS	BHEL APPROVED MAKE
32	CASTINGS	KOLHAPUR STEEL / GNAT FOUNDRY / KIRTI ALLOYS
33	FIRE EXTINGUISHER	BIS APPROVED MAKES
34	VVVF DRIVE	YASKAWA (L&T)/ ABB / SIEMENS / SCHNIEDER
35	SHROUDED DSL	SUSHEEL / STROMAG



CLIENT – TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD.
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SECTION-2 CUSTOMER SPECIFICATION

Customer specification of electric overhead travelling (EOT) crane is attached in this section.

Total Pages-07



VOLUME II
SUB-SECTION - 2.19.2
SINGLE GIRDER EOT CRANE

1.0.0 CODES AND STANDARDS

The design, manufacture, erection and testing of the crane shall conform to the latest edition of the following codes and standards along with their amendments:

IS 3177	Code of Practice for Electric overhead travelling cranes and gantry cranes other than steel works cranes.
IS 800	Code of practice for use of structural steel in general building construction.
IS 807	Code of practice for design, manufacture, erection and testing (structural portion) of cranes and hoists.
IS 2266	Steel wire ropes for general engineering purposes.
IS 3443	Crane rail sections.
IS 15560	Point hooks with shank up to 160 tonne specification
IS 4029	Guide for testing three phase induction motors
IS 5749	Forged ramshorn hooks.
IS 4164	Specification for lifting 'C' Hooks with eye - capacity up to 25 tonnes
IS 12162	Specification for lifting hook
IS 3832	Specification for hand-operated chain pulley blocks
IS 3938	Specification for electric wire rope hoists
IS 1835	Specification for Round steel wire for ropes
IS 7847	General Characteristic of Lifting hook.
IS 3815	Specification for point hook with shank

Any other International standards such as ASTM / ASME / ISO / DIN / JIS for design of coal handling system shall be followed.

Under slung crane / over head crane are required to be installed for handling various equipments during maintenance.

- a) EOT cranes conforming to M5 for Mechanical, Structural and M7 for Electrical of IS:3177 – 1999 and Class II of IS 3938 shall be designed, manufactured, inspected, shop tested, erection, site testing and commissioning to well established engineering practices, safety codes and other relevant codes and standards. However, Work shop single girder over head crane conforming to Group M7 for mechanical, structural and electrical of IS 3177.
- b) The crane shall be a complete unit with bridge girder, end carriages for long travel, travelling for cross travel, rope drums, wire ropes, sheaves, drive units, brakes, rails and fixtures, rail clamps (if applicable), end stops, buffers, conductors, all electrical etc. to



make the equipment complete in all respects. The steel used for the crane construction shall be of standard quality. All materials used shall be of recent manufacture, free from defects, mill scales, laminations, pitting, flakes, rust etc. All welds shall be free from defects like blowholes, lack of penetration, slag intrusions etc.

c) Bridge Girder

The crane bridge shall consist of single girder. In case of overhead crane, bridge girder shall be mounted on runway rails. In case of under slung crane, bridge girder shall be mounted on the bottom flanges of I-section. The trolley shall move on the bottom flange of the girder.

The bridge girder shall have enough strength to carry the rated load without causing undue stress or deflection.

d) Wheel

The LT wheel arrangement for overhead crane shall have double flanged wheel and CT wheel arrangement shall have single flanged wheel. The under slung crane shall single flanged wheel arrangement for both LT & CT. The wheels shall be machined on their tread to match the runway rail section for overhead crane and profile of the I-section for under slung crane.

e) The ratio between wheelbase and crane span shall be as stipulated in IS 807.

f) Trolley frames shall be fabricated from rolled structural steel section and not from re-rolled structural steel section.

g) Design shall provide for easy maintenance of all parts, particularly the wheel bearings on end carriage.

h) Platforms/walkways shall be provided for maintenance of crane components with access ladder to access the platforms from operating floor/maintenance area.

•
i) Deflections and Camber

i. The total maximum vertical deflections of the girders for the safe weight of working load plus the weight of the crab in central position (without taking into consideration the impact factor) shall not exceed limit of span/900 as specified by the relevant IS 807 or any other code whichever is having higher deflection shall be taken for limit.

ii. The girder shall be cambered by an amount equal to the maximum deflection due to dead load plus one half the live load and trolley.

2.0.0 ELECTRICAL REQUIREMENTS

a) Electrical equipment shall be adequately rated to permit simultaneous operation of any combination of motions of the crane for its duty service.

b) Motor ratings shall be 25% (at least) over the maximum power requirement. The hoist motors shall be rated to lift 125% of the design load at rated speed.

c) Motors shall suit the duty class S4, cyclic duration factor 60% and 300 starts per hour and shall be suitable for VVF operation. Motor pull out torque shall not be less than 2.75 times/ rated torque. Motor shall have class F insulation temperature rise limited to class B and enclosures shall conform to the degree of protection IP-55.

d) All motors shall be capable of the following :



- Operating satisfactorily at full load for 5 minutes without injurious heating with 75% rated voltage at motor terminals.
 - Withstand 120% of rated speed for two minutes.
 - Current shall not exceed 6 times full load current for creep speed motor.
 - Withstanding the stresses imposed if started at 110% rated voltage.
 - Start with rated load and accelerate to full speed with 80% rated voltage at motor terminals.
 - The locked rotor motor withstand time under hot condition at 110% rated voltage shall be more than motor starting time at minimum permissible voltage by at least 3 seconds for motors upto 20 seconds starting time.
 - Maximum torque shall not be below 200% of full load torque.
- e) Each motor more than 30 KW rating shall be provided with space heater. All electrical equipment accessories and wiring shall have tropical protection.
- f) The crane(s) shall be furnished complete with all electrical equipment, accessories, like drive motors with VVF drives, conductors, insulators, protective & operating devices, cables, current collectors, all protective devices, anti collision limit switches, mechanical overload and protection for electrical faults etc.
- g) The limit switches shall be totally enclosed type IP-55.
- h) Each hoist shall be furnished with two (2) limit switches meeting the following requirements:
- A screw type limit switch with self resetting features which will act in case of over hoisting.
 - A gravity operated hand reset type limit switch as a back up protection against over hoisting.
- i) Track type limit switches shall be provided on the bridge and trolley to prevent over travelling in either direction.
- j) Trailing cable shall be 1100 V grade, tinned copper, heat resistant, with EPR insulation and as per Class – 5 of IS-8130. Also should have inner PCP sheath and outer CSP sheath with nylon chord reinforcement & heat resistant, oil resistant and flame retardant heavy duty FRLS type.
- k) Necessary start/stop and emergency controls shall be provided. Automatic reset type limit switches shall be provided to prevent over-travel for:
- Over hoisting and lowering motions of the hook.
 - Long travel motion
 - Cross travel motion
- l) Down Shop Leads (DSL)

One (1) set of shrouded type down shop leads (DSL) with copper conductor for the crane runway length shall be provided. Conductor shall be colour coded for R, Y, B phases and ground. Current carrying capacity of Runway conductors shall be designed for simultaneous operation of the two cranes as applicable.

The shrouded copper bus bar conductor system shall comprise of 4 wire suitable for single power feed to mid point. The material of shroud shall be PVC suitable for 70 deg. C. The continuous current rating of the conductors shall be so chosen that the voltage drop from load break switch to the motor terminal is restricted to 3 % based on maximum derated current and 10% based on peak current. Minimum 20% allowance for wear and tear shall be provided over the calculated size.



m) VVVF control

The VVF drive control shall be used for control of each motion. The VVF drive shall be equipped at least with 1024 pulse in card, droop control for synchronization and crane software. The rating of VVF shall be decided considering 250% of full load current of respective drive motor based on in panel rating with derated at 50 Deg C ambient temperature.

VVVF system shall be rated for continuous duty as per IEC 146 (clause II). Output frequency range shall be minimum 0 to 50 Hz at constant torque and 0 to 100 Hz at constant power. Efficiency of VVVF shall be minimum 97%.

Individual converters shall be provided for each vector drive. The harmonic content reflected on incoming line is to be limited to 5% THD and 3% for individual harmonics. Harmonics filters preferably along with 12 pulse converter/IGBT based converter shall be used to achieve this.



ANNEX 2.19.2.1
SPECIFIED DESIGN DATA FOR SINGLE GIRDER EOT CRANE

	Description	Unit	Data
1.0	GENERAL		
1.1	Type of control proposed		Pendant
2.0	HOISTING SYSTEM		
2.1	Rope		As per IS 2266, Rope grade 1770
a)	Rope construction		IS 2266 / 6 x 36 multi strand construction Fibre core.
b)	Rope quality (material)		Extra flexible plough steel
c)	Factor of safety		As per IS
2.2	Rope drum		Hoist drum length shall be such that each lead of wire rope has a minimum of two full turns on the drum when the hook is at its lowest position not taking into consideration turns covered by wire rope anchorage and one spare groove for each lead of wire rope on the drum when the hook is at its highest position.
a)	Drum material		Fabricated from carbon steel as per IS 2062, Grade B and stress relieved or seamless pipe as per ASTM A 106 Grade A or B.
b)	Whether stress relieved		Yes (if fabricated)
2.3	Bearing type		Antifriction ball or roller
2.4	Hook		
a)	Hook type		Swivel "C" type single shank of suitable grade of either circular or standard trapezoidal section, point hook suitably heat treated with adequate lifting capacity. Swivel lock pin shall be provided.
b)	Hook material		Forged steel
c)	Safety latches provided		Yes
d)	Hook suspension		Thrust Bearing
2.5	Sheave material		Fabricated from cast steel / steel plate IS 2062 Gr A or B / CS Gr 280-520 IS 1030
2.6	Hoist Brake		
a)	Type		DCEM "fail to safe"



	Description	Unit	Data
b)	Torque		150% of rated torque or greater than the torque transmitted to the brake drum from the suspended load up-to the test load.
2.7	Gear box		Fabricated Fe 410w IS:2062 Gr A/B & stress relieved
a)	Material of gears		EN 9 / 55C8
b)	Material of pinions		EN 19 /EN 24
c)	Type of gears & pinions		Spur / helical
2.8	Limit Switch type		Rotary geared + gravity type
3.0	CROSS TRAVEL		
3.1	CT brake		
a)	Type		DCEM “ fail to safe”
b)	Torque	Nm	150% of rated torque
3.2	Gear box		Fabricated Fe 410w IS:2062 Gr A/B & stress relieved
a)	Material of gears		EN 9 / 55C8
b)	Material of pinion		EN 19 / EN 24
c)	Type of gears & pinion		Spur / Helical
3.3	Wheels		
a)	Materials		Forged steel
b)	Hardness	BHN	Not more than 200BHN
c)	Type		Single flanged
d)	Wheel bearing type		Antifriction Ball/Roller
3.4	Type of limit switches		Lever
4.0	LONG TRAVEL		
4.1	CT brake		
a)	Type		DCEM “ fail to safe”
b)	Torque	Nm	150% of rated torque
4.2	Gear box		Fabricated Fe 410w IS:2062 Gr A/B & stress relieved
a)	Material of gears		EN 9 / 55C8



	Description	Unit	Data
b)	Material of pinion		EN 19 / EN 24
c)	Type of gears/pinion		Spur / Helical
4.3	Wheels		
a)	Materials		Overhead Crane – C55 Mn 75 for overhead crane & Steel used for wheel shall not contain more than 0.06% of Sulphur or Phosphorous. Under slung Crane – Forged steel
b)	Hardness	BHN	Overhead crane – 300 to 350 BHN for under slung crane – Not more than 200BHN
c)	Type		overhead crane – Double flanged under slung crane – Single flanged
d)	Wheel bearing type		Antifriction Ball/Roller
4.4	Type of limit switches		lever
5.0	Type of Buffer Stoppers		Rubber / spring
6.0	Electrical		
6.1	Power supply		Shrouded type down shop leads (copper) shall be provided to supply power to crane. Power supply to Crab shall be through flexible trailing conductors.
6.2	Rating		S4, 60% CDF
6.3	Number of starts/hour		300 starts /hour



11.2 Single Girder Crane (Over Head / Under slung)

Note: Contractor to fill up the particulars in the format as specified below (as applicable) for each and every Single girder crane offered separately.

Cl.No.	Description	Unit	Data
1.0.0	GENERAL		
1.1.0	Manufacturer		
1.2.0	Type/ Model		
1.3.0	Quantity		
1.4.0	Design according to standard service class/ load class		
1.5.0	Nominal load carrying capacity (SWL)	Ton	
2.0.0	SPEEDS		
2.1.0	Long travelling speed		
	Main	M/min	
	Creep	M/min	
2.2.0	Cross travelling speed		
	Main	M/min	
	Creep	M/min	
2.3.0	Hoisting speed		
	Main	M/min	
	Creep	M/min	
3.0.0	Location (Indoor/ Outdoor)		
4.0.0	Clearances and Hook Approaches, as per Tender (If no, specify)		Yes/No
5.0.0	Type of control proposed		
6.0.0	Gantry Rail / Mono rail Size		
7.0.0	CONSTRUCTIONAL FEATURES		
7.1.0	Weight of complete crane (unladen)	Ton	
7.2.0	Maximum crab weight (unladen)	Ton	
7.3.0	Maximum wheel load (without impact)	Ton	
8.0.0	HOISTING SYSTEM		
8.1.0	Rope		
8.1.1	Rope diameter mm		
8.1.2	Rope construction		
8.1.3	Rope quality (material)		
8.1.4	Rope grade		
8.1.5	Number of rope falls		
8.1.6	Factor of safety		
8.2.0	Rope drum		
8.2.1	Drum diameter and length	mm	
8.2.2	Drum material		
8.2.3	Whether stress relieved		
8.2.4	Bearing type		
8.3.0	Hook		
8.3.1	Hook type		
8.3.2	Hook material		
8.3.3	Safety latches provided		



Cl.No.	Description	Unit	Data
8.3.4	Hook suspension		
8.3.5	Material of block suspension		
8.4.0	Sheaves		
8.4.1	Lower sheave diameter	mm	
8.4.2	Lower sheave material		
8.4.3	Equalizing sheave diameter	mm	
8.5.0	Hoist Brake		
8.5.1	Type		
8.5.2	Make		
8.5.3	Size	mm	
8.5.4	Torque	Nm	
8.6.0	Brake Drum		
8.6.1	Material		
8.6.2	Width	mm	
8.7.0	Coupling type		
8.7.1	Gear box input		
8.7.2	Gear box output		
8.8.0	Gear box		
8.8.1	Material of gears		
8.8.2	Material of pinions		
8.8.3	Type of gears/pinions		
8.9.0	Limit Switch		
8.9.1	Numbers		
8.9.2	Type		
8.9.3	Make		
9.0.0	CROSS TRAVEL		
9.1.0	CT brake		
9.1.1	Type		
9.1.2	Make		
9.1.3	Size	mm	
9.1.4	Torque	Nm	
9.2.0	Brake Drum		
9.2.1	Material		
9.2.2	Width	mm	
9.3.0	Coupling type		
9.3.1	Gear box input		
9.3.2	Gear box output		
9.4.0	Gear box		
9.4.1	Material of gears		
9.4.2	Material of pinion		
9.4.3	Type of gears/pinion		
9.5.0	Wheels		
9.5.1	Materials		
9.5.2	Hardness	BHN	
9.5.3	Type		
9.5.4	Diameter	mm	
9.5.5	Wheel bearing type		
9.6.0	Limit switches		
9.6.1	Number		
9.6.2	Type		
9.6.3	Make		
9.7.0	Type of Buffer Stoppers		
9.8.0	Number of driven wheels		
9.9.0	Number of total wheels		



Cl.No.	Description	Unit	Data			
10.0.0	LONG TRAVEL					
10.1.0	End carriage length	mm				
10.2.0	Coupling type					
10.3.1	Material of gears					
10.3.2	Material of pinion					
10.3.3	Type of gears/pinion					
10.4.0	Wheels					
10.4.1	Materials					
10.4.2	Hardness	BHN				
10.4.3	Type					
10.4.4	Diameter	mm				
10.4.5	Wheel bearing type/ make					
10.5.1	Hand Chain Material					
10.5.2	Hand Chain Wheel Material					
10.6.0	Type of Buffer Stoppers					
10.7.0	Number of total wheels					
11.0.0	MOTOR (To be filled separately for each main and creep motor)		Hoist		Trolley Travel	
			Main	Creep	Main	Creep
11.1.0	General					
11.1.1	Make					
11.1.2	Type					
11.1.3	Number					
11.2.0	Rating					
11.2.1	Rating : kW at 50 °C					
	Time					
	CDF					
11.2.2	Permissible Starts/Hr.					
11.2.3	Voltage-phase, frequency					
11.2.4	Rated current					
11.2.5	Rated torque	Nm				
	i) Starting					
	ii) Braking					
11.2.6	15% margin for motor ratings considered					
12.0.0	CRANE CONTROL					
12.1.0	Type					
12.2.0	Inching Speed Control					
12.2.1	Inching speed in % full load speed					
12.2.2	Detailed write-up furnished on inching speed control					
12.2.3	Individual control panel furnished for all crane motions ?					
12.2.4	Detailed write-up on speed control furnished?					



11.2 Single Girder Crane (Over Head / Under slung)

Note: Contractor to fill up the particulars in the format as specified below (as applicable) for each and every Single girder crane offered separately.

Cl.No.	Description	Unit	Data
1.0.0	GENERAL		
1.1.0	Manufacturer		
1.2.0	Type/ Model		
1.3.0	Quantity		
1.4.0	Design according to standard service class/ load class		
1.5.0	Nominal load carrying capacity (SWL)	Ton	
2.0.0	SPEEDS		
2.1.0	Long travelling speed		
	Main	M/min	
	Creep	M/min	
2.2.0	Cross travelling speed		
	Main	M/min	
	Creep	M/min	
2.3.0	Hoisting speed		
	Main	M/min	
	Creep	M/min	
3.0.0	Location (Indoor/ Outdoor)		
4.0.0	Clearances and Hook Approaches, as per Tender (If no, specify)		Yes/No
5.0.0	Type of control proposed		
6.0.0	Gantry Rail / Mono rail Size		
7.0.0	CONSTRUCTIONAL FEATURES		
7.1.0	Weight of complete crane (unladen)	Ton	
7.2.0	Maximum crab weight (unladen)	Ton	
7.3.0	Maximum wheel load (without impact)	Ton	
8.0.0	HOISTING SYSTEM		
8.1.0	Rope		
8.1.1	Rope diameter mm		
8.1.2	Rope construction		
8.1.3	Rope quality (material)		
8.1.4	Rope grade		
8.1.5	Number of rope falls		
8.1.6	Factor of safety		
8.2.0	Rope drum		
8.2.1	Drum diameter and length	mm	
8.2.2	Drum material		
8.2.3	Whether stress relieved		
8.2.4	Bearing type		
8.3.0	Hook		
8.3.1	Hook type		
8.3.2	Hook material		
8.3.3	Safety latches provided		



Cl.No.	Description	Unit	Data
8.3.4	Hook suspension		
8.3.5	Material of block suspension		
8.4.0	Sheaves		
8.4.1	Lower sheave diameter	mm	
8.4.2	Lower sheave material		
8.4.3	Equalizing sheave diameter	mm	
8.5.0	Hoist Brake		
8.5.1	Type		
8.5.2	Make		
8.5.3	Size	mm	
8.5.4	Torque	Nm	
8.6.0	Brake Drum		
8.6.1	Material		
8.6.2	Width	mm	
8.7.0	Coupling type		
8.7.1	Gear box input		
8.7.2	Gear box output		
8.8.0	Gear box		
8.8.1	Material of gears		
8.8.2	Material of pinions		
8.8.3	Type of gears/pinions		
8.9.0	Limit Switch		
8.9.1	Numbers		
8.9.2	Type		
8.9.3	Make		
9.0.0	CROSS TRAVEL		
9.1.0	CT brake		
9.1.1	Type		
9.1.2	Make		
9.1.3	Size	mm	
9.1.4	Torque	Nm	
9.2.0	Brake Drum		
9.2.1	Material		
9.2.2	Width	mm	
9.3.0	Coupling type		
9.3.1	Gear box input		
9.3.2	Gear box output		
9.4.0	Gear box		
9.4.1	Material of gears		
9.4.2	Material of pinion		
9.4.3	Type of gears/pinion		
9.5.0	Wheels		
9.5.1	Materials		
9.5.2	Hardness	BHN	
9.5.3	Type		
9.5.4	Diameter	mm	
9.5.5	Wheel bearing type		
9.6.0	Limit switches		
9.6.1	Number		
9.6.2	Type		
9.6.3	Make		
9.7.0	Type of Buffer Stoppers		
9.8.0	Number of driven wheels		
9.9.0	Number of total wheels		



Cl.No.	Description	Unit	Data			
10.0.0	LONG TRAVEL					
10.1.0	End carriage length	mm				
10.2.0	Coupling type					
10.3.1	Material of gears					
10.3.2	Material of pinion					
10.3.3	Type of gears/pinion					
10.4.0	Wheels					
10.4.1	Materials					
10.4.2	Hardness	BHN				
10.4.3	Type					
10.4.4	Diameter	mm				
10.4.5	Wheel bearing type/ make					
10.5.1	Hand Chain Material					
10.5.2	Hand Chain Wheel Material					
10.6.0	Type of Buffer Stoppers					
10.7.0	Number of total wheels					
11.0.0	MOTOR (To be filled separately for each main and creep motor)		Hoist		Trolley Travel	
			Main	Creep	Main	Creep
11.1.0	General					
11.1.1	Make					
11.1.2	Type					
11.1.3	Number					
11.2.0	Rating					
11.2.1	Rating : kW at 50 °C					
	Time					
	CDF					
11.2.2	Permissible Starts/Hr.					
11.2.3	Voltage-phase, frequency					
11.2.4	Rated current					
11.2.5	Rated torque	Nm				
	i) Starting					
	ii) Braking					
11.2.6	15% margin for motor ratings considered					
12.0.0	CRANE CONTROL					
12.1.0	Type					
12.2.0	Inching Speed Control					
12.2.1	Inching speed in % full load speed					
12.2.2	Detailed write-up furnished on inching speed control					
12.2.3	Individual control panel furnished for all crane motions ?					
12.2.4	Detailed write-up on speed control furnished?					

SECTION 3**PROJECT DETAILS AND GENERAL SPECIFICATIONS****3.0 GENERAL**

This section stipulates the General Technical Requirements under the contract and will form an integral part of the Technical Specification.

The provisions under this section are intended to supplement general requirements for the materials, equipment and services covered under other sections and are not exclusive. However in case of conflict between the requirements specified in this section and requirements specified under other sections, the requirements specified under respective sections shall hold good.

3.1 SITE INFORMATION

SL.NO.	DESCRIPTION	
3.1	PROJECT INFORMATION	
	a) Customer	Tamil Nadu Generation and Distribution Corporation (TANGEDCO)
	b) Project	400kV GIS at 2 x 660 MW Udangudi STPP (Stage-I)
	c) Project location	
	i) Country	India
	ii) State	Tamil Nadu
	iii) Administrative district	Thoothukudi
	iv) Next Big cities to site	Thoothukudi (approx.. 45 kms from site)
	v) Road access	East Coast Road- State high way (176)
	vi) Nearest Railway Station	Thiruchendur (approx.. 12 kms from site)
	vii) Nearest Airport	Vaigai (approx.. 60 kms from site)
	viii) Nearest Harbour	Tuticorin (approx.. 45 kms from site)
3.2	SITE CONDITIONS	
3.2.1	Ambient Air Temp.	

	a) Maximum dry bulb temp. (max.) °C	41 ⁰ C
	b) Minimum dry bulb temp. (min.) °C	17 ⁰ C
	Design ambient temperature	50 ⁰ C
3.2.2	Relative humidity	
	Mean Maximum humidity (Summer)	84 %
	Mean Minimum humidity (Summer)	62 %
	Maximum humidity (Monsoon)	97%
	Minimum humidity (Monsoon)	45%
3.2.3	Rain fall	
	Annual rainfall (Maximum)	718.2 mm
	Annual rainfall (Minimum)	384.1 mm
	Twenty four (24) Hour max	138.2 mm
3.2.4	High Flood Level	
	High Flood Level for site	RL 2.450 m
3.2.5	Wind	
	Mean Wind Speed (max)	39 m/sec (As per IS: 875)
	Wind direction	North, North east, North west, East
3.3	Seismic intensity	
	Seismic Intensity	As per IS:1893 Latest
	Zone	II

3.2 INSTRUCTION TO BIDDERS

The bidders shall submit the technical requirements, data and information as per the technical data sheets, provided in Section-4.

The bidders shall furnish catalogues, engineering data, technical information, design documents, drawings etc fully in conformity with the technical specification.

It is recognized that the Manufacturer may have standardized on the use of certain components, materials, processes or procedures different than those specified herein. Alternate proposals offering similar equipment based on the manufacturer's standard practice will also be considered provided such proposals meet the specified designs, standard and performance requirements and are acceptable to the Purchaser. Unless brought out clearly, the Bidder shall be deemed to conform to this specification scrupulously.

3.3 STANDARDS

The works covered by the specification shall be designed, engineered, manufactured, built, tested and commissioned in accordance with the Acts, Rules, Laws and Regulations of India.

The equipment to be furnished under this specification shall conform to latest issue (with all amendments) of specified standards.

In addition to meeting the specific requirement called for in Sections 1 and 2 of the Technical Specification, the equipment shall also conform to the general requirement of the applicable standards, which shall form an integral part of the specification.

The Bidder shall note that standards mentioned in the specification are not mutually exclusive or complete in themselves, but intended to complement each other.

When the specific requirements stipulated in the specifications exceed or differ from those required by the applicable standards, the stipulation of the specification shall take precedence.

Other internationally accepted standards, which ensure equivalent or better performance than that specified in the standards referred, shall also be accepted. The bidder shall submit copies of such standards.

In case governing standard for the equipment is different from IS or IEC, the salient points of difference shall be clearly brought out in the offer along with English language version of standard or relevant extract of the same. The equipment conforming to standards other than IS/IEC shall be subject to Purchaser's / owner's approval.

The bidder shall clearly indicate in his bid the specific standards in accordance with which the works will be carried out.

3.4 SERVICES TO BE PERFORMED BY THE EQUIPMENT BEING FURNISHED

All equipment shall also perform satisfactorily under various other electrical, electro mechanical and meteorological conditions of the site of installation. All equipment shall be able to withstand all external and internal mechanical, thermal and electro mechanical forces due to various factors like wind load, temperature variation, ice & snow, (wherever applicable) short circuit etc for the equipment.

3.5 ENGINEERING DATA

3.5.1 Drawings

The Supplier shall necessarily submit all the drawings/ documents unless anything is waived. The Supplier shall submit drawings/ design documents/ data/ test reports/manuals as may be required for the approval of the purchaser. All drawings submitted by the Manufacturer including those submitted at the time of bid shall be in sufficient detail to indicate the type, size, arrangement, material description, Bill of Materials, weight of each component, break-up for packing and shipment, the external connections, fixing arrangement required. The dimensions required for installation and interconnections with other equipment and materials, clearances and spaces required for installation and interconnections between various portions of equipment and any other information specifically requested in the specifications.

Each drawing submitted by the Manufacturer shall be clearly marked with the name of the Purchaser, the unit designation, the specifications title, the specification number and the name of the Project. If standard catalogue pages are submitted, the applicable items shall be indicated therein. All titles, noting, markings and writings on the drawing shall be in English. All the dimensions should be in metric units.

Further work by the Manufacturer shall be in strict accordance with these drawings and no deviation shall be permitted without the written approval of the Purchaser, if so required.

The review of these data by the Owner will cover only general conformance of the data to the specifications and documents, interfaces with the equipment provided under the specifications, external connections and of the dimensions which might affect substation layout. Owner may not indicate a thorough review of all dimensions, quantities and details of the equipment, material, any devices or items indicated or the accuracy of the information submitted. This review and /or approval by the Owner shall not be considered by the Manufacturer, as limiting any of his responsibilities and liabilities for mistakes and deviations from the requirements, specified under these specifications and documents.

All manufacturing and fabrication work in connection with the equipment prior to the approval of the drawings shall be at the Manufacturer's risk. The Manufacturer may make any changes in the design which are necessary to make the equipment conform to the provisions and intent of the Contract and such changes will again be subject to approval by the Purchaser. Approval of Manufacturer's drawing or work by the Purchaser shall not relieve the manufacturer of any of his responsibilities and liabilities under the Contract.

All engineering data submitted by the Manufacturer after final process including review and approval by the Owner shall form part of the Contract Document and the entire works performed under these specifications shall be performed in strict conformity, unless otherwise expressly requested by the Owner in Writing.

The title block of drawings shall contain the following information incorporated in all contract drawings

Title block for project:

1. Customer : Tamil Nadu Generation and Distribution Corporation (TANGEDCO)
2. Consultant : DESEIN PRIVATE LIMITED, DESEIN HOUSE, NEW DELHI
3. Project : 400kV GIS at 2 x 660 MW Udangudi STPP (Stage-I)
4. Contract No./LOA No. : Lr.No.CE/Proj.II/SE/C/UTPP/EE/E/LOI/D.179/2017, dt.07.12.2017
5. Main Contractor : Bharat Heavy Electricals Limited
6. BHEL Order No. & Date :

3.5.2 Documentation

Document Distribution Schedule - After Placement of Order:

S. No.	Stage	No. of copies	
i)	Submission of Data sheets Datasheet, drawings, documents, write-ups, calculation, test reports, Preliminary	13	As per agreed schedule
ii)	Resubmission of above, if required	13	As per agreed schedule
iii)	Final approved documents	13	As per agreed schedule
iv)	Instruction manuals for erection and O&M	6	As per agreed schedule
v)	As built drawings including O &M manual -Hard copy -Soft copy in CD/Pendrive	13 6	As per agreed schedule

NOTES:

- a) The manufacturer may note that all re-submissions must incorporate all comments given in the prior submission by the Purchaser. Adequate justification for not incorporating the same must be submitted, failing which the submitted documents may be returned.

3.5.3 Format of Documentation

- a) All engineering documents and drawings shall be of international "A" series sizes, that is, A0, A1, A2, A3 and A4.
- b) Two set of CD/ pendrive containing all the drawings in Auto CAD shall also be supplied in addition to hard copies. Soft copy of all documents shall be supplied in a CD/pendrive in PDF format.
- c) Grouped documents shall be provided by size A4, with the inclusion of bigger size drawings which, however, have to be folded as Size A4.

3.5.4 Instruction manuals and operating manuals

The Supplier shall provide Instruction & Maintenance Manuals for each part of the Plant and Equipment included in the Works and Operating Manuals for each Station.

The Instruction Manuals and Operating Manuals shall be arranged in an organized library adequately cross referenced to facilitate issuing clauses of the manuals as required by the work i.e. erection instructions shall be required before operating & maintenance instructions.

All Manuals provided by the Supplier shall be fully detailed and specifically prepared for the Works and equipment provided. General manuals not specifically required for the work shall not be acceptable.

The instruction manuals shall at least contain:

- a) A general description of all components
- b) Storage instructions
- c) Erection instructions
- d) Pre-commissioning Instruction:
- e) Material and part list.
- f) Design clearances and settings
- g) Complete sets of drawings as finally issued
- h) Operating Instructions:
- i) Routine and Preventive Maintenance instructions with material requirement for each site
- j) Preventive Maintenance Schedule.
- k) Replacement instruction for all equipment

The operation manuals shall at least contain:

- a) Operator oriented functional descriptions of the equipment.
- b) Operator oriented description of the protection and control systems
- c) Description of the equipment auxiliary systems
- d) Fault finding and diagnostic tools
- e) User software interface tools for modification/augmentation etc.

Notes:

The supplier may please note that all resubmissions must incorporate all comments given in the earlier submission by the Owner/Purchaser or adequate justification for not incorporating the same must be submitted failing which the submission of documents is likely to be returned.

If after the commissioning and initial operation of the substation, the instruction manuals require any modifications/ additions/changes, the same shall be incorporated and the updated final instruction manuals shall be submitted by the Supplier to the Owner/Purchaser.

The Supplier shall furnish to the Owner/Purchaser, catalogues of spare parts also.

3.6 QUALITY ASSURANCE PROGRAMME

This section contains general requirements for inspection of material, parts, equipment and workmanship during manufacture, assembling to demonstrate compliance with specification, codes and standards to ensure overall reliability of product operation and performance.

The Owner and/or authorized Representatives shall, at any time, be allowed free and ready access to the Contractor's premises and those of his suppliers as well as to the site installation and the Contractor has to make the items available for the purpose of inspection of the specified equipment components and obtaining information as to the progress of the work. Failure on the part of the Owner, at this or any other time, to discover or reject materials or work which do not meet specified requirements shall not be deemed an acceptance thereof nor a waiver of defects therein.

The approval of the Owner shall not prejudice the right to reject equipment if it does not give complete satisfaction in service.

To ensure that the equipment and services under the scope of this Contract, whether manufactured or performed within the Manufacturer's Works or at his Sub-manufacturer's premises or at the Purchaser's site or at any other place of Work, are in accordance with the specifications, the Manufacturer shall adopt a suitable quality assurance programme to control such activities at all points, as necessary.

Before manufacture commences and not later than 45 days after award of contract, the Contractor shall submit an outline of his proposed inspection program, which shall include all major stages during manufacturing. The inspection and test program shall include for the various items the designation No., name of equipment, part of equipment, the kind of test, test standard, company which carries out the test, place, date and witnesses by the Contractor, third party or Owner's Representative. The detailed manufacturer's quality assurance plan shall be subject to approval after award of contract.

The Owner will return a copy of the Contractor's proposed inspection program indicating those inspection stages for which notification is required. Notification shall be by Fax or email in a format to be agreed and shall be sent prior to the intended test. If the Owner intends to be represented at the test he will provide at least 24 hours' notice and if his representative does not attend on the notified date, an alternative date has to be informed by the Owner.

A quality assurance programme of the manufacturer shall generally cover the following:

- (a) Manufacturer's organisation structure for the management and implementation of the proposed quality assurance programme;
- (b) Documentation control system;
- (c) Qualification data of bidder's key personnel;
- (d) The procedure for purchases of materials, parts components and selection of sub-Manufacturer's services including vendor analysis, source inspection, incoming raw material inspection, verification of material purchases etc.
- (e) System for shop manufacturing and site erection controls including process controls and fabrication and assembly control;
- (f) Control of non-conforming items and system for corrective actions;
- (g) Inspection and test procedure both for manufacture and field activities;
- (h) Control of calibration and testing of measuring instruments and field activities;
- (i) System for indication and appraisal of inspection status;
- (j) System for quality audits;
- (k) System for authorising release of manufactured product to the Purchaser
- (l) System for maintenance of records;
- (m) System for handling storage and delivery; and
- (n) A quality plan detailing out the specific quality control measures and Procedures adopted for controlling the quality characteristics relevant to each item of equipment furnished and/or services rendered. The Purchaser or his duly authorised representative reserves the right to carry out quality audit and quality surveillance of the system and Procedure of the Manufacturer/his vendors quality management and control activities.

3.7 Quality Assurance Documents

The Manufacturer shall be required to submit all Quality Assurance Documents as stipulated in the quality plan at the time of purchaser's inspection of equipment/material.

3.8 TYPE TESTING, INSPECTION, TESTING & INSPECTION CERTIFICATE

All equipment being supplied shall conform to type tests and shall be subject to routine and acceptance tests in accordance with requirements stipulated under respective sections. Purchaser reserves the right to witness any or all the tests. The

Manufacturer shall intimate the Purchaser the detailed programme about the tests at least three (3) weeks in advance in case of domestic supplies & six (6) weeks in advance in case of foreign supplies. The Manufacturer shall also submit type test procedure for approval of the Purchaser.

In the event of any discrepancy in the test reports i.e. any test report not acceptable due to any design/manufacturing changes (including substitution of components) or due to non-compliance with the requirement stipulated in the technical specification or any/all additional type tests not carried out, Such test shall be conducted fresh without any additional cost implication to the Purchaser.

The price of conducting all tests and additional type tests is deemed to be included in Bid price. In case any bidder indicates that he shall not carry out a particular test, his offer shall be considered incomplete and shall be liable to be rejected.

Inspection may be made at any stage of manufacture, dispatch or at site at the option of the Purchaser and the equipment if found unsatisfactory due to bad workmanship or quality, material is liable to be rejected.

The Purchaser or Inspector shall, within fifteen (15) days from the date of inspection as defined herein, give notice in writing to the Manufacturer, of any objection to any drawings and all or any equipment and workmanship which in his opinion is not in accordance with the Contract. The Manufacturer shall give due consideration to such objections and shall either make the modifications that may be necessary to meet the said objections or shall confirm in writing to the Purchaser/ inspector giving reasons therein, that no modifications are necessary to comply with the Contract.

When the factory tests have been completed at the Manufacturer's works, the Purchaser/inspector shall issue a certificate to this effect within fifteen (15) days after completion of tests but if the tests are not witnessed by the Purchaser/inspector, the certificate shall be issued within fifteen (15) days of receipt of the Manufacturer's Test certificate by the Engineer/ Inspector. Failure of the Purchaser/inspector to issue such a certificate shall not prevent the Manufacturer from proceeding with the Works. The completion of these tests or the issue of the certificate shall not bind the Purchaser to accept the equipment should it, on further tests/ after erection, be found not to comply with the Contract. The equipment shall be dispatched to site only after approval of test reports and issuance of MICC by the Purchaser.

In all cases where the Contract provides for tests whether at the premises or at the works of the Manufacturer or of any Sub-Contractor, the Manufacturer except where otherwise specified shall provide free of charge such items as labour, materials, electricity, fuel, water, stores, apparatus and instruments as may be reasonably demanded by the Purchaser /Inspector or his authorised representative to carry out effectively such tests of the equipment in accordance with the Contract and shall give

facilities to the Purchaser Inspector or to his authorised representative to accomplish testing.

The inspection by Purchaser and issue of Inspection Certificate thereon shall in no way limit the liabilities and responsibilities of the Manufacturer in respect of the agreed quality assurance programme forming a part of the Contract.

The Purchaser reserves the right for getting any field tests not specified in respective sections of the technical specification conducted on the completely assembled equipment at site. The testing equipment for these tests shall be provided by the Purchaser.

3.9 MATERIALS AND WORKMANSHIP

Equipment materials and components shall be new, of high grade and good quality and be to the latest engineering practice. The material and workmanship throughout shall be in accordance with the purpose for which they are intended. Each component shall be designed to be consistent with its duty.

All the information concerning materials or components to be used in manufacturing, machinery, equipment, materials and components supplied, installed or used shall be submitted for approval. Without such approval the supplier shall run risk of subsequent rejection. The cost as well as time delay associated with such rejection shall be borne by the supplier.

3.10 COLOUR SCHEME

The Supplier shall propose a colour scheme for the equipment for the approval of the Employer. The decision of the Employer shall be final. However, the finishing colour shall be RAL 7035 for all Control panels/ MCC/ Switchgear panels. The scheme shall include:

- Finishing colour of Indoor equipment
- Finishing colour of Outdoor equipment
- Finishing colour of various auxiliary system equipment including piping
- Finishing colour of various building items.
- Finishing colour of all cubicles.

All steel structures, plates etc shall be painted with non-corrosive paint on a suitable primer. The galvanised structures in the switchyard shall not be painted. However galvanised structures in other areas may require painting for aesthetic reasons.

3.11 PACKING AND STORAGE

Packing specification shall be submitted for BHEL/customer approval after award of contract.

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. On request of the purchaser, the manufacturer shall also submit packing details/associated drawing for any equipment/ material at a later date, in case the need arises. While packing all the materials, the limitation from the point of view of availability of Railway wagon sizes in India should be taken into account. The manufacturer shall be responsible for any loss or damage during transportation, handling and storage due to improper packing. Any demurrage, wharf age and other such charges claimed by the transporters, railways etc shall be to the account of the manufacturer. Purchaser takes no responsibility of the availability of the wagons.

All coated surfaces shall be protected against abrasions, impact, discoloration and any other damages. All exposed threaded portions shall be suitably protected with either a metallic or a non-metallic protecting device.

Supplier shall ensure that equipment shall be properly packed, blocked, padded, coated and protected so that it is not damaged due to possible mishandling. Storage requirements shall be clearly defined by the supplier. Packing shall be such that if required, long time storage (at least 1 year) at site should not deteriorate the performance of the equipment.

3.12 NAME PLATE

Name plates which are to be firmly fixed on all the equipment, buildings and structures shall be provided. For equipment of small size, these are to be fixed on the piping or structure adjacent to the equipment. The contents of nameplate are to include the designation and principal parameters of the equipment.

The nameplate within the field shall be made of a high temperature - resistant metallic sheets, with designation permanently engraved on them. Indoor installed equipments (e.g., panels, cabinets, switchgear, etc.) shall also be labelled by appropriate name plate.

The form, size, base colour and colour of contents of the name plates and prompting plates will be agreed between the Contractor and the Owner. It shall be possible for these to be readily seen by the operator. The designation of warning tags shall be different from that of other tags.

The Equipment identification shall be finalized by vendor in consultation with BHEL/TANGEDCO and should be included in name plates.

3.13 CLAMPS & CONNECTORS

- i) All power clamps and connectors shall conform to IS: 5561, and/or IEC standard and shall be made of materials listed below:

a)	For connecting ACSR conductors	Aluminium alloy casting, conforming to designation A6 of IS: 617 and shall be tested for all tests as per IS:617
b)	For connecting equipment terminals made of copper with ACSR conductors	Bimetallic connectors made from aluminium alloy casting, conforming to designation A6 of IS 617 with 2 mm thick Bimetallic liner and shall be tested as per IS: 617.
c)	For connecting G.I. Shield wire	Galvanised mild steel
d).1	Bolts, nuts & Plain washers.	Electro galvanized for sizes below M12, for others hot dip galvanised
d).2	Spring washers for items 'a' to 'c'	Electro-galvanised mild steel suitable for at least service condition-3 as per IS: 1573

- ii) Equipment shall be supplied with the necessary terminals and connectors, as required by the ultimate design for the particular installation. The conductor terminations of equipment shall be either expansion, sliding or rigid type. The requirements regarding external corona and RIV as specified for any equipment shall include its terminal fittings and the equipment shall be factory tested with the connectors in position. In case the connector is not available then equivalent connector may be used. If corona rings are required to meet these requirements they shall be considered as part of that equipment and included in the scope of Work.
- iii) Where copper to aluminium connections are required, bi-metallic clamps shall be used, which have been properly designed to ensure that any deterioration of the connection is kept to a minimum and restricted to parts which are not current t shall be furnished to the Employer.
- iv) Low voltage connectors, grounding connectors and accessories for grounding all equipment as specified are also included in the scope of Work.
- v) No current carrying part of any clamp shall be less than 10 mm thick. All ferrous parts shall be hot dip galvanised. Copper alloy liner of minimum 2mm thickness shall be cast integral with aluminium body for Bi-metallic clamps. When copper alloy is not cast integral with aluminium body, a bimetallic washer or strip shall be used to meet the functional requirement.
- vi) All casting shall be free from blow holes, surface blisters, cracks and cavities. All sharp edges and corners shall be blurred and rounded off.

- vii) Flexible connectors, braids or laminated straps made for the terminal clamps for bus posts shall be suitable for both expansion or through (fixed/sliding) type connection of IPS Aluminium tube as required. In both the cases the clamp height (top of the mounting pad to centre line of the tube) should be same.
- viii) Clamp shall be designed to carry the same current as the conductor and the temperature rise shall be equal or less than that of the conductor at the specified ambient temperature. The rated current for which the clamp/connector is designed with respect to the specified reference ambient temperature, shall also be indelibly marked on each component of the clamp/connector, except on the hardware.
- ix) All current carrying parts shall be designed and manufactured to have minimum contact resistance.

x) TESTS

The following is the list of type tests.

- a) Temperature rise test (maximum temperature rise allowed is 35deg C over 50 deg C ambient)
- b) Short time current test
- c) Dry corona and RIV test as per annexure-A
- d) Resistance test and tensile test

3.14 GALVANIZING

Galvanizing works shall conform in all respect to B.S. 729, B.S. 3083 and B.S.C.P. 2008 and to DIN 50976 whatever requires the higher quality and shall be performed by the hot dip process, unless otherwise specified. It is essential that details of steel members and assemblies which are to be hot-dip galvanized should be designed in accordance with B.S 4479.

Vent-holes and drain-holes should be provided to avoid high internal pressures and air-locks during immersion, which may cause explosions, and to ensure that molten zinc is not retained in pockets during withdrawal.

Careful cleaning of welds is necessary before welded assemblies are dipped. The welds and the surrounding metal should be cleaned separately, preferably by blast-cleaning, because the usual preliminary pickling cannot be relied on to remove the welding slag.

All defects of the steel surface including cracks, surface laminations, laps and folds shall be removed in accordance with B.S. 4360. All drilling, cutting, welding, forming and final fabrication of unit members and assemblies shall be completed, where feasible, before the structures are galvanized. The surface of the steelwork to be galvanized shall be free from paint, oil, grease and similar contaminants in

accordance with DIN 55928, part 4 and DIN 50976. The weight of zinc coating per unit area has to be noted in the manufacturing documents in accordance with DIN 50976.

The minimum average coating weight shall be as specified in Table 1 of B.S. 729 or Table 2, DIN 50976, whatever requires higher quality.

Structural steel items shall be initially grit-blasted to B.S. 4232, second quality, (Sa 21/2) or by pickling in a bath and the minimum average coating weight on steel sections 5 mm thick and over shall be 610 g/m² (DFT = 85μ).

On removal from the galvanizing bath, the resultant coating shall be smooth, continuous, free from gross surface imperfections such as bare spots, lumps, blisters and inclusions of flux, ash or dross.

Galvanized contact surfaces to be joined by high-tensile friction-grip bolts shall be roughened before assembly so that the required slip factor (defined in B.S. 3294, part 1 and B.S. 4604,

part 1) is achieved. Care shall be taken to ensure that the roughening is confined to the area of the mating faces.

Bolts, nuts and washers, including general grade high-tensile friction grip bolts (referred to in B.S. 3139, and B.S.4395 part 1) shall be hot dip galvanized and subsequently centrifuged (according to B.S. 729). Nuts shall be tapped up to 0.4 mm oversize after galvanizing and the threads oiled to permit the nuts to be finger-turned on the bolt for the full depth of the nut. No lubricant, applied to the projecting threads of galvanized high-tensile friction-grip bolt after the bolt has been inserted through the steelwork, must be allowed to come into contact with the mating faces of the steelwork,. A local remelting of the galvanized parts to achieve the nuts to be finger turned on the bolt is possible in accordance with DIN 50976.

Protected slings must be used for offloading and erection. Galvanized work which is to be stored at the works or on site shall be stacked so as to provide adequate ventilation to all surfaces to avoid wet storage staining (white rust).

Small areas of the galvanized coating damaged in any way shall be restored in accordance with DIN 55928, part A and DIN 50976 by:

- Cleaning the area of any weld slag rust and other impurities and by thorough wire brushing to give a metallic clean surface.
- Application of suitable number of coats of zinc-rich paint containing more than 90 % w/w of zinc in dried film. The dry film thickness shall exceed at least 50 % the thickness of the desired galvanization. In case of application of a low melting point zinc alloy repair rod, the rods shall be in accordance with DIN1707, the thickness of the alloy shall be at least as of the desired galvanization.

The restored area is not to exceed 1 % of the galvanized surface. Surface restoration of parts in contact with drinking water is not allowed and the quality of the galvanization is to be in accordance with DIN 2444.

After fixing, bolt heads, washers and nuts shall receive two coats of zinc-rich paint.

Connections between galvanized surfaces and copper, copper alloy or aluminum surfaces shall be protected by suitable preferably hydrophobe tape wrappings to the owner's approval.

3.15 DEGREE OF PROTECTION

The enclosures of the control cabinets, Junction boxes and Marshalling boxes, panels etc. to be installed as detailed here under:

The minimum requirements for panels are as follows:

- Installed out door: IP- 55
- Installed indoors in air-conditioned area: IP-32
- Installed in covered area: IP-52
- Installed indoors in non air-conditioned area where possibility of entry of water is limited: IP-41.
- For LT Switchgear (AC & DC distribution Boards): IP-52.

The degree of protection shall be in accordance with IS:13947 (Part-I) / IEC-947 (Part-I) / IS 12063 / IEC 529. Type test report for degree of protection test, on each type of the box shall be submitted for approval



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CONSULTANT- TATA CONSULTING ENGINEERS LIMITED BENGALURU
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SECTION-4 ENCLOSURES TO SPECIFICATION

SCHEDULES TO BE FILLED UP BY THE BIDDER

- Schedule 1 **Schedule of makes of Equipments**
- Schedule 2 **Schedules of Deviations**
- Schedule 3 **Schedule of past experience and qualifying requirements**
- Schedule 4 **Schedule of performance certificates**
- Schedule 5 **Schedule of type test and special tests**
- Schedule 6 **Details of contact persons (technical & commercial)**
- Schedule 7 **Enclosures to Specification**



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SCHEDULE-1

MAKES OF IMPORTANT ITEMS / COMPONENTS OF EQUIPMENTS AND THEIR DETAILS

ITEM NAME	NAME OF MANUFACTURER	PLACE OF MANUFACTURE OF ITEM	PLACE OF TESTING AND INSPECTION	COMPLIANCE WITH ISO 9001 (YES/NO)

Place

Signature of the authorized representative of Bidder

Name -----

Date

Designation-----

Company seal-----



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SCHEDULE-2

SCHEDULE OF TECHNICAL DEVIATION

The following are the deviations / variations / exceptions from the specification:

Section	Clause No. / Page No.	Statement of deviation/ Variations/Exceptions
---------	--------------------------	--

- 1) In case, this schedule is not submitted, it will be presumed that the equipment /material to be supplied under this contract are deemed to be in compliance with the specification.
- 2) If there is NIL deviation, even then the format to be filled as **NIL DEVIATION**
- 3) Continuation sheets of like size and format may be used as per the Bidder's Requirement and shall be annexed to this schedule.

Place

Signature of the authorized representative of Bidder

Name -----

Date

Designation-----

Company seal-----



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SCHEDULE – 3

SCHEDULE OF PAST EXPERIENCE AND QUALIFYING REQUIREMENT

Following is the list of earlier orders executed by us for supply of equipment / material of similar nature over the last past five years:

S.No.	Item	Brief rating	Qty	customer	Date Of order	Date of supply	Order value
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Place

Signature of the authorized representative of Bidder

Date

Name-----

Designation-----

Company seal -----

Note: Continuation sheets of like size and format may be used as per the Bidder's Requirement and shall be annexed to this schedule.



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SCHEDULE – 4

SCHEDULE OF PERFORMANCE CERTIFICATE

Bidder shall furnish the performance certificate of the similar equipment having
The following details:

S.No.	Item	Brief rating	Qty	Customer	Date Of supply
-------	------	--------------	-----	----------	----------------

Place

Signature of the authorized representative of Bidder

Date

Name-----

Designation-----

Company seal -----

Note:

Continuation sheets of like size and format may be used as per the Bidder's
Requirement and shall be annexed to this schedule.



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SCHEDULE-5

SCHEDULE OF TYPE TESTS AND SPECIAL TESTS

The following type tests and special tests as called for in the Specification shall be conducted (all type tests / special tests as mentioned in the relevant clauses of the Specification shall be listed here):

Sl no.	Clause no/ page no of Specification	Details of test	Lab in which to be conducted	Whether test to be conducted free or on chargeable basis. Mention 'FREE' or 'CHARGEABLE'	If charges per test have been quoted for in the price bid. YES / NO
		A. Type Tests			
		1.			
		2.			
		B. Routine Tests			DO NOT
		1.			MENTION
		2.			ANY PRICE
		C. Site Tests			IN THIS
		1.			COLUMN
		2.			
		D. Special Tests (specified)			
		1.			
		2.			
		E. Other tests at works / site recommended by the Bidder			
		1.			
		2.			

NOTE:

- 1) Details have to be furnished on cables as well as accessories, each separately.
- 2) **NO PRICE SHALL BE FURNISHED IN THIS FORMAT.**

Place

Signature of the authorized representative of Bidder

Name-----

Date

Designation-----

Company seal-----



CLIENT – TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD.
CONSULTANT- TATA CONSULTING ENGINEERS LIMITED BENGALURU
PROJECT: 2X660MW UDANGUDI STPP (STATE-1)
TECHNICAL SPECIFICATION FOR EOT CRANE FOR 400KV GIS

TB-400-316-122-00

Rev. 00

Page | 7

SCHEDULE-6

DETAILS OF CONTACT PERSON BOTH TECHNICAL AND COMMERCIAL

Name

Address for correspondence

Phone No.

Fax No.

Email

Place

Signature of the authorized representative of Bidder

Date

Name-----

Designation-----

Company seal -----

Note:

Continuation sheets of like size and format may be used as per the Bidder's Requirement and shall be annexed to this schedule.



CLIENT – TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD.
CONSULTANT- TATA CONSULTING ENGINEERS LIMITED BENGALURU
PROJECT: 2X660MW UDANGUDI STPP (STATE-1)
TECHNICAL SPECIFICATION FOR EOT CRANE FOR 400KV GIS

TB-400-316-122-00

Rev. 00

Page | 8

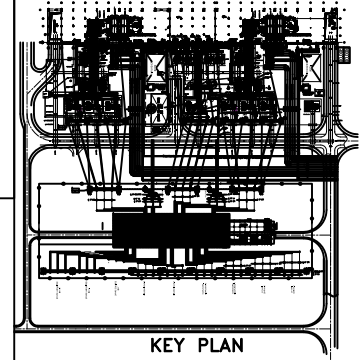
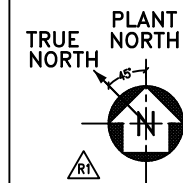
SCHEDULE –7

ENCLOSURES TO SPECIFICATION

DRAWINGS

1. ***TB-1-400-607-640-1, R1: Architectural Drawing GIS Building (Plan, Section, Elevation).***

DRAWING NO.



KEY PLAN

TYP. DETAIL OF EXPANSION JOINT
AT COLUMN LOCATION
(DETAIL C)

DETAIL C

MATCH LINE - A

GROUND FLOOR PLAN

LEGEND :-	
FGL	FINISHED GROUND LEVEL
FFL	FINISHED FLOOR LEVEL
TOC	TOP OF CONCRETE
FC	FALSE CEILING
UDI	UNDER DECK INSULATION
RS	ROLLING SHUTTER
D	DOOR
W	WINDOW
V	VENTILATOR
EF	EXHAUST FAN
WB	WASH BASIN

REFERENCE DRAWING:-

1 CONCEPTUAL GIS BUILDING LAYOUT - TB-1-400-316-005

NOTES:-

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3. ALL DOOR-WINDOW, ETC. HEIGHT SHALL BE CONSIDERED FROM FINISH FLOOR LEVEL.

JOB NO.
STATUS CONTRACT
DISTRIBUTION

PROJECT	2X660 MW UDANGUDI SUPERCRITICAL TPS, STAGE-I
CUSTOMER	TAMILNADU GENERATION AND DISTRIBUTION CORPORATION LIMITED (TANGEDCO)
CONSULTANT	TATA CONSULTING ENGINEERS LIMITED BENGALURU
	BHARAT HEAVY ELECTRICALS LTD TRANSMISSION BUSINESS GROUP NOIDA

REV.	DATE	ALT.	CHK.	APP.	REV.	DATE	ALT.	CHK.	APP.	REV.	DATE	ALT.	CHK.	APP.
01	11.04.20		TKR	DKU	SG									

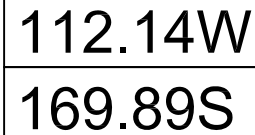
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indirectly in any way detrimental to the interest of the company.

DEPT.	NAME	DATE
DESIGN	TKR	20.01.20
DESIGN	SS	20.01.20
DESIGN	DKU	20.01.20
DESIGN	SG	20.01.20

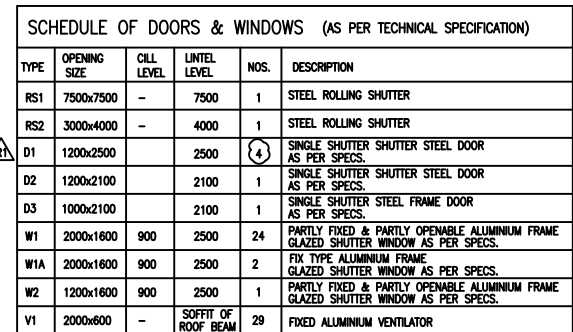
TITLE ARCHITECTURAL DRAWING GIS BUILDING (PLAN)

DEPT.	SCALE	DRAWING NO.
DESIGN	1:75	TB-1-400-607-640-1

SHEET 01 OF 06 REV. 01

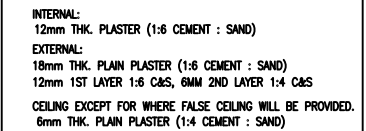


W=1200
T= 250
R= 169.64



A diagram showing a horizontal beam supported by a triangular support labeled R_1 .

HIGH SOLID CONTENT LIQUID APPLIED ELASTOMERIC WATER PROOFING MEMBRANE WITH SEPARATE WEARING COURSE AS PER ASTM C - 898. THICKNESS OF THE MEMBRANE SHALL BE 1.5 MM. THIS TREATMENT SHALL INCLUDE APPLICATION OF POLYMERISED MASTIC OVER THE ROOF TO ACHIEVE SMOOTH SURFACE AND PRIMER COAT. WEARING COURSE ON TOP OF MEMBRANE SHALL CONSIST OF 40MM. THICK PCC (1:2:4) CAST IN PANELS OF MAX. 1200X1200 SIZE AND REINFORCED WITH 0.56 MM. DIA. GALVANIZED CHICKEN WIRE MESH AND SEALING OF JOINTS USING SEALING COMPOUND/ ELASTOMETRIC WATER PROOFING MEMBRANE.



NOTES:-

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3. ALL DOOR-WINDOW, ETC. HEIGHT SHALL BE CONSIDERED FROM FINISH FLOOR LEVEL.

[illegible]

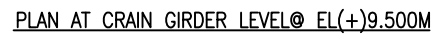
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CUSTOMER	 TAMILNADU GENERATION AND DISTRIBUTION CORPORATION LIMITED (TANGEDCO)									
CONSULTANT	 TATA CONSULTING ENGINEERS LIMITED BENGALURU									
	 BHARAT HEAVY ELECTRICALS LTD TRANSMISSION BUSINESS GROUP NOIDA									
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	APPS	AG			20.01.20					
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	DEPT.	SCALE	DRAWING NO.							
		1:75	TB-1-400-607-640-1							
	SHH		PREPARED BY: _____ CHECKED BY: _____ DATE: _____							



NOTES:-

- [illegible]

PROJECT	2X660 MW UDANGUDI SUPERCRITICAL TPS, STAGE-I				
CUSTOMER	 TAMILNADU GENERATION AND DISTRIBUTION CORPORATION LIMITED (TANGEDCO)				
CONSULTANT	 TATA CONSULTING ENGINEERS LIMITED BENGALURU				
 Bharat Heavy Electricals Limited Bengaluru	BHARAT HEAVY ELECTRICALS LTD TRANSMISSION BUSINESS GROUP NOIDA				
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	SIGN			SHEET 03 OF 06	REV. 01

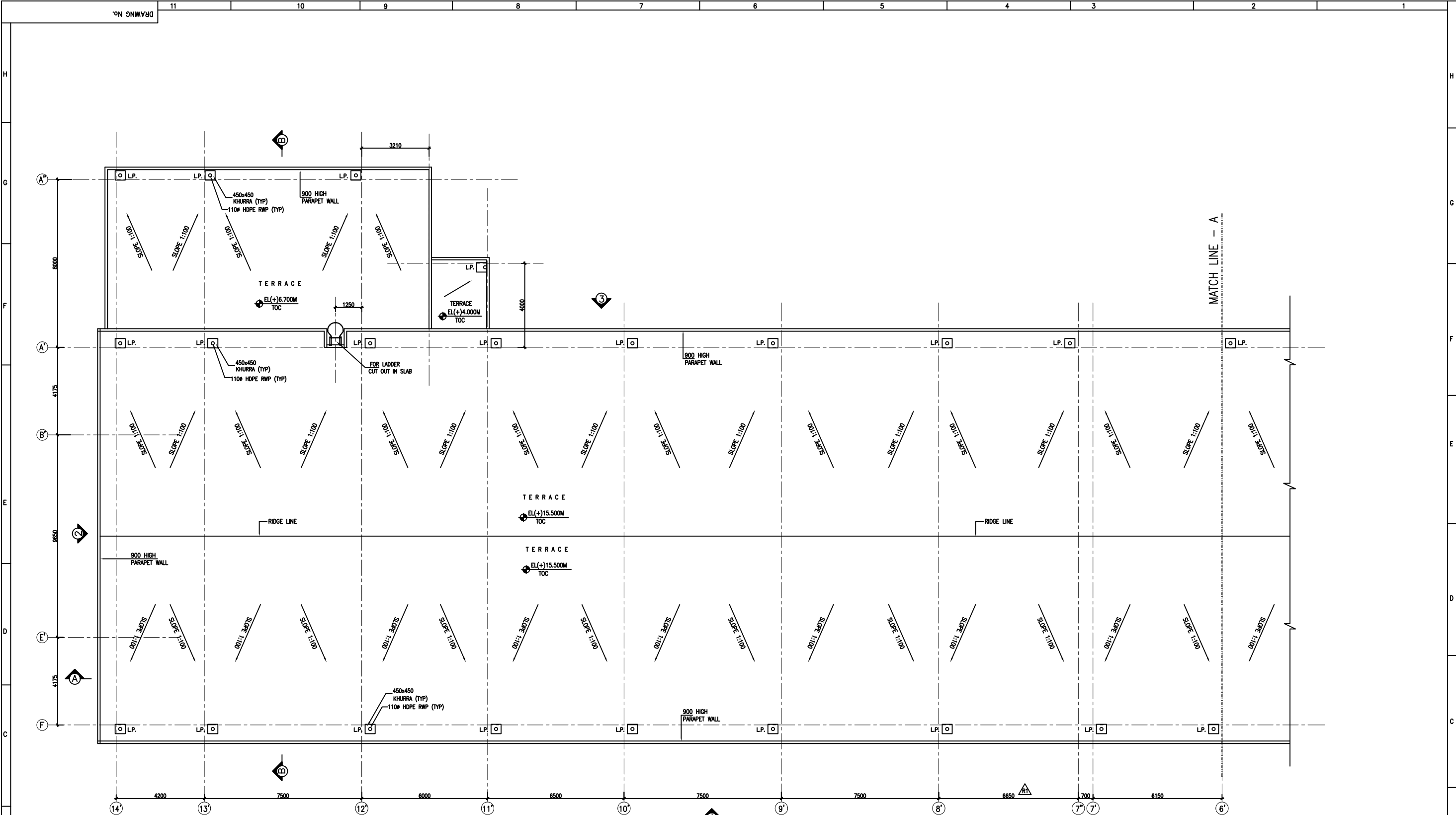


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		CUSTOMER		 TAMILNADU GENERATION AND DISTRIBUTION CORPORATION LIMITED (TANGEDCO)																					
		CONSULTANT		 TATA CONSULTING ENGINEERS LIMITED BENGALURU																					
JOB NO.				BHARAT HEAVY ELECTRICALS LTD																					
STATUS		CONTRACT		TRANSMISSION BUSINESS GROUP																					
DISTRIBUTION		NOIDA																							
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				SHEET 04 OF 06																					
				REV. 01																					



TERRACE PLAN

NOTES:-

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CUSTOMER	 TAMILNADU GENERATION AND DISTRIBUTION CORPORATION LIMITED (TANGEDCO)
CONSULTANT	 TATA CONSULTING ENGINEERS LIMITED BENGALURU
JOB NO.	
STATUS	CONTRACT
DISTRIBUTION	
BHARAT HEAVY ELECTRICALS LTD TRANSMISSION BUSINESS GROUP NOIDA	
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CHK DKU	DATE 20.01.20
APPRO AC	DATE 20.01.20
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SHEET 05 OF 06	
REV.	01



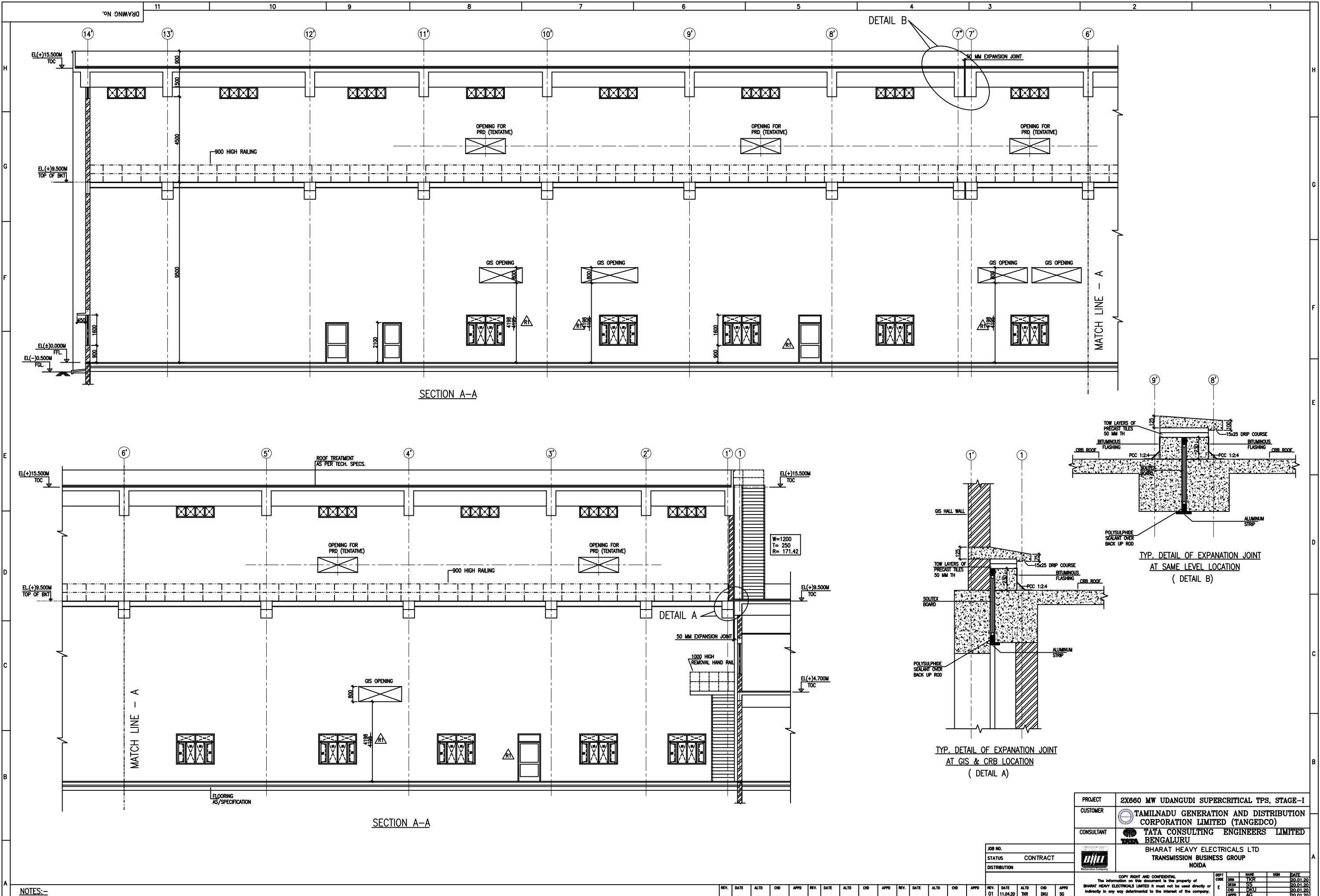
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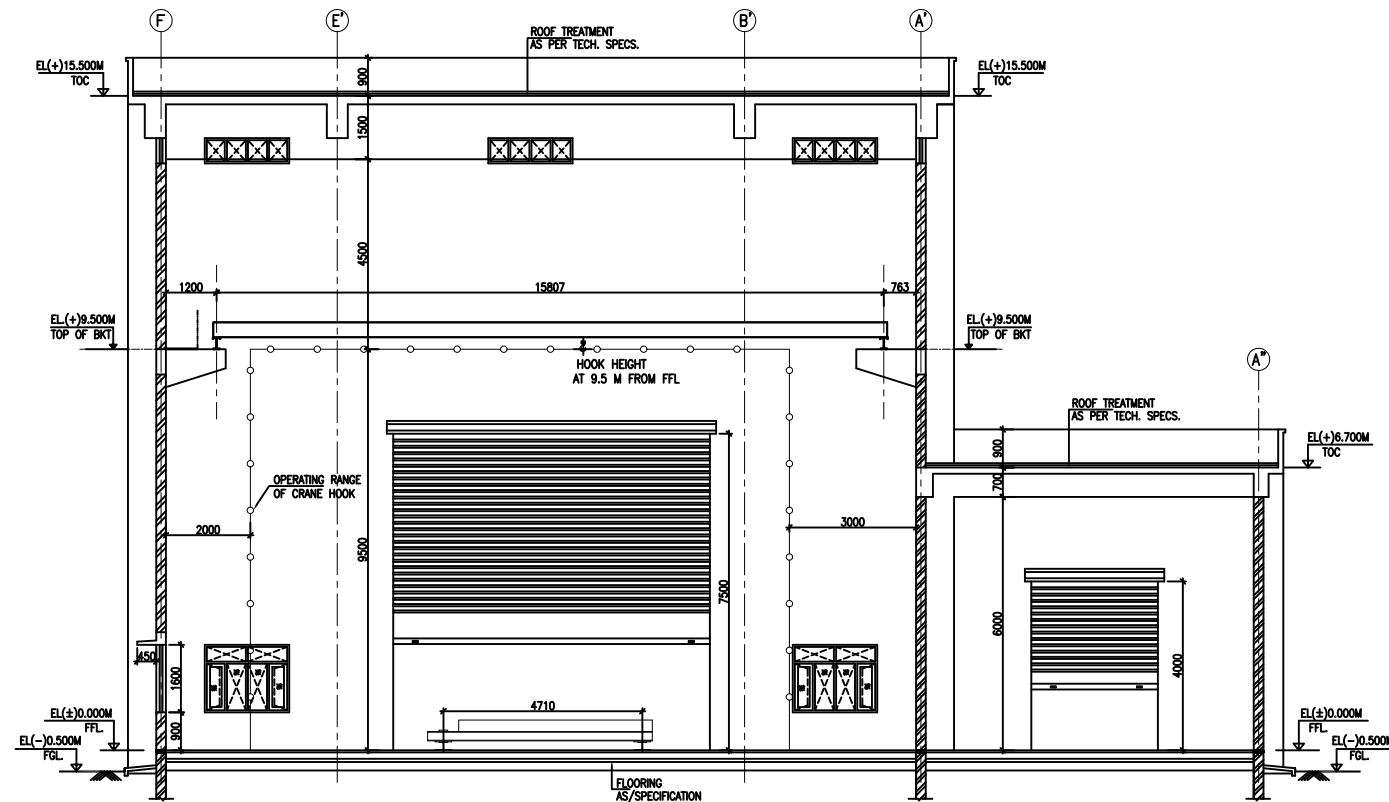
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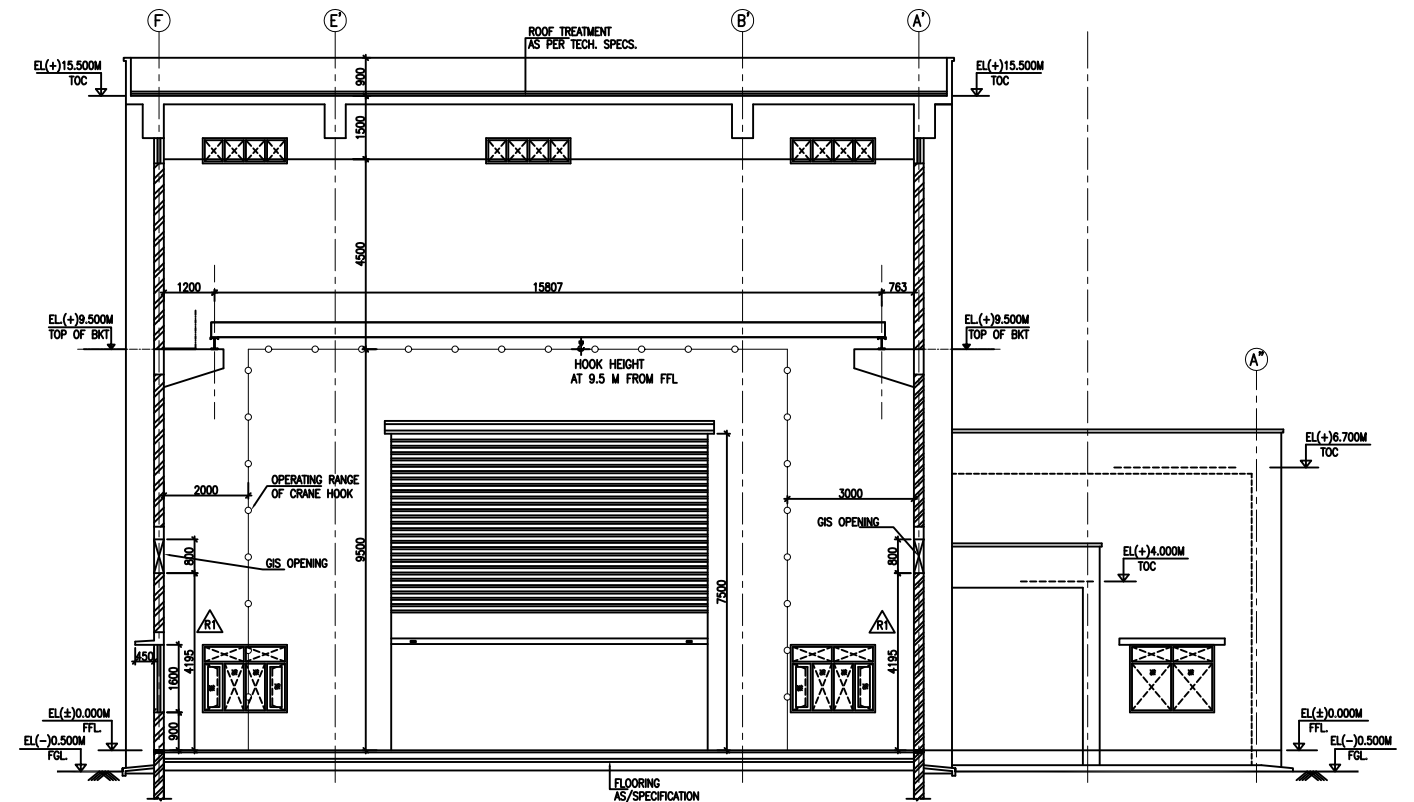
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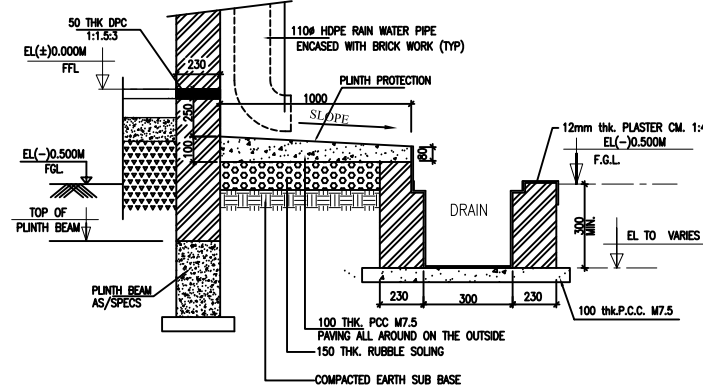
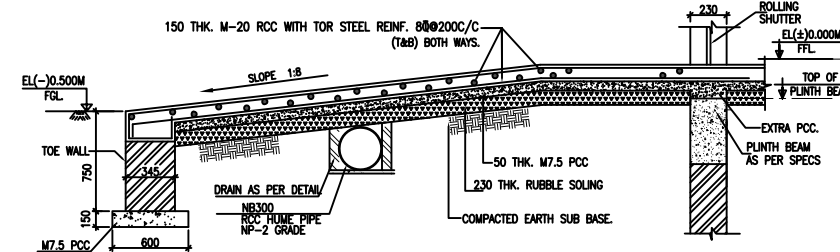
PROJECT	2X660 MW UDANGUDI SUPERCRITICAL TPS, STAGE-I
CUSTOMER	TAMILNADU GENERATION AND DISTRIBUTION CORPORATION LIMITED (TANGEDCO)
CONSULTANT	TATA CONSULTING ENGINEERS LIMITED BENGALURU
DEPT	BHARAT HEAVY ELECTRICALS LTD TRANSMISSION BUSINESS GROUP NOIDA
DESIGNER	TRR
CHECKED	DKU
APPROVED	AG
DATE	20.01.20



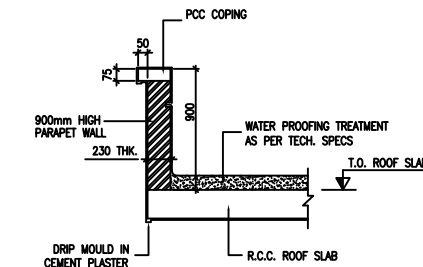
SECTION B-B



SECTION C-C

PLINTH PROTECTION ALONG BUILDING
WITH DRAIN-TYPICAL

DETAIL OF RAMP



TYP. DETAIL OF PARAPET

NOTES:-

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CUSTOMER	 TAMILNADU GENERATION AND DISTRIBUTION CORPORATION LIMITED (TANGEDCO)			
CONSULTANT	 TATA CONSULTING ENGINEERS LIMITED BENGALURU			
 Bharat Heavy Electricals Company	BHARAT HEAVY ELECTRICALS LTD TRANSMISSION BUSINESS GROUP NOIDA			
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	CHK	DKU		20.01.20
	APPS	AG		20.01.20
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		1:75	TB-1-400-607-640-3	
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			REV. 01	

